NO. I

MINISTRY OF INFORMATION AND COMMUNICATIONS
THE KINGDOM OF NEPAL

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE EXPANSION
OF
THE RURAL TELECOMMUNICATIONS NETWORK
IN
THE NORTH-WESTERN REGION
OF
THE KINGDOM OF NEPAL

JANUARY, 1996

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

NIPPON TELECOMMUNICATIONS CONSULTING CO.,LTD.(NTC)

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PREFACE

In response to a request from the Government of the Kingdom of Nepal the Government of Japan decided to conduct a basic design study on the Expansion of the Rural Telecommunications Network in the North-Western Region of the Kingdom of Nepal and entrusted the study to the Japan International Cooperation Agency (JICA).

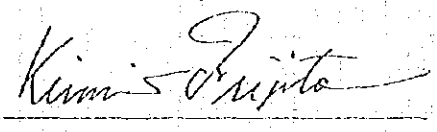
JICA sent to Nepal a study team from May 13 to June 18, 1995.

The team held discussions with the officials concerned of the Government of Nepal, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Nepal in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Nepal for their close cooperation extended to the teams.

January 1996



Kimio Fujita
President
Japan International Cooperation Agency

January, 1996

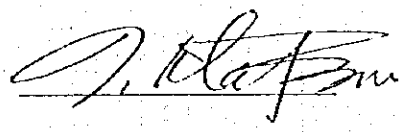
LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for the Expansion of the Rural Telecommunications Network in the North-Western Region of the Kingdom of Nepal.

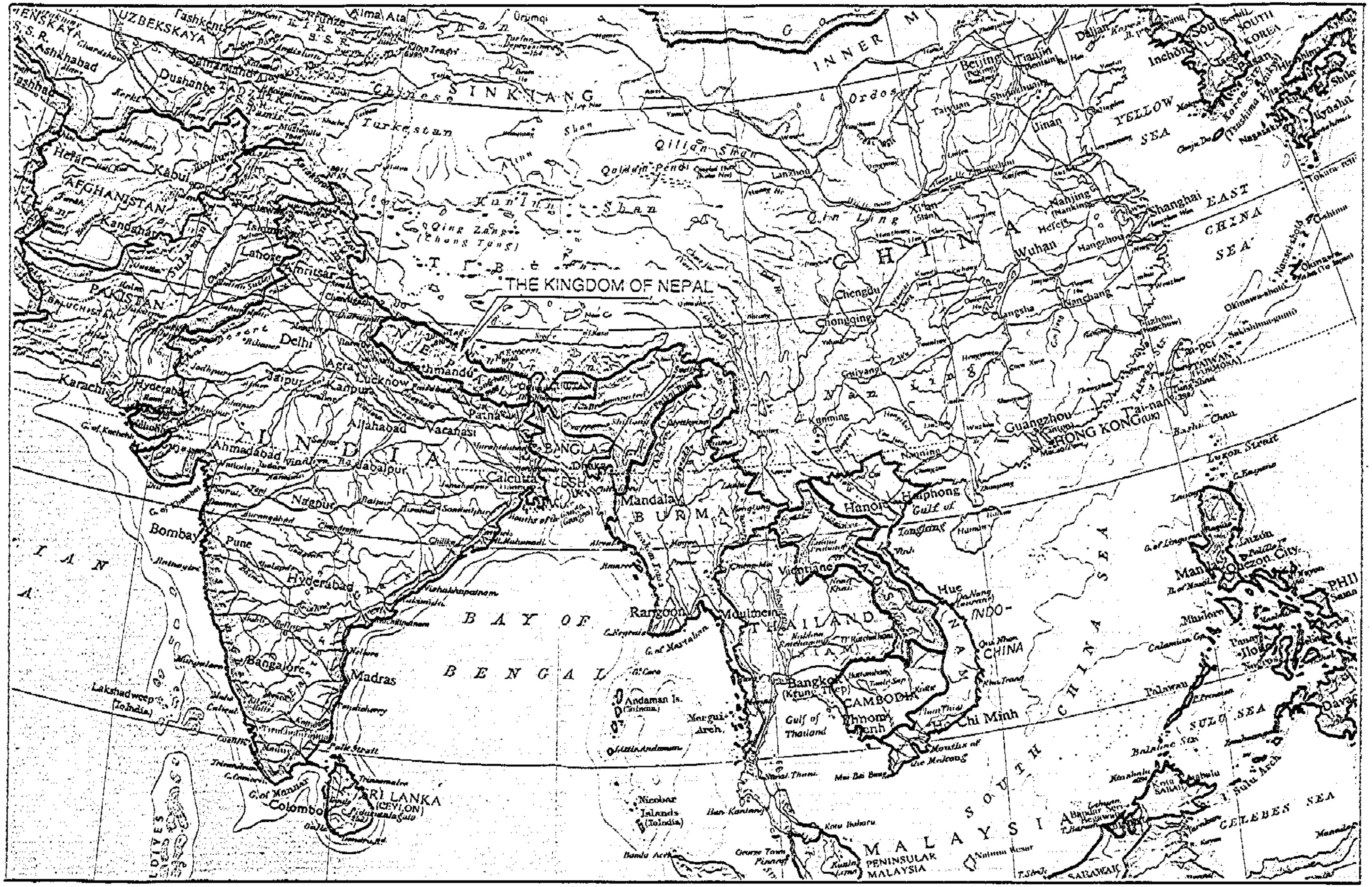
This study was conducted by Nippon Telecommunications Consulting Co., Ltd., under a contract to JICA, during the period from May 8, 1995 to January 16, 1996. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Nepal and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

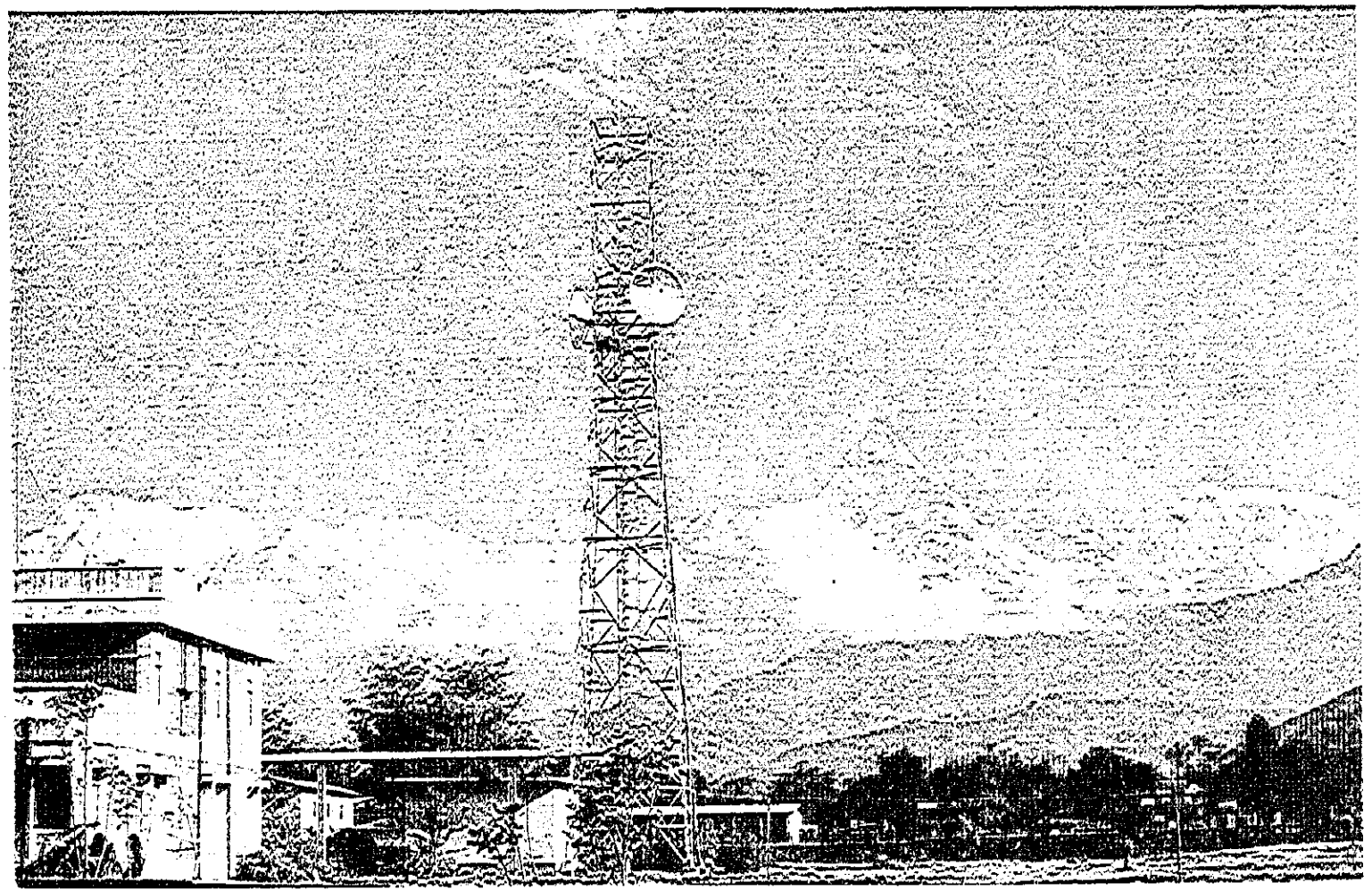
Very truly yours,



Takashi Matsuoka
Project Manager,
Basic design study team on the Project for the Expansion of the Rural Telecommunications Network in the North-Western Region of the Kingdom of Nepal
Nippon Telecommunications Consulting Co.,Ltd.

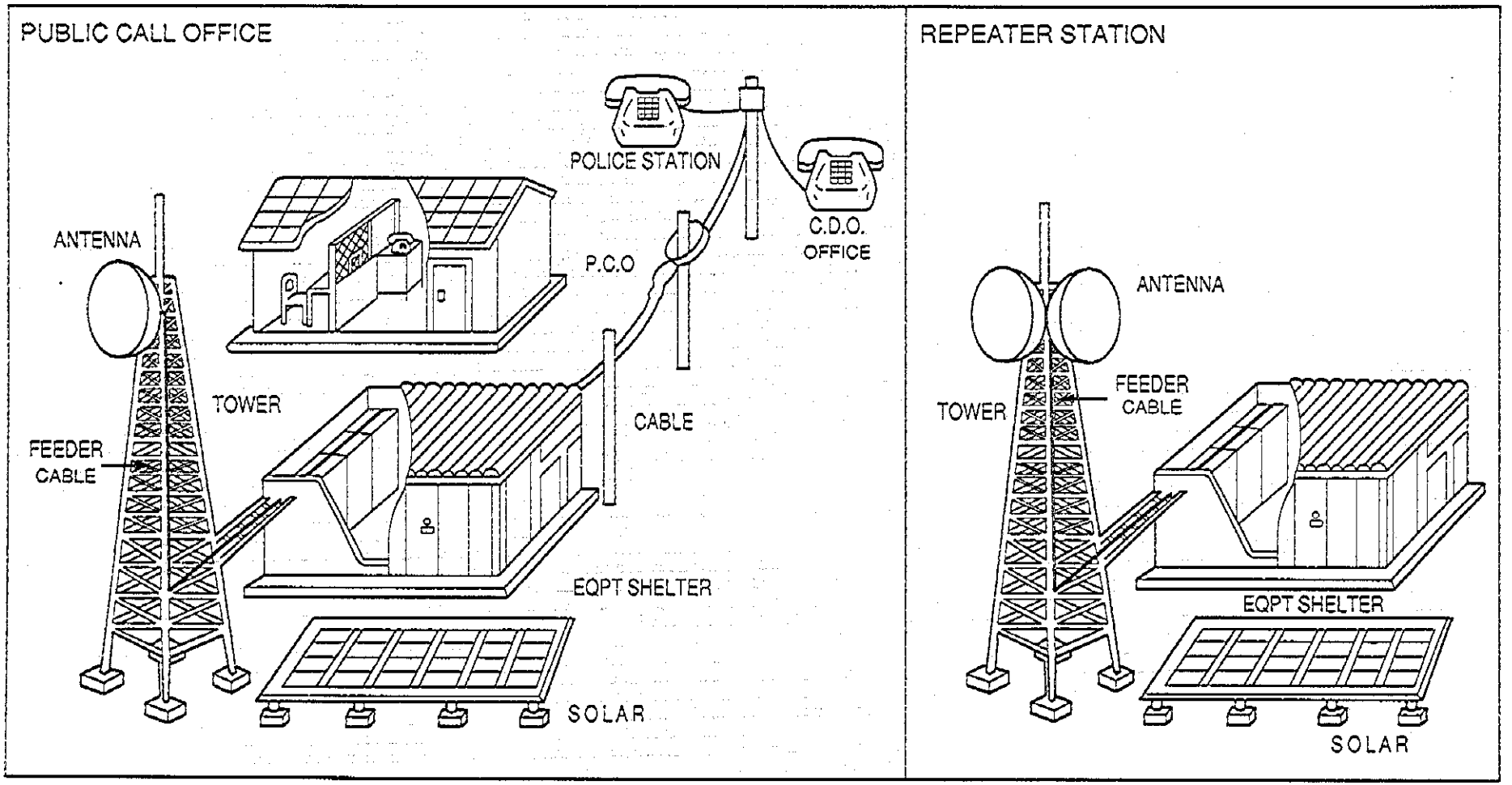


Location Map of The Kingdom of Nepal



THE PROJECT FOR THE EXPANSION OF THE RURAL TELECOMMUNICATIONS NETWORK IN THE NORTH-WESTERN REGION OF THE KINGDOM OF NEPAL

System Configuration



ABBREVIATIONS

1. Authorities Concerned

MOIC	Ministry of Information and Communications
NTC	Nepal Telecommunications Corporation
IDA	International Development Association
ITU-R	Radiocommunication Sector of International Telecommunication Union
ITU-T	Telecommunication Standardization Sector of International Telecommunication Union

2. Technical Terms

MARTS	Multi Access Radio Telephone System
PCO	Public Call Office
BER	Bit Error Ratio
F/S	Feasibility Study
CODEC	Coder Decoder
DCME	Digital Circuit Multiplication Equipment

CONTENTS

CHAPTER 1 BACKGROUND OF THE PROJECT

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The Kingdom of Nepal is a landlocked country in South Asia, and lying between China and India. On the north along the Himalaya highlands the country is bordered by the Tibetan autonomous region of China, and on the east, south and west, bounded by India. It extends 885 km from east to west, and 145 ~ 240 km from north to south, with a total land area of 147,181 km^2.

Geographically, the country is divided into three regions: (1) the Himalayan Highlands region over 3,000 m in elevation, (2) the hilly region between 900 to 3,000 m, and the Terai region, less than 300 m. The total population is approx. 20,000,000. The flat and fertile land of Terai is the area known for its high productivity in agriculture. It occupies only 17% of the national land area but accommodates approx. 40% of the total population. Other areas, i.e., the Himalayan Highlands and hilly regions, are all mountainous and, therefore, communications and transportation are extremely difficult even in main cities.

Telecommunications services in Nepal were started in 1960, with the establishment of the Telecommunications Bureau in the Ministry of Communications. At that time HF radio links were the only available communications means to connect zones.

Then in 1976, Nepal Telecommunications Corporation (NTC) was established as an agency responsible for operation and management of national and international communication services. The Telecommunications Master Plan was prepared in 1978 and switching systems and analogue transmission links were installed, based on this Plan. However, such improvement was made only for the major cities in Kathmandu basin, Pokhara basin and the southern Terai plains, while other mountainous areas were kept unimproved.

In March 1982, His Majesty's Government of Nepal requested the cooperation by the Japanese Government for realization of "Rural Telecommunications Improvement Plan." In answer to this request, the Japan International Cooperation Agency (JICA) conducted the feasibility study for this Plan, and prepared the Feasibility Study Report in October 1983. Of the four implementation phases recommended by the Report, the Phase-I and Phase-II to cover 33 cities in the southern area of the Central-Western Region were materialized with the fiscal 1985-1987 Japanese Yen loan.

Then a request for the remaining Phase-III and Phase-IV was made by His Majesty's Government. In answer to this request, a basic design study was made by JICA in November 1990 for the high priority 11 cities in the Eastern Region out of 30 cities involved in the Phase-III and Phase-IV. The study report was prepared in June 1991, and based on this report, rehabilitation of telecommunications in these cities was materialized.

As a result of the abovementioned improvement in rural telecommunications, enhancement in efficiency of administration services, activation of commodity distribution, improvement of emergency medical services, etc. have been realized particularly in nucleus cities, such as zone and district centers, where no telecommunication services, or only HF radio links or telegram services, if any, were available.

Under the above situation, His Majesty's Government requested that the Japanese Government extend the grant aid for expansion of telecommunications services to the remaining 11 cities so that the backbone rural telecommunications network can be established in Nepal covering the whole country as recommended in the Feasibility Study Report.

On the other hand, His Majesty's Government is proceeding with the 5th Five Year Plan (1992-1997). Under this Plan, a number of development projects, such as introduction of digital switching systems in major rural cities, digitalization of junction network to connect major cities in the Terai plains, rehabilitation of Kathmandu local switches and optical fibre junction network, introduction of MARTS systems in district centers, etc., are being materialized with the assistance and cooperation from IDA, Finland, Denmark, Sweden and Belgium.

With respect to MARTS systems, it has been confirmed through our study that the NTC's basic plan will not lead to overlapping implementation of facilities in the objective areas of this Project.

CHAPTER 2 CONTENTS OF THE PROJECT

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This project for the Expansion of the Rural Telecommunications Network in the North-Western Region of the Kingdom of Nepal is to connect 11 rural districts in the North-Western Region to the rural telecommunications network constructed by the previous Japan's grant aid projects covering the Central, Westernmost and Eastern Regions. These districts are the last to be connected and, with the materialization of this Project, a nationwide backbone rural telecommunication network can be established in Nepal. This Project aims to realize the minimum necessary rehabilitation of the telecommunication system in the North-Western Region with the provision of toll telephone service to important subscribers, such as governmental agencies and local offices, and public call offices (PCOs) in the objective areas.

The contents of the Project confirmed with the Nepal Telecommunications Corporation (NTC), the implementing agency of His Majesty's Government of Nepal, through the basic design study and discussions with the NTC staff concerned, are as outlined below.

(1) Objective Areas

Objective areas and PCO sites of this Project are as follows:

Area	Zones	PCO Sites
01	Bagmati	1. Chautara
08	Rapti/Karnali/Bheri	2. Dailekh
		3. Kalikot (Manma)
		4. Jumla
		5. Salyan
		6. Jajarkot
		7. Musikot
		8. Pyuthan
		9. Libanggaon
09	Mahakali/Seti	10. Chainpur
		11. Martadi

(2) Objective Facilities

Facilities finally requested by His Majesty's Government are as follows:

1) Radio and transmission facilities
2) Antennas and towers
3) Power supply facilities for radio and transmission systems
4) Shelters for standby diesel engine generator sets

(3) Radio Frequency Band

2 GHz band will be employed, in consideration of the use of the frequency band which can be free from interference noises, in compliance with the WARC*-92 recommendations.

Note*: WARC ... World Administrative Radio Conference

2.1 Objectives of the Project

His Majesty's Government of Nepal intends to promote regional development and has given the highest and urgent priority to the establishment of a backbone rural telecommunications network in the mountain districts where more than 50% of the total population reside. This Project will significantly contribute to the advancement of the regional development in Nepal.

Objectives of this Project are to construct a permanent telecommunication network which can provide high quality DDD (Direct Distance Dialing) services in the objective areas, aiming at the enhancement of efficient and effective administrative and other public services, such as emergency medical services, as well as modernization of distribution services, promotion of social and economic activities, increase in employment opportunities, enhancement of social welfare, etc.

The target of telephone density planned by NTC under the 6th Telecom. Project (9th Five-Year Plan/1997-2001) is as follows:

Urban districts	:	10.0/100 inhabitants
Rural districts	:	2.5/100 inhabitants

Transmission facilities of this Project are so designed that the abovementioned telephone density for the rural districts can be achieved. To cover the increased demand in and after 2000 when the demand is expected to exceed 500 as a result of population increase, introduction of switching systems is considered.

For urban areas, telecommunications modernization and expansion are now under way in accordance with the 5th Telecom. Project. In addition, for elimination of regional imbalance, rural telecommunications are now being rehabilitated through the introduction of MARTS (Multi Access Radio Telephone System) with the financial assistance from the World Bank. This, however, is not a permanent system but merely a temporary measure to cope with the urgent demand.

With the completion of this Project in conjunction with the modernization in urban areas under the 5th Telecom. Project as mentioned above, the telecommunications network in Nepal can be improved throughout the country, leading to the significant upgrading of living conditions of the whole nation.

2.2 Basic Concept of the Project

This Project aims to establish a rural telecommunications network in 11 district centers in 01, 08 and 09 areas in the North-Western Region, following the previous projects for the Central, Middle Western and Westernmost Regions.

(1) For 01, 08 and 09 areas, the MARTSs are being introduced by the World Bank Project: in 10 of the objective 11 district centers, the MARTSs are already in operation and in 1 center (09 Area: Chainpur), the construction work is underway. This, however, does not mean the overlapping installation by the two projects, i.e., the World Bank Project and the current JICA Project.

The basic concept of the Rural Telecommunications Plan envisaged by NTC is that the aid from Japan is to cover the transmission routes to connect district centers with the backbone network, and that from the World Bank is to cover remote areas by installing the MARTSs.

Whereas the World Bank project was commenced in advance to the materialization of this Project. Hence, the Nepal side decided to cope with the urgent demand from most important subscribers in these areas by temporarily installing MARTSs by the World Bank Project, and remove them to other districts after the completion of this Project. Removal of the MARTSs is quite easy and they will be re-installed in remote areas after the inauguration of the system by this Project.

(2) The number of important subscribers to be connected by this Project is set at 30 for each site, taking into account the result of the Feasibility Study, utilization condition of the facilities provided by the previous projects, the number of waiting applicants, etc. The said figure is almost equal to the number of connections requested by NTC initially.

(3) The optimum transmission capacity is set at 8 Mb/s, in consideration of the telephone density target (2.5%), demand forecast (500 subscribers) and the small capacity switching system introduction plan in the future, etc.

(4) Maximum utilization of the existing facilities is pursued in order to avoid overinvestment. More precisely, local outside plant (cables and poles) installed under the World Bank Project for important subscribers, existing buildings, and so on are to be utilized to the maximum extent.

(5) As for the radio frequency band, a study will be made on use of 1,700 Mhz - 1,970 Mhz band which can be free from interference noise problems, in consideration of the request from NTC. A detailed study will be made at the time of detail designs.

2.3 Basic Design

2.3.1 Design Concept

This Project aims to construct an optimum rural telecommunication network in the objective districts, in consideration of natural, social and economic conditions, demand for telecommunications, etc. in respective districts, and paying due attention to ease in installation, and further in operation and maintenance after installation.

Basic design concept of this Project is as follows:

(1) Natural Environment

Objective areas of this Project are located mostly in hilly areas and partly in high mountain areas. There are no trekking routes, and natural conditions are preserved as they are.

Consideration should be given to the protection of environmental conditions in selecting sites for radio repeater stations. Utilization of helicopters for saving of access time to the sites and employment of a solar power supply system for protection of environment should also be considered.

(2) Social Requirements

Public call offices having no switching function are installed in 11 cities of administrative centers and agricultural and commercial centers in the objective areas. Minimum necessary public telecommunications services consisting mainly of telephone service and partly of telegram service are provided. For governmental agencies and local offices, toll subscriber telephone services are provided. Toll circuits from PCOs are concentrated on their respective parent exchange offices (PEOs) which deal with switching, connection and call metering for charging.

(3) Special Conditions Related to Construction Work

- In connection with the construction work in Nepal, no specific license or approval will be required and no restrictions are posed by laws and regulations.

- As for the work efficiency, correction value of 2.24 (with 1 for Japanese workers) will have to be applied, in view of the undermentioned conditions, in addition to the level of local contractors and labourers:

  a) A hot and humid subtropical climate in Summer and a bitter climate in Winter in the objective areas located in the mountainous district will certainly lower the work efficiency.

b) Road conditions in the objective areas are extremely poor, posing problems in transportation of equipment and work force.

c) Objective areas are agricultural districts where civil/construction work labourers are scarcely found. That is, it is very difficult to obtain local labourers and technicians.

d) Even in urban areas, experts in wiring, jumpering, etc. who will be required in large number for telecommunication facilities construction can hardly be found.

- Materials obtainable locally are limited to the following:

a) Cement

Since this Project is for the public works, cement can be obtained by taking formal procedures through a governmental agency. Japan's technologies have been introduced here for its production, and it is satisfactory in quality.

b) Gravel, sand and crushed stones

They can be obtained from nearby rivers, with no problem in quality.

c) Reinforcing iron bars and frame materials (lumber, plywood boards, flat plates, etc.)

They are obtainable locally, with no problem in quality.

(4) Employment of Local Contractor and Local Products

Use of local contractors should be considered positively, and the consultant for the Project should provide adequate guidance to them. Utilization of the abovementioned local products should also be considered positively.

(5) Operation/Maintenance Capability of Implementing Agency

The existing operation/maintenance system of NTC is well organized, under a long term human resource plan. The technical level of operation/maintenance staff of NTC has been improved since training courses for new projects and seminars on new technologies are held at the Training Center from time to time, when occasion demands. Under this project, operation/maintenance training is to be conducted for new systems to be introduced.

(6) Dimensions of Objective Facilities and Service Grade

Objective Facilities of this Project are as follows:

1) Radio and Transmission Facilities

- Transmission system

  A digital line-of-sight radio system (point to point communication system) is adopted. Frequency band to be used is 2 GHz band.

- Transmission quality

  In compliance with relevant ITU-R/T Recommendations and Reports.

- System Configuration

  A cold-standby system is adopted to minimize power consumption and realize an economic power supply system.

- Capacity of Radio Facilities at PCOs

  In order to achieve the telephone density target for rural areas, i.e., 2.5/100 inhabitants, under the 6th Telecom. Project (Five-Year Plan) capacity of radio facilities at each site should be at least 8 Mb/s per PCO, as shown in the table, Capacities of Radio Facilities at PCOs.

  In and after 2000 when the above capacity will not be enough to cover the increased demand, small capacity switching systems will have to be introduced. The capacities of radio facilities assigned to each PCO under this Project will prove to be useful on that occasion.

- Capacity of Transmission Facilities (CODEC) at PCOs

  Probable demand in the objective areas estimated based on the information obtained through interviews with responsible persons of regional development committees of respective sites is as listed in the following table. It can be seen from the table that initial capacity of CODEC (Coder-Decoder) should be 30 CH per site. This coincides with the request of NTC.

Probable Demand for Telephone Subscription

AREA	NAME OF PCO	IMPORTANT SUBSCRIBERS	PCO PLANNED	TOTAL	COMMUNITIES, CLUBS,NGO,SHOPS, CO,OFFICES etc	GRAND TOTAL	EXISTING SUBSCRIBERS LINE
01	CHAUTARA	25	2	27	35	62	8
08	DAILEKH	60	2	62	75	137	5
	KALIKOT	33	2	35	112	147	11
	JUMLA	57	2	59	132	191	12
	SALYAN	35	2	37	110	147	12
	JAJARKOT	18	2	20	100	120	12
	MUSIKOT	15	2	17	90	107	11
	PYUTHAN	24	2	26	100	126	12
	LIBANGGAON	12	2	14	80	94	10
09	CHAINPUR	25	2	27	150	177	Under Construction
	MARTADI	23	2	25	70	95	12
		327	22	349	1054	1403	105

* Important Subscribers: Government Offices
Hospitals
Schools
Banks

Capacities of Radio Facilities at PCOs

AREA CODE	DISTRICT	DISTRICT HEADQUARTER	OBJECTIVE AREAS	POPULATION 1991 DISTRICT	POPULATION 1991 TOWN	1991 HOUSE HOLD	POPULATION ASSUMED IN 2000 (2% / YEAR)	TARGET OF TELEPHONE DEMAND BY NTC (2.5 TEL./100 POP.)	TARGET OF CAPACITY FOR SY (M b/s)	PLAN (MIN.REQUIRED M b/s)
01	SINDHUPALCHOK	CHOUTARA	CHOUTARA	261,025	3,734	782	4,552			
			BARDELAU		5,879	1,130	7,160			
			JALBIRE		2,026	414	2,469			
			KARADHAS		3,133	571	3,819			
			KALIKA		1,190	415	2,069			
			TOTAL		16,962	3,312	20,675	516	17	8
08	DAILEKH	DAILEKH	DAILEKH	187,400	5,276	878	6,431			
			SARASWOTI		3,836	680	4,670			
			NARAYAN		3,743	747	4,562			
			KAL BHAIRAB		3,787	713	4,616			
			BADA KHOLA		2,201	402	2,683			
			TOTAL		18,842	3,520	22,968	574	17	8
	KALIKOT	KANKA	KANKA	88,805	4,409	827	5,374			
			KUMALGAUN		2,617	413	3,190			
			RUKSA		2,659	423	3,241			
			KOTAL KUDI		3,162	499	3,854			
			KOGRAHA		1,856	358	2,260			
			TOTAL		14,701	2,520	17,919	447	8	8
	JUMLA	JUMLA	JUMLA	75,964	5,842	1,000	7,121			
			SANIGAUN		3,719	682	4,533			
			TATOPANI		3,818	774	4,655			
			TOTAL		13,380	2,456	16,309	407	8	8
	SALYAN	SALYAN	SALYAN	181,785	5,548	1,100	6,762			
			KARKE		4,180	770	5,100			
			DANDAGAUN		4,198	740	5,117			
			LAKHPUR		3,678	648	4,483			
			TOTAL		17,613	3,258	21,458	536	17	8
	JAJARKOT	JAJARKOT	JAJARKOT	113,958	8,140	1,533	9,922			
			JAGATIPUR		4,614	816	5,624			
			PUNARA		5,096	830	6,211			
			TOTAL		17,850	3,239	21,757	543	17	8
	RUKUM	RUKUM	KUSIKOT	155,554	7,279	1,474	8,873			
			CHHUYANG		4,258	805	5,183			
			BHALARADHA		2,875	534	3,504			
			SYALAPUNDIA		4,590	905	5,602			
			TOTAL		19,002	3,718	23,162	579	17	8
	PYUTHAN	PYUTHAN	PYUTHAN	175,459	5,001	1,000	6,188			
			DHARAMPANI		2,859	560	3,485			
			NARAYANA		4,747	922	5,786			
			TOTAL		12,607	2,548	15,440	386	8	8
	ROLPA	LIBANG	LIBANG	179,621	6,462	1,381	7,877			
			KORGAUN		3,335	701	4,065			
			RUNA		3,528	665	4,300			
			DUNAI		3,855	683	4,699			
			TOTAL		17,180	3,450	20,941	523	17	8
09	BAJHANG	CHAINPUR	CHAINPUR	139,032	4,143	759	5,050			
			RITHAPATA		2,017	392	2,458			
			JHANTABADA		2,583	441	3,148			
			KAITELA		1,948	365	2,374			
			TOTAL		10,691	1,957	13,030	325	8	8
	BAJURA	KARTADI	KARTADI	82,010	4,618	942	5,629			
			BUDHIGANGA		2,450	470	2,987			
			BRAHMATOLA		4,855	1,011	5,918			
			TOTAL		11,923	2,423	14,544	363	8	8

* POPULATION OF NEPAL by Districts and Village Development Committees / Municipalities (Population Census 1991)

- Introduction of Remote Supervisory & Control System

  All the stations except PEOs are unattended stations, so that maintenance staff can be minimized.

2) Power Supply System

- Stations Where Commercial Power is Available

  Full floating system (battery holding time: 5 days) + standby diesel engine generator

- Stations Where Commercial Power is Unavailable

  Solar power supply system (battery holding time: 15 days)

3) Transmission Quality

a) The transmission quality of a digital radio link is required to meet the ITU-R relevant to BER. That is, the quality of a link between PEO and PCO should meet the following, in compliance with ITU-R No. 634-2:

- Time when BER exceeds 10^{-3} should be less than 0.006% for any month, when measured for one second.
- Time when BER exceeds 10^{-6} should be less than 0.045% when measured for one minute.

b) Fading occurrence probability should be calculated, by applying parameters for N.W. Europe given in ITU-R No. 338-6.

(7) Construction Period

Nepal is located in a subtropical monsoon zone where natural conditions are severe, and road conditions in the objective areas are extremely poor due to their geographical environments. These are important factors to be taken into account in planning the construction work schedule.

In Nepal, the rainy season lasts 4 months, i.e., June, July, August and September, during which heavy rains are seen locally, sometimes leading to natural disasters, such as flood, and resulting in washing away of bridges and roads. Construction work, therefore, should be done avoiding the raining season.

For the sites not accessible by vehicles due to poor road conditions, transportation means should be studied carefully. Delay in transportation of

equipment and materials easily leads to delay in completion of the Project.

In view of the above, the implementation work schedule has been planned, paying attention to the avoidance of the raining season and the use of helicopter for transportation of equipment and materials for some sites.

For details, refer to Items 2.1.2 (2) and 2.1.6.

2.3.2 Basic Design

Main facilities to be provided under this Project are digital radio and transmission facilities, power supply facilities, antenna towers and prefabricated shelters as listed below:

(1) Digital Radio and Transmission Facilities

Facilities to connect PCOs and PEOs by digital radio system, and consisting of the following:

Area	Route	PCO	Repeater Station**	Capacity	Installed CODEC
01	Kathmandu (KTM)* - Chautara (CTR)	1	1	8Mb/s	30CH
08	Nepalganj (NGJ)* - Dailekh (DLK)	1	2	8Mb/s	30CH
	" - Jumla (JML)	1	5	8Mb/s	30CH
	" - Kalikot (KKT)	1	3	8Mb/s	30CH
	" - Pyuthan (PYN)	1	2	8Mb/s	30CH
	" - Salyan (SYN)	1	2	8Mb/s	30CH
	" - Jajarkot (JKT)	1	3	8Mb/s	30CH
	" - Musikot (MKT)	1	3	8Mb/s	30CH
	" - Libanggaon (LBG)	1	3	8Mb/s	30CH
09	Dangadhi (DGD)* - Chainpur (CPR)	1	5	8Mb/s	30CH
	" - Martadi (MTD)	1	5	4Mb/s***	30CH

Note * : Existing Parent Exchange Office
** : The number of radio repeater stations includes the existing stations subject to capacity expansion.
*** : The capacity of Suide (SUD) which is the higher ranking exchange of Martadi (MTD) is 8 Mb/s, of which 4 Mb/s is being allocated to other PCO. Hence, the capacity of Martadi (MTD) is 4Mb/s.

Existing radio route capacities to be expanded in connection with the new installation of PCOs under this Project are as follows:

Area	Existing Radio Route	Existing Radio System Capacity	New Radio System Capacity	Equipment to be Replaced
08	Nepalganj (NGT) - Rajhakot (RKT)	34Mb/s	34Mb/s+34Mb/s	
09	Buretora (BTR) - Kaphali (KPL)	17Mb/s	34Mb/s	17Mb/s --> 34Mb/s
	Kaphali (KPL) - Dandeldhura (DDR)	17Mb/s	34Mb/s	17Mb/s --> 34Mb/s
	Dandeldhura (DDR) - S.Dot (SDT)	8Mb/s	17Mb/s	8Mb/s --> 17Mb/s

For radio frequency band, 2GHz band is adopted, and a cold-standby system is employed.

(2) Power Supply Facilities

To keep continuous and stable operation of the telecommunications facilities, the following power supply system is adopted.

Supply System	Objective Sites			Remarks
	Area	Site Name	Number of Sites	
Full Floating System + Standby Diesel Engine Generator	01 08 08	Chautara (PCO) Salyan (PCO) Pyuthan (PCO)	3	Commercial power is available.
Solar Power Supply System	08 08 08 08 08 08 08 08 08 08 08 08 09 09 09 09 09	Dailekh (PCO) Jumla (PCO) Kalikot (PCO) Jajarkot (PCO) Musikot (PCO) Libanggaon (PCO) Ranimatta (R/S) Bhartalgna (R/S) Maithapla (R/S) Chimaralekh ((R/S) Sauniyapani (R/S) Ratamatta (R/S) Swalgadwari (R/S) Chainpur (PCO) Martadi (PCO) Rayal (R/S) Bantalekh (R/S) Siudi (R/S)	18	Commercial power is not available.

Note*: R/S ... radio repeater station

(3) Antenna Tower

Antenna towers are installed as follows:

Type	Site		
	Area	Site Name	Number of Sites
Pole type (12 m high)	01 08 08 08 09	Chautara (PCO) Jumla (PCO) Jajarkot (PCO) Musikot (PCO) Chainpur (PCO)	5

Self-supporting 4-legged tower (17 m high)	08 08 08 08 08 08 09 09 09	Dailekh (PCO) Kalikot (PCO) Salyan (PCO) Libanggaon (PCO) Phyuthan (PCO) Ratamatta (PCO) Martadi (PCO) Rayal (R/S) Bantalekh (R/S)	9
Self-supporting 4-legged tower (22 m high)	08 08 08 08 08 08	Sauniyapani (RS) Ranimatta (R/S) Bhartalgna (R/S) Maithapla (R/S) Chimaralekh (R/S) Swalgadwari (R/S)	6

(4) Prefabricated Shelters

Prefabricated shelters are constructed at the following sites:

Area	Site Name	Number of Sites	Remarks
01 08 08	Chautara (PCO) Salyan (PCO) Pyuthan (PCO)	3	To accommodate Standby Diesel Engine Generator Set

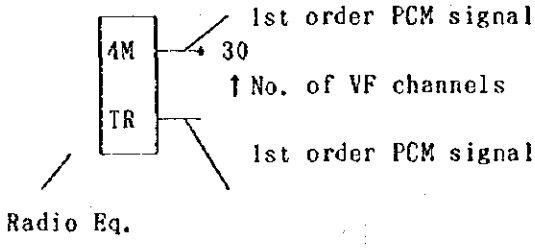
(5) Basic Designs Drawings

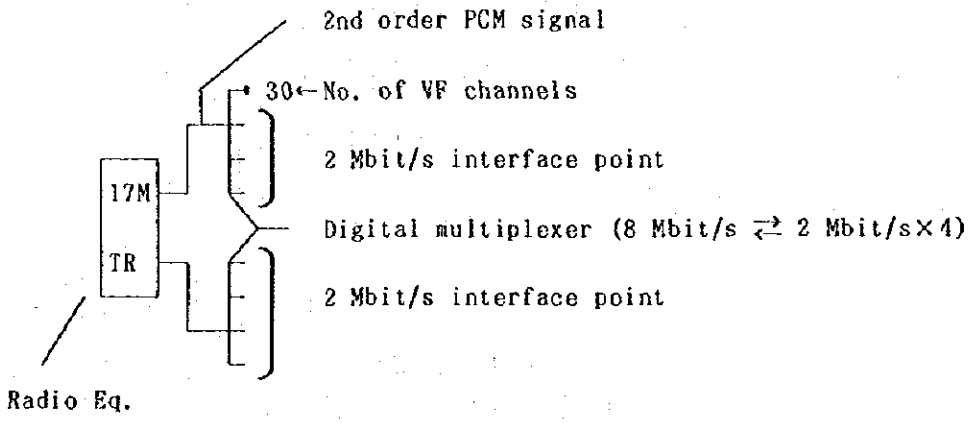
The undermentioned drawings are attached:

1) Channel Accommodation Plan

2) Equipment Layout Plan for Each Site

Legend:





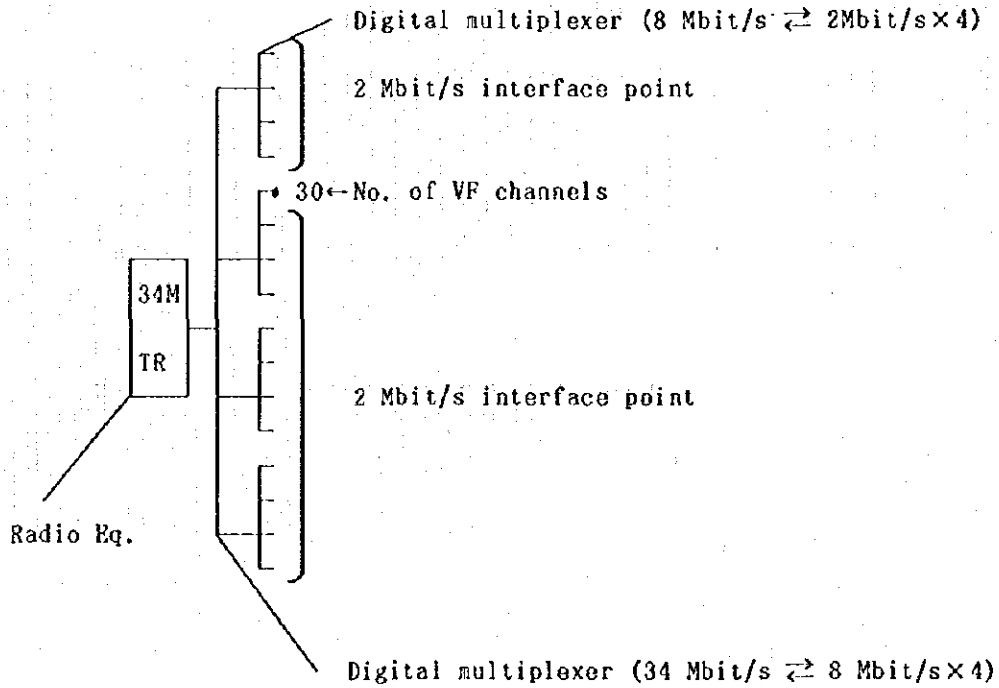
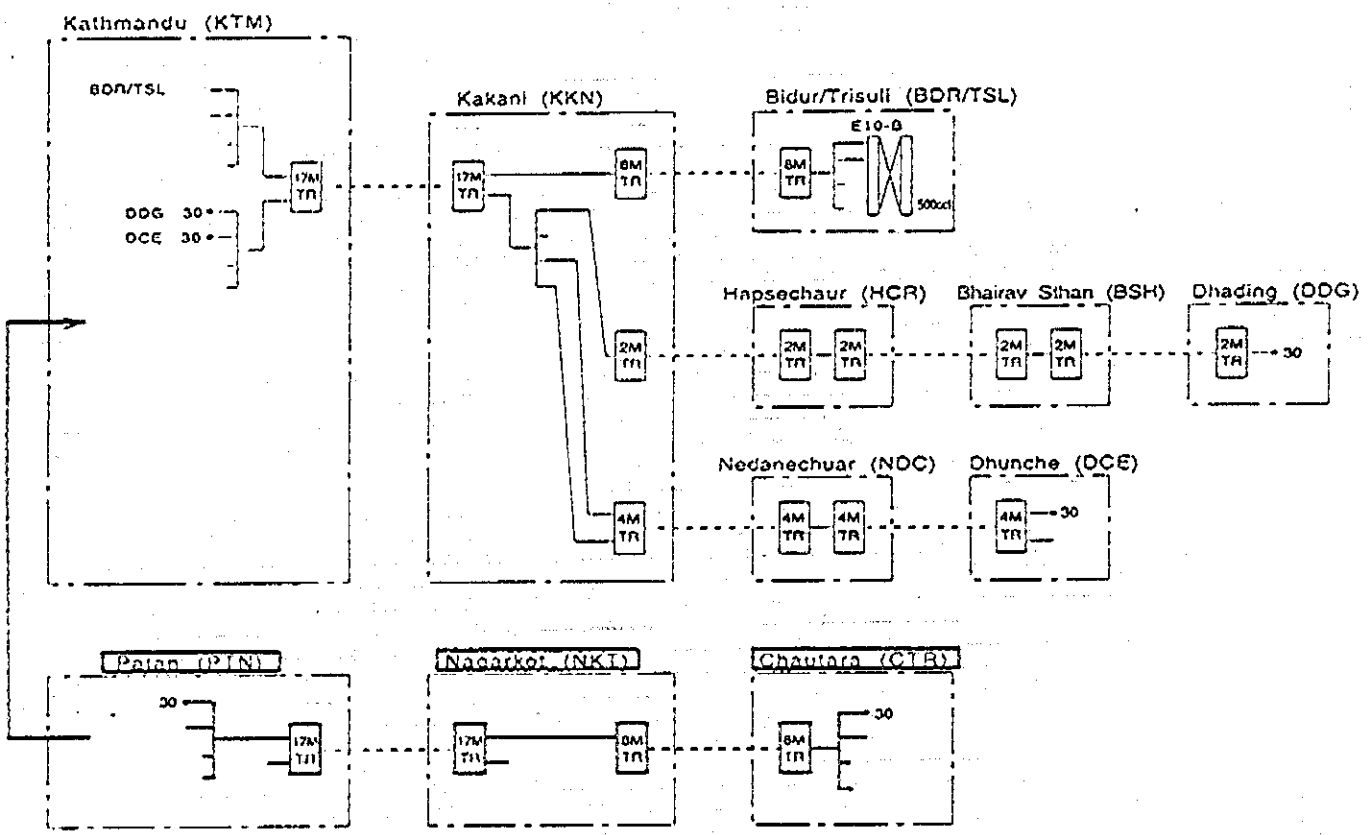
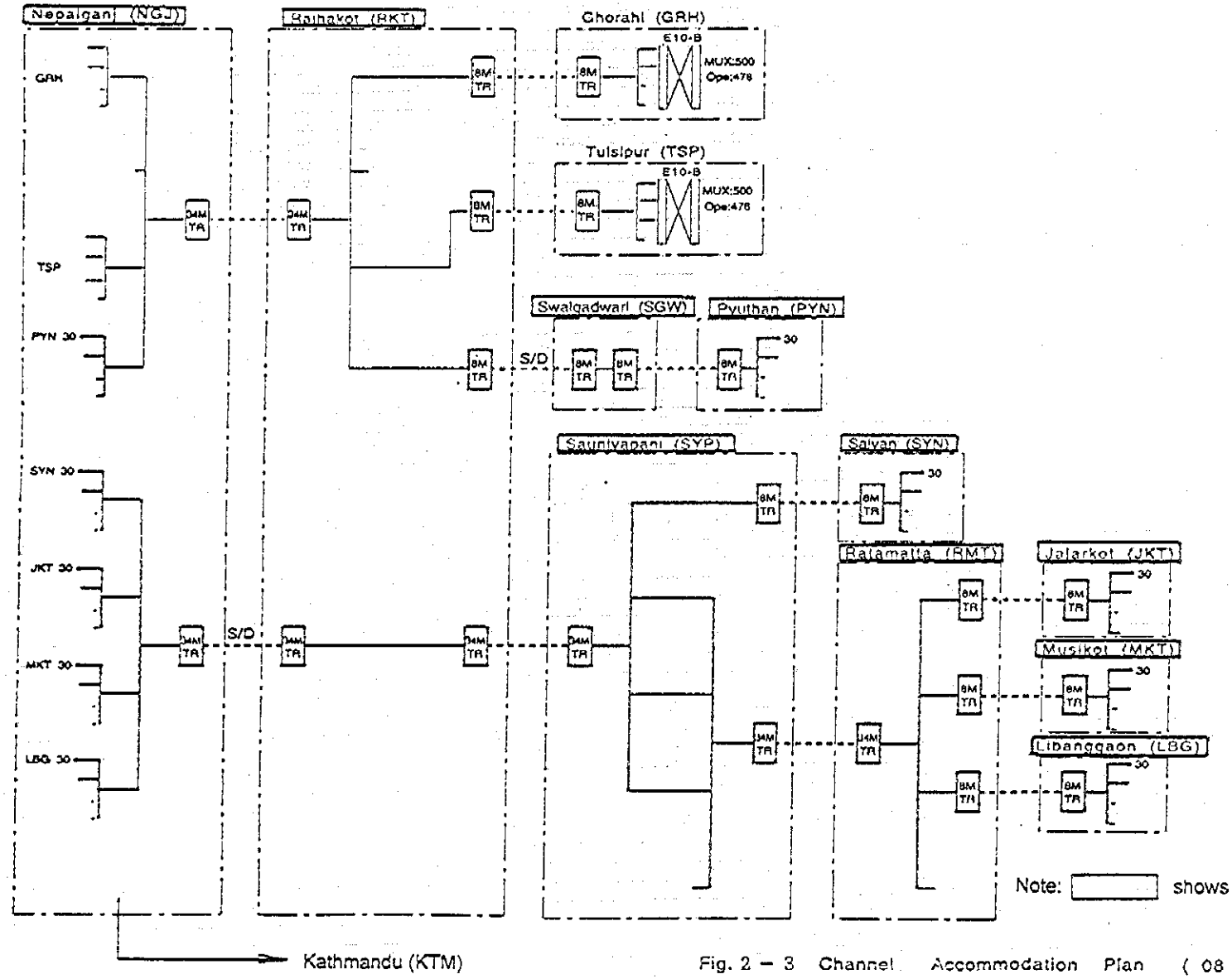


Fig. 2 – 1 Channel Accommodation Plan



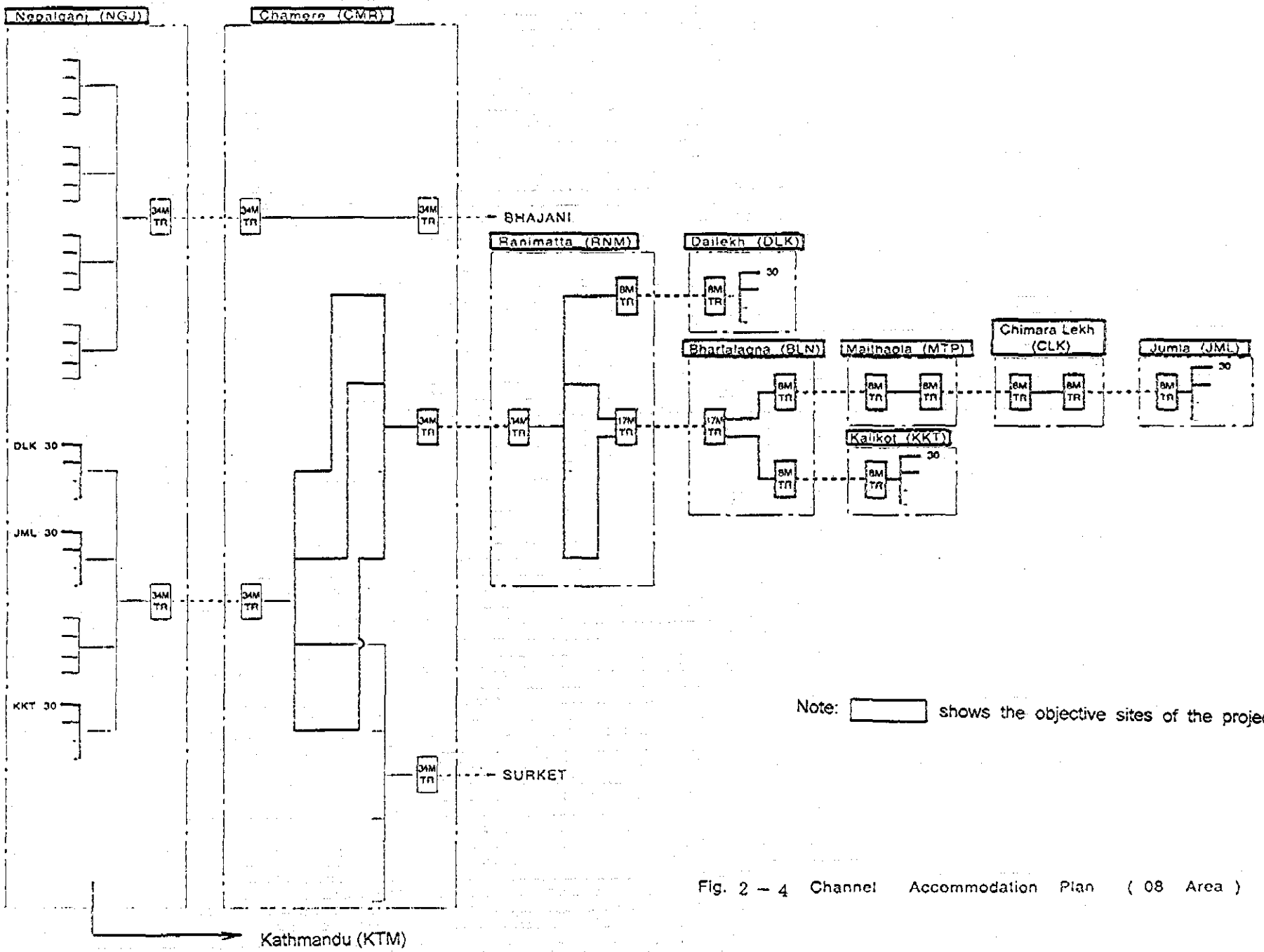
Note: ▭ shows the objective sites of the project.

Fig. 2 – 2 Channel Accommodation Plan (01 Area)



Note: ▭ shows the objective sites of the project.

Fig. 2 – 3 Channel Accommodation Plan (08 Area)



Note: ▭ shows the objective sites of the project.

Fig. 2 – 4 Channel Accommodation Plan (08 Area)

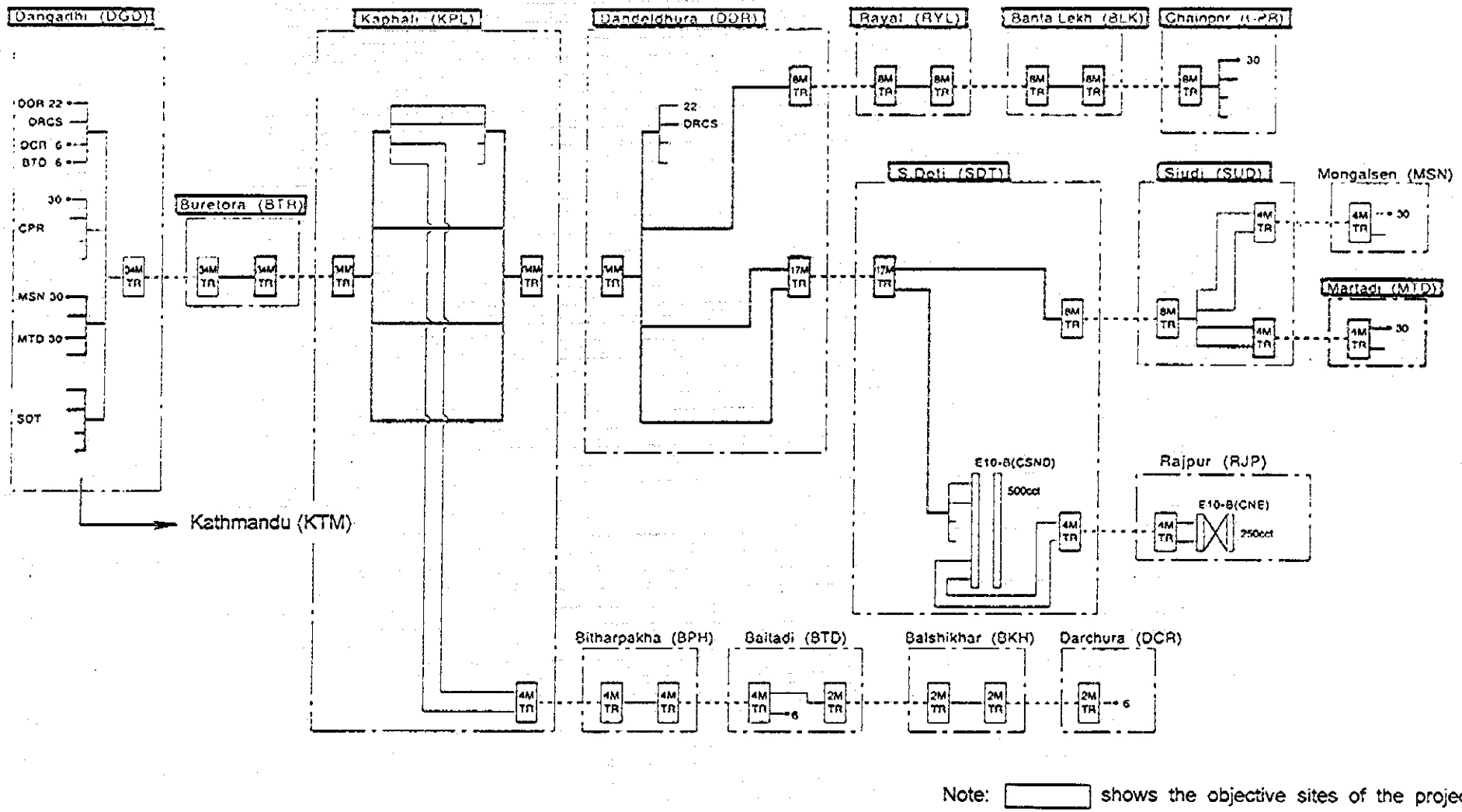
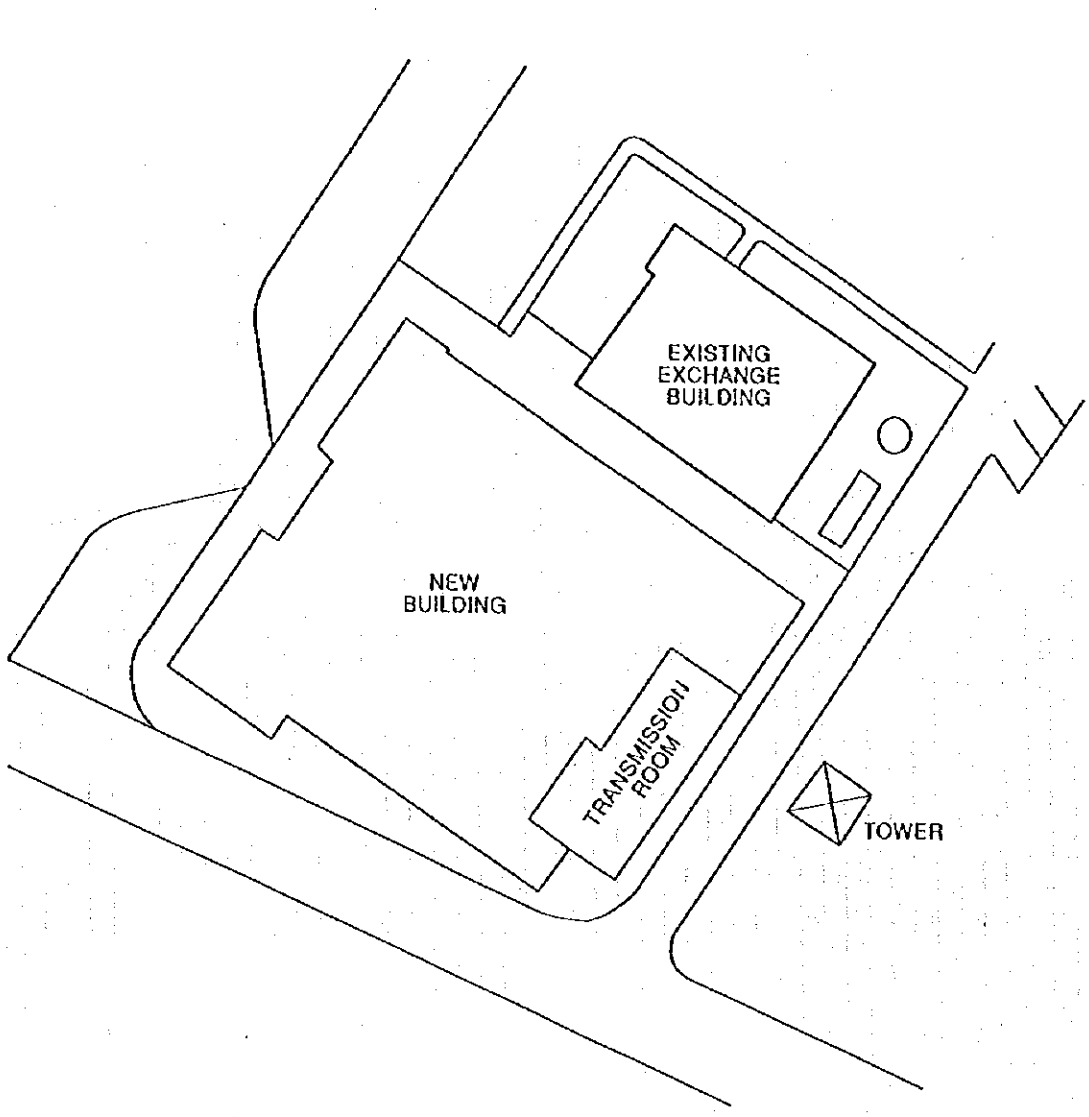
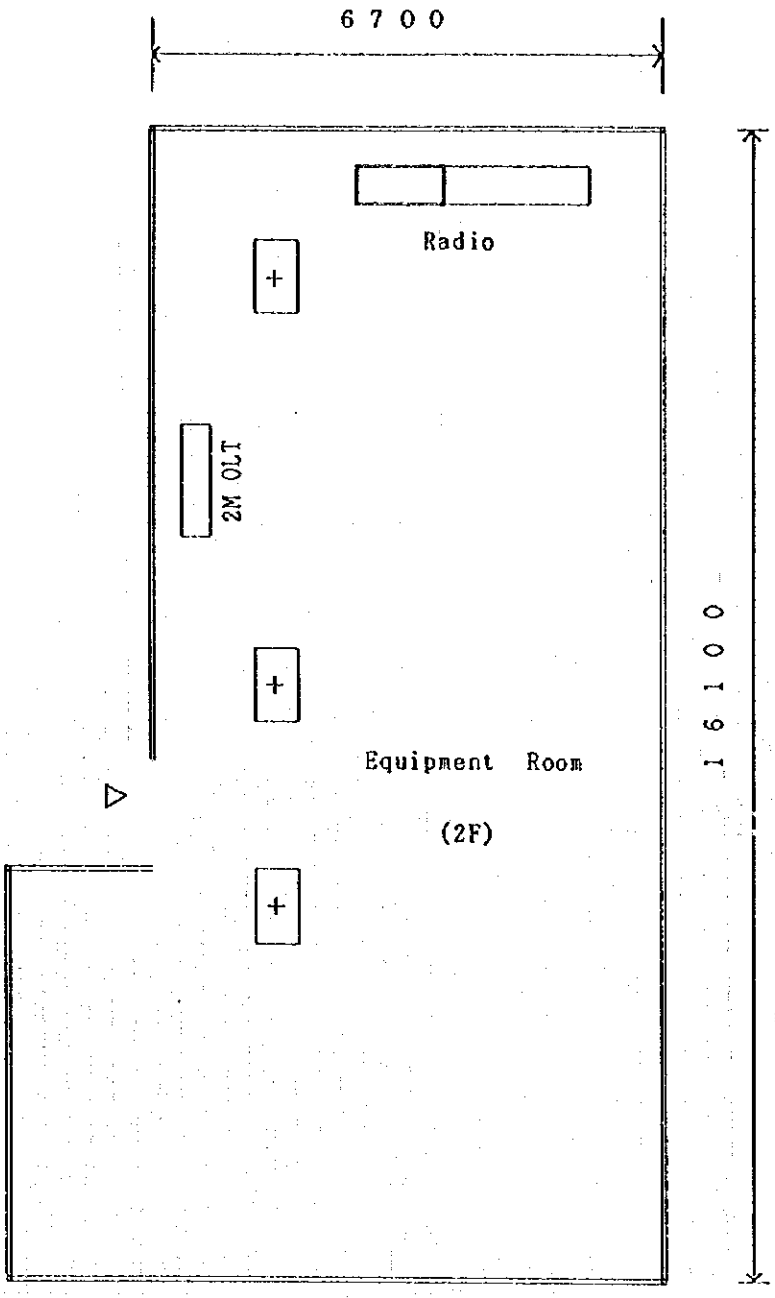


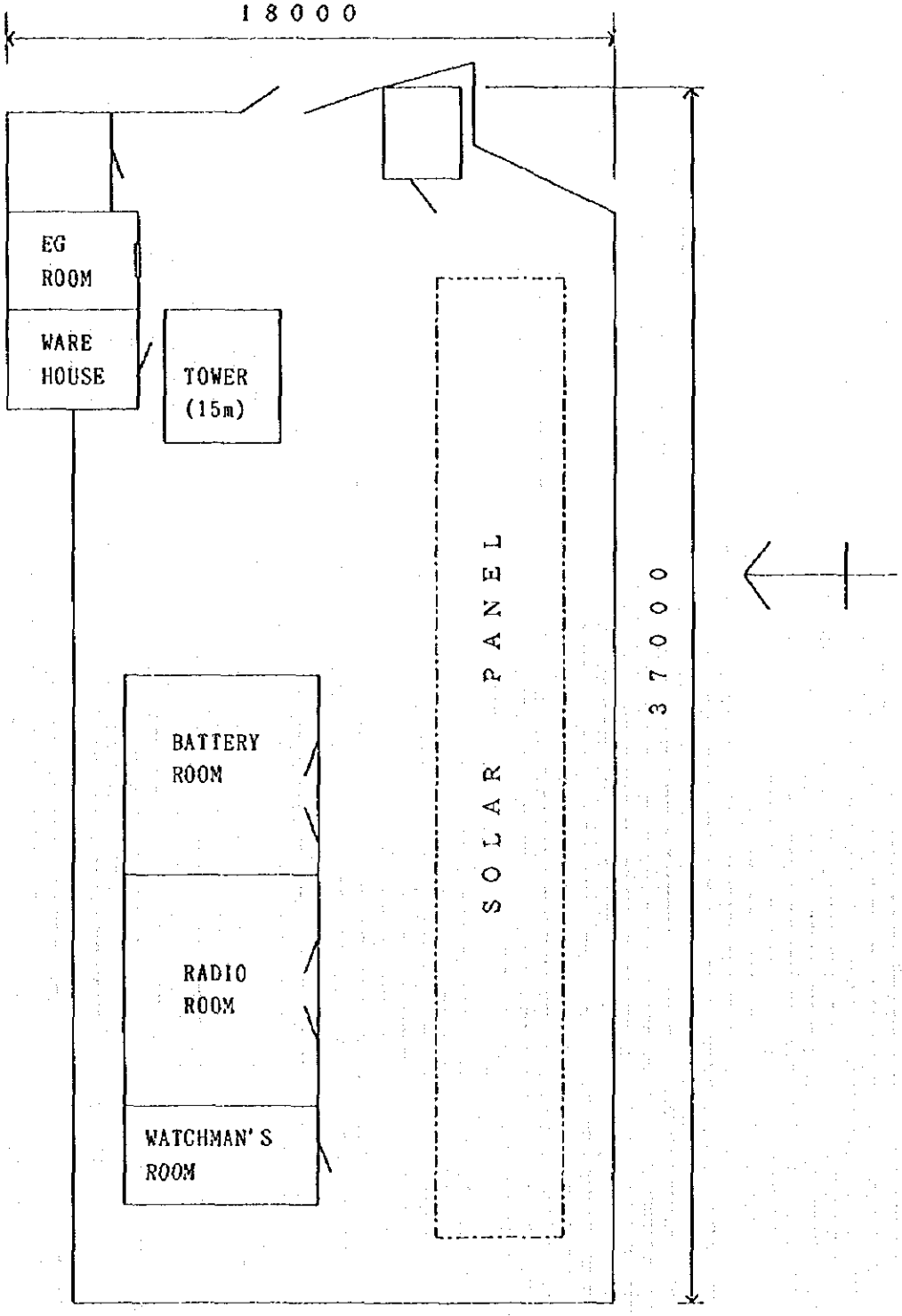
Fig. 2 — 5 Channel Accommodation Plan (09 Area)



DRW	:	SITE LAYOUT
SITE	:	PATAN (PTN)
SCALE	:	1 : 200
FIG	:	2 – 6



DRW : FLOOR LAYOUT
SITE : PATAN (PTN)
SCALE: 1:100
UNIT : mm
FIG : 2 – 7



DRW	: SITE LAYOUT
SITE	: NAGARKOT (NKT)
SCALE:	1:200
UNIT	: mm
FIG	: 2 – 8

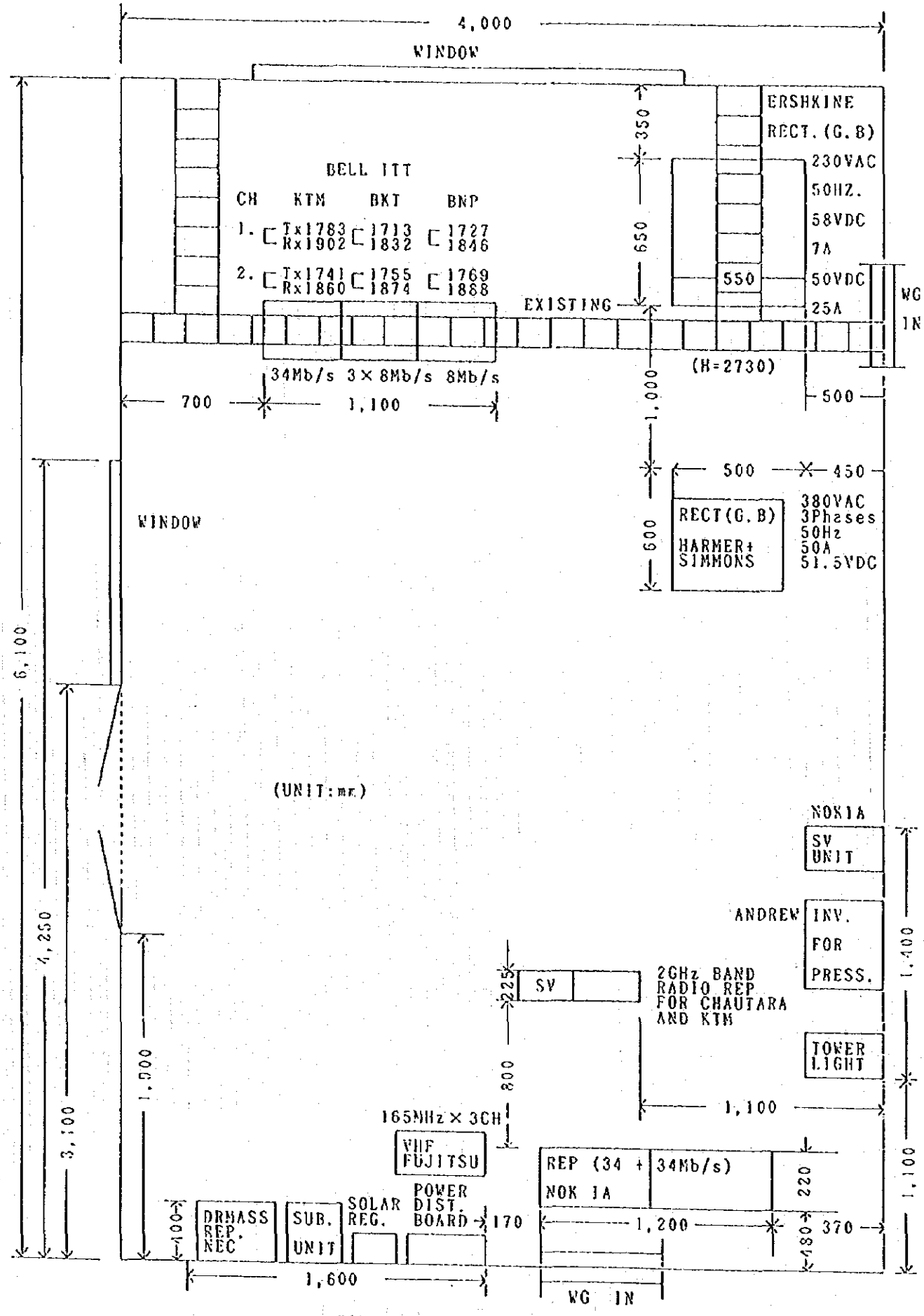
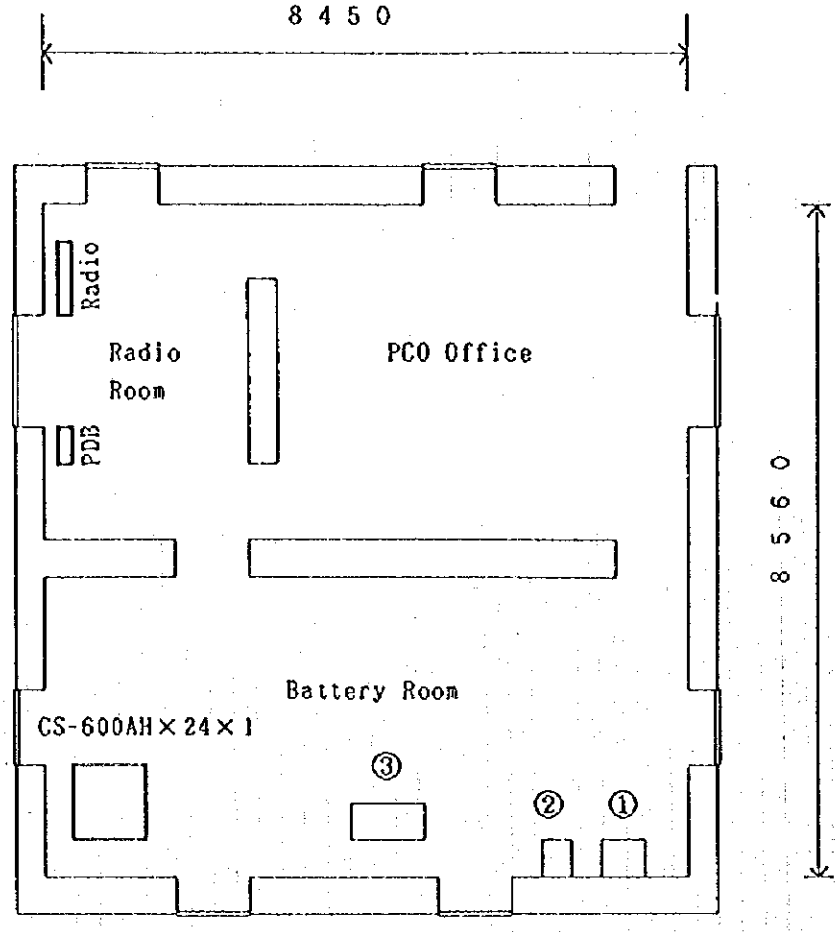


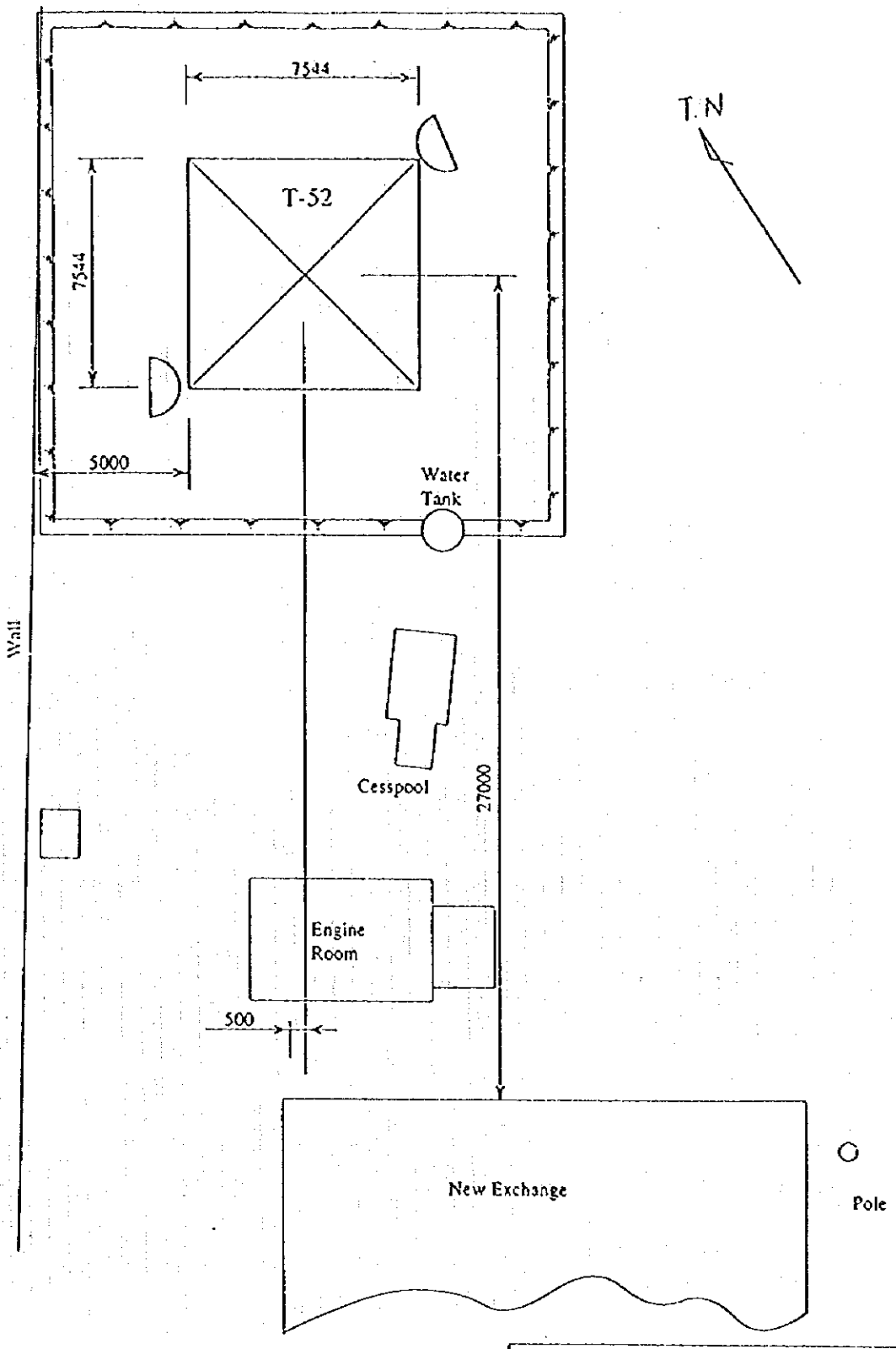
Fig. 2 – 9 EQUIPMENT LAYOUT PLAN FOR NAGARKOT REPEATER STATION



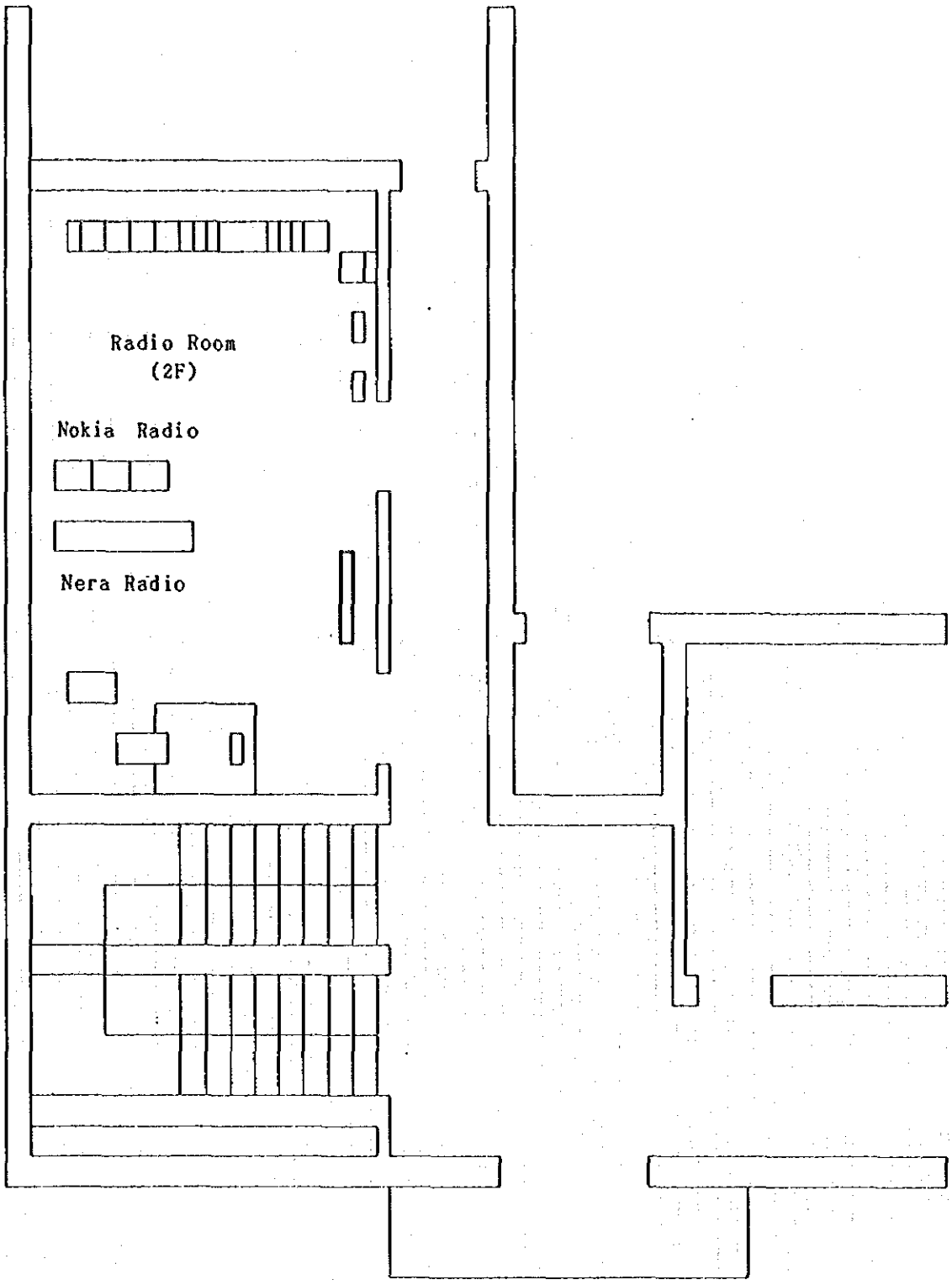
Existing Equipment

① Sel Alcatel TDMA (T/R)
② Charge Control 400W
③ Battery 660 AH/10h

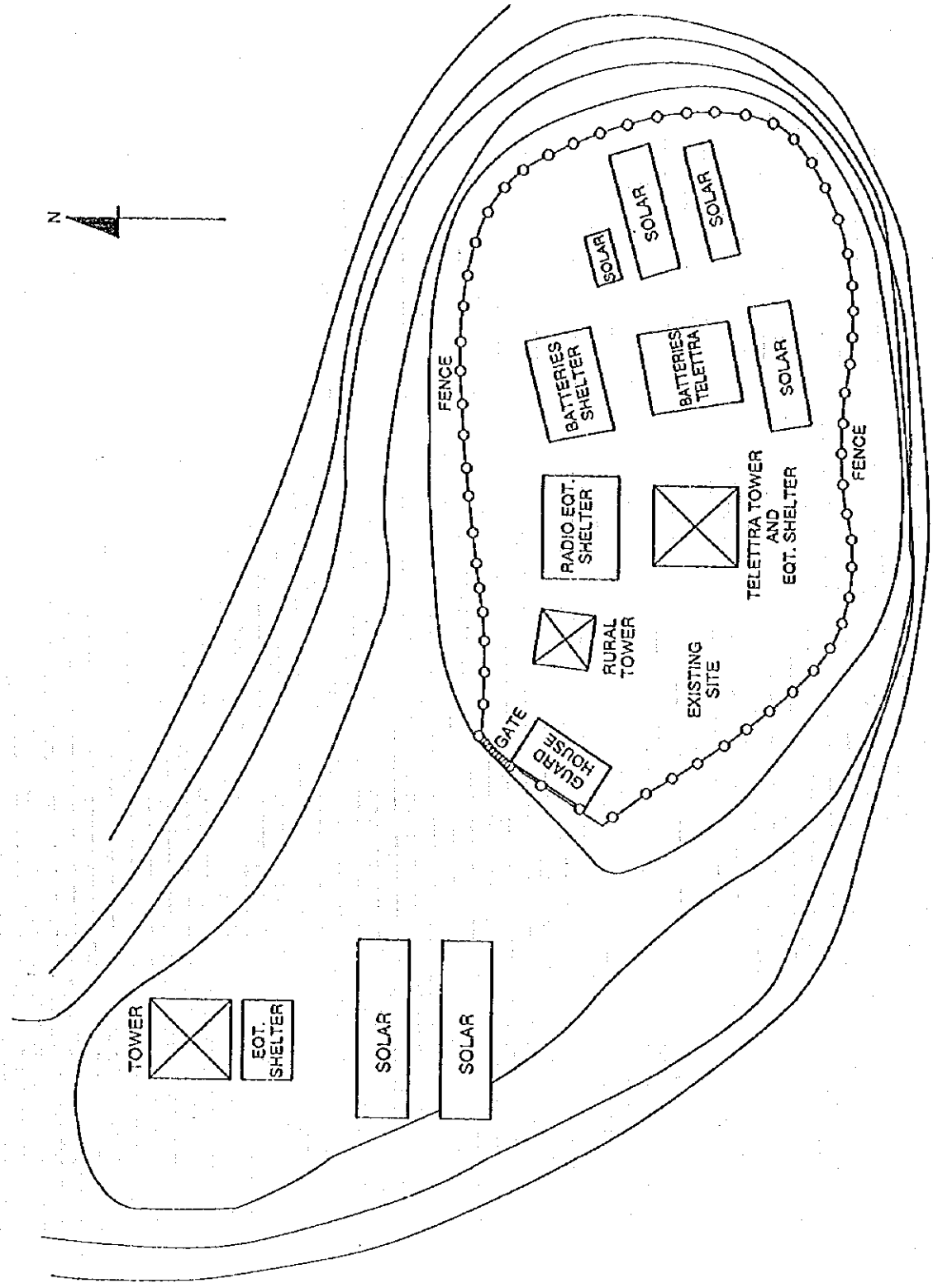
DRW : FLOOR LAYOUT
SITE : CHAUTARA (CTR)
SCALE: 1:100
UNIT : mm
FIG : 2 – 1 0



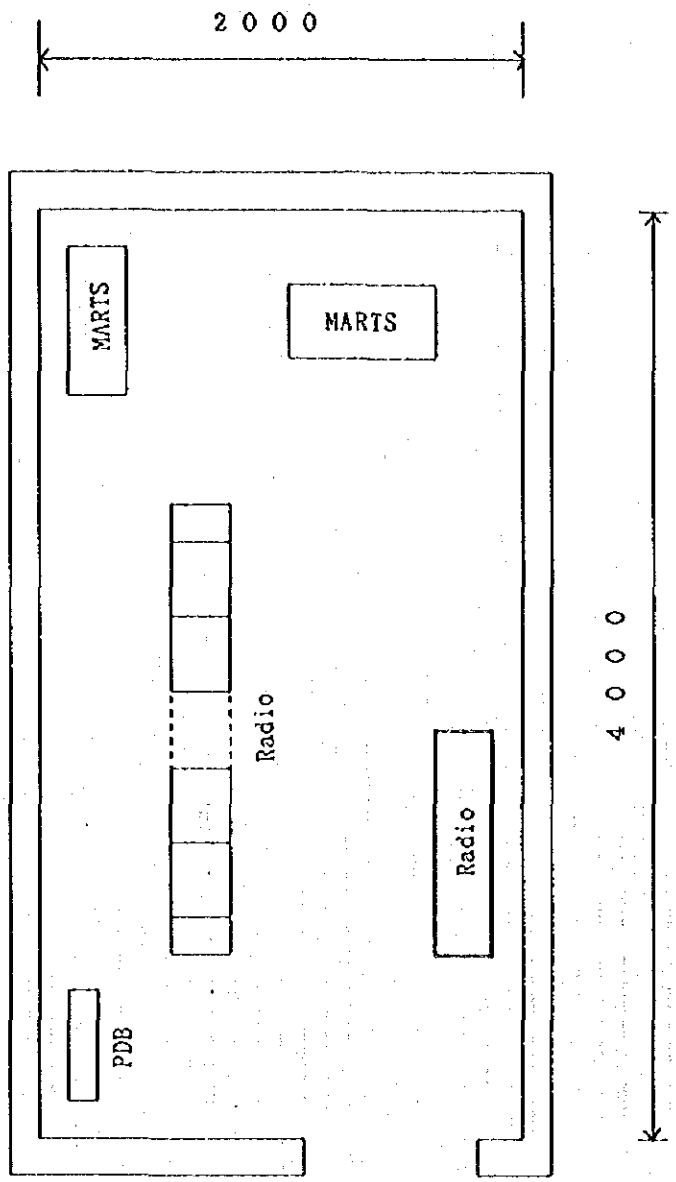
DRW : SITE LAYOUT	
SITE : NEPALGUNJ (NGJ)	
SCALE:	
UNIT : mm	
FIG : 2 – 1 1	



DRW : FLOOR LAYOUT
SITE : NEPALGUNJ (NGJ)
SCALE: 1:100
UNIT : mm
FIG : 2－12

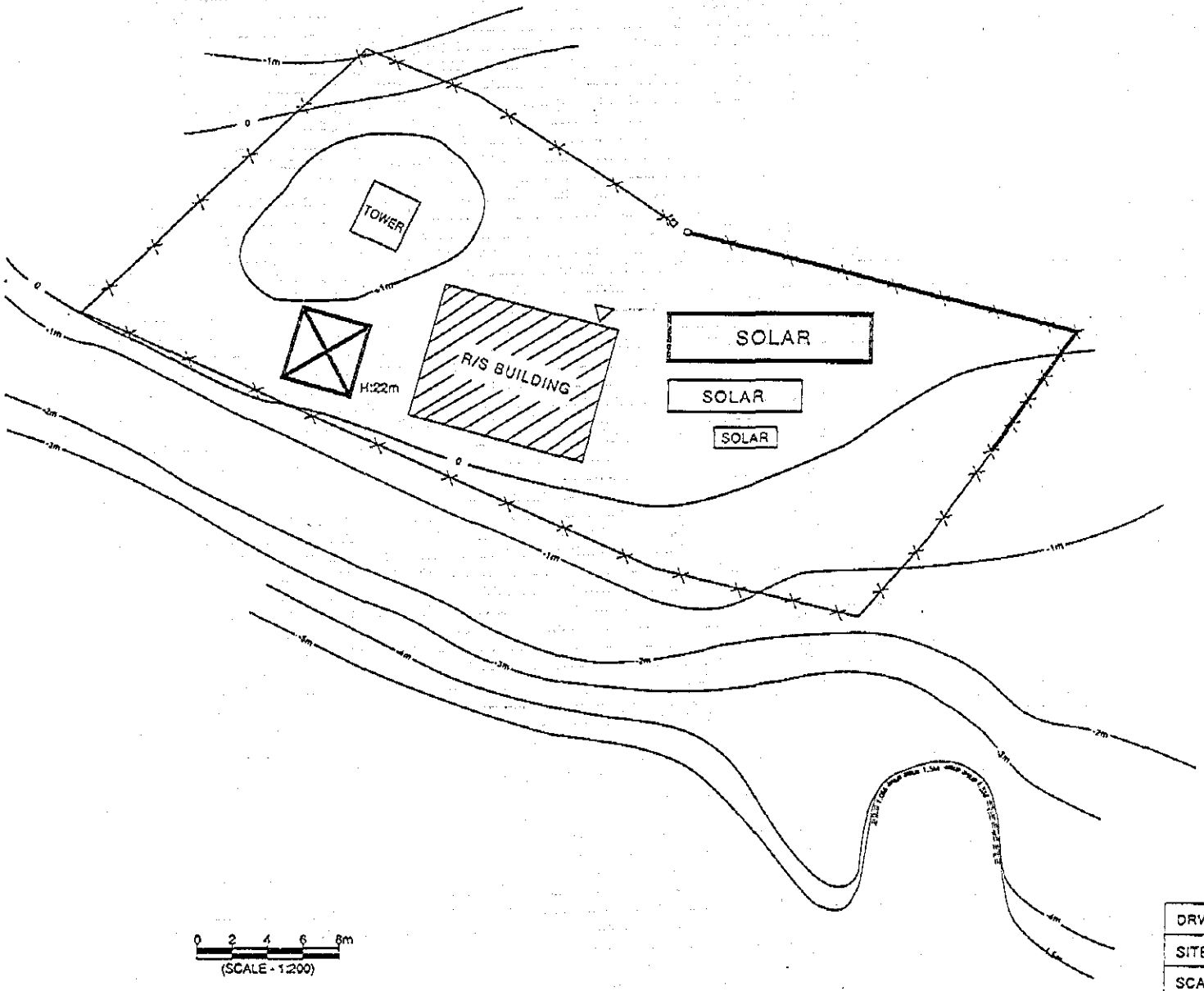


DRW	:	SITE LAYOUT
SITE	:	RAJAKOT (RKT)
SCALE	:	1 : 200 .
FIG	:	2 – 1 3

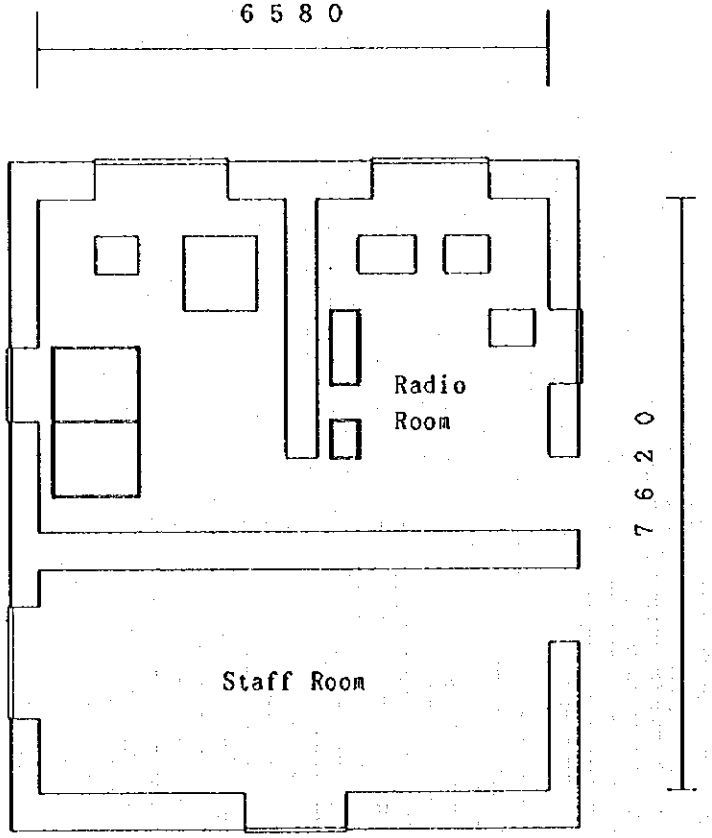


Radio Equipment Shelter

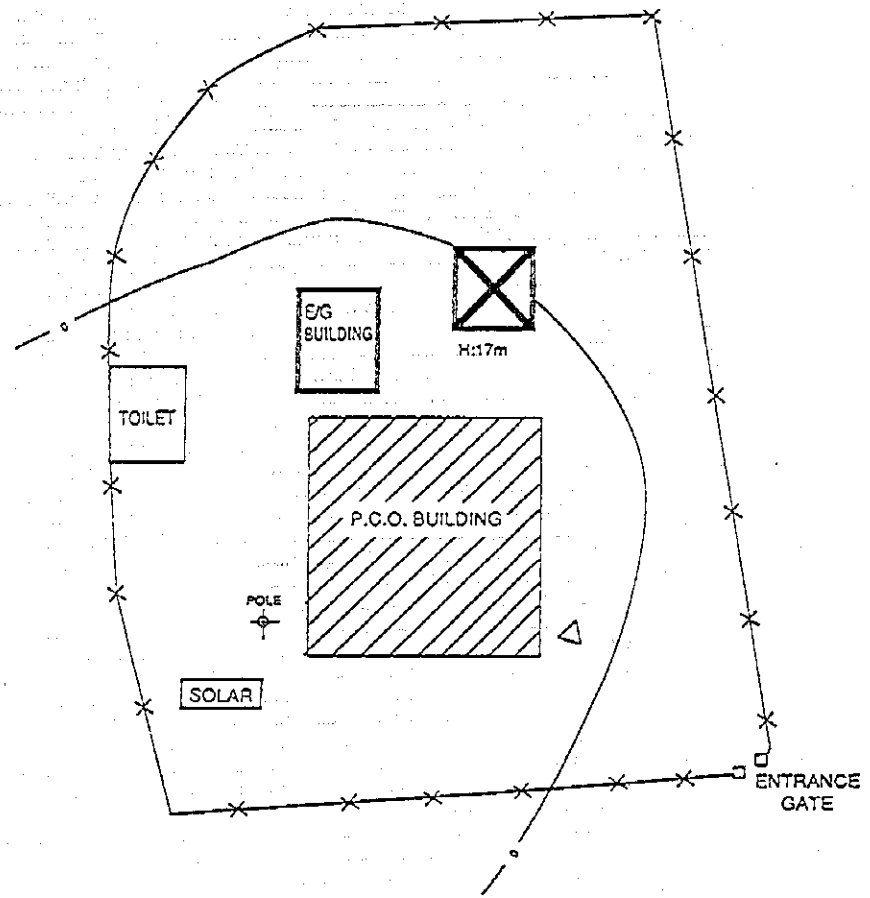
DRW : FLOOR LAYOUT
SITE : RAJHAKOT (RKT)
SCALE: 1:30
UNIT : mm
FIG : 2 - 1 4

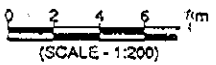


DRW	:	SITE LAYOUT
SITE	:	SWALGADWARI (SGW)
SCALE	:	1 : 200
FIG	:	2 – 1 5

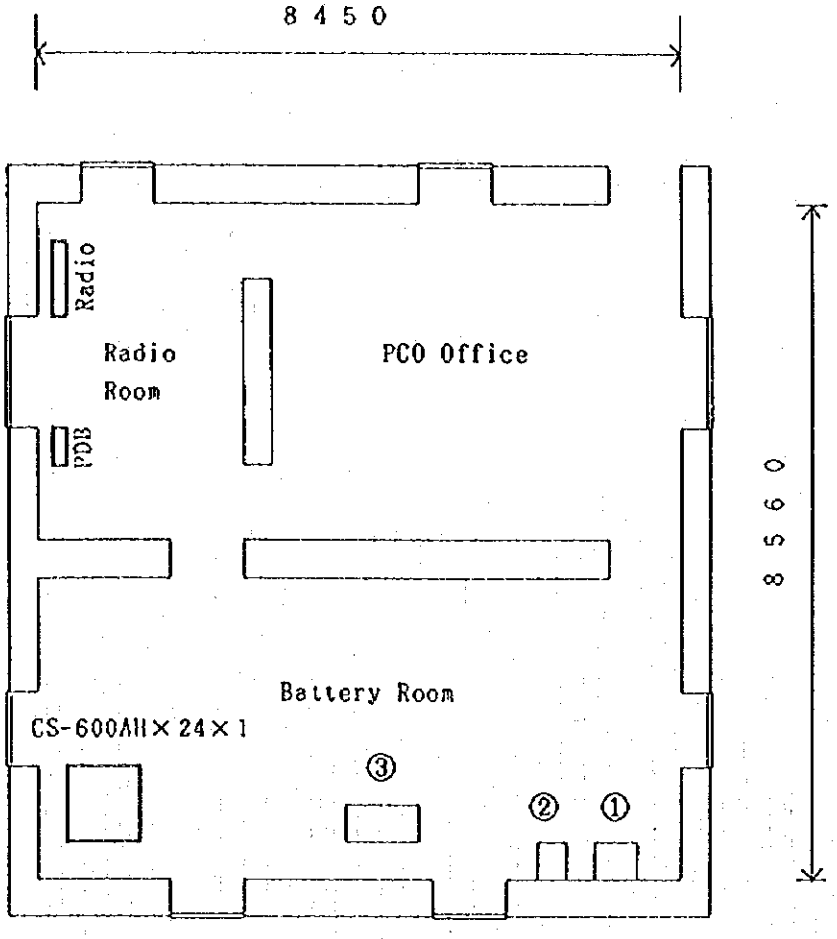


DRW	: FLOOR LAYOUT
SITE	: SWALGADWARI (SGW)
SCALE:	1:100
UNIT	: mm
FIG	: 2 – 16





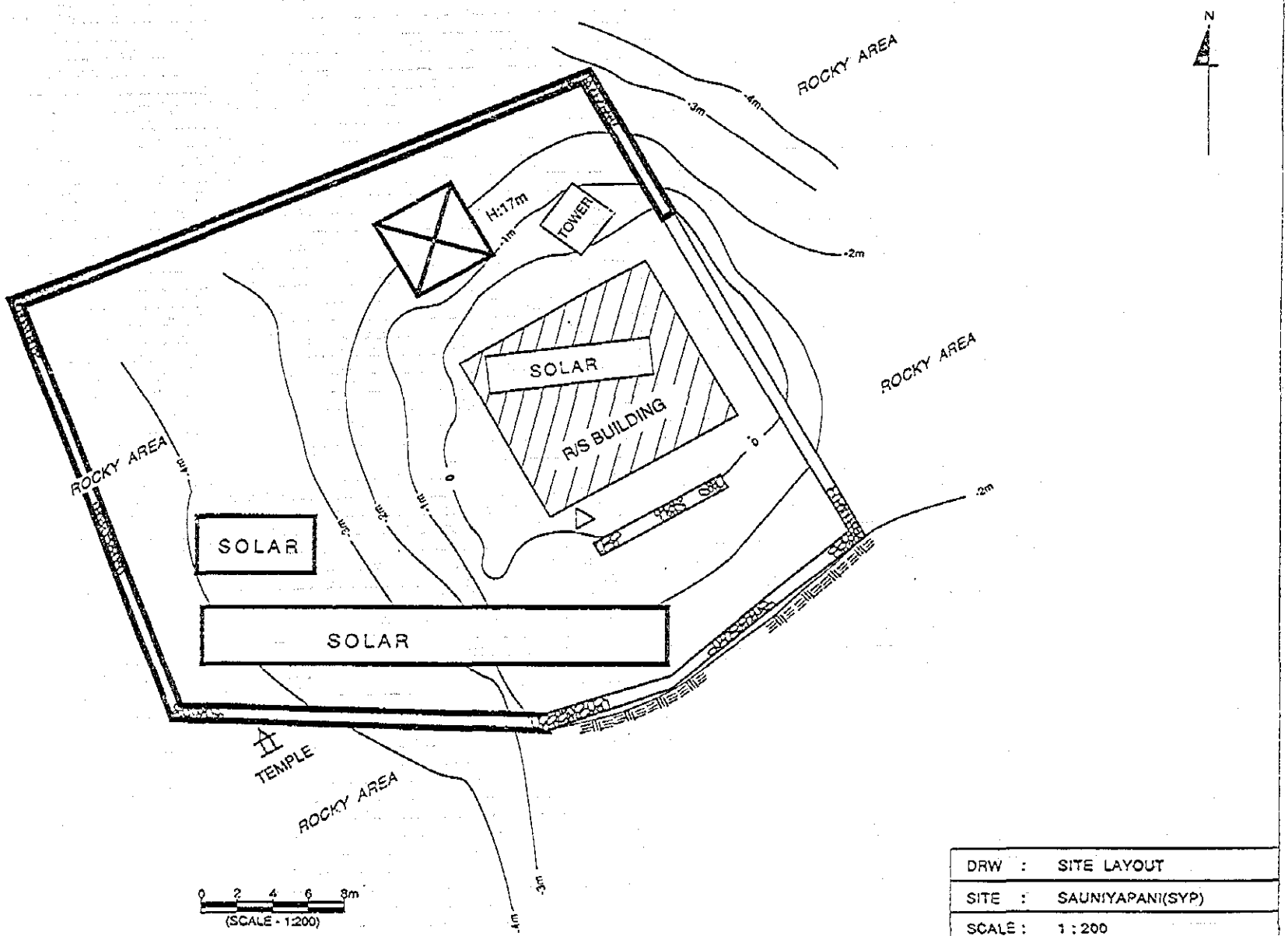
DRW	:	SITE LAYOUT
SITE	:	PYUTHAN(PYN)
SCALE	:	1 : 200
FIG	:	2 – 1 7

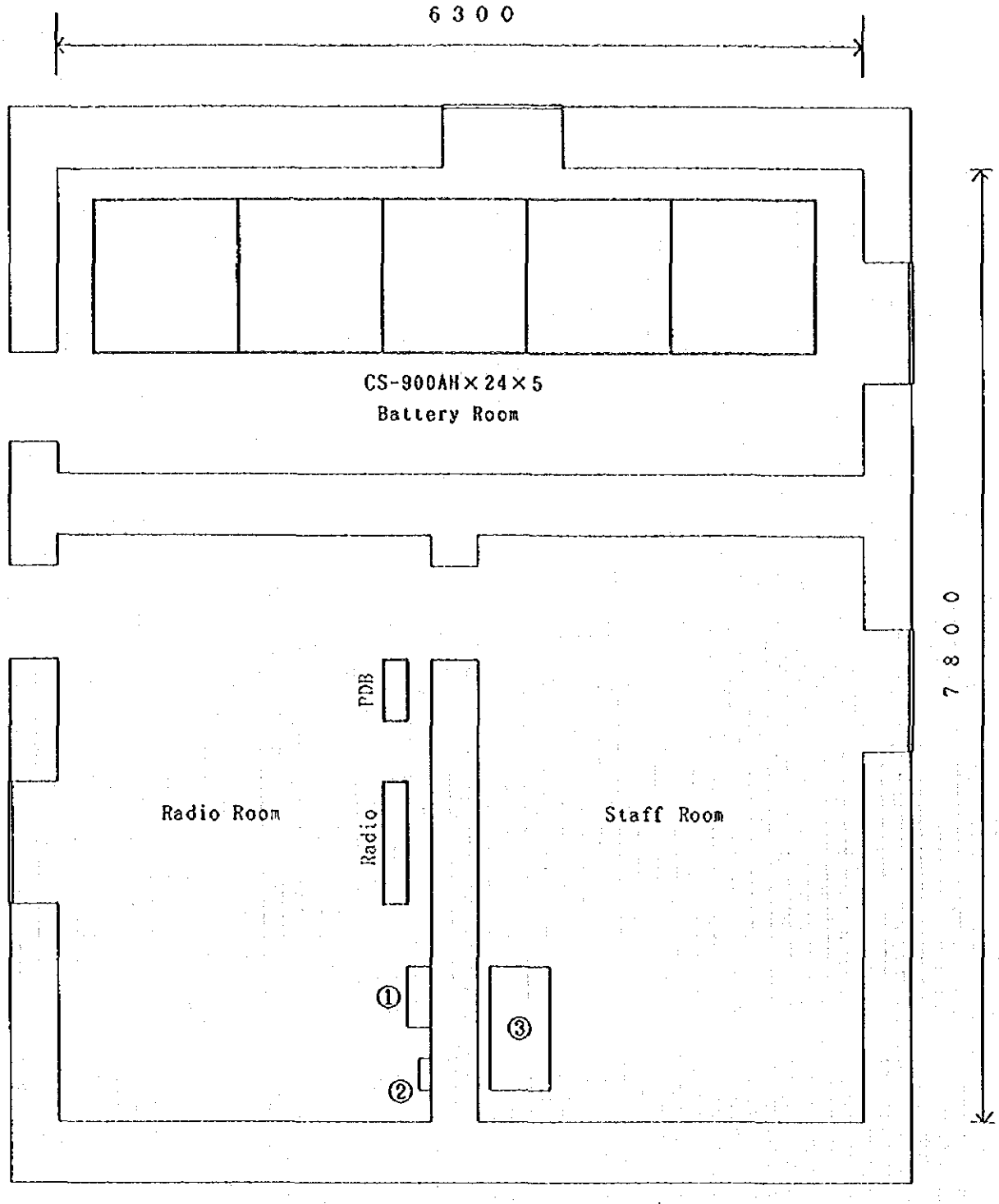


Existing Equipment

① Sel Alcatel TDMA (T/R)
② Charge Control 400W
③ Battery 660 AH/10h

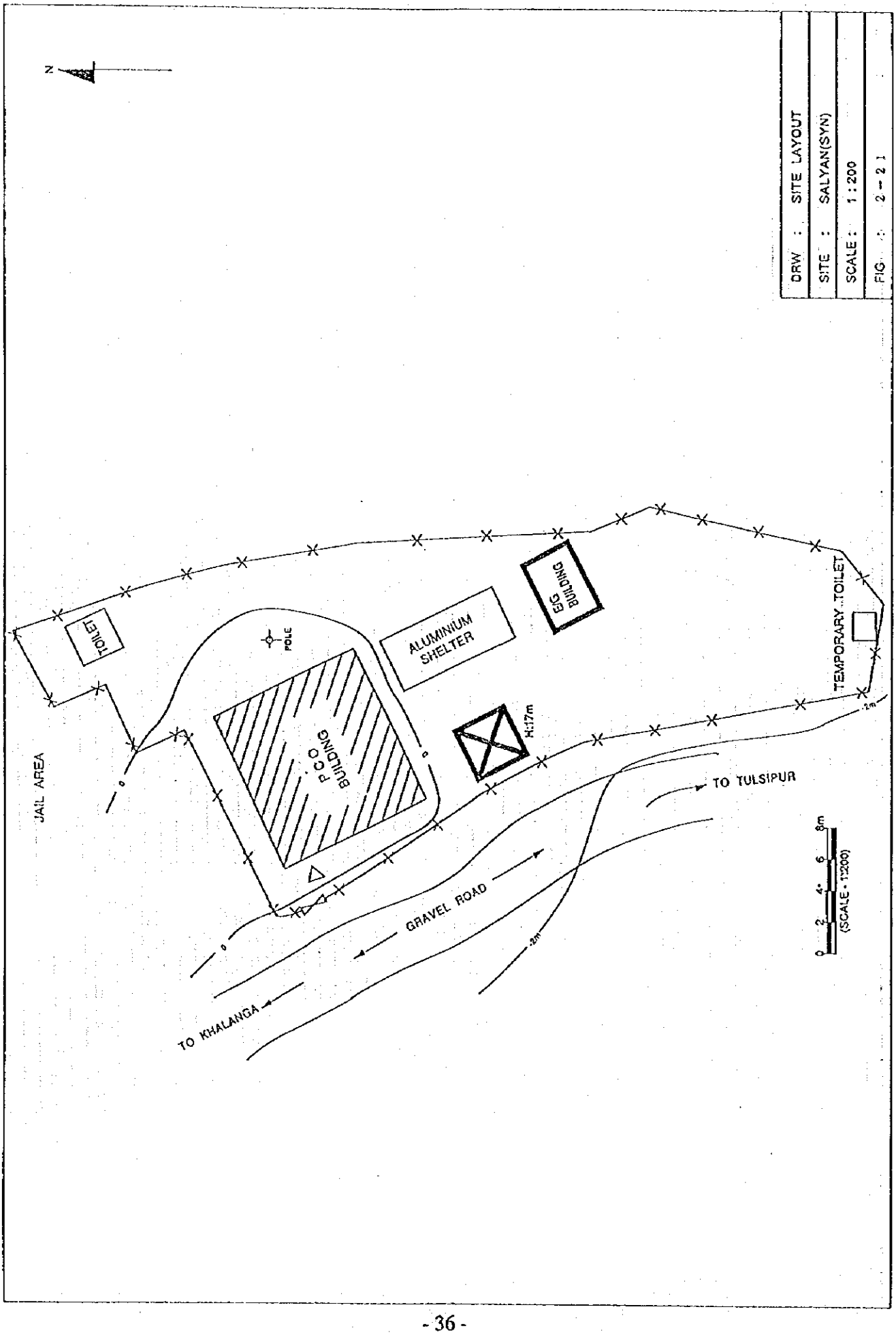
DRW : FLOOR LAYOUT
SITE : PYUTHAN (PYN)
SCALE: 1:100
UNIT : mm
FIG : 2 – 1 8

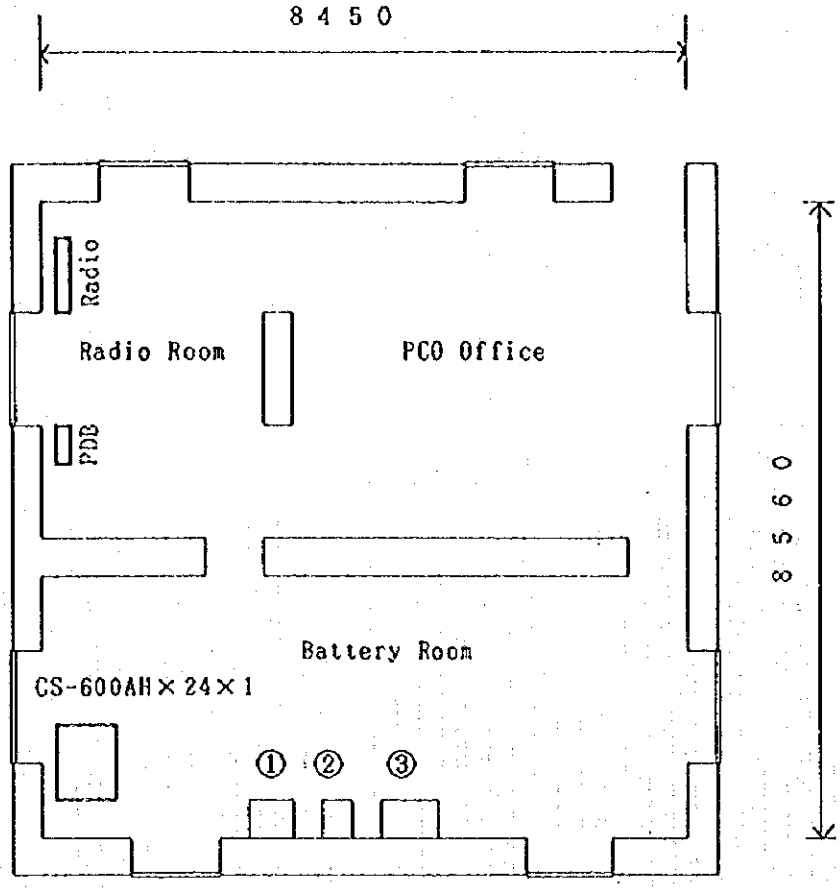

N
ROCKY AREA
ROCKY AREA
ROCKY AREA
ROCKY AREA
H:17m
TOWER
SOLAR
R/S BUILDING
SOLAR
SOLAR
TEMPLE
3m
4m
2m
1m
0
0 2 4 6 8m
(SCALE - 1:200)
DRW : SITE LAYOUT
SITE : SAUNIYAPANI(SYP)
SCALE : 1 : 200
FIG : 2 - 1 9



Existing Equipment
① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : SAUNIYAPANI (SYP)
SCALE: 1:50
UNIT : mm
FIG : 2 - 2 0

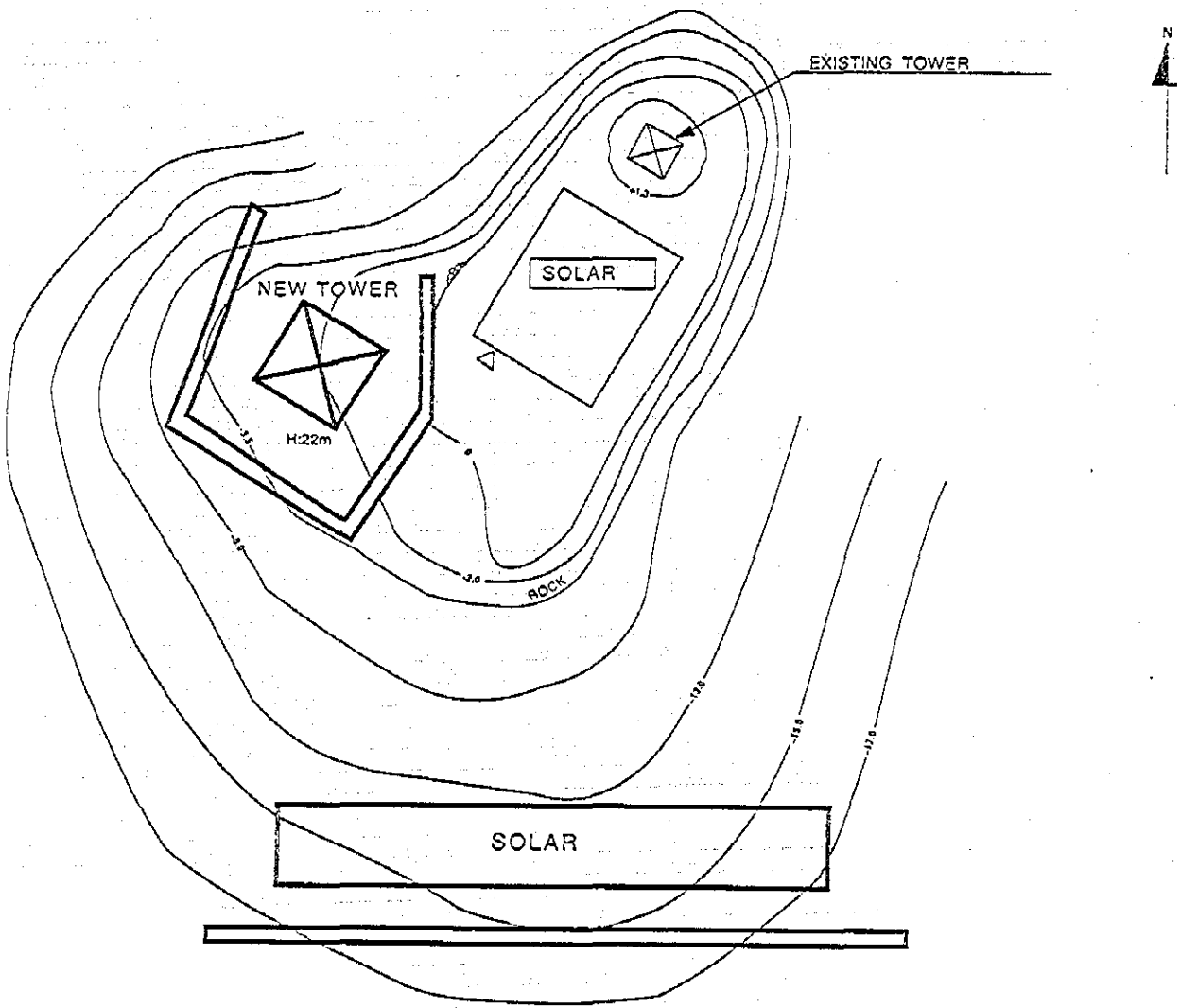

N
DRW : SITE LAYOUT
SITE : SALYAN(SYN)
SCALE : 1:200
FIG : 2 - 2 1
TOILET
POLE
ALUMINIUM SHELTER
BIG BUILDING
TEMPORARY TOILET
P.C.O BUILDING
H:17m
JAIL AREA
TO TULSIPUR
GRAVEL ROAD
TO KHALANGA
0 2 4 6 8m
(SCALE - 1:200)



Existing Equipment

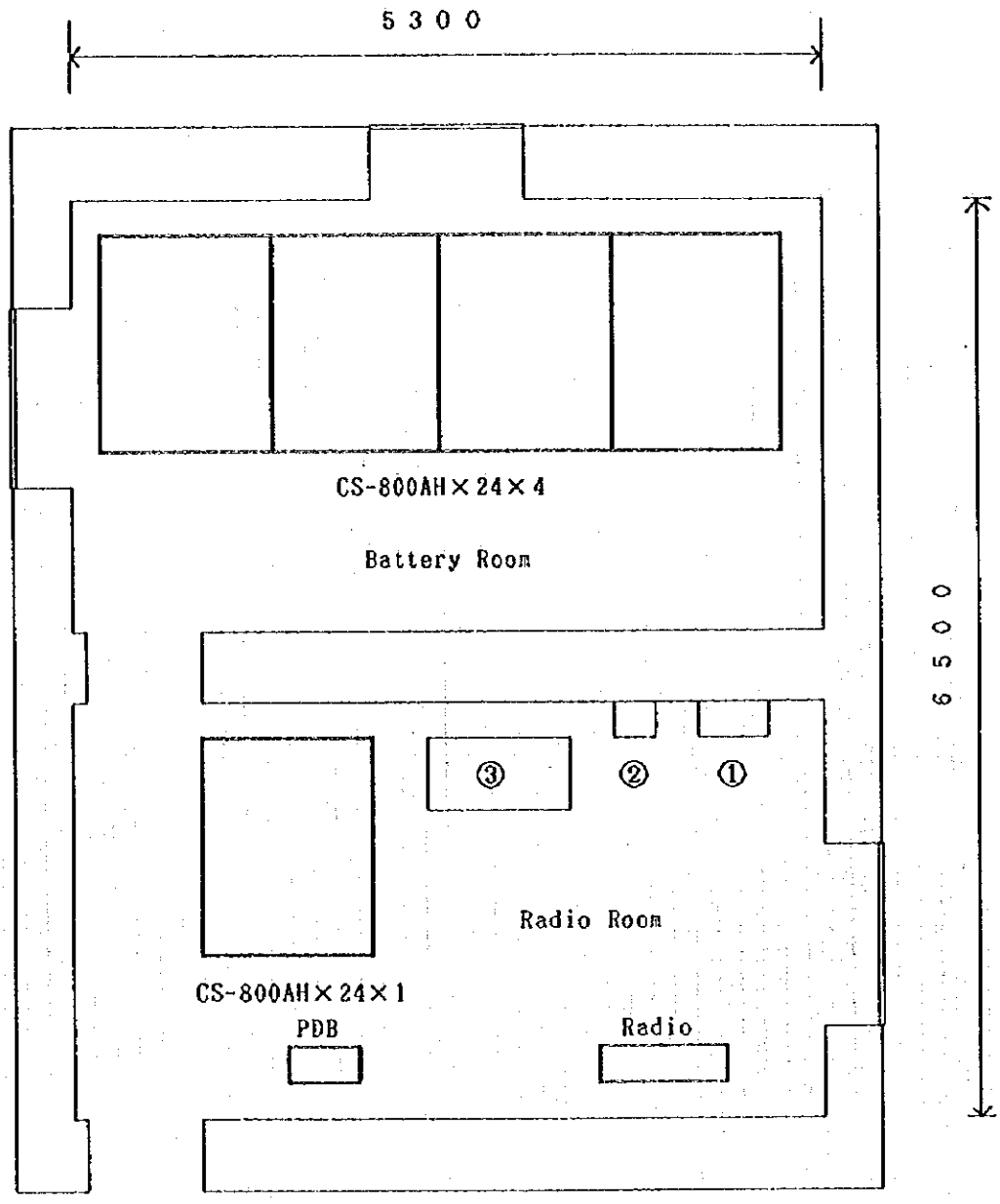
① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : SALYAN (SYN)
SCALE: 1:100
UNIT : mm
FIG : 2－22



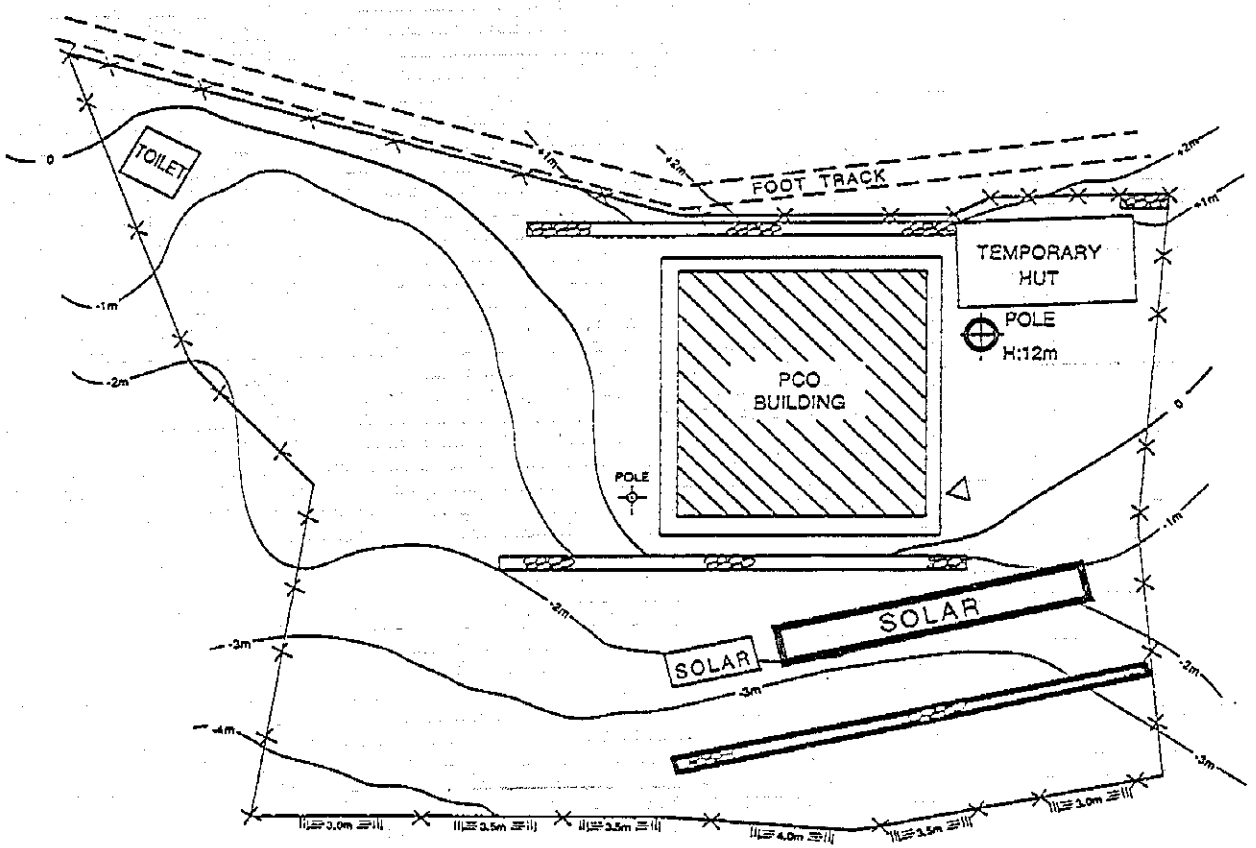
0 4 8 12 16m
(SCALE - 1:200)

DRW	:	SITE LAYOUT
SITE	:	RATAMATTA (RMT)
SCALE	:	1 : 200
FIG	:	2 – 2 3



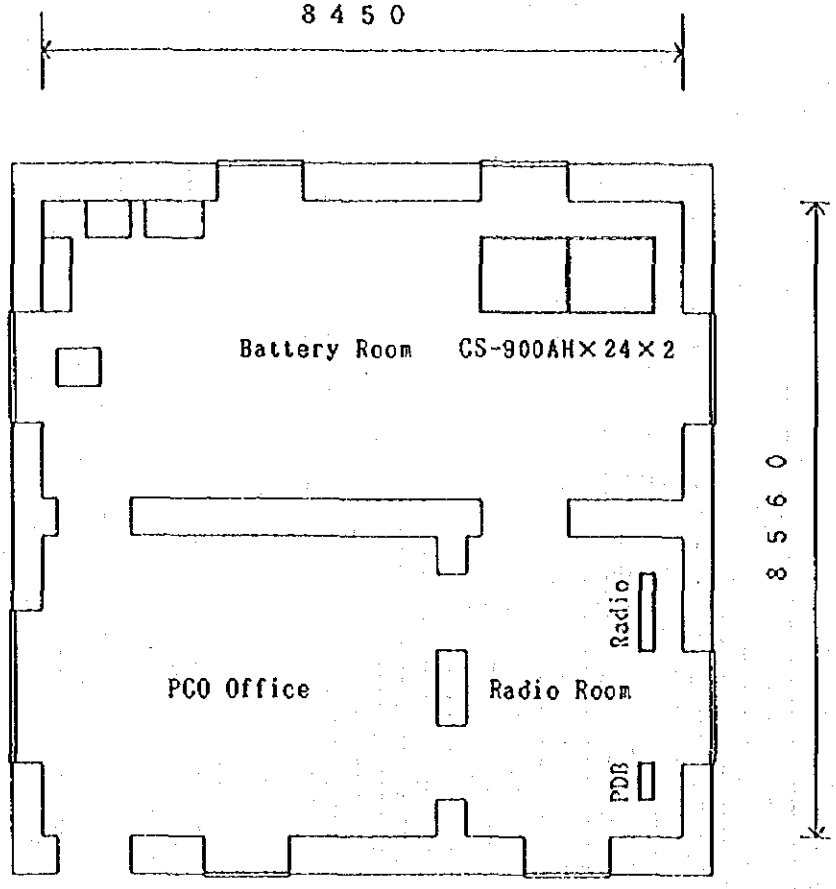
Existing Equipment
① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : RATAMATTA (RMT)
SCALE: 1:50
UNIT : mm
FIG : 2 - 2 4

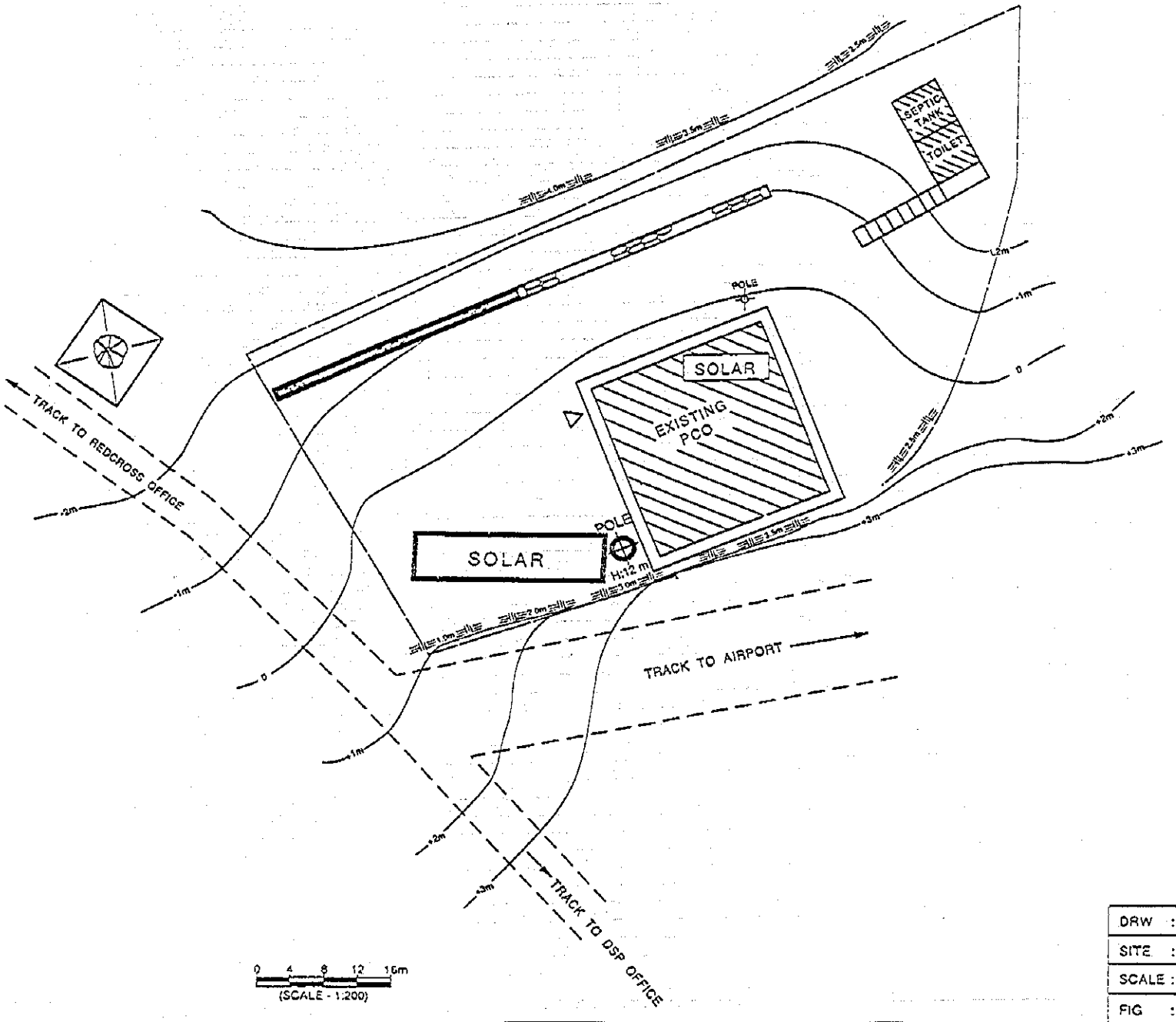


0 2 4 6 8m
(SCALE - 1:200)

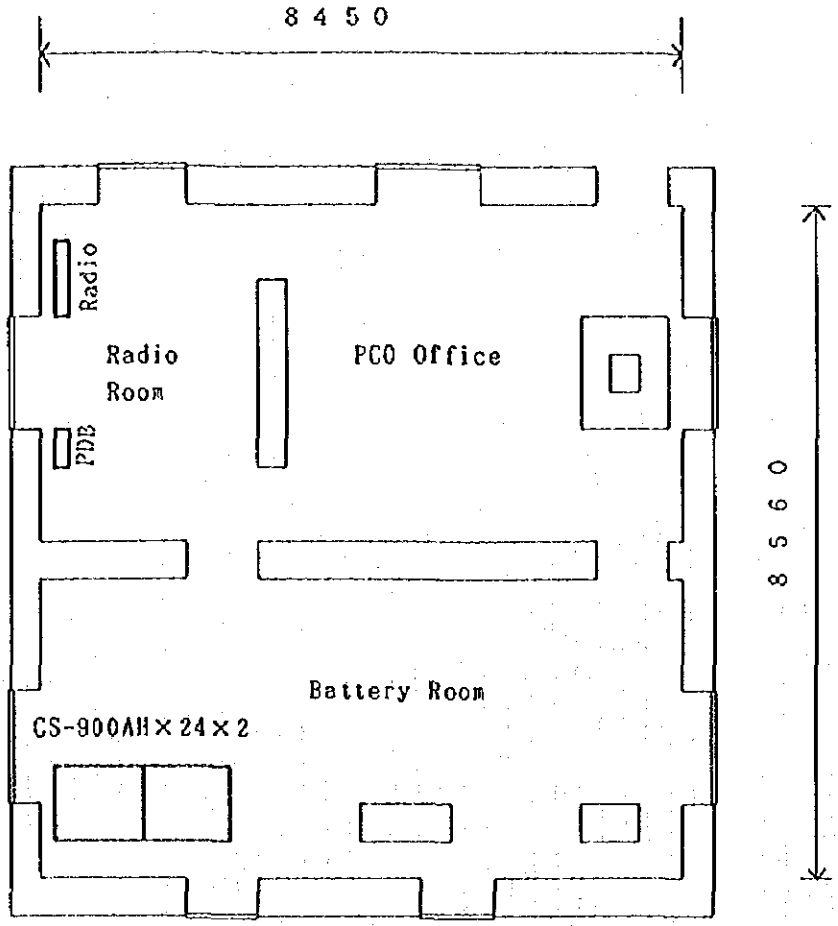
DRW	:	SITE LAYOUT
SITE	:	JAJARKOT(JKT)
SCALE	:	1 : 200
FIG	:	2 – 2 5



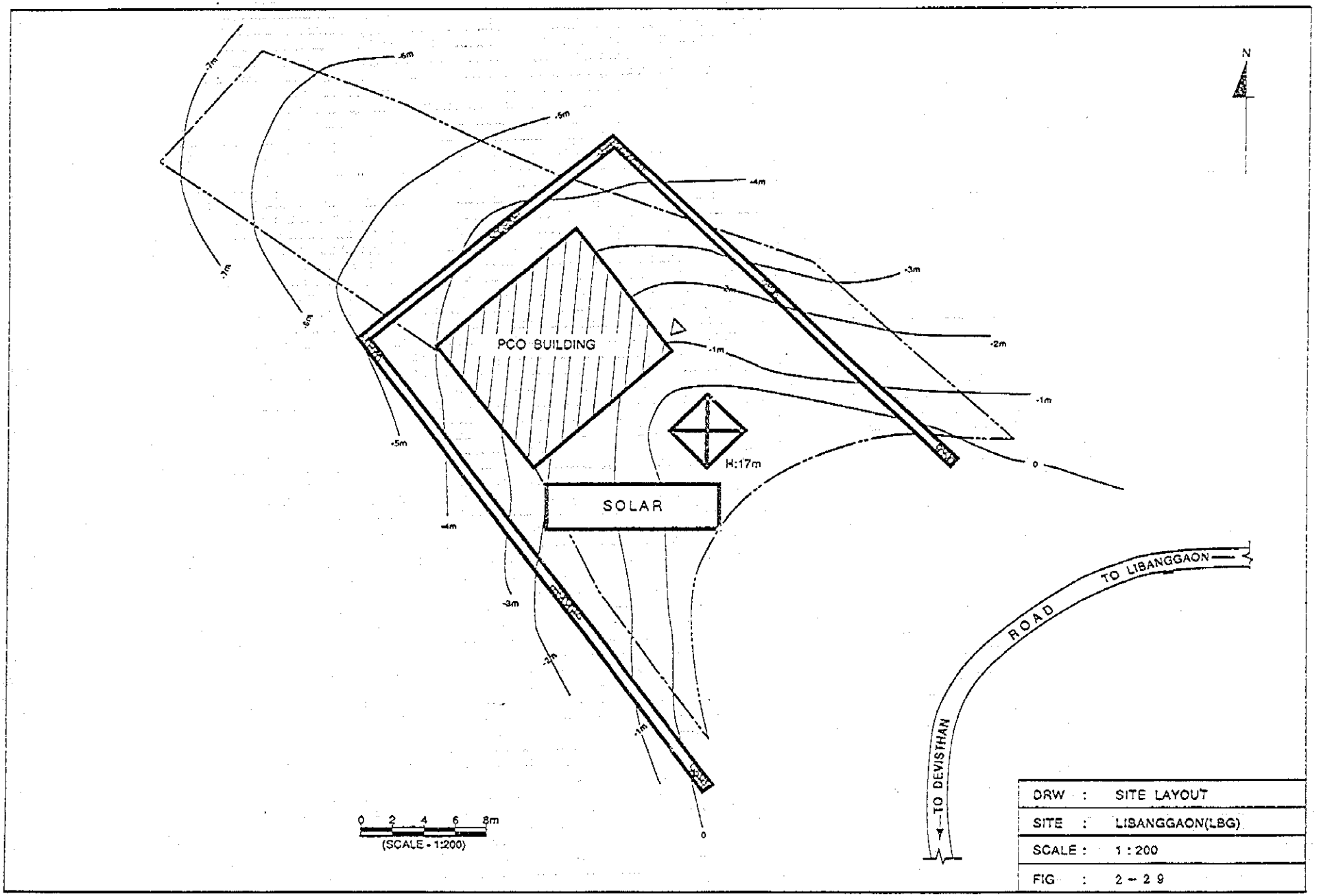
DRW : FLOOR LAYOUT
SITE : JAJARKOT (JKT)
SCALE: 1:100
UNIT : mm
FIG : 2 - 2 6

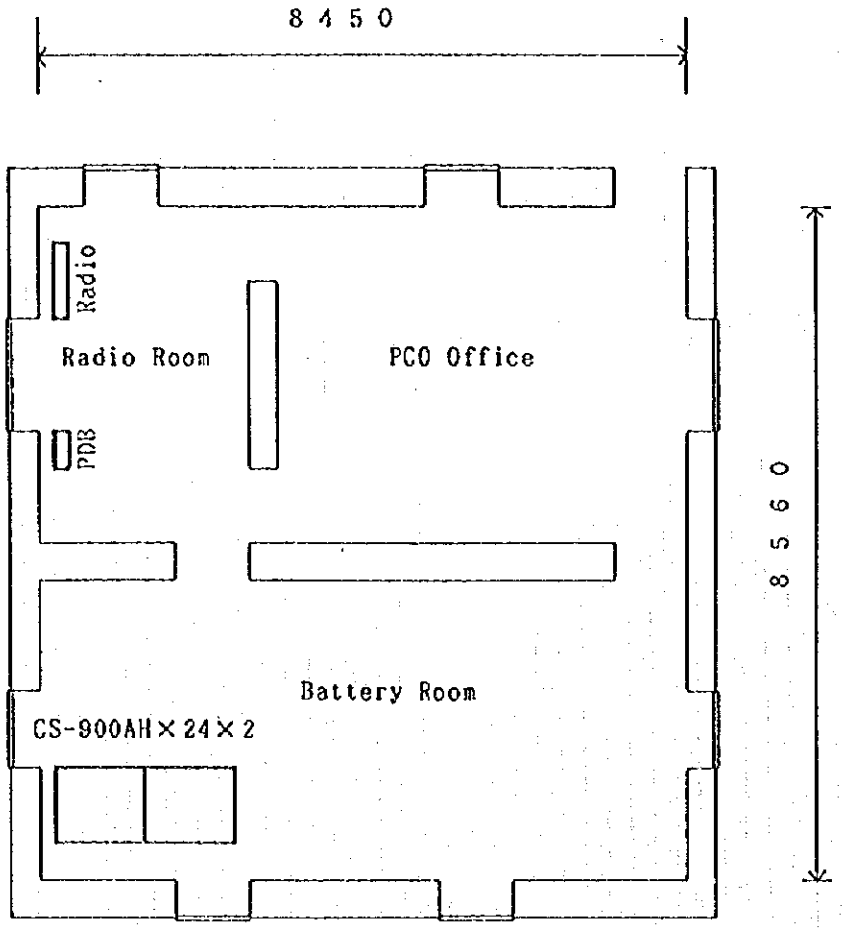


DRW	:	SITE LAYOUT
SITE	:	MUSIKOT(MKT)
SCALE	:	1 : 200
FIG	:	2 – 2 7

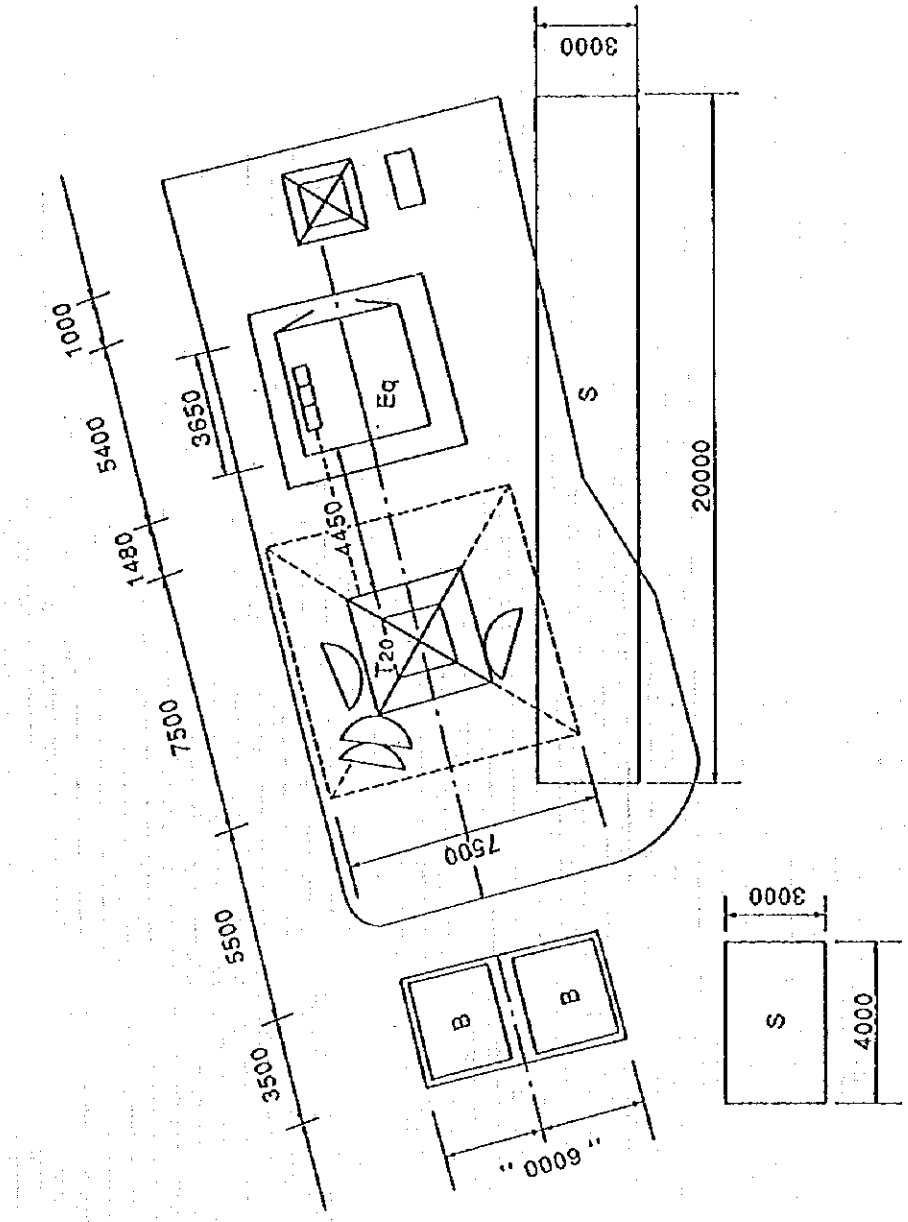


DRW : FLOOR LAYOUT
SITE : MUSIKOT (MKT)
SCALE: 1:100
UNIT : mm
FIG : 2－28

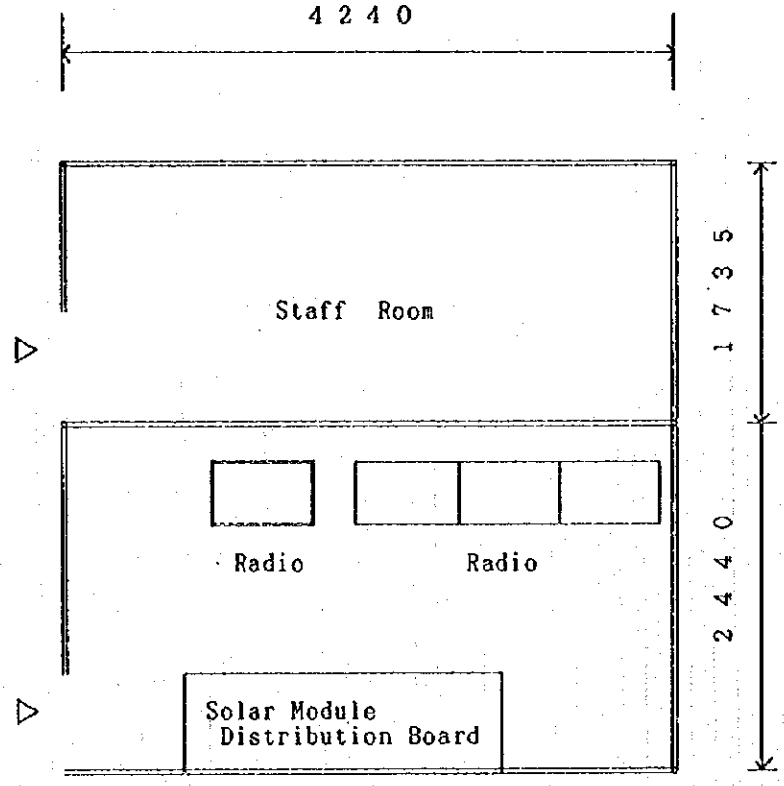

N
PCO BUILDING
SOLAR
H:17m
-7m
-6m
-5m
-4m
-3m
-2m
-1m
0
TO LIBANGGAON
ROAD
TO DEVISTHAN
0 2 4 6 8m
(SCALE - 1:200)
DRW : SITE LAYOUT
SITE : LISANGGAON(LBG)
SCALE : 1 : 200
FIG : 2 - 2 9



DRW : FLOOR LAYOUT
SITE : LIBANGGAON (LBG)
SCALE: 1:100
UNIT : mm
FIG : 2－30

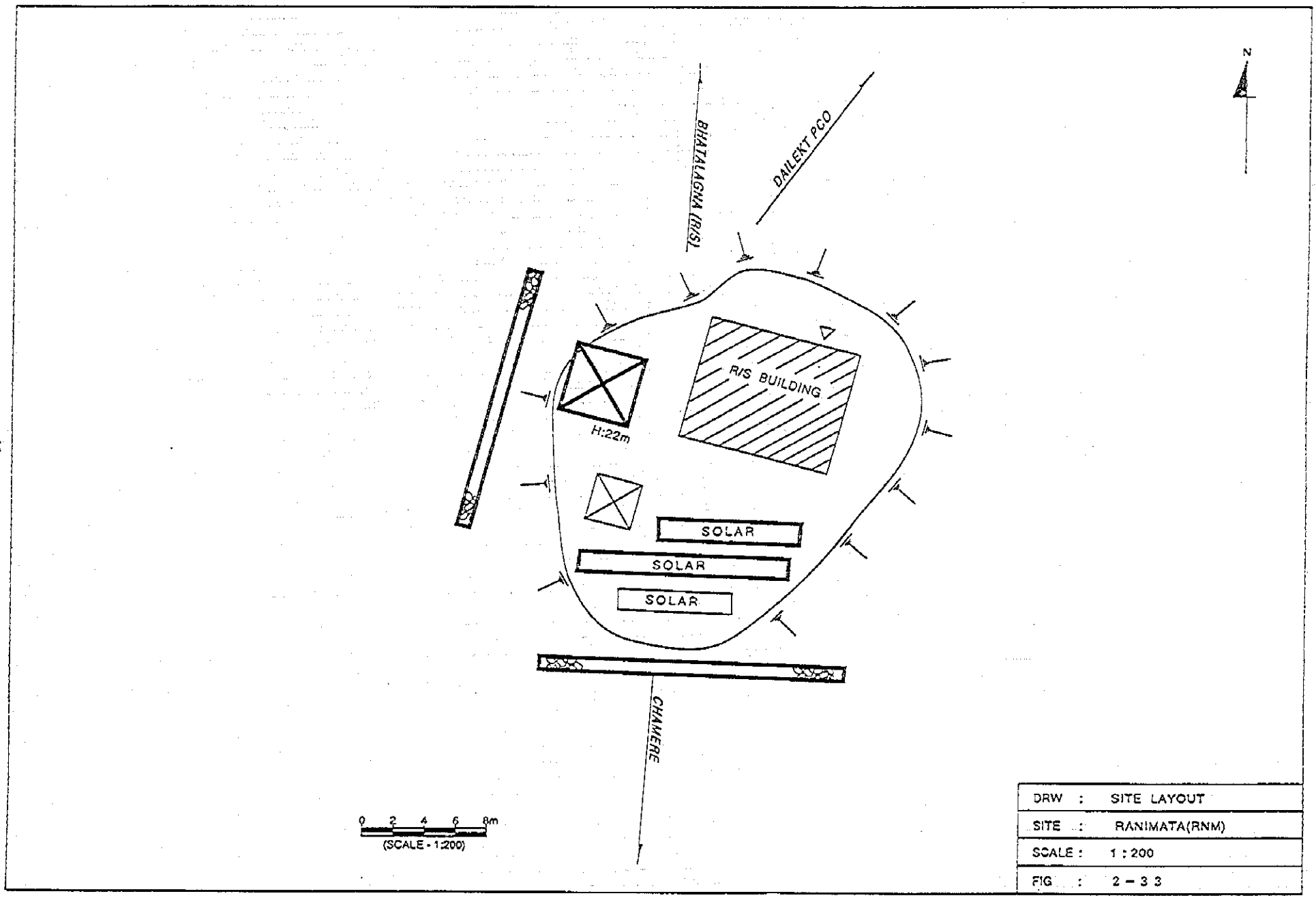


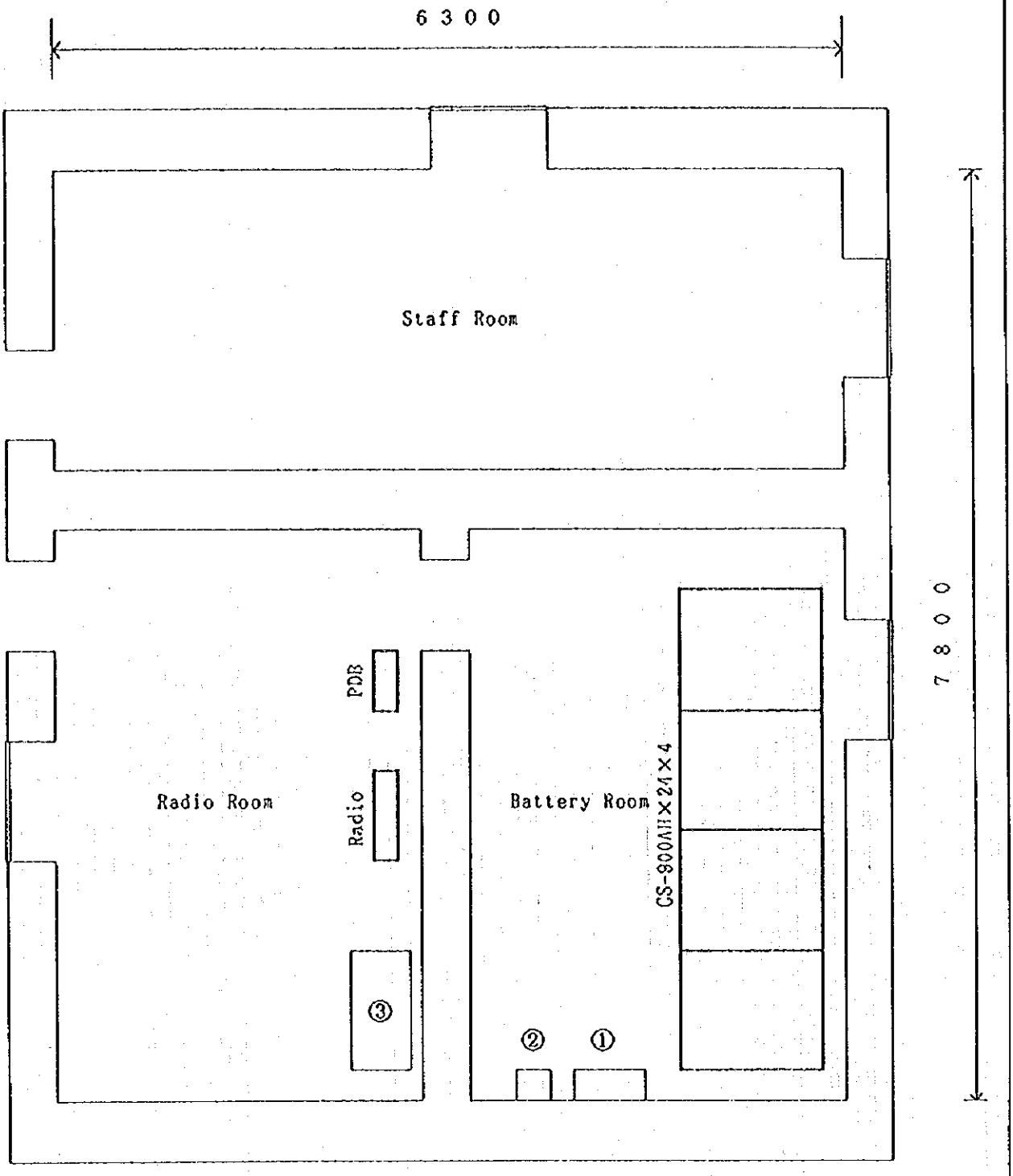
DRW	:	SITE LAYOUT
SITE	:	CHAMERE(CMR)
SCALE	:	1 : 200
FIG	:	2 – 3 1



Radio Equipment Shelter

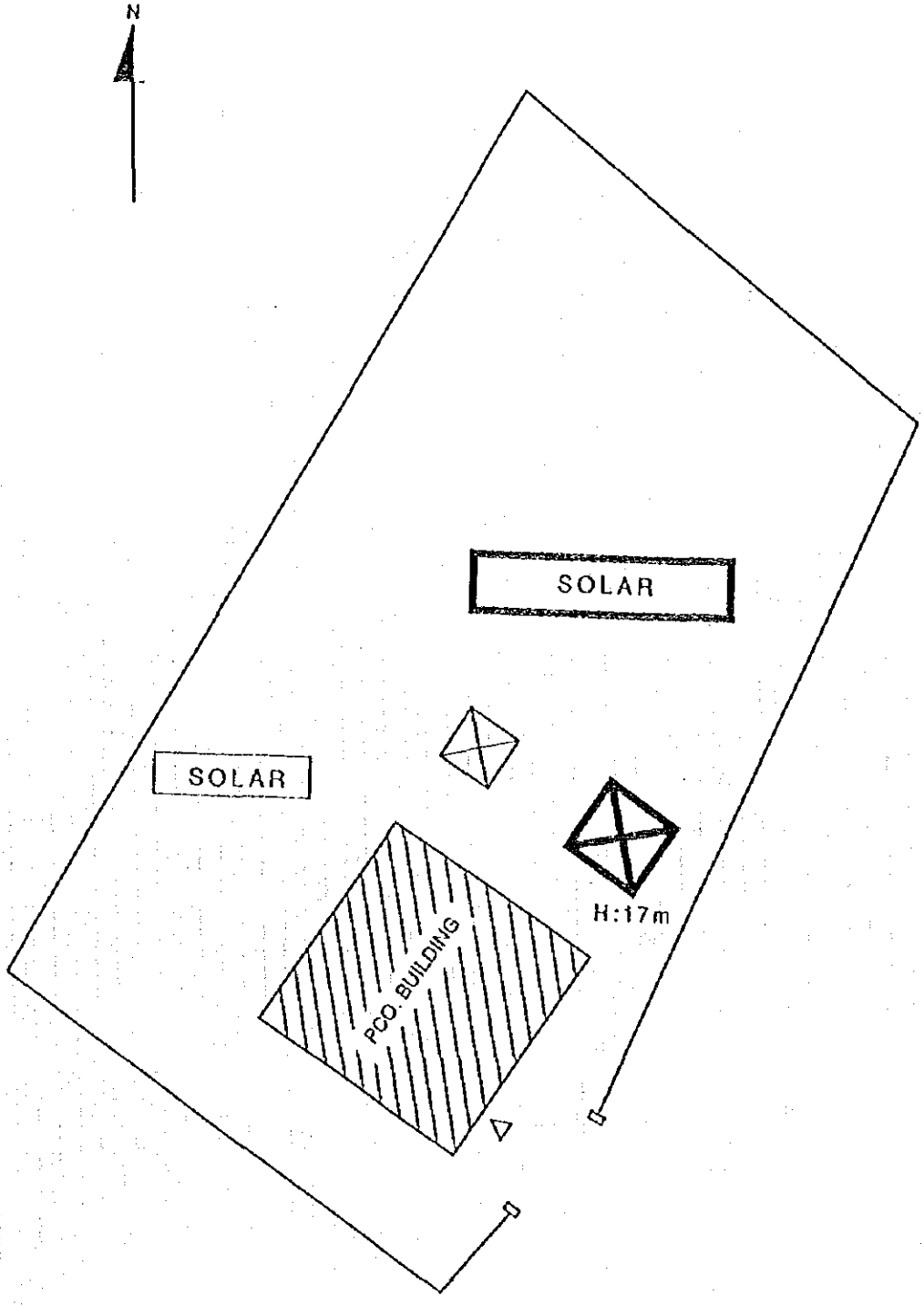
DRW : FLOOR LAYOUT
SITE : CHAMERE (CMR)
SCALE: 1:50
UNIT : mm
FIG : 2 - 3 2


N
BHATALAGMA (R/S)
DAILEKT PCO
R/S BUILDING
H:22m
SOLAR
SOLAR
SOLAR
CHAMHERE
0 2 4 6 8m
(SCALE - 1:200)
DRW : SITE LAYOUT
SITE : RANIMATA(RNM)
SCALE : 1 : 200
FIG : 2 – 3 3



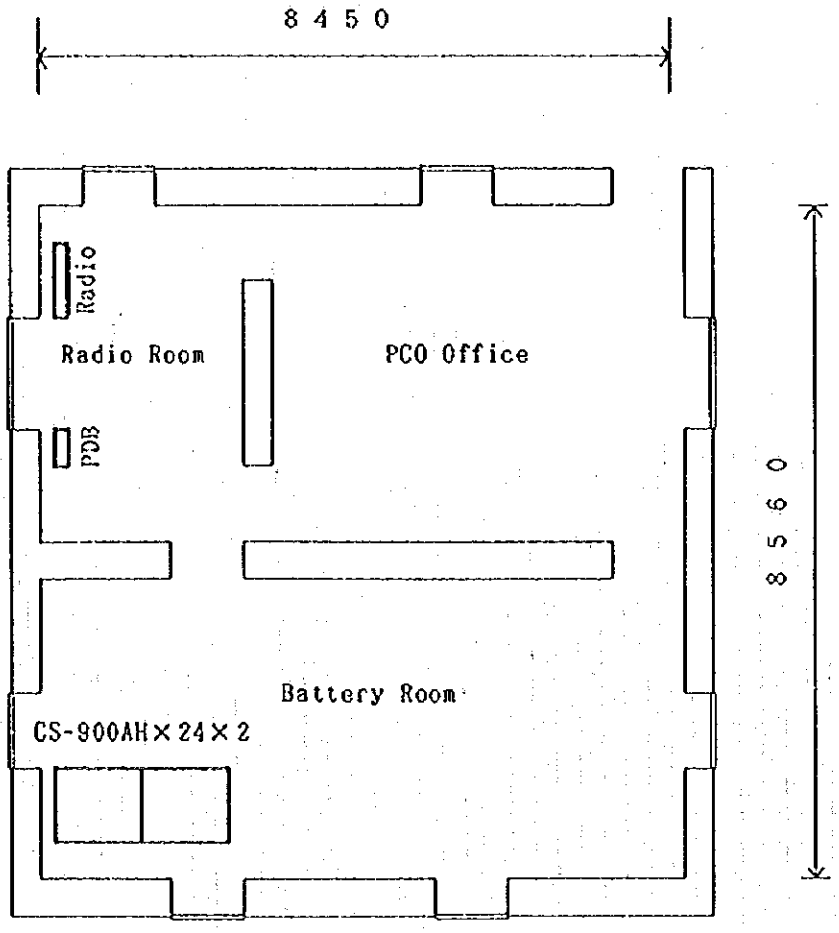
Existing Equipment
① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : RANIMATTA (RNM)
SCALE: 1:50
UNIT : mm
FIG : 2 – 3 4

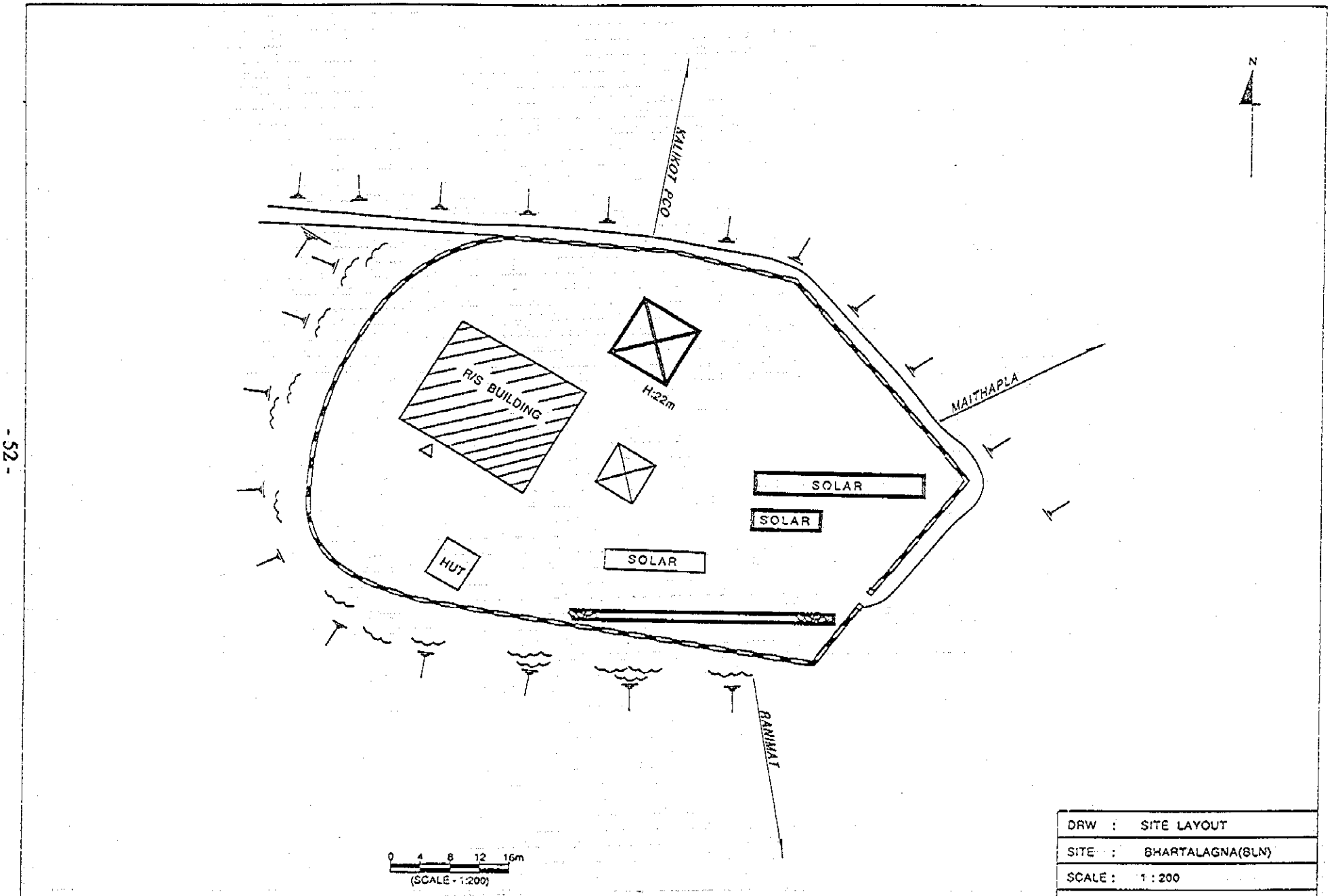


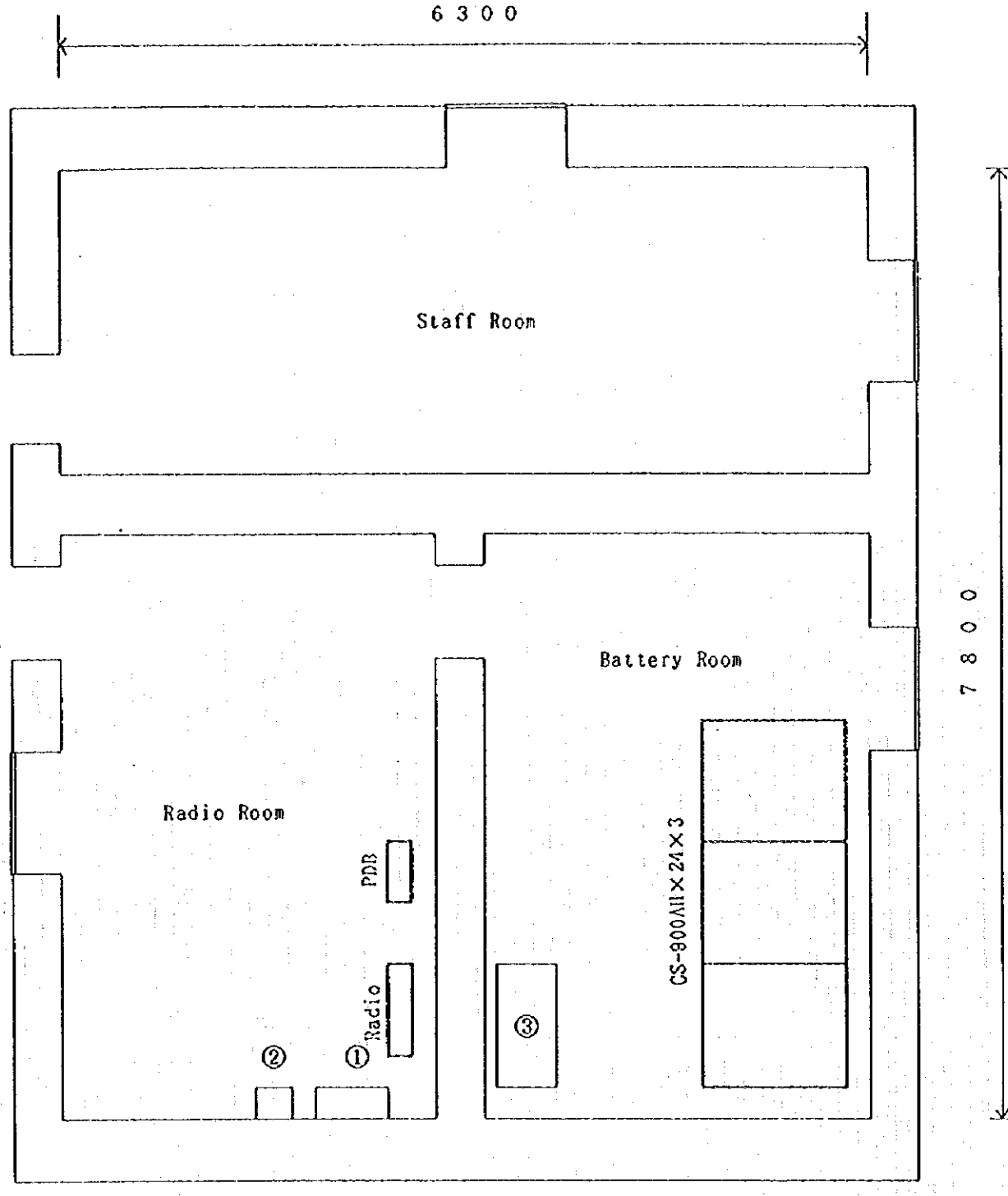
0 2 4 6 8m
(SCALE - 1:200)

DRW :	SITE LAYOUT
SITE :	DAILEKH (DLK)
SCALE :	1 : 200
FIG :	2 – 3 5



DRW : FLOOR LAYOUT
SITE : DAILEKH (DLK)
SCALE: 1:100
UNIT : mm
FIG : 2 – 3 6

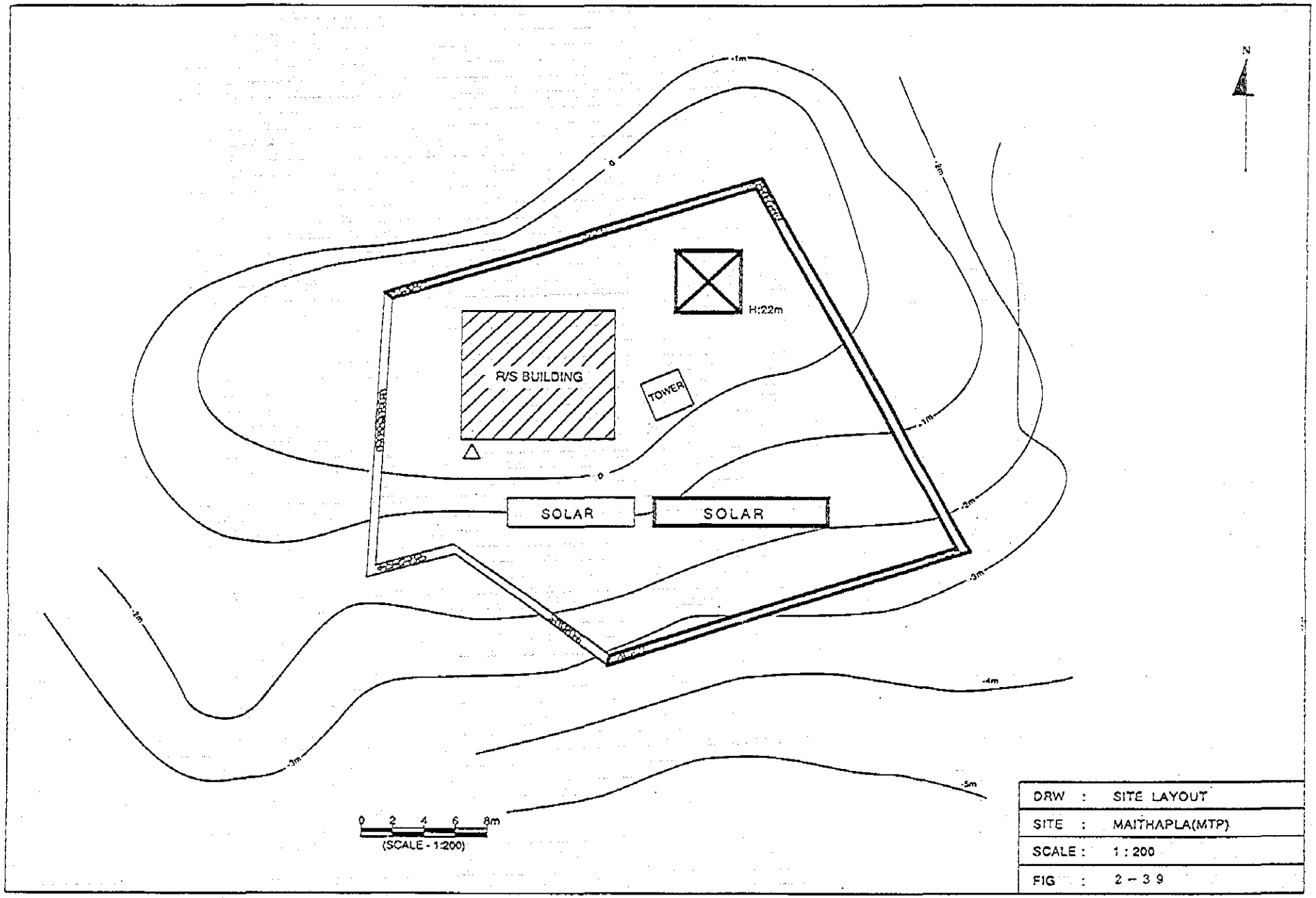

N
KAMKOT PCO
MAITHAPLA
RIS BUILDING
H:22m
SOLAR
SOLAR
SOLAR
HUT
BANIMAT
0 4 8 12 16m
(SCALE - 1:200)
DRW : SITE LAYOUT
SITE : BHARTALAGNA(BLN)
SCALE : 1 : 200
FIG : 2 – 3 7



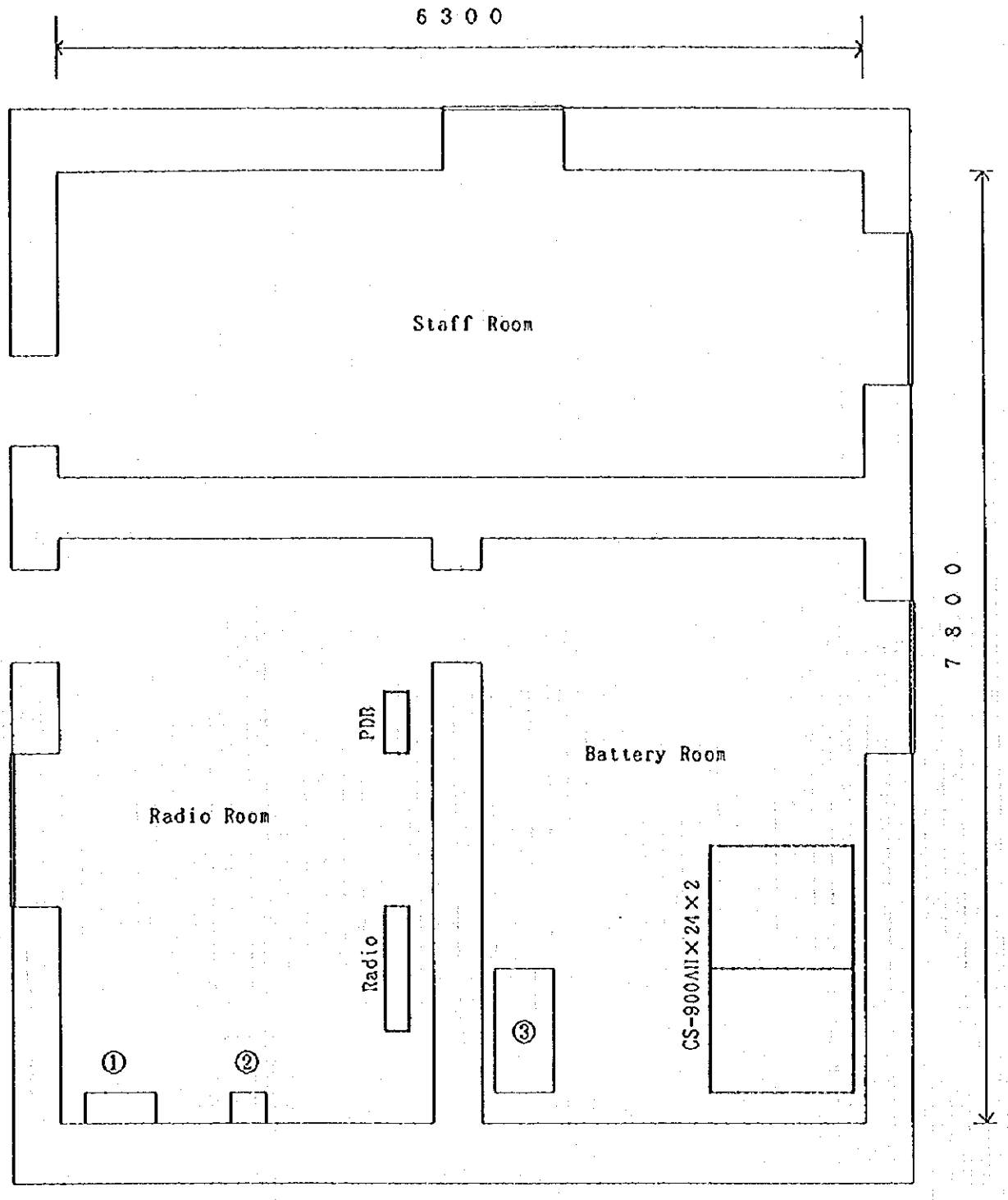
Existing Equipment

① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : BHARTALAGNA (BLN)
SCALE: 1:50
UNIT : mm
FIG : 2 – 3 8

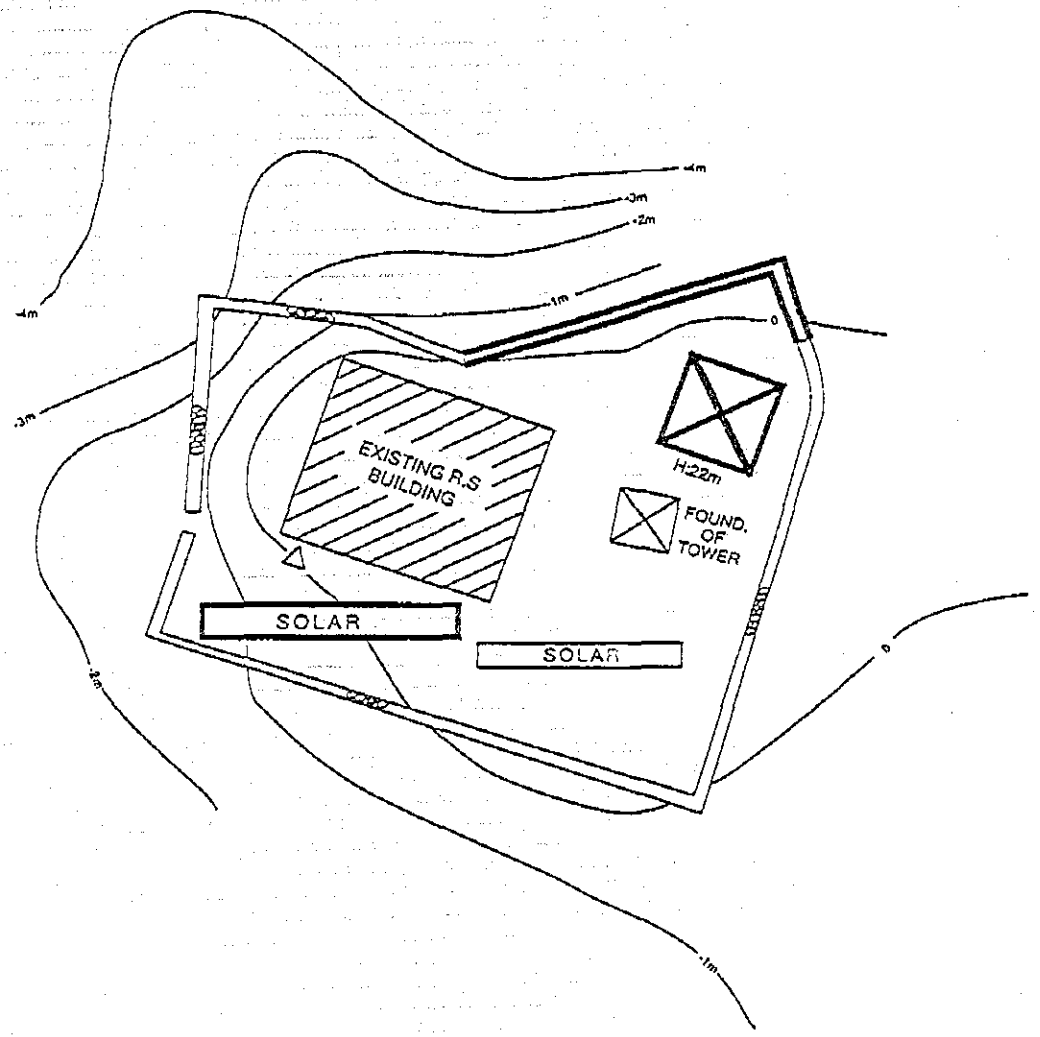


DRW	:	SITE LAYOUT
SITE	:	MAITHAPLA(MTP)
SCALE	:	1 : 200
FIG	:	2 – 3 9

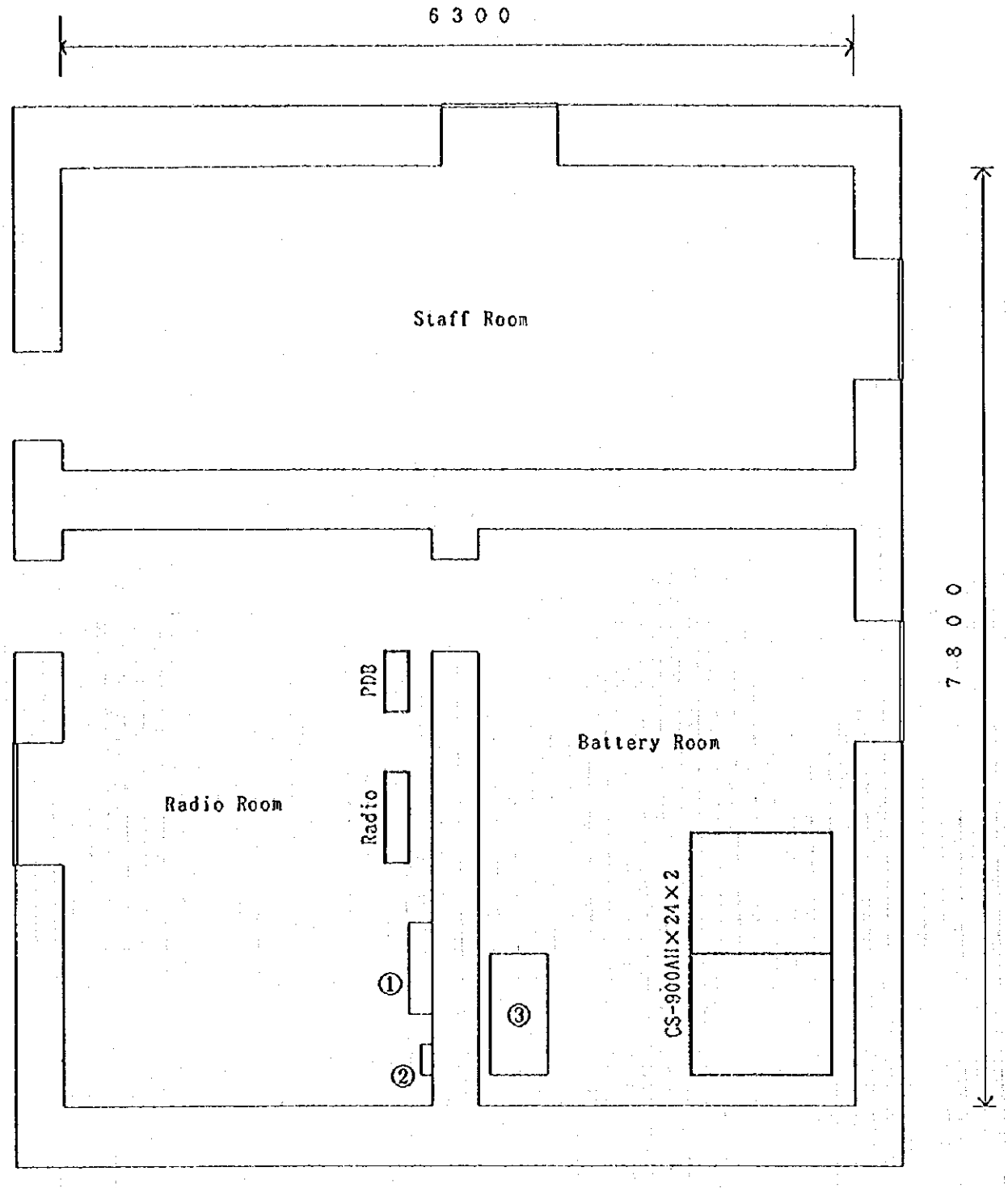


Existing Equipment
① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : MAITHAPLA (MTP)
SCALE: 1:50
UNIT : mm
FIG : 2 – 4 0

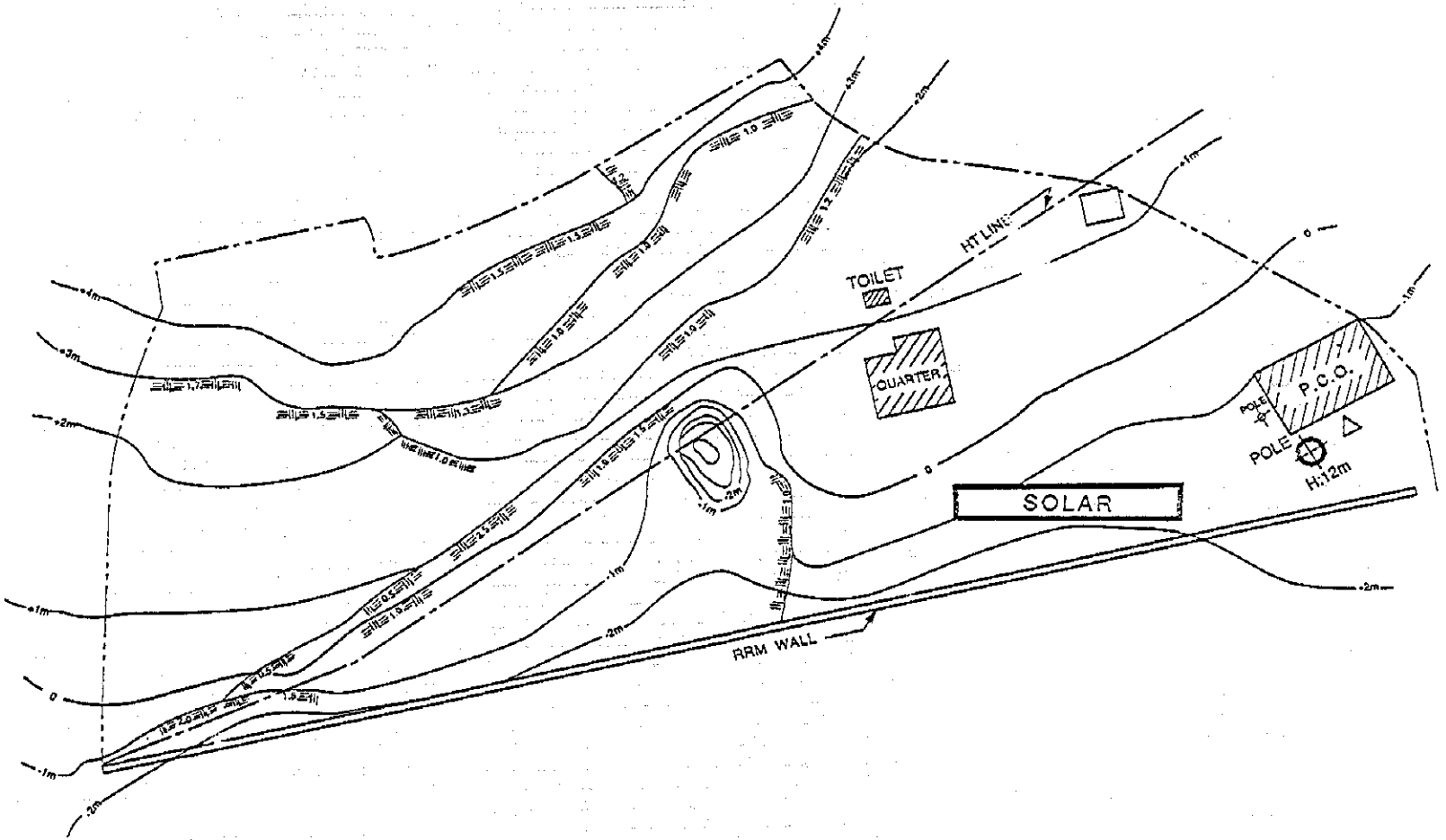


DRW	:	SITE LAYOUT
SITE	:	CHIMARA LEKH(CLK)
SCALE	:	1 : 200
FIG	:	2 – 4 1

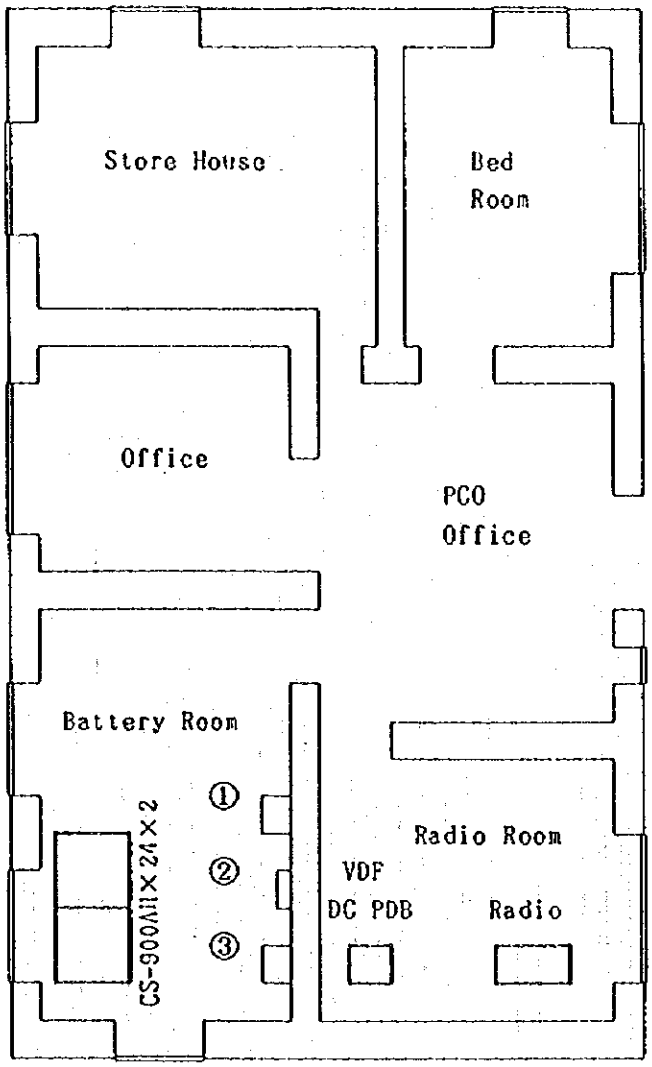


Existing Equipment
① T/R
② Regulator
③ Battery

DRW : FLOOR LAYOUT
SITE : CHIMARALEKH (CLK)
SCALE: 1:50
UNIT : mm
FIG : 2 – 4 2

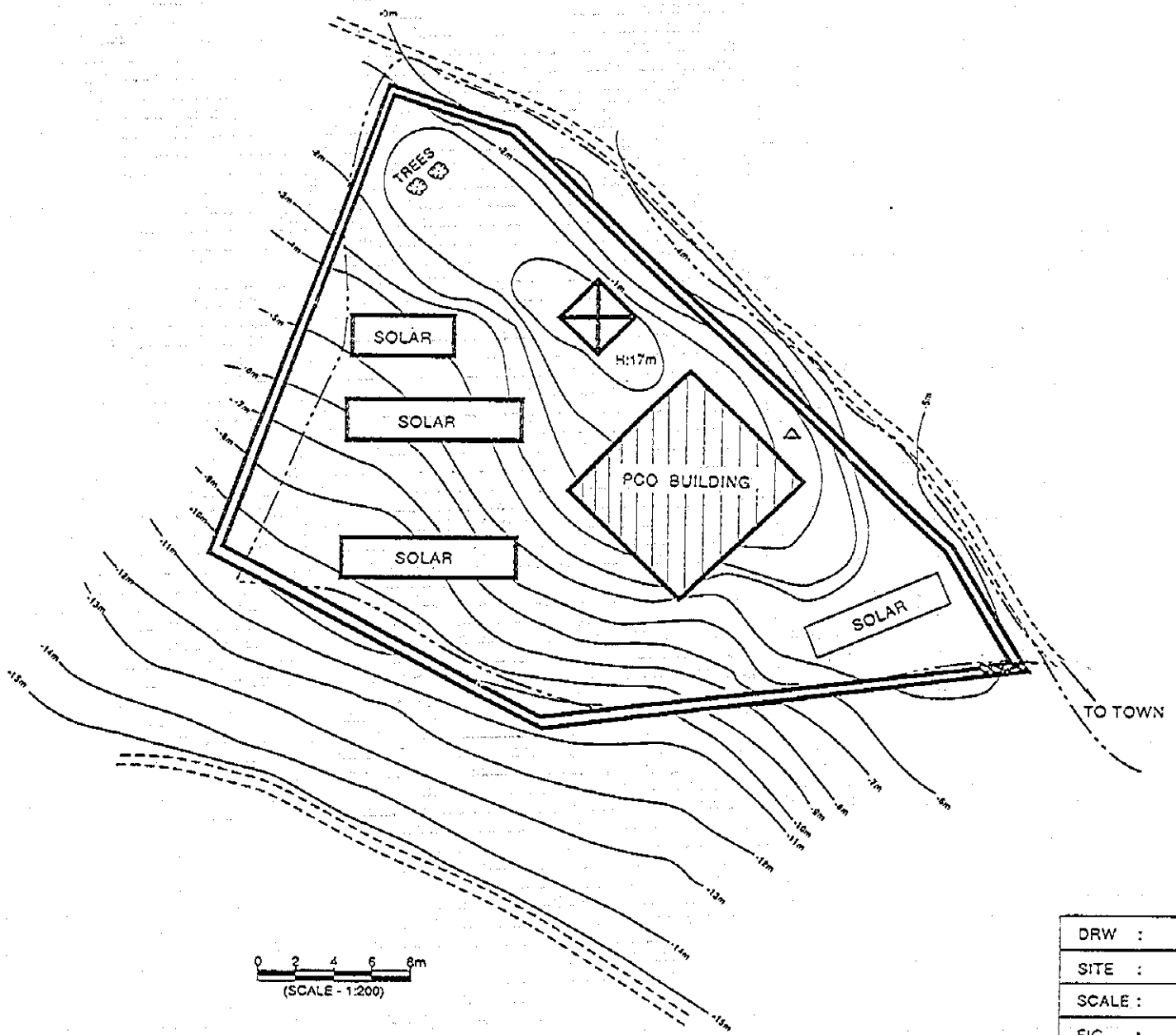


DRW	:	SITE LAYOUT
SITE	:	JUMLA(JML)
SCALE	:	1 : 500
FIG	:	2 – 4 3

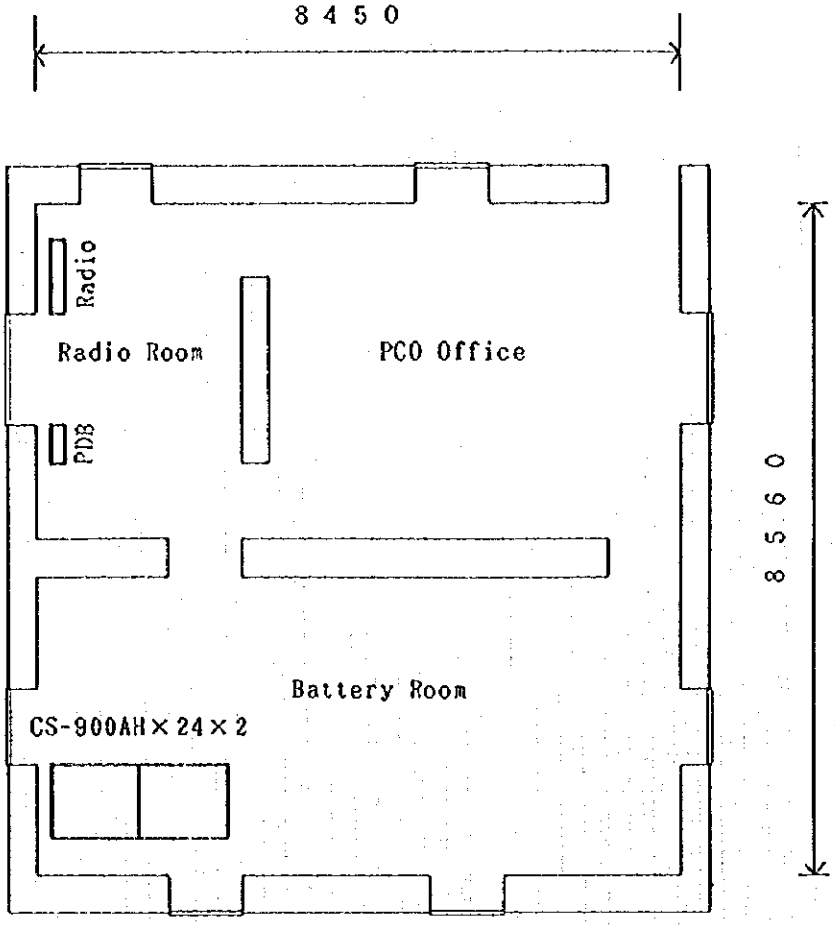


Existing Equipment
① T/R
② Regulator
③ Battery

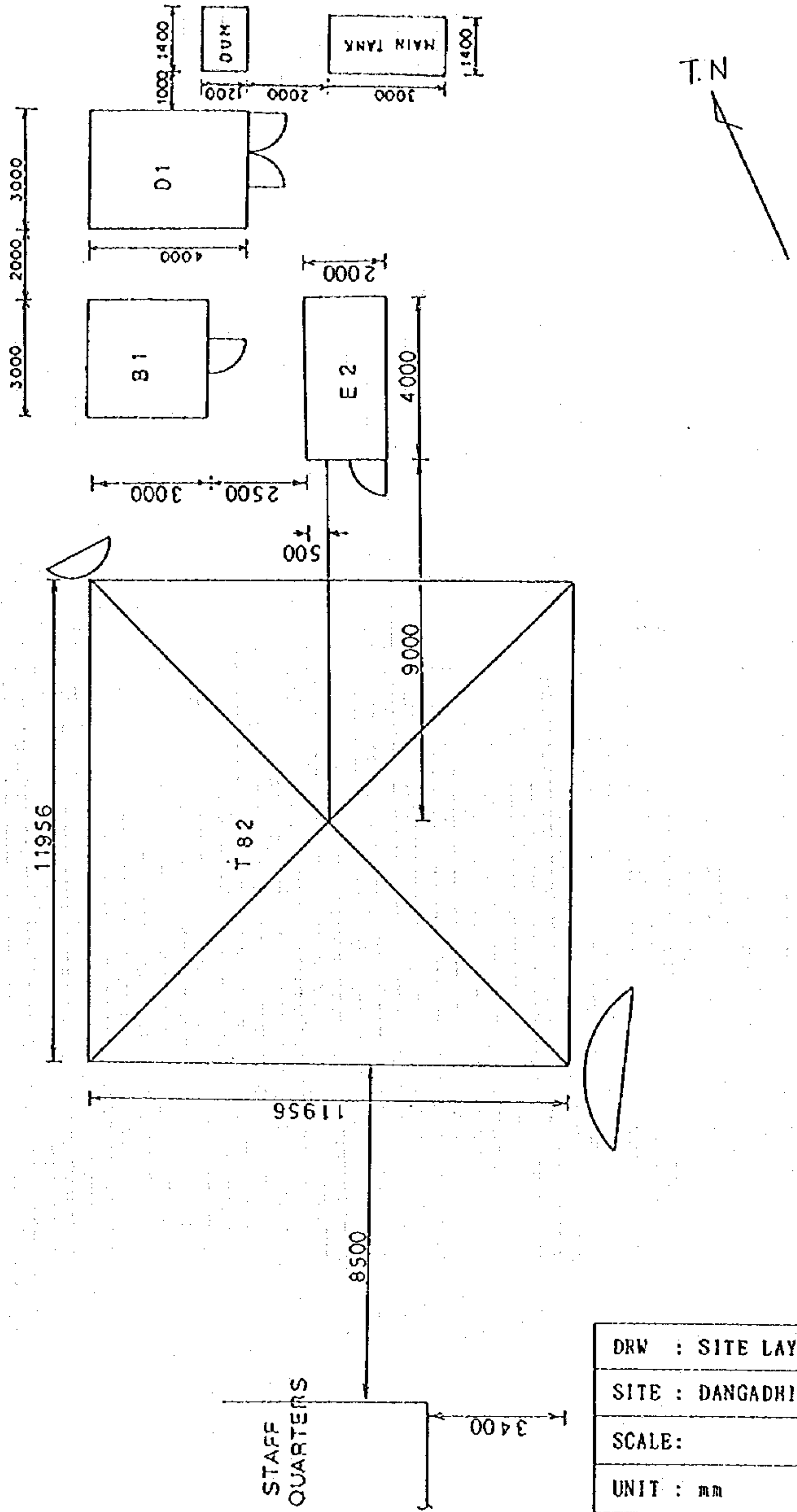
DRW : FLOOR LAYOUT
SITE : JUMLA (JML)
SCALE: 1:100
UNIT : mm
FIG : 2－44



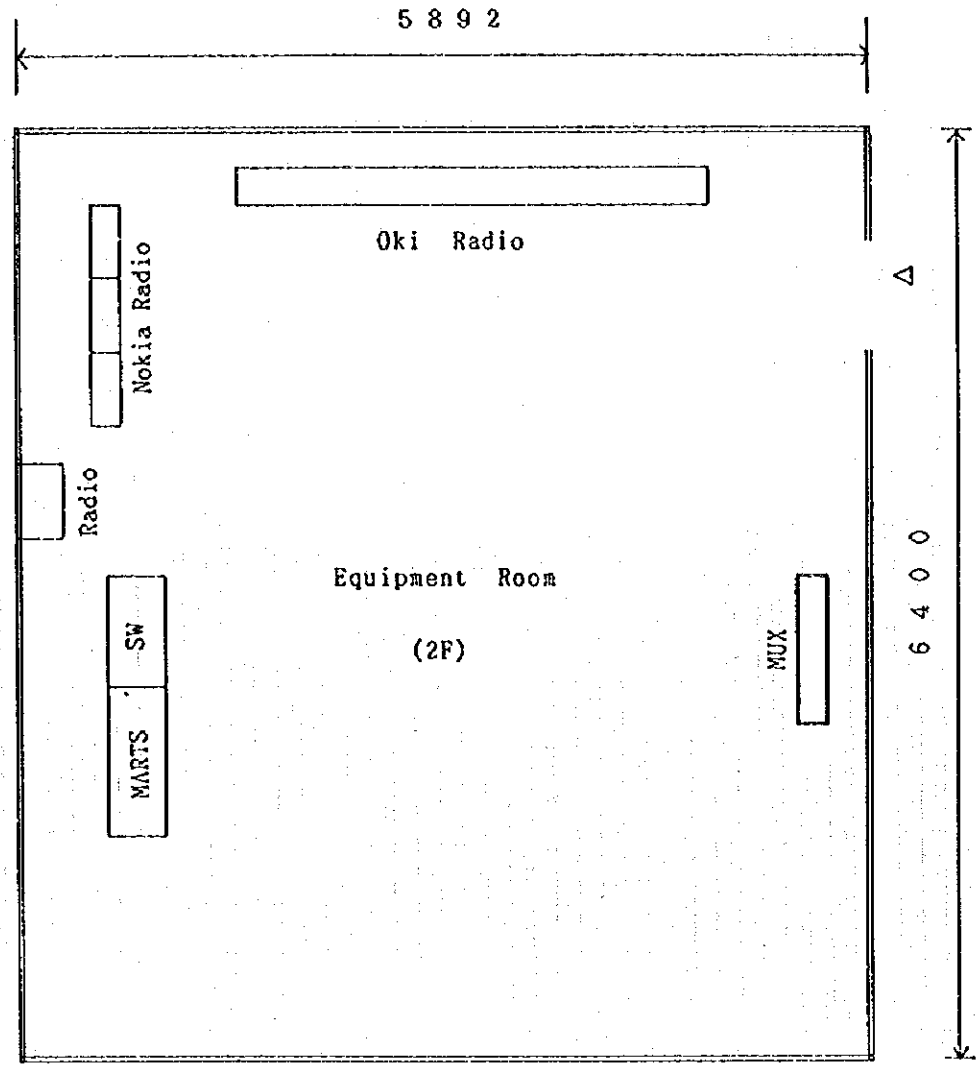
DRW	:	SITE LAYOUT
SITE	:	KALIKOT (KKT)
SCALE	:	1 : 200
FIG	:	2 – 4 5



DRW : FLOOR LAYOUT
SITE : KALIKOT (KKT)
SCALE: 1:100
UNIT : mm
FIG : 2-46

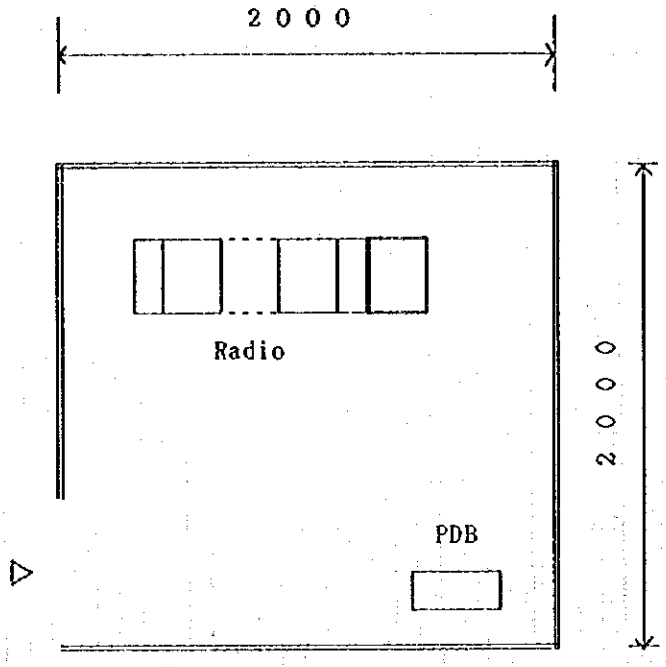


DRW	: SITE LAYOUT
SITE	: DANGADHI (DGD)
SCALE:	
UNIT	: mm
FIG	: 2 - 4 7



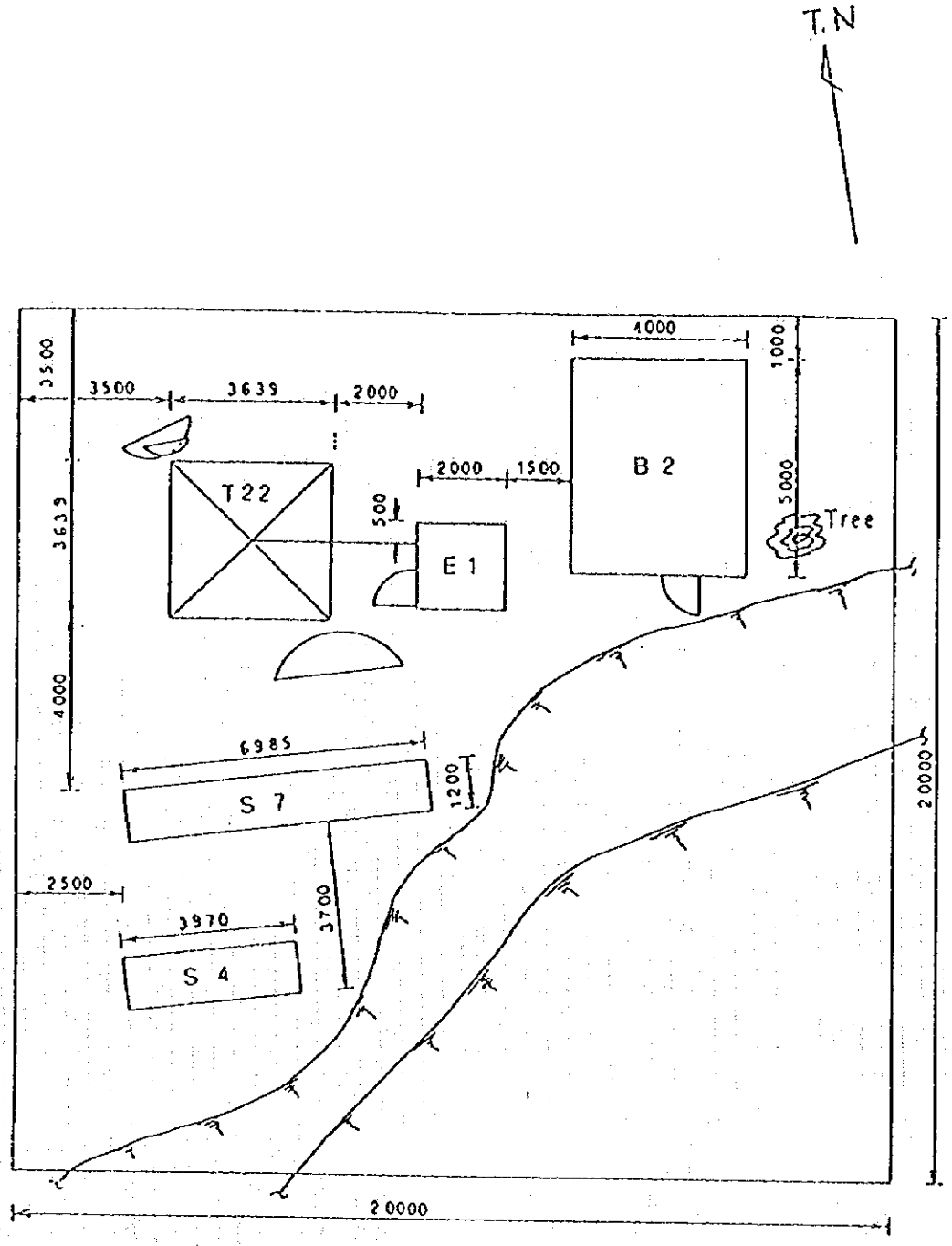
DRW : FLOOR LAYOUT	
SITE : DANGADHI (DGD)	
SCALE: 1:50	
UNIT : mm	
FIG : 2 – 4 8	

DRW : SITE LAYOUT	
SITE : BURETOLA (BTR)	
SCALE:	
UNIT : mm	
FIG : 2 – 4 9	

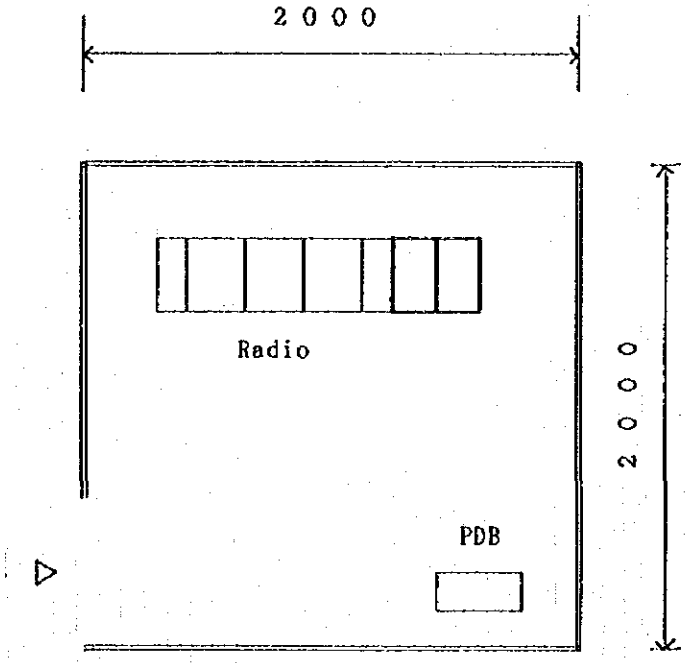


Radio Equipment Shelter

DRW : FLOOR LAYOUT	
SITE : BURETORA (BTR)	
SCALE: 1:20	
UNIT : mm	
FIG : 2 - 5 0	

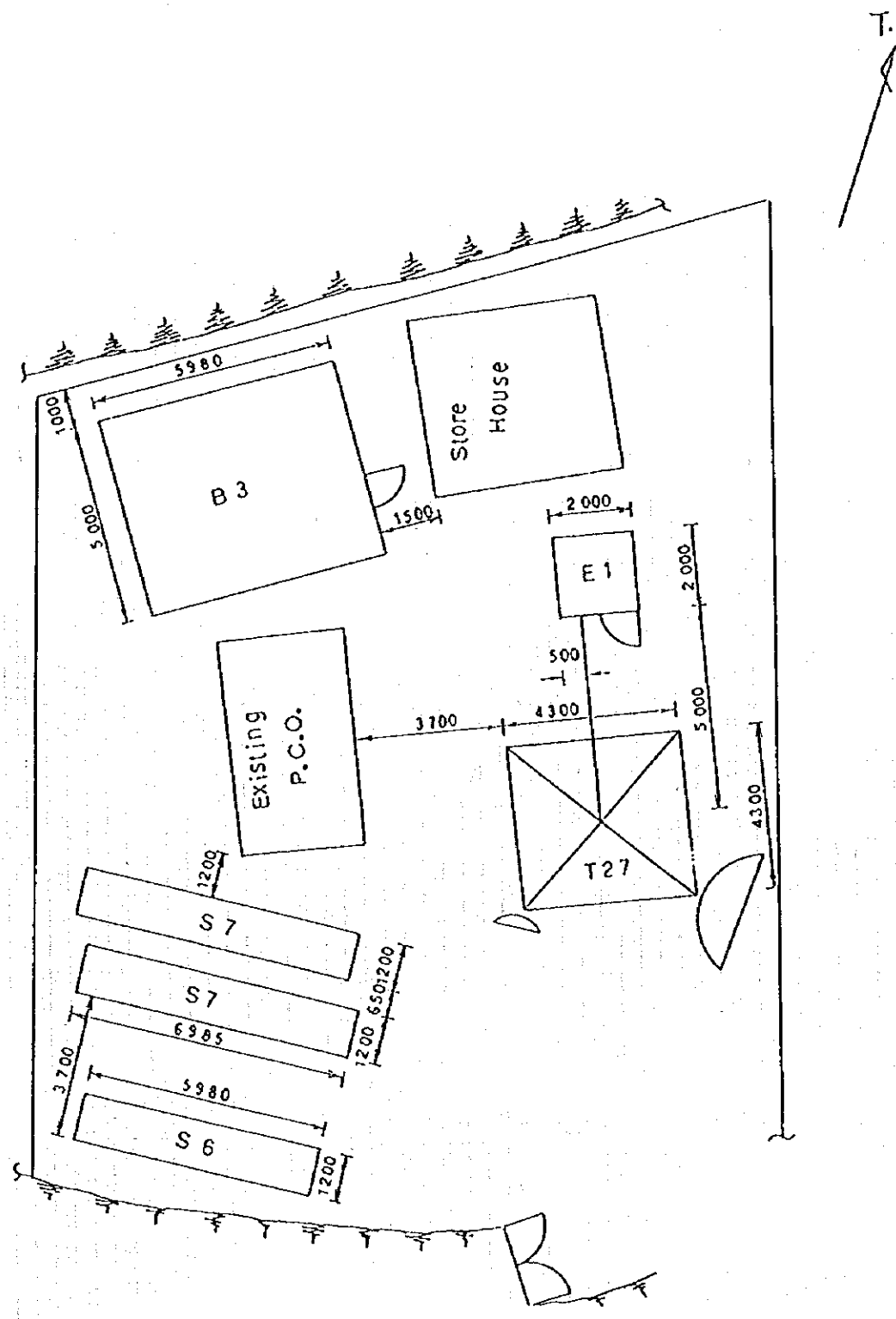


DRW : SITE LAYOUT
SITE : KAPHALI (KPL)
SCALE:
UNIT : mm
FIG : 2 – 5 1

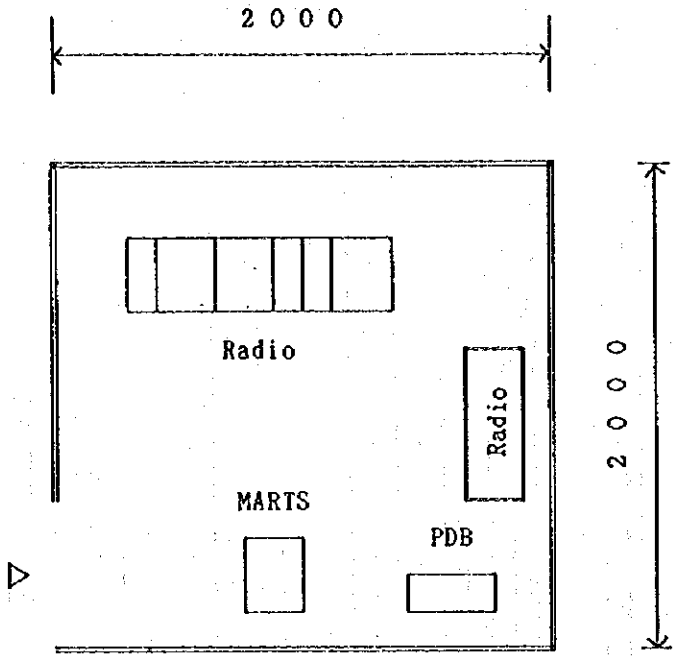


Radio Equipment Shelter

DRW : FLOOR LAYOUT	
SITE : KAPHALI (KPL)	
SCALE: 1:30	
UNIT : mm	
FIG : 2 - 52	

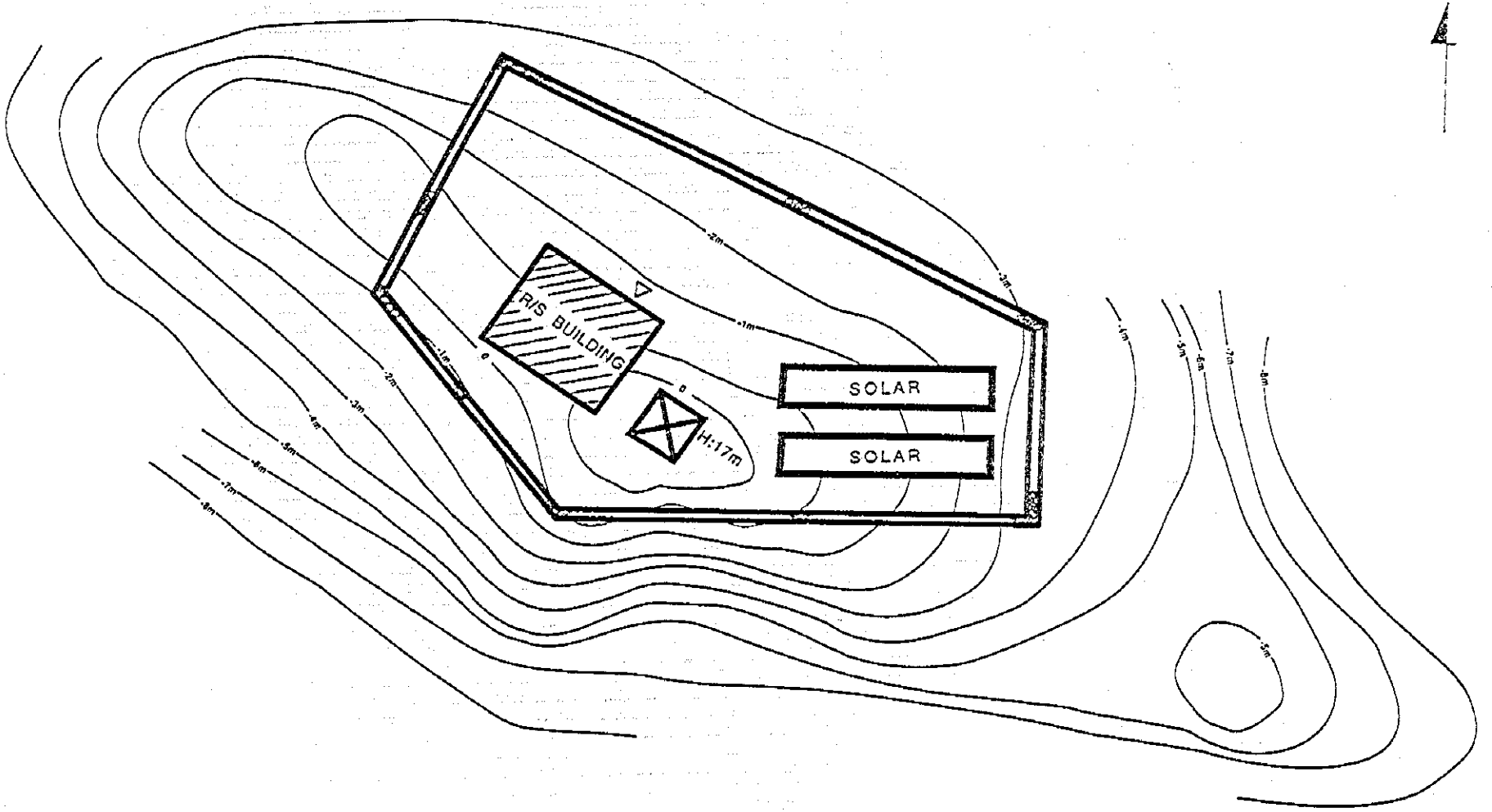


DRW : SITE LAYOUT	
SITE : DANDELDHURA (DDR)	
SCALE:	
UNIT : mm	
FIG : 2 – 5 3	



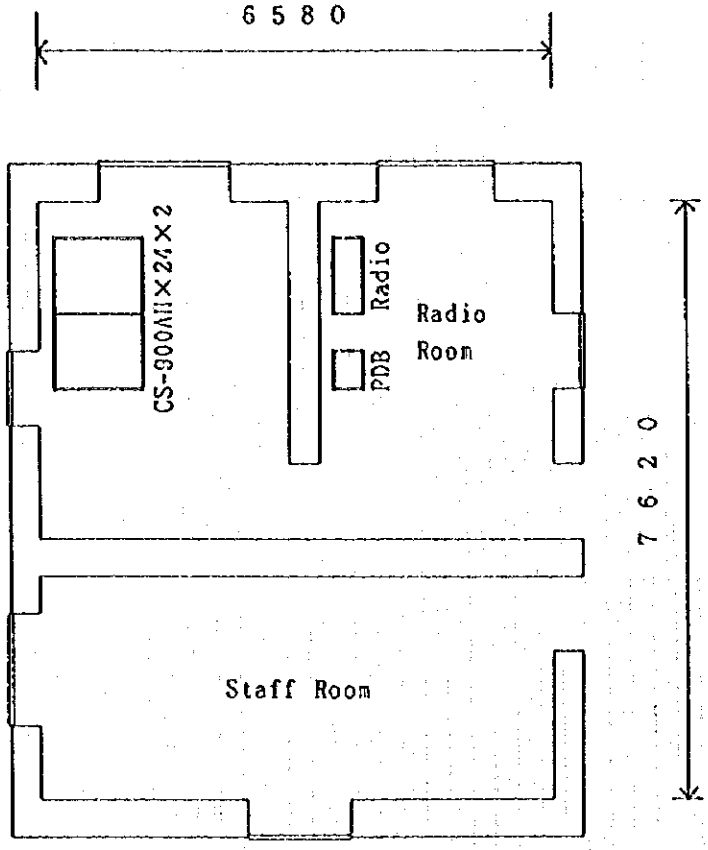
Radio Equipment Shelter

DRW : FLOOR LAYOUT	
SITE : DANDELDHURA (DDR)	
SCALE: 1:30	
UNIT : mm	
FIG : 2 – 5 4	

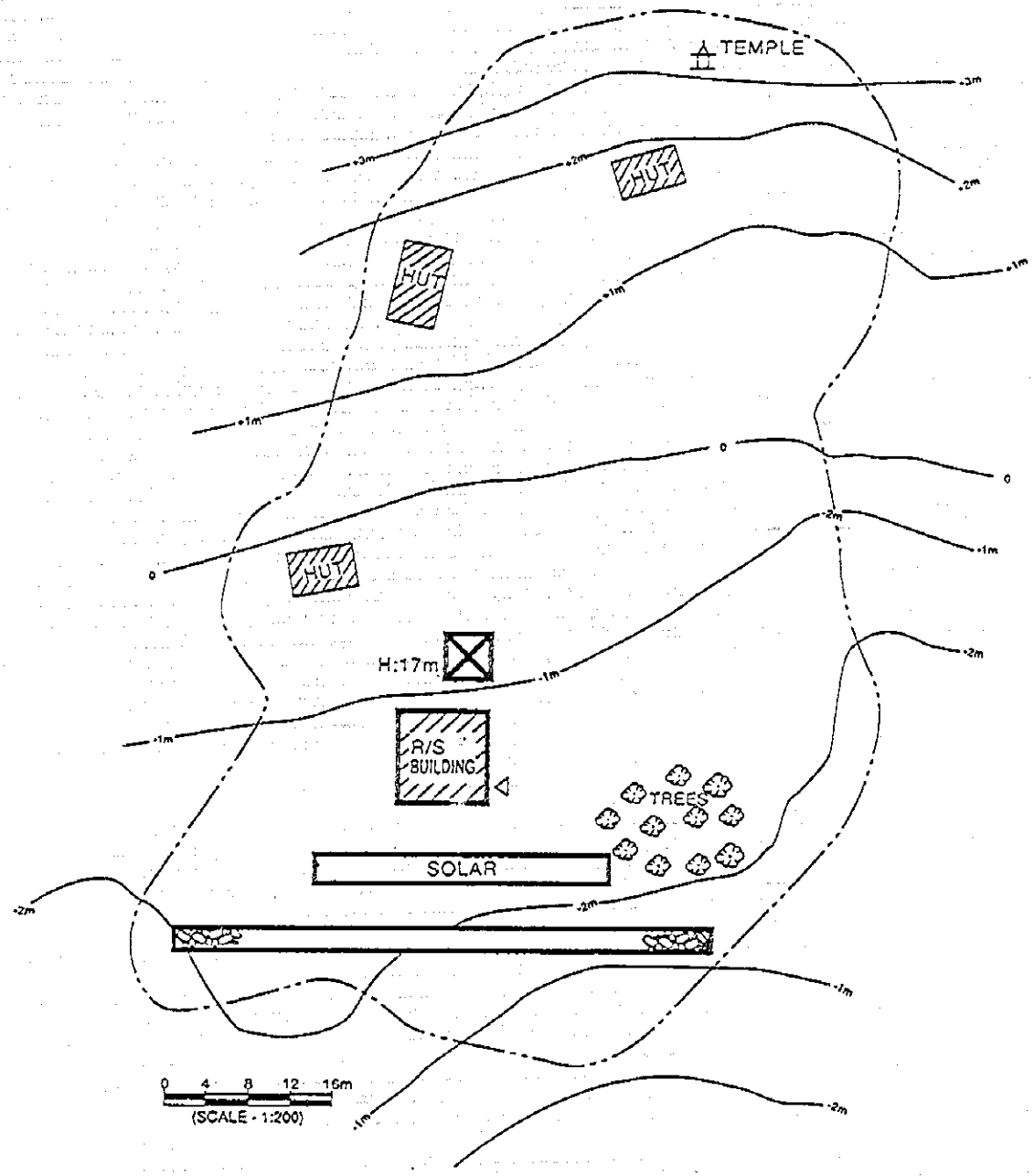


0 4 8 12 16m
(SCALE - 1:200)

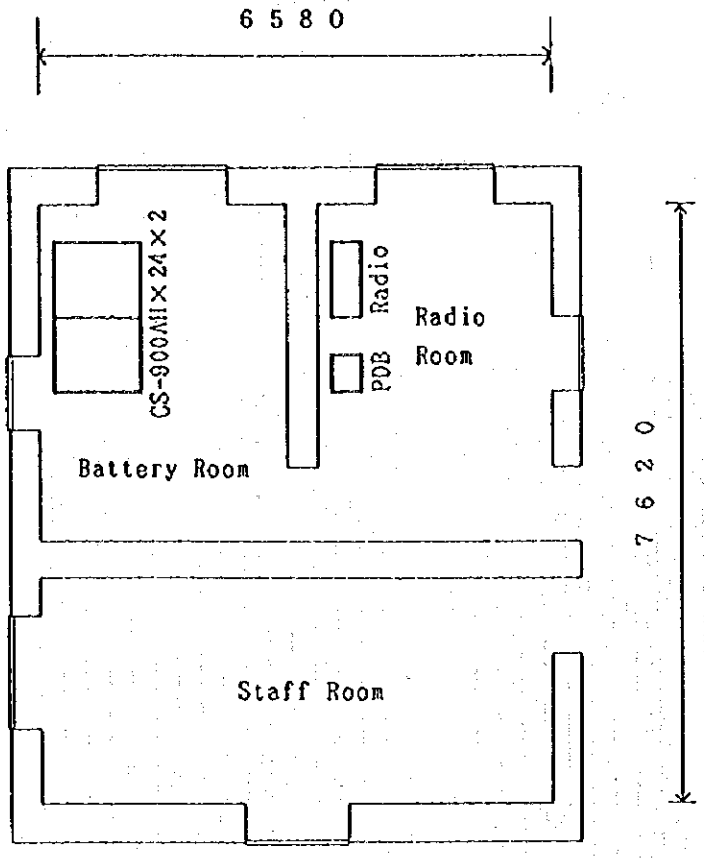
DRW	:	SITE LAYOUT
SITE	:	RAYAL (RYL)
SCALE	:	1 : 250
FIG	:	2 – 5 5



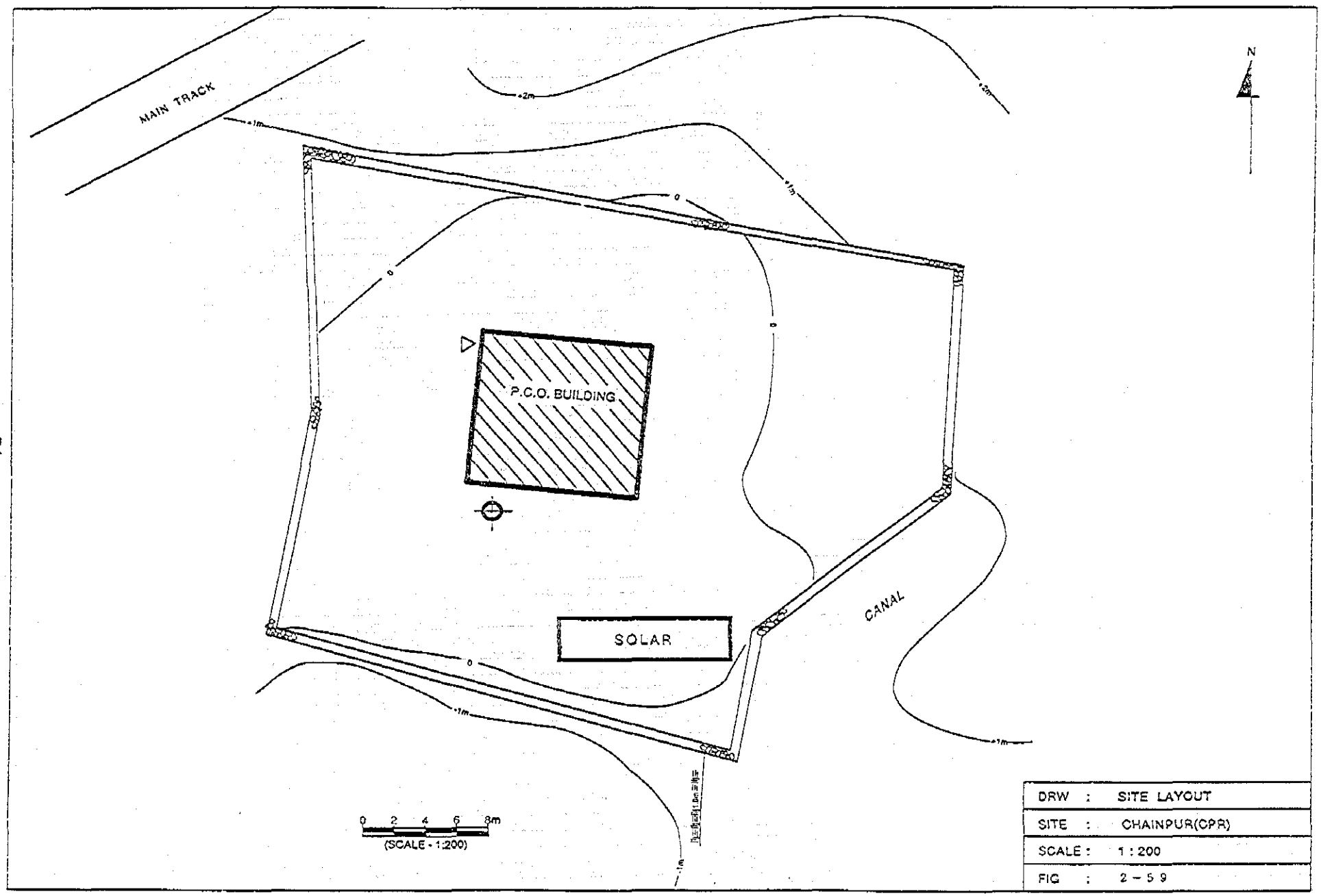
DRW : FLOOR LAYOUT
SITE : RAYAL (RYL)
SCALE: 1:100
UNIT : mm
FIG : 2－56

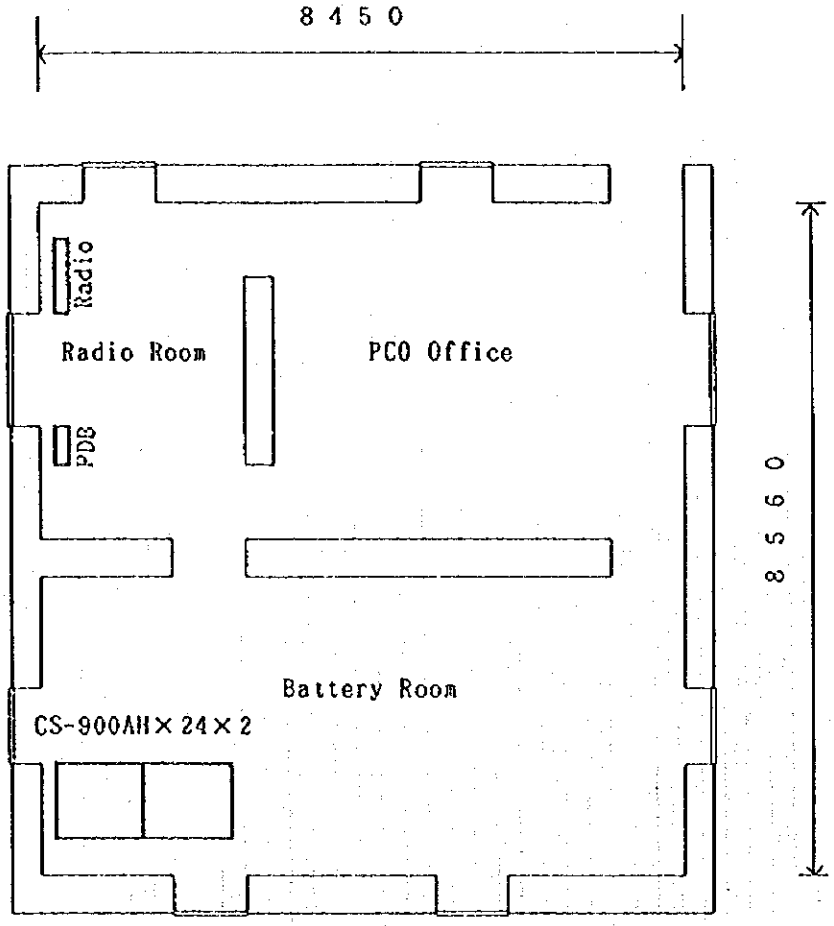


DRW	:	SITE LAYOUT.
SITE	:	BANTA LEKH (BLK)
SCALE	:	1 : 400
FIG	:	2 – 5 7

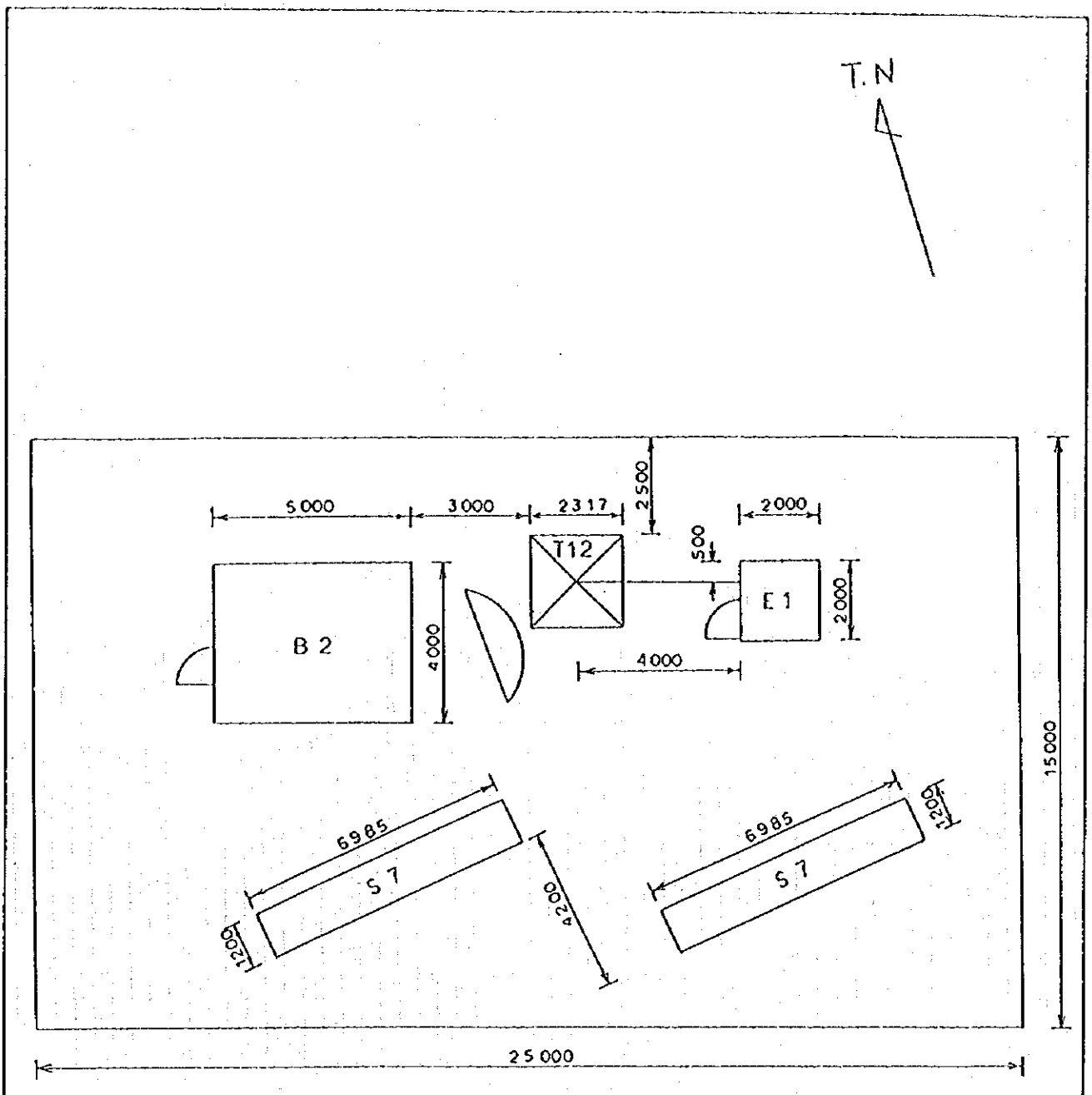


DRW : FLOOR LAYOUT
SITE : BANTA LEKH (BLK)
SCALE: 1:100
UNIT : mm
FIG : 2 – 5 8

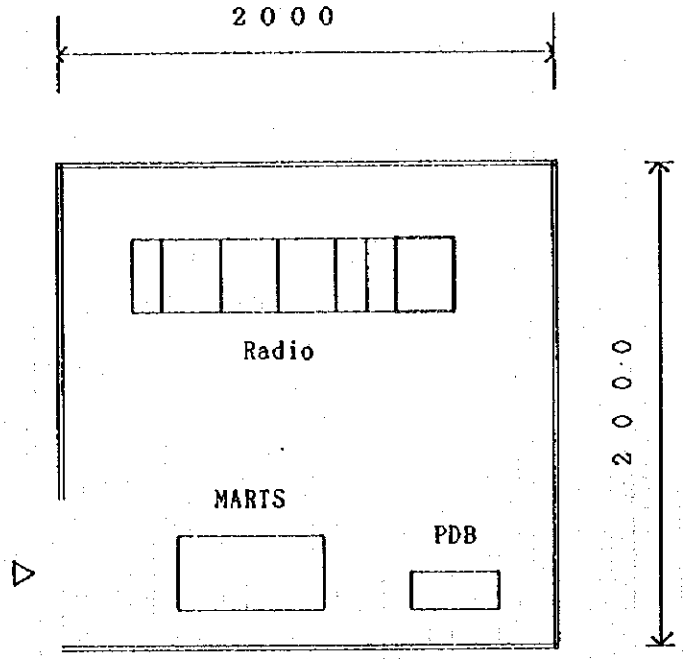

MAIN TRACK
+2m
+1m
0
P.C.O. BUILDING
SOLAR
CANAL
N
0 2 4 6 8m
(SCALE - 1:200)
DRW : SITE LAYOUT
SITE : CHAINPUR(CPR)
SCALE : 1 : 200
FIG : 2 – 5 9



DRW : FLOOR LAYOUT	
SITE : CHAINPUR (CPR)	
SCALE: 1:100	
UNIT : mm	
FIG : 2 – 6 0	

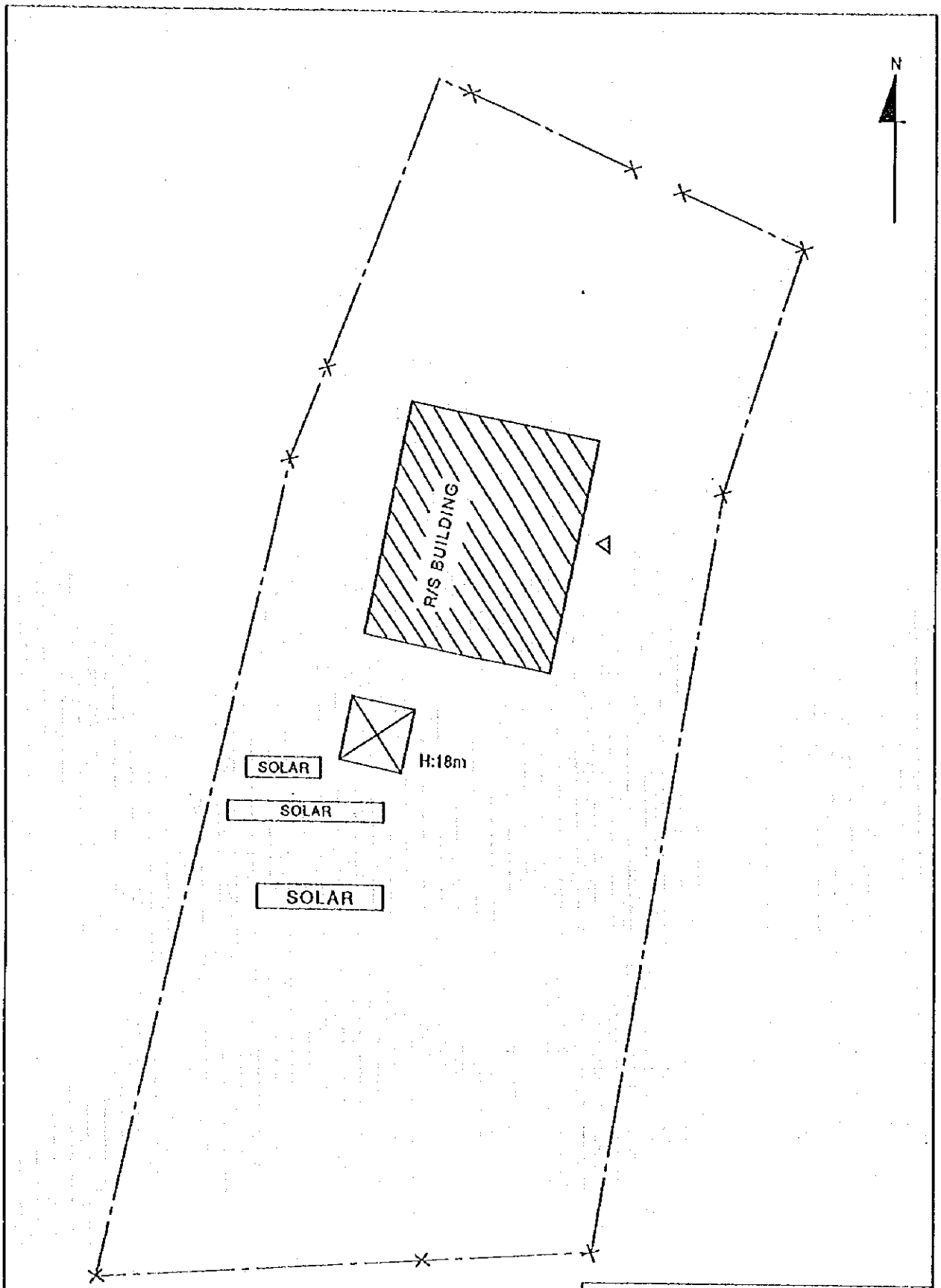


DRW : SITE LAYOUT	
SITE : S.DOTI (SDT)	
SCALE:	
UNIT : mm	
FIG : 2 – 6 1	

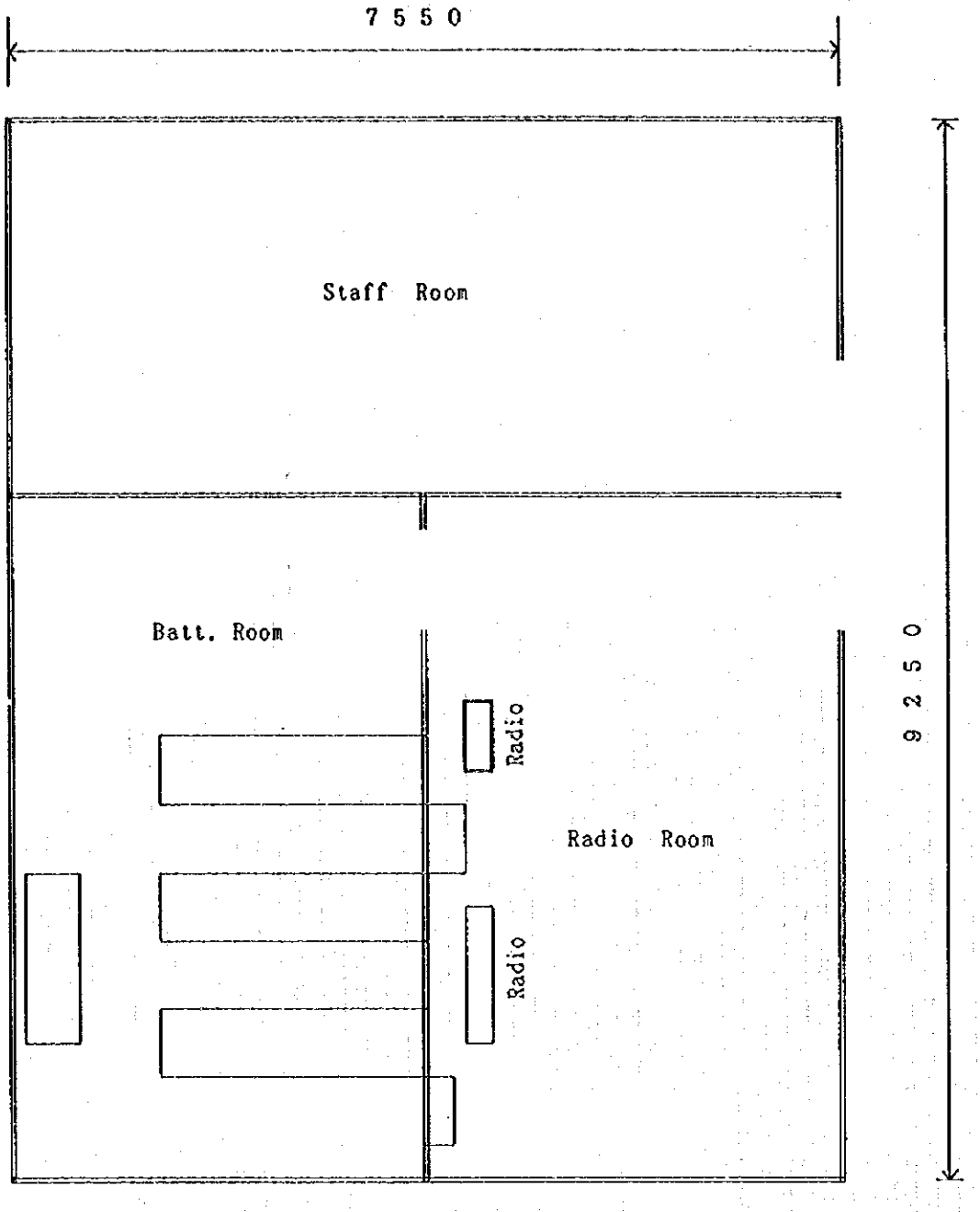


Radio Equipment Shelter

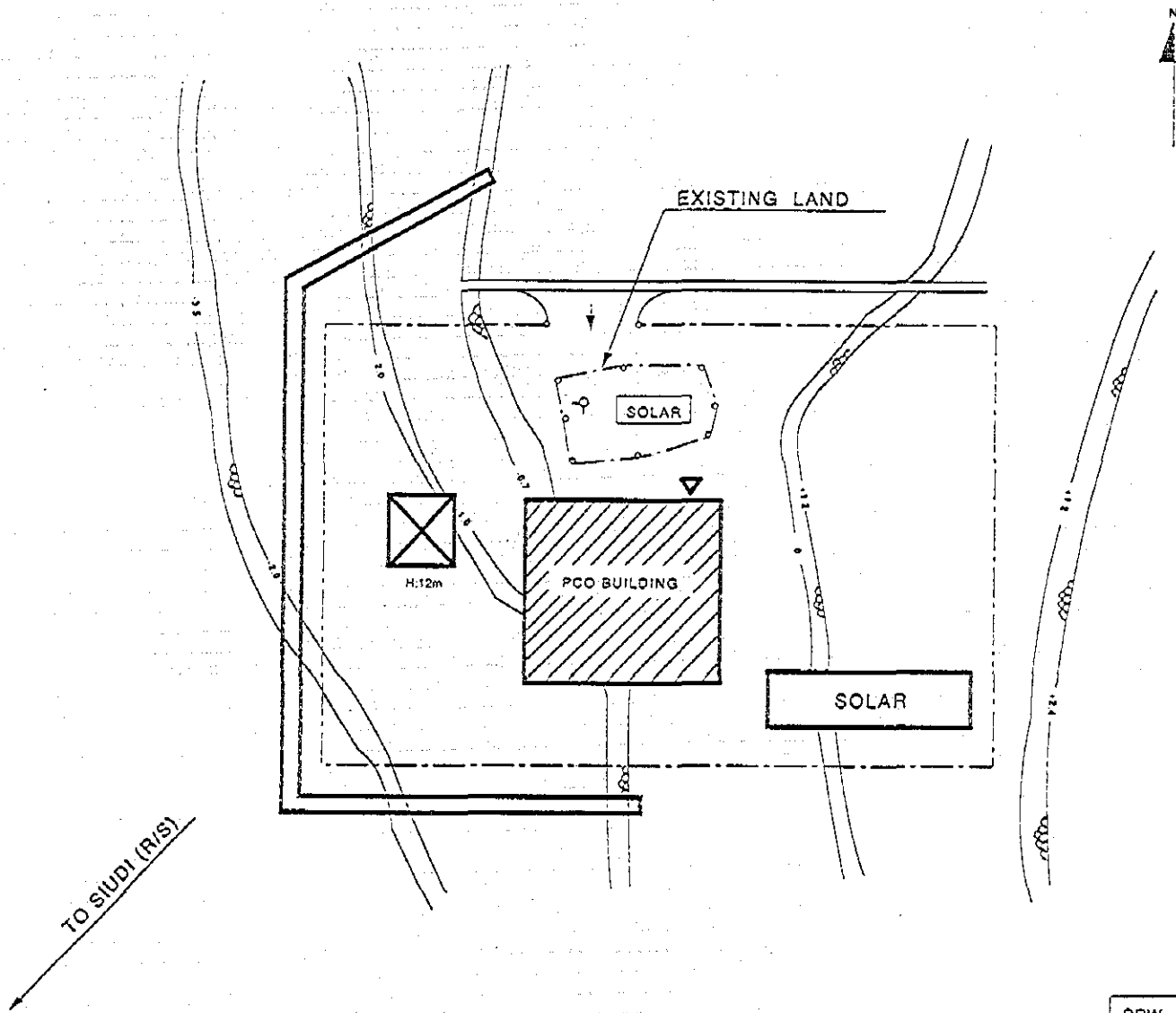
DRW : FLOOR LAYOUT
SITE : S.DOTI (SDT)
SCALE: 1:30
UNIT : mm
FIG : 2 – 6 2



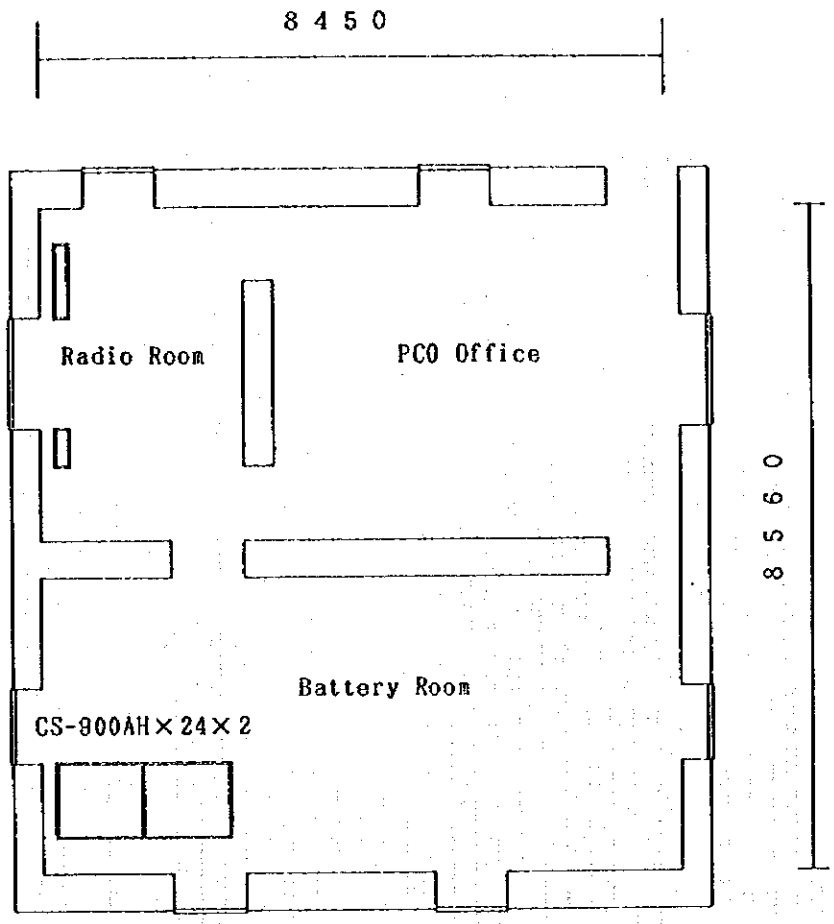
DRW	:	SITE LAYOUT
SITE	:	SIUDI (SUD)
SCALE	:	1 : 200
FIG	:	2 – 6 3



DRW : FLOOR LAYOUT
SITE : SIUDI (SUD)
SCALE: 1:50
UNIT : mm
FIG : 2 – 6 4



DRW	:	SITE LAYOUT
SITE	:	MARTADI (MTD)
SCALE	:	1 : 200
FIG	:	2 – 6 5



DRWD : FLOOR LAYOUT
SITE : MARTADI (MTD)
SCALE: 1:100
UNIT : mm
FIG : 2 – 6 6

CHAPTER 3 IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3.1 Implementation Plan

3.1.1 Implementation Concept

The network to be constructed under this Project is required to satisfy the international standards in transmission quality. For, this network, though a rural network, is to be connected to the backbone route, and with the introduction of a switching system at each PCO in the future, is expected to constitute a transmission line of a comprehensive national telecommunications network.

Local contractors in Nepal have accumulated know-how concerning telecommunications facilities construction work through the two rural telecommunication expansion projects already implemented. Hence, their use should be considered positively, particularly for civil work, under the instruction of Japanese experts.

However, for incidental works related to radio, transmission and power facilities installation, e.g., wiring, piping, jumpering, testing, etc., experts in specific items can hardly be obtained, and to minimize the construction work period, use of Japanese experts will be inevitable.

The responsible ministry for this Project is the Ministry of Information and Communications, and the implementing agency is Nepal Telecommunications Corporation (NTC). NTC's organization is as shown in Fig. 3-1 on which the departments/offices responsible for the construction work of this Project are marked by bold lines.

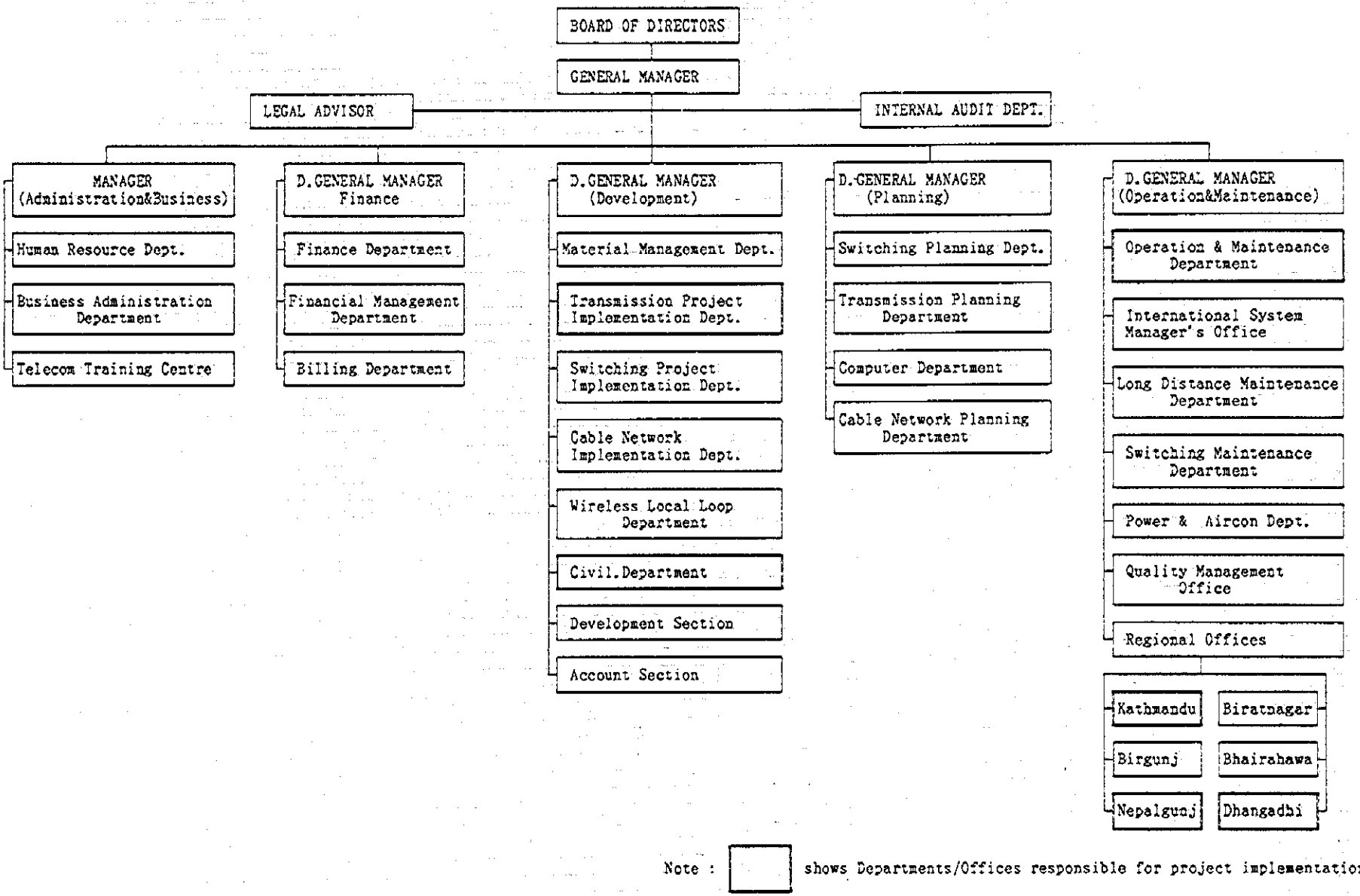


Fig. 3-1 ORGANIZATION CHART OF NTC

Responsible Departments/Offices are in charge of the following, respectively:

Work Items	Responsible Departments/Offices
Retaining walls E/G shelter foundation Antenna tower foundation Power supply facilities foundation	Civil Engineering Department
Antenna tower construction Shelter construction Lightning arrester erection Outdoor power supply facilities installation Antenna installation Transmitter/receiver installation Multiplex converter installation Power supply facilities installation	Transmission Project Implementation Department Kathmandu, LDMD* Office Nepalganj, Regional Office Dangadi, Regional Office
Local test Acceptance test	Operation & Maintenance Department
Guidance in operation	Kathmandu, LDMD Office Nepalganj, Regional Office Dangadi, Regional Office

Note* : LDMD ... Long Distance Maintenance Department

3.1.2 Implementation Condition

Matters to be observed in construction work in the objective sites are as follows:

(1) Limitation on Outdoor Work Schedule due to Meteorological Conditions

During the rainy season which starts in June and continues until September throughout the country, efficiency of outdoor work is lowered extremely. In addition, in areas over 2,000 m in elevation (which account for 50% of the objective sites), there are snowfalls in December, January and February, and outdoor work can hardly be done. In areas over 3,000 m in elevation, temperature goes down to lower than -10°C and there is a possibility of the ground being frozen, which means a possibility of the cast concrete being frozen.

That is, during six (6) months in a year, outdoor work cannot be free from

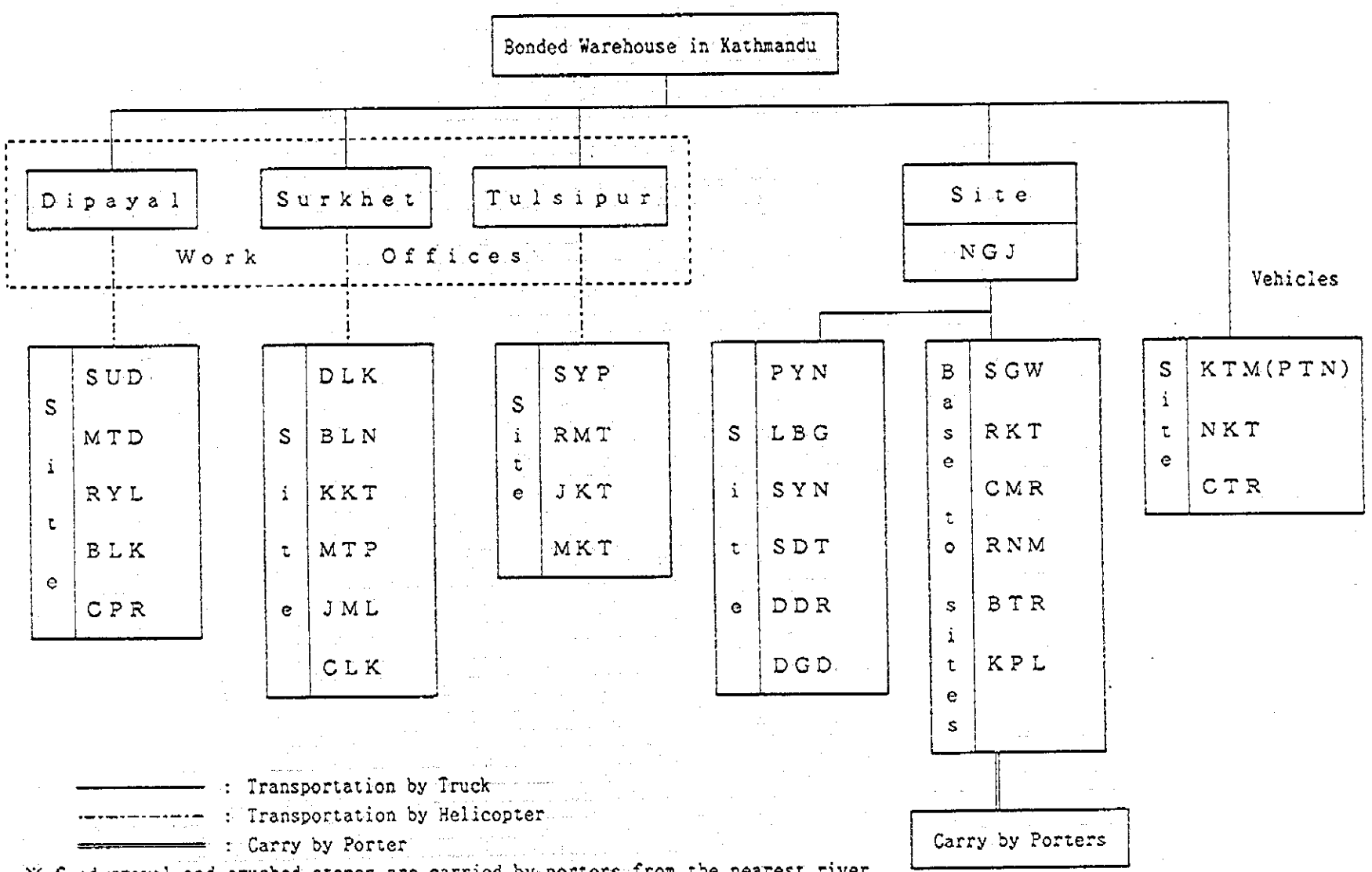
unfavourable effects of the meteorological conditions.

The above should be duly taken into account in planning the implementation time schedule.

(2) Transportation to Sites

As mentioned previously, condition of access roads to sites are extremely poor. Particularly, the roads to 08 and 09 areas are only 1 - 2 m in width, and transportation of equipment and materials by vehicle is difficult. In addition, local porters are not available since the Western Region is not a tourist resort. Under the above conditions, transportation by helicopter should be considered for a certain number of sites.

On the basis of the survey results, transportation routes and means are planned as follows:



Work Offices and Transportation Bases

(3) Procurement of Equipment and Materials

Equipments for the Project are to be procured from Japan or third country and materials (cement, aggregate, iron reinforcing bars, boards, etc.) are to be procured in Nepal. Previous projects prove that local products pose no problems in quality.

3.1.3 Scope of Works

With a view to smooth materialization of the Project, demarcations between the works to be undertaken by the Nepal and Japanese sides are made as follows:

		Japanese Side	Nepal Side
1	Access road rehabilitation		o
2	Procurement of sites and ground leveling		o
3	Construction of PCO building		o
4	Commercial power lead-in and water supply and drainage		o
5	Security		o
6	Relevant authorities' permits and approvals		o
7	Warehouse and space for storage of equipment and materials at the final destination		o
8	Equipment and materials supply	o	
9	Construction/installation and tests	o	
10	Local outside plant and connection of subscribers		o
11	Acceptance tests	o	o
12	Training in operation and maintenance	o	
13	Operation and maintenance		o

3.1.4 Consultant Supervision

(1) Contents of Supervision Work

In order to ensure satisfactory materialization of the Project, the Project Implementation Headquarters consisting of NTC staff and Consultant Team should be established as shown in Fig. 3-2. The Headquarters should secure closer coordination among parties concerned to achieve successful completion of the Project and execute the supervision work as follows:

(a) Conclusion of Contract for Construction Work

Preparation of designs and tender documents, pre-qualification of tenderers, tender floating, evaluation of proposals, assistance in selection of Successful Tenderer, preparation of contract documents, and assistance in contract negotiation, etc., and reporting the work progress and outcome to NTC.

(b) Check and Review of Drawings, etc. Submitted by Contractor(s)

Check and review of installation drawings, illustrations, samples, etc. submitted by Contractor(s) and manufacturers.

(c) Witness to Factory Tests

Witness to factory tests/inspections on equipment and materials at manufacturers' factory(ies) prior to their shipping to confirm their conformity to relevant specifications.

Contractor(s) proceeds to the shipping of the equipment and materials after obtaining certificates on them.

(d) Supervision Work

Check and review of construction/installation work methods and processes submitted by Contractor(s), and comments and instructions wherever necessary. Supervisor(s) will be sent to sites to supervise the conformity of work performance and progress with the contract documents and specifications.

(e) Examination of Invoices Submitted by Contractor(s)

Examination of invoices, etc. submitted by Contractor(s) for payments under this Project, and cooperation in taking payments procedures.

(f) Acceptance of Facilities

Witness to acceptance testing and examination of as-built drawings. Confirmation of conformity of the completed facilities/systems to the contract documents and specifications, and reporting to NTC the acceptance of the completed facilities/systems.

(2) Supervisory Staff Plan

For this Project, supervisory work will have to be done carefully under the severe environmental conditions. Consultants in charge of supervisory work is required to have a good grasp of the overall progress of the work all through the work period and give proper guidance and advice to NTC staff and Contractor(s) whenever necessary, so that facilities and structures can be constructed satisfying qualitywise and timewise requirements.

To achieve the above, supervisory staff should be stationed at sites throughout the whole construction work period, with the support of additional spot supervisors to cope with a tight schedule. Provision of staff for factory tests should also be taken into consideration.

More precisely, one administration staff and one supervisory engineer should be stationed in Nepal covering the whole period. In addition, one engineer each for radio, transmission, power and civil work supervision should be sent to sites for spot supervision work when occasion demands. The supervisory staff should be selected from among those who have extensive experience and can take broad view of things, besides being superior in judging technical matters and procuring materials.

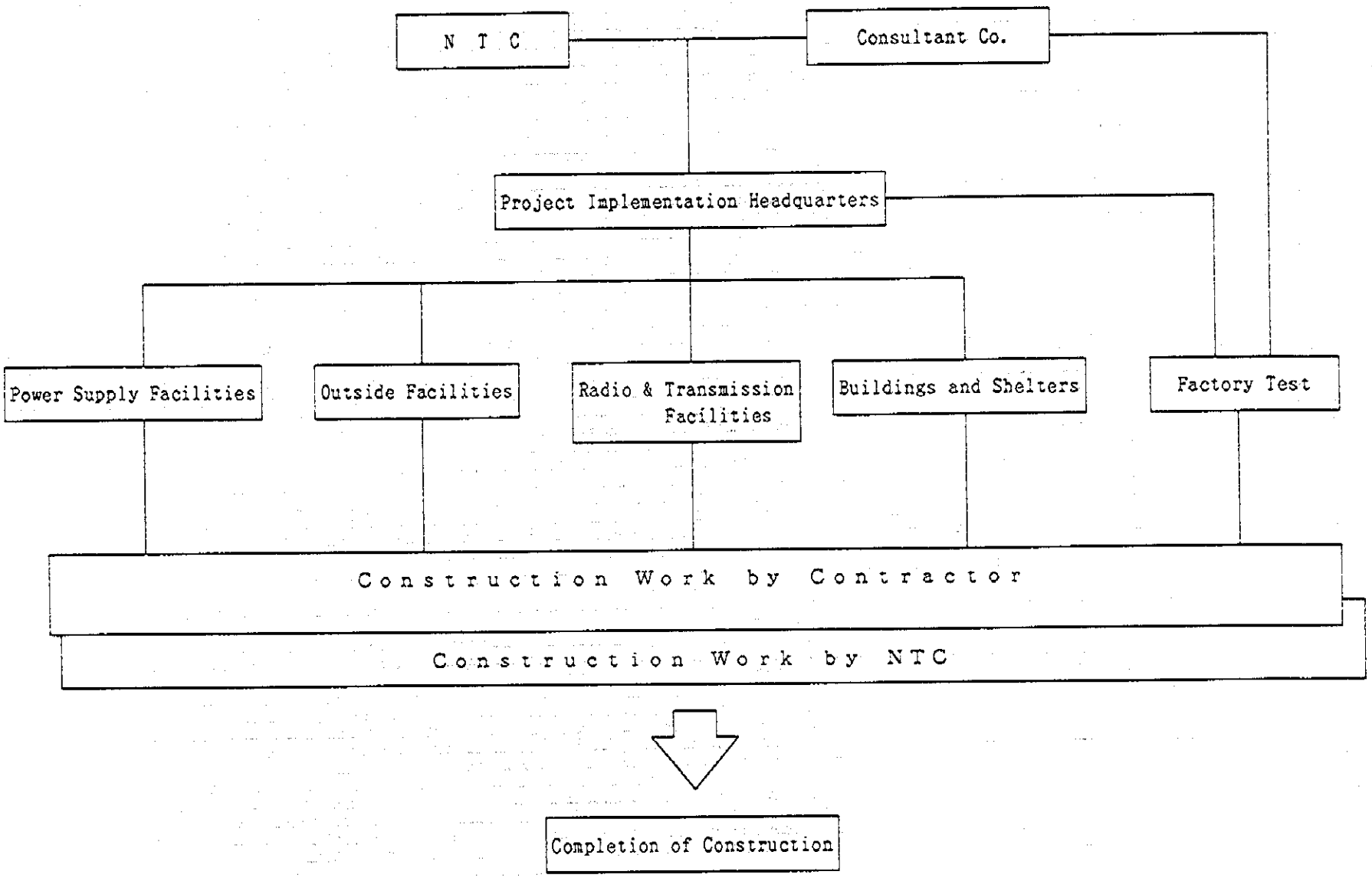


Fig. 3-2 Project Inplementation and Supervision Organization

3.1.5 Procurement Plan

Of the equipment and materials necessary for this Project, main equipment and materials for transmission facilities and others are to be procured from Japan and other industrialized countries, since they are difficult to obtain in Nepal and its neighboring countries. Building materials, such as cement, reinforcing bars, etc., are obtainable in Nepal and, therefore, will be used.

Materials to be procured in Nepal are as follows:

(1) Fuel

Gasoline, diesel engine oil, and lubrication oil.

(2) Building materials

Cement, reinforcing bars, sand, gravel, crushed stones, frame materials (lumber, plywood boards, flat boards, etc.)

3.1.6 Implementation Schedule

The implementation schedule for this Project is as follows:

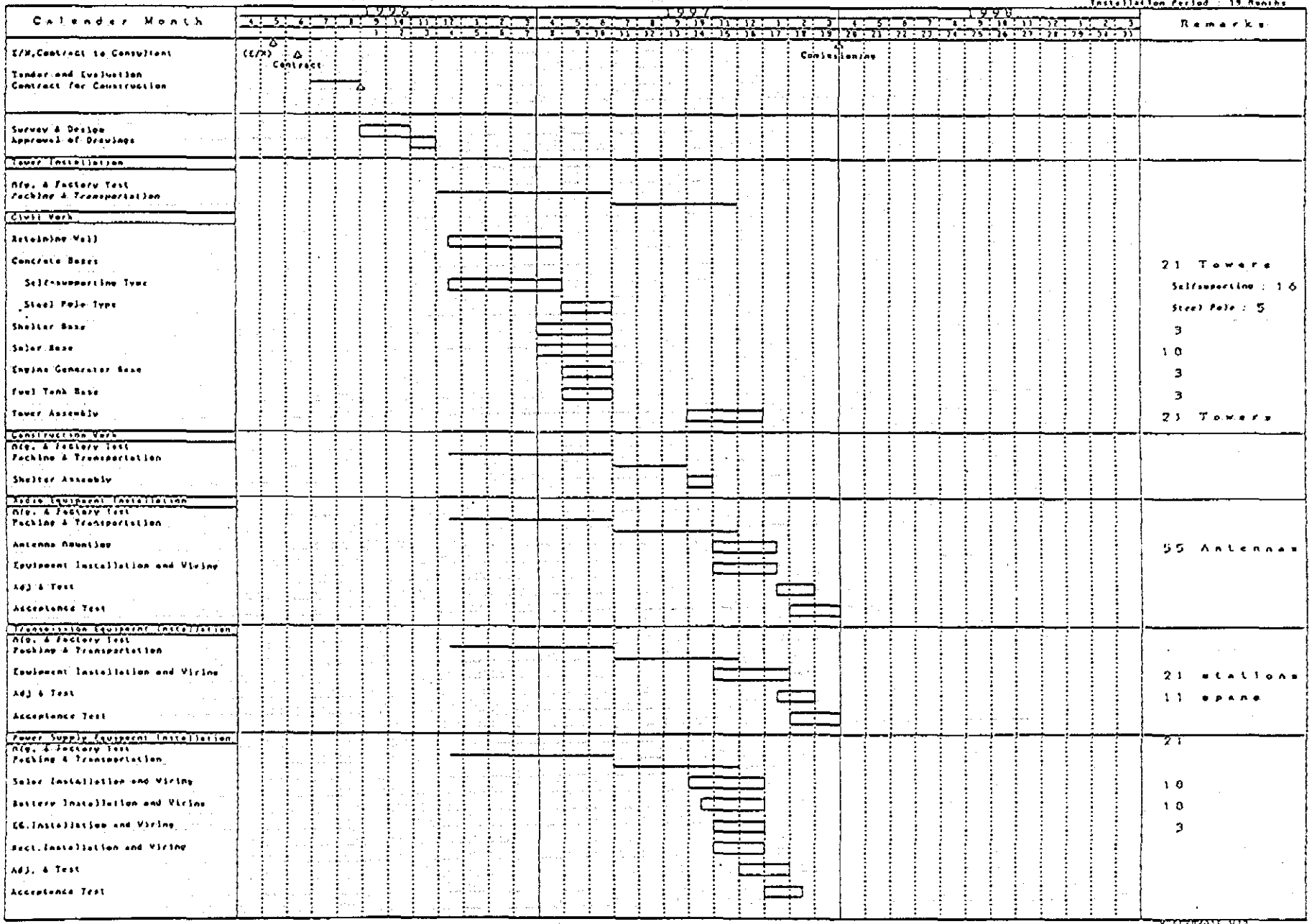
After signing of the Exchange of Notes by both the Japanese and His Majesty's Governments, His Majesty's Government concludes a consultancy service agreement with a Japanese consulting firm for design and supervision of the Project.

The consulting firm prepares, under the contract with His Majesty's Government, detail designs and tender specifications for the facilities which fall under the scope of the work by the Japanese side. Then, tenders for this Project are invited. After tender evaluation, the construction contract is concluded between His Majesty's Government and the Successful Tenderer, and the construction work is commenced.

In view of the locations and natural conditions of the objective sites, and the contents and size of works to be undertaken by His Majesty's Government, Type A fund should be applied for this Project.

The construction period is estimated to be nineteen (19) months consisting of two (2) months for survey and design, and seventeen (17) months for procurement and construction work. The implementation time schedule is given below.

IMPLEMENTATION TIME SCHEDULE



3.1.7 Obligations of Recipient Country

In addition to the scope of the works mentioned in Item 3.1.3 above, the following should also be undertaken by the Nepal side:

(1) Arrangements for exemption from the following taxes:

- Customs clearance and import taxes on equipment and materials to be imported from foreign countries
- Taxes on durable consumer goods to be procured locally

(2) Local support

- Telecommunications means (toll and local communications)
- Work offices and utilities (fuel and light expenses)

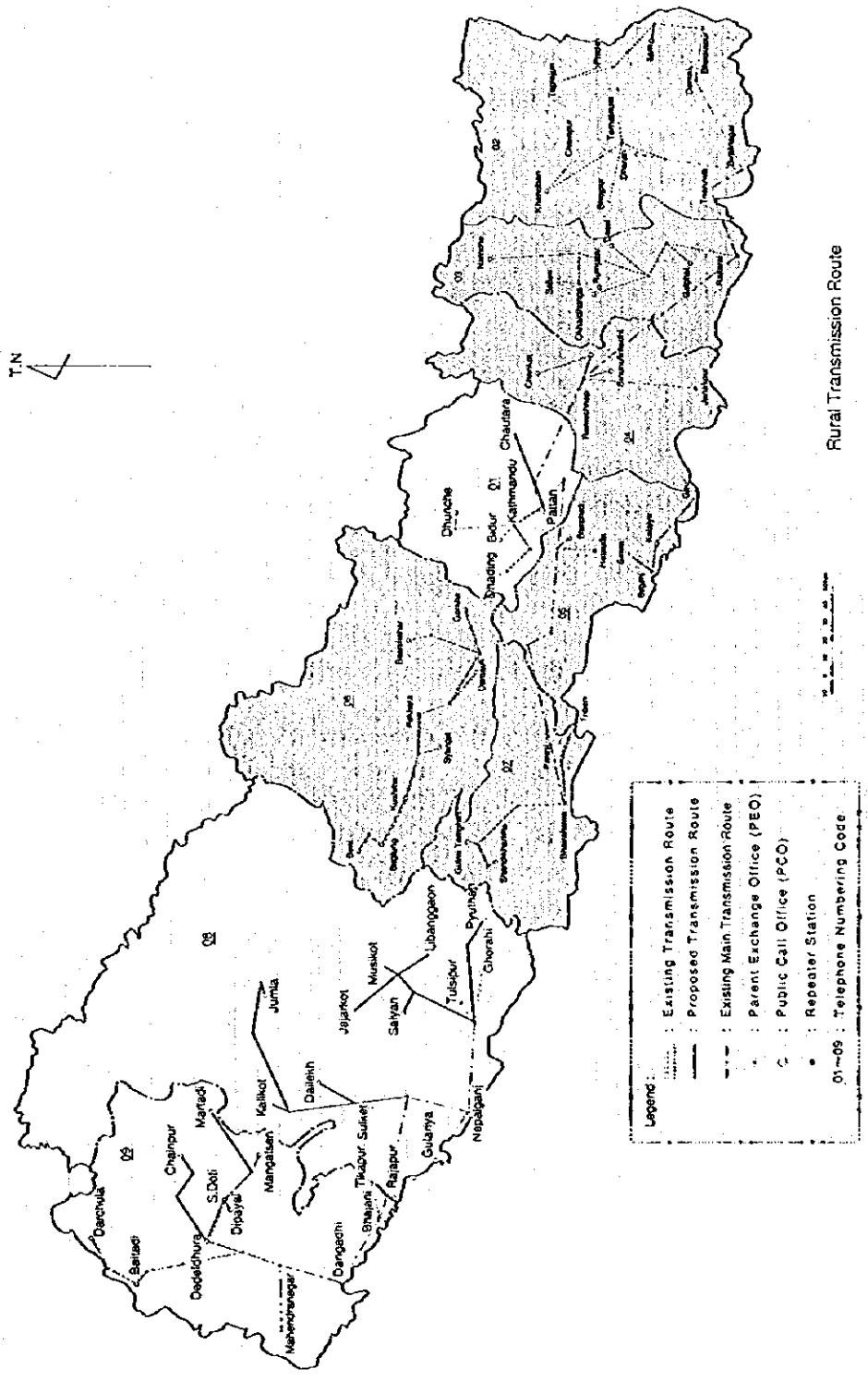
(3) Permits and approvals to be required in connection with the construction of the following:

- Shelters for standby Diesel engine generator Set
- Work offices, warehouses, etc.

Detail designs, tender specifications, equipment and materials procurement, and supervision of construction work for the facilities which fall under the scope of work by the Nepal side are to be undertaken by NTC and the Project Implementation Organization.

3.2 Operation and Maintenance Plan

(1) With the materialization of the previous projects, NTC has established an integrated nationwide operation and maintenance organization, classifying the whole country into 9 areas, from 01 to 09, as shown in the map below.



The objective areas of this Projects belong to 01, 08 and 09 areas and supervised by respective O/M exchanges as follows:

01 Area	O/M Exchange	:	Kathmandu Central Telecom. Office
	PCO to be supervised	:	Chautara
08 Area	O/M Exchange	:	Nepalganj Central Western Telecom. Office
	PCOs to be supervised	:	Salyan Pyuthan Musikot Libanggaon Dailekh Jajarkot Kalikot (Manma) Jumla
09 Area	O/M Exchange	:	Dangadi Westernmost Telecom. Office
	PCOs to be supervised	:	Martadi Chainpur

In view of the geographical and road conditions in Nepal, the establishment of 9 areas for operation and maintenance of the nationwide system is most appropriate, since such system permits efficient use of staff and spare parts and can shorten the time to be required for trouble shooting.

To realize most efficient and effective operation/maintenance organization in each O/M Area related to this Project, the following number of staff should be positioned for respective Areas. The staff of Long Distance Maintenance Department in NTC Headquarters should also be reinforced as follows:

Staffing for O/M Areas

	01 Area	08 Area	09 Area	Total
O/M Staff				
Transmission/Radio Engineer	1	1	1	3
Transmission/Radio Asst. Engineer	1	2	1	4
Transmission/Radio Supervisor	1	2	1	4
Transmission/Radio Technician	1	4	2	7
Power Supervisor	1	2	1	4
Power Technician	1	4	1	6
Sub-Total	6	15	7	28
Others				
PCO Operator	1	8	2	11
Telegram Messenger	2	16	4	22
Driver	1	2	1	4
Charge Collector	1	8	2	11
Guardsman	1	15	4	20
Sub-Total	6	49	13	68
Total	12	64	20	96

Staffing for Long Distance Maintenance Department

	O/M Section I*	O/M Section II*	Total
Transmission/Radio Engineer	1	1	2
Transmission/Radio Supervisor	2	2	4
Transmission/Radio Technician	2	2	4
Power Engineer	1	1	2
Power Supervisor	2	2	4
Power Technician	2	2	4
Driver	1		1
Total	11	10	21
Grand Total			**117**

Note*: O/M Section I in Kathmandu HQ
To support regional O/M Office
O/M Section II in Kathmandu HQ
Mainly in charge of repairs of faulty equipment

In NTC's application for the Japan's grant aid for this Project, the number

of O/M staff to be required after the Project implementation is mentioned as 127 in total. The above study results prove that the number estimated by NTC is quite reasonable.

(2) Income and Expenditure of the Project

The optimum number of telephones per PCO is studied, based on the information concerning probable demand obtained through interviews with responsible persons (regional development committee, etc.) at each site. As a result, the reasonable number of telephone lines per PCO site at the initial stage is set at 30, consisting of the following:

For important subscribers	28 lines
For ordinary subscribers	2 lines

Income

The income, i.e., telephone charges, can be obtained from each PCO. The income is calculated as follows:

Average number of calls per PCO	:	100/day
Average holding time per call	:	4 minutes
Average distance between calling and called parties per call	:	100-200 Km (D stage)
Average charge per call	:	Rs.28.80*

Note*: Source ... NTC's List of Tariff

Then, the income from 11 PCOs per day is:

100/day x Rs.28.80 x 11 PCOs = Rs.31,680

In consequence, the annual income from telephone charges is:

Rs.31,680 x 365 days = Rs.11,563,200

Expenditure

Personnel expenses and overhead to be incurred as a result of the implementation of this Project are estimated to be as follows:

(Unit: Rs.1,000)

	Items	Amount
1	Personnel expenses	5,424
2	Overhead	542
3	Maintenance costs (spare parts)	4,700
4	Others	578
Total		11,244

The personnel expenses for regional and Headquarters staff mentioned previously are given below:

Staff	Number	Salary (Monthly) (Rs)	Total (Rs)
Transmission/Radio Engineer	5	6,000	30,000
Transmission/Radio Asst. Engineer	4	5,000	20.000
Transmission/Radio Supervisor	8	4,500	36,000
TX/Radio Technician	11	4,000	44,000
Power Engineer	2	6,000	12,000
Power Supervisor	8	4,500	36,000
Power Technician	10	4,000	40,000
PCO Operator	11	4,000	44,000
Telegram Messenger	22	3,000	66,000
Charge Collector	11	4,000	44,000
Driver	5	4,000	20,000
Guardsman	20	3,000	60,000
Total			452,000

Ten percent (10%) of the personnel expenses is taken into account for overhead charges, one percent (1%) of the equipment cost for spar parts, and five percent (5%) of the expected income for other expenses.

Balance

When the facilities materialized by this Project are operated as expected, the balance will be:

Income	Rs. 11,563,000
Expenditure	Rs. 11,244

Hence, the profit in the amount of Rs.319,000 per year can be expected. For the time being, the operation and maintenance costs can be covered by the income from telephone charges, though the personnel expenses will increase annually. The demand for telephones will certainly increase after the system by this Project has been put into service successfully, leading to income increase. NTC also plans to introduce a small capacity exchange system utilizing the transmission routes of this Project. There is great expectation of further increase in income from ordinary subscribers.

Hence it is considered that sufficient budgetary arrangement has already been made by NTC.

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

4.1 Project Effect

The effect of this Project can be divided into two: (1) direct effect from the introduction of toll telephone services in non-telephone districts, and (2) indirect effect in social and economic activities, regional administrative and medical services, etc.

(1) Direct Effect

Telecommunications services in the objective North-western area are extremely poor, and this Project aims to provide toll telephone facilities for high priority, important subscribers. Further, the transmission facilities installed by this Project will be able to function, at the same time, as a backbone transmission route to connect the toll parent exchange offices (PEOs) and district centers. This will permit the introduction of small-sized switching systems when necessity arises in the future to meet the increased demand.

In addition, with the utilization of the existing temporary system, MARTS (multi access radio telephone system), telephone services can be extended to remote areas from the backbone link, and much more investment effects can be achieved.

(2) Indirect Effect

Improvement of telecommunications is vital to the social and economic development in Nepal, particularly in the districts where road conditions are extremely poor.

Improved telecommunications will serve for:

(1) Modernization of distribution systems for agricultural products. This will bring about a great deal of benefits to agricultural people in rural areas, and stimulate the activities of the people who used to be socially and economically isolated.

(2) Improvement of efficiency in regional development administration.

(3) Speedy and timely transmission of directions and information for local administration, leading to efficient local management.

Realization of rural telephone services will also contribute to enhancement of inhabitants' reliance on governmental administrations.

Pervasive effect of this Project is summarized in the following, which will

well prove the appropriateness of this Project as a grant aid project.

- Improvement in efficiency of regional administrative services and enhancement of inhabitants' reliance on the administration.

- Enhancement of social welfare of the nation through the improved emergency medical services, etc.

- Development of regional economy mainly in agricultural and forest industries and increase in employment opportunities through the modernization of distribution systems.

- Promotion of development of the tourist industry in the North-Western region.

(3) Benefits

The population who will benefit directly from this Project is estimated to be 1,720,000 in 11 objective areas, and those who will benefit indirectly is estimated to be 19,000,000 covering the whole country.

4.2 Recommendation

As discussed in the foregoing, a great deal of benefits and the contribution to the basic human needs of the nation can be expected from this Project. Hence the materialization of the Project is significant.

In order to ensure the successful materialization of this Project, due attention should be paid to the following:

(1) The Project consists of two parts: one to be realized by the Japan's grant aid and the other to be undertaken by the Nepal side. Technical compatibility between the facilities provided by the Japanese side and those by the Nepal side and coordination of work schedules are a key to successful implementation of the Project. This means the necessity of close contact and cooperation among the parties concerned of both countries.

1) Immediately after the signing of the Exchange of Notes by both the Governments, His Majesty's Government should raise fund necessary for execution of the obligations of the Government for this Project.

2) Prior to the commencement of the installation work, a minute, overall implementation plan should be prepared through discussions between Japanese and local consultants concerning the basic technical matters and the time schedule of the installation work to be done by the Nepal side.

3) All the installation work by the Nepal side should be completed at

least one (1) month prior to the commencement of the relevant work by the Japanese side.

(2) Necessary number of operation and maintenance staff should be reinforced through internal and external recruiting. For these staff, sufficient training should be conducted at the Training Center and/or on-the-job training, in advance to the service-in of the facilities of this Project.

(3) Coordination with Other Projects

As mentioned previously, coordination with other projects will lead to effective investments for rural telecommunications development.

Particularly with respect to the removal of MARTS and their re-installation for local networks, thorough discussions should be made with NTC in advance so that installation time schedule, number of necessary lines, requirements for technical interface, etc. can be clarified.

APPENDICES

APPENDICES

1. Member List of the Survey Team
2. Survey Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Cost Estimation Borne by the Recipient Country

Appendix 1. Member List of the Survey Team

(1) Member List of Basic Design Study on the Project for the Expansion of the Rural Telecommunication Network in the North-western Region in the Kingdom of Nepal

1. Leader, Project Coordinator : Mr. Toshinobu KATO
   Second Basic Design Study Div., Grant Aid Study & Design Dep., JICA

2. Telecommunication Planner : Mr. Suemori HAMASAKI
   Section Chief, International Cooperation Div., International Affairs Dep., Ministry of Post and Telecommunications

3. Chief Consultant, Telecom. Network Planner : Mr. Takashi MATSUOKA
   Nippon Telecommunications Consulting Co., Ltd.

4. Radio Transmission Planner : Mr. Kanji TAKAYAMA
   Nippon Telecommunications consulting Co., Ltd.

5. Switching System, Outside Plant, Demand Estimation : Mr. Akira IWAMI
   Nippon Telecommunications Consulting Co., Ltd.

6. Civil, Architecture, Cost Estimation : Mr. Teruhiro TAHARA
   Nippon Telecommunications Consulting Co., Ltd.

7. Power Supply Planner : Mr. Hitoshi MUROGA
   Nippon Telecommunications Consulting Co., Ltd.

(2) Member List of Basic Design Study on the Project for the Expansion of the Rural Telecommunication Network in the North-western Region in the Kingdom of Nepal (The Explanation Team for Draft Basic Design)

1. Leader, Telecommunication Network Planner : Mr. Osamu MAKINO
   Senior Telecommunication Adviser,
   Institute for International Cooperation, JICA

2. Technical Advisor : Mr. Masahiro IWABUCHI
   Special Advisor, International Cooperation Div.,
   International Affairs Dept.,
   Ministry of Posts and Telecommunications

3. Project Coordinator : Mr. Masafumi NAGAISHI
   Second Basic Design Study Div., Grant Aid Study and Design Dept., JICA

4. Chief Consultant, Telecom. Network Planner : Mr. Takashi MATSUOKA
   Nippon Telecommunications Consulting Co., Ltd.

5. Radio Transmission Planner : Mr. Kanji TAKAYAMA
   Nippon Telecommunications Consulting Co., Ltd.

6. Civil, Architecture Plan, Cost Estimation : Mr. Teruhiro TAHARA
   Nippon Telecommunications Consulting Co., Ltd.

Appendix 2. Survey Schedule

(1) Field Survey for Basic Design Study

May.13 (Sat.)	Study Team	A,B,C,D,E :	Movement (Tokyo to KTM)
14 (Sun.)		A,B,C,D,E :	Observation Trip to Existing Bidur and Kakani Stations
15 (Mon.)		A,B,C,D,E :	Courtesy visit to Japanese Embassy, JICA, HMG / NTC, NPC, MOF and MOIC Submission of Inception Reports
16 (Tue.)		A,B,C,D,E :	Explanation / Discussion on Inception Report
17 (Wed.)		A,B,C,D,E :	Explanation / Discussion and Preparation for Site Survey
18 (Thu.)		B, C, D, E :	Explanation / Discussion / Data-arrangement and Move to Nepalganj
19 (Fri.)	Official Members and Study Team A	:	Signing Minutes of Discussion
	B, D, E	:	Site Survey (Nepalganj)
	C	:	Move to Chainpur
20 (Sat.)	Official Members	:	Leave Kathmandu for Bangkok
	Study Team B	:	Site Survey (Nepalganj, Chamere)
	C	:	Site Survey (Chainpur)
	D	:	Move to Dhangadhi
	E	:	Move to Jumula
21 (Sun.)	A	:	Data Arrangement
	B	:	Move to Dailekh
	C	:	Site Survey (Bantalekh) and Move to Teibu
	D	:	Site Survey (Dhangadhi)
	E	:	Site Survey (Jumla)
22 (Mon.)	A	:	Data Collection
	B	:	Site Survey (Dailekh)
	C	:	Move to Rayal
	D	:	Move to Nepalganj
	E	:	Site Survey (Jumla)

23 (Tue.)	Study Team	A	:	Data Collection
		B	:	Move to Surkhet
		C	:	Site Survey (Rayal) and Move to Nagarigado
		D	:	Site Survey (Chamere)
		E	:	Move to Chimaralekh
24 (Wed.)		A	:	Data Collection
		B	:	Site Survey (Ghorahi, Tulsipur)
		C	:	Move to Doti
		D	:	Site Survey (Salyan)
		E	:	Site Survey (Chimaralekh) and Move to Jumla
25 (Thu.)		A	:	Data Collection
		B	:	Move to Pyuthan
		C	:	Site Survey (Doti, Dadeldhura)
		D	:	Move to Kathmandu
		E	:	Move to Tatopani
26 (Fri.)		A	:	Data Collection
		B	:	Site Survey (Pyuthan, Libang) and Move to Nepalganj
		C	:	Site Survey (Dadeldhura, Dhangadhi) and Move to Nepalganj
		D	:	Data Arrangement
		E	:	Move to Maithapla
27 (Sat.)		A	:	Data Collection
		B	:	Move to Safebagar
		C	:	Move to Kathmandu
		D	:	Data Arrangement
		E	:	Site Survey (Maithapla) and Move to Nagma
28 (Sun.)		A	:	Data Arrangement
		B	:	Data Collection
		C, D	:	Data Arrangement
		E	:	Move to Karagad
29 (Mon.)		A	:	Move to Nagarkot
		B	:	Data Arrangement
		C	:	Data Arrangement
		D	:	Leave Kathmandu for Bangkok
		E	:	Move to Latadabar

30 (Tue.)	Study Team	A	:	Site Survey (Nagarkot)
		B	:	Move to Doti
		C	:	Data Arrangement
		D	:	Arriving at Tokyo
		E	:	Move to Kalikot
31 (Wed.)		A	:	Move to Chautara
		B	:	Move to Dadeldhura
		C	:	Data Arrangement
		E	:	Site Survey (Kalikot)
Jun. 1 (Thu.)		A	:	Site Survey (Chautara)
		B	:	Site Survey (Dadeldhura, Dhangadhi) and Move to Nepalganj
		C	:	Data Arrangement
		E	:	Move to Baruta
2 (Fri.)		A	:	Move to Kathmandu
		B	:	Site Survey (Nepalganj)
		C	:	Data Arrangement
		E	:	Move to Bhartalagna
3 (Sat.)		A	:	Data Arrangement
		B	:	Site Survey (Salyan) and Move to Sauniyapani
		C	:	Data Arrangement
		E	:	Site Survey (Bhartalagna)
4 (Sun.)		A	:	Data Arrangement
		B	:	Site Survey (Sauniyapani)
		C	:	Data Arrangement
		E	:	Move to Danimadi
5 (Mon.)		A	:	Data Collection
		B	:	Move to Salyan
		C	:	Data Arrangement
		E	:	Move to Doungisaku
6 (Tue.)		A	:	Data Collection
		B	:	Move to Kathmandu
		C	:	Data Arrangement
		E	:	Move to Ranimatta
7 (Wed.)		A	:	Data Collection
		B	:	Data Arrangement
		C	:	Move to Jajarkot
		E	:	Site Survey (Ranimatta)

8 (Thu.)	Study Team	A	:	Data Collection
		B	:	Data Arrangement
		C	:	Site Survey (Jajarkot) and Move to Ramanagat
		E	:	Move to Surket
9 (Fri.)		A	:	Data Collection
		B	:	Site Survey (Kathmandu)
		C	:	Move to Musikot
		E	:	Move to Nepalganj
10 (Sat.)		A	:	Data Collection
		B	:	Site Survey (Kathmandu)
		C	:	Site Survey (Musikot) and Move to Rukum
		E	:	Move to Bharatpur
11 (Sun.)		A, B, C	:	Data Collection
		E	:	Move to Kathmandu
12 (Mon.)		A, B, C, E	:	Data Collection
13 (Tue.)		A, B	:	Data Collection
		C	:	Move to Kathmandu
14 (Wed.)		A, B, C, E	:	Data Arrangement
15 (Thu.)		A, B, C, E	:	Report to NTC and Meeting
16 (Fri.)		A, B, C, E	:	Report to Embassy of Japan and JICA
17 (Sat.)		A, B, C, E	:	Leave Kathmandu for Bangkok
18 (Sun.)		A, B, C, E	:	Arrive at Tokyo

Note:
- Study Team A : Network Planning, Chief of Consultant
- Study Team B : Radio Transmission Systems & Planning
- Study Team C : Switching System, Outside Plant & Demand Estimation
- Study Team D : Power Supply Systems & Planning
- Study Team E : Civil, Construction Planning & Budgeting

(2) Explanation of Draft Basic Design and Supplementary Survey

Oct. 8 (Sun.)	Study Team	A, B, C	: Tokyo - Bangkok
9 (Mon.)		A, B, C	: Bangkok - Kathmandu
10 (Tue.)		A, B, C	: Courtesy visit to Japanese Embassy, JICA and HMG / NTC
11 (Wed.)		A, B, C	: Meeting with NTC on Field Survey
12 (Thu.)		A, B, C	: Preparation for Field Survey
13 (Fri.)		A, B	: Site Survey (Patan Station)
		C	: Meeting with NTC
14 (Sat.)		A	: Data Arrangement
		B	: Move to Nepalganj
		C	: Meeting with NTC
15 (Sun.)		A	: Site Survey (Nagarkot Existing Station)
		B	: Move to Dadeldhura
		C	: Preparation for Field Survey
16 (Mon.)		A	: Data Arrangement
		B	: Move to Naledam
		C	: Move to Nepalganj
17 (Tue.)	Official Members		: Arrive at Kathmandu
	Study Team	A	: Meeting with NTC
		B	: Move to Socoti
		C	: Move to Panduson
18 (Wed.)	Official Members		: Courtesy visit to Embassy of Japan, JICA and HMG / NTC
	Study Team	A	
		B, C	: Mirror Test between Siudi - Martadi
19 (Thu.)	Official Members and Study Team	A	: Draft Report Explanation and Discussion with NTC
	Study Team	B	: Site Survey (Siudi) and Move to Socoti
		C	: Site Survey (Martadi) and Move to Porke

20 (Fri.)	Official Members and Study Team A	: Discussion with NTC, signing Minutes of Discussion and Reporting to JICA and Embassy
	Study Team B	: Move to Naledam
	C	: Move to Bajura
21 (Sat.)	Official Members and Study Team A	: Observation Trip to Nagarkot Radio Rep. Station
	Study Team B	: Move to Doti
	C	: Move to Nepalganj
22 (Sun.)	Official Members and Study Team A	: Observation Trip to Bidur and Kakani Existing Station
	Study Team B	: Site Survey (Doti and Dadeldhura)
	C	: Data Arrangement
23 (Mon.)	Study Team A	: Data Arrangement and Report Revision
	B	: Site Survey (Kaphali)
	C	: Site Survey (Nepalganj)
24 (Tue.)	Official Members	: Leave Kathmandu for Bangkok
	Study Team A	: Report Revision
	B	: Site Survey (Buretora, Dhangadhi) and Move to Nepalganj
	C	: Site Survey (Nepalganj) and Data Arrangement
25 (Wed.)	A	: Preparation for Field Survey
	B	: Move to Surket
	C	: Move to Tulsipur
26 (Thu.)	A	: Move to Butawal
	B	: Site Survey (Surket)
	C	: Move to Kathbada
27 (Fri.)	A	: Site Survey (Nepalganj)
	B	: Site Survey (Chamere)
	C	: Move to Ratamatta and Site Survey (Buretora)
28 (Sat.)	A	: Move to Dhangadhi and Discussion in Telecom. Office
	B	: Move to Tulsipur
	C	: Site Survey (Ratamatta)
29 (Sun.)	A	: Site Survey (Dhangadhi), Move to Nepalganj
	B	: Site Survey (Rajhakot), Move to Nepalganj
	C	: Move to Tatke

30 (Mon.)	A	: Site Survey (Nepalganj)
	B	: Move to Kathmandu
	C	: Move to Tulsipur
31 (Tue.)	A	: Move to Butawal
	B	: Data Arrangement
	C	: Move to Bhingri
Nov.1 (Wed.)	A	: Move to Kathmandu
	B	: Data Arrangement
	C	: Site Survey (Swalgadwari)
2 (Thu.)	A, B	: Data Arrangement
	C	: Site Survey (Swalgadwari)
3 (Fri.)	A	: Data Arrangement
	B	: Discussion in NTC Office
	C	: Move to Bhingri
4 (Sat.)	A, B	: Data Arrangement
	C	: Move to Nepalganj and Discussion in Telecom. Office
5 (Sun.)	A	: Preparation of Survey Report
	B	: Discussion in NTC Office
	C	: Move to Bharatpur
6 (Mon.)	A	: Preparation of Survey Report
	B	: Data Arrangement
	C	: Move to Kathmandu
7 (Tue.)	A, B, C	: Report to NTC and Meeting
8 (Wed.)	A, B, C	: Report to Embassy of Japan and JICA
9 (Thu.)	A, B, C	: Survey Tool Arrangement and Preparation for Return
10 (Fri.)	A, B, C	: Leave Kathmandu for Bangkok
11 (Sat.)	A, B, C	: Arrive at Tokyo

Note: Study Team A : Network Planning, Chief of Consultant
Study Team B : Radio Transmission Systems & Planning
Study Team C : Civil, Construction Planning & Budgeting

Appendix 3. List of Party Concerned in the Recipient Country

1. National Planning Commission

   Mr. Shanker Nath Rimal
   Honorable Member

2. Ministry of Finance

   Mr. M.P. Ghimire
   Joint Secretary

   Mr. Deepak Kharel
   Section Office (FACD)

3. Ministry of Information and Communications

   Mr. Bhoj Raj Pokhrel
   Secretary

   Mr. Prahlad Pokhrel
   Section Office (Policy & Planning)

4. Nepal Telecommunications Corporation

   Mr. G.S. Bora
   General Manager

   Mr. V.B. Bajracharya
   Deputy General Manager (Planning)

   Mr. Bala Ram Pradhananga
   Deputy General Manager (Finance & Administration)

   Mr. Rupak Halder
   Manager (Transmission, Planning Dept.)

   Mr. B.R. Kanel
   Regional Manager, Kathmandu Region

   Mr. Lok Raj Sharma
   Manager (Transmission Project Imple. Dept.)

Mr. K.B. Shah
Director (Telecommunication Training Center)

Mr. B.M.S. Pradhan
Regional Manager, Nepalgunj Region

Mr. K.P. Ghimire
Regional Manager, Dhangadhi Region

Mr. Durga Shrestha
Manager (Civil Dept.)

5. The World Bank

Mr. Bigyan Prodhan
Programme Officer

6. Embassy of Japan

Mr. Shigenobu Yoshida
Ambassador

Mr. Masao Ishikawa
Minister-Counsellor

Mr. Yoshitake Iida
Minister-Counsellor

Mr. Hisaki Indou
First Secretary

Mr. Tatsuo ikenaka
Third Secretary

7. JICA Nepal Office

Mr. Masao Watanabe
Representative

Mr. Hiroshi Murakami
Deputy Representative

Mr. Norio Naito
Assistant Representative

Mr. Jun Uchida

Mr. Narendra Kumar Gurung
Senior Programme Officer

8. NTC, Regional Office, Nepalgunj

Mr. Madhusudan Karmacharya
Manager, Regional Office

Mr. S.P. Bharati
Transmission Engineer

Mr. Shresta Krisna Kumar
Transmission Supervisor

Mr. K. Arjung
Power Supervisor

Mr. L.S. Sijapati
Account Officer

Mr. D.R. Upadhyay
Account Officer

9. NTC, Regional Office, Dangadhi

Mr. Gagan Chand Thakuri
Power Supervisor

Mr. Bal Ram Joshi
Switching Supervisor

Mr. Ashwin Kumar Karki
Account Officer

10. NTC, Martadi PCO Office

Mr. Dhundi Raj Kharal
Office In Charge

Mr. Shib Bahadur K.C.
Radio Operator

Mr. Dhan Krishna Jaisi
Supporting Staff

11. NTC, Surkhet PCO Office

Mr. C.N. Kandel
Transmission Supervisor

12. Officials (Local)

(1) Sindhupalchoke District (Chautara)

Mr. Chandra Lal Shrestha
Chairman of District Development Committee
Sindhupalchock District

(2) Dailekh District

Mr. Him Bahadur Sahi
District Development Committee President

(3) Rolpa District

Mr. Rameswar Das Mishra
Local Development Officer

(4) Salyan District

Mr. Harihar Sharma
Chief District Officer

(5) Pyuthan District

Mr. Vinod Jnawal
Chief District Officer