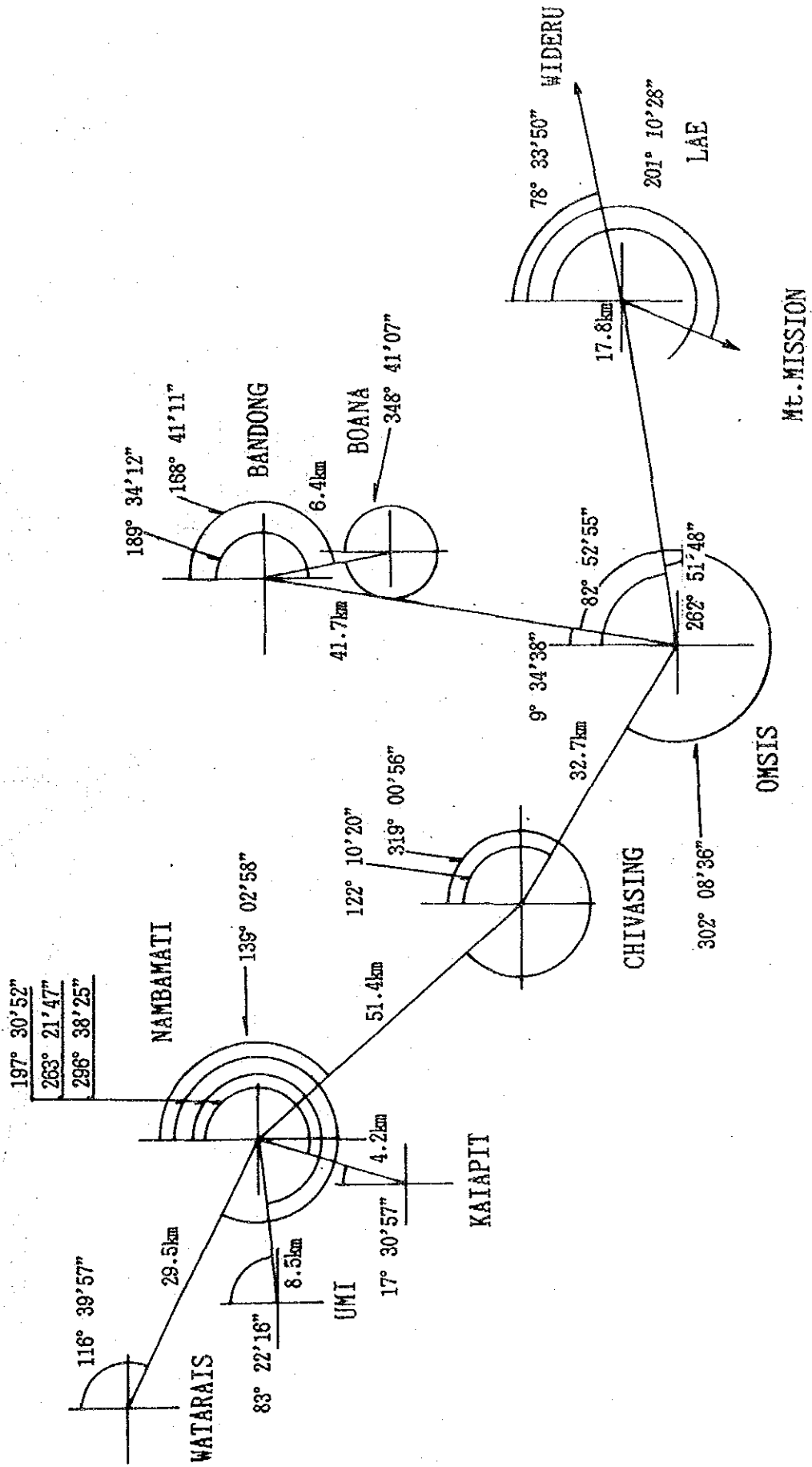


付属資料 2

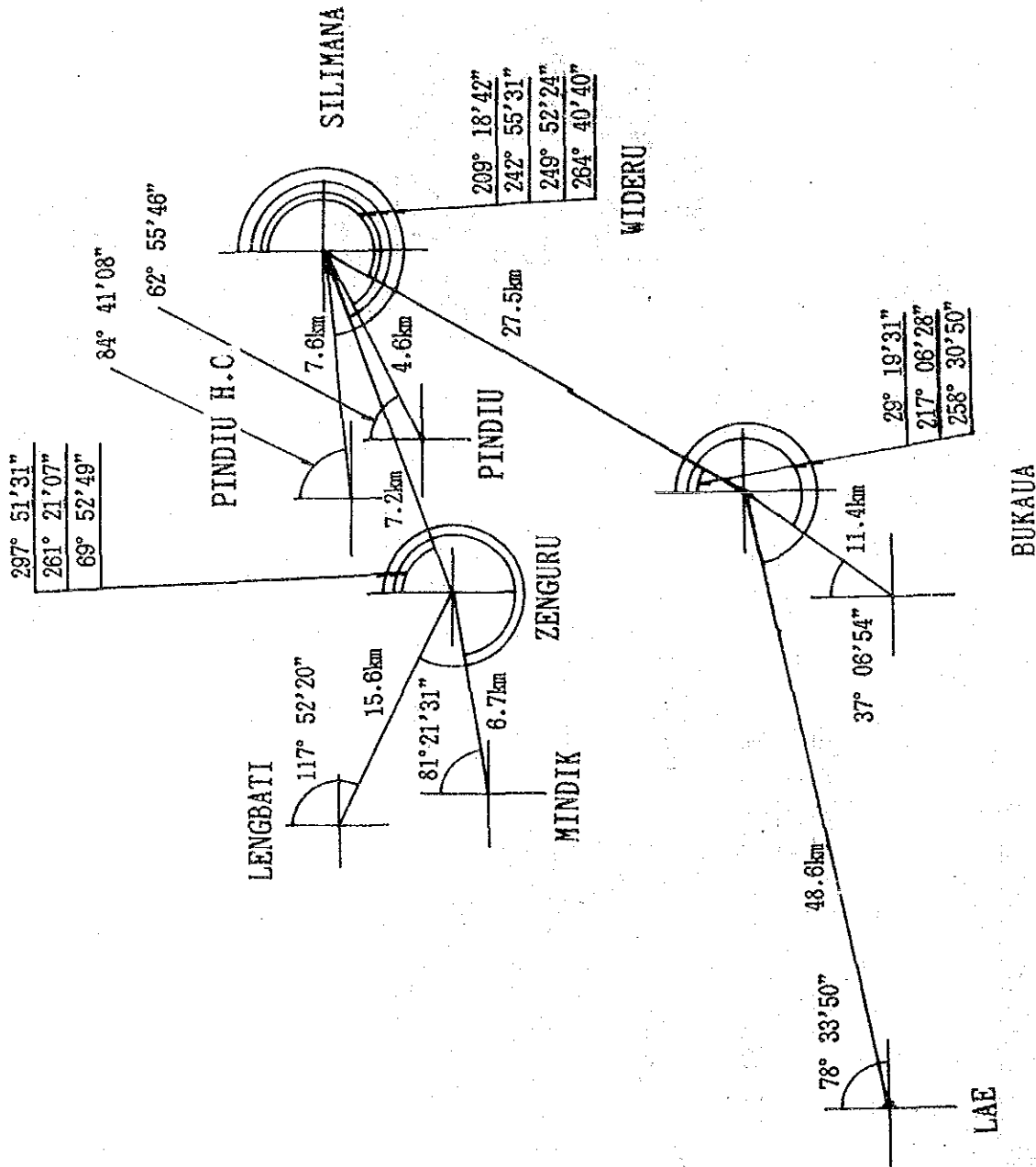
各区間の方位角

Morobe Province	1 ~ 3
New Ireland Province	4 ~ 5
Western Province	6 ~ 7

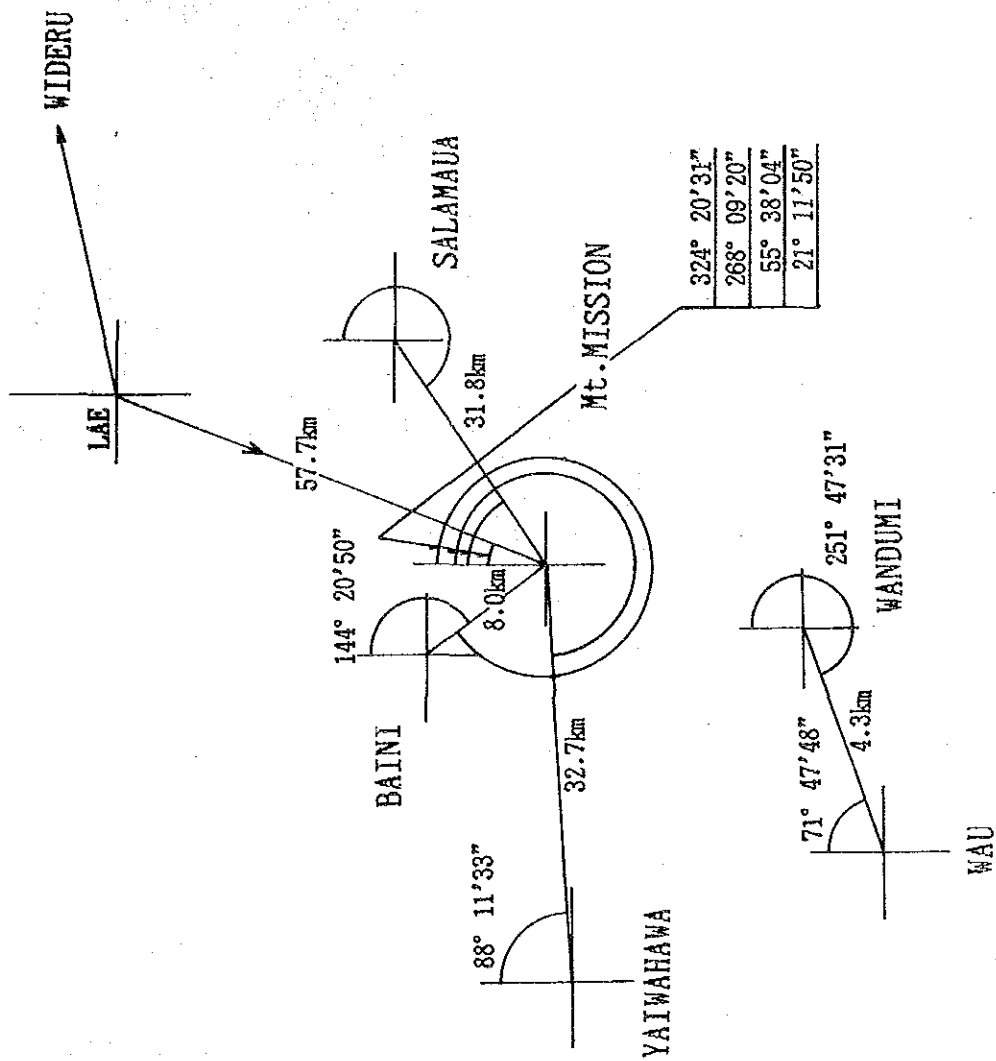
MOROBE PROVINCE(1/3)



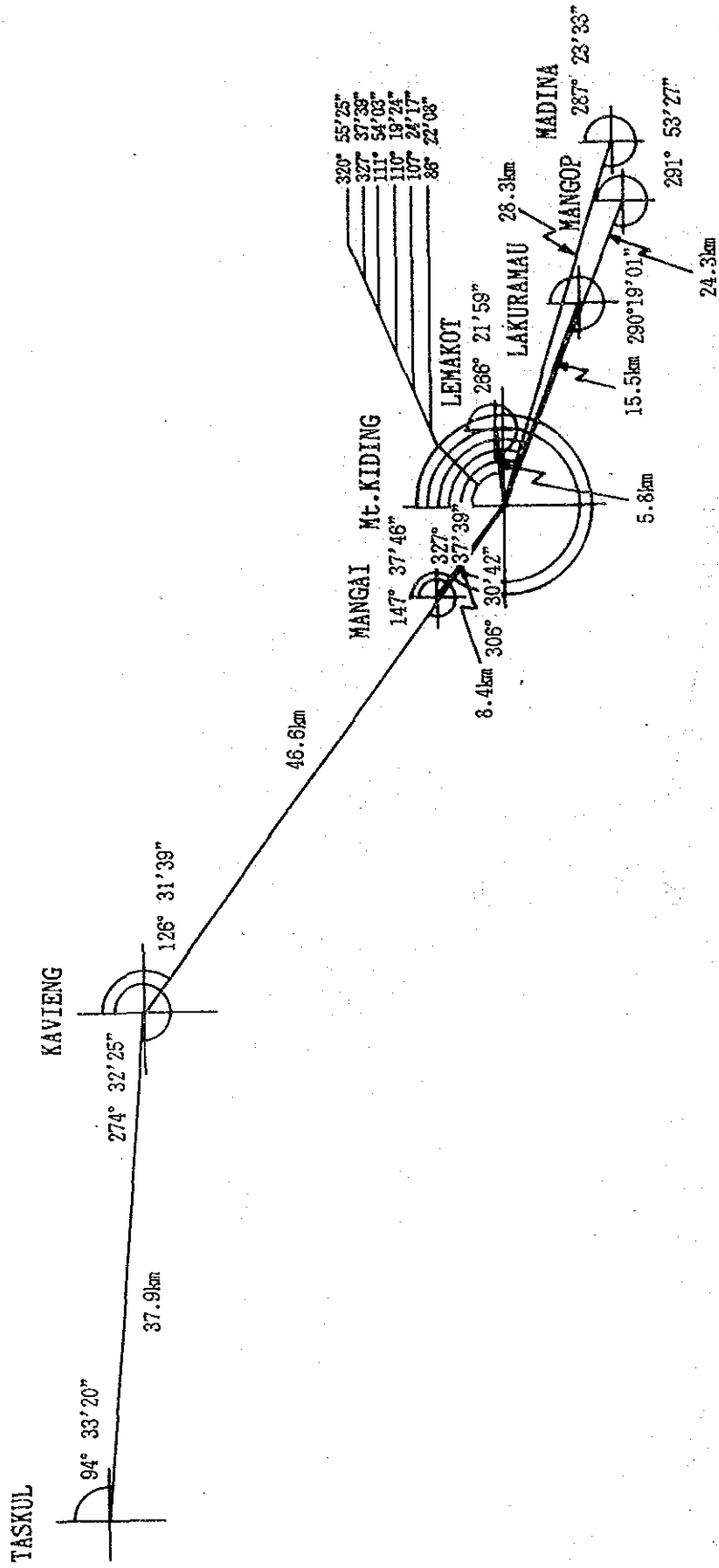
MOROBE PROVINCE(2/3)



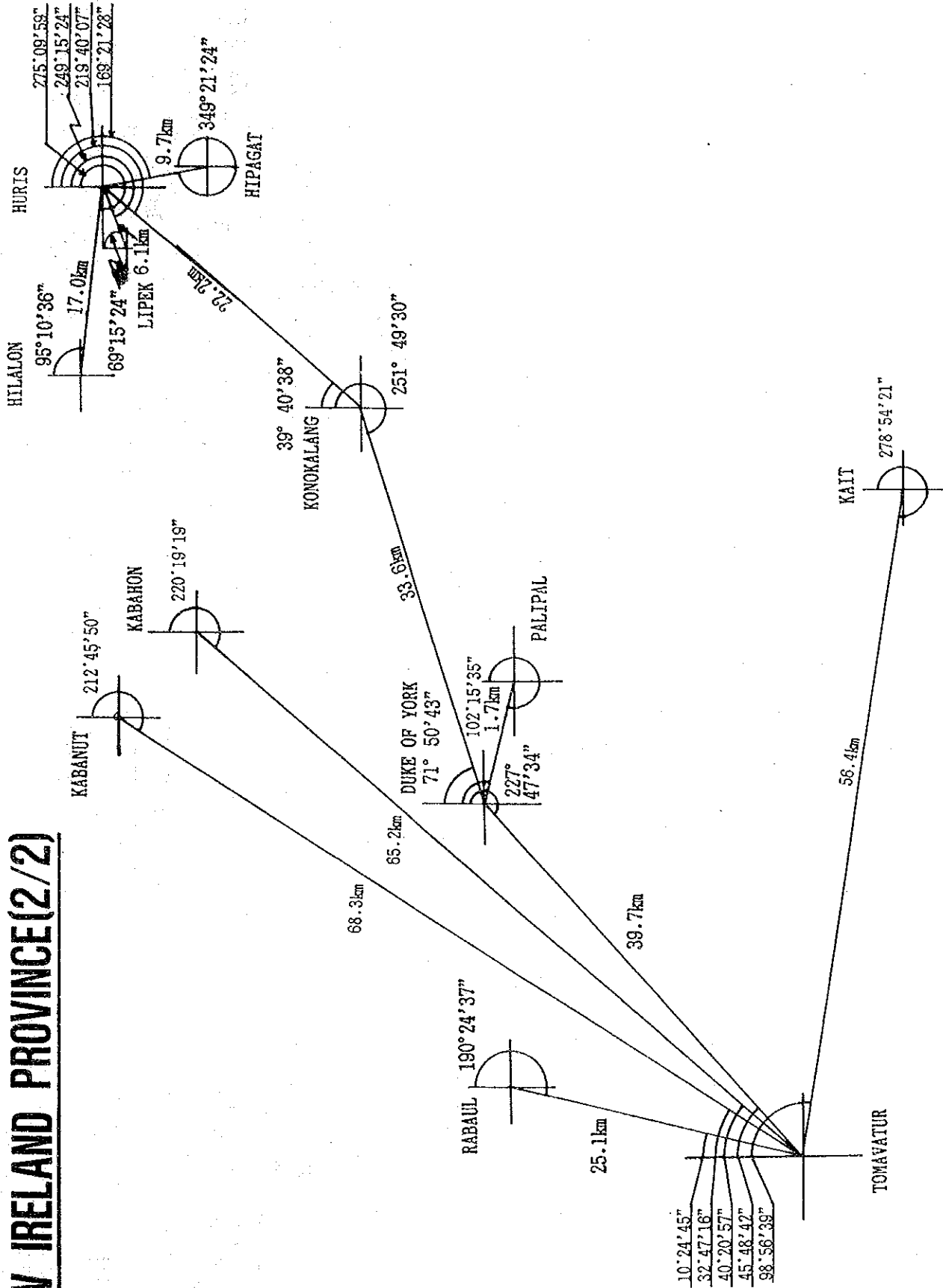
MOROBE PROVINCE(3/3)



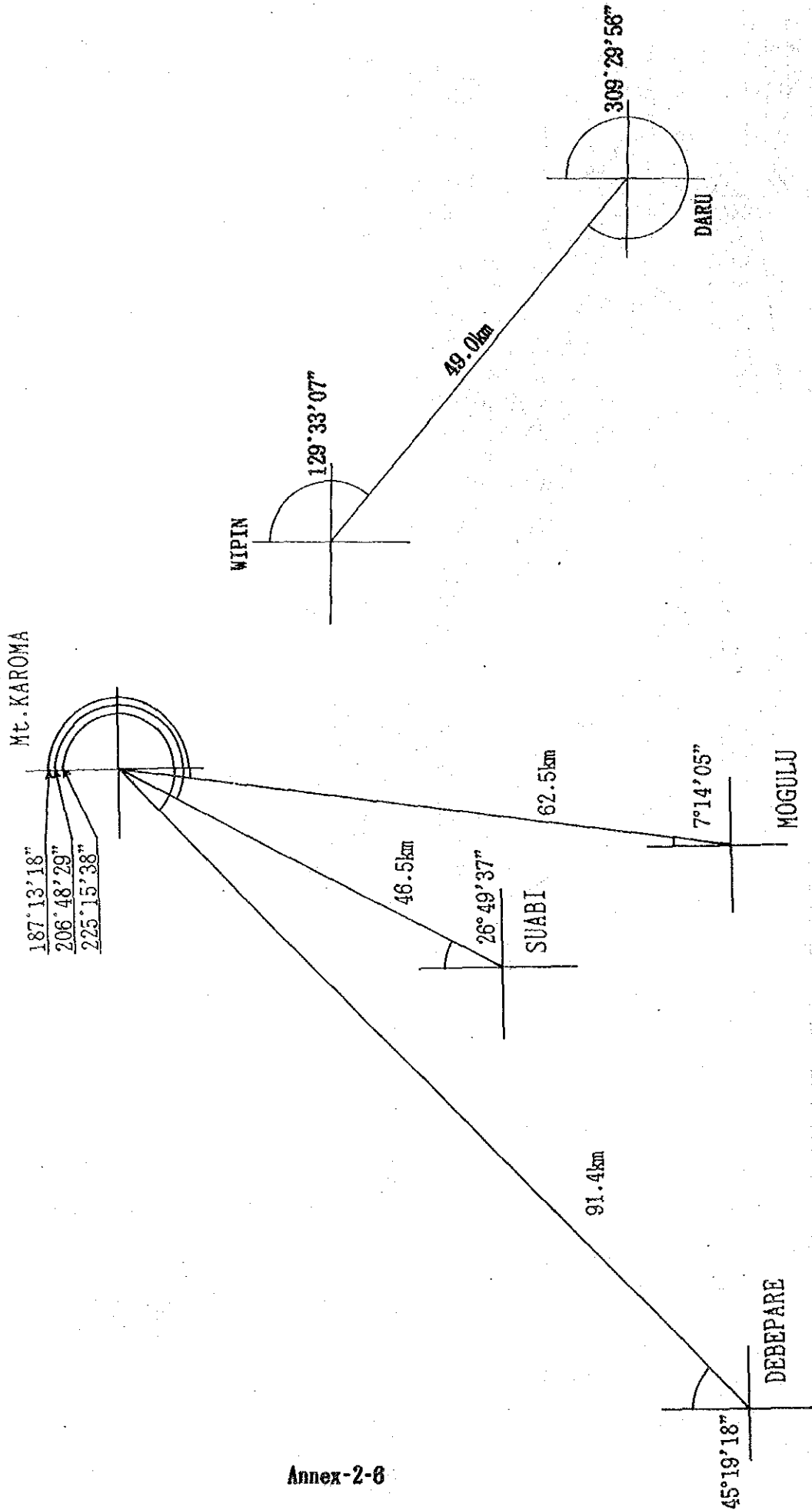
NEW IRELAND PROVINCE(1/2)



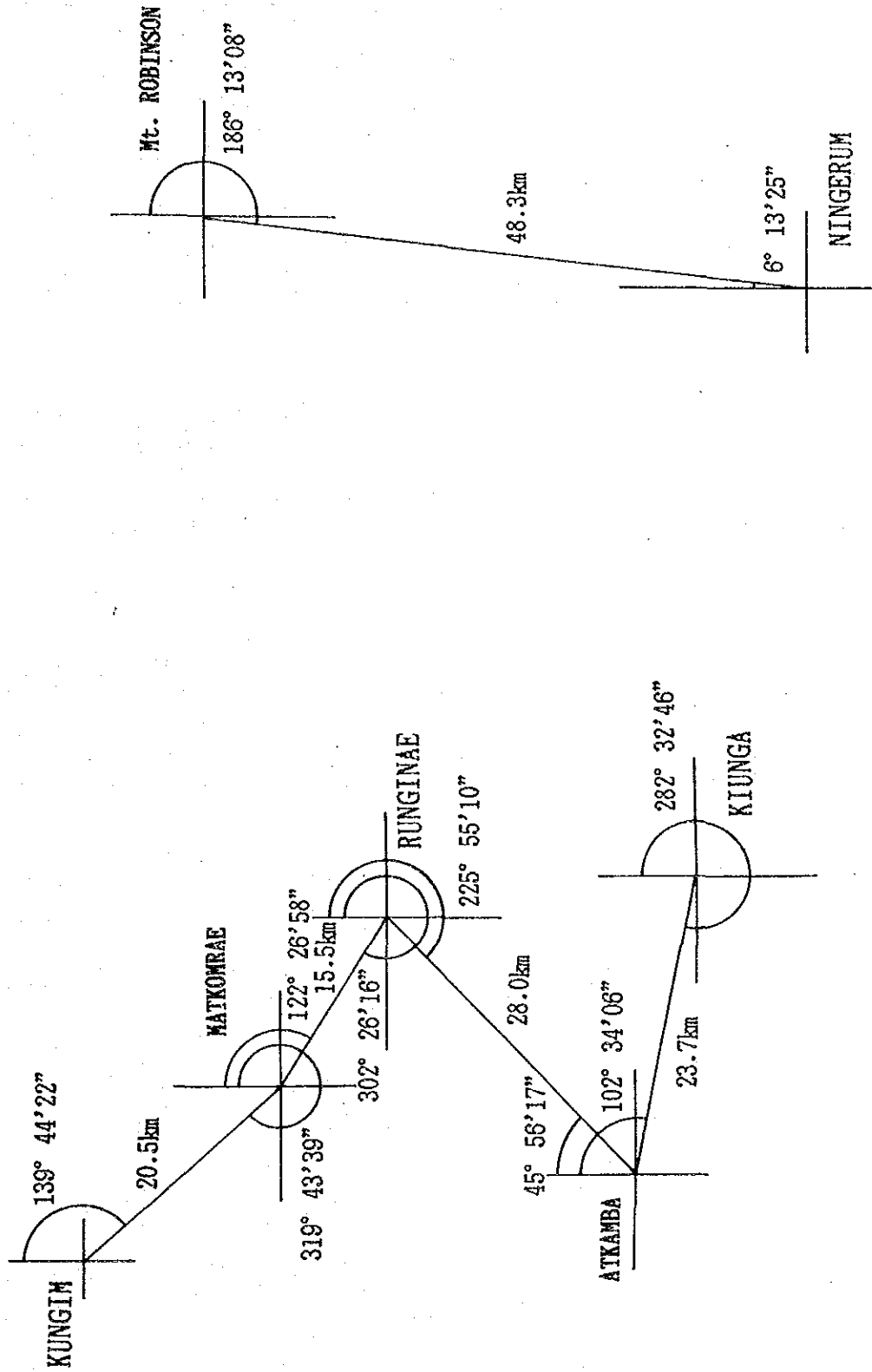
NEW IRELAND PROVINCE(2/2)



WESTERN PROVINCE(1/2)



WESTERN PROVINCE(2/2)



付属資料 3

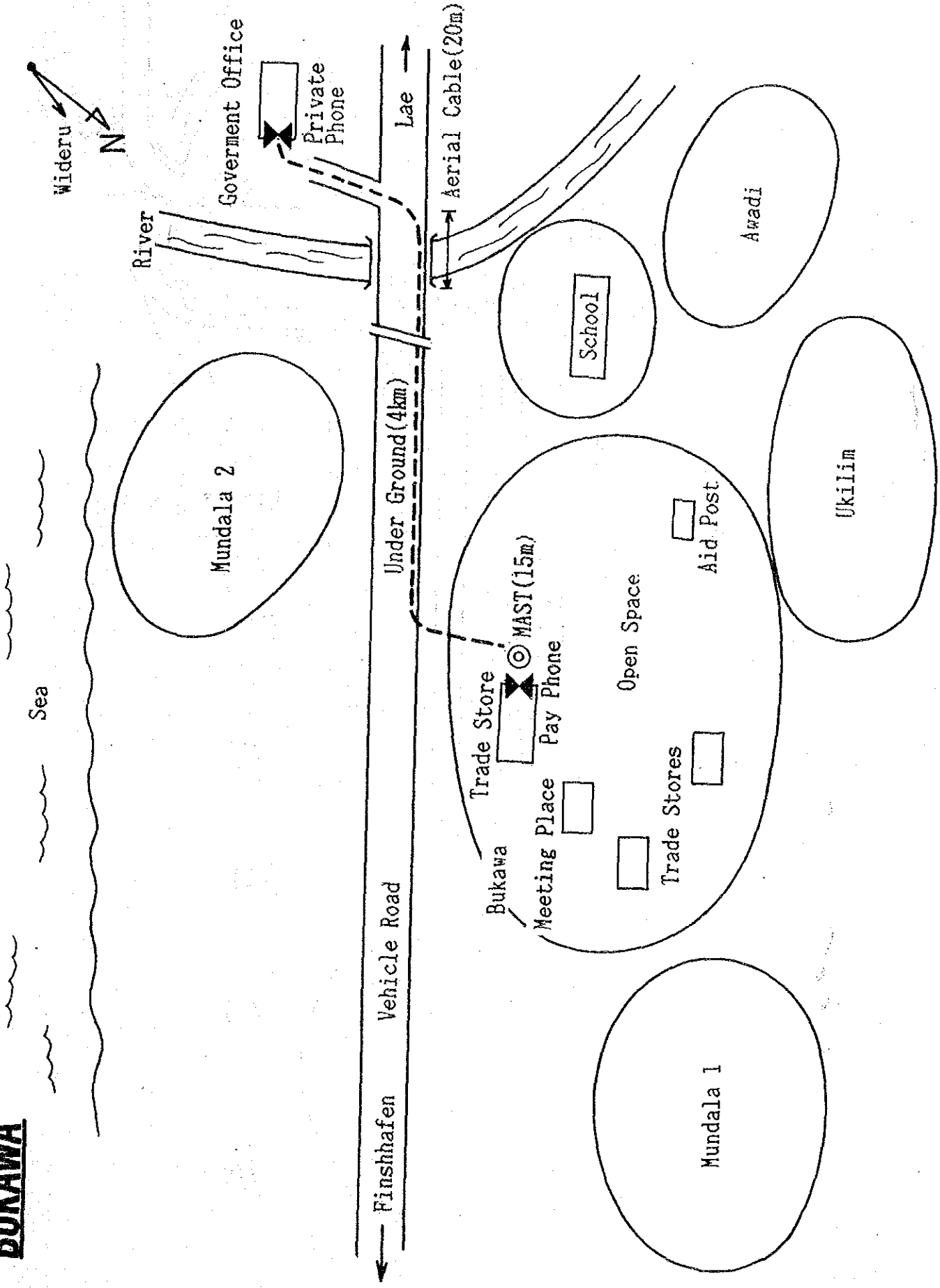
サイトの見取り図

Morobe Province	1 ~ 28
New Ireland Province	29 ~ 51
Western Province	52 ~ 63

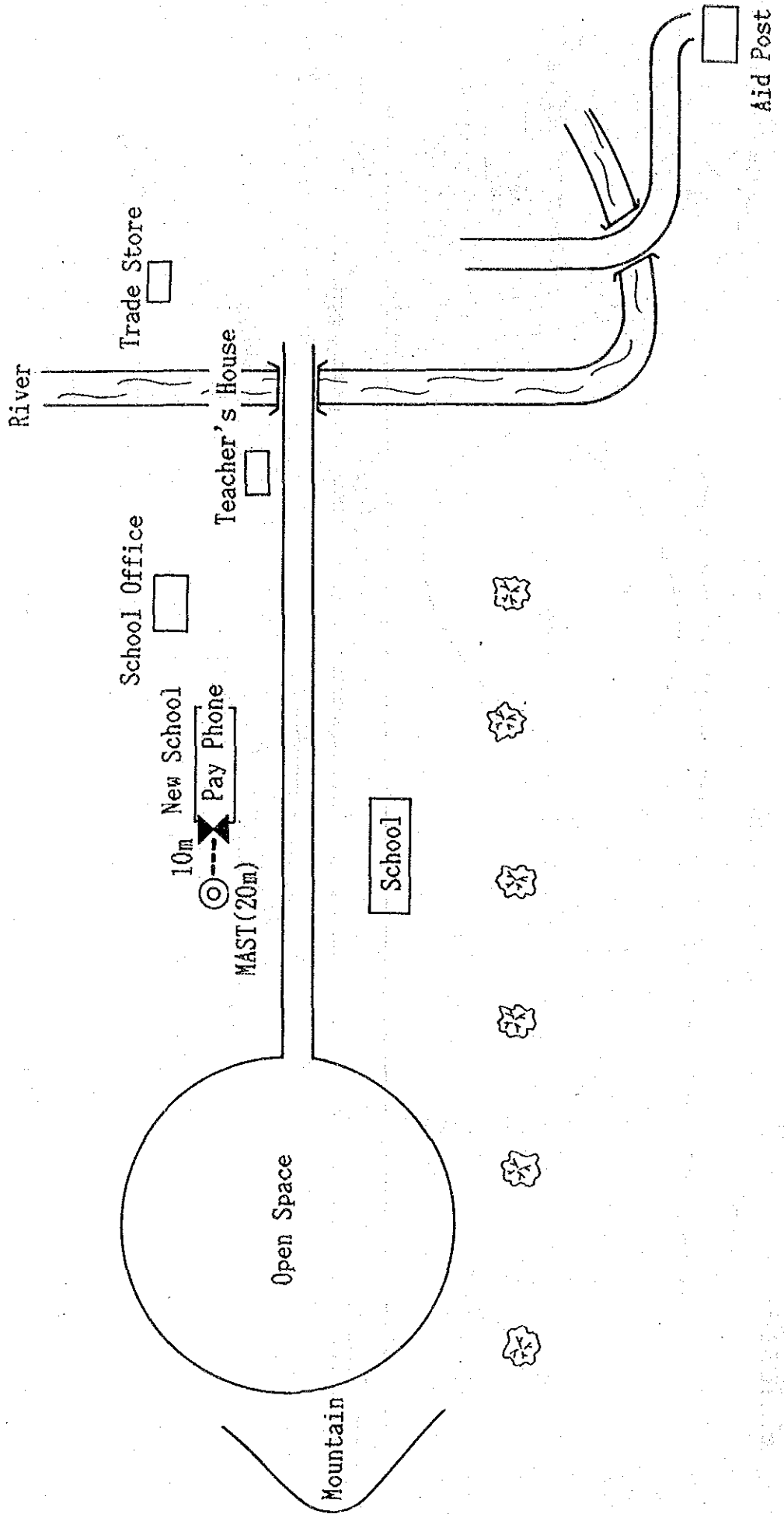
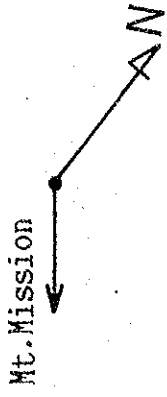
MOROBE PROVINCE

Bukaua	-----	1
Baini	-----	2
Wandumi	-----	3
Yaiwahawa	-----	4
Saramaua	-----	5
Boana	-----	6
Bandong	-----	7
Watarais	-----	8
Kaiapit	-----	9
Chivasing	-----	1 0
Umi	-----	1 1
Silimana	-----	1 2
Lengbati	-----	1 3
Zenguru	-----	1 4
Mindik	-----	1 5
Pindiu H. C	-----	1 6
Pindiu	-----	1 7
Lae	(Exchange Office) -----	1 8
Wau	(") -----	2 0
Omsis	(Repeater Station) -----	2 2
Mt. Mission	(") -----	2 4
Widerui	(") -----	2 6
Mt. Nambamati	(") -----	2 7

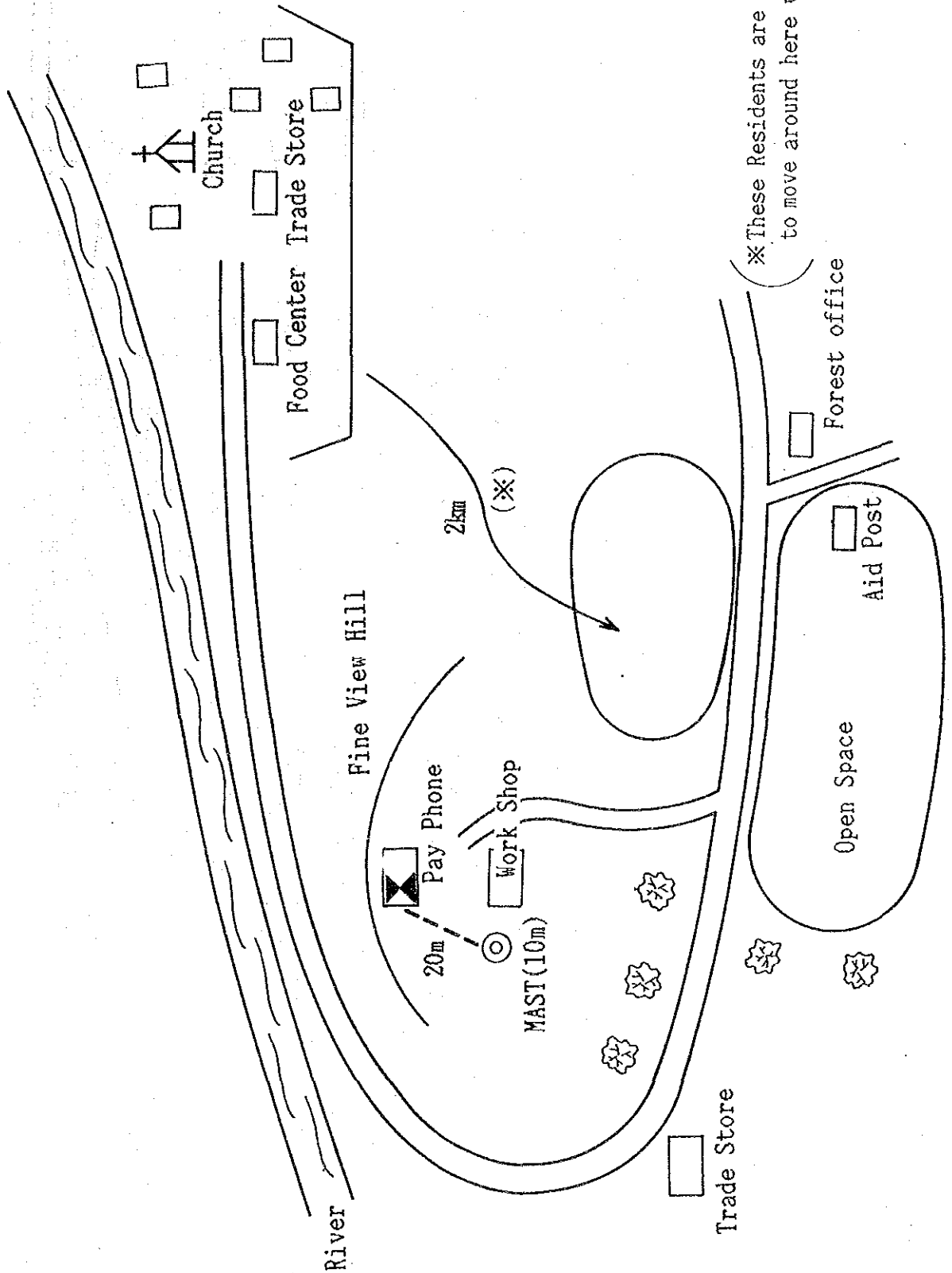
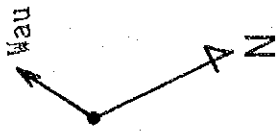
BUKAWA



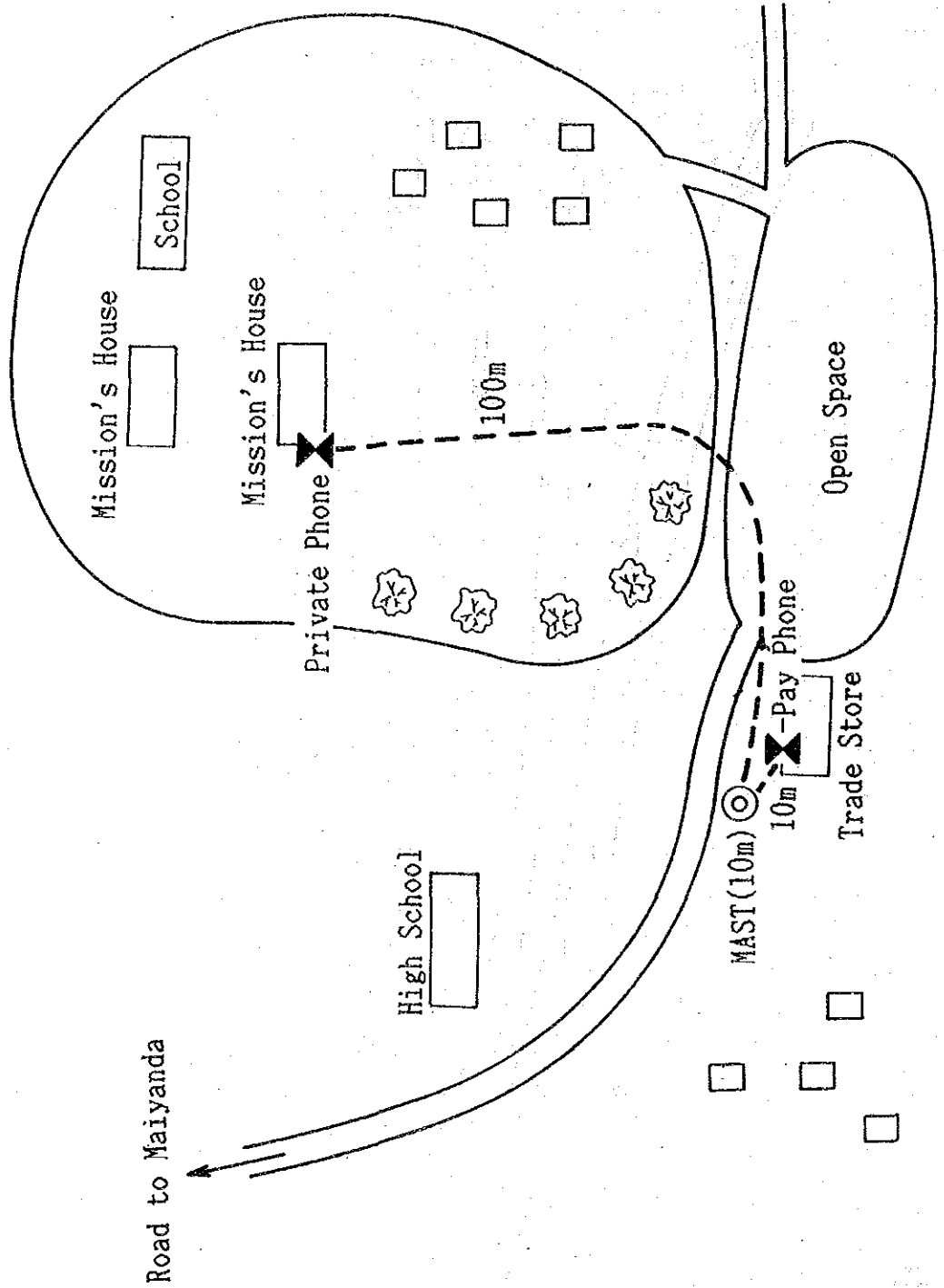
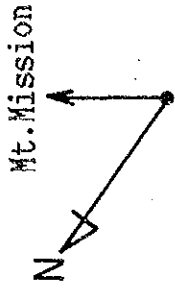
BAINI



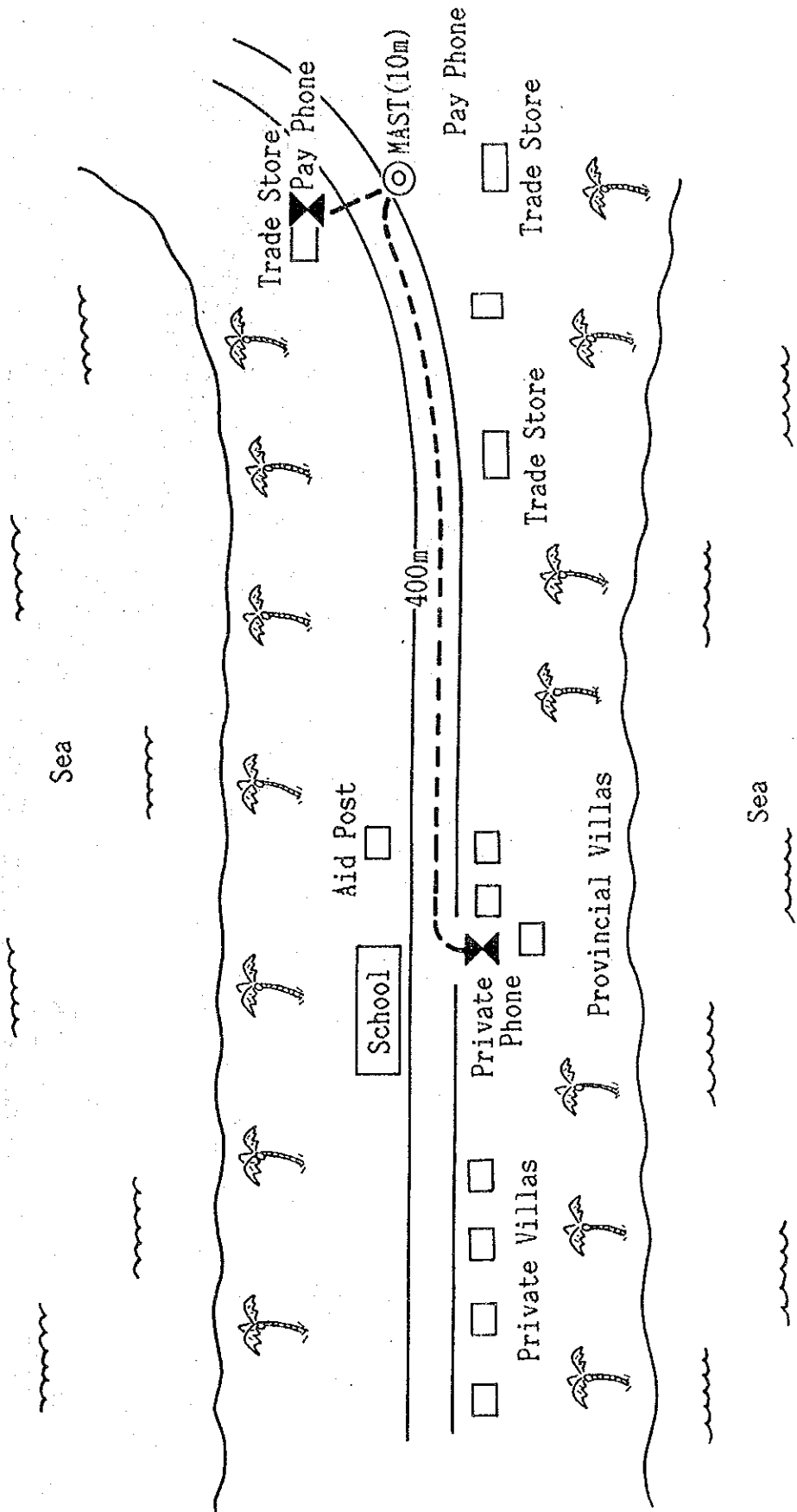
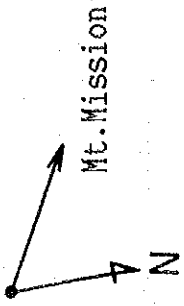
WANDUMI



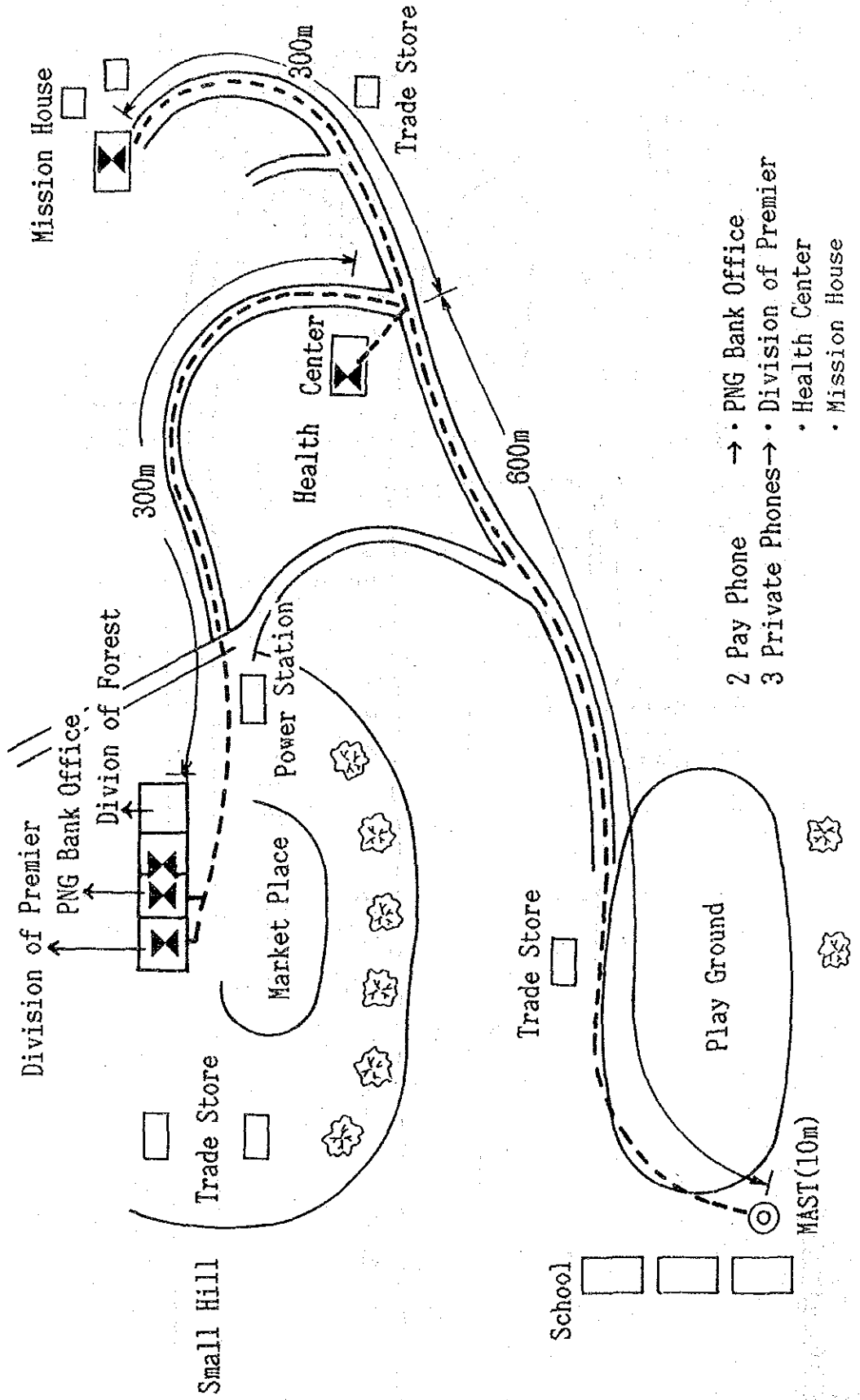
YAIWAHAWA



SALAMAUA

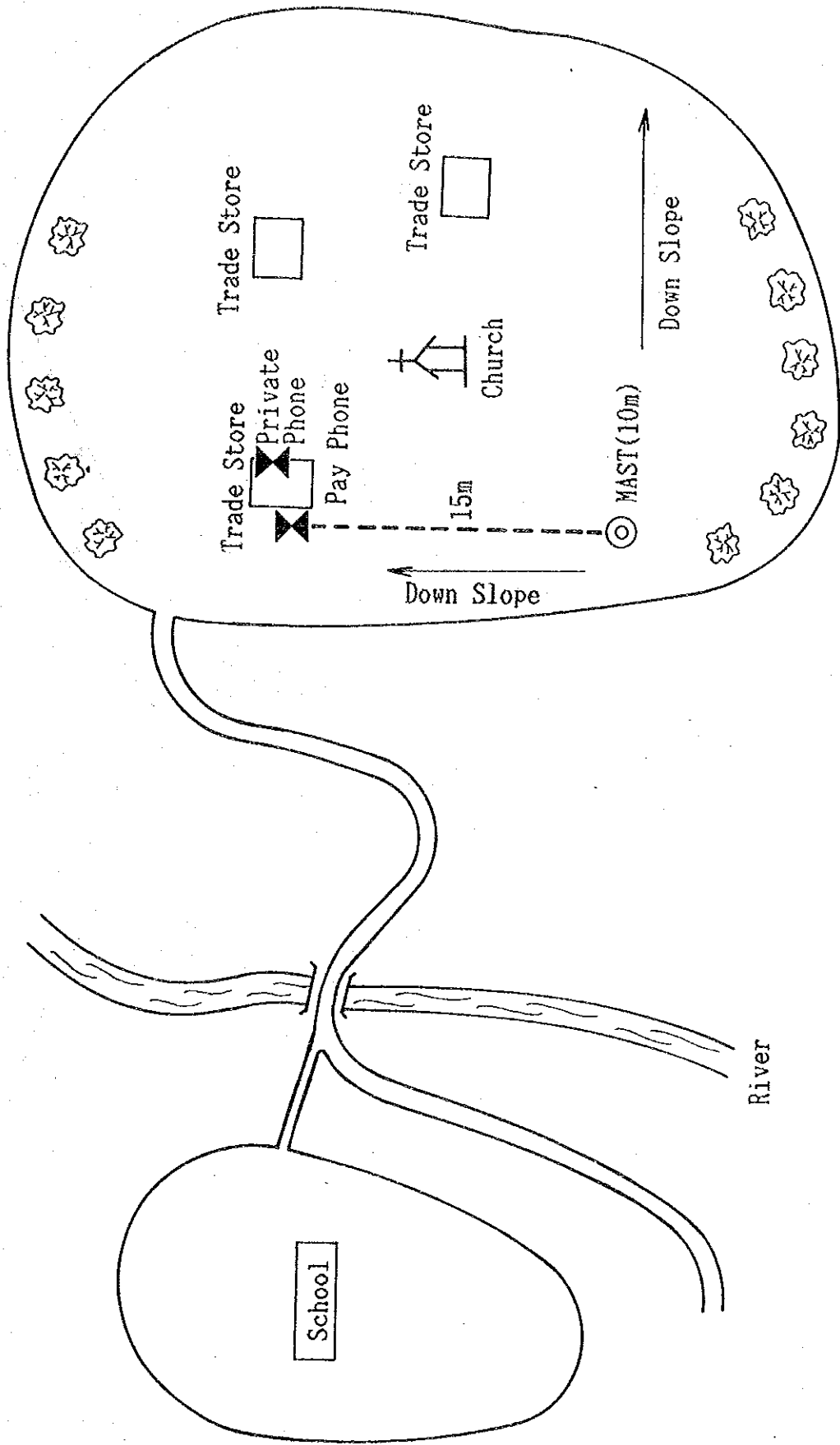
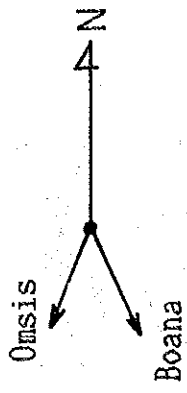


BOANA



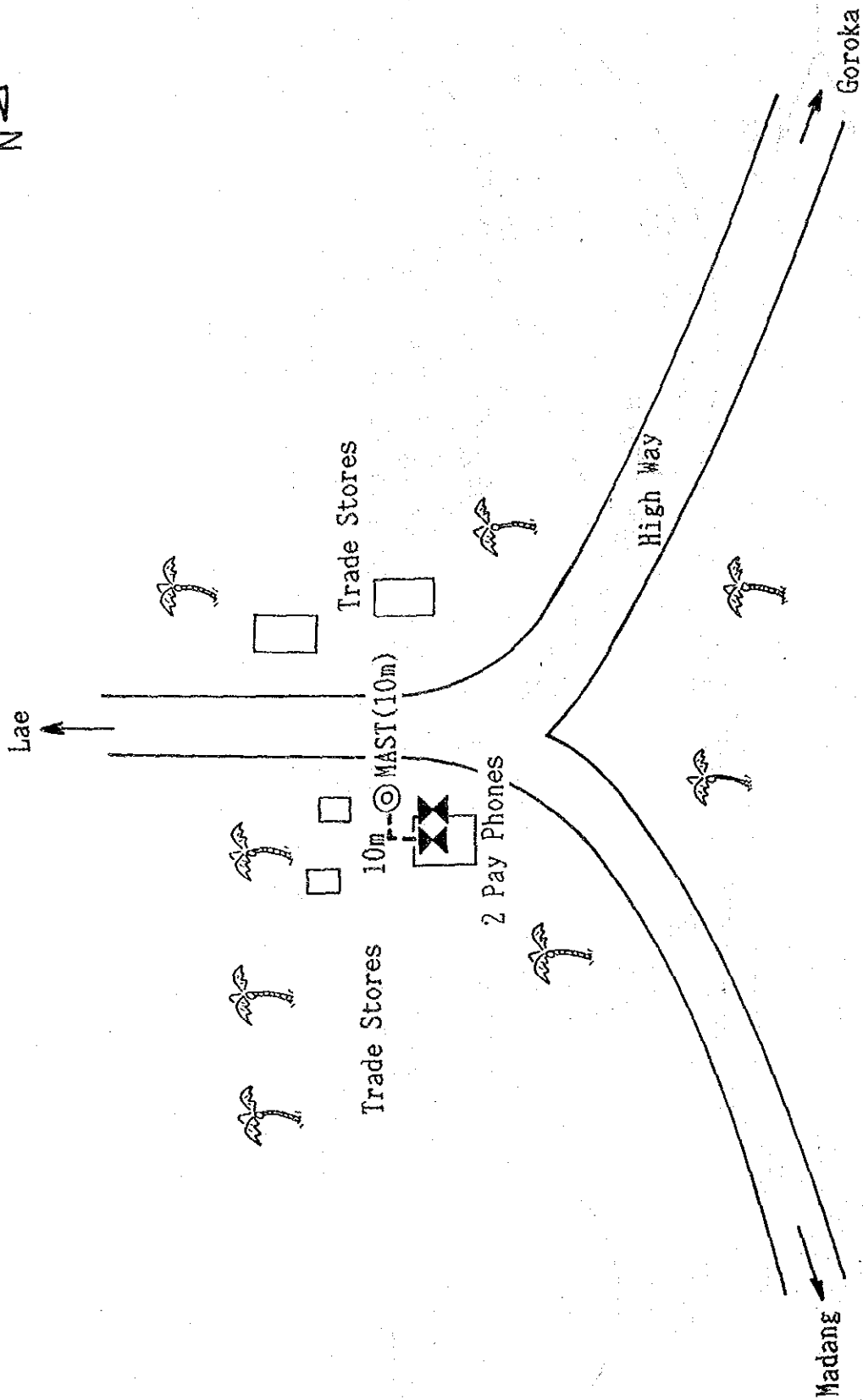
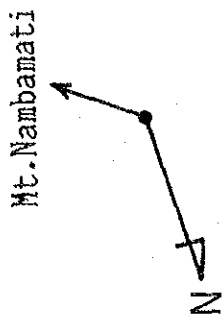
- 2 Pay Phone → PNG Bank Office
- 3 Private Phones → Division of Premier
- Health Center
- Mission House

BANDONG

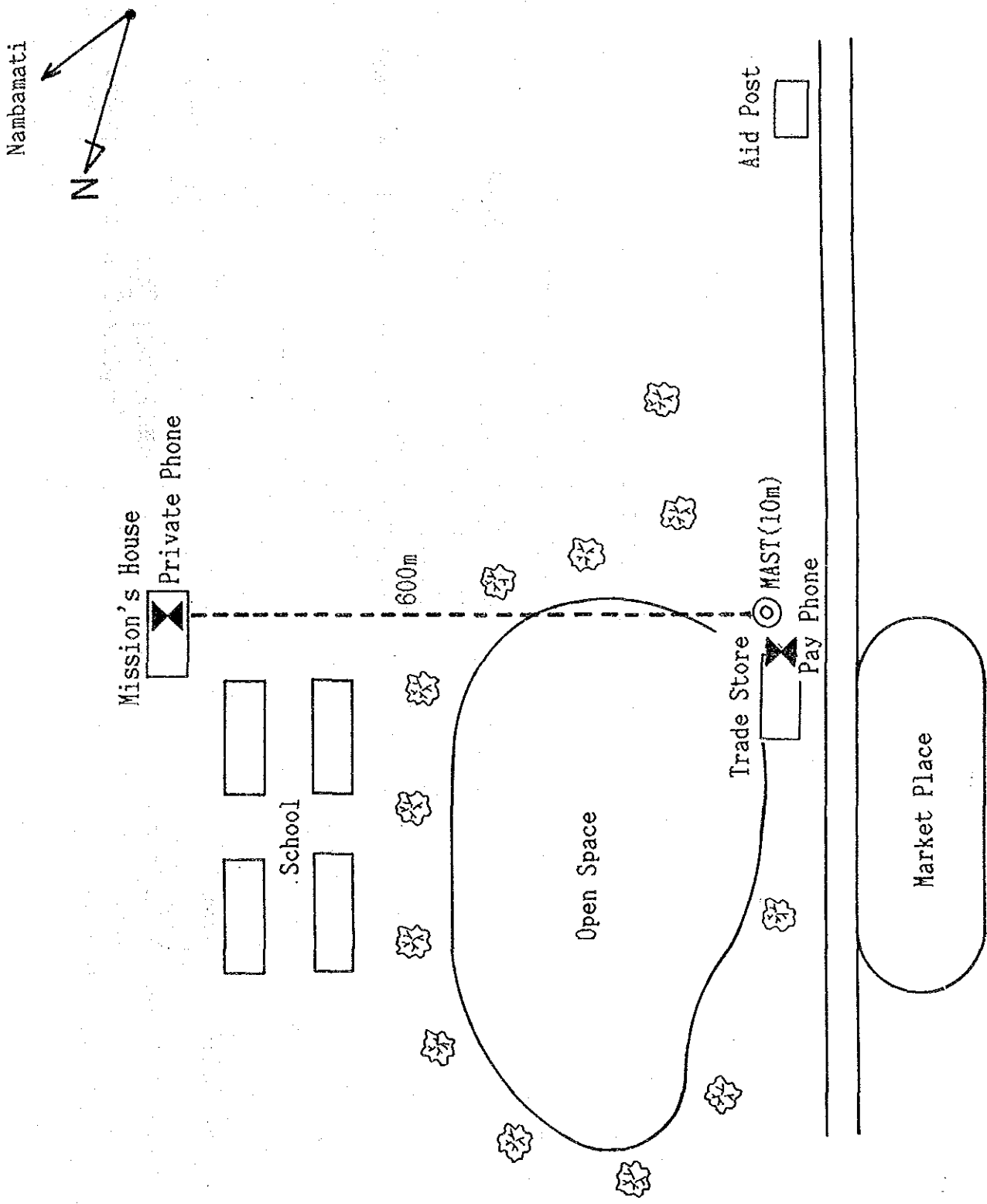


Annex-3-7

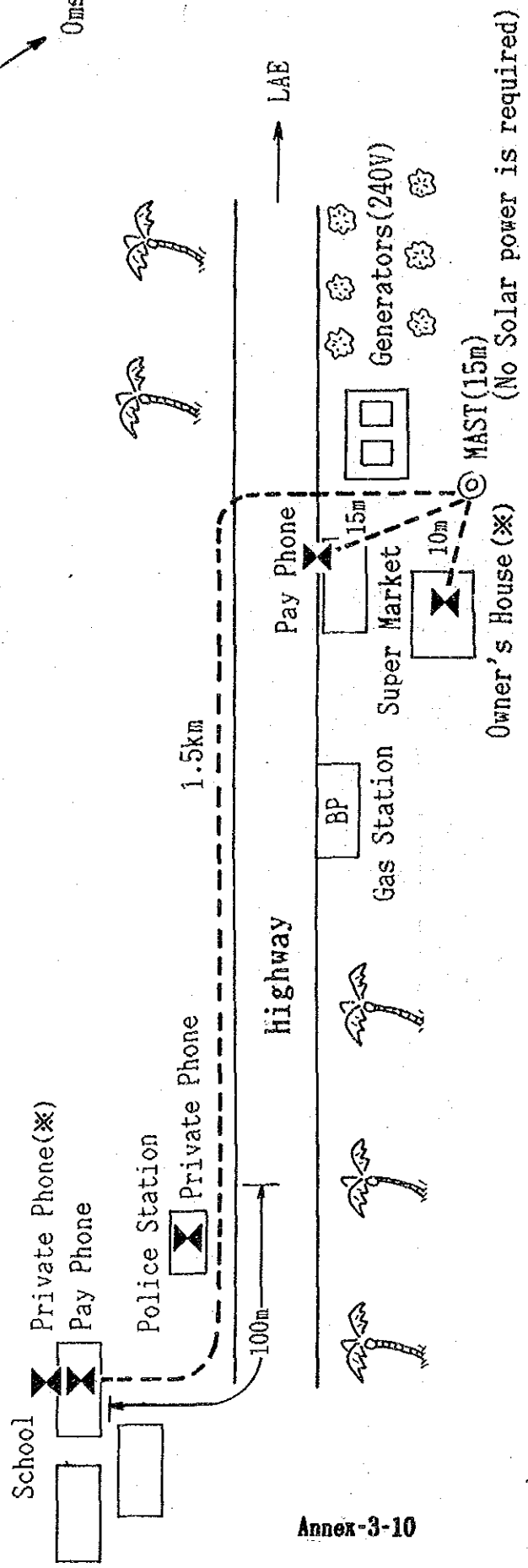
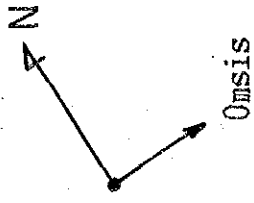
WATARAIS



KAIAPIT



CHIVASING



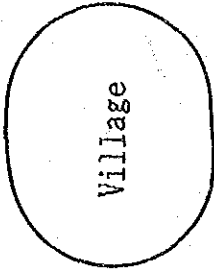
(No Solar power is required)

- 2 Pay Phones
- 3 Private Phones
- School
- Super Market
- Police Station
- Super Market Owner
- School

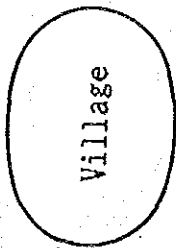
(*) Private Phone
(Replace Existing Telephone)

N

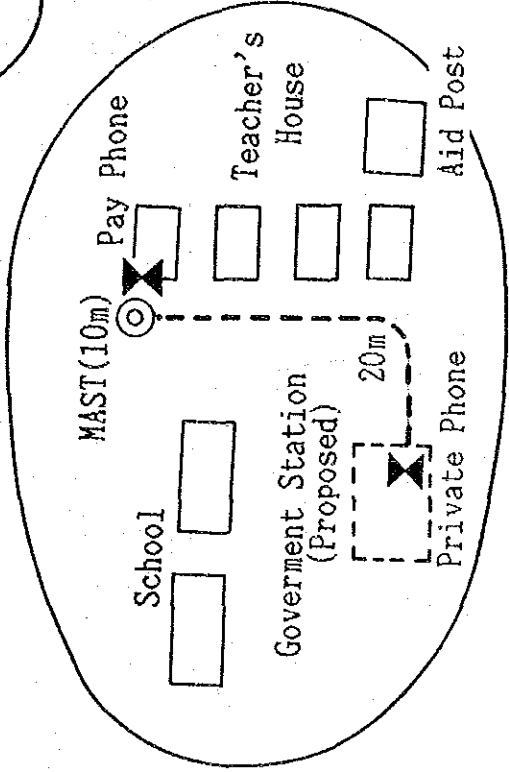
Nambamati



Village



Village



MAST (10m)

Pay Phone

School

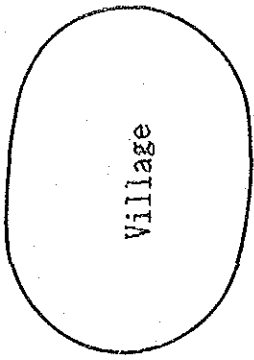
Government Station (Proposed)

Teacher's House

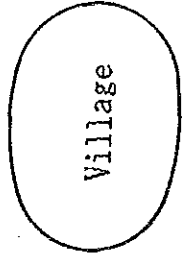
20m

Private Phone

Aid Post



Village



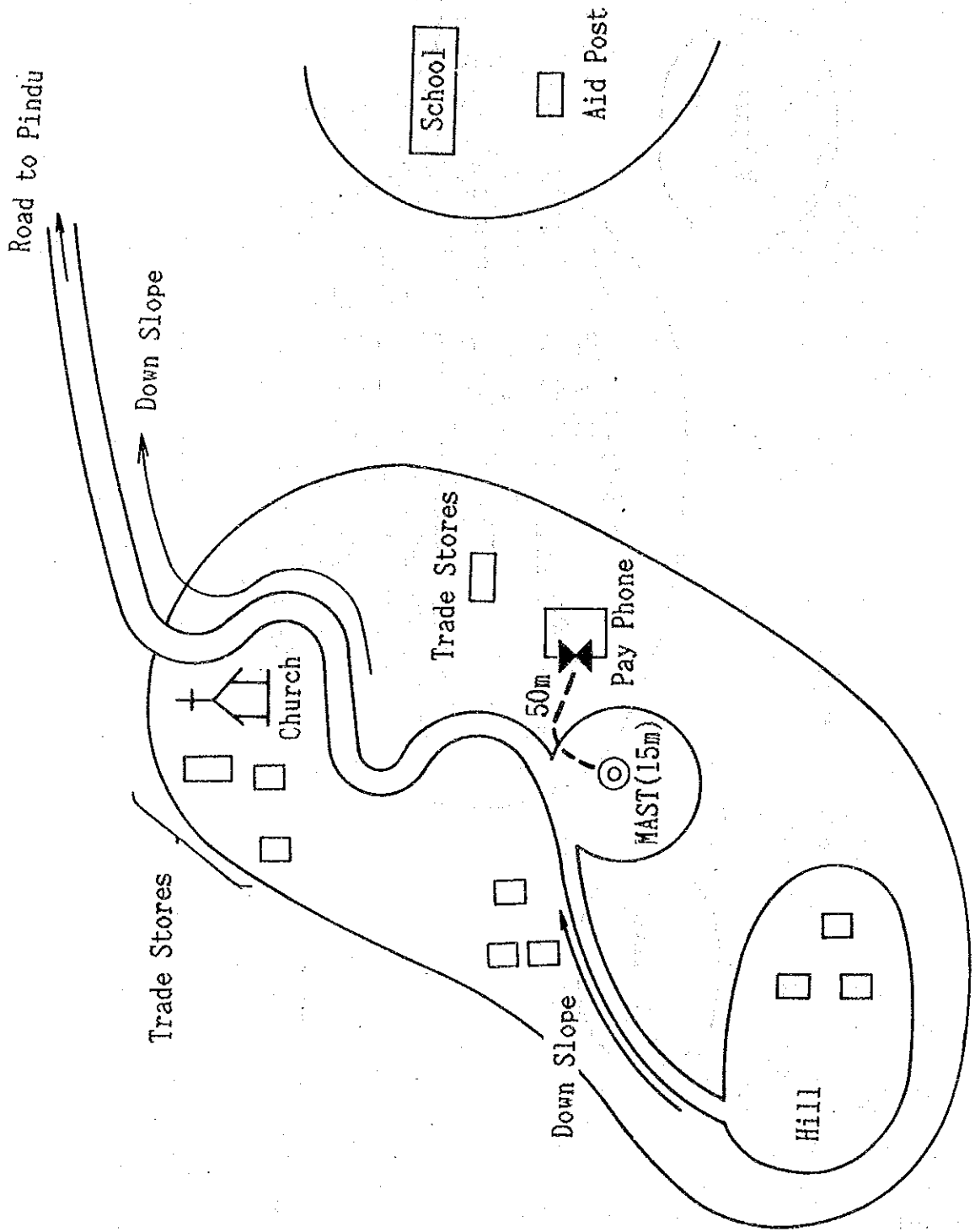
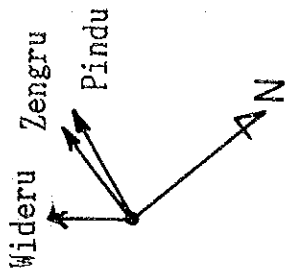
Village

Goroka

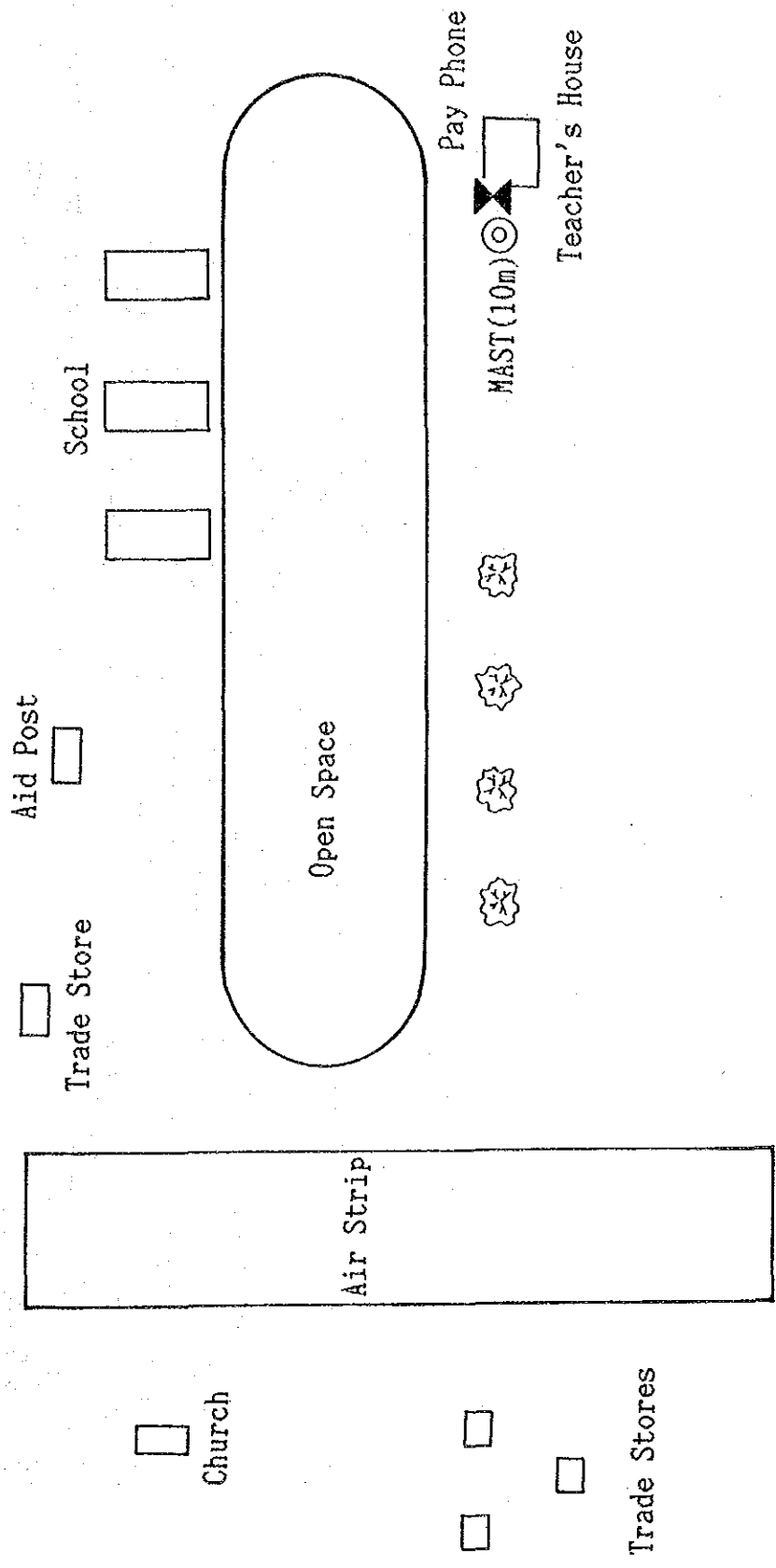
High Way

Lae

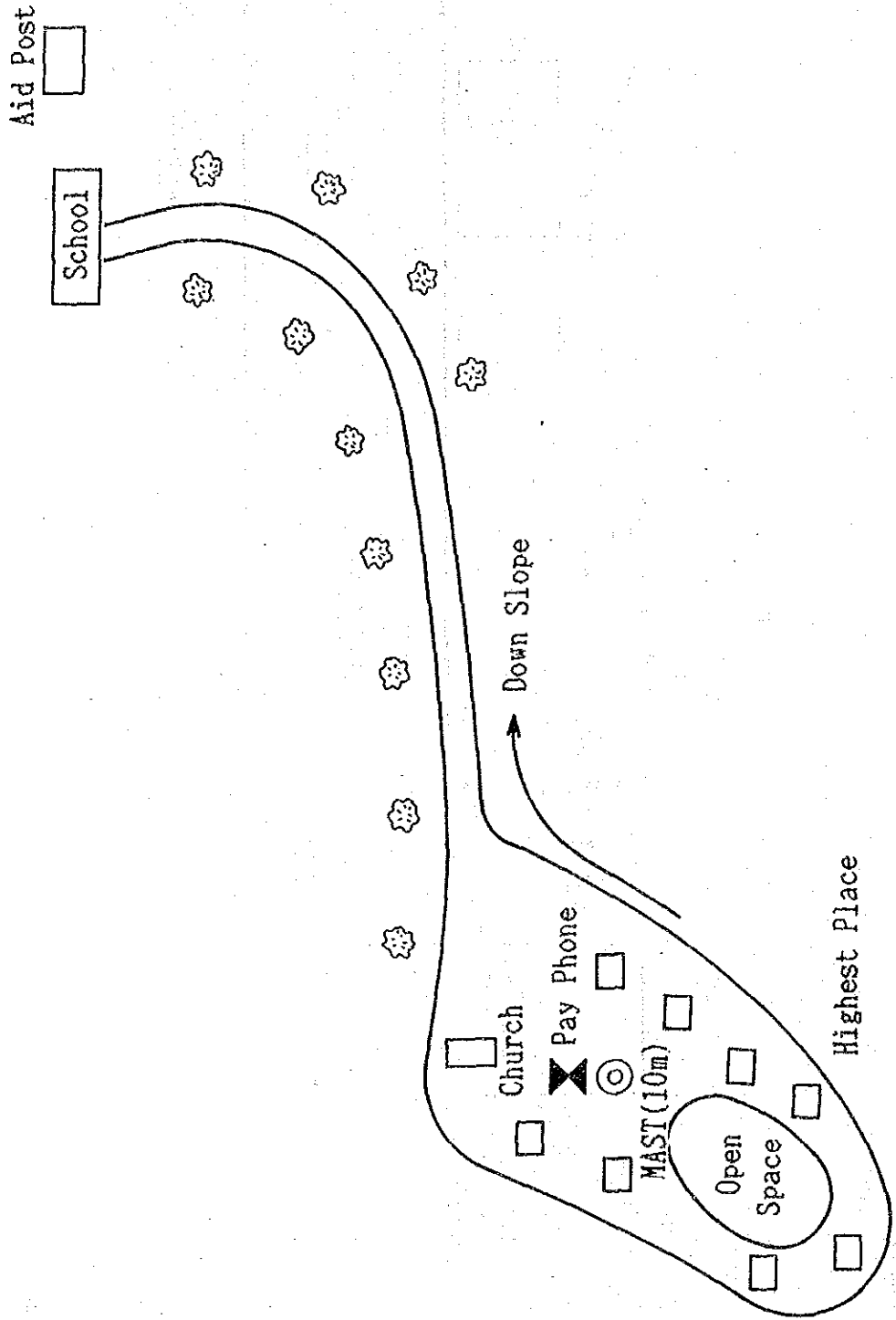
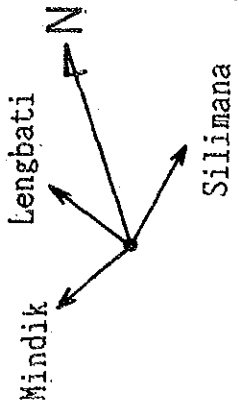
SILIMANA



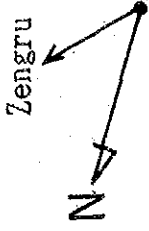
LEGBATI



ZENGURU



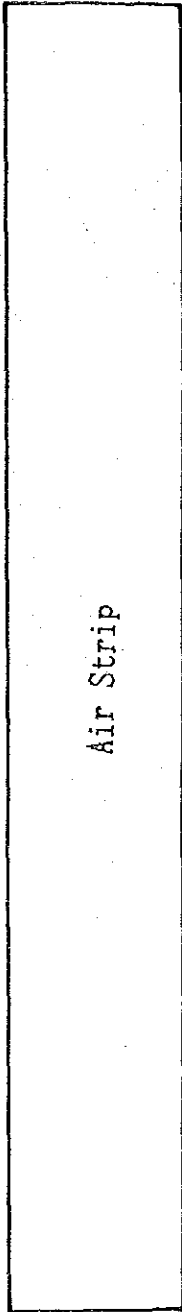
MINDIK



Mission House
(Nobody living at present)



Mission Office



Frag Hill



Mast (10m)

50m



Pay Phone

Private Phone

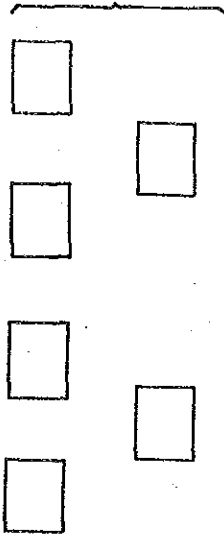


Government House

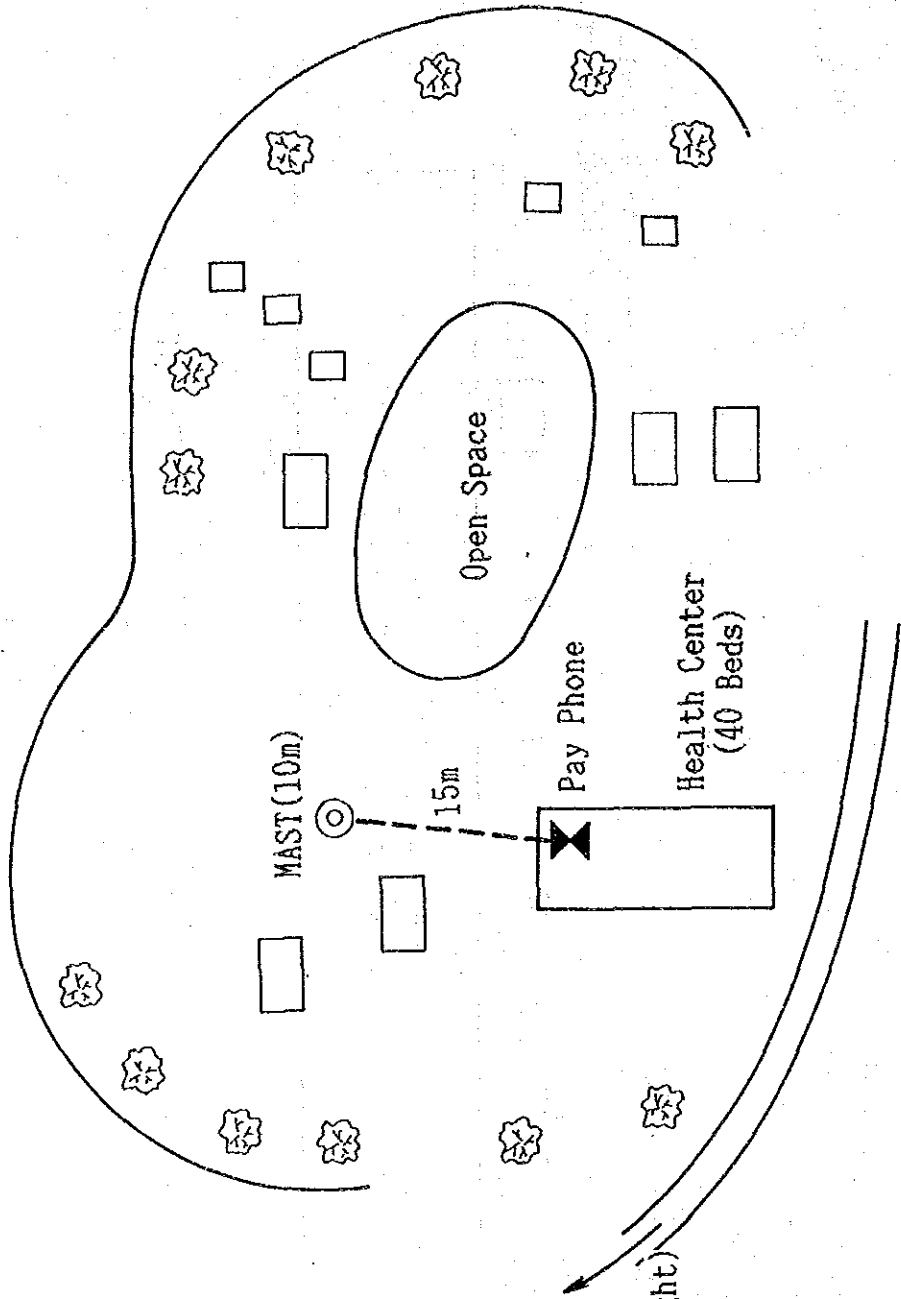
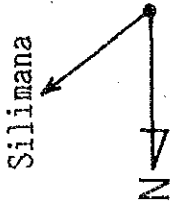


Health Center

Trade Stores (7)



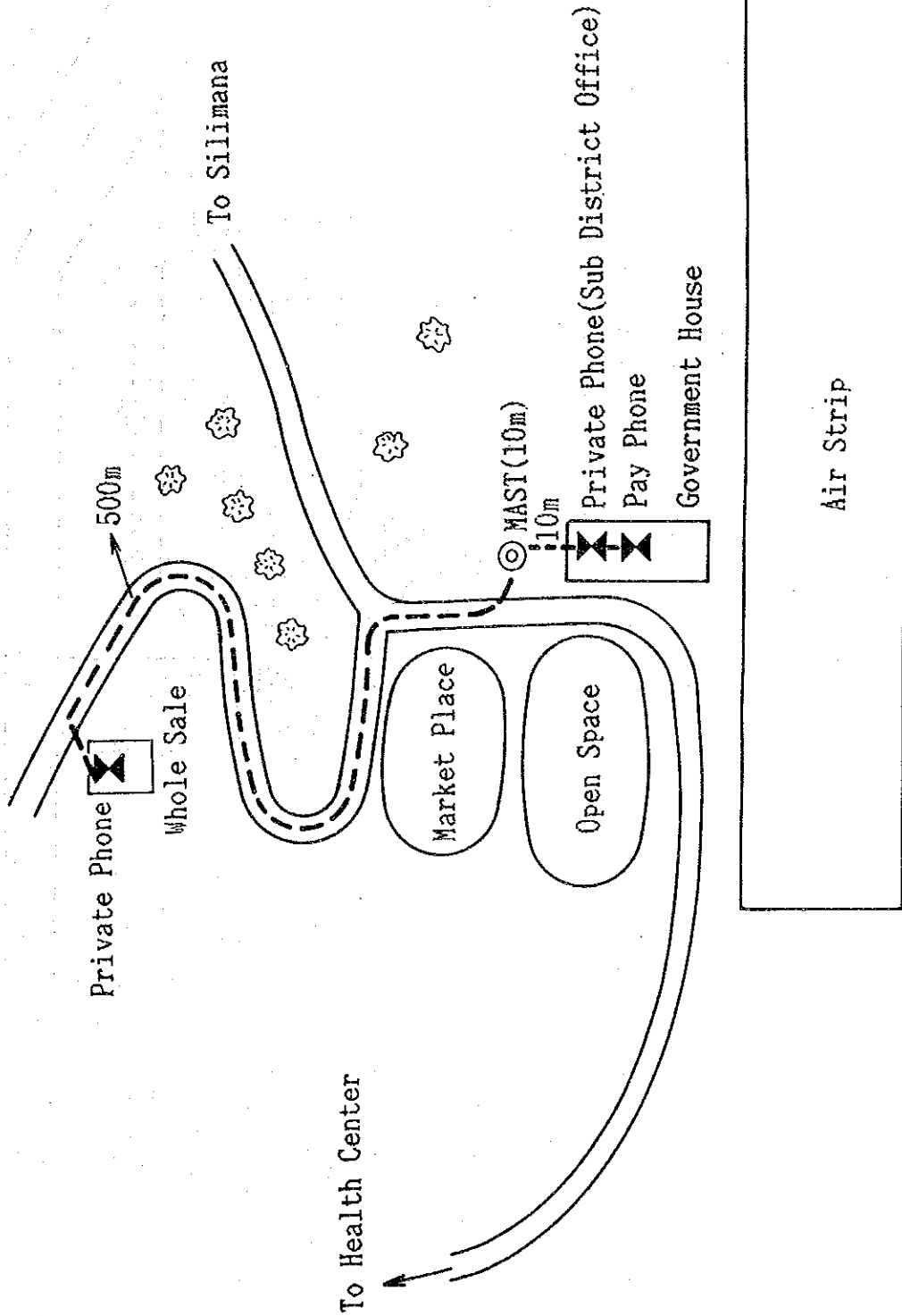
PINDIU (Health Center)



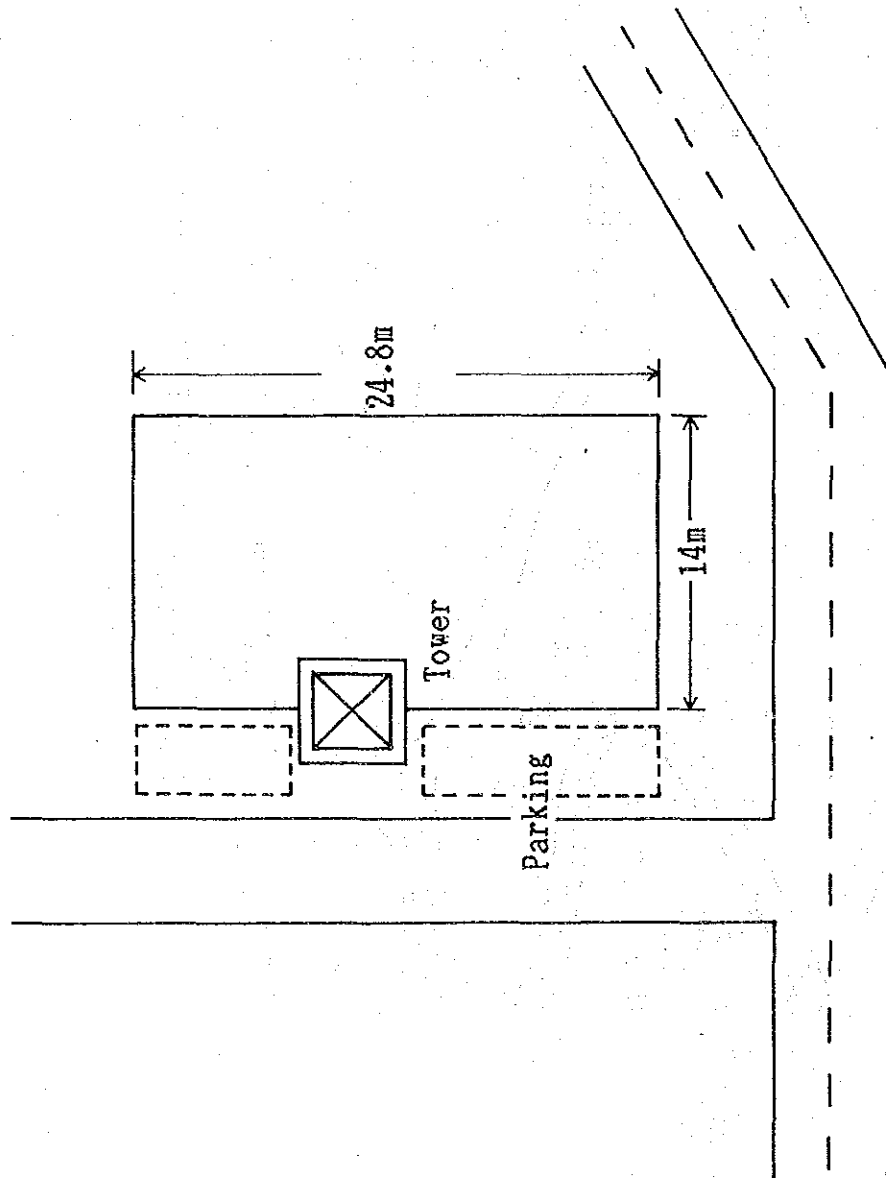
To Pindu
(6km From Pindu and
there isn't line of sight)

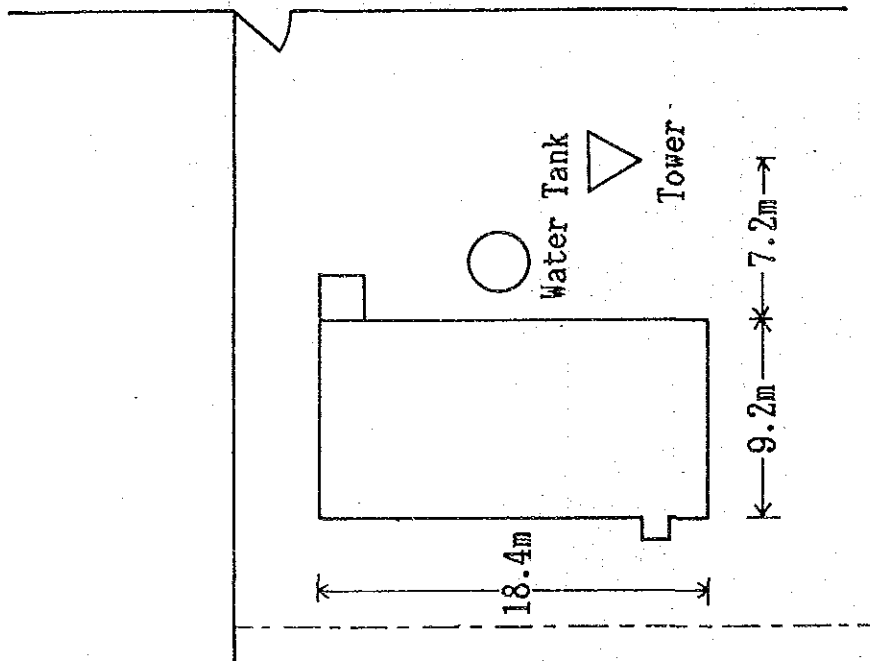
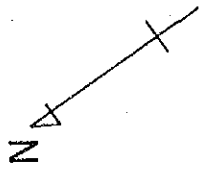
PINDIU

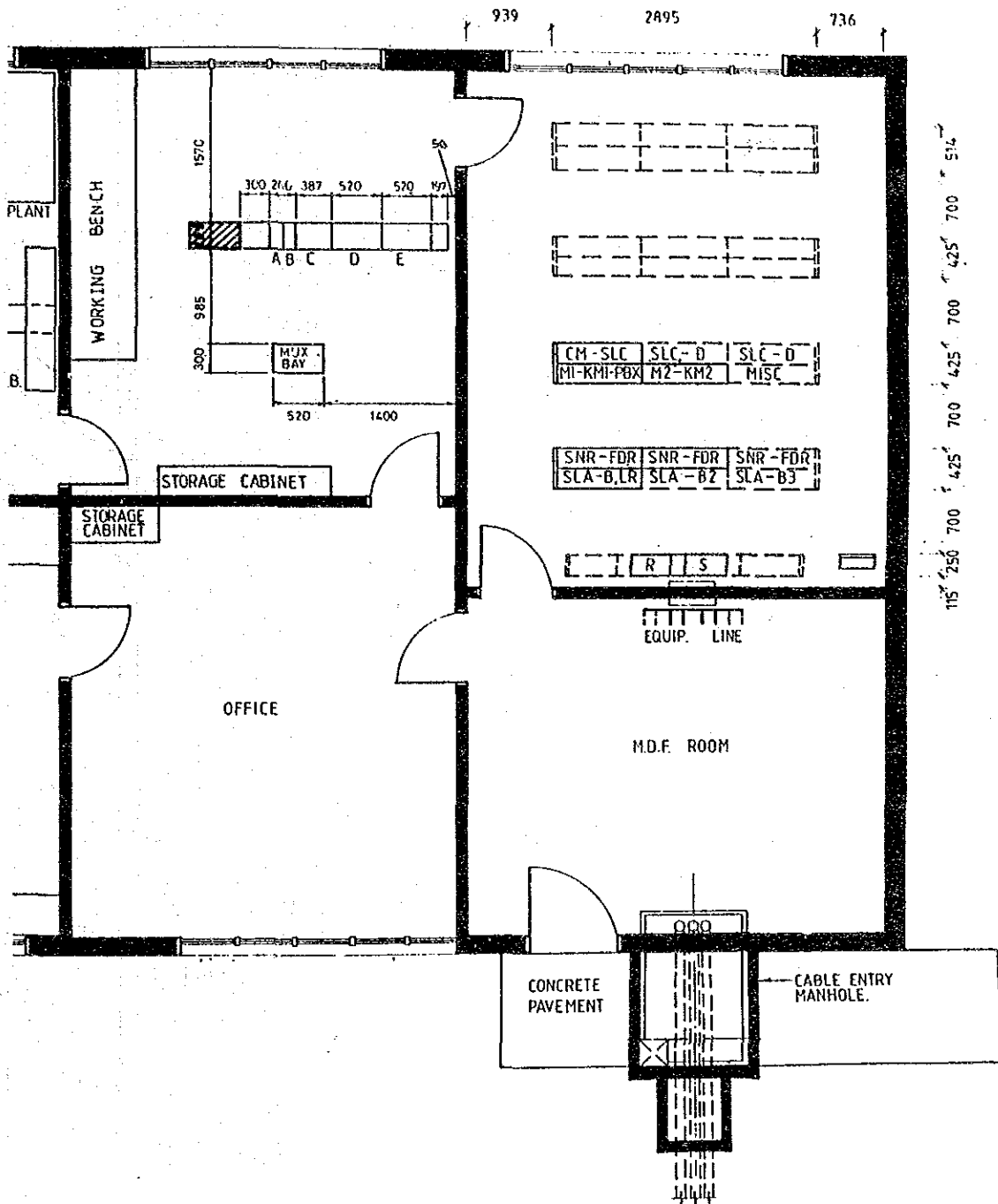
Silimana N



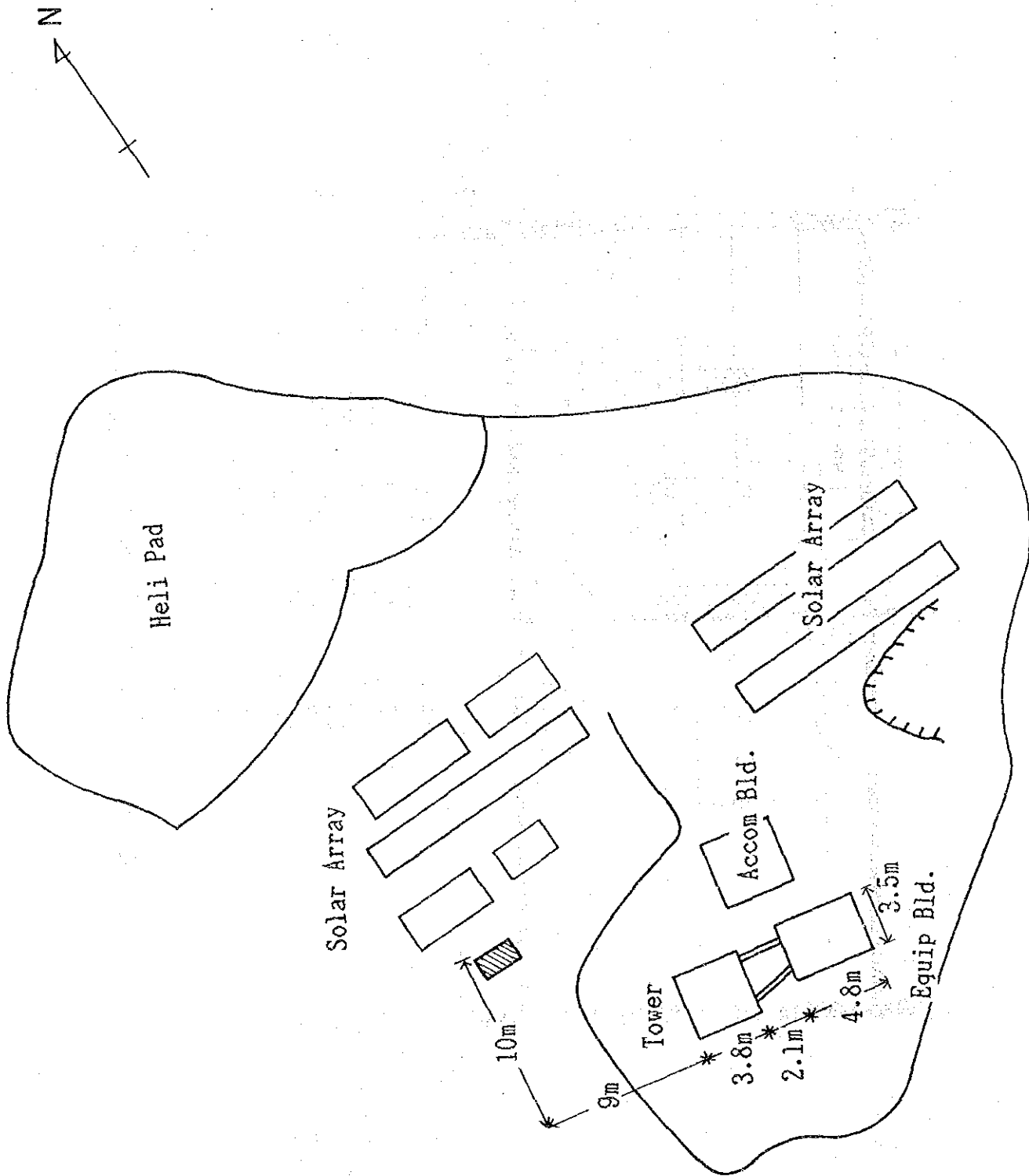
LAE

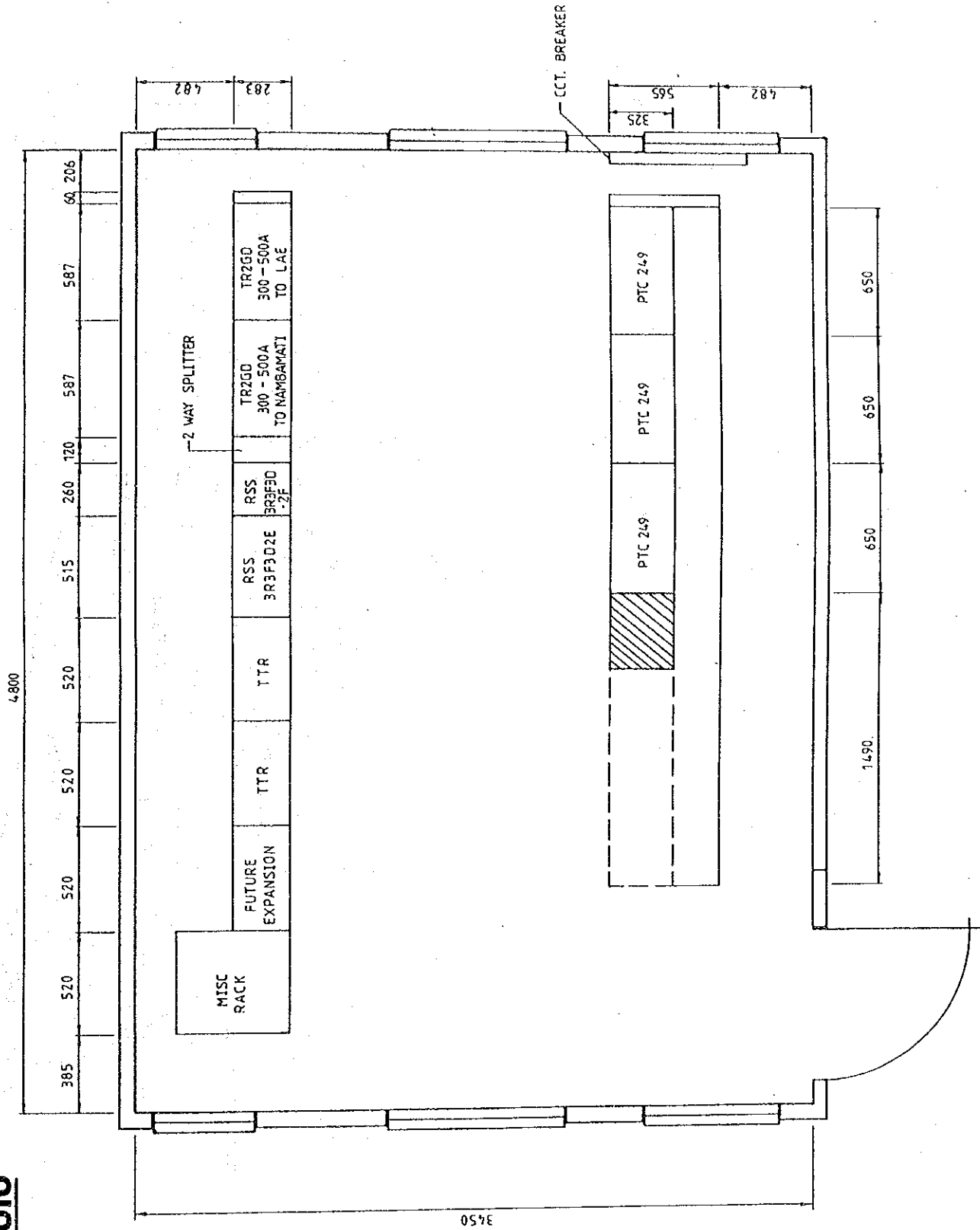




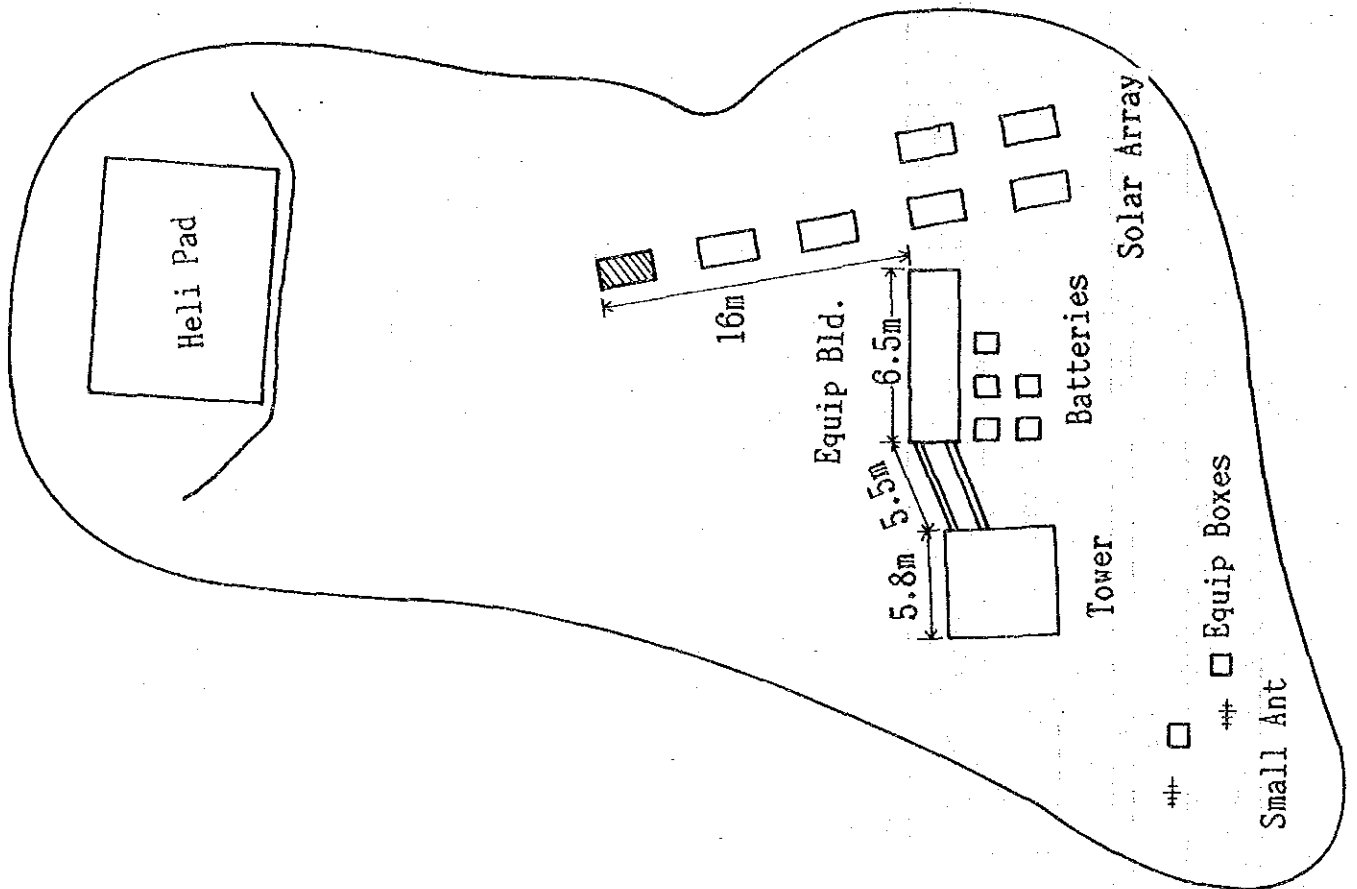


WAU

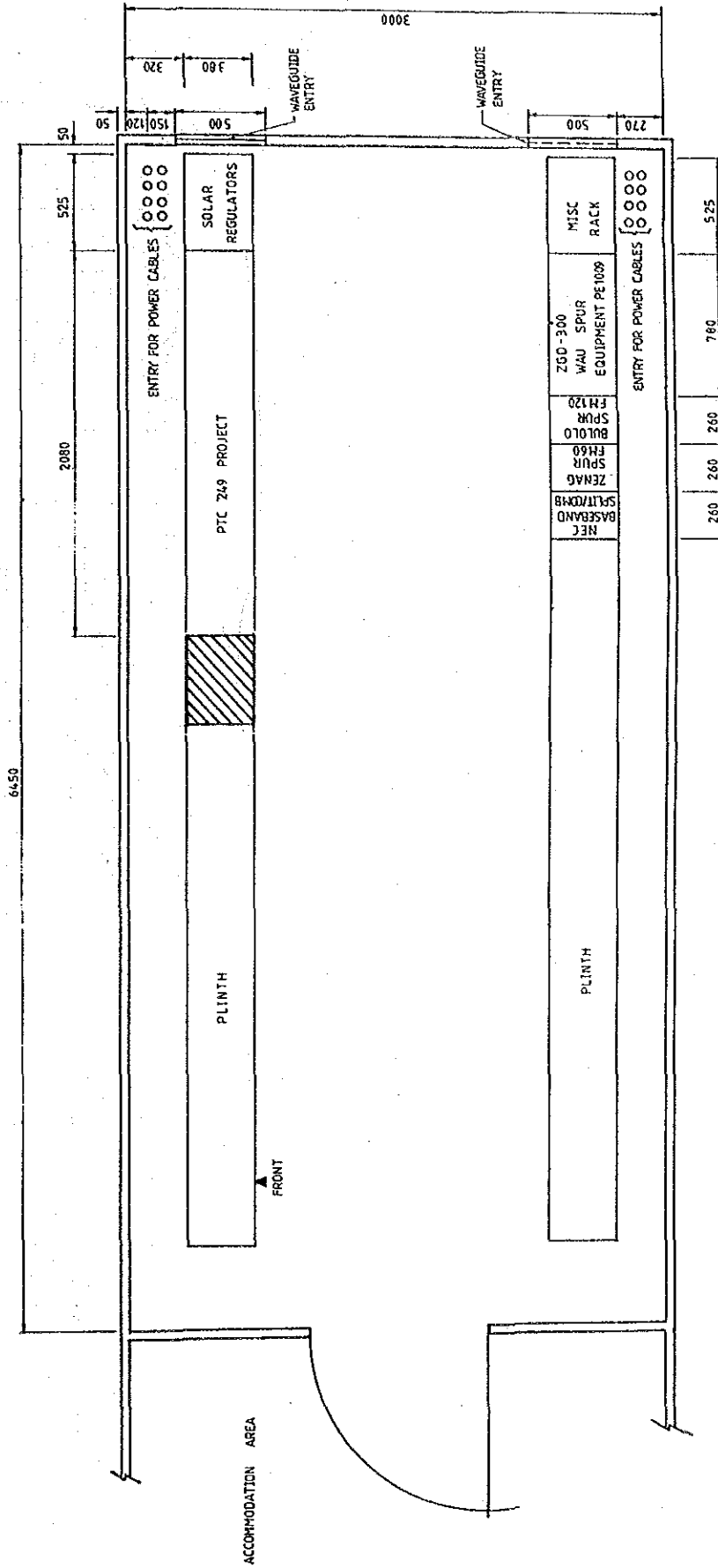




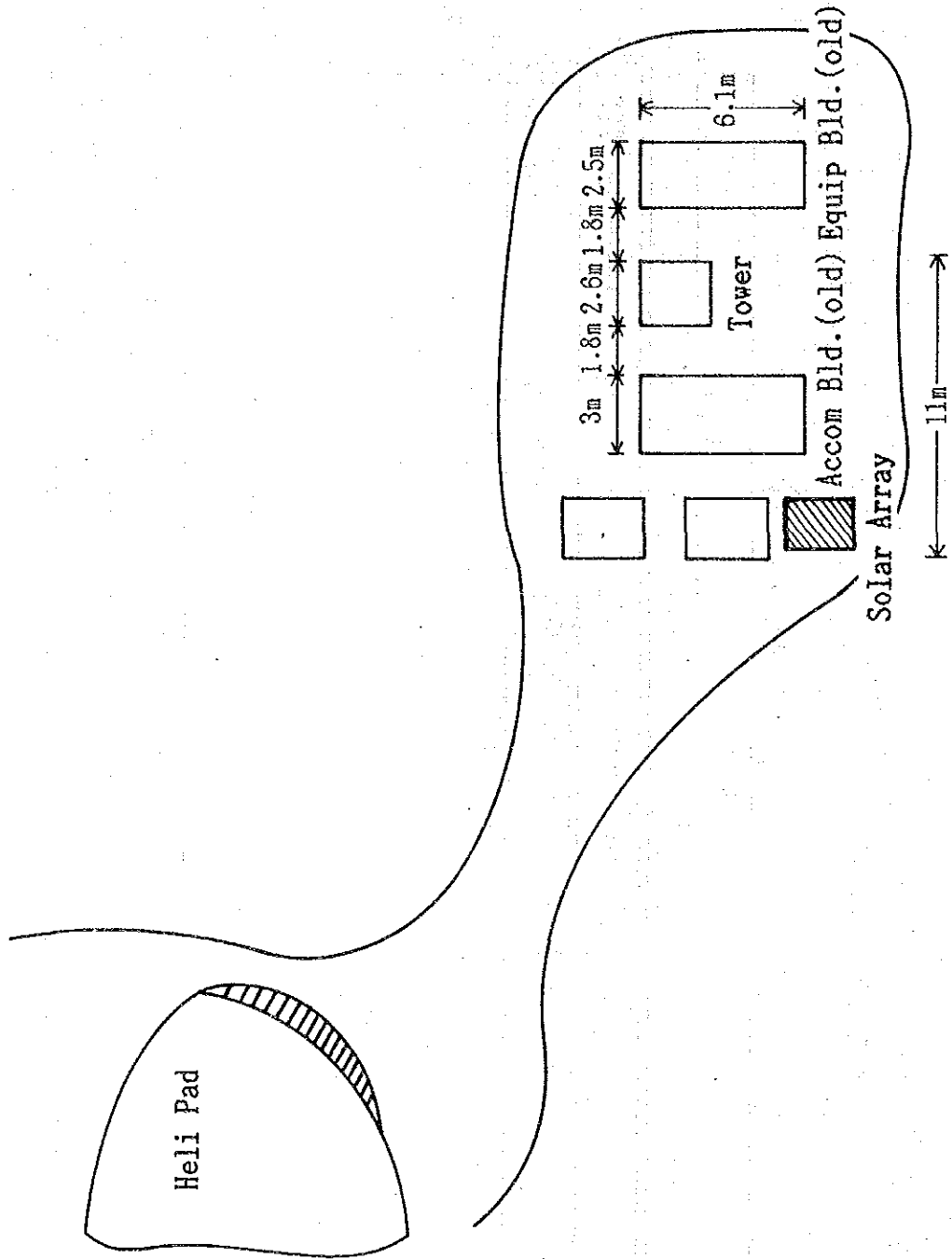
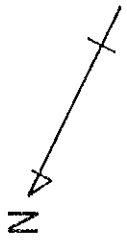
Mt. MISSION



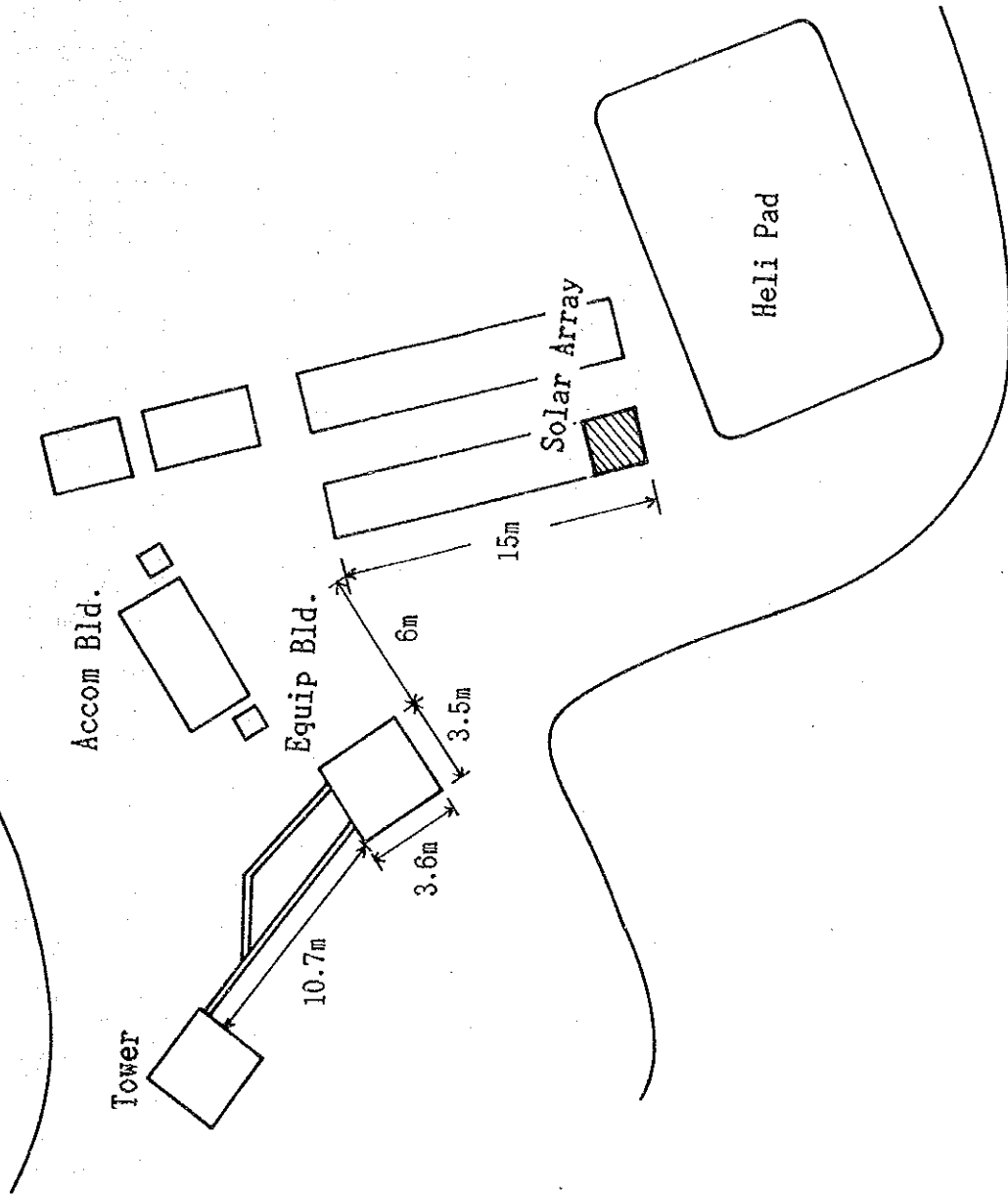
Mt. MISSION

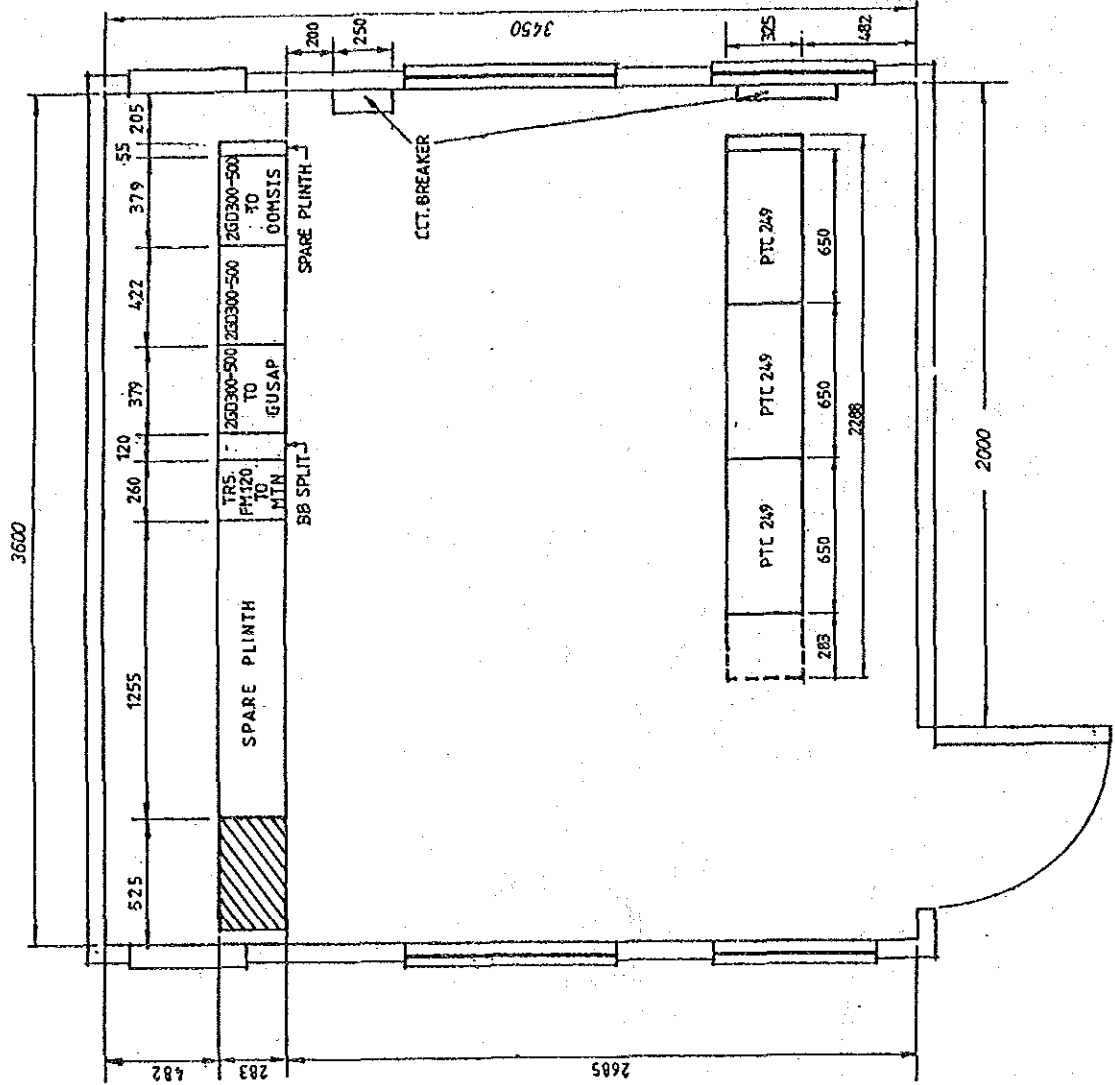


WIDERU



Mt. NAMBAMATI

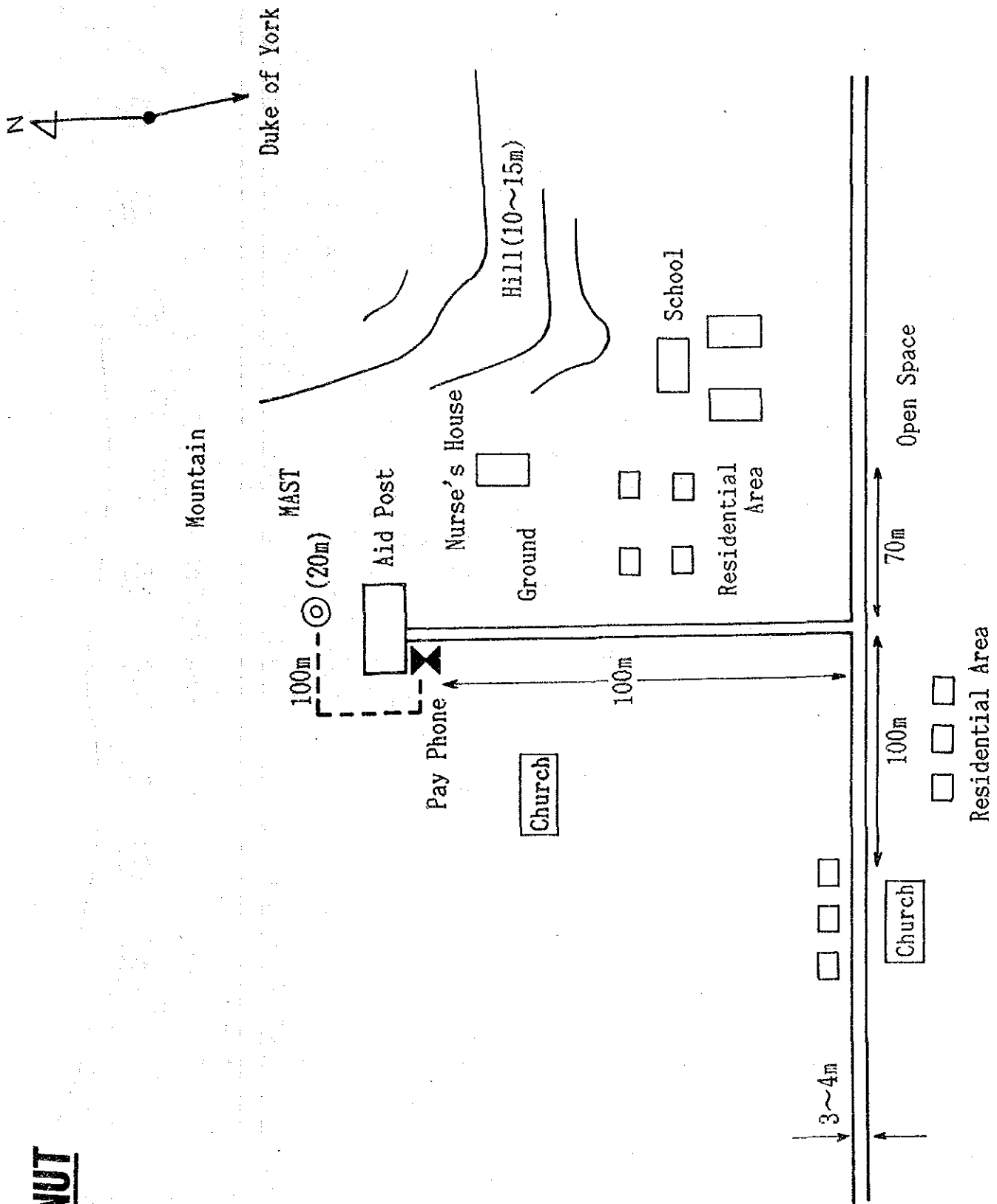




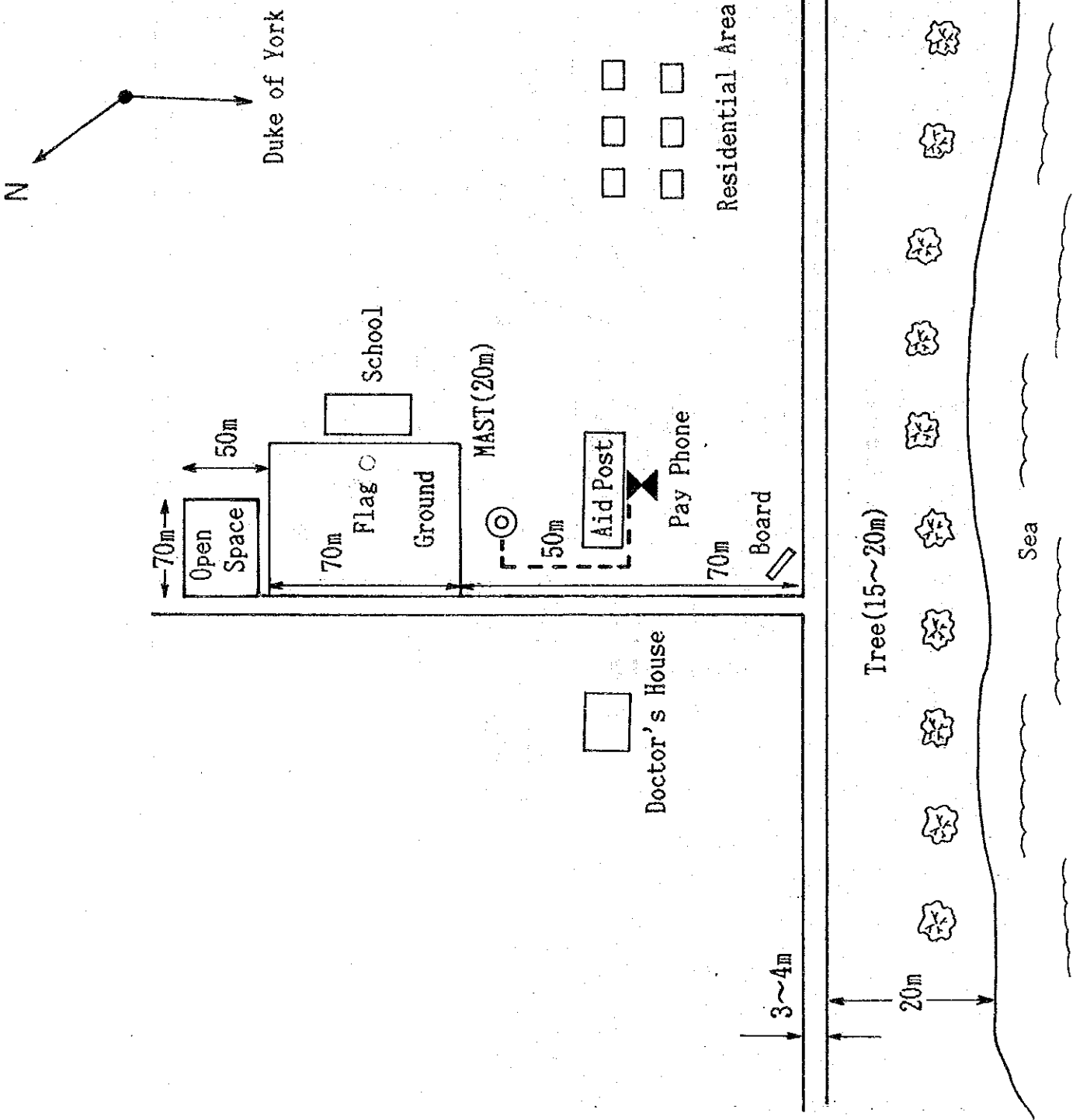
NEW IRELAND PROVINCE

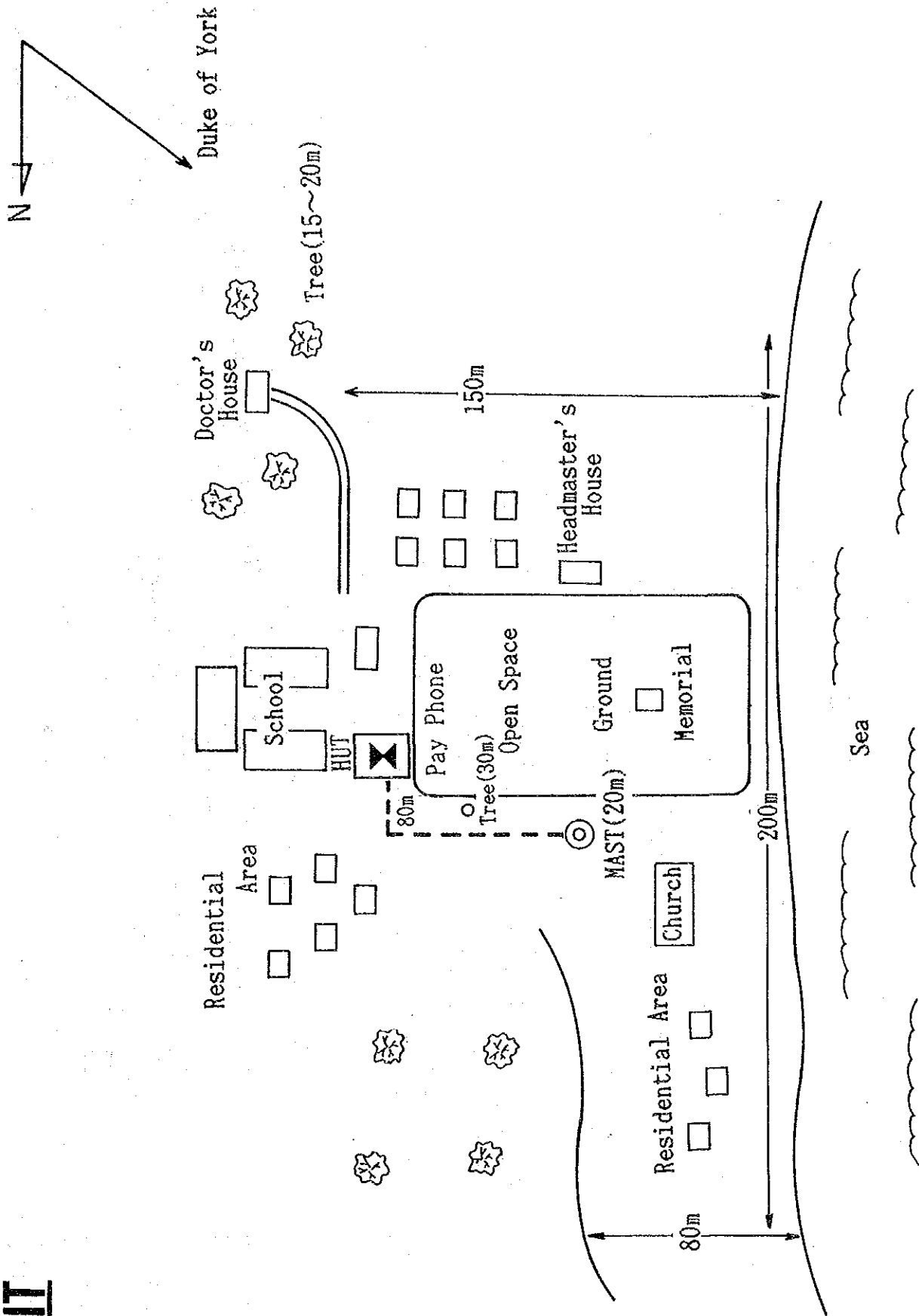
Kabanut	-----	2 9
Kabahong	-----	3 0
Kall	-----	3 1
Palipal	-----	3 2
Hilalon	-----	3 3
Lipek	-----	3 4
Hipagat	-----	3 5
Taskul	-----	3 6
Mangai	-----	3 7
Lemakot	-----	3 8
Lakulamau	-----	3 9
Madina	-----	4 0
Mangop	-----	4 1
Huris	-----	4 2
Duke of York	-----	4 3
Mt. Kiding	-----	4 4
Rabaul	(Exchange Office) -----	4 5
Kavieng	(") -----	4 7
Tomabatur	(Repeater Station) -----	4 9
Konokalang	(") -----	5 1

KABANUT

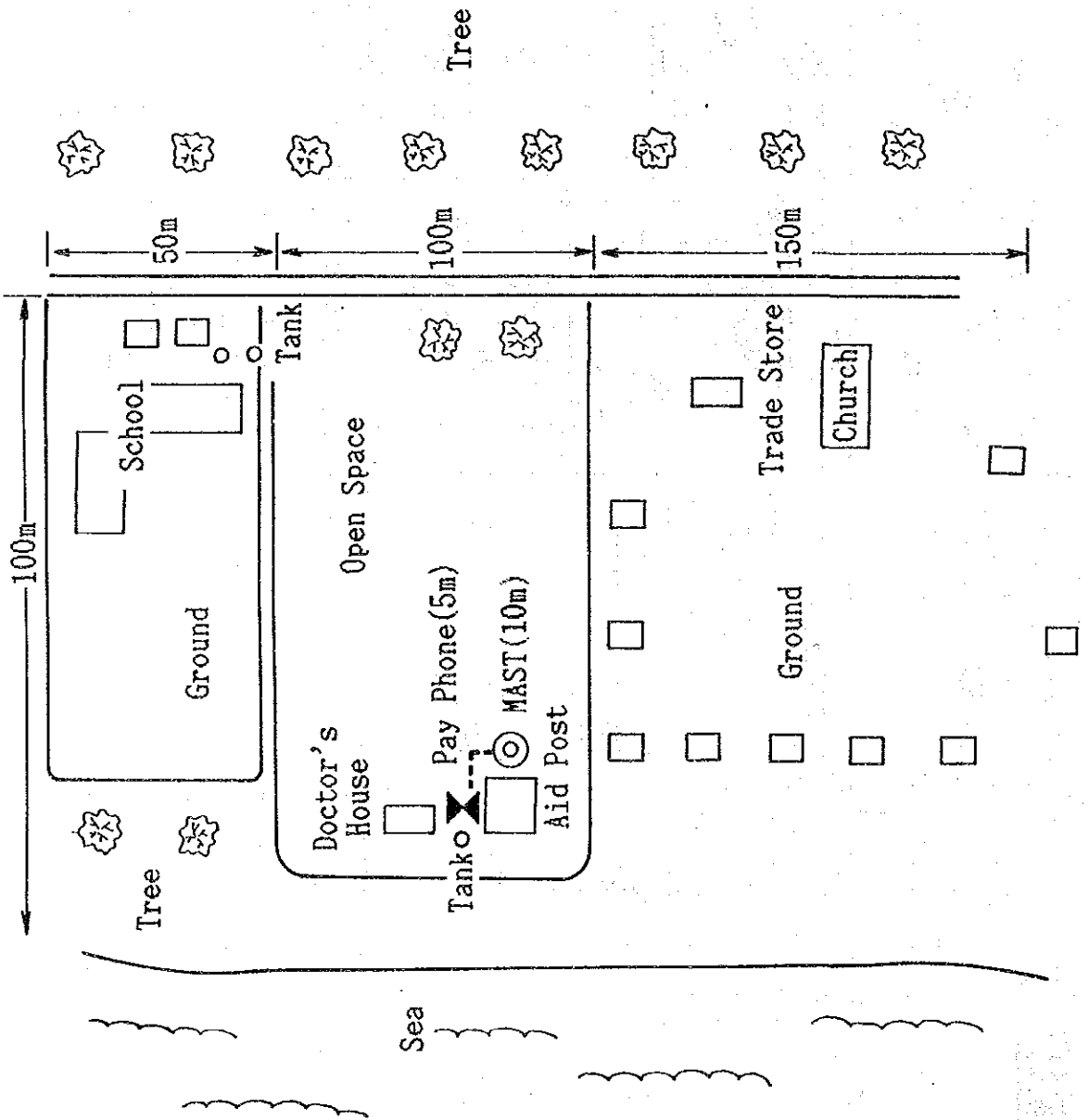
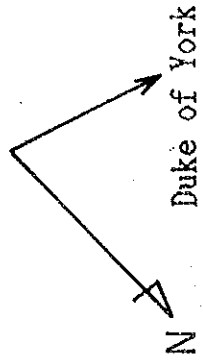


KABAHON

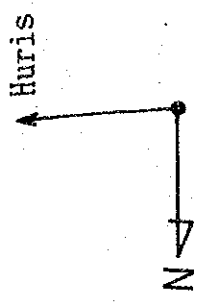




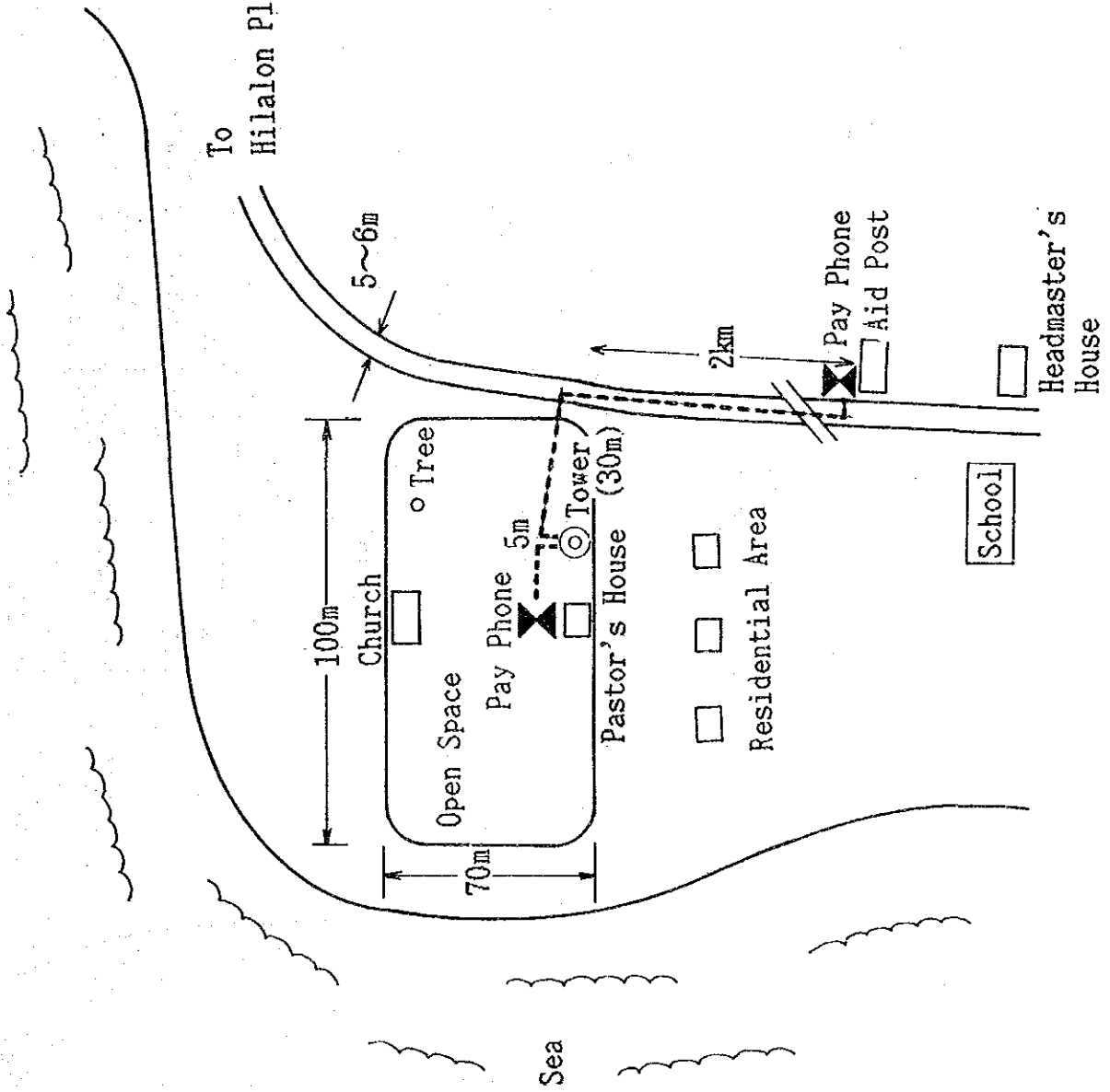
PALIPAL (Duke of York)



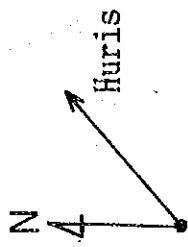
HILALON



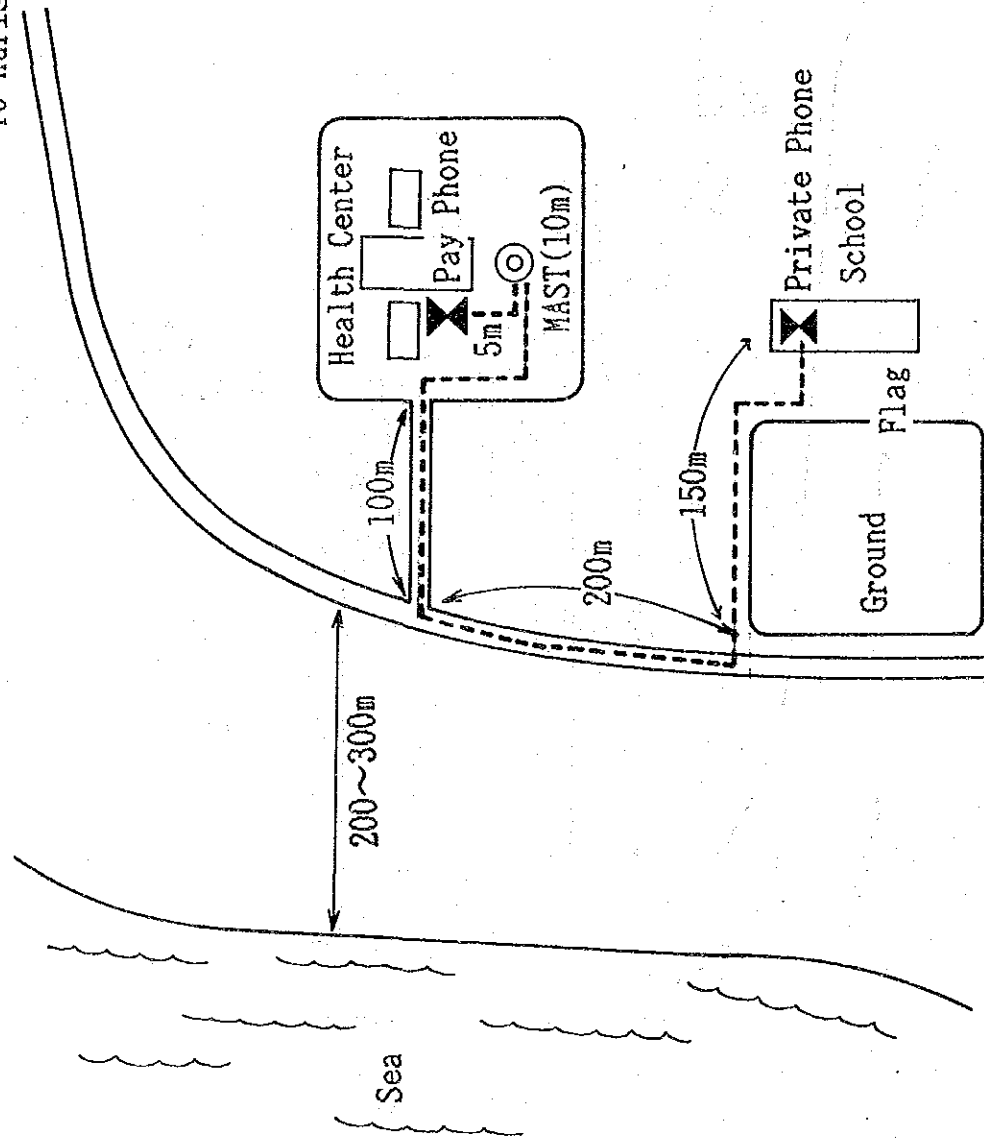
To Hilalon Plantation (5km)



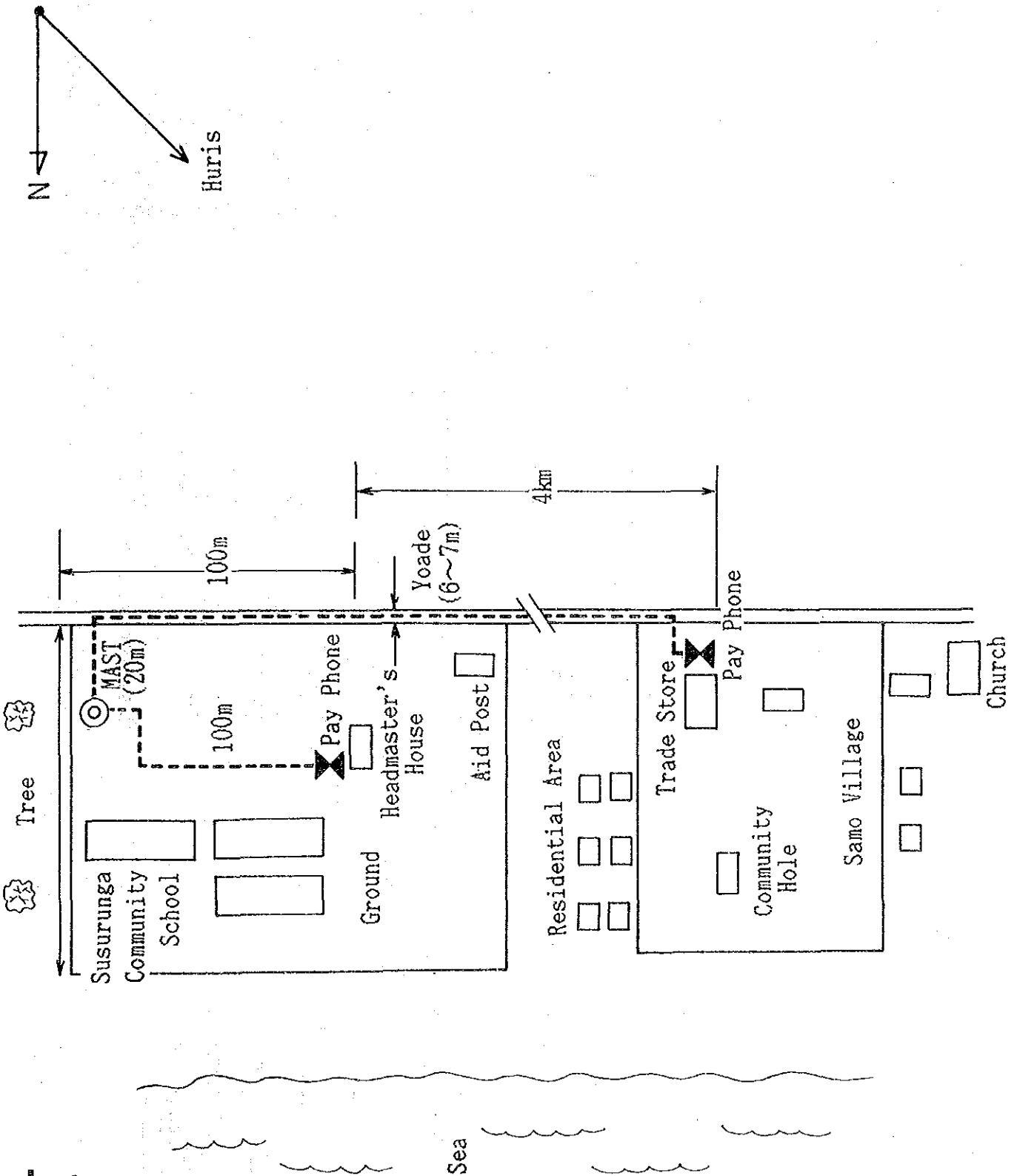
LIPEK



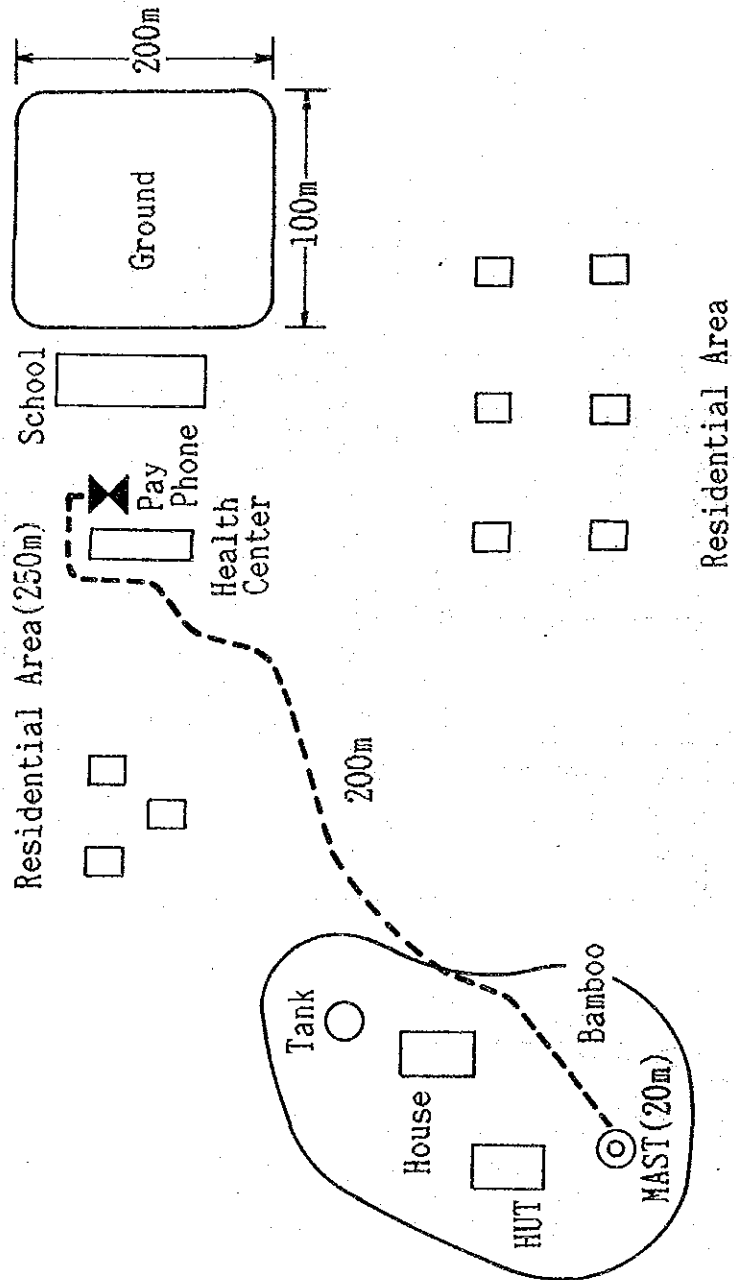
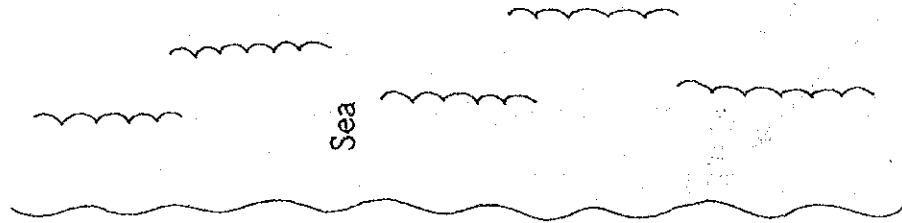
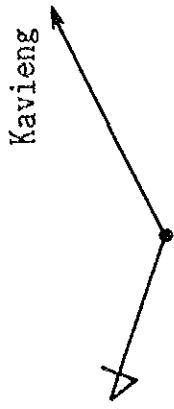
To Huris Village



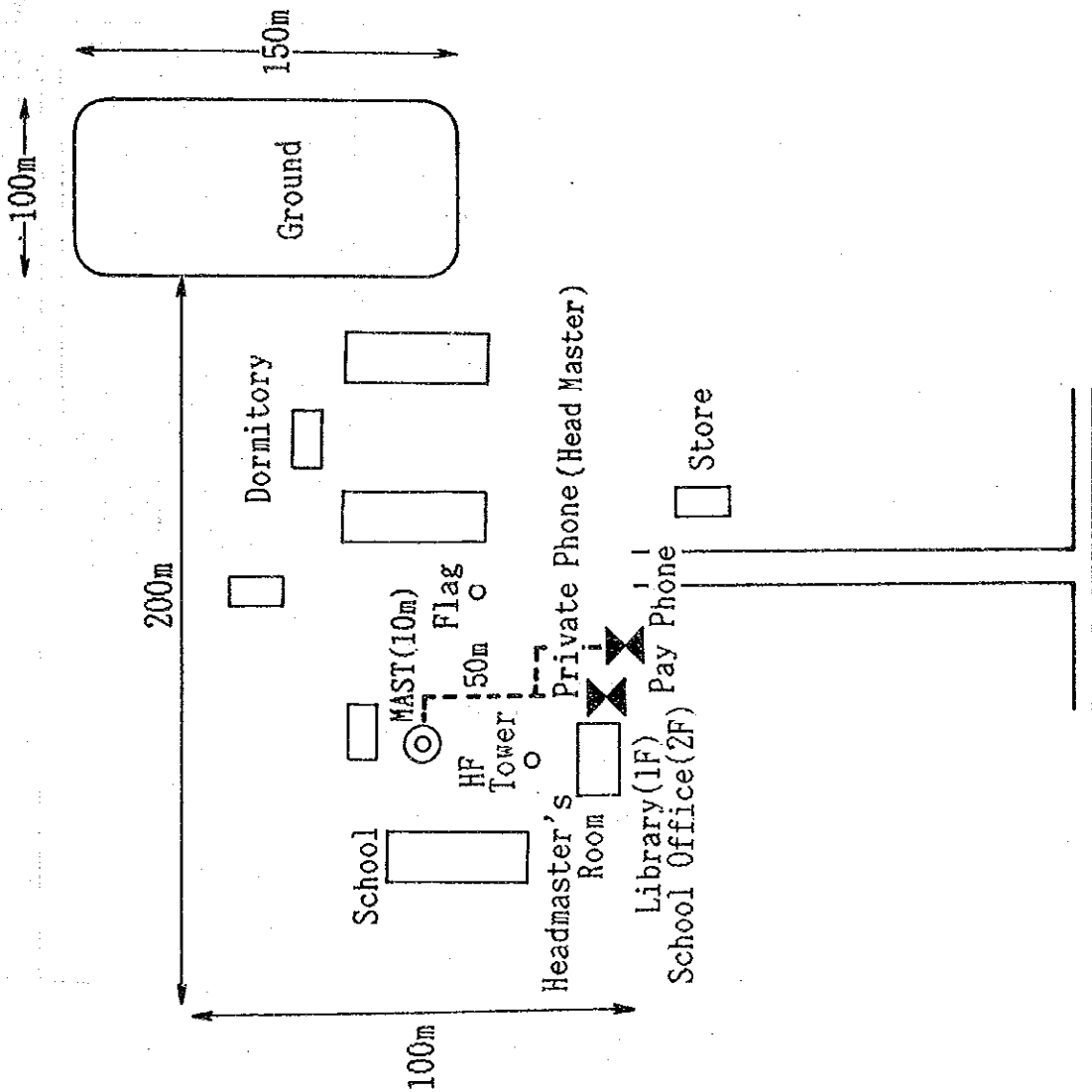
HIPAGAT



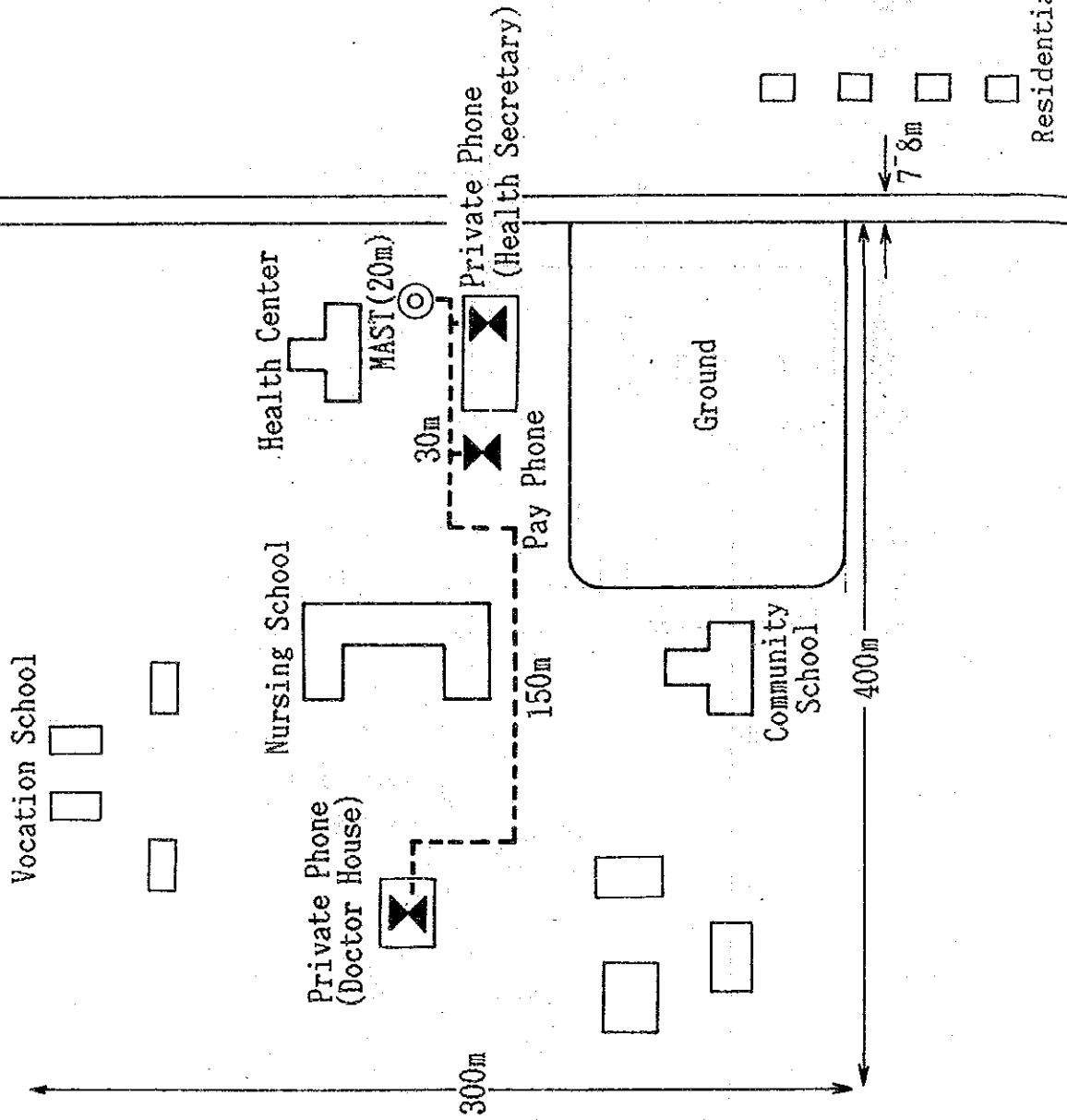
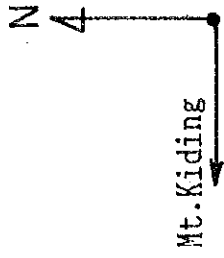
TASKUL



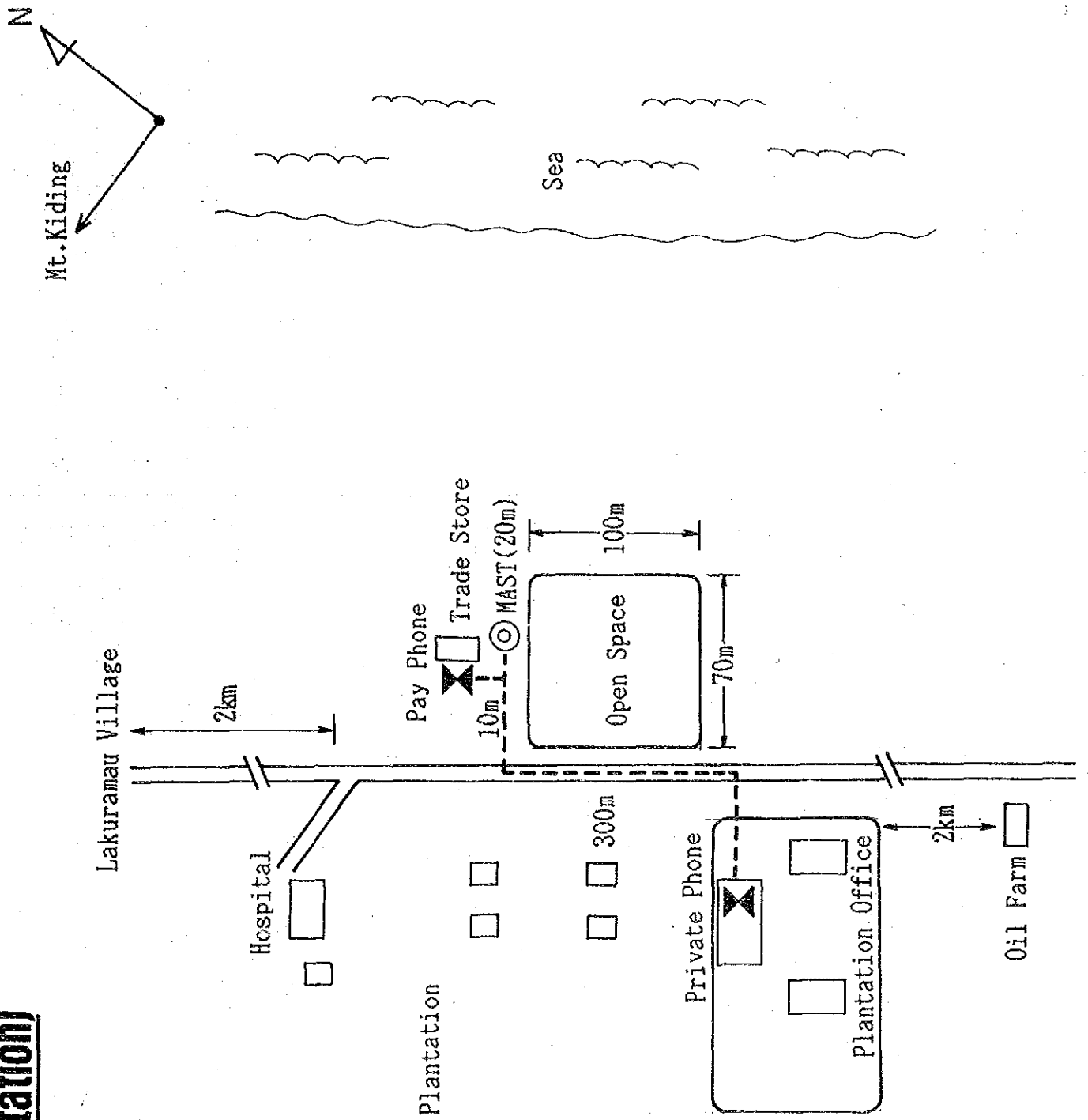
MANGAI

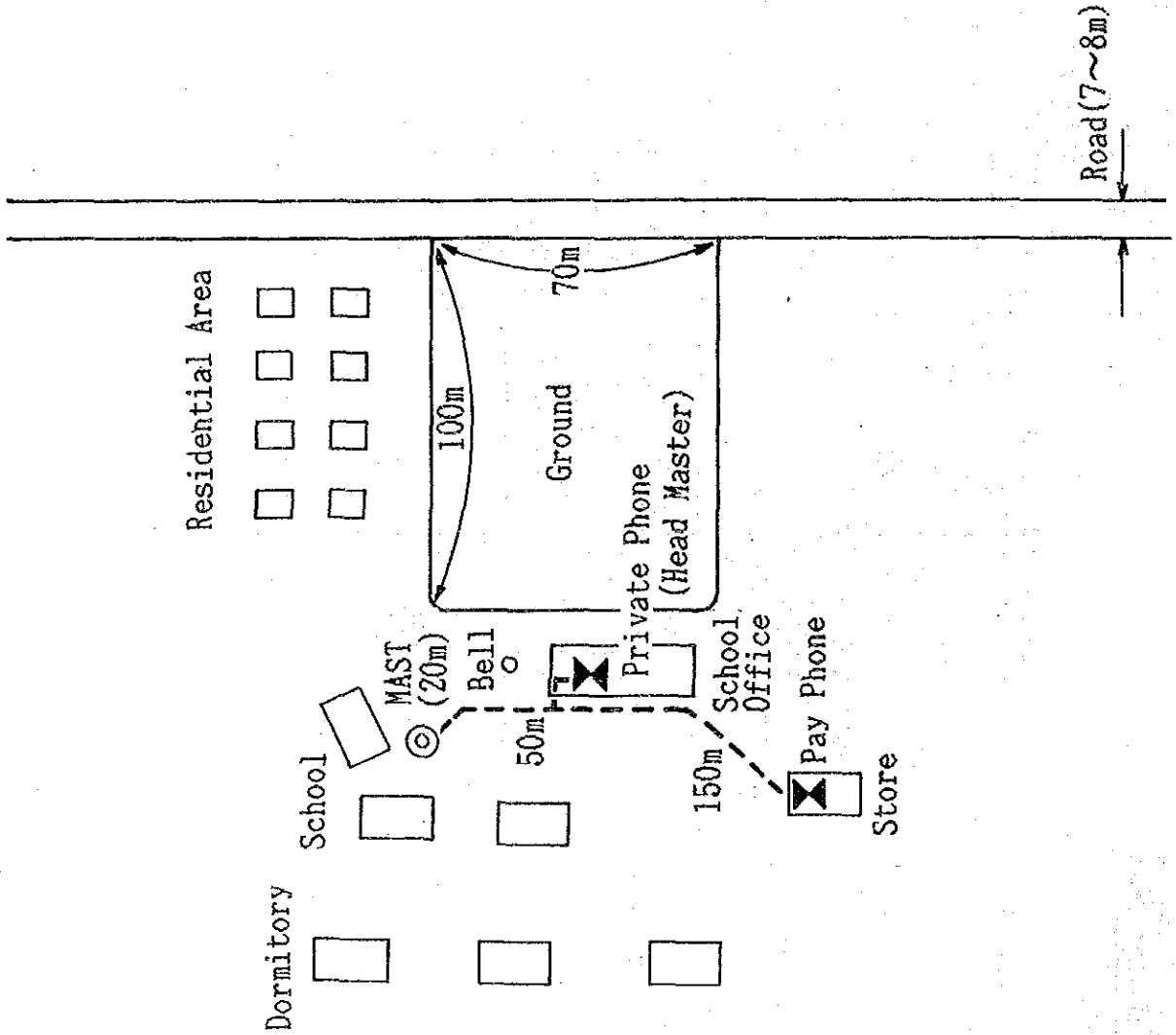
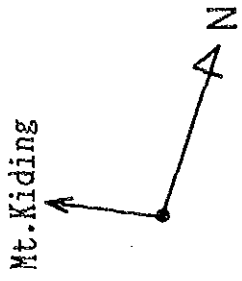


LEMAKOT

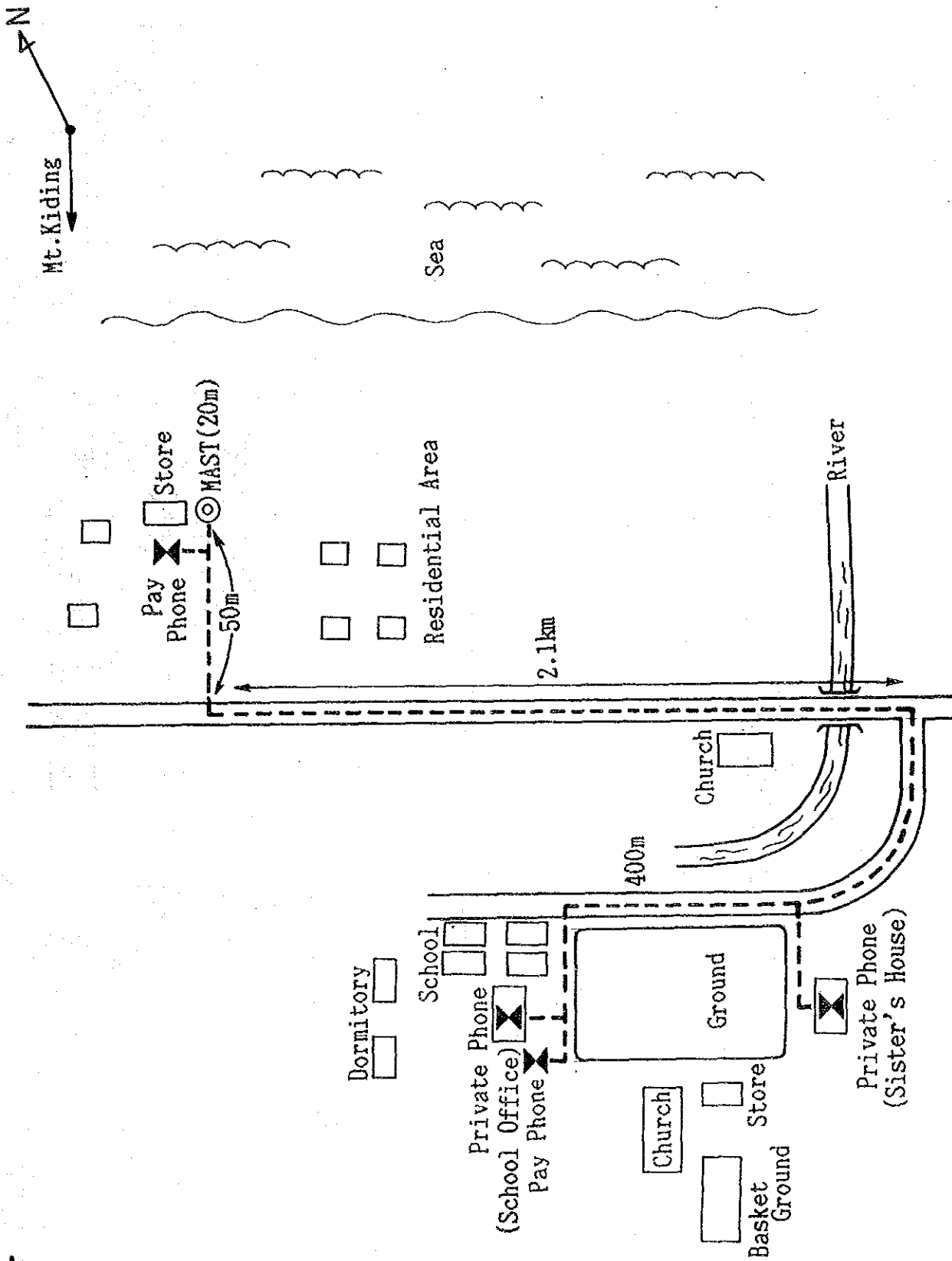


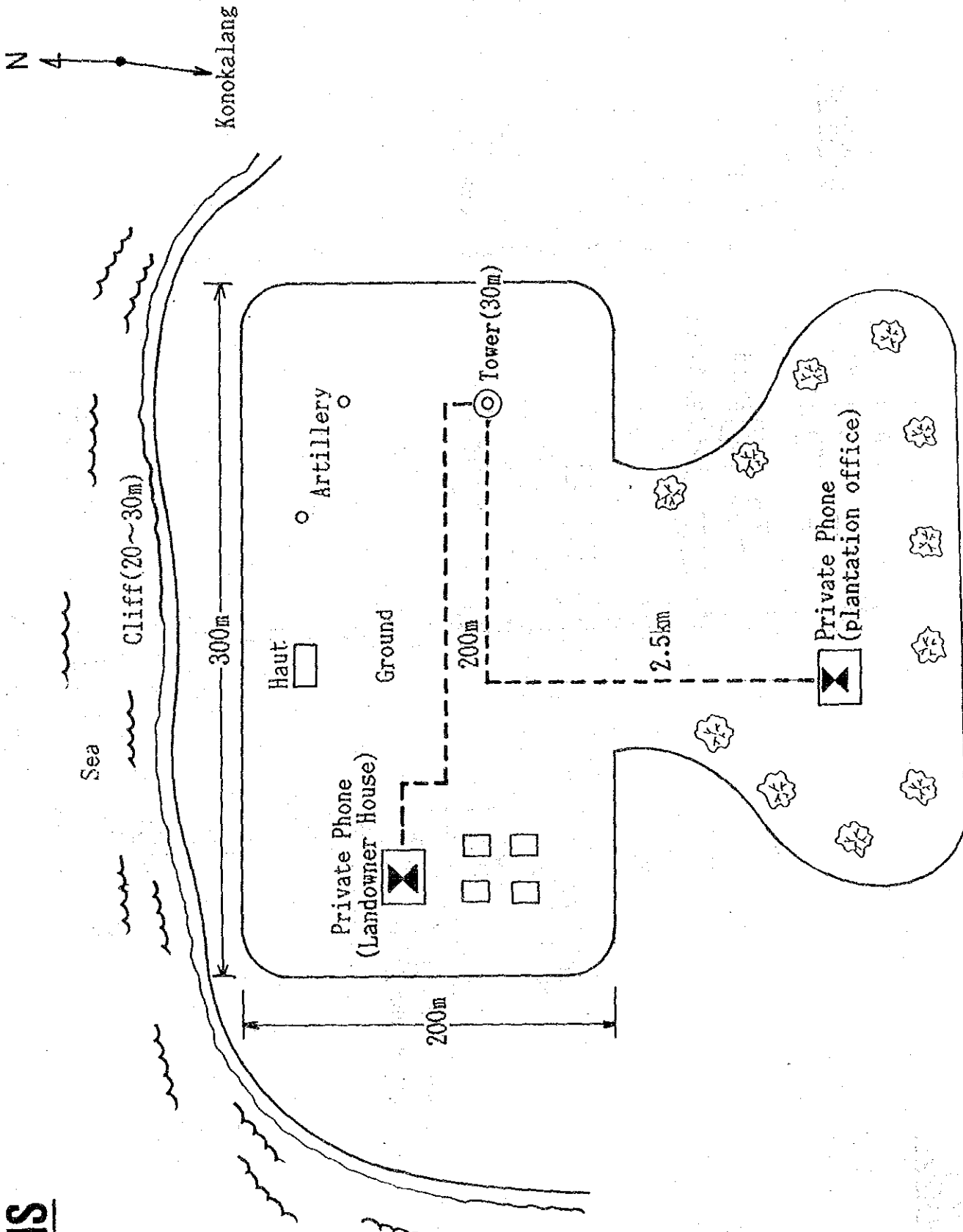
LAKURAMAU (Plantation)



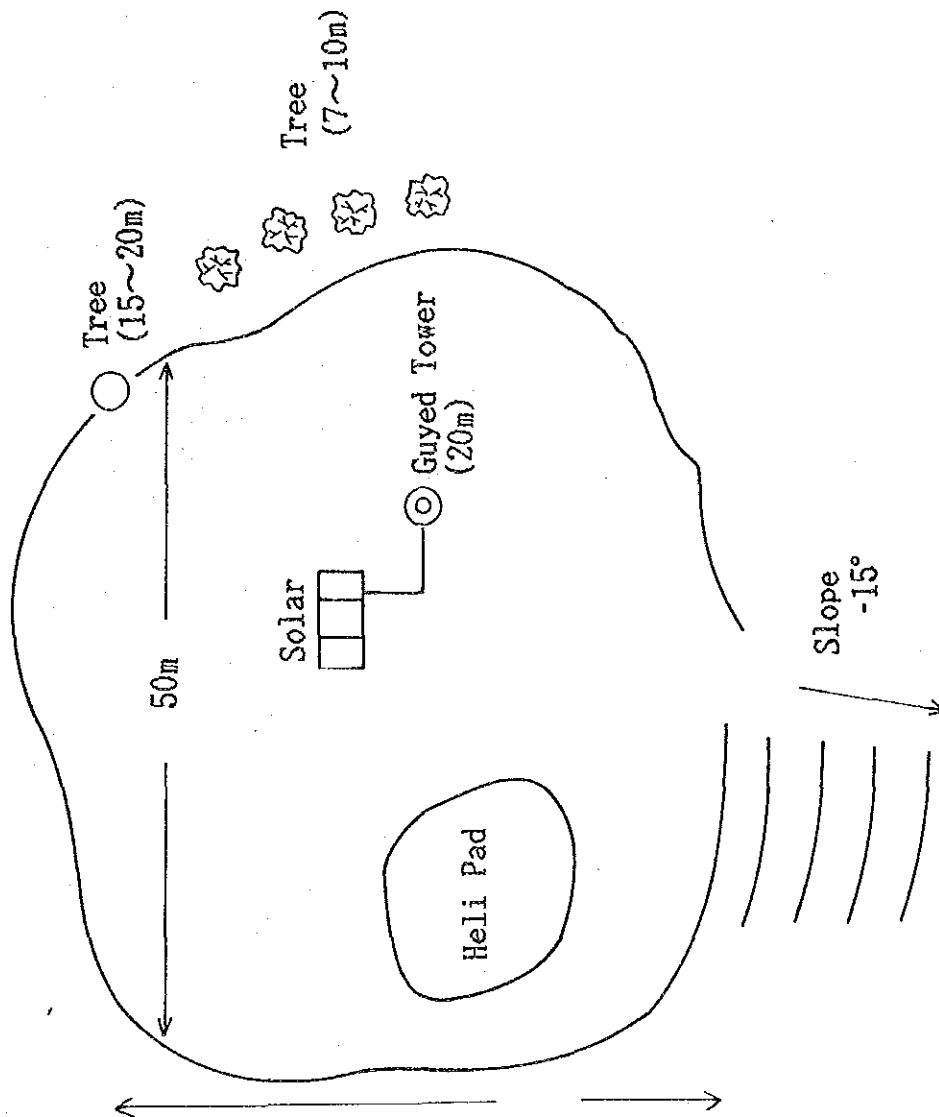
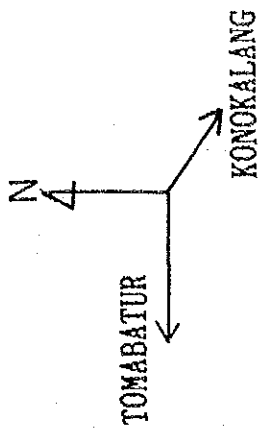


MANGOP

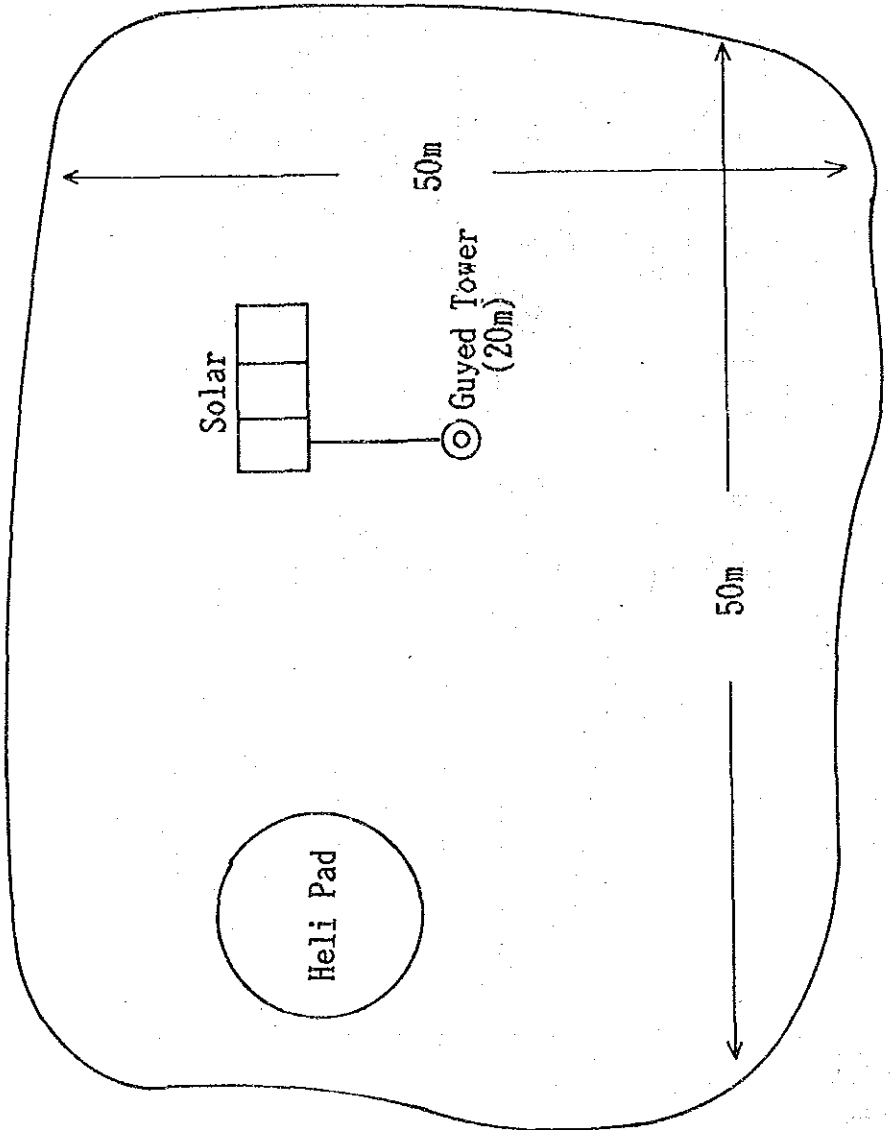
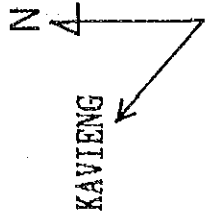




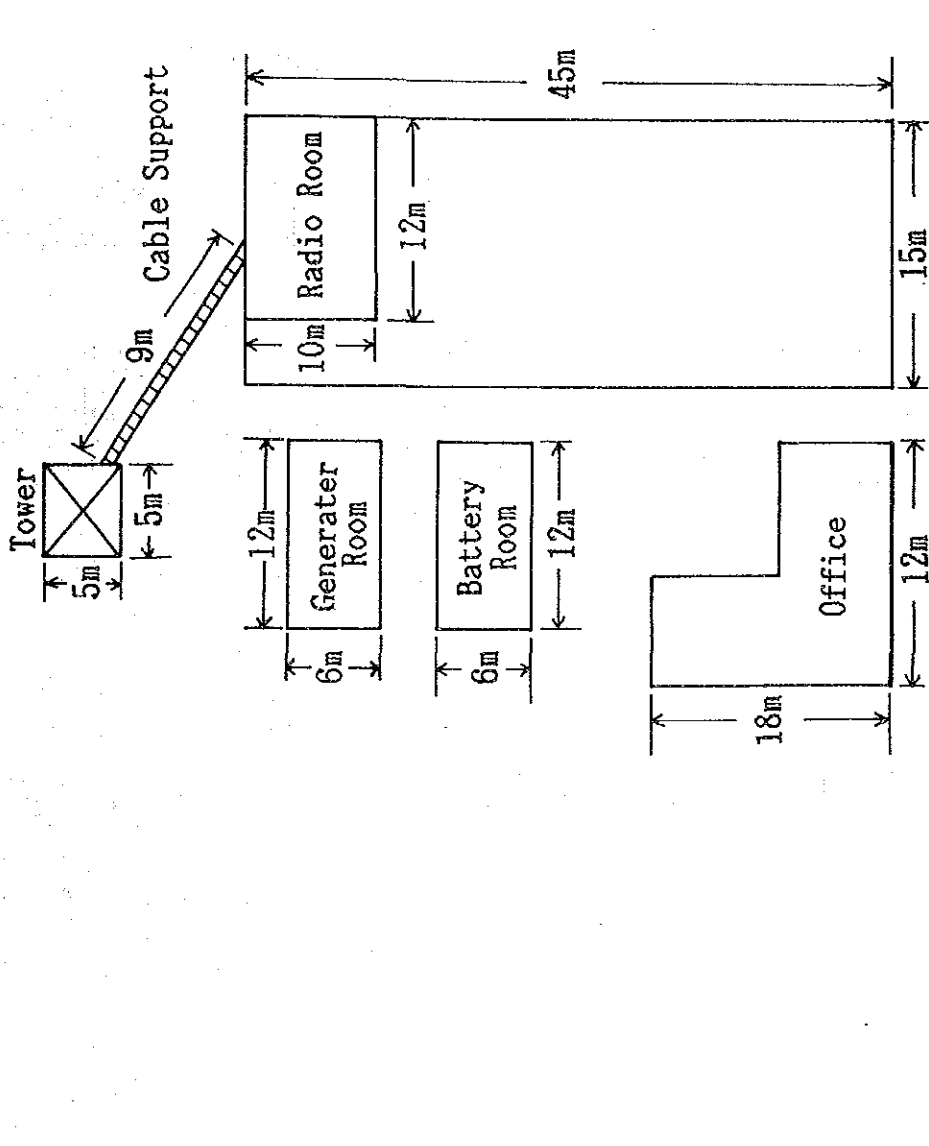
DUKE OF YORK



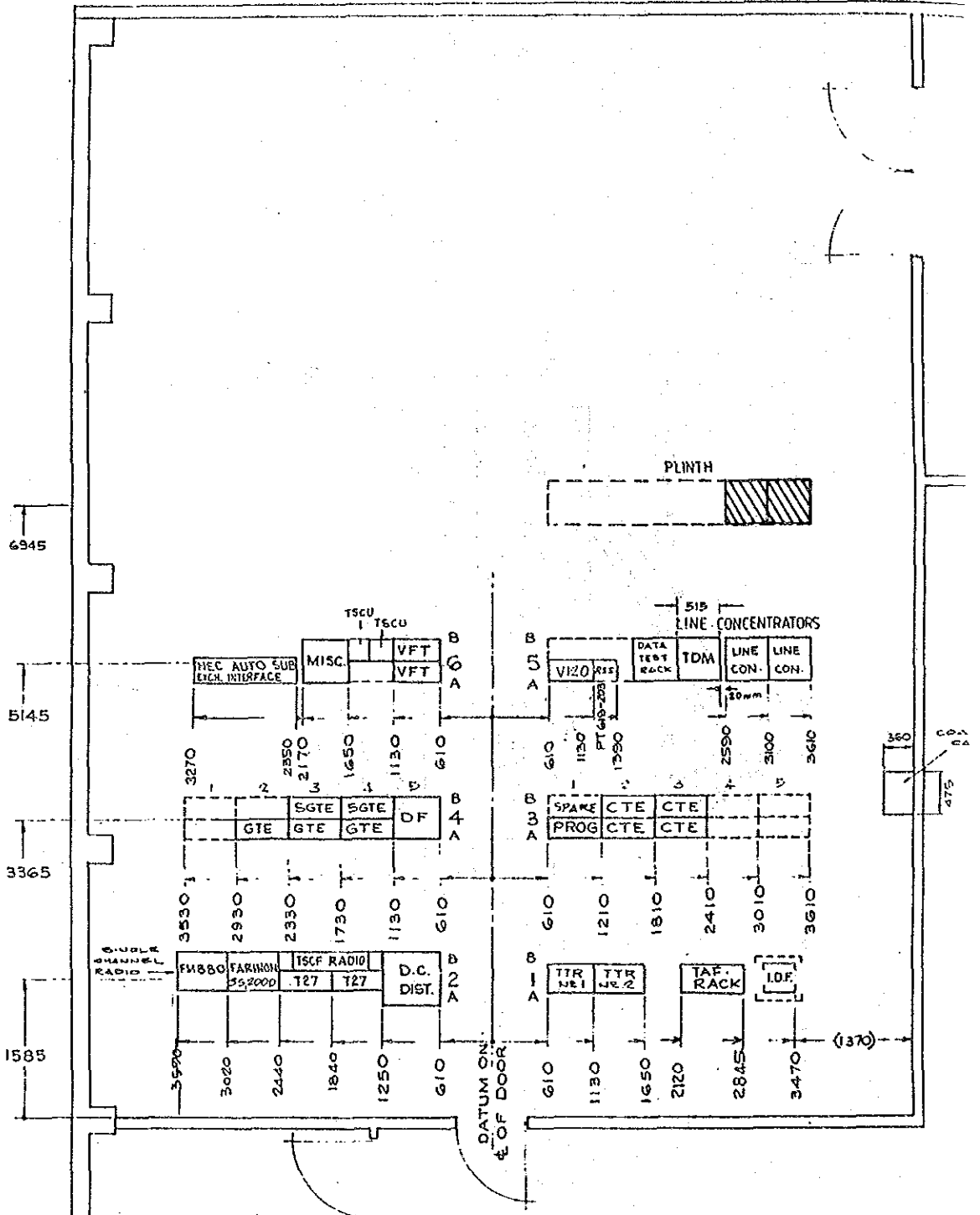
Mt. KIDING



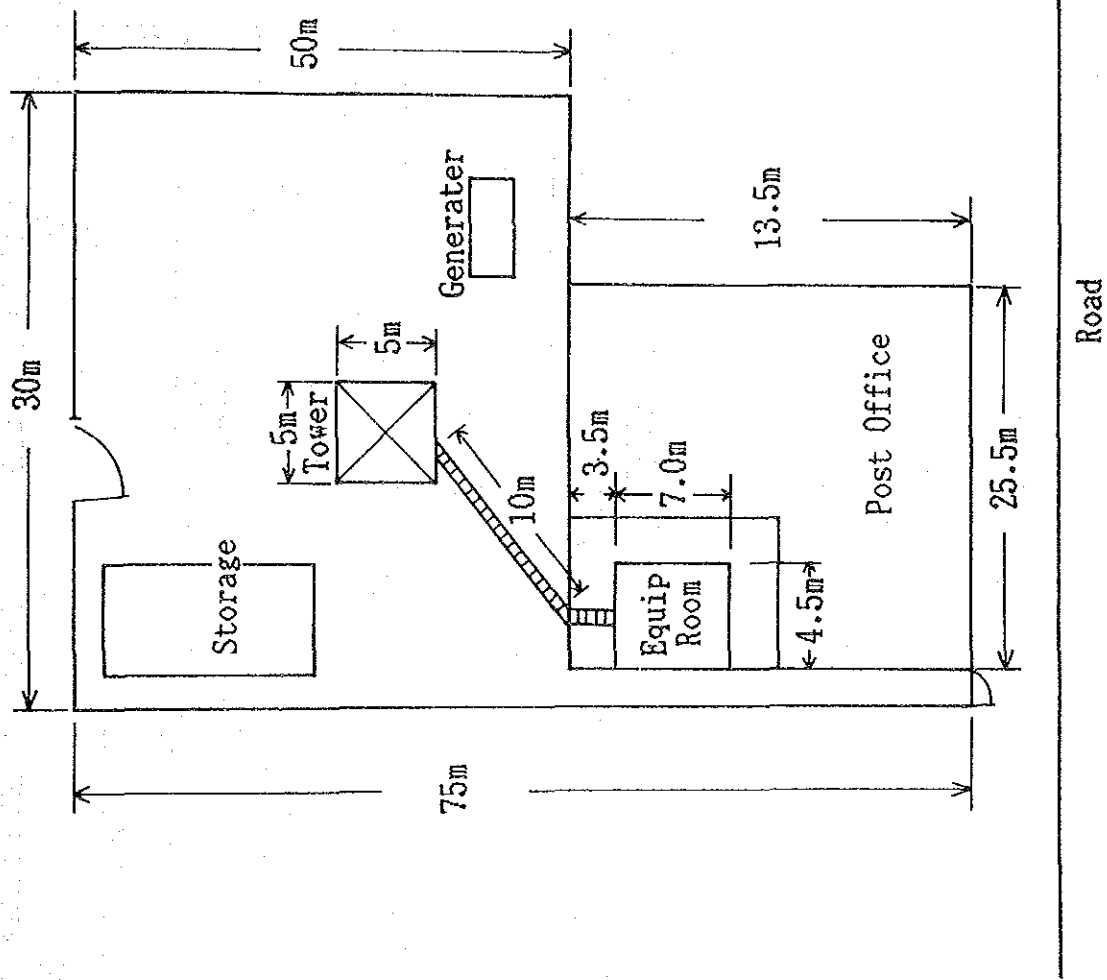
RABAU



RABAU

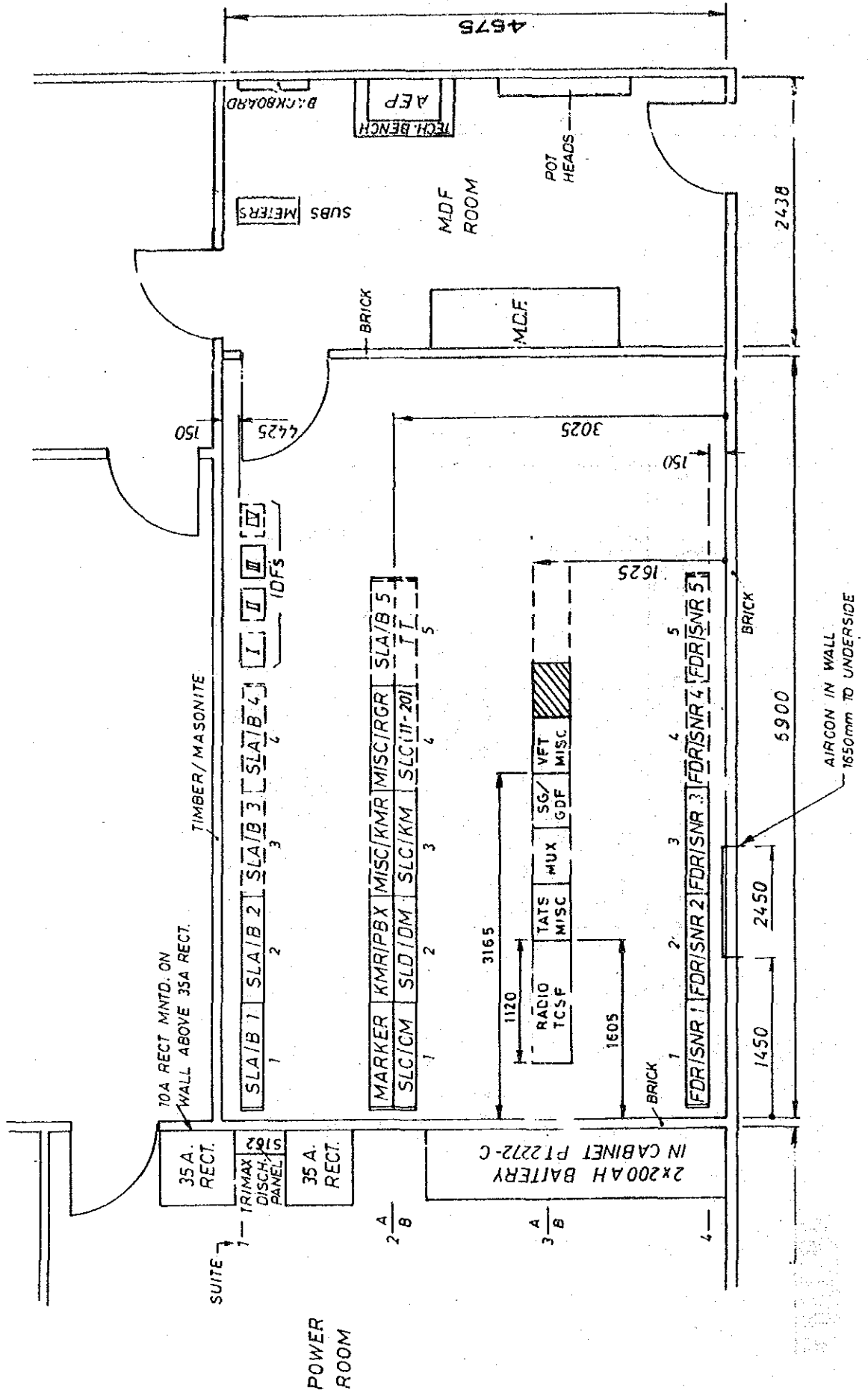


KAVIENG

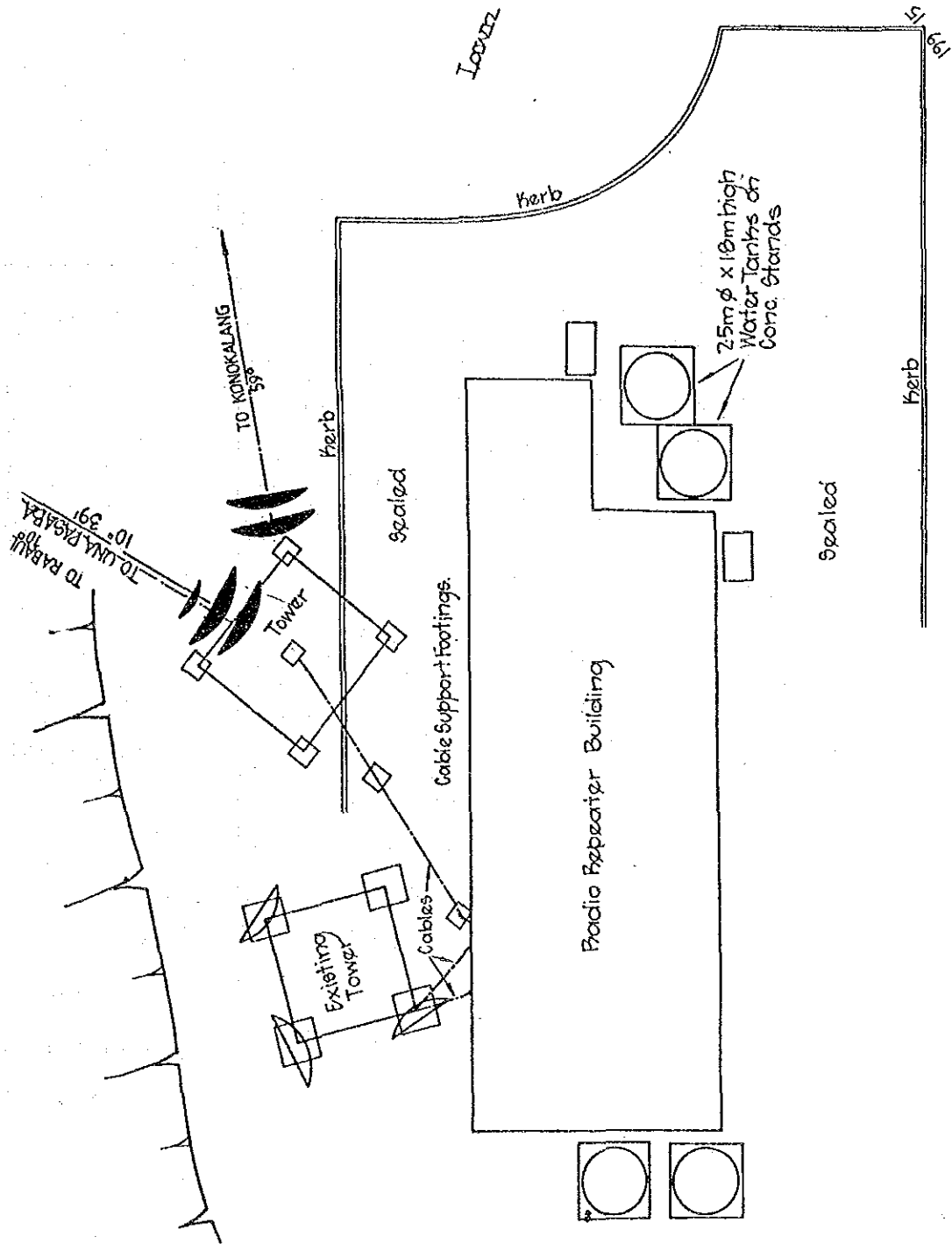


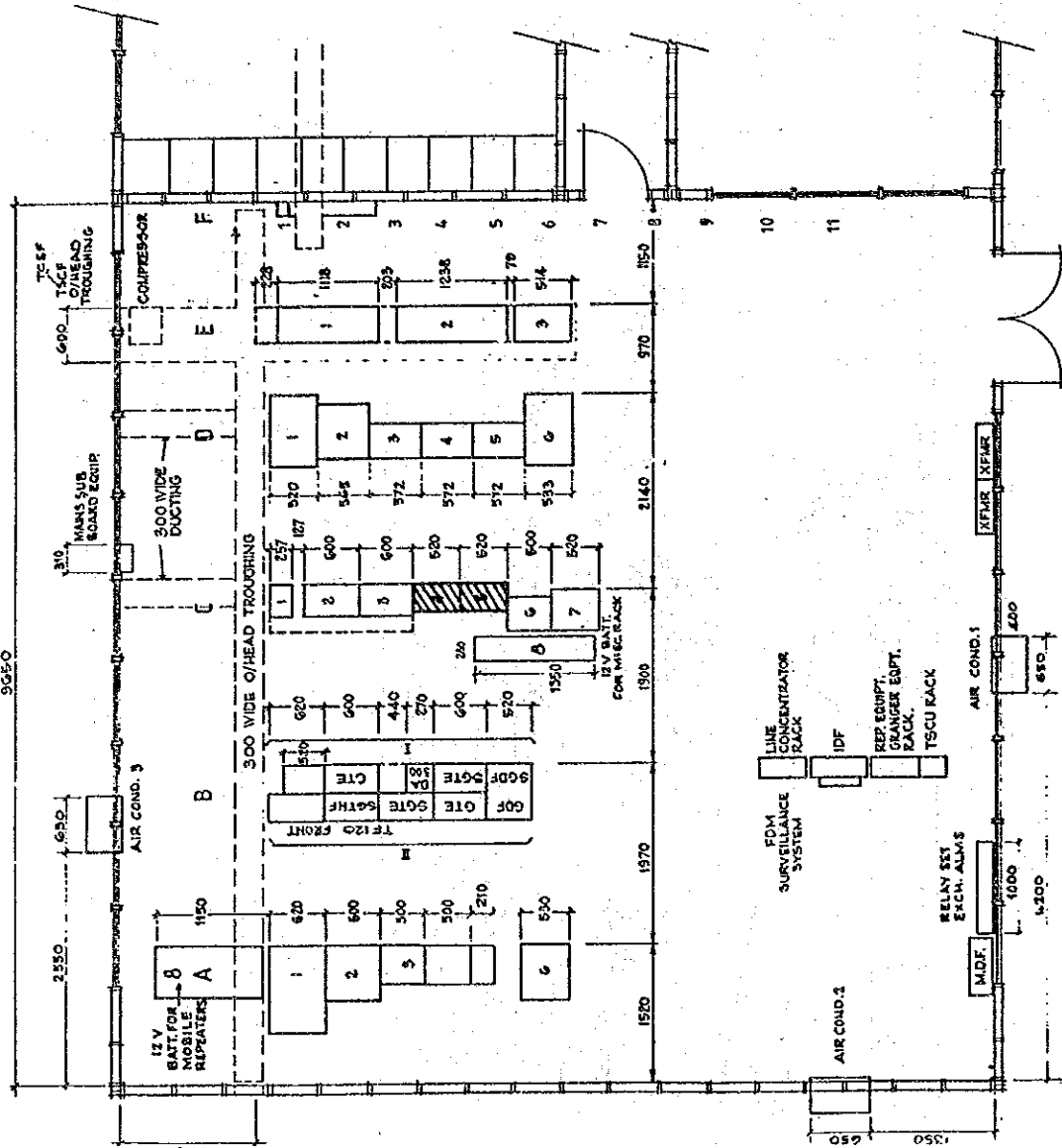
KAVIENG

Annex-3-48

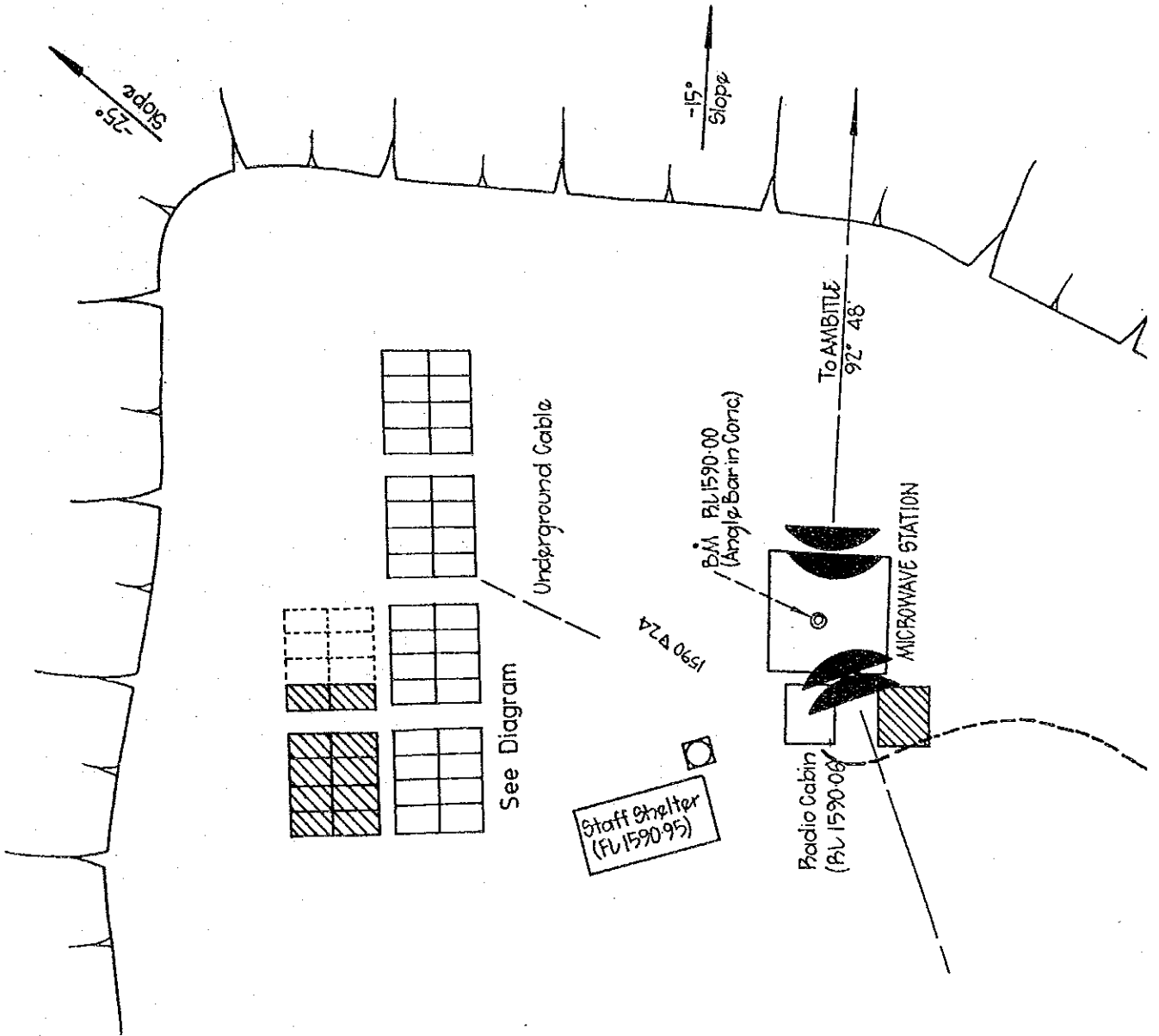


TOMOAVATUR



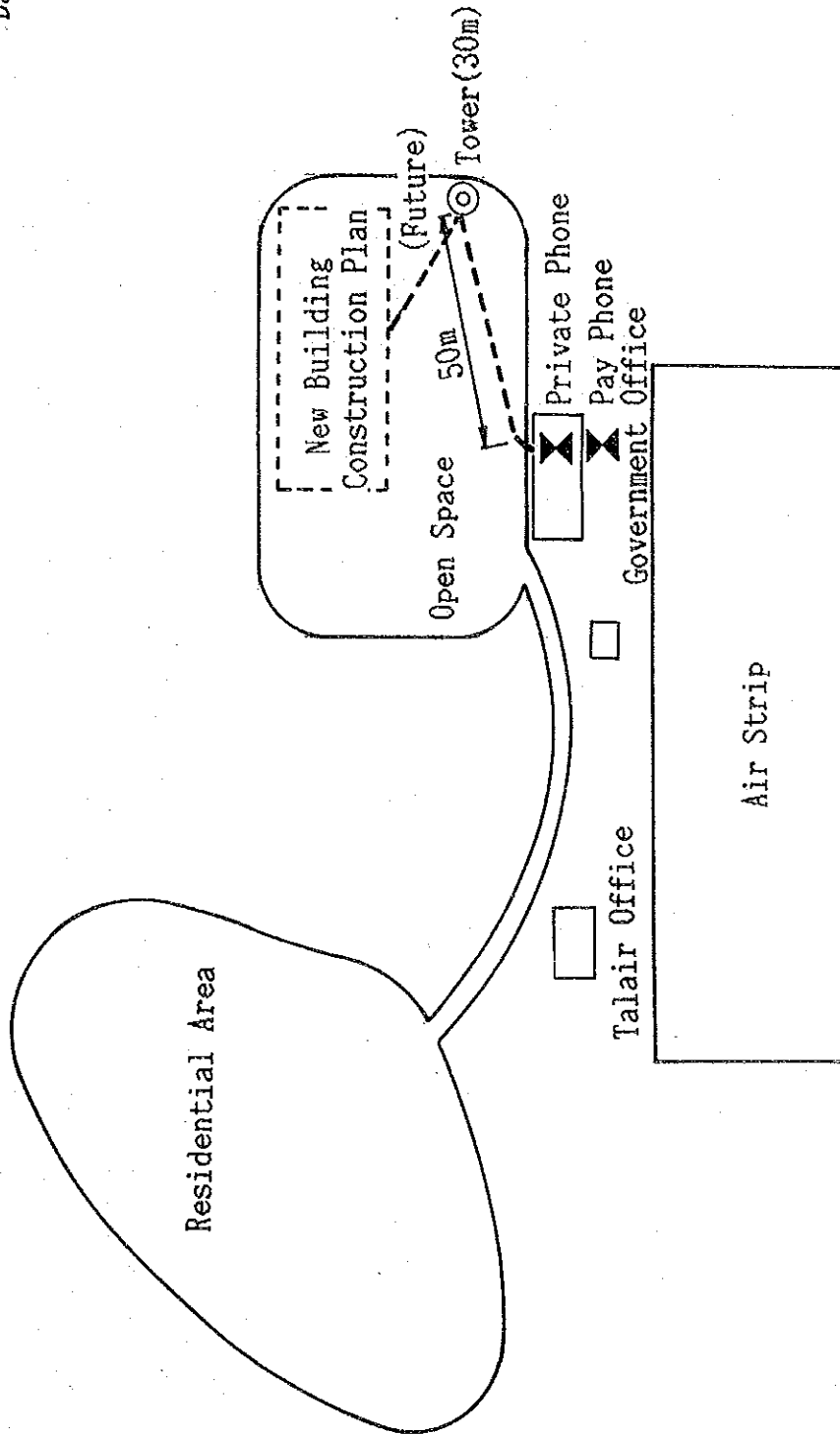
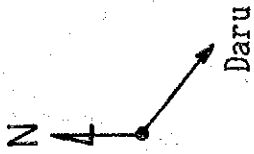


KONOKALANG

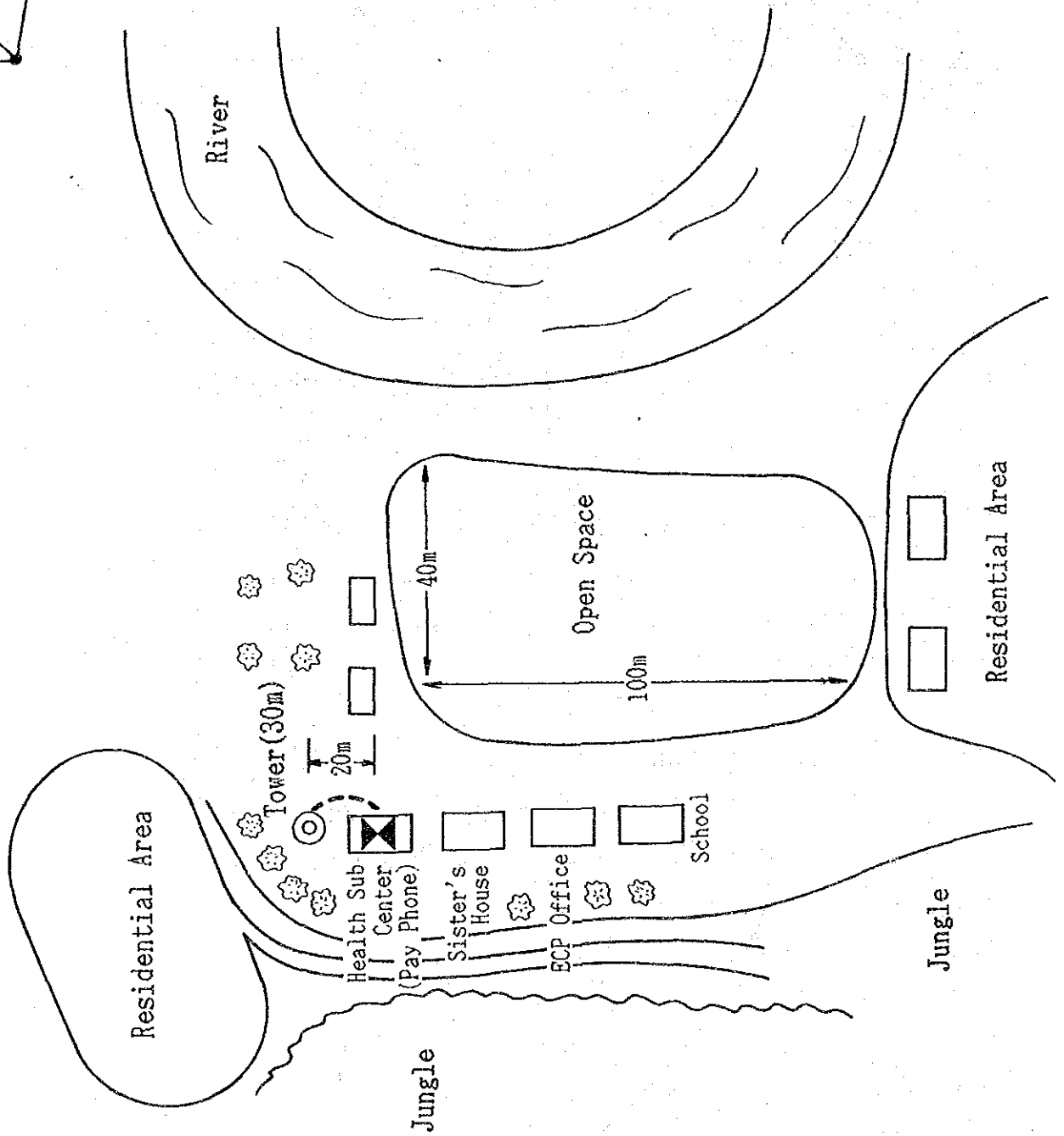
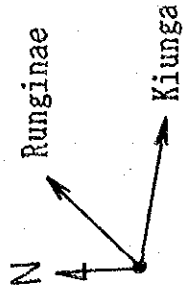


WESTERN PROVINCE

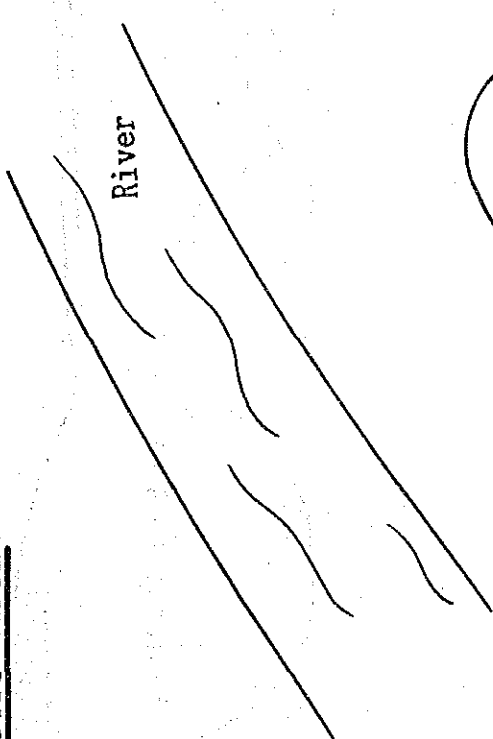
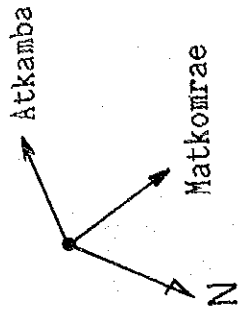
Wipim	-----	5 2
Atkamba	-----	5 3
Runginae	-----	5 4
Matkomrae	-----	5 5
Kungim	-----	5 6
Ningerum	-----	5 7
Debepare	-----	5 8
Mogulu	-----	5 9
Suabi	-----	6 0
Daru	(Exchange Office) -----	6 1
Mt. Karoma	(") -----	6 3



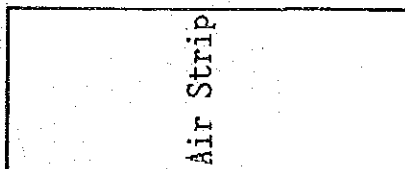
ATKAMBA



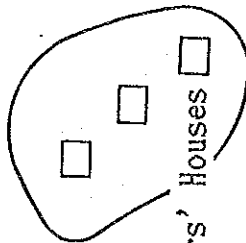
RUNGINAE



River

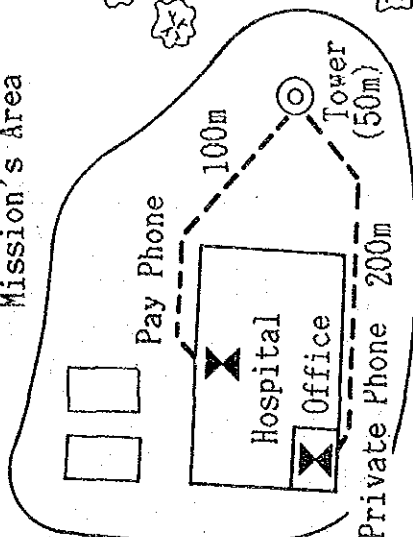


Air Strip

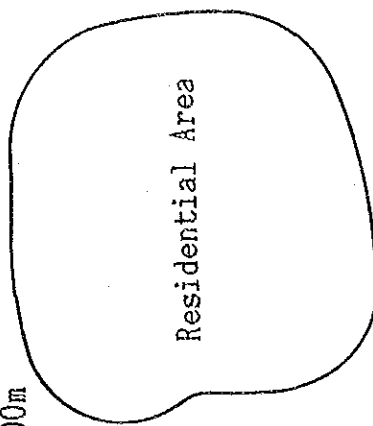


Doctors' Houses

Mission's Area

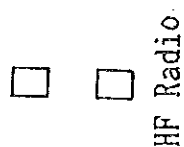


Tall Tree



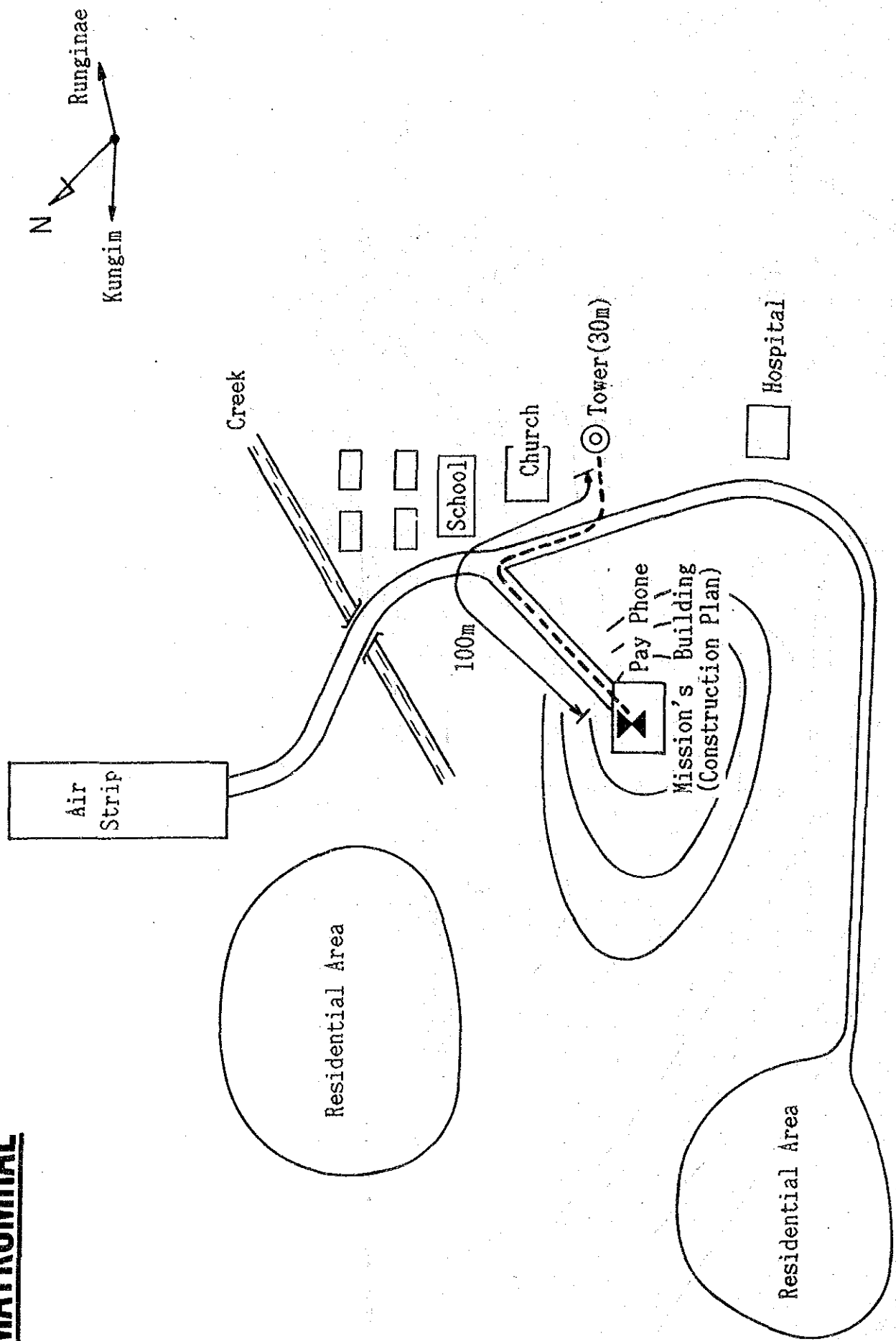
Residential Area

400m

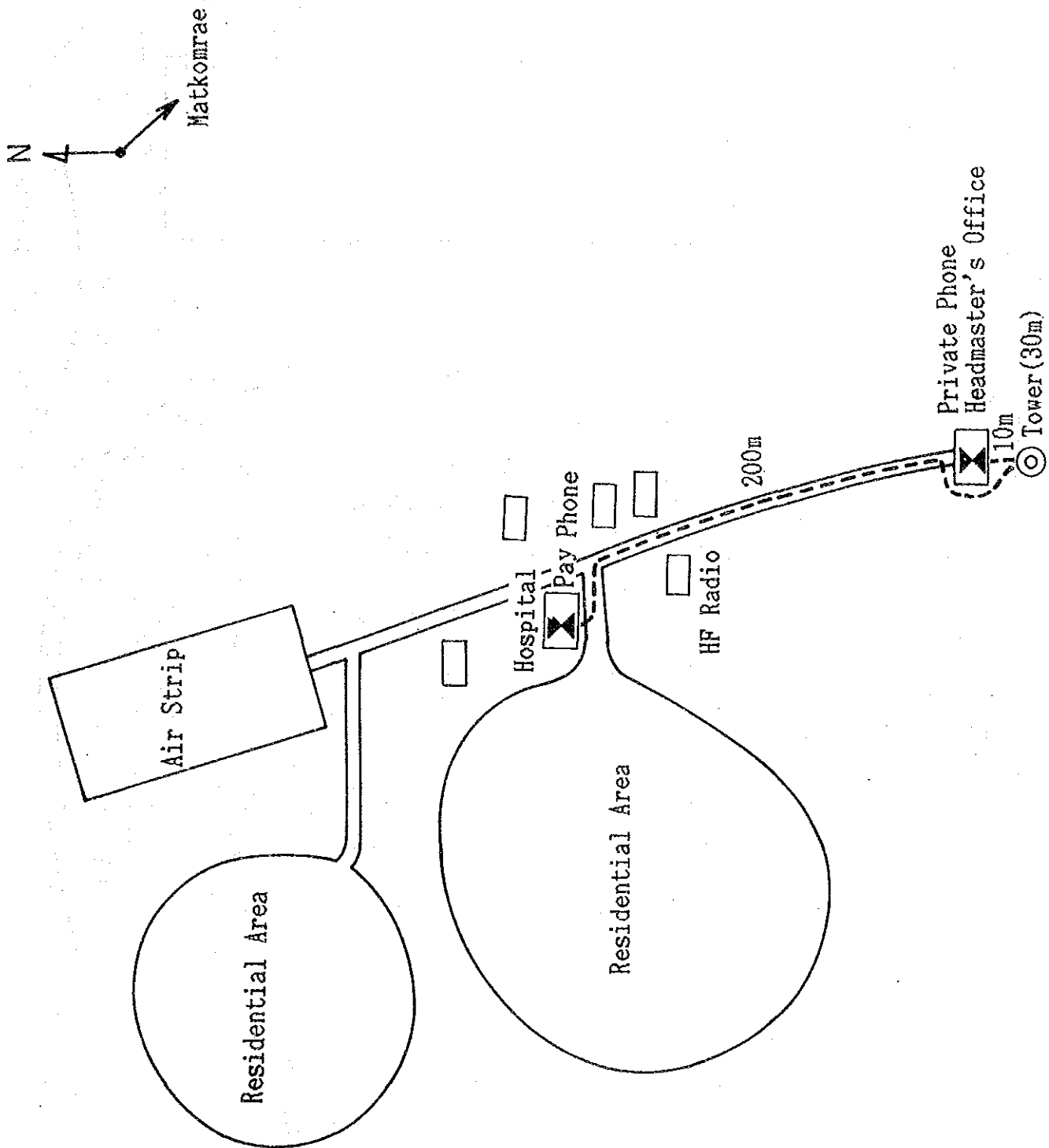


HF Radio

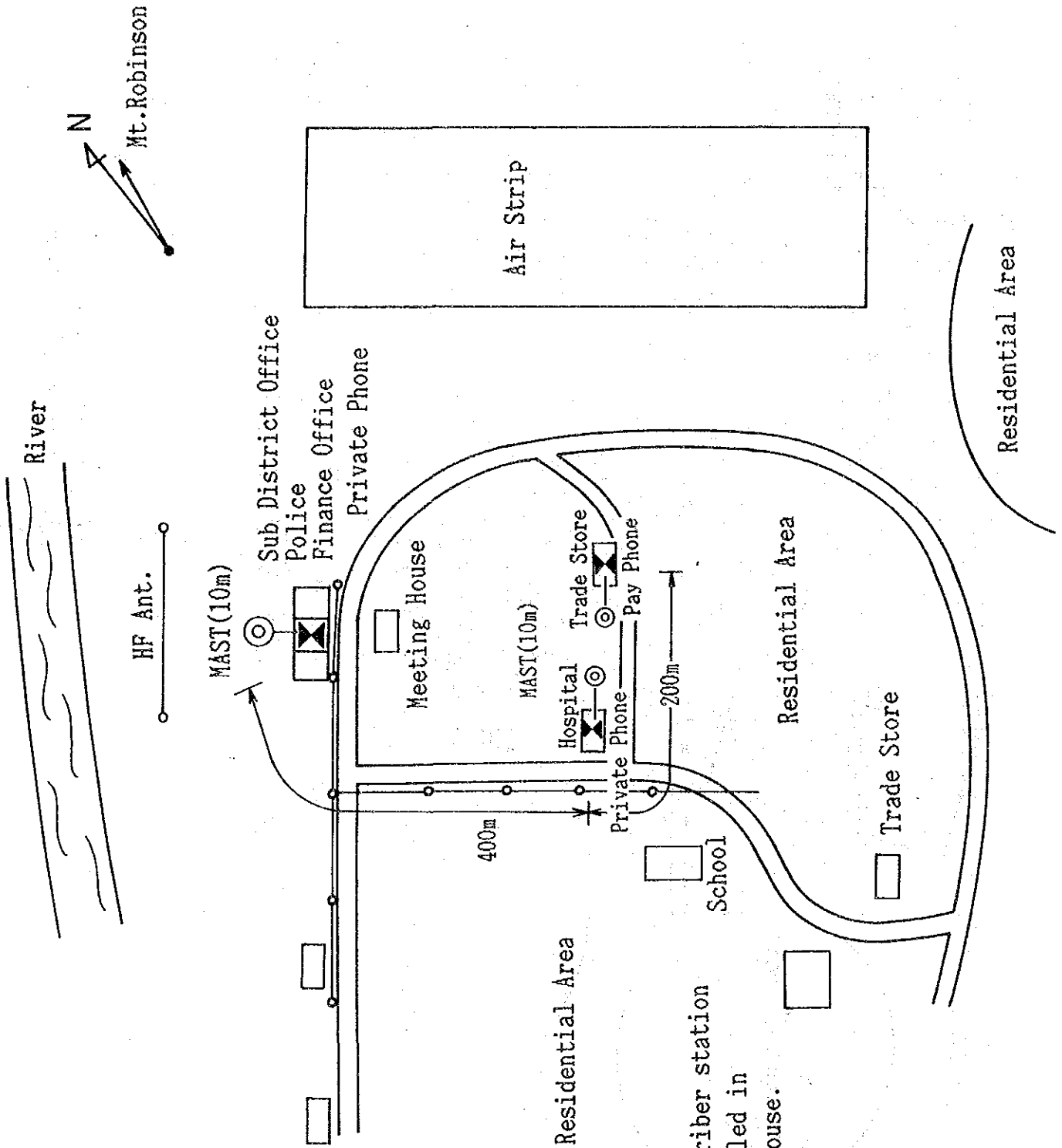
MATKOMRAE



KUNGIM

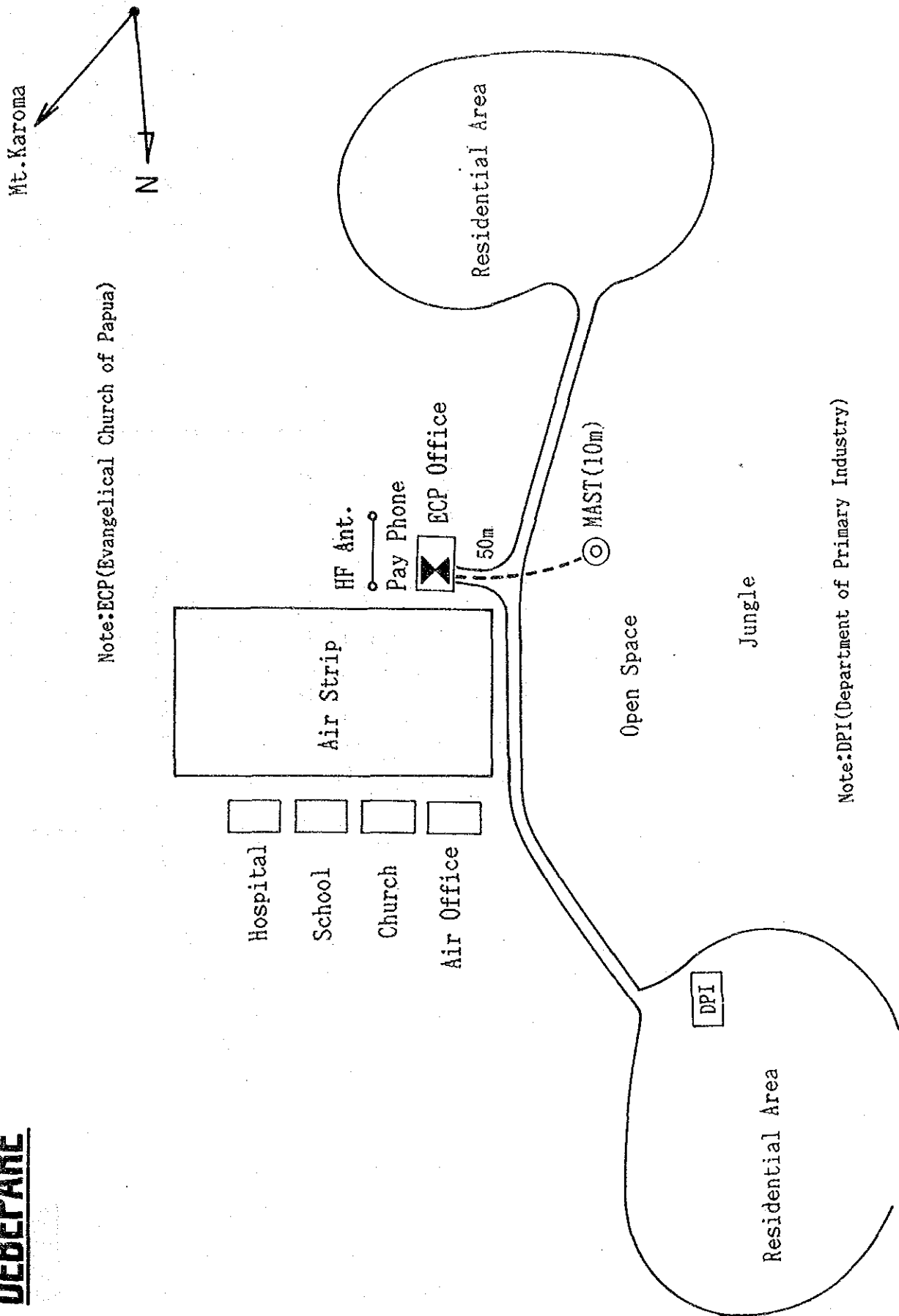


NINGERUM

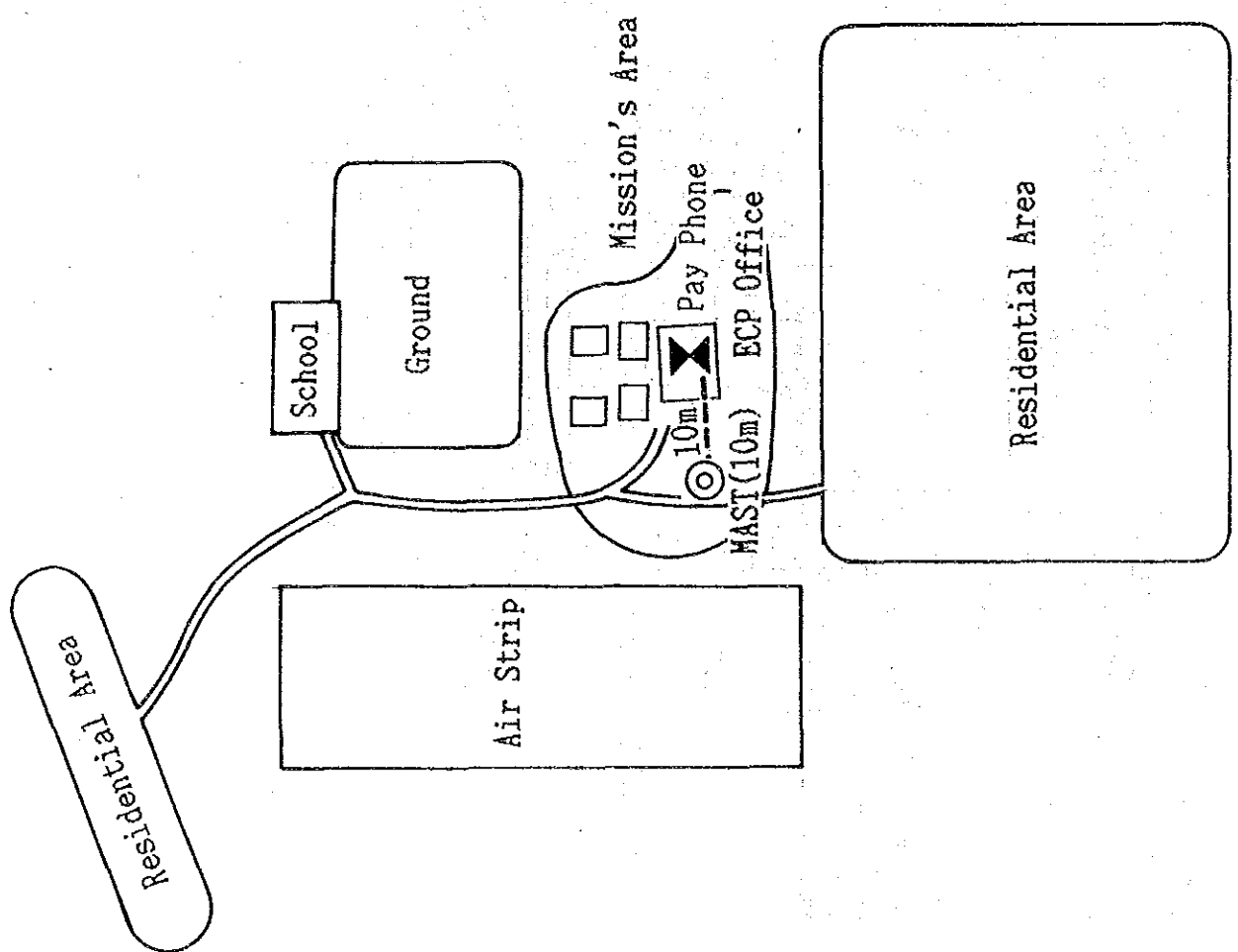
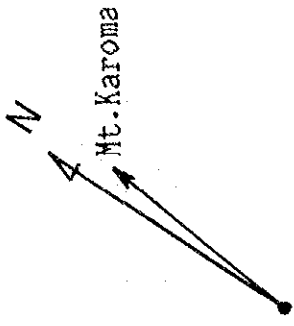


Note: The each subscriber station will be installed in subscriber's house.

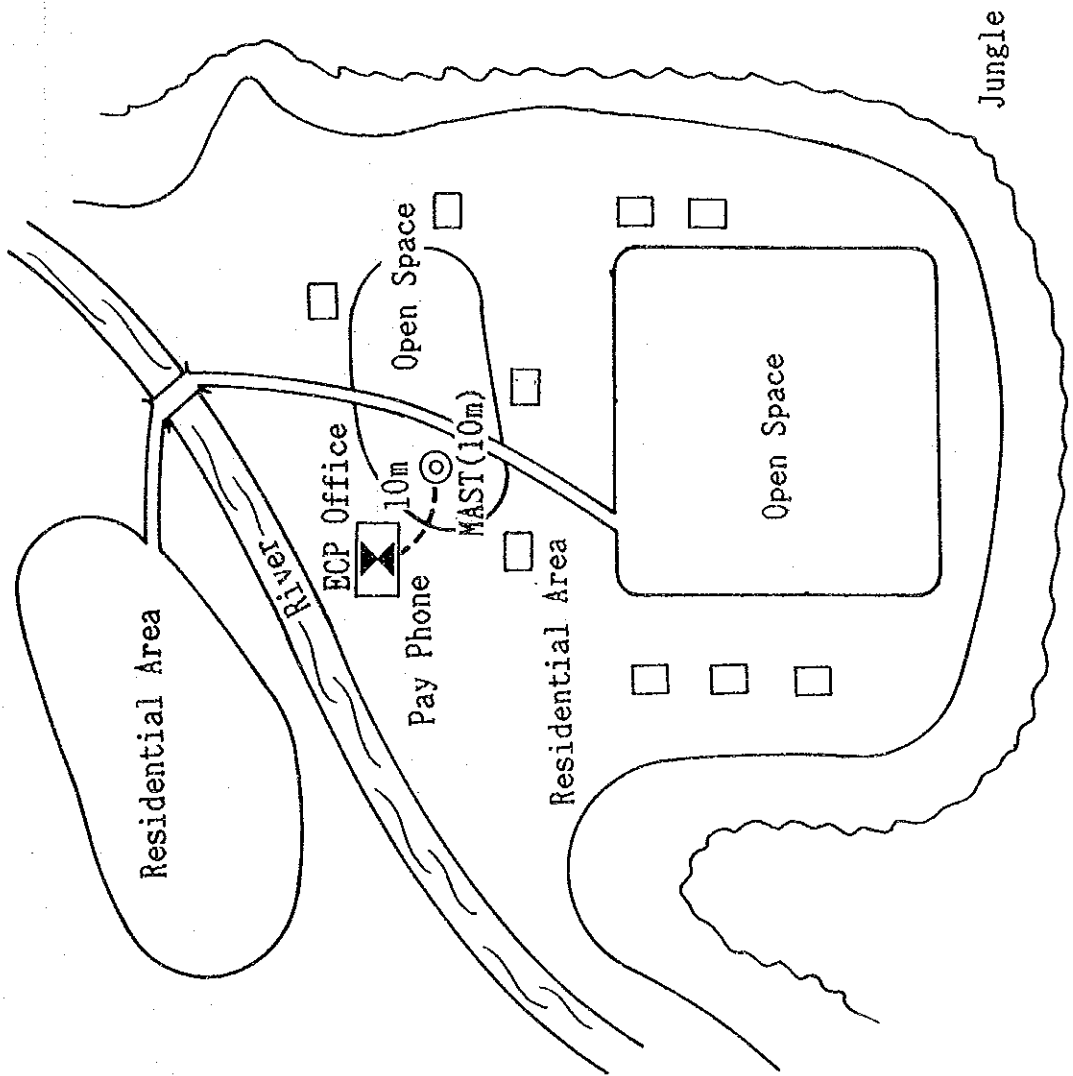
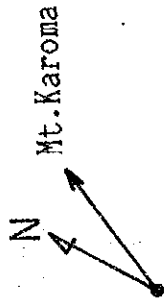
DEBEPARE

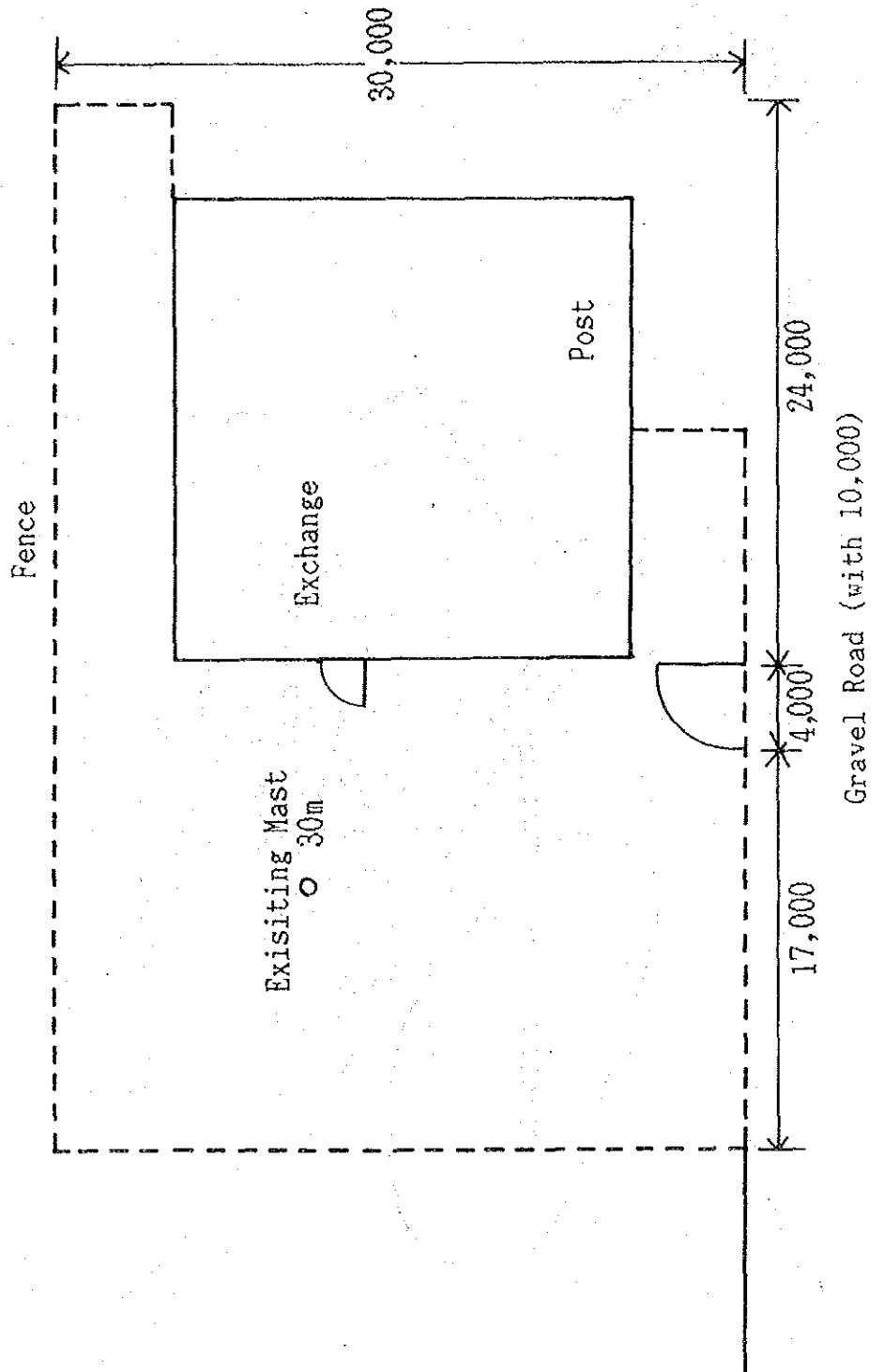
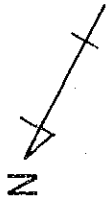


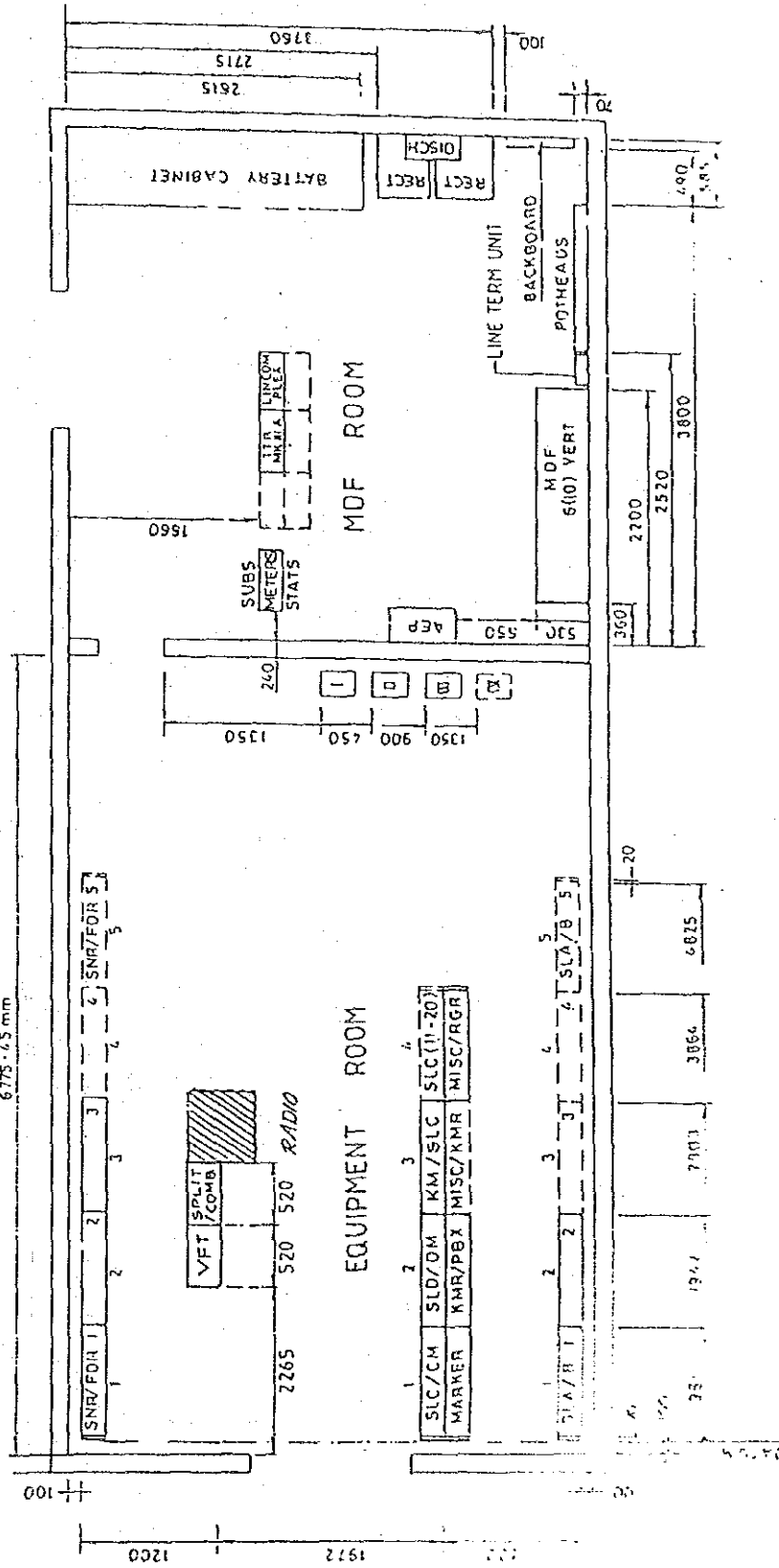
MOGULU



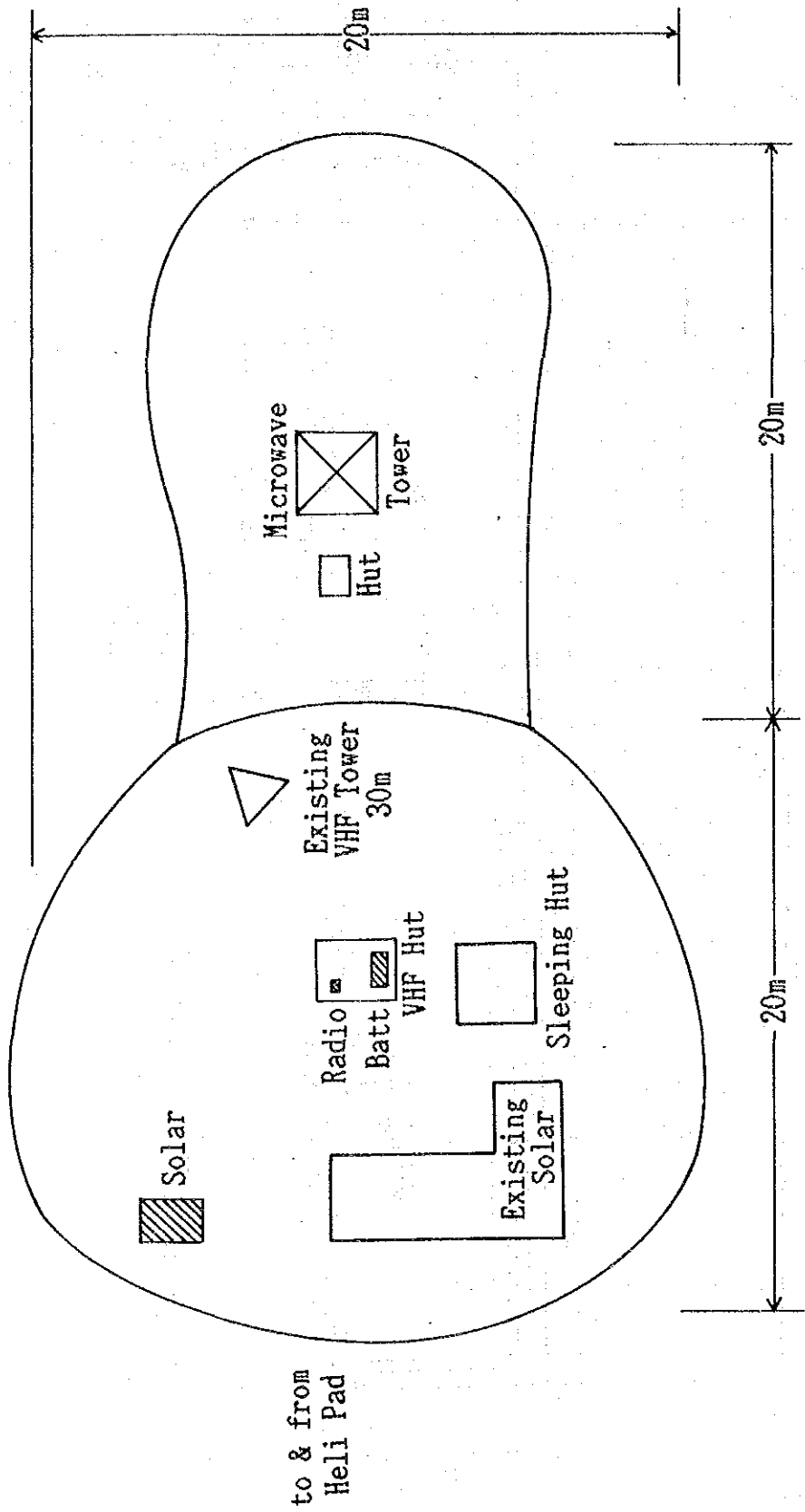
SUABI







MT. KAROMA



to & from
Heli Pad

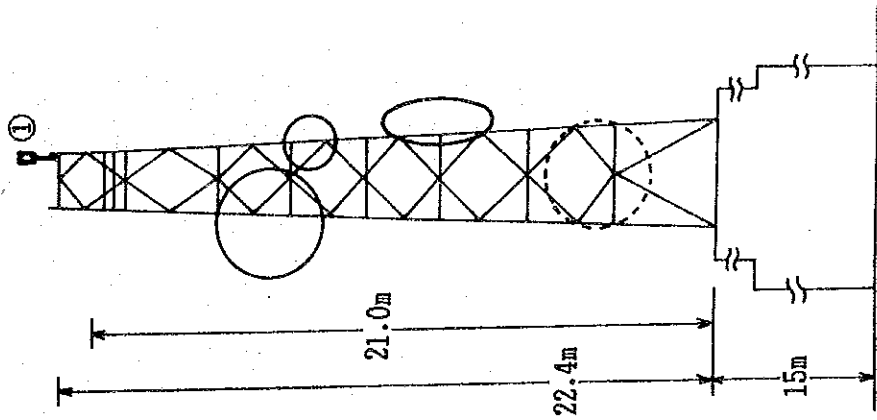
付属資料 4

既設局での機械及びアンテナ設置図

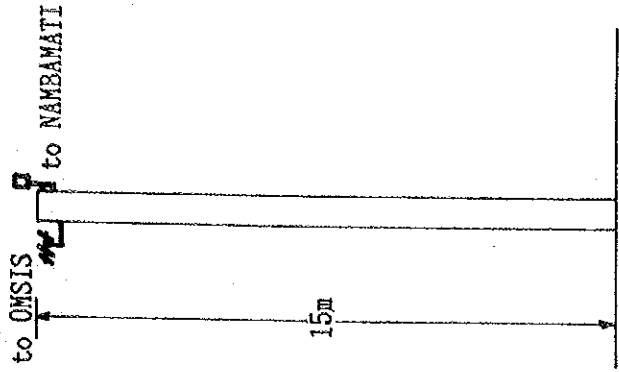
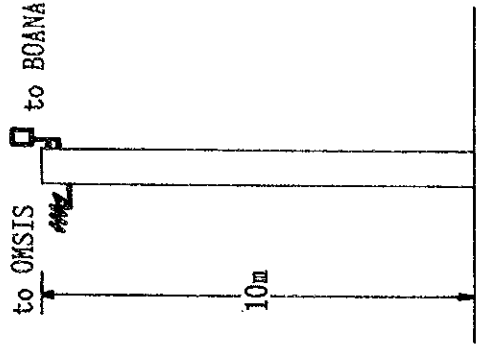
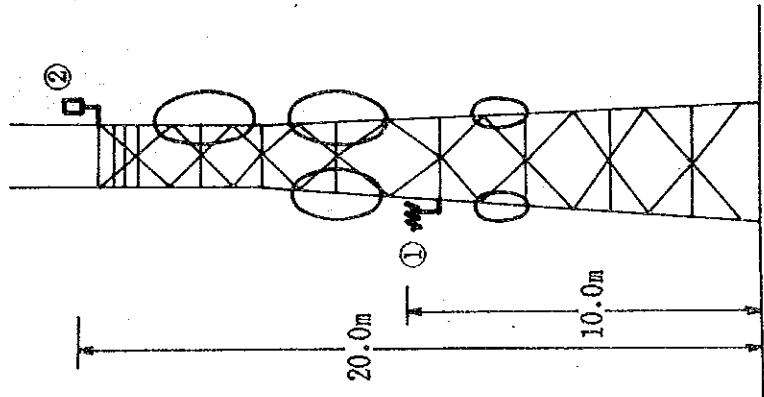
Morobe Province	1 ~ 3
New Ireland Province	4 ~ 5
Western Province	6 ~ 8

MORobe PROVINCE(1/3)

① to OMSIS, WIDERU
Mt. MISSION
(omni)

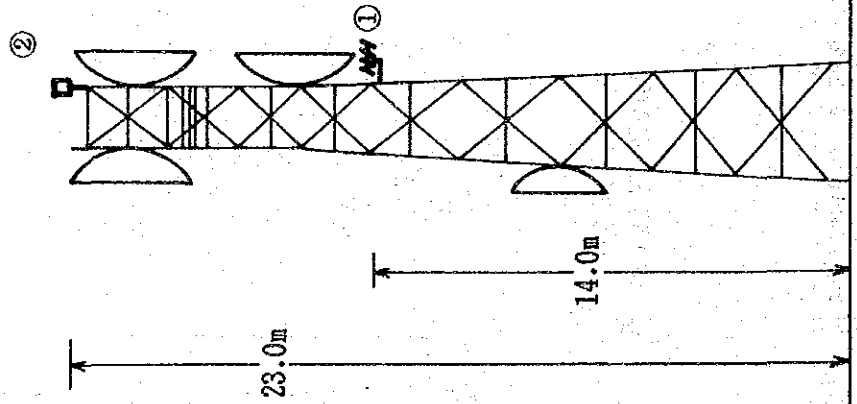


① to LAE (Yagi)
② to BANDONG
CHIVASING (omni)



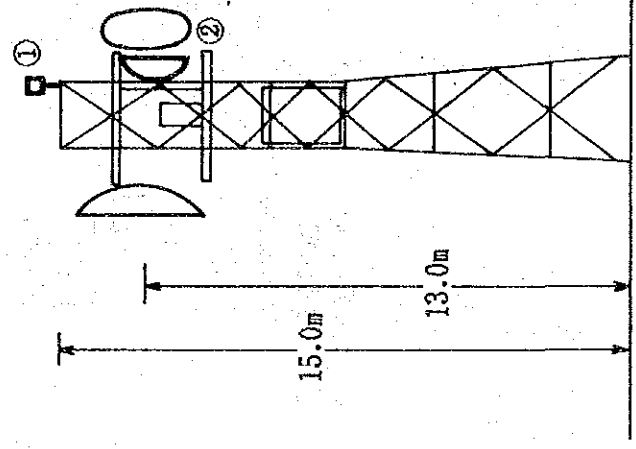
MOROBE PROVINCE(2/3)

- ① to CHIVASING (Yagi)
 - ② to KAIAPIT
- UMI
MATARAI
(omni)

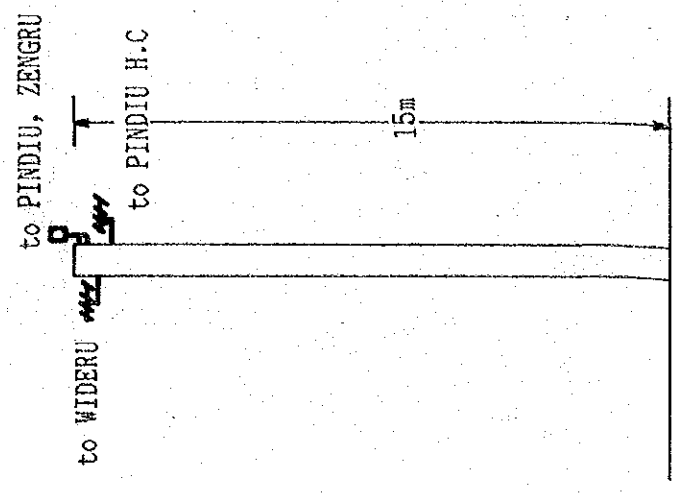


NANBAMATI

- ① to SILIMANA
- BUKAUA (omni)
- ② to LAE (1.2mφ)



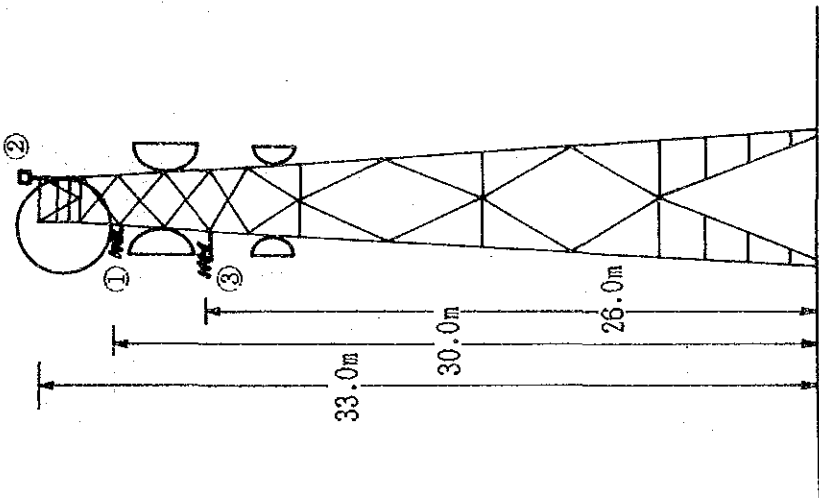
WIDERU



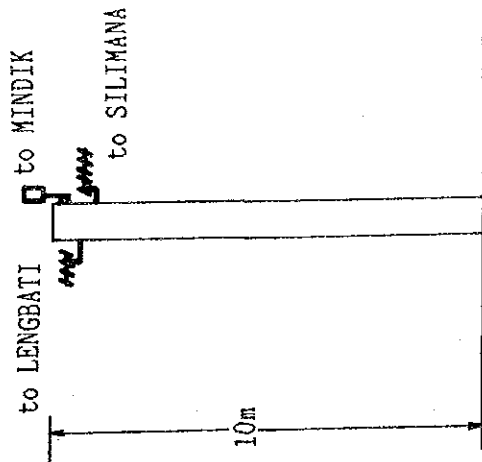
SILIMANA

MOROBE PROVINCE(3/3)

- ① to LAE (Yagi)
- ② to SALAMUA (omni)
YAIWAHAWA
- ③ to BAINI (Yagi)

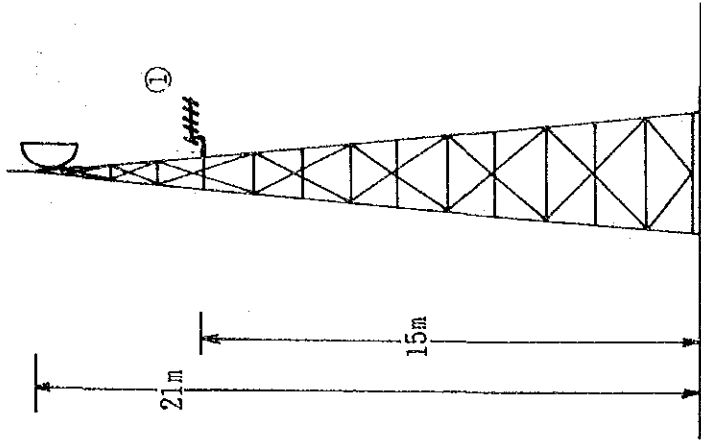


Mt. MISSION



ZENGURU

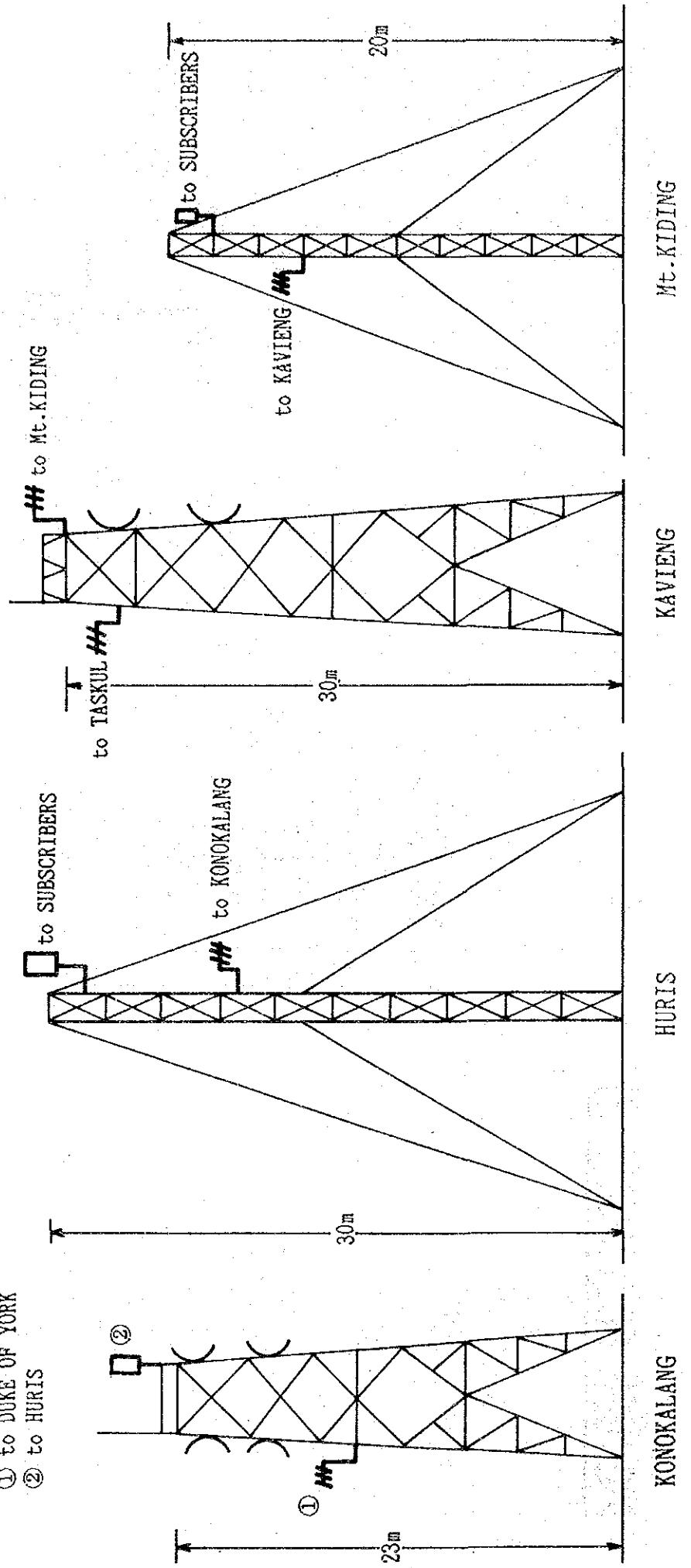
① to WANDUMI



WAU

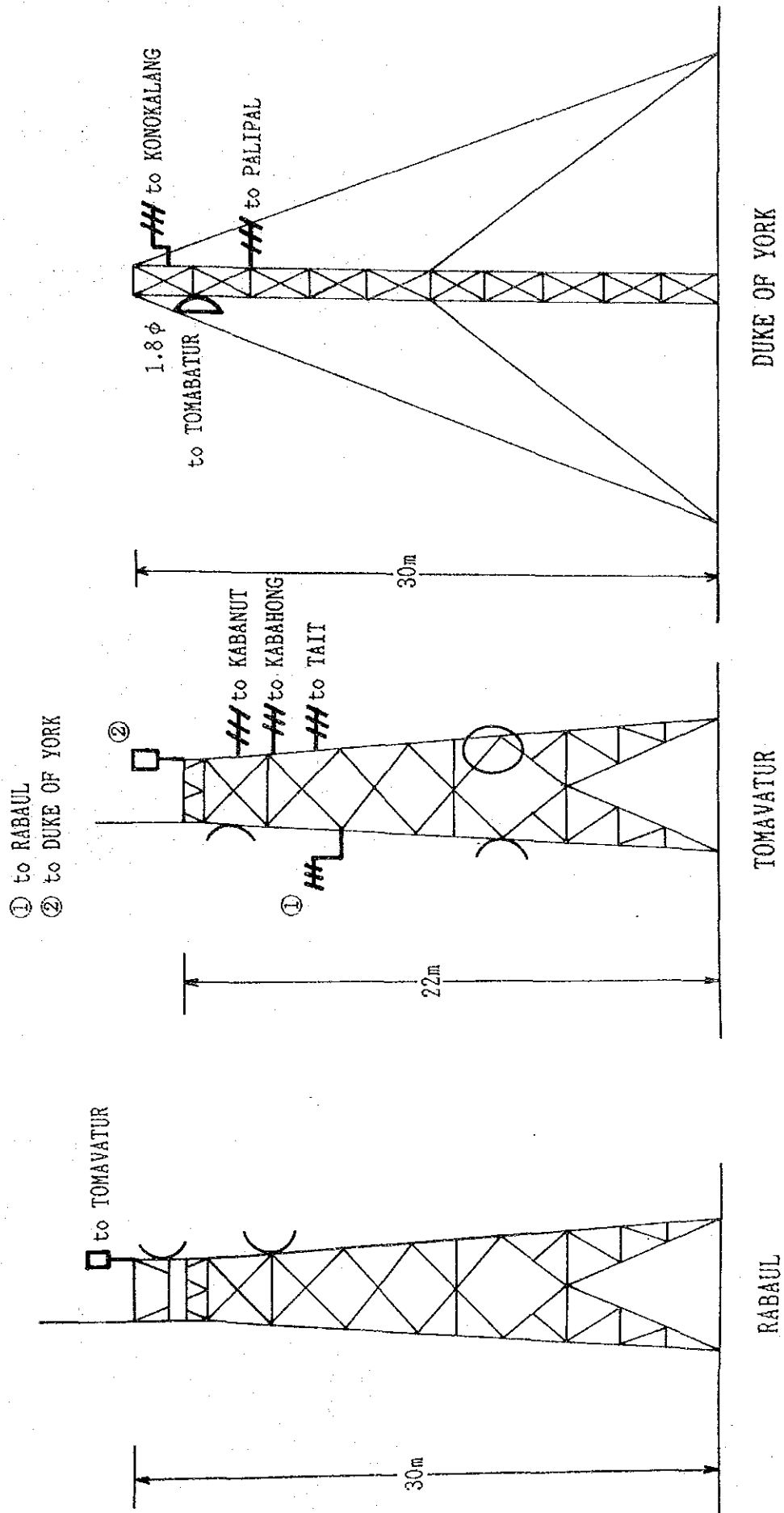
NEW IRELAND(1/2)

- ① to DUKE OF YORK
- ② to HURIS

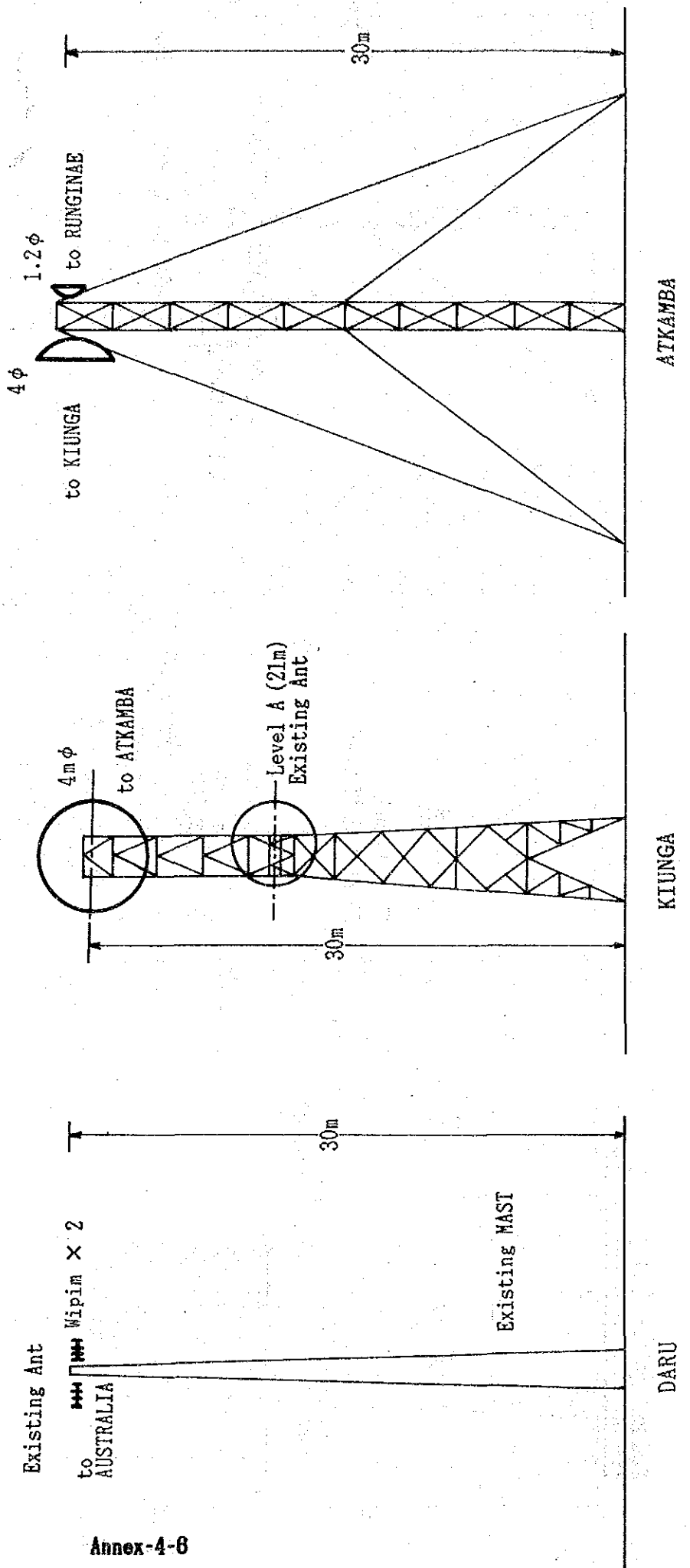


Annex-4-4

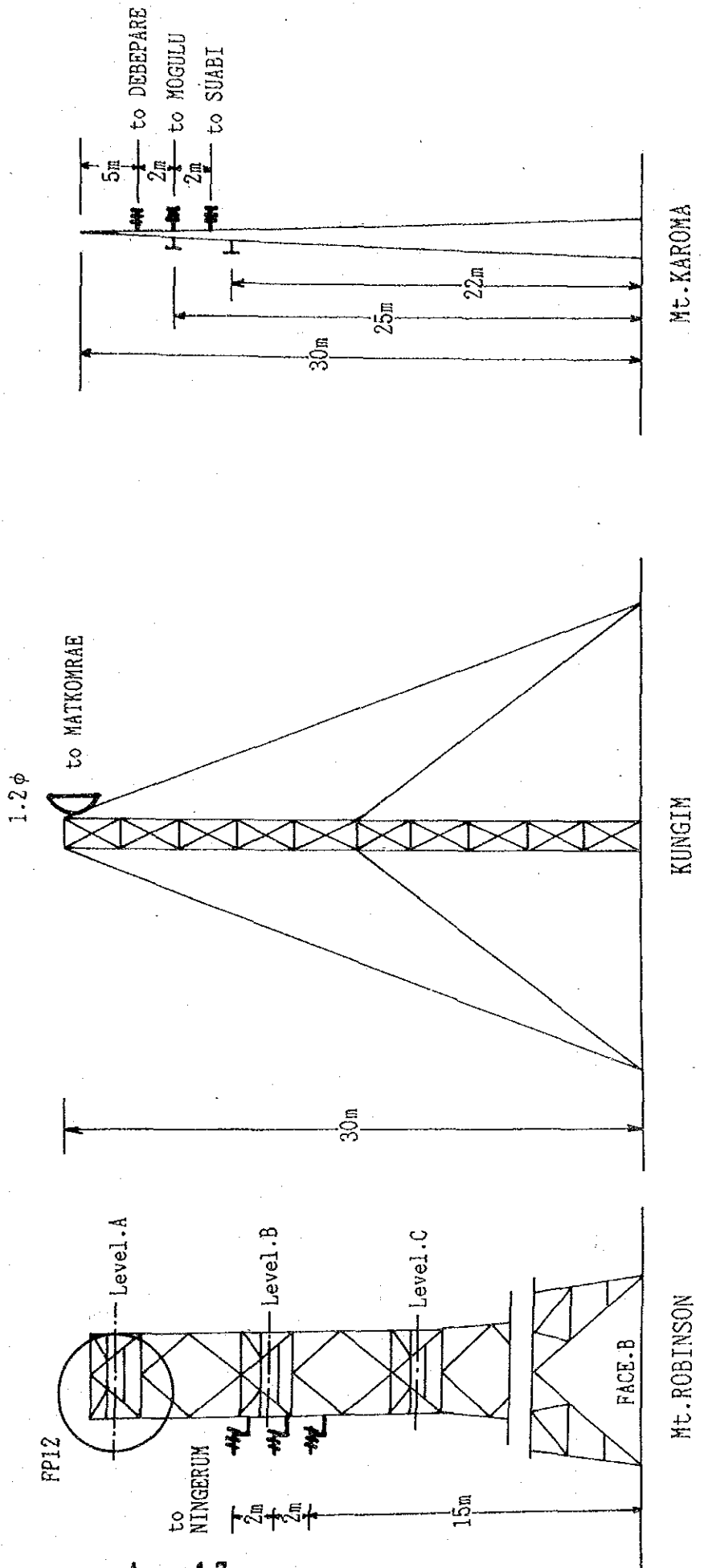
NEW IRELAND(2/2)



WESTERN PROVINCE(1/3)

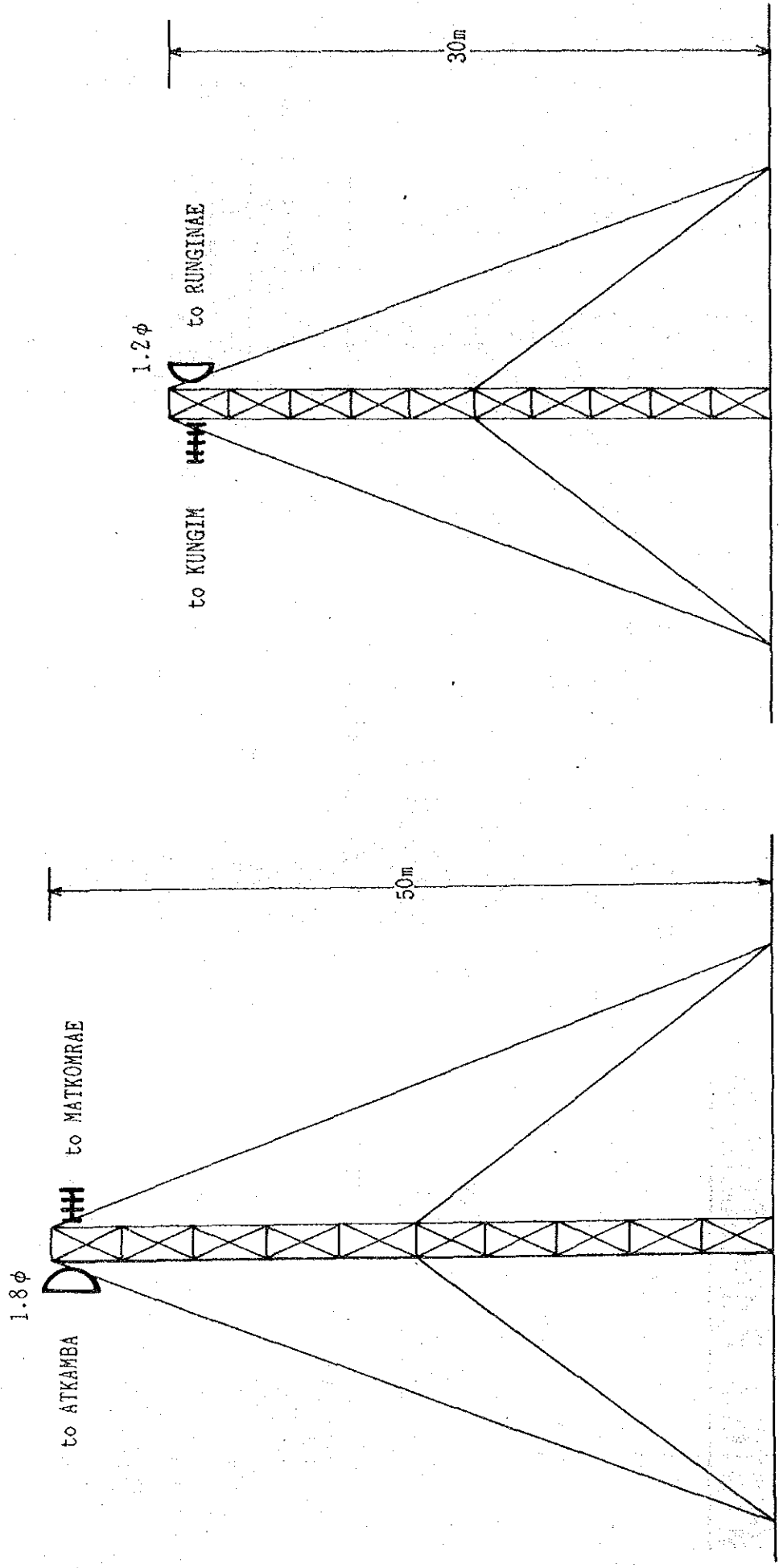


WESTERN PROVINCE(2/3)



Annex-4-7

WESTERN PROVINCE(3/3)



MATKOMRAE

RUNGINAE

付属資料 5

ソーラシステム容量の算出

Morobe TDMA (Subscriber Terminal)	1
Western TDMA (Subscriber Terminal)	2
New Ireland TDMA (Subscriber Terminal)	3
Morobe TDMA (Repeater Equipment)	4
Western TDMA (Repeater Equipment)	5
New Ireland TDMA (Repeater Equipment)	6
Morobe Single Channel	7
Western Single Channel	8
New Ireland Single Channel	9

Calculation of photovoltaic capacity(Morobe :TDMA Subscriber)

1. Condition

- 1) Installation place : P.N.G (MOROBE)
- 2) Latitude : 6 °S
- 3) Kind of load : TDMA(Subscriber terminal)
- 4) System voltage : V=12 (V)
- 5) Average load consumption : PL=21.3(W)
- 6) Global solar radiation: Q(cal/cm²·day) 345(min.)-474(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 180.9
- 2) Battery capacity : 298.2

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
- Array angle factor : F 1.09(min.)-0.94(max.)
- On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1/(K_1 \cdot K_2 \cdot K_3)$$

Q'_{min.} : Minimum value of Q' 436mWH/cm²·day

K₁ : Charge efficiency 0.9

K₂ : Loss by dirt of glass 0.9

K₃ : Safety factor 0.8

$$P_m = (2400/436) \times 21.3 \times 1/(0.9 \times 0.9 \times 0.8) \\ = 180.9$$

- 2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D)/(V)$$

D : Number of no sun day 7

$$B_e = (21.3 \times 24 \times 7.0)/(12) \\ = 298.2$$

Calculation of photovoltaic capacity(Western :TDMA Subscriber)

1. Condition

- 1) Installation place : P.N.G (Western)
- 2) Latitude : 8.5 °S
- 3) Kind of load : TDMA(Subscriber terminal)
- 4) System voltage : V=12 (V)
- 5) Average load consumption : PL=21.3(W)
- 6) Global solar radiation: Q(cal/cm²·day) 366(min.)-539(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 170.4
- 2) Battery capacity : 298.2

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.94(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1/(K_1 \cdot K_2 \cdot K_3)$$

Q' min. : Minimum value of Q' 463 mWH/cm²·day

K1 : Charge efficiency 0.9

K2 : Loss by dirt of glass 0.9

K3 : Safety factor 0.8

$$P_m = (2400/463) \times 21.3 \times 1/(0.9 \times 0.9 \times 0.8) \\ = 170.4$$

- 2) Battery capacity : B_e (Ah)

$$B_e = (PL \cdot 24 \cdot D)/(V)$$

D : Number of no sun day 7

$$B_e = (21.3 \times 24 \times 7.0)/(12) \\ = 298.2$$

Calculation of photovoltaic capacity(New Ireland :TDMA Subscriber)

1. Condition

- 1) Installation place : P.N.G (New Ireland)
- 2) Latitude : 4 S
- 3) Kind of load : TDMA(Subscriber terminal)
- 4) System voltage : V=12 (V)
- 5) Average load consumption : PL=21.3(W)
- 6) Global solar radiation: Q(cal/cm²·day) 398.3(min.)-475.9(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 156.6
- 2) Battery capacity : 298.2

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.99(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1 / (K_1 \cdot K_2 \cdot K_3)$$

Q'_{min.} : Minimum value of Q' 503.6mWH/cm²·day

K₁ : Charge efficiency 0.9

K₂ : Loss by dirt of glass 0.9

K₃ : Safety factor 0.8

$$P_m = (2400/503.6) \times 21.3 \times 1 / (0.9 \times 0.9 \times 0.8) \\ = 156.6$$

- 2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D) / (V)$$

D : Number of no sun day 7

$$B_e = (21.3 \times 24 \times 7.0) / (12) \\ = 298.2$$

Calculation of photovoltaic capacity(Morobe :TDMA Repeater)

1. Condition

- 1) Installation place : P.N.G (Morobe)
- 2) Latitude : 6° S
- 3) Kind of load : TDMA(Repeater equipment)
- 4) System voltage : V=24 (V)
- 5) Average load consumption : PL=56.7(W)
- 6) Global solar radiation: Q(cal/cm²·day) 345(min.)-474(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 481.7
- 2) Battery capacity : 298.2

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.94(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1 / (K_1 \cdot K_2 \cdot K_3)$$

Q'_{min.} : Minimum value of Q' 436mWH/cm²·day

K₁ : Charge efficiency 0.9

K₂ : Loss by dirt of glass 0.9

K₃ : Safety factor 0.8

$$P_m = (2400/436) \times 56.7 \times 1 / (0.9 \times 0.9 \times 0.8) \\ = 481.7$$

- 2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D) / (V)$$

D : Number of no sun day 7

$$B_e = (56.7 \times 24 \times 7.0) / (24) \\ = 396.9$$

Calculation of photovoltaic capacity(Western :TDMA Repeater)

1. Condition

- 1) Installation place : P.N.G (Western)
- 2) Latitude : 8.5 °S
- 3) Kind of load : TDMA (Repeater equipment)
- 4) System voltage : V=24 (V)
- 5) Average load consumption : PL=56.7(W)
- 6) Global solar radiation: Q(cal/cm²·day) 366(min.)-539(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 453.6
- 2) Battery capacity : 396.9

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.94(max.)
On array solar radiation : Q'

1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1/(K_1 \cdot K_2)$$

Q'_{min.} : Minimum value of Q' 463 mWH/cm²·day

K₁ : Charge efficiency 0.9

K₂ : Loss by dirt of glass 0.9

K₃ : Safety factor 0.8

$$P_m = (2400/463) \times 56.7 \times 1/(0.9 \times 0.9 \times 0.8) \\ = 453.6$$

2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D)/(V)$$

D : Number of no sun day 7

$$B_e = (56.7 \times 24 \times 7.0)/(24) \\ = 396.9$$

Calculation of photovoltaic capacity(New Ireland :TDMA Repeater)

1. Condition

- 1) Installation place : P.N.G (New Ireland)
- 2) Latitude : 4 °S
- 3) Kind of load : TDMA(Repeater equipment)
- 4) System voltage : V=24 (V)
- 5) Average load consumption : PL=56.7(W)
- 6) Global solar radiation: Q(cal/cm²·day) 398.3(min.)-475.9(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 417.0
- 2) Battery capacity : 396.9

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.99(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1 / (K1 \cdot K2 \cdot K3)$$

Q' min. : Minimum value of Q' 503.6mWh/cm²·day

K1 : Charge efficiency 0.9

K2 : Loss by dirt of glass 0.9

K3 : Safety factor 0.8

$$P_m = (2400/503.6) \times 56.7 \times 1 / (0.9 \times 0.9 \times 0.8) \\ = 417.0$$

- 2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D) / (V)$$

D : Number of no sun day 7

$$B_e = (56.7 \times 24 \times 7.0) / (24) \\ = 396.9$$

Calculation of photovoltaic capacity(Morobe :Single Channel)

1. Condition

- 1) Installation place : P.N.G (Morobe)
- 2) Latitude : 6 °S
- 3) Kind of load : Single channel
- 4) System voltage : V=12(V)
- 5) Average load consumption : PL=9.0(W)
- 6) Global solar radiation: Q(cal/cm²·day) 345(min.)-474(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 76.5
- 2) Battery capacity : 126.0

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.94(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1/(K_1 \cdot K_2 \cdot K_3)$$

Q' min. : Minimum value of Q' 436mWH/cm²·day

K1 : Charge efficiency 0.9

K2 : Loss by dirt of glass 0.9

K3 : Safety factor 0.8

$$P_m = (2400/436) \times 9.0 \times 1/(0.9 \times 0.9 \times 0.8) \\ = 76.5$$

- 2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D)/(V)$$

D : Number of no sun day 7

$$B_e = (9.0 \times 24 \times 7.0)/(12) \\ = 126.0$$

Calculation of photovoltaic capacity(Western :Single Channel)

1. Condition

- 1) Installation place : P.N.G (Western)
- 2) Latitude : 8.5 °S
- 3) Kind of load : Single channel
- 4) System voltage : V=12 (V)
- 5) Average load consumption : PL=9.0(W)
- 6) Global solar radiation: Q(cal/cm²·day) 366(min.)-539(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 72.0
- 2) Battery capacity : 126.0

3. Calculation procedure

- Array angle : $\theta_a=15^\circ$
Array angle factor : F 1.09(min.)-0.94(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1/(K_1 \cdot K_2 \cdot K_3)$$

Q' min. : Minimum value of Q' 463 mWH/cm²·day

K₁ : Charge efficiency 0.9

K₂ : Loss by dirt of glass 0.9

K₃ : Safety factor 0.8

$$P_m = (2400/463) \times 9.0 \times 1/(0.9 \times 0.9 \times 0.8) \\ = 72.0$$

- 2) Battery capacity : Be (AH)

$$Be = (PL \cdot 24 \cdot D)/(V)$$

D : Number of no sun day 7

$$Be = (9.0 \times 24 \times 7.0)/(12) \\ = 126.0$$

Calculation of photovoltaic capacity(New Ireland :Single Channel)

1. Condition

- 1) Installation place : P.N.G (New Ireland)
- 2) Latitude : 4 °S
- 3) Kind of load : Single channel
- 4) System voltage : V=12(V)
- 5) Average load consumption : PL=9.0(W)
- 6) Global solar radiation: Q(cal/cm²-day) 398.3(min.)-475.9(max.)

2. Result of calculation

- 1) Photovoltaic capacity : 66.2
- 2) Battery capacity : 126.0

3. Calculation procedure

- Array angle : $\theta = 15^\circ$
Array angle factor : F 1.09(min.)-0.99(max.)
On array solar radiation : Q'

- 1) Photovoltaic capacity : P_m (Wp)

$$P_m = (2400/Q'_{\min.}) \times PL \times 1/(K_1 \cdot K_2 \cdot K_3)$$

Q'_{min.} : Minimum value of Q' 503.6mWH/cm²-day

K₁ : Charge efficiency 0.9

K₂ : Loss by dirt of glass 0.9

K₃ : Safety factor 0.8

$$P_m = (2400/503.6) \times 9.0 \times 1/(0.9 \times 0.9 \times 0.8) \\ = 66.2$$

- 2) Battery capacity : B_e (AH)

$$B_e = (PL \cdot 24 \cdot D) / (V)$$

D : Number of no sun day 7

$$B_e = (9.0 \times 24 \times 7.0) / (12) \\ = 126.0$$

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