APPENDIX C: DATA AND PAPERS CONCERNED

C-1. Detailed Record of the Existing Wells Investigated

C-2. Water Quality Analysis

C-3. Data of Geoelectrical Resistivity Survey

C-4. Analysis of Hydrogeological Pumping Test

C-5. Population and Administrative Area of Each Village

C-6. Administrative Organization of Villages and Districts

C-7. Climate Record

C-8. Rural Water Supply Situation in Indonesia

C - 1.1 SUMMARY OF DETAILED RECORDS OF THE EXISTING WELLS INVESTIGATED

13 Dec. 1979

Survey No. of Wells	Well Location			Survey Condition				Well								Water Quality										
	District (Recamatan)	Village (Desa)	Proprietor	Date	Time	Weather	Temperature (°C)	Type	Population Supplied	Utilization	Ground Height (m)	Depth (m)	Diameter (cm)	Water Level	Quantity (l/s)	W.T. (°C)	P.H.	EC EC(t) EC(18) (μS/cm)	Fe (mg/l)	Cl (mg/l)	NH_4 (mg/l)	Turbidity (mg/l)	COD (mg/l)	Total Bact. (/cc)	Coliform Group (/cc)	Taste
27-1	Medang Deras	Medang	(Medang)	27 Nov.	a.m. 10:30	rain	26	Artesian Deep Well	300	All purpose except bathing	3	96	3 (1 1/4")	+0 over	0.1	33	7.8	(920) 708	Less 0,2	Less 40	7	Neg	Neg	800	360	Salty
27-2	Medang Deras	Medang	(Medang)	27 Nov.	a.m. 11.15	rain	26	Shallow Well	300 - 400	Drinking & cooking	5	2.8	109	-0.42		27	6.3	(220) 186	Neg	Less 40	0.1	6	1	710	150	Roughly
27-3	Medang Deras	Pagurawan	(Beringir)	27 Nov.	p.m. 3:30	rain	24	Artesian Deep Well	1,050	Drinking & cooking	5	67	3 (1 1/4")	+0.6	0.15	35	8.0	(780) 582	0.1	40-200	1.5	Neg	1	Neg	Neg	Tasteles
27-4	Medang Deras	Pagurawan	Health Center	27 Nov.	p.m. 4:00	rain	24	Artesian Deep Well		All purpose	6	87	3 (1 1/4")	+0.5		32	7.0	(910) 710	0.3	40-200	0.5	-	-	-	-	Metalic
28-1	Air Putih	Limau Sundai	(Lima)	28 Nov.	a.m. 10:00	cloudy	28	Shallow Well	13	All purpose except washing	7	3	60	-1.06		27.8	6.5	(510) 425	Less 0.1	40	5.0	100	20-40	250	190	Tasteles
28-2	Lima Puluh	Lima Puluh	Health Center	28 Nov.	a.m. 11:50	cloudy	29	Shallow Well (hand pump)	4 houses & Peskuimus		30	13-20	3 (1 1/4")		enough	28	6.0	(100) 83	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Tasteles
29-1	Air Putih	Tg. Kasau	Rubber plantation factory	29 Nov.	a.m. 10:30	fine	32	Deep Well (suction pump)	500 - 600	Factory-30 m3/d Community-10 m3/d	11	80	20	S.W.L; -4.5m D.W.L; -7.5m	40 m3/d (12-15 hrs Operation)	32.8	6.9	(370) 285	1.0	Less 20	0.8	0.5	1	230	220	Metalic
29-2	Air Putih	Simodong	(Lolong - 1)	29 Nov.	p.m. 12:40	fine	28.1	Shallow Well	300 -	Drinking Cooking Bathing	10	2.84	100x 102	-0.74		26.5	6.2	(260) 222	Neg	45	Neg	1	2	170	140	Slightly rich
30-1	Lima Puluh	Guntung	Public	30 Nov.	a.m. 10:00	fine	31.7	Artesian Deep Well	1,000-	All purpose	8	about 200	10 (4")	+2.7	1.34	46.3	8.0	(660) 420	Neg	20	4	Neg	Neg	Neg	Neg	Metalic little
30-2	Lima Puluh	Purpuk	Cholk factory	30 Nov.	a.m. 11:00	fine	32	Deep Well (suction pump)	200 -	Factory-45 m3/d Community-	5	120	4		1.12	35	8.0	(650) 485	Neg	15	3	Neg	Neg	60	Neg	Slightly salty
30-3	Air Putih	Indrapura	Health Center	30 Nov.	p.m. 13:00	fine	29.2	Shallow Well (suction pump)	Health Center & 250 -	Drinking Cooking	11	2.15	160	-0.17	4-5 m3/d	28.5	5.8	(395) 326	Neg	60	Neg	Neg	Neg	2,050	10	Slightly rough
1-1	Lima Puluh	Simpang Dolok	Public	1 Dec.	a.m. 10:00	fine	27	Artesian Deep Well	300 - 400	All purpose	10	about 200	10 (4")	+2.4	0.18	40	8.5	(610) 424	Neg	15	1.5 - 2	Neg	3	Neg	Neg	Slightly rough
1-2	Air Putih	Tg. Muda	Health Center	1 Dec.	a.m.	fine	30	Shallow Well	for H.C. only	All purpose for clinic	20	6	95	-4.18		28	6.5	(240) 200	Neg	20	Neg	12	Neg	150	50	Slightly rough
1-3	Air Putih	Indrapura	Public	1 Dec.	p.m.	fine		Artesian Deep Well		All purpose	13.5	about 120	10	+1.7	0.1-	37										

C-1.2 Detailed Record of the Existing Wells Investigated

DATA SHEET OF EXISTING WELL

Survey No. of Well; 27-1

Survey Condition

Date; 27 Nov. Time; a.m. 10:30 Weather; Rain Temperture; 26 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Medang Deras	Medang	Joint ownership

Geographical Condition Ground Height; 3 (m)

In the low and flat lands. The surface of the groud is covered with medium and fine sands.

Details of Well

Type; Deep Well (Driven type)

Method of Yeild; Natural flowing

Population Supplied; 300

Utilization; All purpose except bathing

Others;
Construction:
Date - March 1979
Cost - Rp. 400,000
Constructor - Mr. Ateng (T.Tingi)

Well Depth; 96 (m) (Pipe length - 74m)

Well Diameter; 3 (cm)

Depth of Aquifer; 74 - 96 (m) ?

S.W.L.; + 0 over (m)

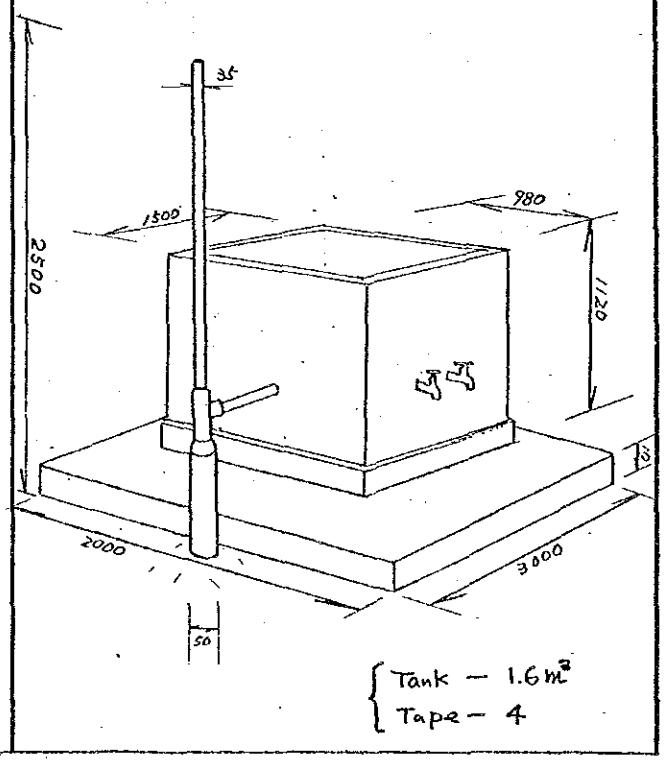
D.W.L.; (m)

Yeild; 0.1 (l/s)
* High tide - 5 hours full in tank
Low tide - 6 hours "

Water Quality Sampling: (Yes), No)

Water temp.	;	33	(°C)
Appearance	;	Pure	
Taste	;	Slightly salty	
pH	;	7.8	
EC(t)	;	920	(μ℧/cm)
EC(18)	;	708	(μ℧/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Less 0.2	(mg/l)
Cl	;	Less 40	(mg/l)
NH_4	;	7	(mg/l)
COD	;	Negative	(mg/l)
Total Bact.	;	800	(/cc)
Coliform Group	;	360	(/cc)

Sketch of Well



DATA SHEET OF WATER RESOURCES

Survey No. of Well; 27-2

Survey Condition

Date; 27 Nov. Time; a.m. 11:15 Weather; Rain Temperture; 26 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Medang Deras	Medang	Public

Geographical Condition Ground Height; 5 (m)

In the low and flat lands. The surface of the ground is covered with fine sands. One family have about 80 palm trees.

Details of Well

Type; Shallow Well

Method of Yeild; Manual (Bucket)

Population Supplied; 300 - 400 (50 - 60 family)

Utilization; Drinking & Cooking

Others;

Well Depth; 2.80 (m)

Well Diameter; 109 (cm)

Depth of Aquifer; (m)

S.W.L.; - 0.42 (m) (Dry season - 0.50m)

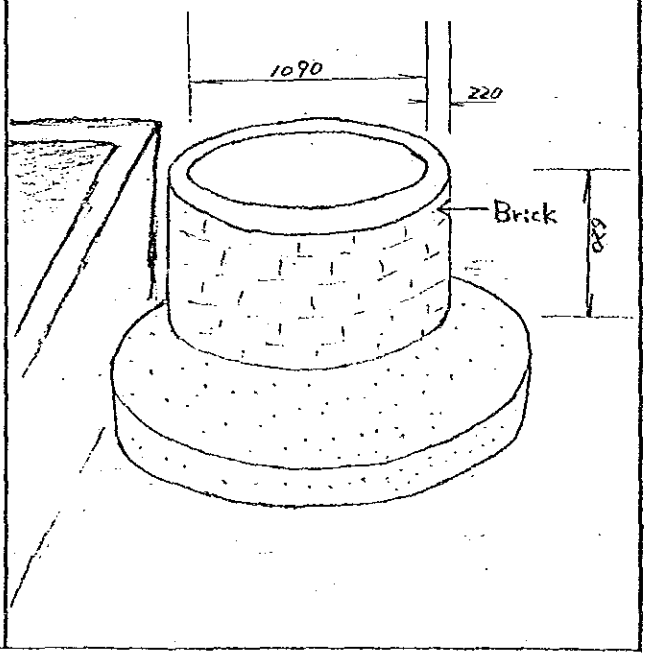
D.W.L.; (m)

Yeild; (l/s)

Water Quality Sampling: (Yes), No)

Water temp.	;	27	(°C)
Appearance	;	Turbid	
Taste	;	Roughly	
pH	;	6.3	
EC(t)	;	220	(μS/cm)
EC(18)	;	186	(μS/cm)
Turbidity	;	6	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	Less 40	(mg/l)
NH_4	;	0.1	(mg/l)
COD	;	1	(mg/l)
Total Bact.	;	710	(/cc)
Coliform Group	;	150	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 27-3

Survey Condition

Date; 27 Nov. Time; p.m. 3:30 Weather; Rain Temperture; 24 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Medang Deras	Pagurawan	Joint ownership

Geographical Condition Ground Height; 5 (m)

Fishing village. Along the Pagurawan River.

Details of Well

Type; Deep Well (Driven type)

Method of Yeild; Natural flowing

Population Supplied; 1,050

Utilization; Drinking & Cooking

Others;
Construction:
Date - June 1979
Cost - Rp. 425,000
Constructor - from T.Tingi

Well Depth; 67 (m)
(Pipe length 67m)

Well Diameter; 3 (cm)

Depth of Aquifer; ? (m)

S.W.L.; + 0.6 (m)

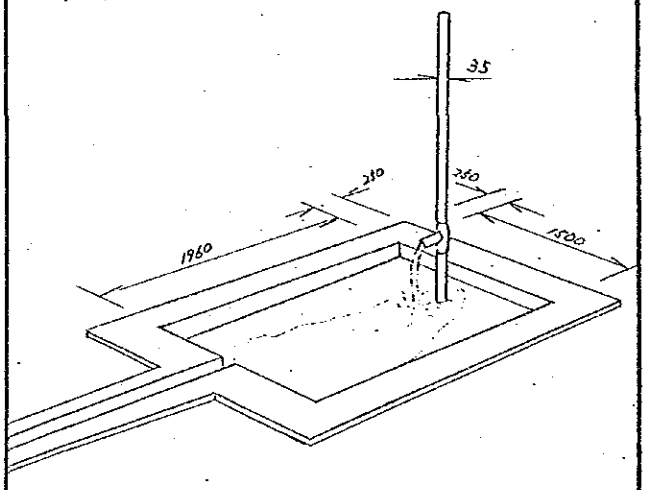
D.W.L.; (m)

Yeild; 0.15 (l/s)

Water Quality Sampling: (Yes, No)

Water temp.	;	35	(°C)
Appearance	;	Pure	
Taste	;	Tasteless	
pH	;	8.0	
EC(t)	;	780	(μS/cm)
EC(18)	;	582	(μS/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	0.1	(mg/l)
Cl	;	40 - 200	(mg/l)
NH_4	;	1.5	(mg/l)
COD	;	1	(mg/l)
Total Bact.	;	Negative	(/cc)
Coliform Group	;	Negative	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 27-4

Survey Condition

Date; 27 Nov. Time; p.m. 4:00 Weather; Rain Temperture; 24 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Medang Deras	Pagurawan	Health Center

Geographical Condition Ground Height; 6 (m)

In the low and flat lands. Near the sand coast.

Details of Well

Type; Deep Well (Driven type)

Method of Yeild; Natural flowing

Population Supplied;

Utilization; All purpose & Clinic

Others;
Constructed : Sept. 1977

Well Depth; 87 (m)

Well Diameter; 3 (cm)

Depth of Aquifer; (m)

S.W.L.; + 0.50 (m)

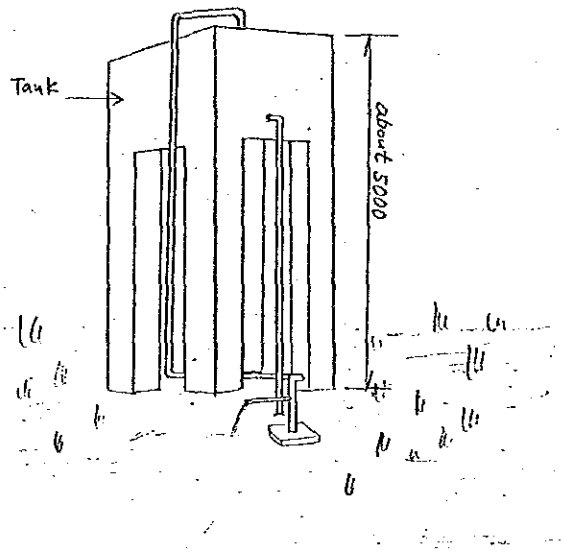
D.W.L.; (m)

Yeild; (l/s)

Water Quality Sampling:(Yes,(No))

Water temp.	; 32	(°C)
Appearance	; Pure	
Taste	; Metalic	
pH	; 7.0	
EC(t)	; 910	(μ℧/cm)
EC(18)	; 710	(μ℧/cm)
Turbidity	; -	(mg/l)
Total Fe	; 0.3	(mg/l)
Cl	; 40 - 200	(mg/l)
NH_4	; 0.5	(mg/l)
COD	; -	(mg/l)
Total Bact.	; -	(/cc)
Coliform Group	; -	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 28-1

Survey Condition

Date; 28 Nov. Time; a.m. 10:00 Weather; Cloudy Temperture; 28 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Air Putih	Limau Sundai	Chief of the Lolon

Geographical Condition Ground Height; 7 (m)

In the flat lands. Surrounded with the rice fields.

Details of Well

Type; Shallow Well

Method of Yeild; Manual (Bucket)

Population Supplied; 13

Utilization; All purpose except washing

Others; Useing domestic sand filter

Well Depth; 3 (m)

Well Diameter; 60 (cm)

Depth of Aquifer; (m)

S.W.L.; - 1.06 (m)

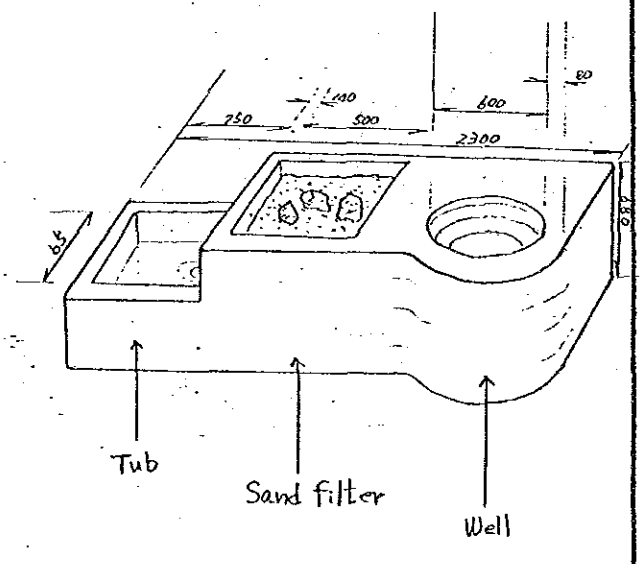
D.W.L.; (m)

Yeild; (l/s)

Water Quality Sampling: (Yes), No)

Water temp.	; 27.8	(°C)
Appearance	; Very turbid	
Taste	; Tasteless	
pH	; 6.5	
EC(t)	; 510	(μU/cm)
EC(18)	; 425	(μU/cm)
Turbidity	; 100	(mg/l)
Total Fe	; Less 0.1	(mg/l)
Cl	; 40	(mg/l)
NH_4	; 5	(mg/l)
COD	; 20 - 40	(mg/l)
Total Bact.	; 250	(/cc)
Coliform Group	; 190	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 28-2

Survey Condition

Date; 28 Nov. Time; a.m. 11:50 Weather; Cloudy Temperture; 29 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Lima Puluh	Lima Puluh	Health Center

Geographical Condition

Ground Height; 30 (m)

Hilly area.

Details of Well

Type; Shallow Well

Method of Yeild; Hand Pump (Lucky Pump)

Population Supplied; 4 houses & Peskimus

Utilization; All purpose

Others; Constructed by INPRES,1975

Well Depth; 13 - 20 (m)

Well Diameter; : 3 (cm)

Depth of Aquifer; ? (m)

S.W.L.; (m)

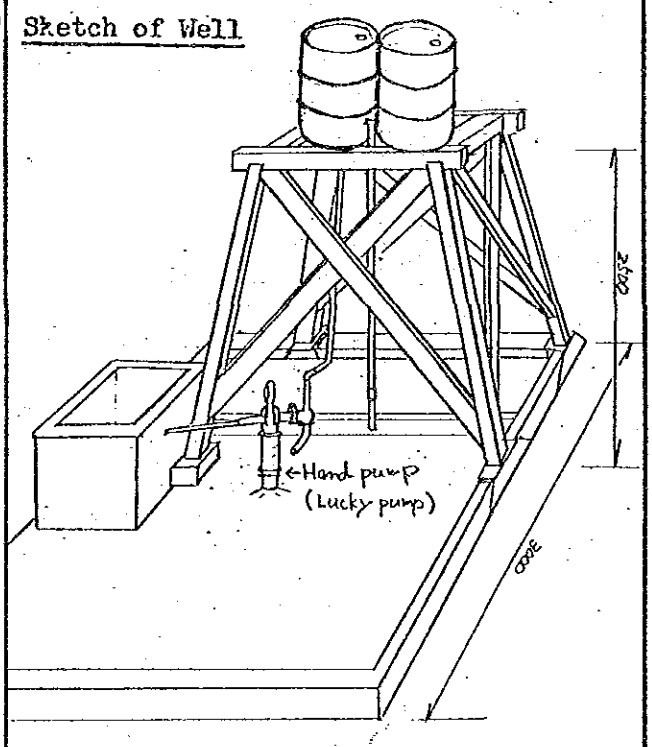
D.W.L.; (m)

Yeild; enough (l/s)

Water Quality Sampling: (Yes), No)

Water temp.	;	28	(°C)
Appearance	;	Pure	
Taste	;	Tasteless	
pH	;	6.0	
EC(t)	;	100	(μS/cm)
EC(18)	;	83	(μS/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	Negative	(mg/l)
NH_4	;	Negative	(mg/l)
COD	;	Negative	(mg/l)
Total Bact.	;	Negative	(/cc)
Coliform Group	;	Negative	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 29-1

Survey Condition

Date; 29 Nov. Time; a.m. 10:30 Weather; Fine Temperture; 32 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Air Putih	Tanjung Kasau	Rubber plantation factory

Geographical Condition

Ground Height; 11 (m)

Hilly area, In site of the Rubber Plantation.

Details of Well

Type; Deep Well

Method of Yeild; Suction Pump (YAMMER 13 HP)

Population Supplied; 500 - 600

Utilization; Factory - 30 m3/d
Community - 10 m3/d

Others;

Pumping:- 12 - 15 hrs./d operation
(3 hrs. continious
0,5 hrs. rest time)

Well Depth; 80 (m)

Well Diameter; 20 (cm)
(Suction pipe-8 cm x 12 m)

Depth of Aquifer; (m)

S.W.L.; About - 4.5 (m)

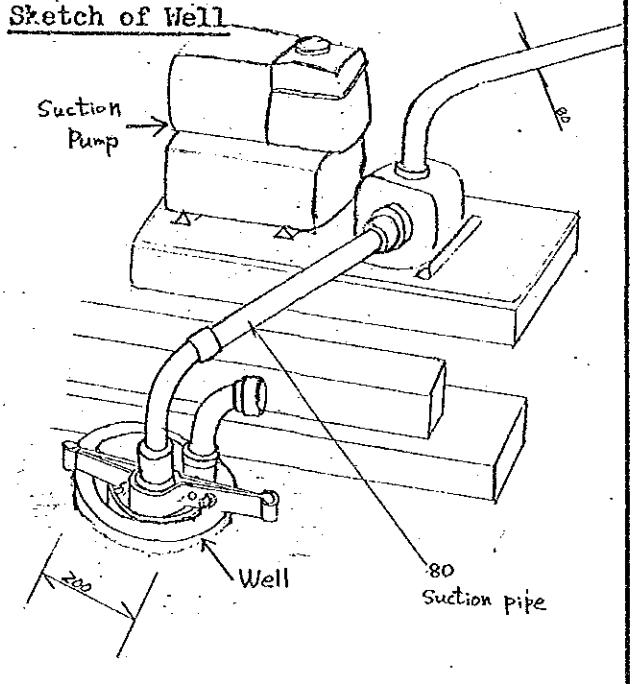
D.W.L.; " - 7.5 (m)

Yeild; 11.1 (l/s)
(12 - 15 hrs. operation)

Water Quality Sampling: (Yes), No)

Water temp.	;	32.8	(°C)
Appearance	;	Reddish-black	
Taste	;	Metalic	
pH	;	6.9	
EC(t)	;	370	(μS/cm)
EC(18)	;	285	(μS/cm)
Turbidity	;	0.5	(mg/l)
Total Fe	;	1.0	(mg/l)
Cl	;	Less 20	(mg/l)
NH_4	;	0.8	(mg/l)
COD	;	1.0	(mg/l)
Total Bact.	;	230	(/cc)
Coliform Group	;	220	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 29-2

Survey Condition

Date; 29 Nov. Time; p.m. 12:40 Weather; Fine Temperture; 28.1 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Air Putih	Simodong (Lolong - 1)	Public

Geographical Condition

Ground Height; 10 (m)

Flat and Swampy lands. Surrounded with the rice fields.
Infiltration capacity of ground surface is poor.

Details of Well

Type; Shallow Well

Method of Yeild; Manual (Bucket)

Population Supplied; 300 -

Utilization; Drinking, Cooking & Bathing

Others;

Well Depth; 2.84 (m)

Well Diameter; 100 x 102 (cm)

Depth of Aquifer; (m)

S.W.L.; - 0.74 (m)

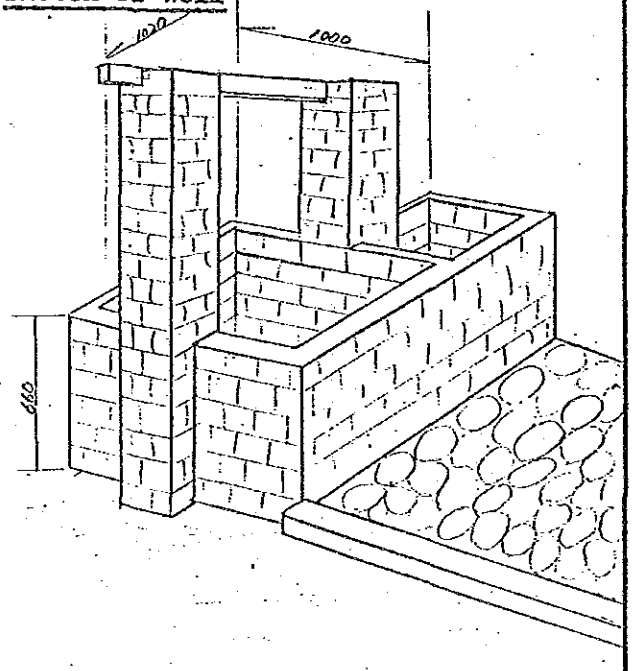
D.W.L.; (m)

Yeild; (l/s)

Water Quality Sampling: (Yes, No)

Water temp.	;	26.5	(°C)
Appearance	;	Slightly turbid	
Taste	;	Slightly rich	
pH	;	6.2	
EC(t)	;	260	(μS/cm)
EC(18)	;	222	(μS/cm)
Turbidity	;	1	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	45	(mg/l)
NH_4	;	Negative	(mg/l)
COD	;	2	(mg/l)
Total Bact.	;	170	(/cc)
Coliform Group	;	140	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 30-1

Survey Condition

Date; 30 Nov. Time; a.m. 10:00 Weather; Fine Temperture; 31.7(°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Lima Puluh	Guntung	Public

Geographical Condition

Ground Height; 8 (m)

In the low and flat lands.

Details of Well

Type; Deep Well

Method of Yeild; Natural flowing

Population Supplied; 2,400

Utilization; All purpose

Others; Originaly dug for petroleum by Hollander

Well Depth; about 200 (m)

Well Diameter; 10 (cm)

Depth of Aquifer; ? (m)

S.W.L.; + 2.7 (m)

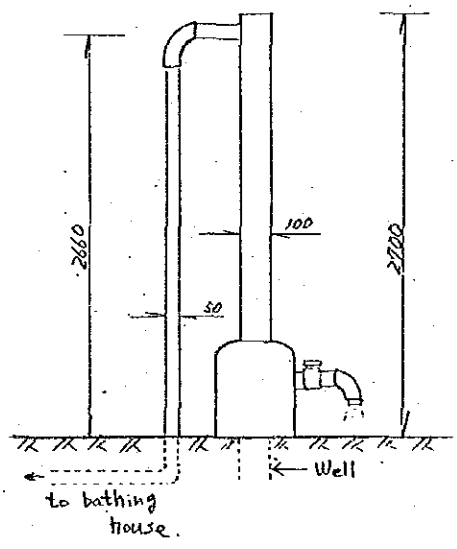
D.W.L.; (m)

Yeild; 1.34 (l/s)
Q1 = 0.483 "
Q2 = 0.743 "
Q3 = 0.115 "

Water Quality Sampling: (Yes, No)

Water temp.	;	46.3	(°C)
Appearance	;	Pure	
Taste	;	Metalic little	
pH	;	8.0	
EC(t)	;	660	(μ℧/cm)
EC(18)	;	420	(μ℧/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	20	(mg/l)
NH_4	;	4	(mg/l)
COD	;	Negative	(mg/l)
Total Bact.	;	Negative	(/cc)
Coliform Group	;	Negative	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 30-2

Survey Condition

Date; 30 Nov. Time; a.m. 11:00 Weather; Fine Temperture; 32 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Lima Puluh	Purpuk	Cholk factory

Geographical Condition

Ground Height; 5 (m)

Closely river and swampy lands.

Details of Well

Type; Deep Well (Driven type)

Method of Yeild; Suction Pump (ROBIN)

Population Supplied; 200 -

Utilization; Factory - 45 m3/d
Community -

Others;
Construction;
Date - May 1977
Cost - Rp. 300,000
Constructor - Sungai Rampah

Well Depth; 120 (m) (6 m/pipe x 20 pipes)

Well Diameter; 4 (cm)

Depth of Aquifer; (m)

S.W.L.; Originally + 0 over (m)

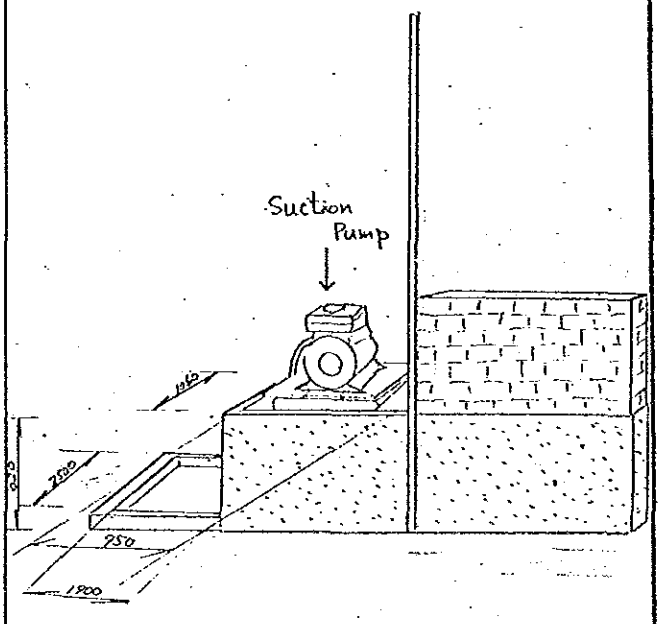
D.W.L.; (m)

Yeild; 1.12 (l/s)

Water Quality Sampling: (Yes), No)

Water temp.	;	35	(°C)
Appearance	;	Pure	
Taste	;	Slightly salty	
pH	;	8.0	
EC(t)	;	650	(μS/cm)
EC(18)	;	420	(μS/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	15	(mg/l)
NH_4	;	3	(mg/l)
COD	;	Negative	(mg/l)
Total Bact.	;	60	(/cc)
Coliform Group	;	Negative	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 30-3

Survey Condition

Date; 30 Nov. Time; p.m. 13:00 Weather; Fine Temperture; 29.2 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Air Putih	Indrapura	Health Center

Geographical Condition

Ground Height; 11 (m)

Surrounded with Swamp.

Details of Well

Type; Shallow Well (Collector Well)

Method of Yeild; Suction Pump (up to elevated tank)

Population Supplied; Health Center & 250 Peoples

Utilization; Drinking & Cooking & Clinic

Others; Constructed in 1975 by IMPRES

Well Depth; 2.15 (m)

Well Diameter; 160 (cm)

Depth of Aquifer; (m)

S.W.L.; - 0.17 (m)

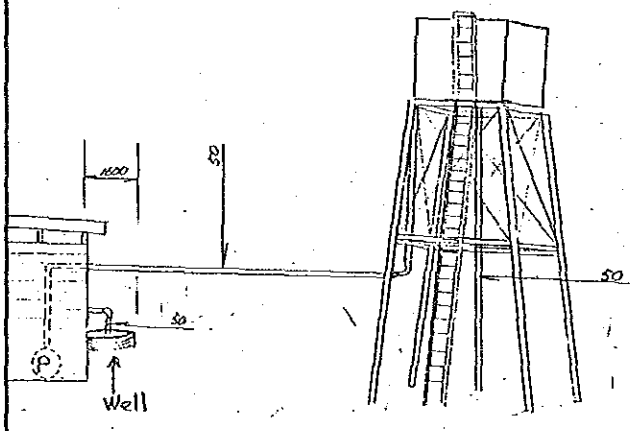
D.W.L.; (m)

Yeild; 4 - 5 m3/d

Water Quality Sampling: (Yes), No)

Water temp.	;	28.5	(°C)
Appearance	;	Slightly turbid	
Taste	;	Slightly rough	
pH	;	5.8	
EC(t)	;	395	(μU/cm)
EC(18)	;	326	(μU/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	60	(mg/l)
NH_4	;	Negative	(mg/l)
COD	;	Negative	(mg/l)
Total Bact.	;	2,050	(/cc)
Coliform Group	;	10	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 1-1

Survey Condition

Date; 1 Dec. Time; a.m. 10:00 Weather; Fine Temperture; 27 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Lima Puluh	Simpang Dolok	Public

Geographical Condition

Flat lands.

Ground Height; 10 (m)

* 15 wells with hand pump costructed by IMPRES. At this time, 9 wells are warking, but 6 wells are bloken.

Details of Well

Type; Deep Well

Method of Yeild; Natural flowing

Population Supplied; 300 - 400

Utilization; All purpose

Others; Oliginaly constructed by Hollander for petroleum in 1918.

Well Depth; about 200 (m)

Well Diameter; 10 (cm)

Depth of Aquifer; (m)

S.W.L.; + 2.4 (m)

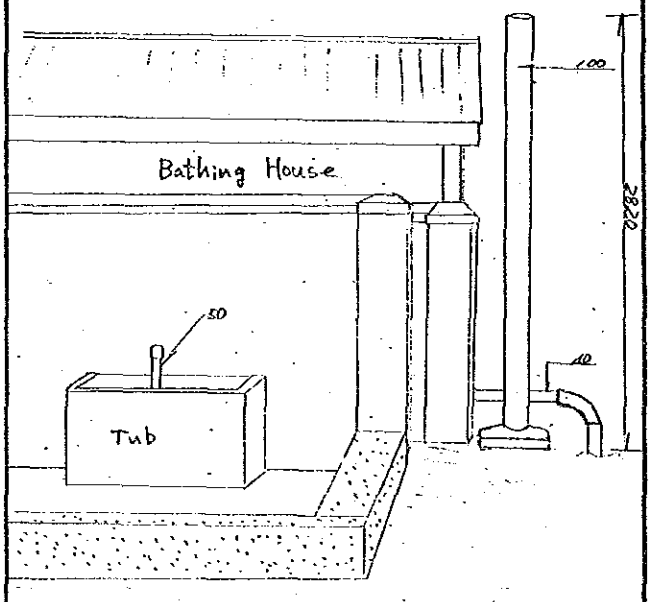
D.W.L.; (m)

Yeild; 0.18 or more (l/s)

Water Quality Sampling: (Yes, No)

Water temp.	;	40.0	(°C)
Appearance	;	Pure	
Taste	;	Slightly rough	
pH	;	8.5	
EC(t)	;	610	(μS/cm)
EC(18)	;	424	(μS/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	15	(mg/l)
NH_4	;	1.5 - 2	(mg/l)
COD	;	3	(mg/l)
Total Bact.	;	Negative	(/cc)
Coliform Group	;	Negative	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 1-2

Survey Condition

Date; 1 Dec. Time; a.m. Weather; Fine Temperture; 30 (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Air Putih	Tanjung Muda	Health Center

Geographical Condition Ground Height; 20 (m)

Hilly lands. Infiltration capacity of the ground surface is better.

Details of Well

Type; Shallow Well

Method of Yeild; Manual (Bucket)

Population Supplied; for Health Center only

Utilization; All purpose for clinic

Others;

Well Depth; 6 (m)

Well Diameter; 95 (cm)

Depth of Aquifer; (m)

S.W.L.; - 4.18 (m)

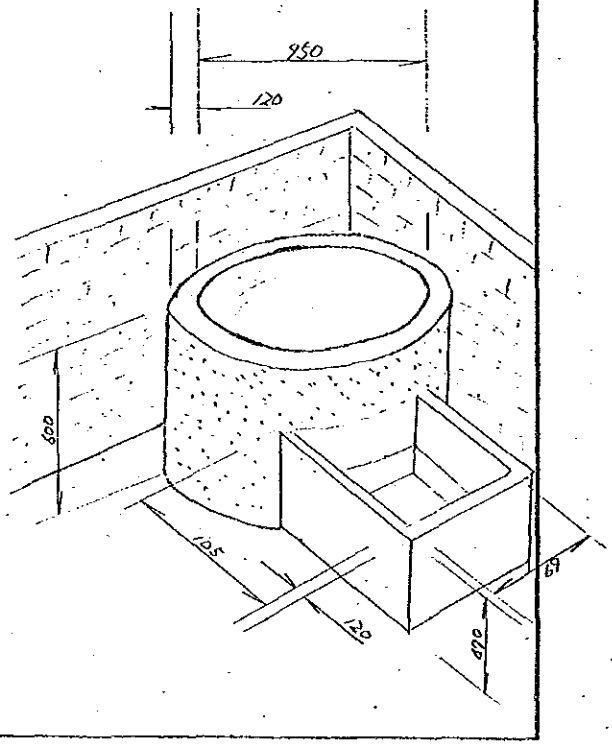
D.W.L.; (m)

Yeild; (l/s)

Water Quality Sampling: (Yes), No)

Water temp.	;	28	(°C)
Appearance	;	Slightly turbid	
Taste	;	Slightly rough	
pH	;	6.5	
EC(t)	;	240	(μ℧/cm)
EC(18)	;	200	(μ℧/cm)
Turbidity	;	Negative	(mg/l)
Total Fe	;	Negative	(mg/l)
Cl	;	20	(mg/l)
NH_4	;	0	(mg/l)
COD	;	0	(mg/l)
Total Bact.	;	150	(/cc)
Coliform Group	;	50	(/cc)

Sketch of Well



DATA SHEET OF EXISTING WELL

Survey No. of Well; 1-3

Survey Condition

Date; 1 Dec. Time; p.m. Weather; Fine Temperture; (°C)

Well Location

District(Kecamatan);	Village(Desa);	Proprietor;
Air Putih	Indrapura	Public

Geographical Condition Ground Height; 13.5 (m)

Close by the Tandjoeng River

Details of Well

Type; Deep Well

Method of Yeild; Natural flowing

Population Supplied;

Utilization; All purpose

Others; Constructed by Hollander, approximately 40 years ago

Well Depth; about 120 (m)

Well Diameter; 10 (cm)

Depth of Aquifer; (m)

S.W.L.; + 1.7 (m)

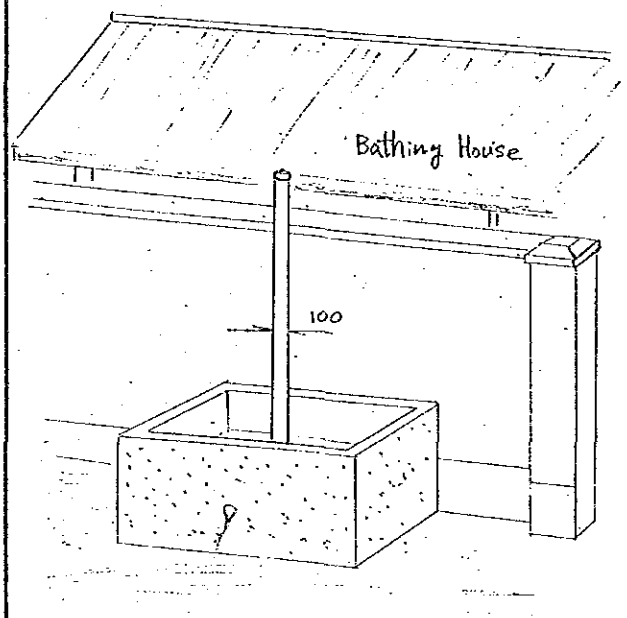
D.W.L.; (m)

Yeild; 0.1 - (l/s)

Water Quality Sampling: (Yes, (No))

Water temp.	; 37	(°C)
Appearance	; Pure	
Taste	;	
pH	;	
EC(t)	;	(μS/cm)
EC(18)	;	(μS/cm)
Turbidity	;	(mg/l)
Total Fe	;	(mg/l)
Cl	;	(mg/l)
NH_4	;	(mg/l)
COD	;	(mg/l)
Total Bact.	;	(/cc)
Coliform Group	;	(/cc)

Sketch of Well



C-2.1 WATER QUALITY ANALYSIS

17 December, 1979

SAMPLE NUMBER		27-1	27-2	27-3	28-1	28-2	29-1	29-2	30-1	30-2	30-3
SAMPLING PLACE		Medang	Medang	Pagurawan	Limau Sundai	Lima Puluh	Tg. Kasau	Simodong	Guntung	Perpuk	Indrapura
KIND OF WELL		Deep well	Shallow well	Deep well	Shallow well	Shallow well	Deep well	Shallow well	Deep well	Deep well	Shallow well
SAMPLING DATE		27Nov.'79	27Nov.'79	27Nov.'79	28Nov.'79	28Nov.'79	29Nov.'79	29Nov.'79	30Nov.'79	30Nov.'79	30Nov.'79
pH	(unit)	7.8	6.3	8.0	6.5	6.0	6.9	6.2	8.0	8.0	5.2
Water temperature	°C	33	27	35	27.8	28	32.8	26.5	46.3	35	28.5
Color	unit	15	26	5	30	5	15	5	5	5	5
Turbidity (silica scale)	mg/l	0.02	0.98	0.02	1.64	0.01	0.99	0.02	0.01	0.03	1.04
Total hardness	°d	3	3	2	6	1	2	4	1	0.8	4
Suspended matter	mg/l	54	12	52	130	12	12	16	64	26	36
Total solids	mg/l	440	144	435	266	174	286	106	128	386	262
Ignition residue	"	275	118	269	136	107	157	71	79	213	134
Permanganate value	"	8.3	6.8	8.8	31.4	4.5	3.1	1.9	2.8	10.1	8.4
Carbonates	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	10.0	0.0
Bicarbonates	"	523	87	392	218	65	239	65	262	349	109
Calcium	"	10	20	8	28	2	8	14	3	2	24
Magnesium	"	7	1	3.5	8.6	3	3.5	8.6	2.5	2.3	2.8
Sodium	"	65	18	44	35	45	36	10	36	41	27
Potassium	"	72	36	71	64	35	56	22	42	51	46
Iron	"	0.0	0.05	0.0	5	trace	0.1	0.0	0.0	0.0	0.0
Manganese	"	0.0	trace	0.0	3.7	0.0	0.0	0.58	0.0	0.0	trace
Copper	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aluminum	"	0.02	0.04	0.02	0.06	0.0	0.02	0.04	0.02	0.02	0.02
Silica	"	42	64	36	83	139	64	26	31	13	86
Lead	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alubuminoid nitrogen	"	0.0	0.0	0.0	6	0.0	0.0	0.0	0.0	0.0	0.0
Nitrates	"	0.0	0.0	0.0	0.0	0.0	0.11	0.53	0.0	0.0	0.0
Nitrites	"	0.012	0.0	0.0	0.0	0.0	0.25	0.15	0.0	0.4	0.0
Sulfides	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sulfates	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorides	"	12	22	20	34	4	4	48	10	20	54
Phosphates	"	0.4	0.7	2	4	3	0.7	3	0.8	3	1
Oxygen	"	6.5	6.4	1.8	5.1	5.6	6.7	7.1	6.7	7.3	3.3
Carbon dioxide	"	6	11	2	16	11	3	6	0.0	0.0	9.5
Electrical conductivity	µ℧/cm	302	139	309	143	171	289	95	226	397	238
Free chloride	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agressive CO2	"	14	24	48	15	23	26	13	0.0	0.0	25
Acidity (NaOH)	meg/l	0.26	0.48	0.10	0.70	0.50	0.11	0.27	0.0	0.0	0.43
Alkalinity(HCl)	meg/l	0.86	0.14	0.64	0.36	0.11	0.39	0.11	0.50	0.64	0.18
COD	mg/l	18	14	8	30	5	3	0.8	1.3	1	5.1

BALAI LABORATORIUM KESEHATAN
DI
MEDAN

C-2.2 STANDARDS OF POTABLE WATER QUALITY

Substance or Property	Unit	Indonesia	W H O Highest Desirable Level	W H O Permissible Level
Color	units	50	5	50
Odours	-	-	unobjectinable	unobjectinable
Taste	-	-	"	"
Turbidity (Silica scale)	mg/l	25	5	25
pH	"	6.5 - 9.2	7.0 - 8.5	6.5 - 9.2
Total hardness	°d	5 - 10	(100 mg/l)	(500 mg/l)
Total solids	mg/l	1,500	500	1,500
Ignition residue	"	less than 1,000	-	less than 500
Permanganate value	"	10	10	10
Calcium	"	200	75	200
Magnesium	"	150	50	150
Iron	"	1.0	0.1	1.0
Manganese	"	0.5	0.05	0.5
Copper	"	1.5	0.05	1.5
Zinc	"	15	5	15
Lead	"	0.1	0.1	0.1
Arsenic	"	0.05	0.05	0.05
Ammonia	"	0	-	-
Nitrates	"	20	-	-
Nitrites	"	0	-	-
Sulfates	"	400	400	400
Chlorides	"	600	200	600
Agressive CO_2	"	0	-	-

C-3 Data of Geoelectric Resistivity Survey

During the period of the field survey, the Team executed geoelectric resistivity survey in several villages in order to ascertain geological structure underground in the project area, with assistance of Indonisian officials/labors. See Fig. B-1 for reference of the survey points.

Method of the survey employed is as follows:

- Methodlogy	:	Vertical survey by Wenner's central 4 electrode method
- Number of the points surveyed	:	14 points in 5 villages
- Depth surveyed	:	240 meters
- Apparatus used	:	Oyo's geoelectric equipment, Model ES-G1, made in Japan (Voltage rating = 600V; Current rating = 3A)
- Technology of analysis	:	Sundberg's standard curve method with straight sight method

Results of the analysis are presented in Appendix B, and ρa-a curves (Apparent resistivity - Electrode spacing curve) are shown in the following pages.

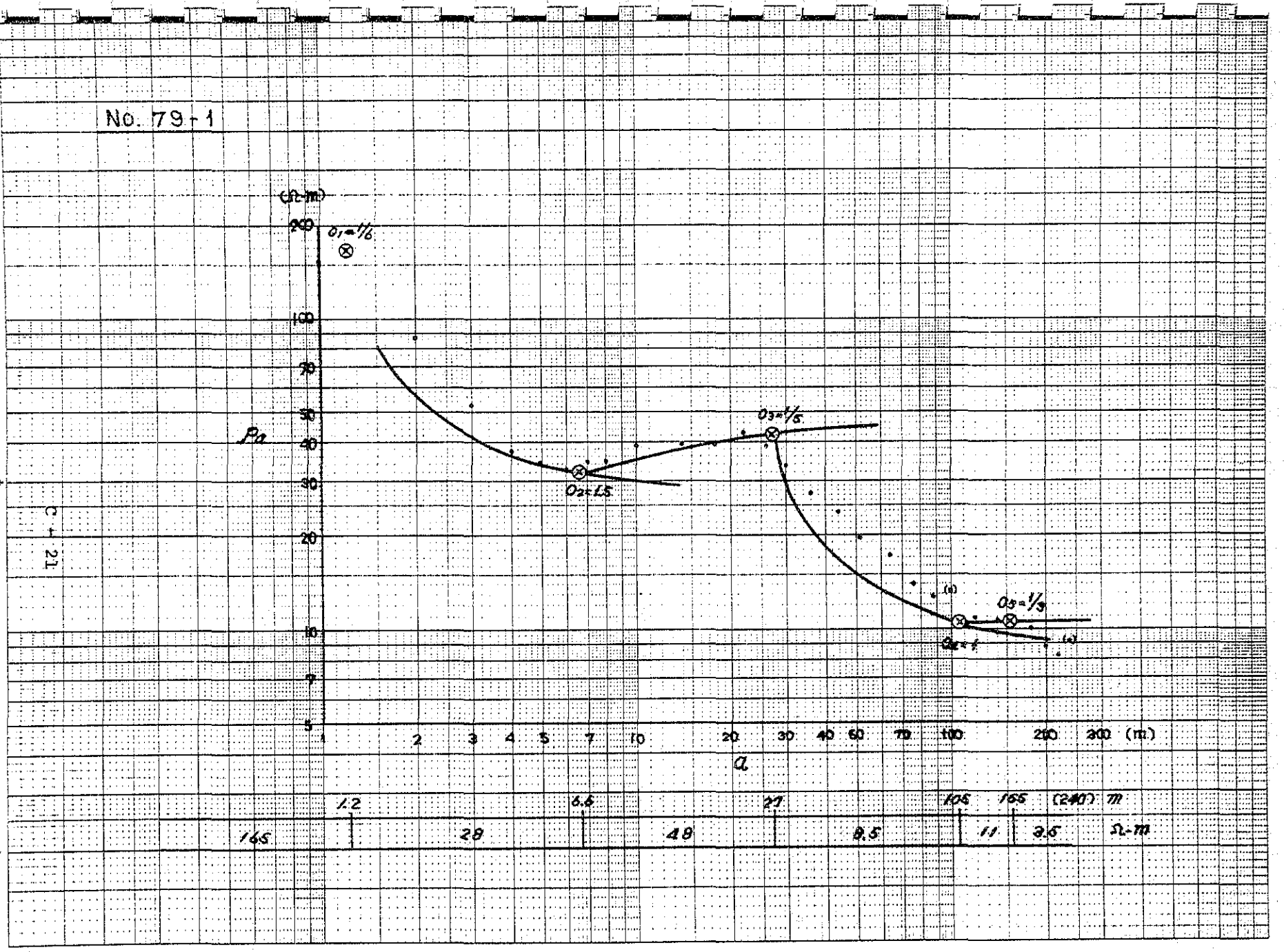
ρa - a Curves

(Apparent resistivity - Electrode spacing curve)

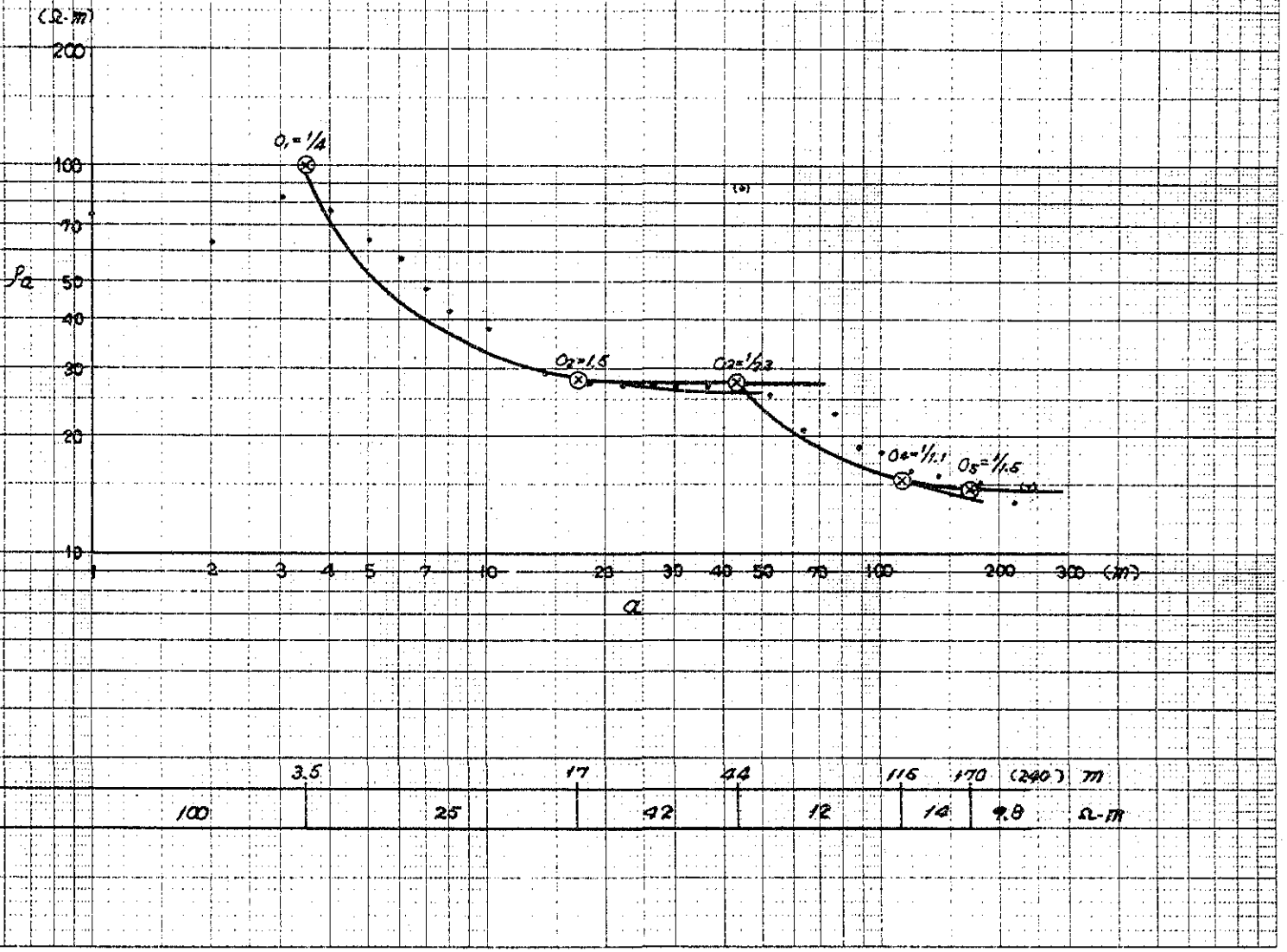
No.79-1 - No.79-14

(Note) : In the case of Nos. 79-7, 79-8 and 79-9, apparent resistivity are recorded at very small values, and ρ-a curves go out of order; the analysis have been hardly possible. This fact seems due to that these surveyed points are located in the vicinity of seashore and saline water is intermixed in the soil.

No. 79-1

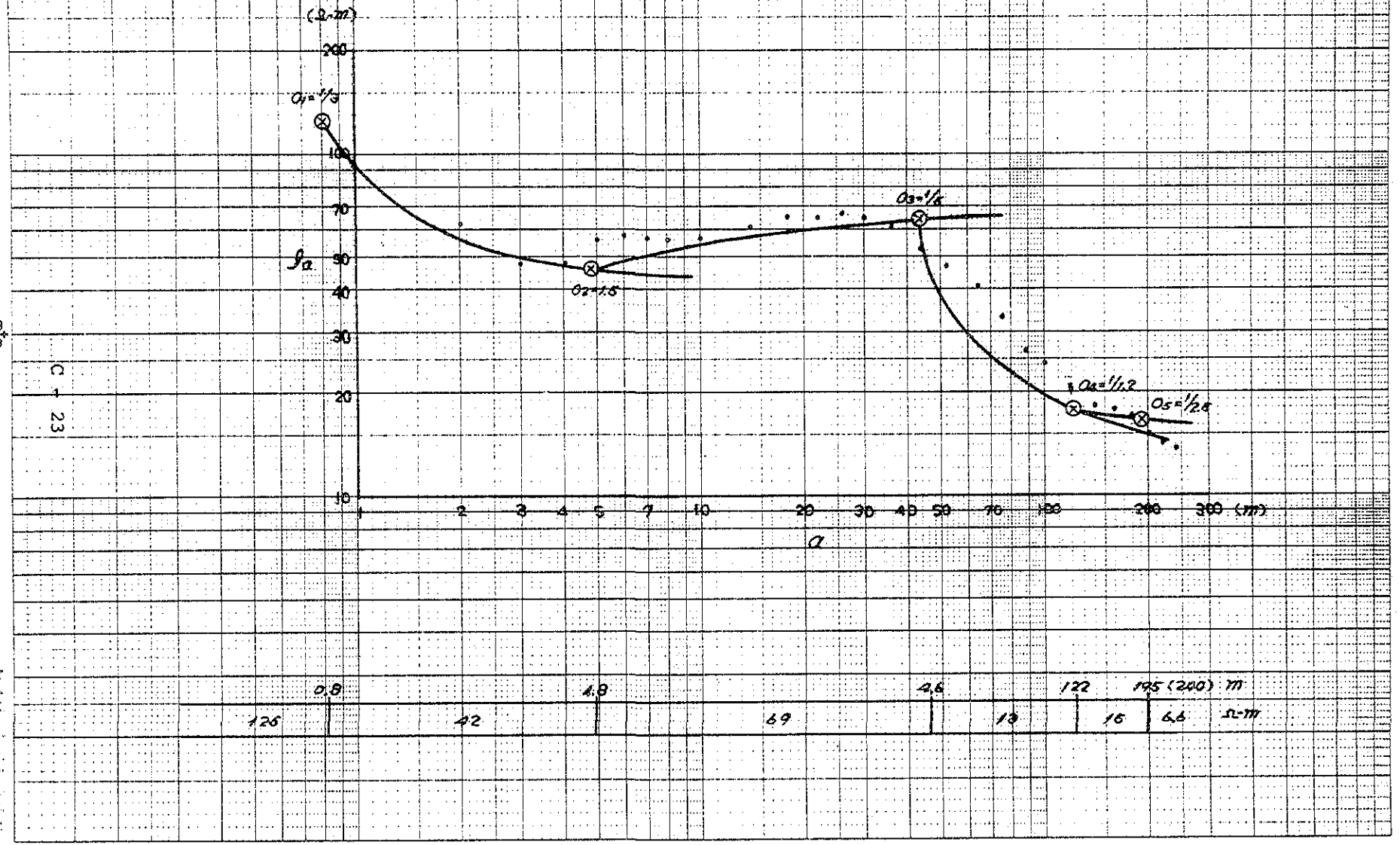

(Ω-m)
200
100
70
50
40
30
20
10
7
5
ρa
$\sigma_1=1/6$
$\sigma_2=1.5$
$\sigma_3=1/5$
$\sigma_4=1/3$
$\sigma_5=f$
(a)
(c)
1 2 3 4 5 7 10 20 30 40 60 70 100 200 300 (m)
a
1.2
6.6
21
105
165
(240) m
165
28
48
8.5
11
3.5
Ω-m

No. 79-2

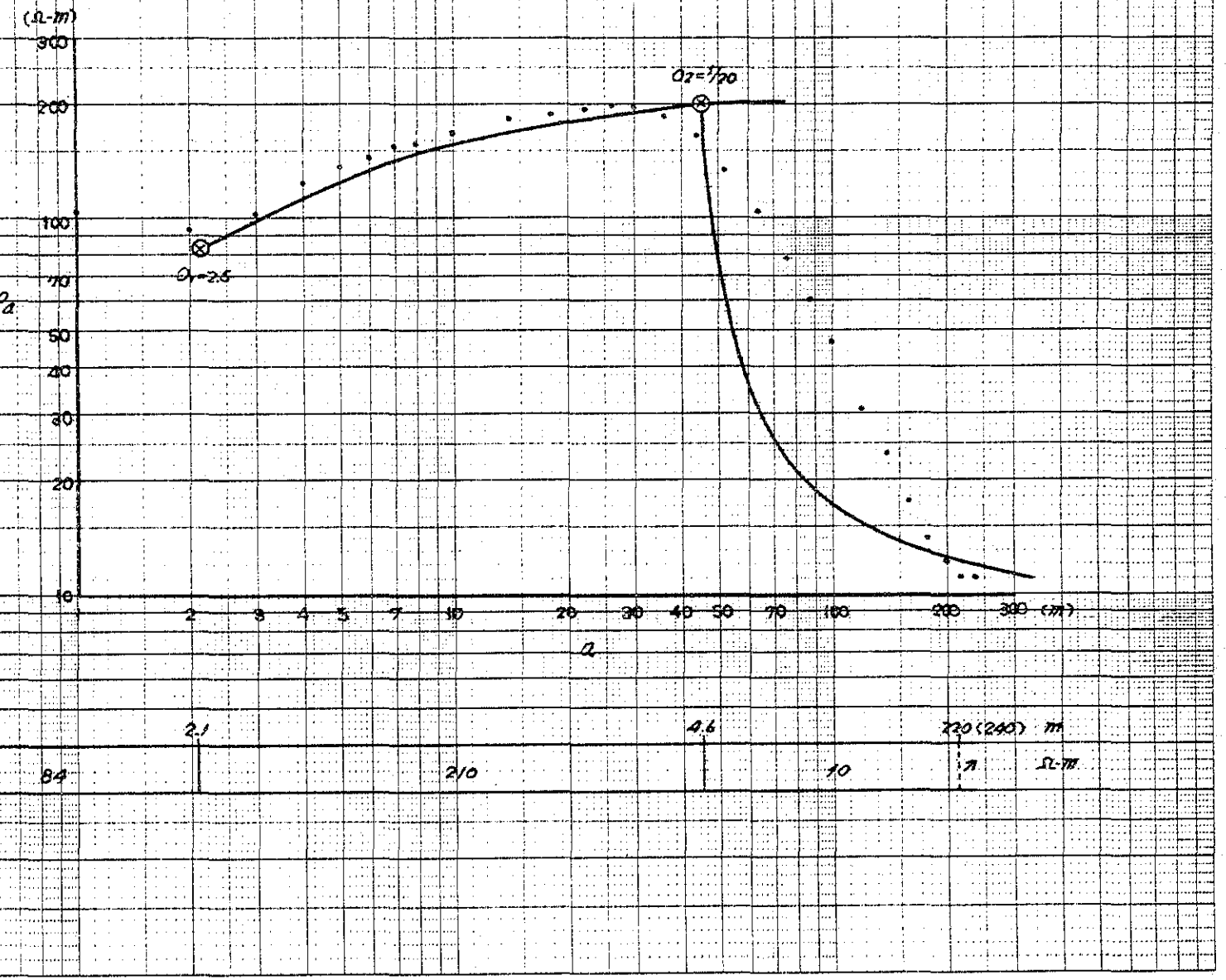

(Ω-m)
200
100
70
50
40
30
20
10
ρ_a
$\alpha_1 = 1/4$
$\alpha_2 = 1.5$
$\alpha_3 = 1/3.3$
$\alpha_4 = 1/1.1$
$\alpha_5 = 1/1.5$
1 2 3 4 5 7 10 20 30 40 50 70 100 200 300 (m)
a
3.5
17
44
116
170
(240) m
100
25
42
12
14
9.8
Ω-m

C 1 22

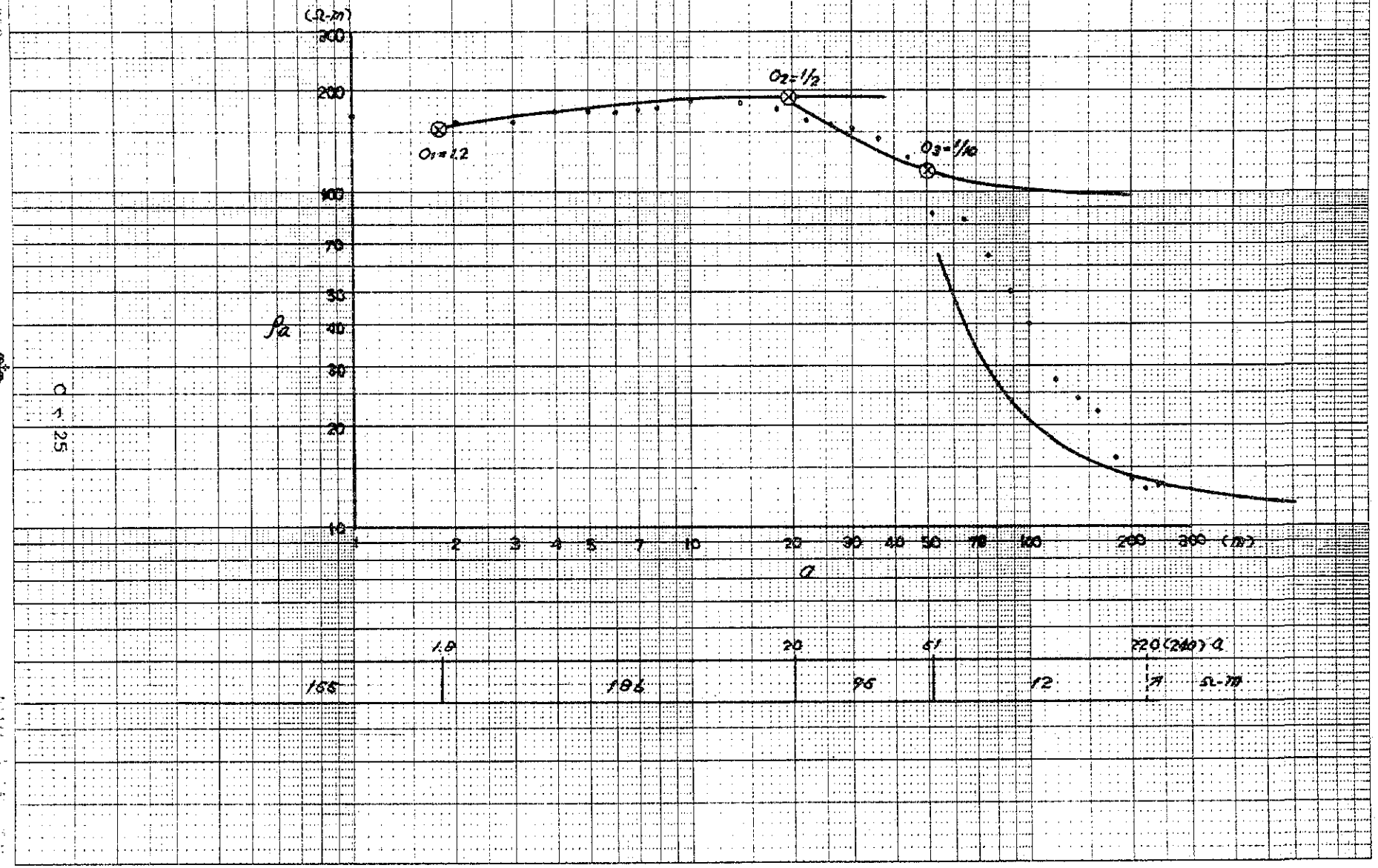
No. 79-3

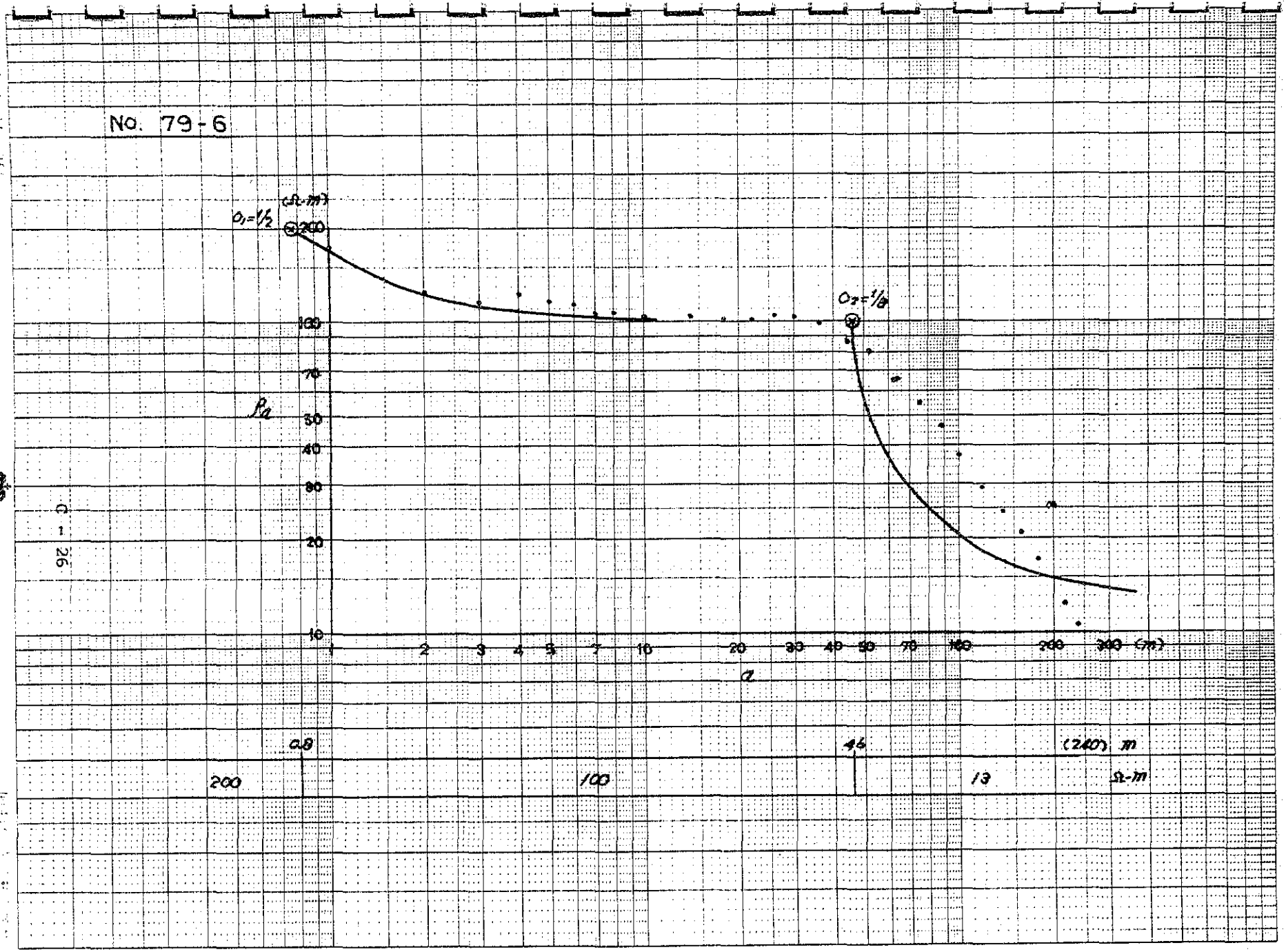

(Ω-m)
200
100
70
50
40
30
20
10
ρ_a
$a_1=1/3$
$a_2=1.5$
$a_3=1/6$
$a_4=1/1.2$
$a_5=1/2.6$
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300
(m)
a
0.8
4.8
4.6
122
195 (240) m
126
42
69
13
15
6.6
Ω-m

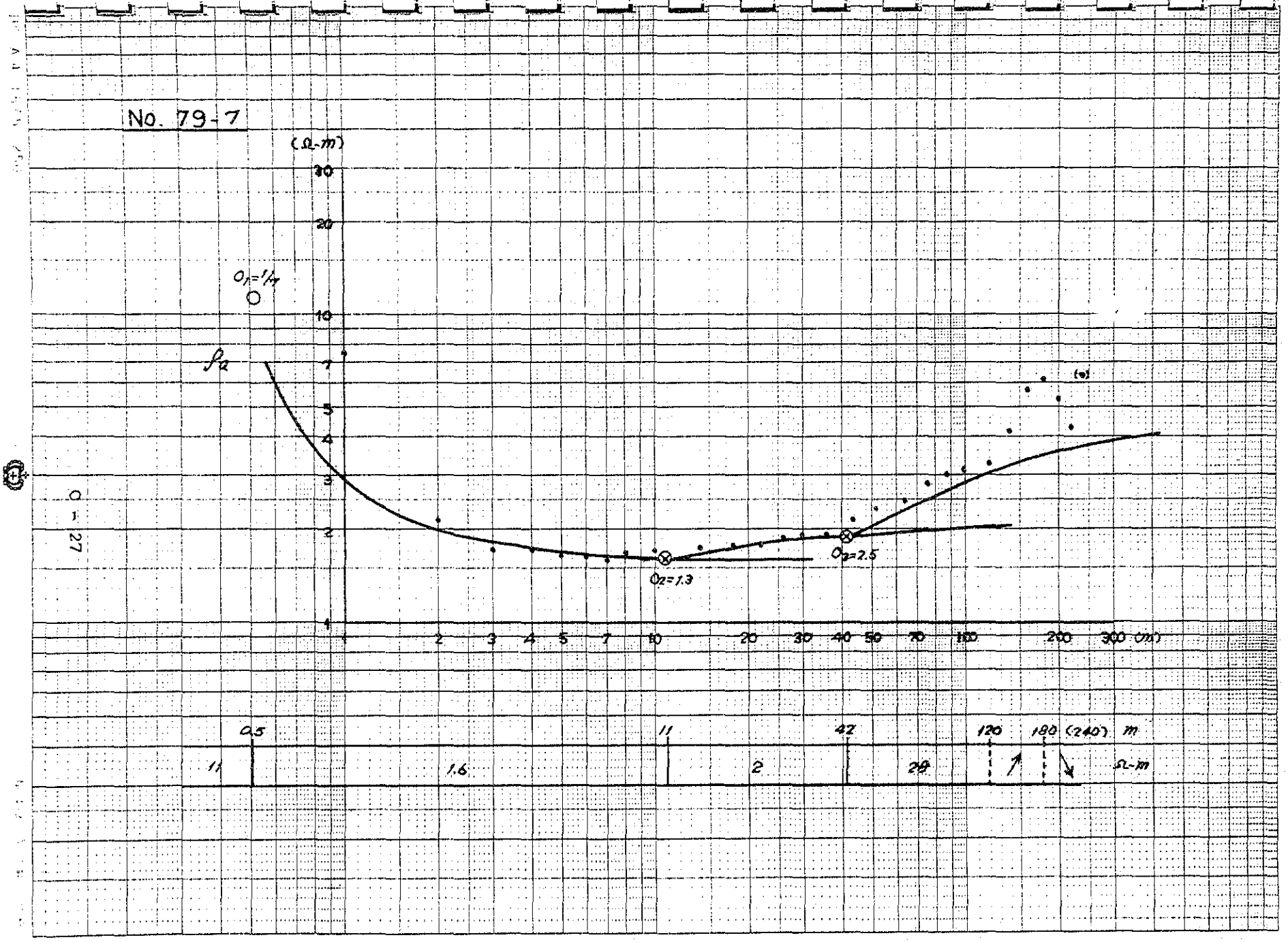
No. 79-4

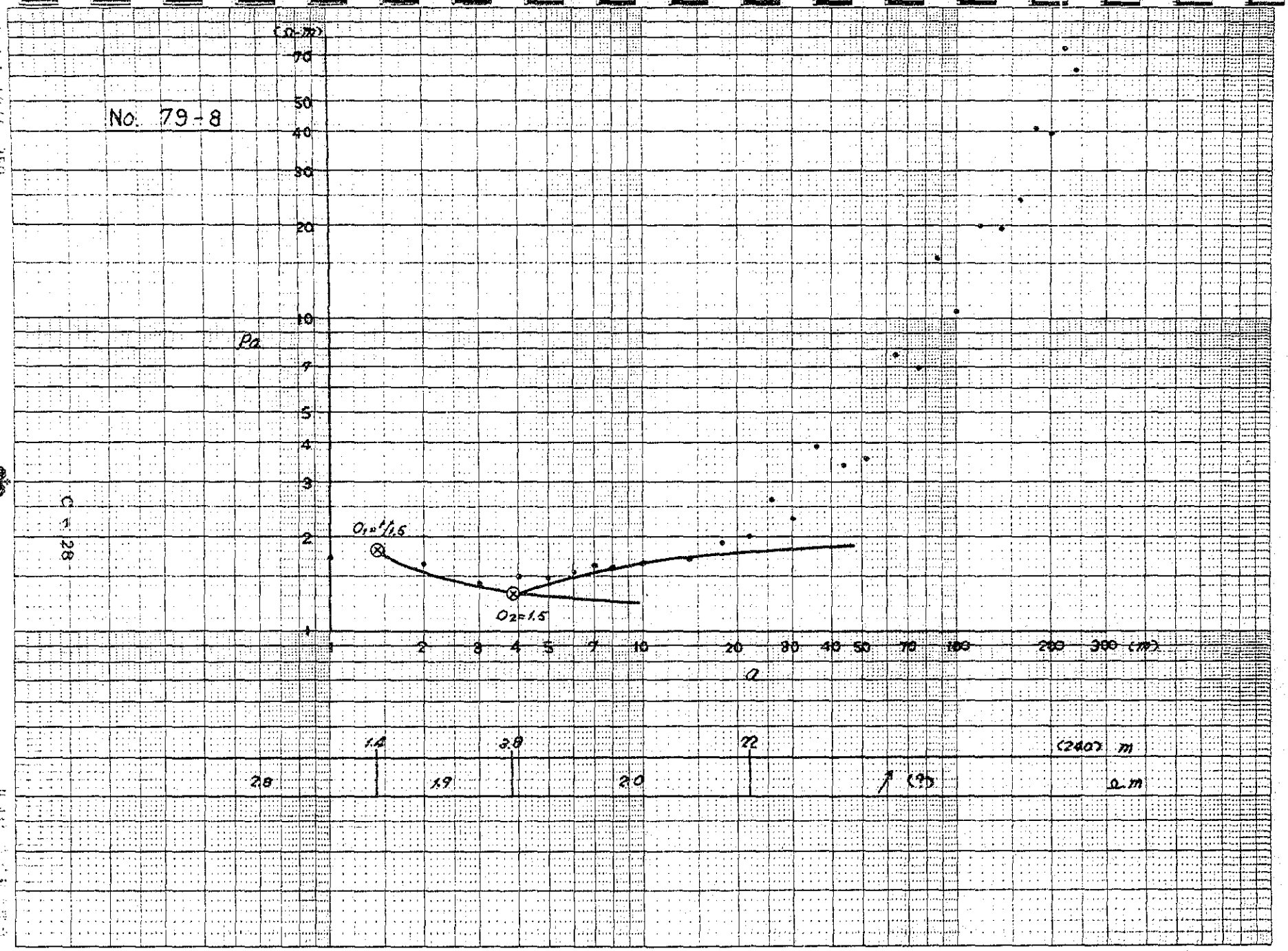

(Ω-m)
300
200
100
70
50
40
30
20
10
ρ_a
σ_1=2.5
σ_2=1/20
2
3
4
5
7
10
20
30
40
50
70
100
200
300
(m)
a
2.1
4.6
220(240) m
2/0
10
84
Ω-m

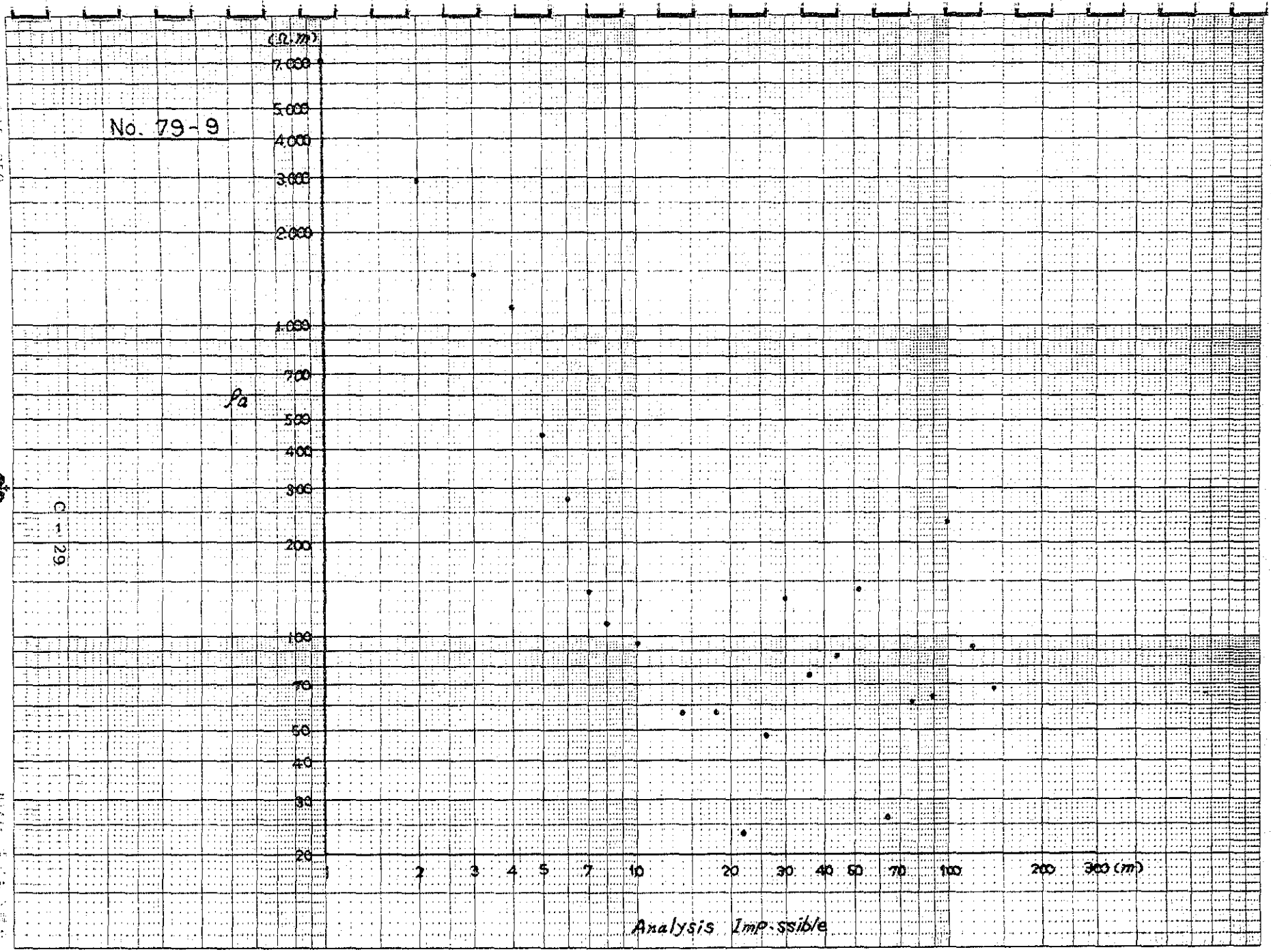
No. 79-5


(Ω-m)
300
200
100
70
50
40
30
20
10
ρa
O1=1.2
O2=1/2
O3=1/10
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300
(m)
a
1.8
20
51
220(240) a
155
106
95
12
m
Ω-m

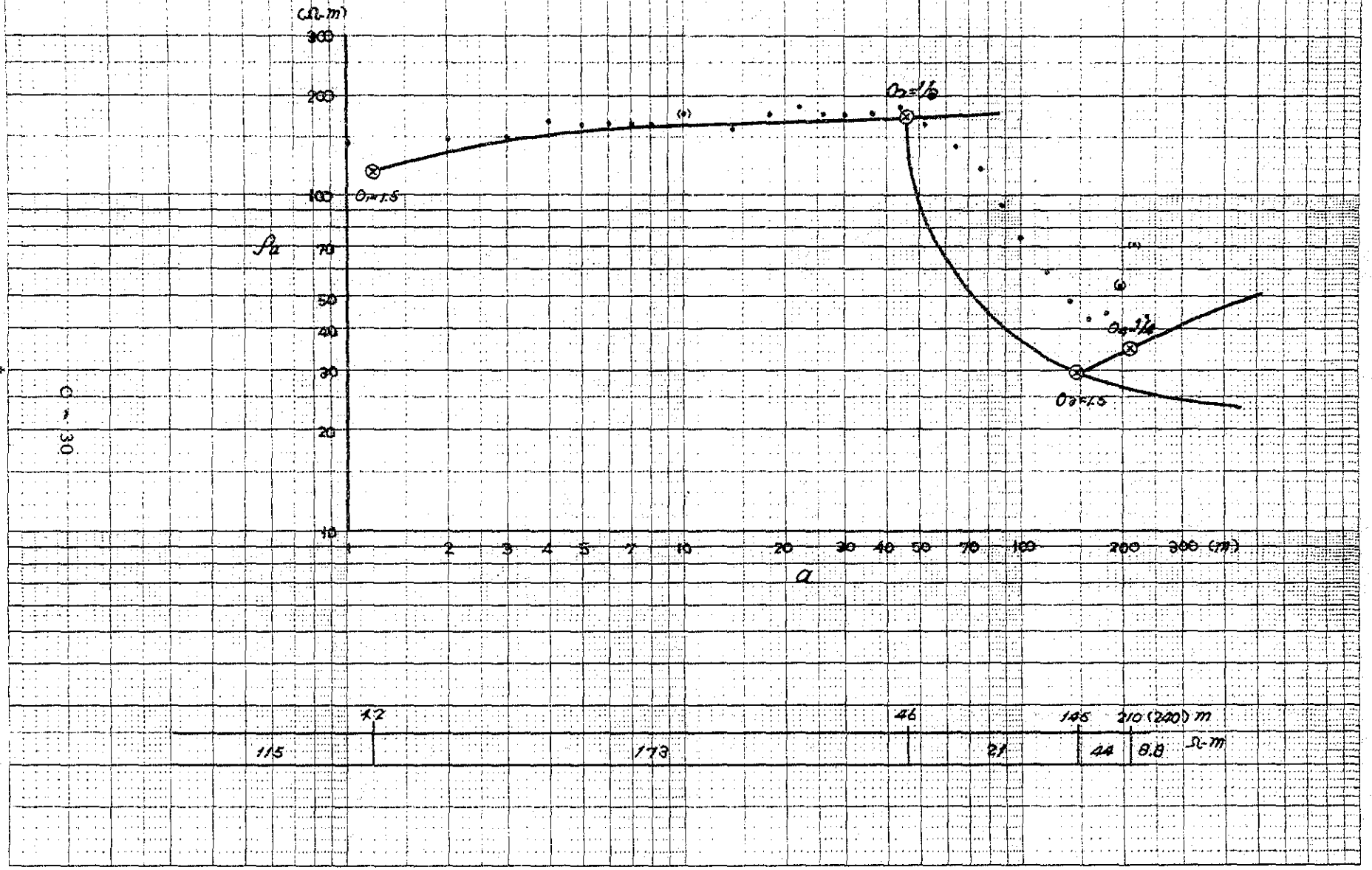

No. 79-6
ρ1=1/2 (Ω-m)
200
ρ2=1/8
100
70
50
40
30
20
10
ρa
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300
(m)
a
0.8
44
(240) m
200
100
13
Ω-m


No. 79-7
(Ω-m)
30
20
10
7
5
4
3
2
1
ρ_a
$O_1=1/7$
$O_2=1.3$
$O_3=2.5$
(*)
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300 (m)
0.5
11
42
120
180 (240) m
1.1
1.6
2
29
Ω-m

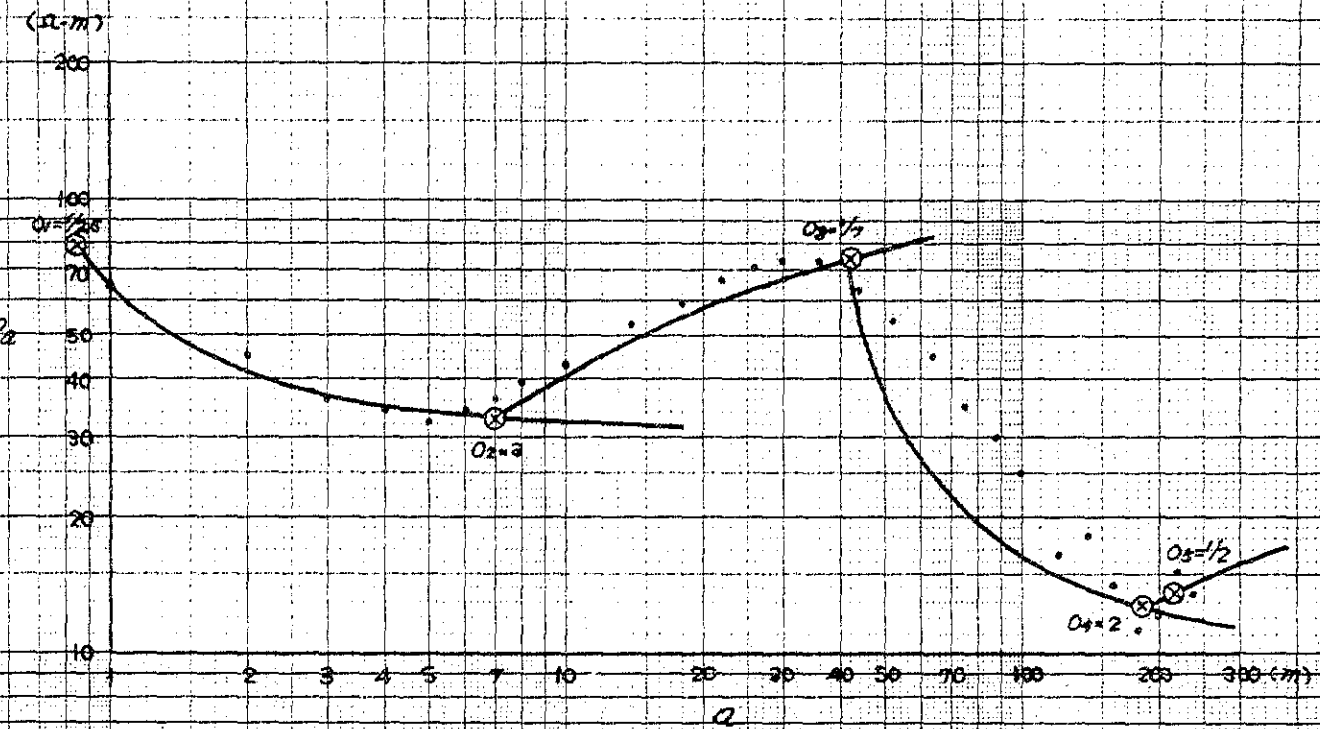

No. 79-8
(Ω-m)
70
50
40
30
20
10
9
5
4
3
2
1
ρa
O_1=1.5
O_2=1.5
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300
(m)
a
1.4
3.8
m
(240)
2.8
1.9
2.0
(?)
a m


No. 79-9
(Ω.m)
7,000
5,000
4,000
3,000
2,000
1,000
700
500
400
300
200
100
70
50
40
30
20
ρa
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300 (m)
Analysis Impossible

No. 79-10


(Ω-m)
300
200
100
70
50
40
30
20
10
ρ_a
$\sigma_2=1/6$
$\sigma_1=1.5$
$\sigma_3=1/6$
$\sigma_2=1.5$
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300 (m)
a
1.2
46
185
210 (220) m
115
173
21
44
8.8
Ω-m

No. 79-11

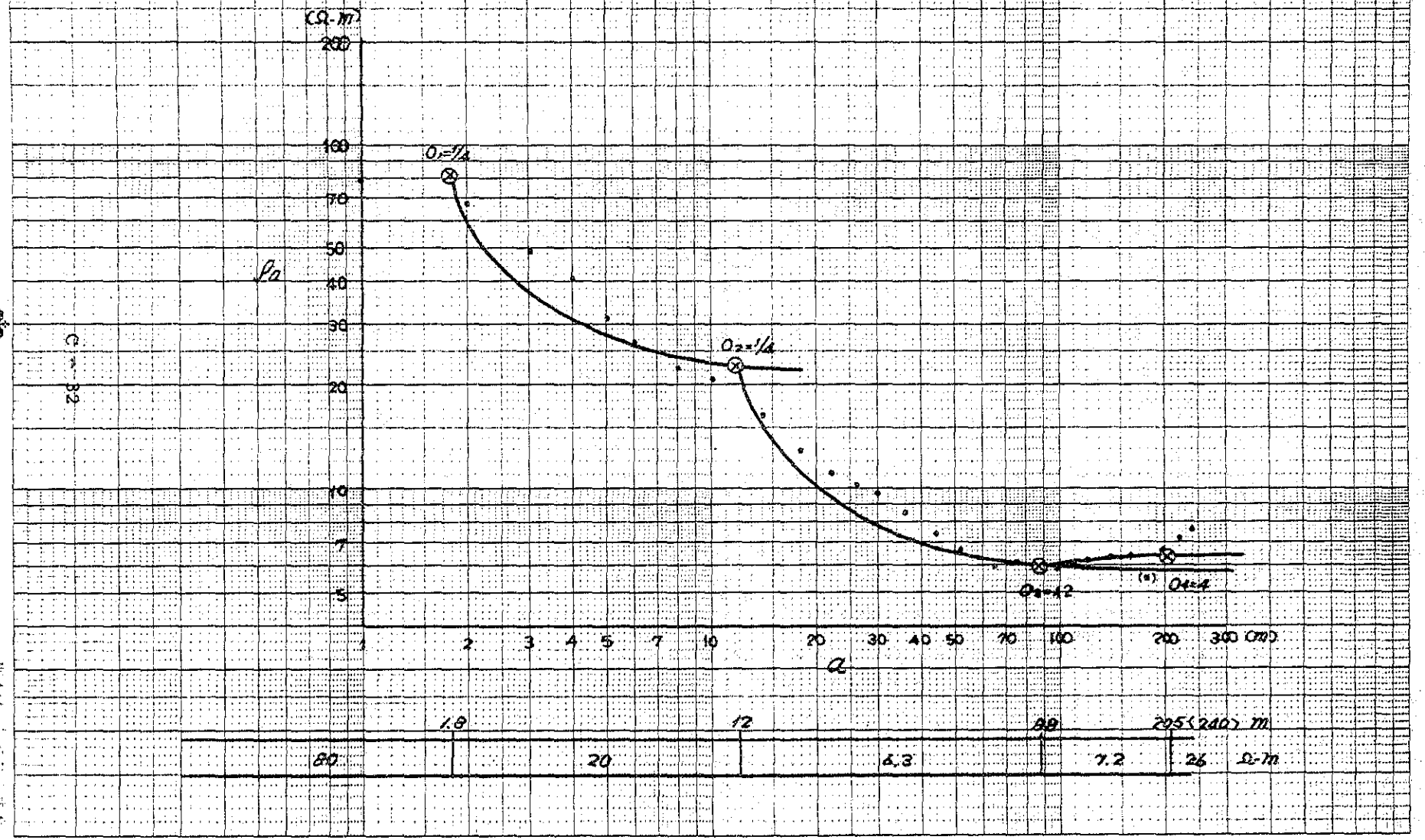


0.85 7 43 185 215 (240) m

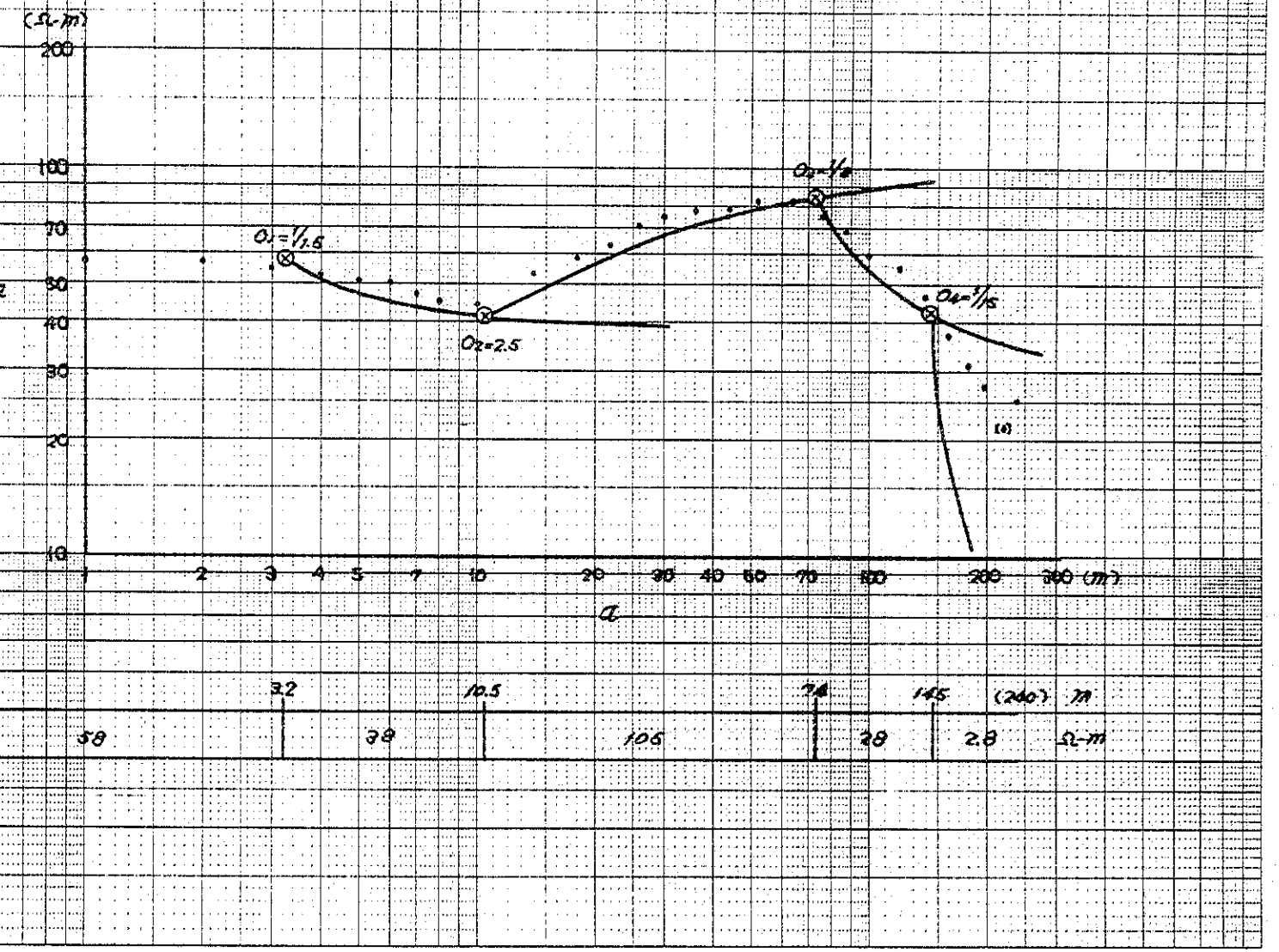
78 31 99 10 26 6.7 Ω-m

C - 31

No. 79-12


(Ω-m)
200
100
70
50
40
30
20
10
7
5
ρa
C = 82
ρ1=14
ρ2=14
ρ3=12
(a) ρ4=4
1 2 3 4 5 7 10 20 30 40 50 70 100 200 300 (m)
a
1.8
12
88
205(240) m
80
20
4.3
7.2
26 Ω-m

No. 79-13


(Ω-m)
200
100
70
50
40
30
20
10
ρa
1
2
3
4
5
7
10
20
30
40
60
70
100
200
300 (m)
a
O1=1/1.6
O2=2.5
O3=1/6
O4=1/15
(4)
3.2
10.5
74
145
(240) m
58
38
105
28
2.8
Ω-m

No. 79 - 14

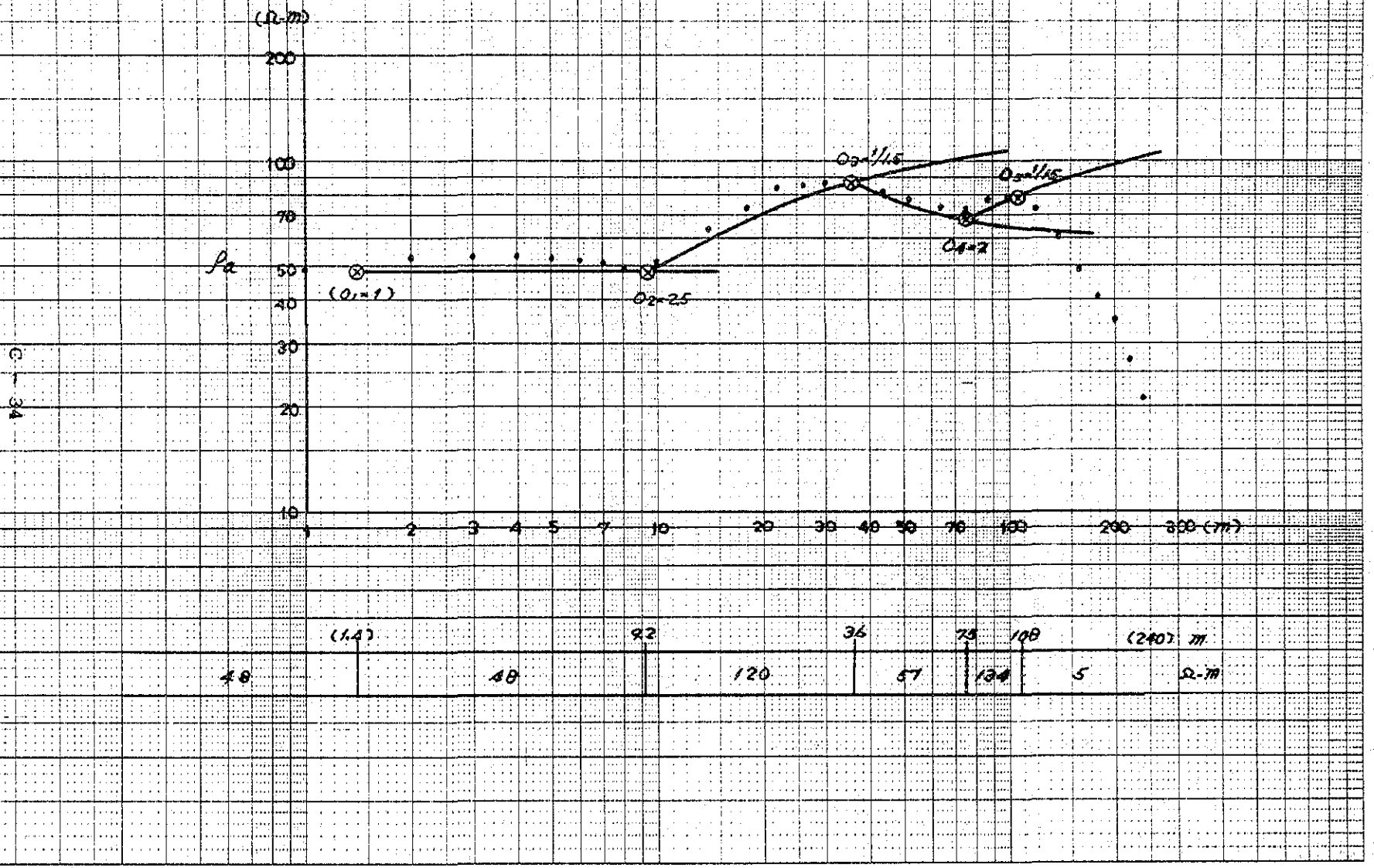

(Ω-m)
200
100
70
50
40
30
20
10
ρa
(0,1=1)
0₂=25
0₃=1/1.5
0₄=2
0₅=1/1.5
1
2
3
4
5
7
10
20
30
40
50
70
100
200
300 (m)
(1.4)
22
36
73
108
(240) m
48
48
120
57
134
5
Ω-m

Fig. C-1 Presumed Geological Logs Based on Geoelectrical Resistivity Method

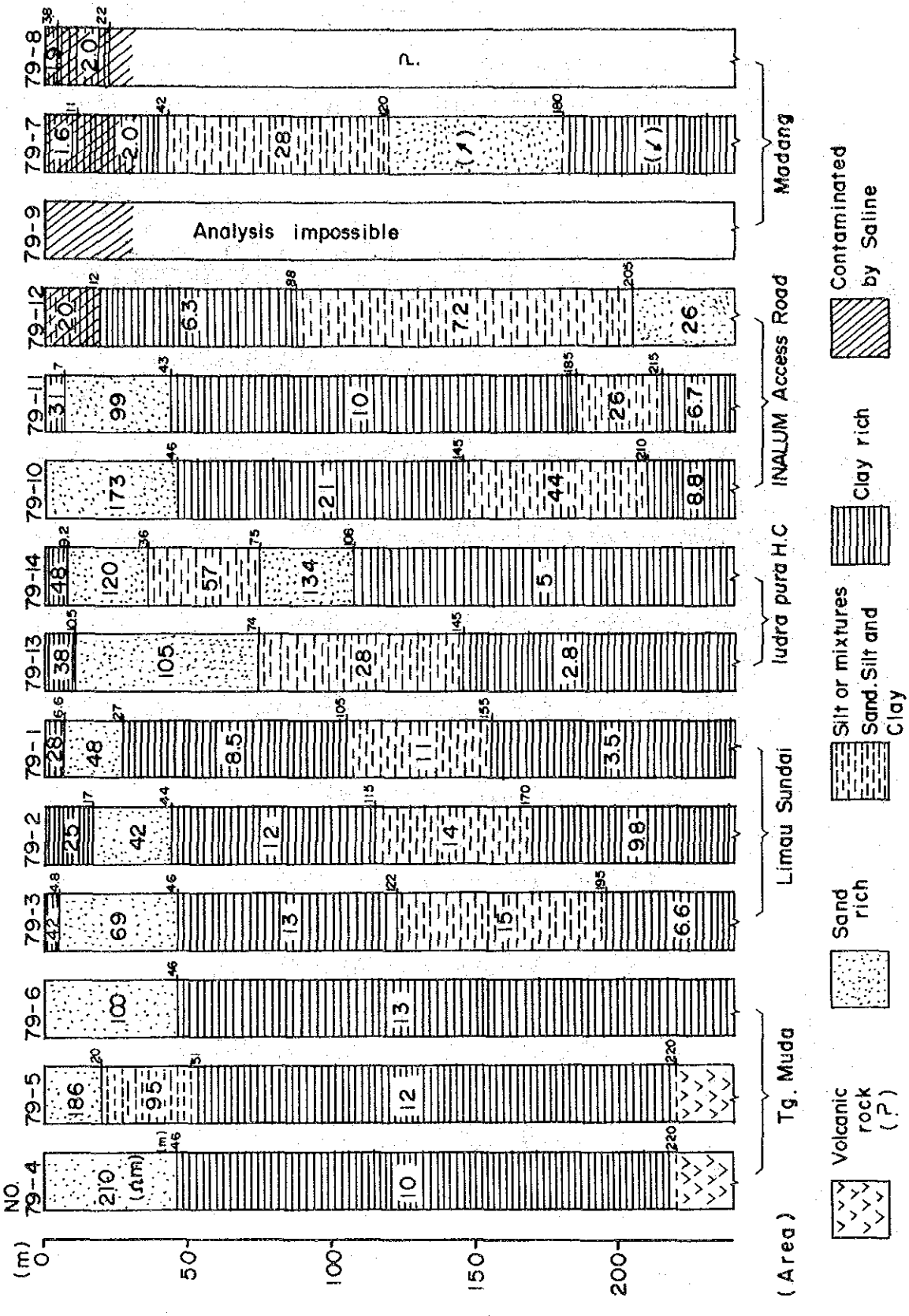
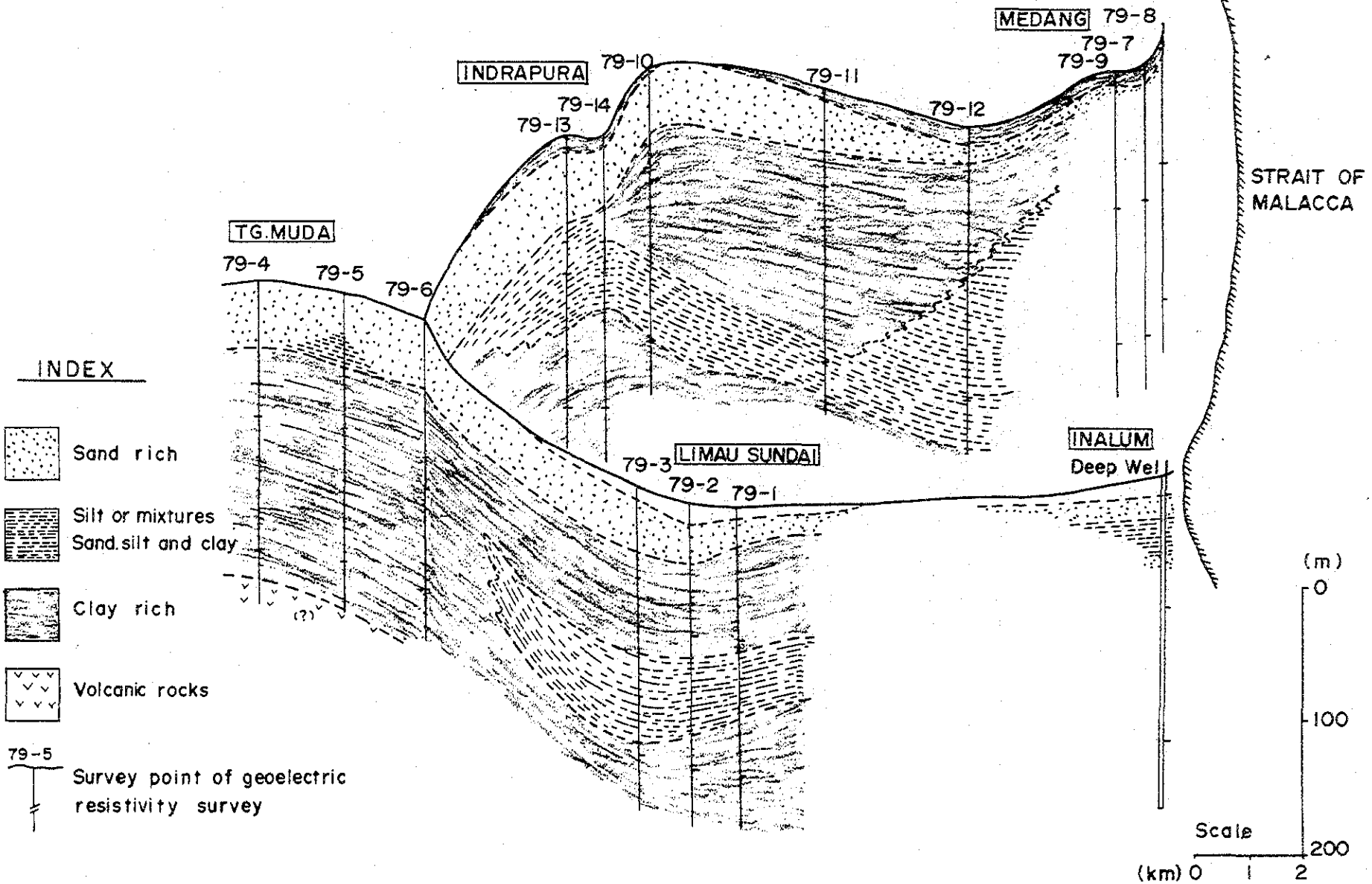


Fig. C－2 Panel Diagram
(Central part of the project area)



c-4 Analysis of Pumping Test by Recovery Method

It is essential to study hydraulic values which are peculiar in the aquifer therein for the consideration of storage and recharge of ground water and water management including yield control.

Generally the hydraulic values can be obtained by the performance of well's pumping test. There are some methods in the pumping test and its analysis; one of them is called the Recovery Method which can be rather easily carried out using existing wells.

The Team, during stay in the field, made the above test using an existing deep well with depth of 80 m, located at the rubber plantation factory in Tanjung Kasau, Air Putih district. After stoppage of the pump, raising speed of the water level in the well casing was measured continuously. The result, shown in Fig. C- , is plotted on semi-logarithm paper.

Coefficient of transmissibility (T), one of the hydraulic values, can be calculated by the following formula:

$$T = \frac{0.183Q}{\Delta S}$$

Here, T : Coefficient of transmissibility
Q : Pumping quantity
ΔS : Difference of water levels at one cycle of log (t/t')
t : Time past from start of pumping
t': Time past from stoppage of pumping

Therefore, referring to Fig. C- ,

$$T = (0.183 \times 0.002\ m^3/sec)/0.85\ m = 4.3 \times 10^{-4}\ m^2/sec$$

Furthermore, coefficient of permeability (k), most important hydraulic value is obtained as follows:

$$k = T/m = (4.3 \times 10^{-4}\ m^2/sec)/20\ m = \underline{2.15 \times 10^{-3}\ cm/sec}$$

Here, m : Thickness of the aquifer (Supposed to be 20 meters)

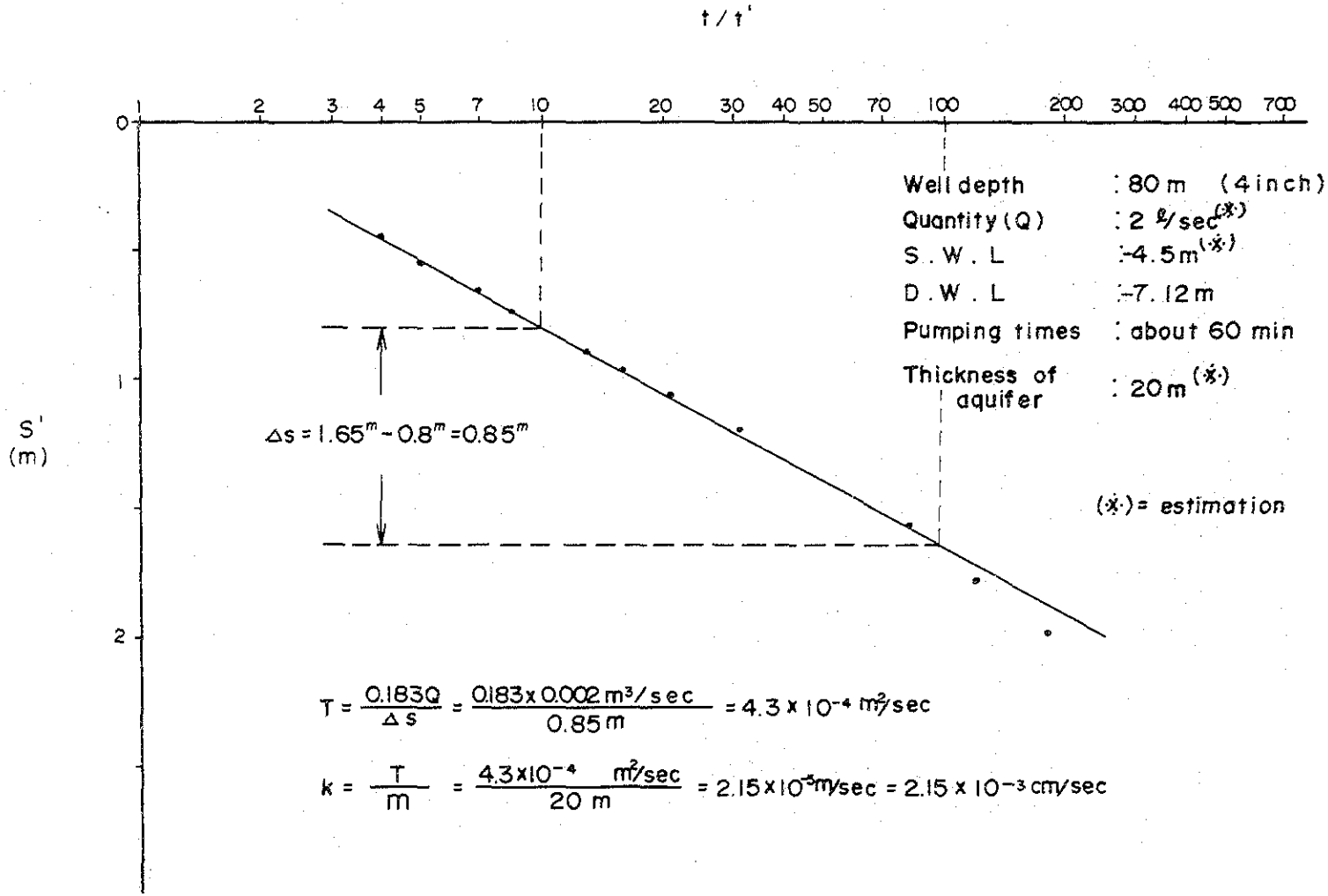
Relation between coefficient of permeability and soil condition is generally shown in the following Table.

Coefficient of Permeability: k (cm/sec)

Coefficient of Permeability	10^2 . .	1.0 . .	10^{-3} . . .	10^{-7} cm/sec . .
Soil Classification	Clean gravel	Clean sand/ mixtures of clean sand and gravel	Very fine sand/ silt/mixture of sand, silt, clay etc.	Clay
Characteristics	Permeable layer (aquifer)		Aqui-clude	Impermeable layer

From the aboves, soil around the well at the rubber plantation in Tanjung Kasau is considered sand layer or sand layer which partly contains clay.

Fig. C-3 S'-t/t' Curue for Analysis of Pumping Test



C-5 Population and Administrative Area of Each Village

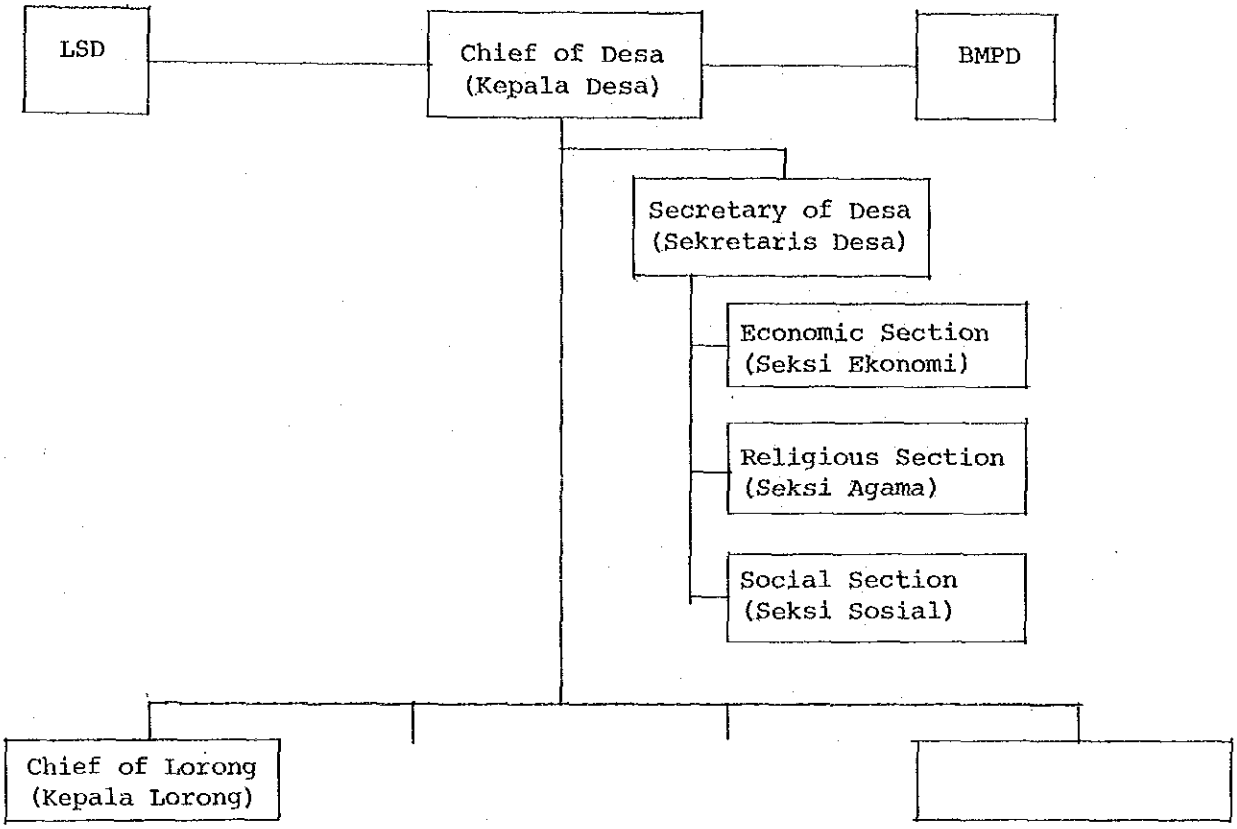
Villages	Present Population	House hold	Administrative area	References
Lima Puluh				
1) Perk. Tanah Gambus	4,474	854	4,408	Plantation
2) Perk. Lima Puluh	2,702	560	1,825	Plantation
3) Perk. Tanah Hitam Ulu	2,500	449	3,023	Plantation
4) Perk. Tanah Itam Iilir	1,408	250	924	Plantation
5) Perk. Dolok	1,757	335	1,058	Plantation
6) Perk. Limau Manis	780	148	230	Plantation
7) Perk. Kwara Gunung	719	118	1,300	Plantation
8) Lima Puluh	2,698	400	100	Plantation
9) Antara	1,389	247	150	
10) Cahaya Pardomuan	1,320	223	287	
11) Kwala Gunung	912	197	360	
12) Air Hitam	2,960	474	2,070	
13) Simpang Dolok	1,598	274	75	Plantation (half)
14) Empat Negri	2,631	567	365	Plantation (half)
15) Lubuk Besar	3,433	658	550	Plantation (half)
16) Sumber Makmur	1,295	250	151	Plantation (half)
17) Sumber Padi	1,883	390	360	Plantation (half)
18) Mangkai Baru	3,575	643	461	Plantation (half)
19) Simpang Gambus	6,759	1,161	883	
20) Pematang Panjang	6,222	1,125	2,250	
21) Guntung	6,227	1,278	2,020	
22) Perpuk	6,227	1,278	2,020	
Total (Lima Pulih)	60,042	11,024	23,995	

Villages	Present Population	House hold	Administrative area (ha)	References
Air Putih				
1) Indrapura	3,809	701	70	
2) Limau Sundai	3,067	520	1,558	
3) Pem. Panjang	3,375	514	580	
4) Suka Raja	1,673	325	380	
5) Tanah Tinggi	2,785	507	240	
6) Tanjung Muda	1,310	262	188	
7) Tanah Merah	1,026	222	280	
8) Aras	2,277	432	820	
9) Tanjung Kubah	2,667	514	1,609	
10) Pasar Lapan	1,829	377	1,160	
11) Sipare-pare	2,696	492	350	
12) Pematang Jering	2,496	484	2,921	
13) Simodong	2,781	498	500	
14) Perk. Sipare-pare	1,405	257	2,274	Plantation
15) Sei Suka Deras	2,454	422	910	Plantation (half)
16) Tanjung Seri	2,866	572	415	
17) Sei Simujur	2,171	437	3,210	Plantation (half)
18) Perk. Tanjung Kasau	2,810	528	3,139	Plantation
19) Perk. Tanjung Kasau	1,383	251	590	Plantation (half)
20) Laut Tador	3,673	671	1,278	Plantation (half)
21) Tanjung Parapat	1,731	327	679	Plantation (half)
22) Kwala Tanjung	2,190	445	1,220	
Total (Air Putih)	52,474	9,758	24,371	

Villages	Present Population	House hold	Administrative area (ha)	References
Medang Deras				
1) Pangkalan Dodek	4,814	849	690	
2) Sidomulyo	1,644	321	650	
3) Sei Buah Keras	2,056	388	450	
4) Aek Nauli	1,089	179	1,000	
5) Nenas Siam	1,241	273	600	
6) Durian	1,824	352	550	
7) Medang	3,039	577	650	
8) Pakam	2,362	456	600	
9) Lalang	2,294	491	675	
10) Pemt. Cengkering	2,305	429	400	
11) Sei Rakyat	1,694	307	400	
12) Tanjung Sigoni	964	180	235	
Total (Medang Deras)	25,326	4,802	6,900	

Appendix C-6 Administrative Organization of Village and District

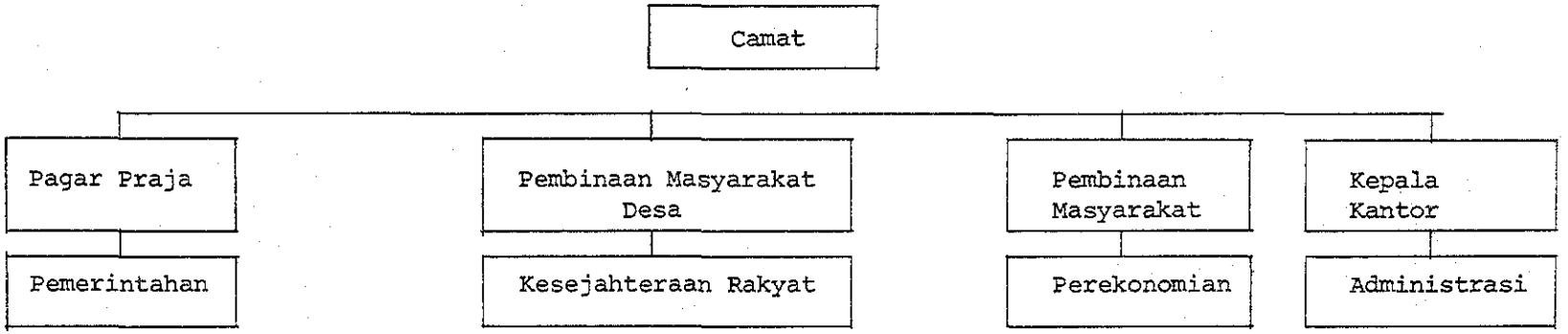
Organization Chart of Desa



LSD : Lembaga Social Desa

BMPD : Badan Musyawarah Pembangunan

Organization Chart of Kecamatan



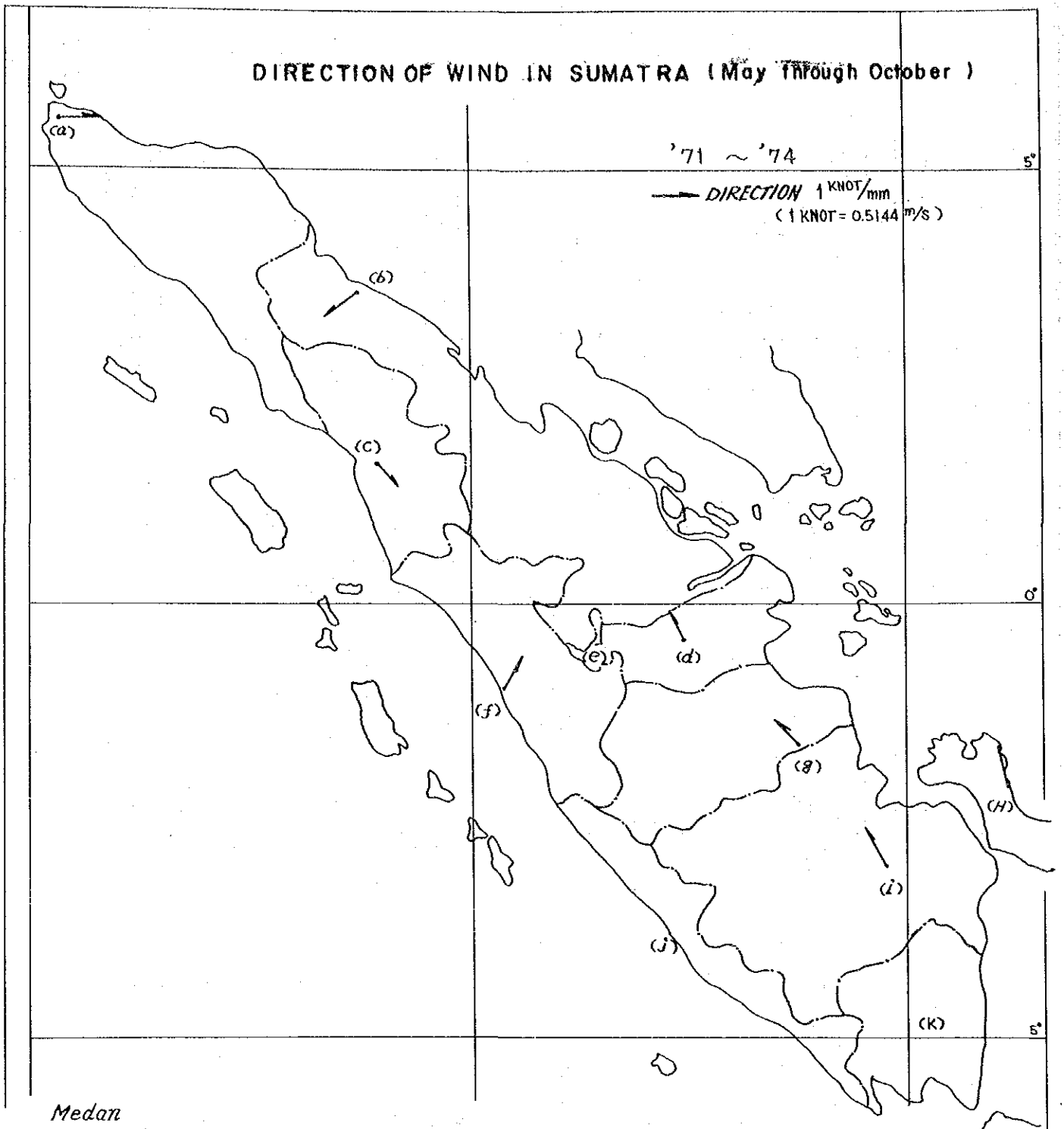
Note: Pagar Praja/Administrative Government. Pemerintahan umum/Public Administrative Government

Rural Community Services Kesejahteraan Rakyat/People walfare-social

Pembinaan Masyarakat Desa Perekonomian/Economic development

Pembinaan Masyarakat/Community Development

Kepala Kantor/Administrative-Management = Administrasi/Office work



Medan

	DIRECTION OF WIND					MEAN VELOCITY OF WIND (KNOT)					MAXIMUM IN AVERAGE VELOCITY OF WIND (KNOT)				
YEAR / MONTH	'71	'72	'73	'74	AVEG	'71	'72	'73	'74	AVEG	'71	'72	'73	'74	AVEG
5	NE	—	N	NE	(NE)	5	—	7	5	(6)	28	—	15	15	
6	NE	NE	NE	NE	(NE)	5	6	7	6	(6)	14	15	12	16	
7	NE	SE	NE	NE	(NE)	2	7	7	6	(6)	50	15	12	13	
8	NE	SE	NE		(NE)	3	7	7	5	(6)	30	25	22	15	
9	NE	NW	SE	NE		5	7	7	6	(6)	16	18	15	12	
10	NE	E	NW	NE		2	7	7	6	(6)	12	18	15	16	

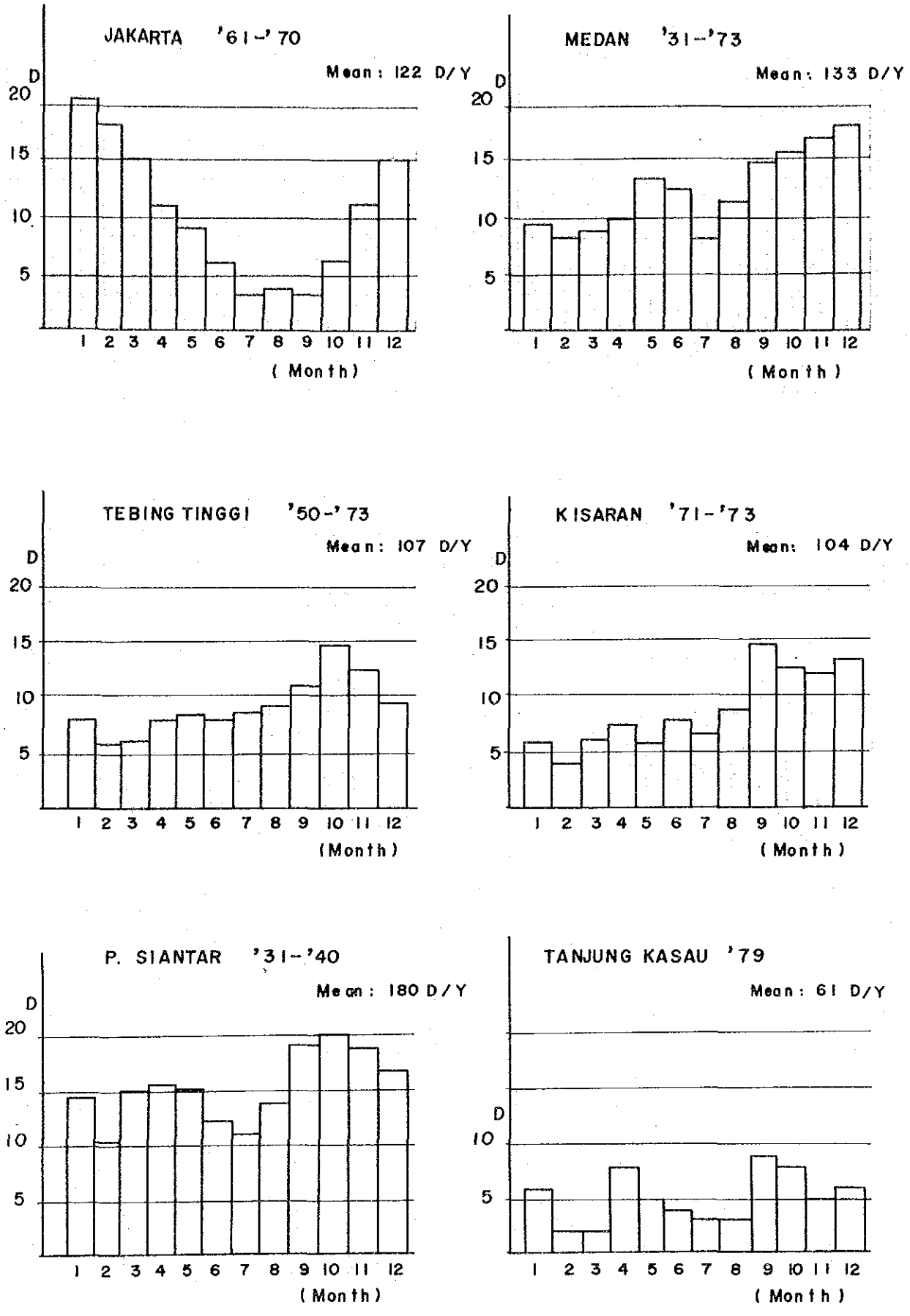


Fig. C-4 Rainy Days Record

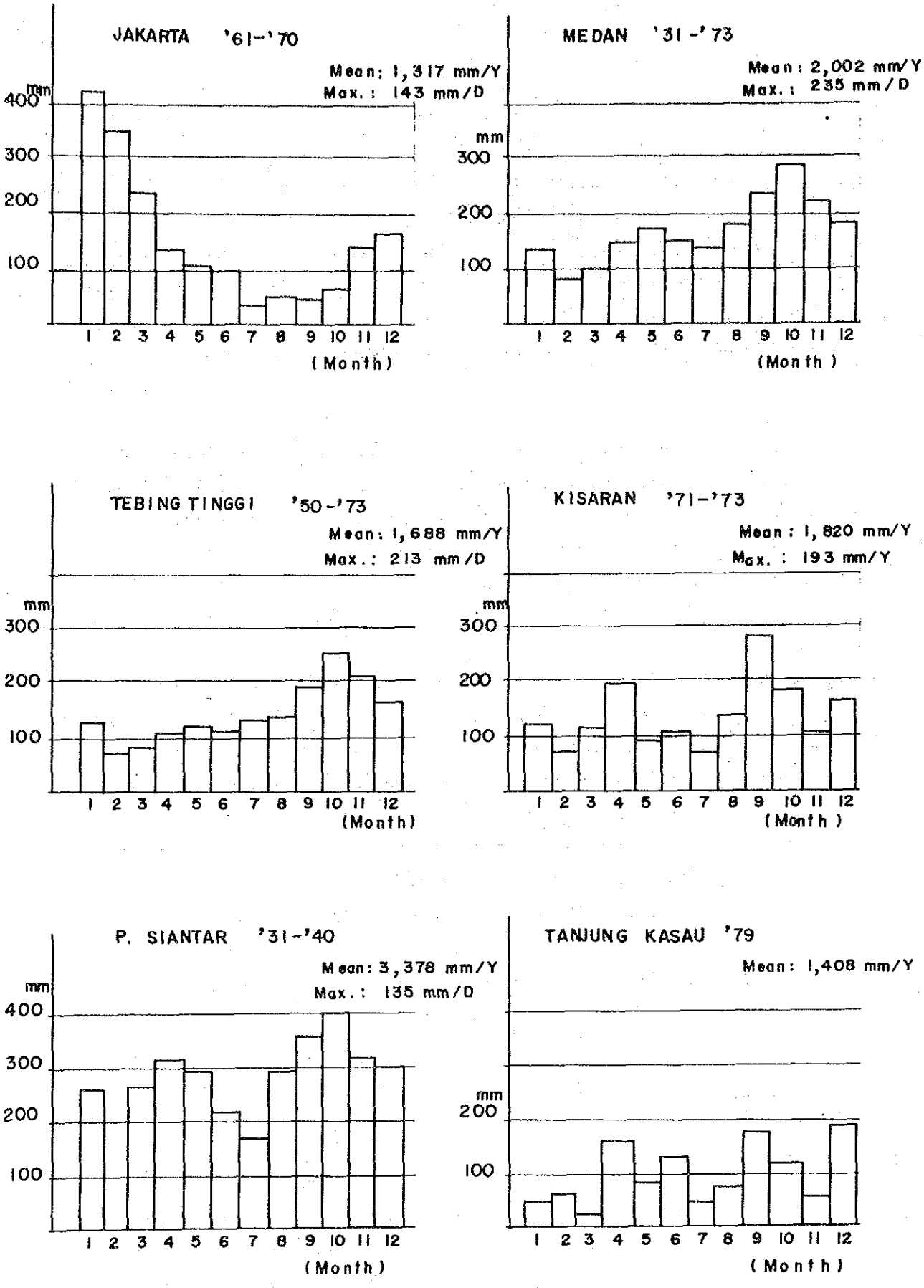


Fig. C – 5 Rainfall Record

C-8 Rural Water Supply Situation in Indonesia

1. General

The Ministry of Health, through its Directorate of Hygiene and Sanitation (DHS) has responsibility for rural water supply. DHS supervises planning, design and construction of water supply facilities, and assists in installing hand pumps and utilities related to drinking water, and in their operation and maintenance. DHS's performance has been negatively influenced by lack of an adequate organizational structure and of enough trained technical manpower.

The provincial and regency public works offices, in conjunction with the provincial and regency health offices, which are directly responsible to the provincial head (Governor) or the regency head (Bupati) and not to the Central Ministries, carry out physical planning and construction of all public works including rural water supplies. These local offices are inadequately staffed.

In rural water supply project of INPRES (Presidential Instructions) program, the initiative for starting the project comes form the local health service which communicates the proposal to the Bupati, and implementation is entrusted to the Bupati. The village authorities are responsible for operation and maintenance of the completed water supply facilities. They are required to participate in construction by supplying labor, and also be responsible for financing those parts of a scheme not provided by the central, provincial or regency authorities.

The Organization chart of the above authorities concerning the rural water supply are shown in Fig. C-6 through Fig. C-9 .

2. Background

Program of rural water supply was initiated in 1969 - 1973 with assistance of WHO, UNICEF and Ministry of Health. The program was known as pilot project which handled simple and small-scalles rural water supply facilities. And it was developed in some provinces (W. Jawa, C. Java, Jogyakarta, E. Java, Bali, S. Sulawesi, N. Sumatra,

W. Sumatra, Lampung, S. Sumatra). During Pelita I, Government of Indonesia, Ministry of Health through Directorate of Hygiene and Sanitation under responsibility of Directorate General of Commicable Diseases Control (COD), constructed some simple water supply systems, such as small-scalled piped systems, artesian wells, shallow wells or deep wells, hand pump facilities, rain water collection, etc.

Budget was finances by several sources such as UNICEF, WHO and Government of Indonesia through Development Budget/DIP-Ministry of Health.

Implementation was made by local governments with financing assistance of central government. Materials such as pipes, valves, accessories, motor pumps, water tanks, hand pumps were prepared by UNICEF, and training personnel was assisted by WHO and ITB.

The objection of the program was to minize waterborne diseases and the areas where gastroenteritis and cholera spread in were selected for the program.

The implementation had been carried out on approximately 1% of rural community, by 45 piped systems, 1,200 hand pumps, and 10 rain water collection wells.

The program continued during PELITA II (1977-1978) through INPRES (Presidential instructions) program or INPRES of Health, named INPRES Pembangunan Sarana Kesehatan. On PELITA II budget came from central government through INPRES's budget and was sent to Kebupaten level directly.

At central leverl, INPRES program was managed with coordination among five Ministries (Ministries of Health, Home Affair, Public Works, Finance, and National Board Planning/Bappenas). At regency level, it was managed by Bupati as administrator.

INPRES program was distributed to the whole Kabupaten in Indonesia. The Schemes consisted of pipe systems, artesian wells, spring protection, rain water collection, shallow and deep wells with hand pumps.

Besides INPRES program also there were water supply program within PELITA II assisted by foreign agency: UNICEF, UNDP/WHO, ADB, Dutch Government, and West Germany, PELITA II had covered approximately 12% of rural community (± 12 million people).

3. Objective

The program had benefited or supported Government development program for rural community in Indonesia.

Main Objectives are:

- To promote health life standard by providing health facilities to rural community, and
- To support commicable disease control program especially in waterborne diseases by creating good environmental and sanitation conditions through water supply facilities and sanitation facilities.

4. Policy/Strategy

Development directed to the rural areas such as:

a. The incidence rate of cholera is high,
b. Area difficult to get water for drinking
c. Kabupaten or regency which have sanitation personnel.
d. Available of rural sanitation survey.

In PELITA III, the program is being continued to rural community and also to the small towns with low income/poor economic condition.

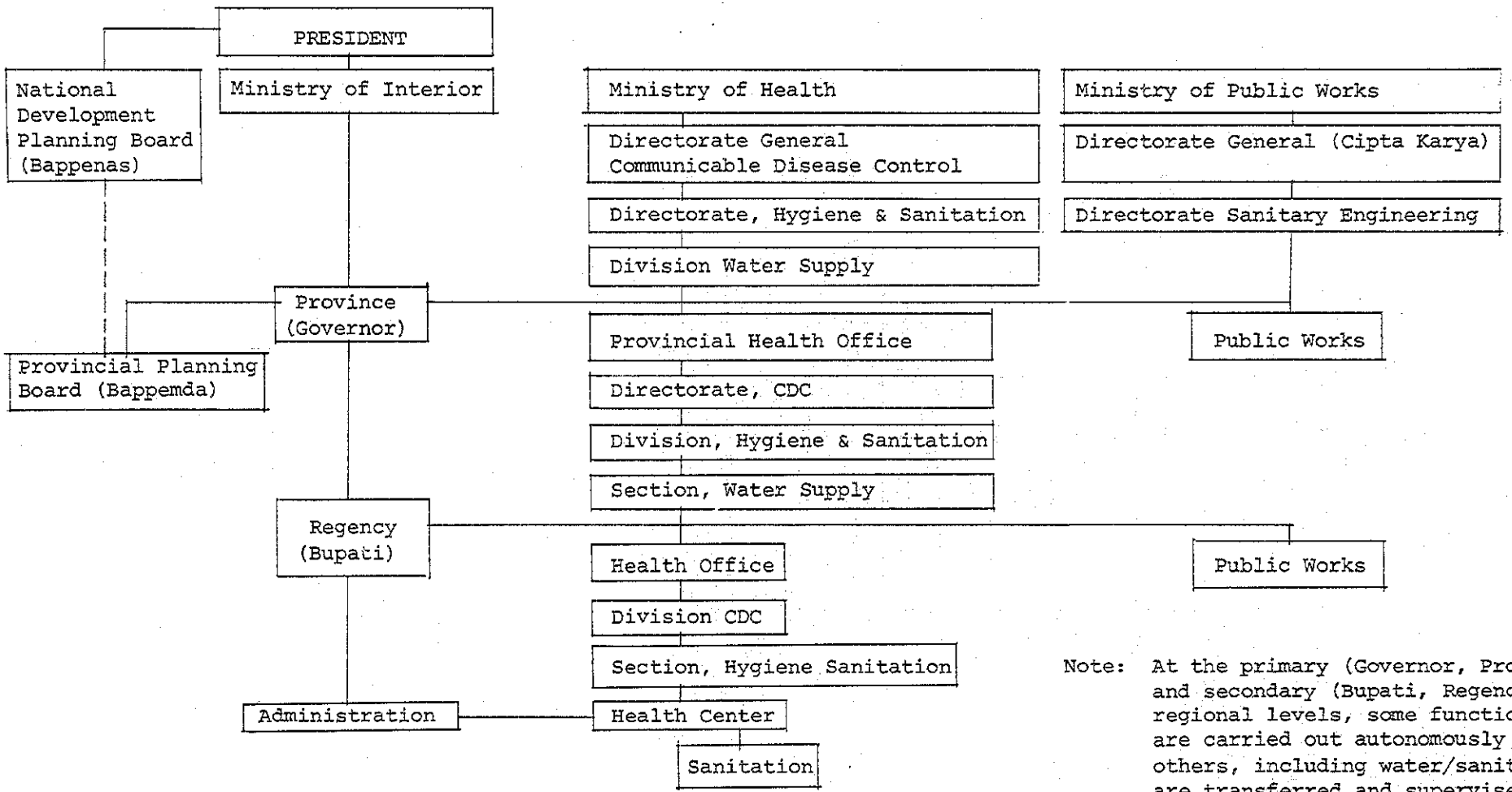
Continuing program in PELITA II in order to provide sanitation staff at Kabupaten level and Kecamatan level with survey equipment, boring equipment and simple tools for operation and maintenance, Government has been training all of the sanitation personnel at Kabupaten level.

Besides INPRES program in PELITA III, there are foreign assistance through UNICEF, UNDP, ADB, West Germany and Dutch Government, and Japan/OTA-43.

During PELITA III, target expected is to serve approximately 30% of rural population by 1,200 piped systems, 2,200 spring protection, 300 artesian wells, 3,500 rain water collection, 200,000 shallow wells with hand pumps and 25,000 deep wells with hand pumps, and 10% of the target is expected by foreign assistance.

In implementation the project management will be improved by cooperation with local Government and Ministries in charge of rural water supply program.

Fig. C - 6 CENTRAL, PROVINCIAL AND LOCAL AUTHORITIES IN CHARGE OF WATER SUPPLY AND SANITATION



Note: At the primary (Governor, Province) and secondary (Bupati, Regency) regional levels, some functions are carried out autonomously and others, including water/sanitation, are transferred and supervised by the Ministry of Interior (general control) as well as by the functional ministries (technical control).

Fig. C-7 THE ORGANIZATION OF THE MINISTRY OF HEALTH

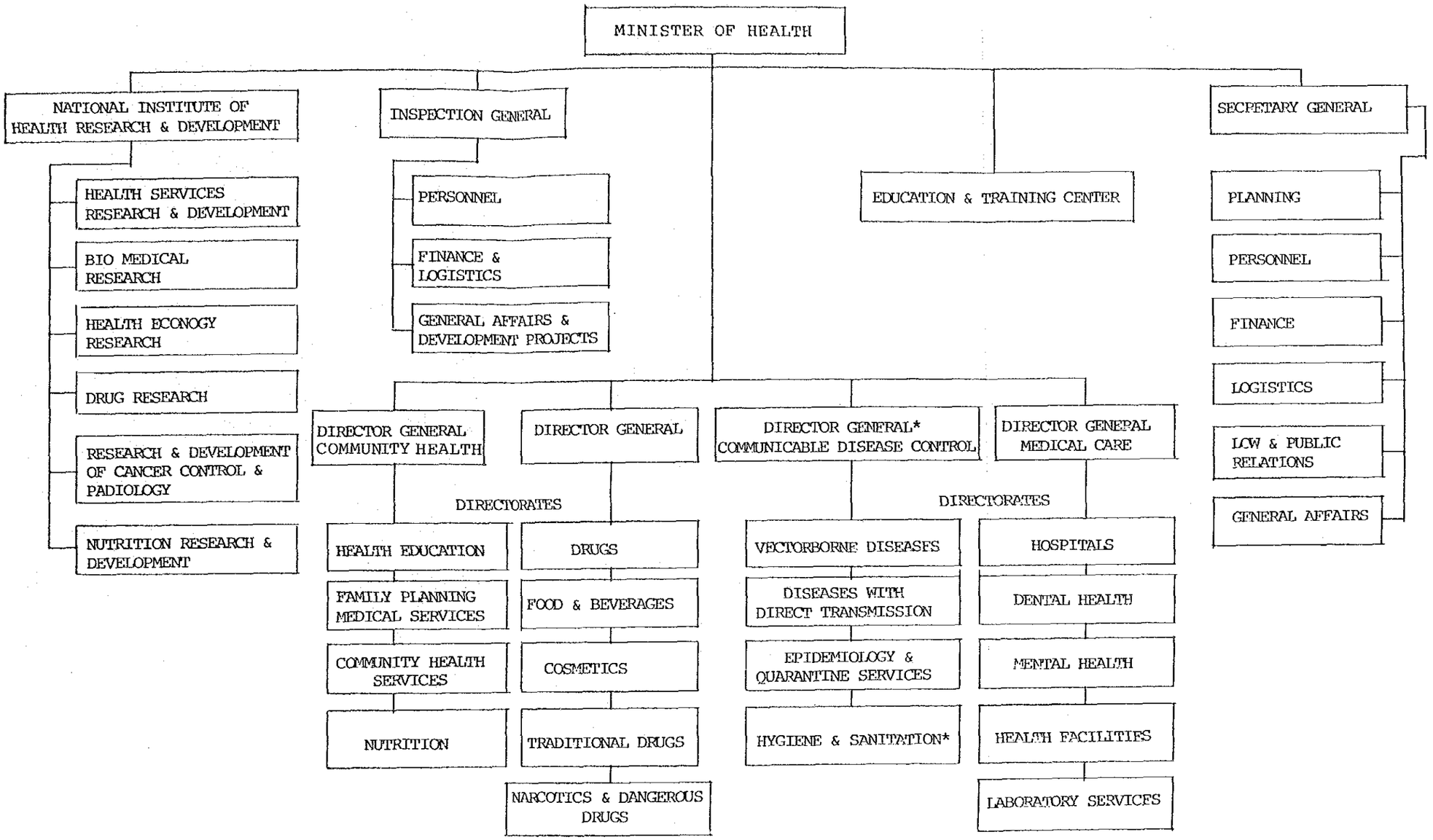


Fig. C-8 ORGANIZATION CHART OF PROVINCIAL HEALTH SERVICES

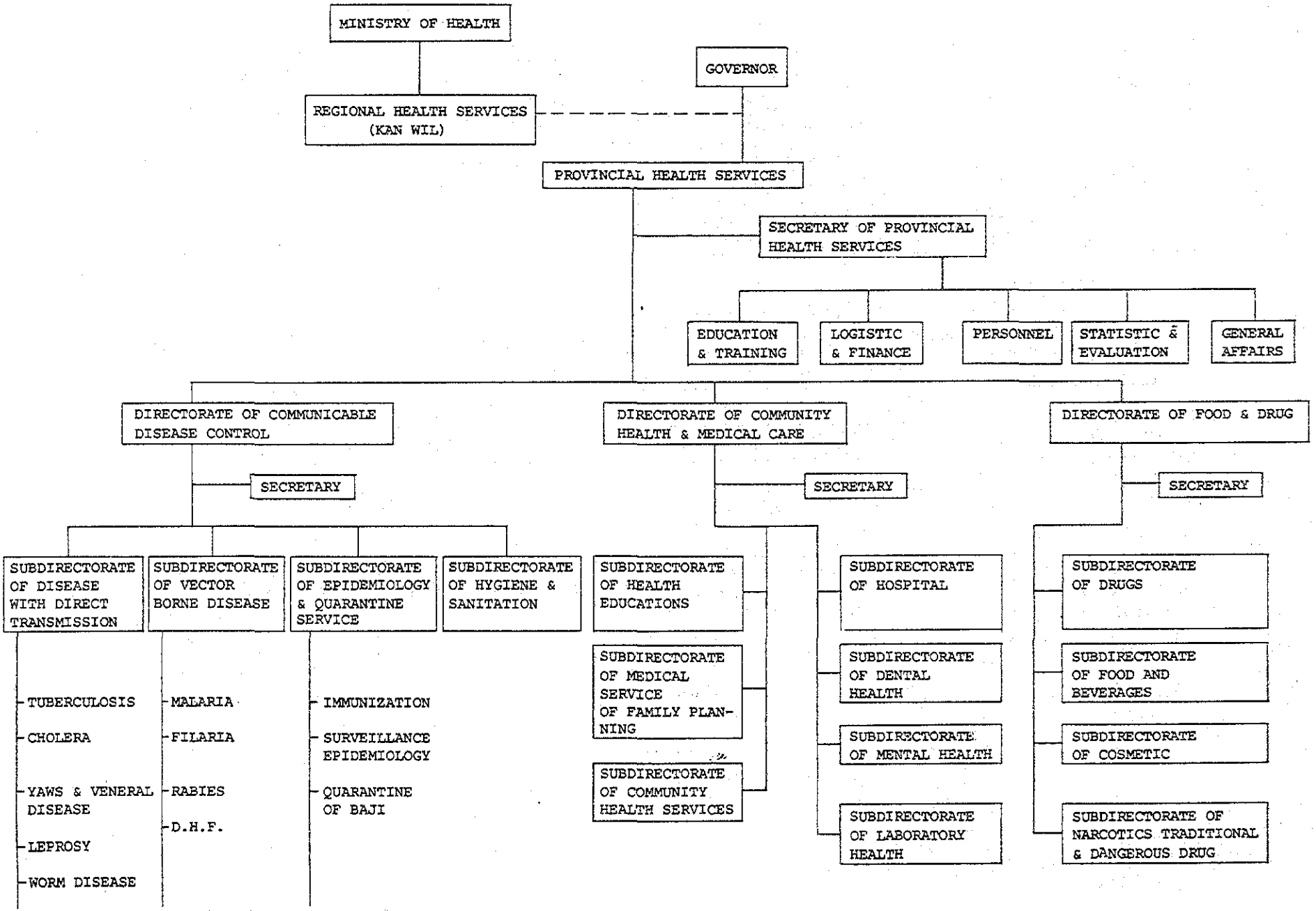
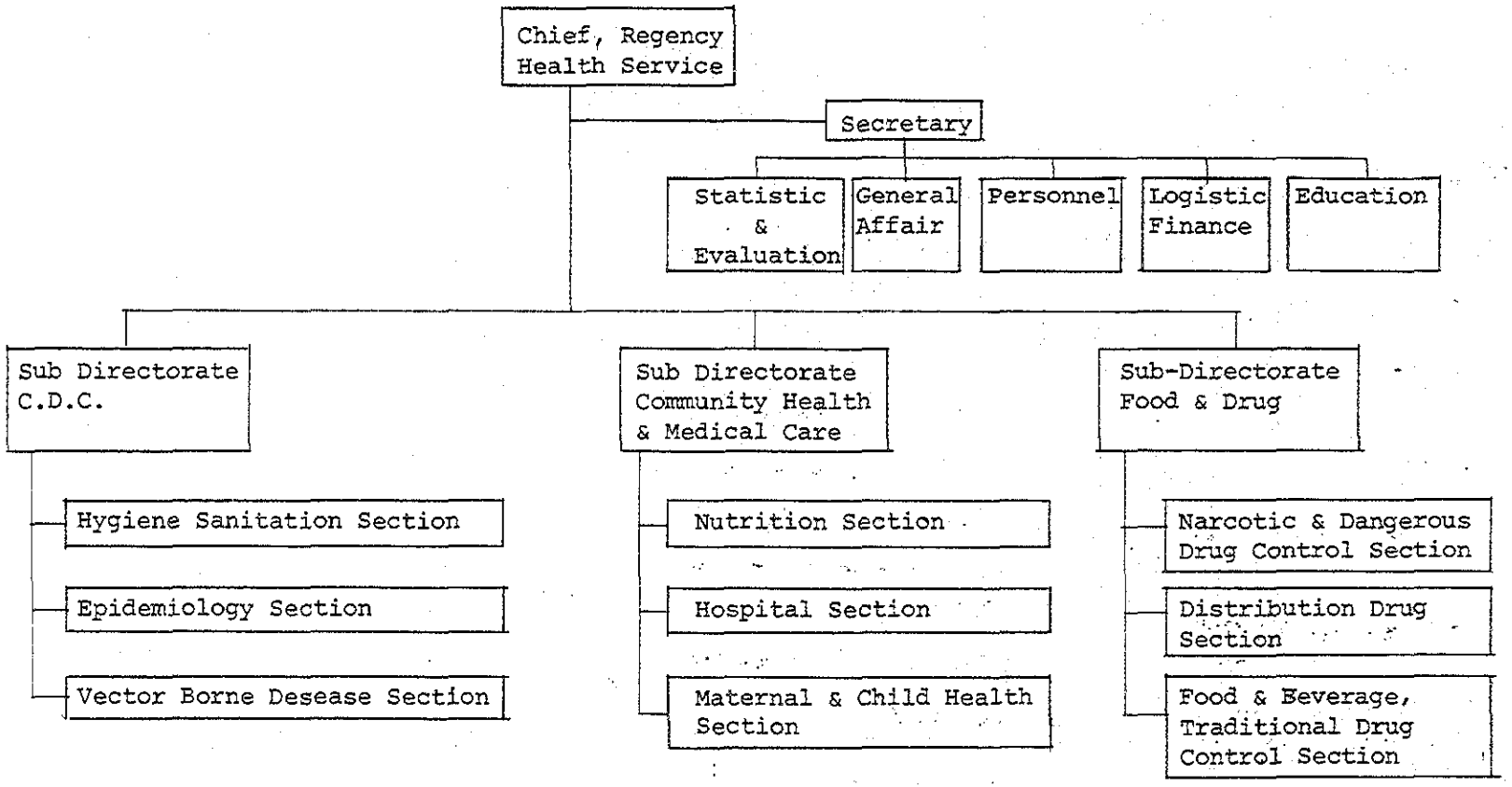


Fig. C-9 Organization Chart of Regency Health Service



APPENDIX D : RECORDS OF DISEASES IN THE PROJECT AREA

D-1: Disease Cases in the Project Area; 1973

		Medang Deras	Air Putih	Lima Puluh
Population		24,260	48,507	59,468
Number of Patients (Clinic Attendant)		2,988	3,258	2,427
Rate of Patient per 1,000		132.2	67.2	40.8
Five Main Diseases	1st	Malaria	Tuberculosis	Malaria
	2nd	Ulcer	Ulcer	Ulcer
	3rd	Diarrhea	Influenza	Tuberculosis
	4th	Bronchitis	Malaria	Aneamia
	5th	Avitaminosis	Bronchitis	Influenze

Source: Med. 77-17 (180) P. 80 JICA

D-2: Cases of Diarrhea, Cholera & Dysentery in the Project Area (1972-1973)

District	Population	Diarrhea		Cholera		Dysentery	
		'72	'73	'72	'73	'72	'73
Medang Deras	24,260	299	237	134	-	131	93
Air Putih	48,507	118	208	9	11	73	88
Lima Puluh	59,468	146	186	40	-	56	45
Total	132,235	563	631	183	11	260	226

Source: Med. 77-17 (180) P. 81 JICA

D-3: Weekly Statistics of Clinically Suspected Cholera in Three Districts of Project Area & Asahan Regency (1978)

Week		Medang Deras	Air Putih	Lima Puluh	Asahan Regency
Jan.	1	0	0	0	18/0
	2	0	0	0	5/0
	3	0	0	0	6/0
	4	0	0	0	1/0
Feb.	5	0	0	0	6/0
	6	0	0	0	1/0
	7	18/0	0	0	24/0
	8	23/0	0	0	24/0
	9	2/0	0	0	3/0
Mar.	9	2/0	0	0	3/0
	10	5/0	0	0	10/0
	11	0	4/1	0	4/1
	12	0	0	0	5/0
Apr.	13	12/0	0	0	13/0
	14	6/0	0	0	10/0
	15	0	0	0	5/0
	16	12/0	0	0	18/0
	17	8/0	0	0	10/0
May	18	0	0	0	5/0
	19	13/0	0	0	15/0
	20	0	2/0	0	6/0
	21	6/0	0	0	7/0
Jun.	22	8/0	0	0	13/0
	23	0	0	0	1/0
	24	7/0	0	0	9/0
	25	10/0	0	0	10/0
Jul.	26	0	0	0	0
	27	0	0	0	0
	28	2/0	0	0	3/0
	29	0	0	0	3/0
	30	2/0	0	0	3/0
Aug.	31	0	0	0	7/0
	32	1/0	0	0	17/2
	33	0	0	0	16/0
	34	0	1/1	1/1	25/5
Sept.	35	0	0	0	7/2
	36	0	0	0	11/0
	37	6/0	0	0	10/0
	38	0	0	0	4/0
Oct.	39	2/0	0	0	5/0
	40	3/0	0	0	9/1
	41	2/0	0	0	13/1
	42	0	0	0	9/0
	43	0	0	0	14/1
Nov.	44	2/0	0	0	8/1
	45	0	0	0	9/1
	46	0	0	0	11/1
	47	2/0	0	0	12/1
Dec.	48	2/0	0	0	6/0
	49	2/1	0	0	23/1
	50	15/0	0	0	15/1
	51	10/2	0	0	11/2
	52	24/1	0	0	26/1
Total		205/4	7/2	1/1	508/21

Scurce: Dr. N. H. Kumazawa (1979) JICA Expert, Medan

D-4: Clinically-Suspected Cholera Cases in the Project Area

Medang Deras & Air Putih (35 Weeks, 1979)
Lima Puluh (January to August 1979)
(p.); Plantation (p.h.); plantation (half)

District	Village	Number of Case	Number of Death	Population	Morbidity
	Pkl. Dodek	118	0	4,814	2.45%
	Sidomuloo	27	1	1,644	1.64%
	Sei Buah Keras	41	2	2,056	1.99%
	Aek Nauli	19	0	1,089	1.74%
Medang Deras	Nenas Siam	29	1	1,241	1.53%
	Durian	11	1	1,824	0.60%
	Medang	4	1	3,039	0.13%
	Pm. Cengkering	38	1	2,305	1.65%
	Sei Rakyat	59	5	1,694	2.48%
	Tang. Sigoni	0	0	964	-
	Lalang	7	1	2,294	0.22%
	Pakam	0	0	2,362	-
Subtotal		374	13	25,326	1.48%
	Limau Sundai	36	0	3,067	1.17%
	Pm. Panjang	24	0	3,375	0.71%
	Suka Raja	6	0	1,673	0.36%
	Aras	6	0	2,277	0.26%
	Tanah Tinggi	4	0	2,785	0.14%
	Tanjung Muda	3	0	1,310	0.23%
	Pasar Lapan	5	0	1,829	0.27%
Air Putih	Tanah Merah	2	0	1,026	0.19%
	Indrapura	13	0	3,809	0.34%
	Tanjung Kubah	7	0	2,667	0.26%
	Sipare-pare	19	0	2,696	0.70%
	Pm, Jering	15	0	2,496	0.60%
	Sei Suka Deras (p.h,)	8	1	2,454	0.33%
	Perk, Siparepare (p,)	1	0	1,405	0.07%
	Simodong	20	0	2,781	0.72%
	Laut Tador (p.h.)	not available		3,673	n.a.

- to be continued -

District	Village	Number of Case	Number of Death	Population	Morbidity
	Tanjung Seri	18	0	2,866	0.63%
	Sei Simujur (p.h.)	2	0	2,171	0.09%
Air Putih	Tanjung Kasau (p. p.h.)	4	0	4,193	0.10%
	Kwala Tanjung	1	0	2,190	0.05%
	Tanjung Parapat (p.)	not available		1,1731	n.a.
Subtotal		195	1	52,474	0.37%
	Lima Puluh (p.)	3	0	2,698	0.11%
	Sumber Makmur (p.h.)	0	0	1,295	-
	Antara	0	0	1,389	-
	Cahaya Pardomuan	0	0	1,320	-
	Kwara Gunung	0	0	912	-
	Air Hitam	1	0	2,960	0.03%
	Lubuka Besar (p.h.)	0	0	3,433	-
Lima Puluh	Empat Negri (p.h,)	1	0	2,631	0.04%
	Simpang Dolok (p.h.)	4	0	1,598	0.25%
	Pematang Panjang	0	0	6,222	-
	Guntung	2	1	6,337	0.03%
	Perpuk	9	3	6,227	0.14%
	Simpang Gambus	7	0	6,759	0.10%
	Perk. Lima Puluh (p.)	0	0	2,702	-
	Perk. T. Bambus (p.)	0	0	4,474	-
	Perk. Dolo (p.)	0	0	1,757	-
	Perk. L. Manis (p.)	0	0	780	-
	Perk. Kwara Gunung (p.)	0	0	719	-

- to be continued -

District	Village	Number of Case	Number of Rate	Population	Morbidity
	Perk. T. Itam Ulu (p.)	1	0	2,500	0.04%
Lima Puluh	Perk. T. Itam Iilir (p.)	0	0	1,408	-
	Sumber Padi (p.h.)	not available		1,883	n.a.
	Mangkai Baru (p.h.)	not available		3,575	n.a.
Subtotal		34	5	60,024	0.06%
Total		603	19	137,824	0.44%

D-5: Summary of Clinically Suspected Cholera Cases in the Project area

(By 35 weeks in 1979; Medang Deras, Air Putih & by August in Lima Puluh)

District	Population '73	Population '79	Case/Death	Morbidity	Fatality
Medang Deras	25,371	25,326	374/13	1.48%	3.47%
Air Putih	49,706	52,474	195/1	0.37%	0.51%
Lima Puluh	62,530	60,024	34/5	0.06%	14.71%
Total	137,607	137,024	603/19	0.44%	3.15%

Source: Med, 77-17 (180) 1977 December JICA
Dr. N. H. Kumazawa JICA Expert 15 November 1979
1979 study.

D-6: Positive Cases of Bacteriological Examination by Water Source

Water Source	Number of Examinees	Positive case	Positive Rate
Boring well	262	1	0.38%
Shallow well	282	7	2.48%
River water	103	1	0.97%
Total	647	9	1.39%

Note: Examination; bacteriological examination of rectal swab samples
Positive; Shigella flexineri 4
Shigella sonnei 5
Place; Sungai Buahkeras, Medang Deras

Source: N. H. Kumazawa & S. Sinulingga 6 October 1979

APPENDIX E : UNIT COST AND CONSTRUCTION COST OF EACH FACILITY

E-1. HARGA BAHAN DAN UPAH PEKERJA, 1979
(Unit Cost of Labor and Materials)

E-2. Data for Cost Estimate

E-3. Construction Cost of Each Facility

Appendix - E Unit Cost and Construction Cost of Each Facility

E-1 HARGA BAHAN DAN UPAH PEKERJA, 1979
(Unit Cost of Labor and Materials)

A. UPAH PEKERJA (Unit Labor Cost)

1.	Pekerja (Labor)	Rp.	800.-/hari (day)
2.	Tukang (Technician)	Rp.	1,600.-/hari (day)
3.	Mandor (Foreman)	Rp.	1,500.-/hari (day)
4.	Kepala Tukang (Chief of Technician)	Rp.	2,500.-/hari (day)

B. HARGA BAHAN (Materials Cost)

1.	Batu Bata (Brick)	Rp.	16.-/ps
2.	Batu Kali (River Stone)	Rp.	3,800.-/m^3
3.	Pasir Pasangan (Sand)	Rp.	2,000.-/m^3
4.	Kerikil Beton (Gravel)	Rp.	3,250.-/m^3
5.	Semen (Cement)	Rp.	1,800.-/zak
6.	Besi Beton (Steel Bar)	Rp.	400.-/kg

E-2 Data for Cost Estimate:

1. Daftar Analisa, Untuk Pekerjaan: Perlindungan Mata Air di Kp. Si-Biru^2 Kec.: Biru^2, Oktober 1978.
2. Rencana Biaya Pemasangan Pipa - Projek Air Minum Sematra Utara, Januari 1979.
3. Daftar Harga Satuan Pekerjaan, Bahan & Upah, DKI Jakarta, Mei 1979.
4. Quotation of Deep Well Construction, Submitted by a Local Well Drilling Contractor in Jakarta, September 1979.
5. Quotation of Deep Well Construction, submitted by an Indonesian Consulting Farm in Jakarta, September 1979.

E-3 Construction Cost of Each Facility

Type-A Facility Construction Cost

ITEM NO.	WORK DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (RP.)	AMOUNT
I	Deep Well (Semi-deep well)				
I.1	Transportation and preparation	1	L.S.		700,000
1.2	Drilling of 200 mm diameter deep well	60	M	22,000	1,320,000
1.3	Soil and water sampling	1	L.S.		100,000
1.4	Furnish and install well casing of 100 mm diameter	60	M	9,000	540,000
1.5	Gravel packing and cement seal	1	L.S.		400,000
1.6	Testing and other miscellanious works	1	L.S.		240,000
	Sub-total I				3,300,000
II	Bathing and Washing Facilities				
II.1	Earth work and leveling works	1	L.S.		200,000
II.2	Concrete works including reinforcement bar and shuttering, curing and all other necessary work complete				
a.	R.C. for water tank (1:1.5:3 mix.)	-	M^3	-	-
b.	Floor conc. (1:2:4 mix.)	2.0	M^3	25,000	50,000
c.	Base conc. (1:3:6 mix.)	4.0	M^3	22,000	88,000
II.3	Brick masonry including cement mortar (1:4 mix.) works and other necessary works	11.0	M^3	23,000	253,000
II.4	Plastering including curing, cleaning and necessary fcaffolding	88.0	M^2	1,000	88,000
II-5	Stone balast foundation including leveling and tamping	5.0	M^3	4,000	20,000
II.6	Furnish and install a hand pump	1	Ea	-	80,000
II.7	Mescellanious works	1	L.S.		11,000
	Sub-total II				610,000

ITEM NO.	WORK DESCRIPTION	QUAN-TITY	UNIT	UNIT PRICE (RP.)	AMOUNT
III	Drain Facilities				
III.1	Sub-surface filter trench	1	L.S.		50,000
	Sub-total III				50,000
IV	Spare Parts and Tools				
IV.1	Tool kits	1	L.S.		20,000
IV.2	Spare parts	1	L.S.		20,000
	Sub-total IV				40,000
	TOTAL OF TYPE-A				4,000,000

Type-B Facility Construction Cost

ITEM NO.	WORK DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (RP.)	AMOUNT
I	Deep Well (Semi-deep Well)				
I.1	Transportation and preparation	1	L.S.		700,000
1.2	Drilling of 200 mm diameter deep well	200	M	27,000	5,400,000
1.3	Soil and water sampling	1	L.S.		100,000
1.4	Furnish and install well casing of 100 mm diameter	200	M	9,000	1,800,000
1.5	Gravel packing and cement seal	1	L.S.		500,000
1.6	Testing and other miscellanious works	1	L.S.		400,000
	Sub-total I				8,900,000
II	Bathing and Washing Facilities				
II.1	Earth work and leveling works	1	L.S.		20,000
II.2	Concrete works including reinforcement bar and shuttering, curing and all other necessary work complete				
a.	R.C. for water tank (1:1.5:3 mix.)	3.0	M^3	12,000	360,000
b.	Floor conc. (1:2:4 mix.)	2.0	M^3	25,000	50,000
c.	Base conc. (1:3:6 mix.)	5.5	M^3	22,000	121,000
II.3	Brick masonry including cement mortar (1:4 mix.) works and other necessary works	9.0	M^3	23,000	207,000
II.4	Plastering including curing, cleaning and necessary fcaffolding	64.0	M^2	1,000	64,000
II-5	Stone balast foundation including leveling and tamping	6.0	M^3	4,000	24,000
II.6	Pipes, valves and water taps		L.S.		45,000
II.7	Mescellanious works		L.S.		29,000
	Sub-total II				920,000

ITEM NO.	WORK DESCRIPTION .	QUAN- TITY	UNIT	UNIT PRICE (RP.)	AMOUNT
III	Drain Facilities				
III.1	Sub-surface filter trench		L.S.		50,000
	Sub-total III				50,000
IV	Spare Parts and Tools				
IV.1	Tool kits and spare parts	1	L.S.		30,000
	Sub-total IV				30,000
	TOTAL OF TYPE- B				9,900,000

Type-C Facility Construction Cost

ITEM NO.	WORK DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (RP.)	AMOUNT
I	Deep Well (Semi-deep well)				
I.1	Transportation and preparation	1	L.S.		700,000
1.2	Drilling of 250 mm diameter deep well	200	M	30,000	6,000,000
1.3	Soil and water sampling	1	L.S.		100,000
1.4	Furnish and install well casing of 150 mm diameter	200	M	14,000	2,800,000
1.5	Gravel packing and cement seal	1	L.S.		500,000
1.6	Testing and other miscellanious works		L.S.		400,000
	Sub-total I				10,500,000
II	Bathing and Washing Facilities				
II.1	Earth work and leveling works	1	L.S.		30,000
II.2	Concrete works including reinforcement bar and shuttering, curing and all other necessary work complete				
a.	R.C. for water tank (1:1.5:3 mix.)	4.0	M^3	12,000	480,000
b.	Floor conc. (1:2:4 mix.)	3.5	M^3	25,000	87,500
c.	Base conc. (1:3:6 mix.)	9.0	M^3	22,000	198,000
II.3	Brick masonry including cement mortar (1:4 mix.) works and other necessary works	10.5	M^3	23,000	241,500
II.4	Plastering including curing, cleaning and necessary fcaffolding	84.0	M^2	1,000	84,000
II-5	Stone balast foundation including leveling and tamping	10.0	M^3	4,000	40,000
II.6	Pipes, valves and water taps	1	L.S.		45,000
II.7	Mescellanious works	1	L.S.		34,500
	Sub-total II				1,240,000

ITEM NO.	WORK DESCRIPTION	QUAN-TITY	UNIT	UNIT PRICE (RP.)	AMOUNT
III	Drain Facilities				
III.1	Sub-surface filter trench	1	L.S.		50,000
	Sub-total III				50,000
IV	Spare Parts and Tools				
IV.1	Tool kits and spare parts		L.S.		30,000
	Sub-total IV				30,000
	TOTAL OF TYPE-C				11,820,000

Type-D Facility Construction Cost

ITEM NO.	WORK DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (RP.)	AMOUNT
I	Deep Well (Semi-deep well)				
I.1	Transportation and preparation	1	L.S.		700,000
1.2	Drilling of 250 mm diameter deep well	200	M	30,000	6,000,000
1.3	Soil and water sampling	1	L.S.		100,000
1.4	Furnish and install well casing of 150 mm diameter	200	M	14,000	2,800,000
1.5	Gravel packing and cement seal	1	L.S.		500,000
1.6	Testing and other miscellanious works	1	L.S.		400,000
	Sub-total I				10,500,000
II	Bathing and Washing Facilities				
II.1	Earth work and leveling works	1	L.S.		50,000
II.2	Concrete works including reinforcement bar and shuttering, curing and all other necessary work complete				
a.	R.C. for water tank (1:1.5:3 mix.)	5.5	M^3	120,000	660,000
b.	Floor conc. (1:2:4 mix.)	4.0	M^3	25,000	100,000
c.	Base conc. (1:3:6 mix.)	10.0	M^3	22,000	220,000
II.3	Brick masonry including cement mortar (1:4 mix.) works and other necessary works	18.0	M^3	23,000	414,000
II.4	Plastering including curing, cleaning and necessary fcaffolding	98.0	M^2	1,000	98,000
II-5	Stone balast foundation including leveling and tamping	11.5	M^3	4,000	46,000
II.6	Pipes, valves and water taps	1	L.S.		55,000
II.7	Mescellanious works	1	L.S.		47,000
	Sub-total II				1,690,000

ITEM NO.	WORK DESCRIPTION	QUAN-TITY	UNIT	UNIT PRICE (RP.)	AMOUNT
III	Drain Facilities				
III.1	Sub-surface filter trench	1	L.S.		70,000
	Sub-total III				70,000
IV	Spare Parts and Tools				
IV.1	Tool kits and spare parts	1	L.S.		40,000
	Sub-total IV				40,000
	TOTAL OF TYPE-D				12,300,000

APPENDIX F : SUPPLEMENTARY PLANNING

F-1. Planning of New Water Supply System at Indrapura Health Center

F-2. Alternative Planning with Pipeline for Limau Sundai Village

F-3. Technical Specifications (Example)

F - 1 PLANNING OF NEW WATER SUPPLY SYSTEM AT INDRAPURA HEALTH CENTER

1.1 Design Criteria

(1) Water demand

a.	Health Center	:	5 m^3/day,
b.	Laboratory	:	5 m^3/day,
c.	Neighbouring inhabitants	:	10 m^3/day
	Total		20 m^3/day

(2) Facilities required

a. Deep well with a depth of 150 m,
b. Submersible vertical turbine pump with electric motor,
c. Elevated water tank with a capacity of 10 m^3,
d. Public stand post with two taps, and
e. Pipelines to connect to the existing system and the proposed public stand post.

(3) Construction of the deep well

a.	Depth	:	150 m,
b.	Bore hole	:	250 mm in diameter,
c.	Casing pipe	:	150 mm in diameter, 50 m and 90 mm in diameter, 70 m, and
d.	Screen	:	80 mm in diameter, 30 m

(4) Submersible vertical turbine pump

Ø32 mm x 36 l/min x 25 m x 0.4 KW - single phase

(5) Elevated water tank

a.	Low water level	:	GL + 7.00 m
b.	Capacity	:	10 m^3
c.	Steel or RC made		
d.	Location	:	As shown on the drawing

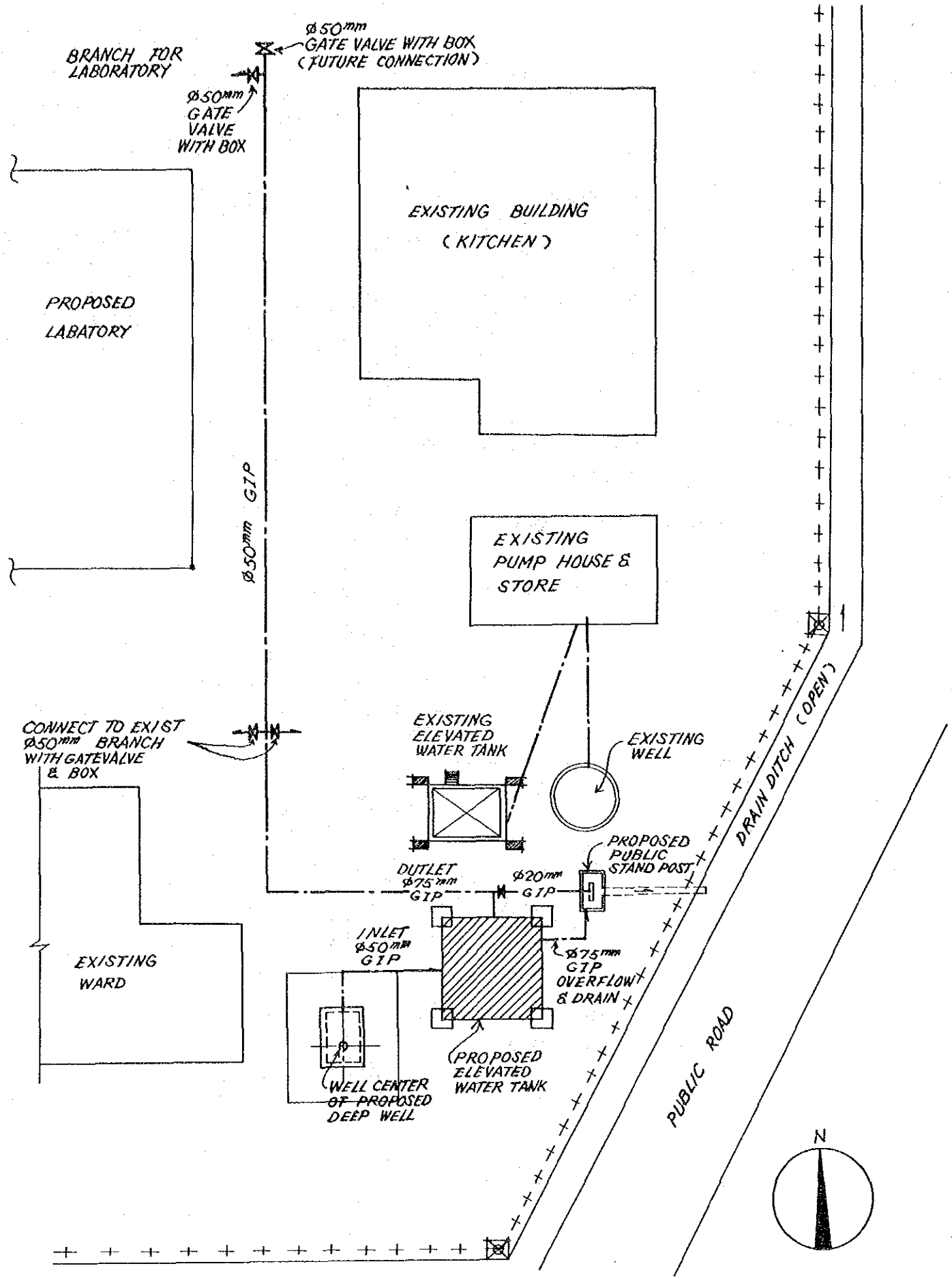


Fig. F-1 GENERAL PLAN OF WATER SUPPLY FACILITY AT INDRAPURA HEALTH CENTER S = 1/50

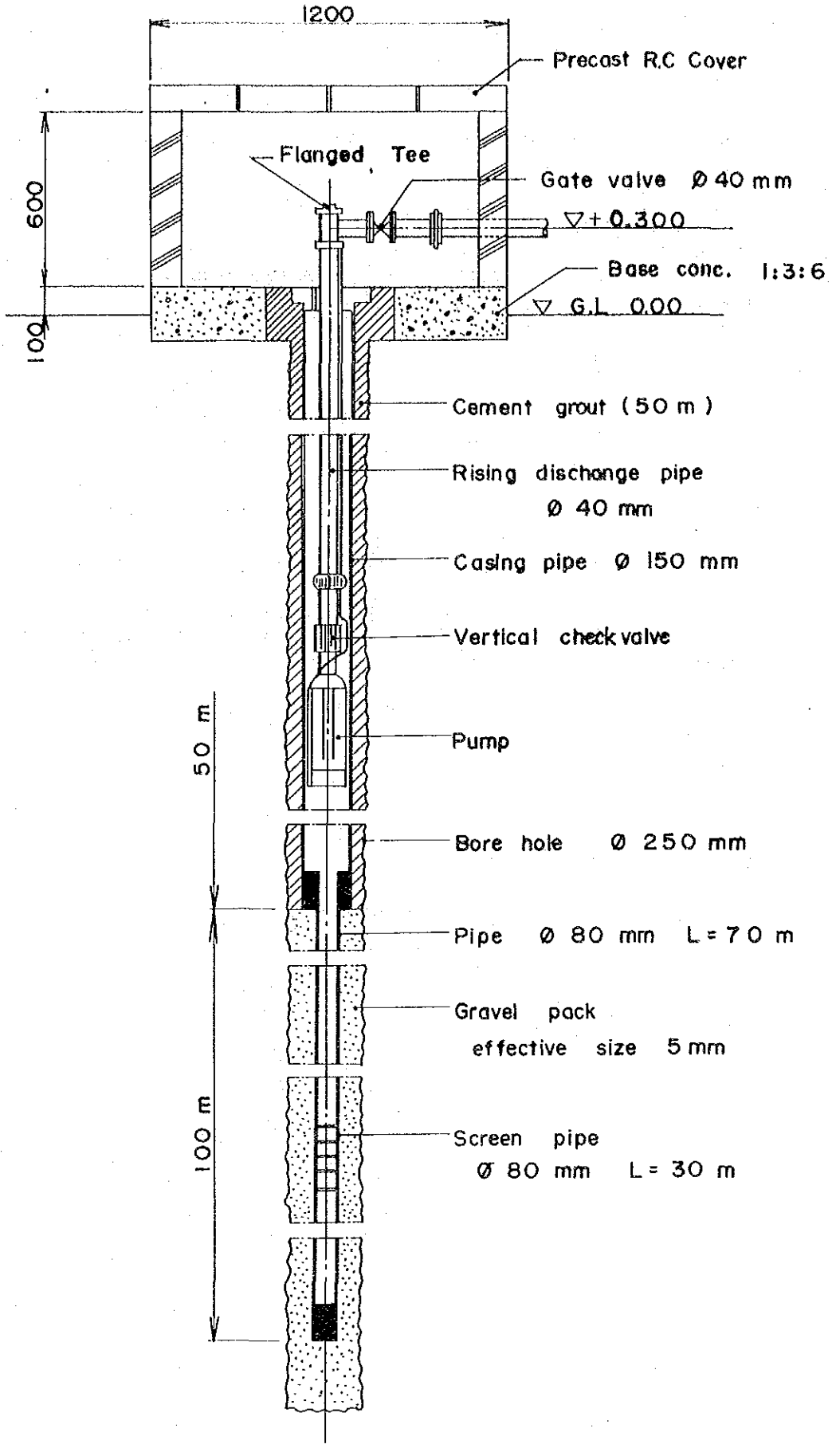


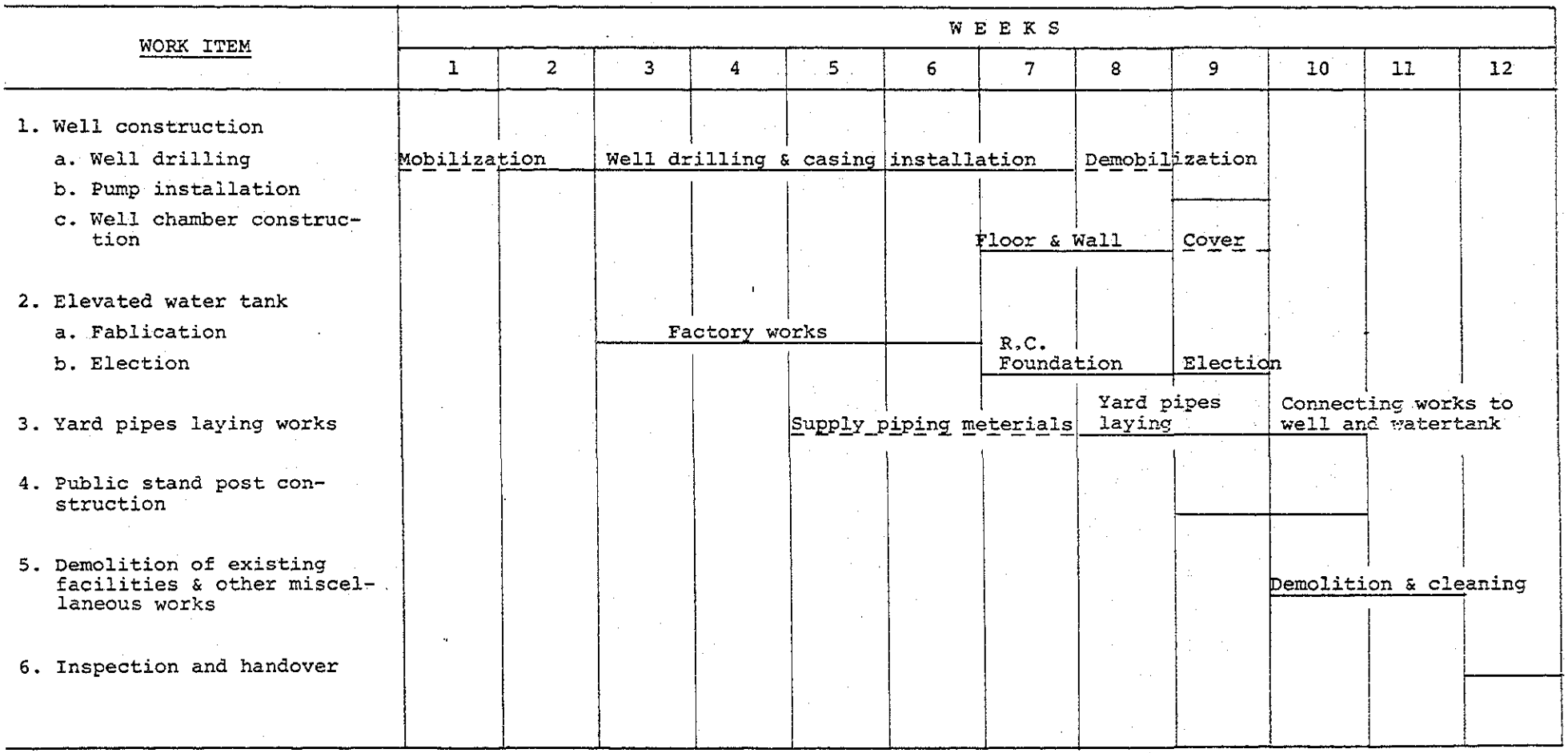
Fig. F-2 Well Structure and Pump Installation

F-1.2 Indrapura Health Center Water Supply Facilities Construction Cost

ITEM NO.	WORK DESCRIPTION	QUAN-TITY	UNIT	UNIT PRICE (RP.)	AMOUNT (RP.)
1	Deep Well				
1.1	Transportation and preparation	1	L.S.		700,000
1.2	Drilling of 250 mm diameter deep well	150	M	27,000	4,050,000
1.3	Soil and water sampling	1	L.S.		100,000
1.4	Furnish and install well casing of 150 mm diameter	50	M	14,000	700,000
1.5	Furnish and install well casing of 80 mm diameter	70	M	4,500	315,000
1.6	Furnish and install well screen of 80 mm diameter	30	M	40,000	1,200,000
1.7	Gravel packing and cement seal	1	L.S.		500,000
1.8	Testing and other miscellanious works	1	L.S.		400,000
1.9	Furnish and install submersible vertical turbine pump cap. 36 l/min, complete with electric motor and accessories	1	L.S.		4,000,000
1.10	Well chamber construction, as per specifications and drawings	1	L.S.		50,000
1.11	Miscellanious works	1	L.S.		285,000
	Sub-total 1				12,300,000

ITEM NO.	WORK DESCRIPTION	QUAN-TITY	UNIT	UNIT PRICE (RP.)	AMOUNT (RP.)
2	Construction of elevated water tank, with capacity of 10 cub. m, as per specifications and drawings	1	L.S.		1,700,000
3	Furnish and install pipes and valves in the yard, as per specifications and drawings	1	L.S.		300,000
4	Construction of public stand post, including civil works and water taps installation	1	L.S.		50,000
5.	Demolition of existing facilities (elevated water tank & others)	1	L.S.		150,000
	Grand Total				Rp.14,500,000

F-1.3 TENTATIVE CONSTRUCTION SCHEDULE FOR INDRAPURA H.C. WATER FACILITY



F - 1.4 SPECIAL PROVISION (TECHNICAL SPECIFICATIONS)

The special provisions are the integral part of the contract documents as well as the general conditions and the drawings for the contuction works contract. A Sample/model special provisions (technical specifications), which are applicable to the well construction works of the whole project, are described in the following sections.

1. GENERAL

1.1 The objective of the well drilling program in the project area of , Asahan Regency, North Sumatra specified herein, is to drill production wells as water sources for the water supply facilities of the as shown in the attached drawings.

The project shall be directed to provide good workmanship and engineering for construction of production wells, and when instructed by the Owner, pumping tests to obtain accurate data for the design of well pumps.

1.2 Project area:

The project area and the location or production wells in the area covered by this specification shall be as shown in the attached drawings.

1.3 Local condition:

The Contractor is required to satisfy himself regarding all local conditions affecting his work, by personal investigations,

and neither the information contained in this section nor that derived from other maps, logs, or information furnished by the Owner or its employees shall act to relieve the contractor of any responsibility of fulfilling any and all of the requirements of this Contract.

1.4 Access road :

An access road from a public way to the drilling site shall be provided by for moving-in of equipment.

1.5 Site Representative :

There shall be continuously on duty at the site during working hours a duly appointed representative of the Contractor who shall be acceptable to the Owner, and in whom shall be vested the necessary authority to supervise the proper execution of the work under the Contract. The representative of the Contractor shall be approved by the Owner prior to his being appointed, and shall not be removed from the project without the prior written consent of the Owner.

1.6 Records and Reporting :

The Contractor shall at all times keep complete and accurate records in accordance with sound engineering practice, and to the satisfaction of the Engineer. All records relating to the work shall be available to the Engineer at all times. In addition a copy of the drawings and specifications shall be kept at the work site at all times.

The Contractor shall report the daily progress of the work to the Engineer. The report shall include the quantities of materials

delivered to the site and used, labor and work, and also the cumulative totals, respectively.

1.7 Liquidated Damages :

The Contractor shall pay liquidated damages in an amount of two-tenths of one percent (0.2%) of the Contract price per day, upto a maximum of five percent (5%) of the total contract price for each day that the Contractor exceeds the agreed-upon time schedule of this contract as specified in the contract Proposal.

1.8 Termination of Contract Due to Excess Delay :

In the event that work behind schedule reaches a value of twenty percent (20%) of the contract price, the Contract may be subject to termination with no additional payment to be made to the Contractor.

2. EQUIPMENT

The following paragraph shall provide a minimal basis for the Contractor's selection of major equipment to be employed in execution of the Contract. For small equipment, such as water level indicator, descriptions in the applicable paragraphs shall be complied with. Other equipment with no such specific requirements shall be selected at the Contractor's option.

2.1 Drilling Machine :

The drilling machine shall be either a hydraulic rotary drilling machine or a cable tool percussion type, and the selection of a method will be at the option of the Contractor, with approval of the Engineer, considering factors such as the size and depth of the well being constructed, and the geologic

formations that are likely to be penetrated. The drilling equipment shall be able to drill to a depth of 200 m with bore size of at least 250 mm.

3. MATERIAL

3.1 Well Casing

Well casing to be used hereunder as a part of production test well shall be of high grade, butt-welded or threaded and coupled steel pipe of the required nominal diameter, and shall conform to the requirements as set forth in JIS G 3452, or its equivalent.

Nominal dia.	O.D.	Min. Wall Thickness
80 mm	89.1 mm	4.2 mm
100 mm	114.3 mm	4.5 mm
150 mm	165.2 mm	5.0 mm

3.2 Well Screen

The Contractor shall submit bids on each of the following types of screen as shown in the Bidding Schedule. Final selection of type of screen to be provided by the Contractor will be decided by Cipta Karya after receipt of bids.

The requirements for the two types of well screen are as follow and as shown on the attached Drawing(Fig.4).

1. Continuous Slot - Well screen shall be mm diameter and shall be fabricated of low-carbon steel, double galvanized to resist corrosion. They shall be constructed with circumferential members attached to a series of interior longitudinal members. The circumferential member should be resistance-welded to the longitudinal members at each juncture.

The screen shall be of the continuous slot design without a restrictive pipe base. The screen slot opening width shall be 1.5 mm, and opening area shall comprise more than 10 percent of the total well screen surface area; or

2. Perforated Pipe - Well screen shall be perforated pipe with brass jacket. Perforated pipe shall be steel pipe having the same properties as the well casing and shall conform to the following requirements :

Nominal Dia.	O.D.	Min. Wall Thickness	Opening Area
80	89.1 mm	4.2 mm	5 percent
100	114.3 mm	4.5 mm	- " -
150	165.2 mm	5.0 mm	- " -

Perforation on the steel pipe shall be cut by machine. Wire shall be wound around the steel pipe to keep space and to support the brass jacket. The opening area of the brass jacket shall be more than percent, and the number and area of openings shall be such that the maximum pumping rate may be developed with a minimum loss of head.

The openings or slots shall be so designed as to prevent clogging and shall be free of jagged edges, irregularities or anything that will accelerate corrosion. Torch-cutting of pipe strainer shall not be accepted.

Packing Gravel :

Gravel pack material for wells shall be clean, with well-rounded grains that are smooth and uniform. The effective size of gravel shall be 1.5 mm and uniformity coefficient of less than 2.0. When continuous slot screens are employed, siliceous and well-graded gravels to fit slot openings of screen shall be

selected for packing. The gradation of the gravel pack will be decided when the surrounding soil material is known.

3.4 Approval of Material :

The Contractor is required to submit for the Engineer's approval, a list of materials which he intends to incorporate into the construction of the production test well, with manufacturer's bulletins or catalog cuts showing the materials conforming to the specification requirements.

4. INSTALLATION OF PRODUCTION WELL

The installation of production wells shall conform to the following procedure :

a. Drill a required size borehole to the designated depth.
b. Assist to conduct an electric logging of borehole.
c. Collect soil and water samples.
d. Install well casing and screen as designed.
e. Pack graded gravels into the annular space between the borehole and the screen and casing.
f. Perform development work of aquifers tapped.
g. Conduct the pumping test as specified, under the direction of the Engineer.

5. DRILLING

5.1 Allowable Deviation :

The well shall be drilled with the diameter and to the depth as required by the Contract as shown in the attached drawing Fig. The bore of the well shall be plumb and straight, and shall be checked for the verticality after completion of the

drilling procedure, by means of an approved method. Allowable maximum deviation of the verticality shall be 20 mm per 100 lineal meters along the axis of well hole.

5.2 Caution :

The Contractor is required to use utmost care in the disposal of drill cuttings during drilling, in order not to cause any damage or create any hazards to existing facilities or structures.

5.3 Record and Test :

The Contractor shall provide a complete record of drilling operations and keep all samples of cuttings. Drilling-time log shall be kept always by the Contractor for the inspection of the Engineer. Samples shall be taken with every change of formation, and additional sampling made at every 1.5 m,or oftener if the occasion warrants. A complete set of samples with pertinent information in a sample box shall be forwarded to the Engineer. An accurate well log shall also be submitted.

6. BOREHOLE ELECTRIC LOGGING

The Contractor shall assist the Engineer in electric logging of the borehole.

7. SAMPLE ANALYSIS

Formation samples shall be taken by the Contractor from possible aquifers, as directed by the Engineer.

8. INSTALLATION OF WELL CASING AND SCREEN

The well screen and casing shall be set round, true to line

and centered. The plumbness and alignment of the well screen and casing shall be corrected by the Contractor at his own expense, and should he fail to correct any faulty alignment or plumbness, the Engineer may refuse to accept the well. Where individual pieces of casing and screen are installed, an accurate record shall be kept of the grades, sizes, and lengths, and the exact position shall be measured and reported by the Contractor.

9. GRAVEL PACKING

The annular space around the casing screen shall be filled with chemically inert and uncontaminated sand and gravel pack to the dimensions and to the elevations indicated in the attached drawing Fig. 5. The packing material shall be well graded and conform to the gradation requirements as set forth in Paragraph 5.03.3.

10. DEVELOPMENT

After the casing and screen are installed and the packing completed, the well shall be developed by bailing, rawhiding, surging, swabbing, high velocity jetting, air lift pumping, or a combination of these methods, or any other approved methods, until the sand content of produced water is less than 10 parts per million. Development shall be continued until all clogging mud has been washed from the wall of drilled well and the surrounding formations have been stabilized. The use of chemicals such as polyphosphate acid shall be made, with the approval of the Engineer, when the removal of mud wall seems extremely difficult.

11. SANITARY SEAL

At completion of testing, the depth of gravel pack shall be established at meters below ground surface; adding additional gravel, if necessary, to compensate for settlement and consolidation. A neat cement or impervious materials sanitary seal shall be installed from the top of the gravel pack to ground surface.

12. PROTECTION AND CLEAN UP OF SITE

The Contractor shall at all times protect and preserve all materials, supplies, and equipment of every description including property which may be Government furnished or owned. All reasonable requests of the Engineer to enclose or specially protect such property shall be complied with. If, as determined by the Engineer, materials, equipment, supplies and work performed are not adequately protected by the Contractor, such property may be protected by the Government and the cost thereof may be charged to the Contractor or deducted from any payments due to him. The Contractor shall protect all drainage, structures, embankments, or other property during the progress of this work. Debris shall not be washed into drainage structures that might cause clogging of drainage in any way. Upon completion of the well, and any test that may be required, the Contractor shall remove by bailing, sand pumping, or any other approved method, any sand, stone or other foreign material that may become deposited in the well, and shall leave the surrounding areas clear and ready for installation of permanent pumping equipment and appurtenant structures.

F-1.5 TECHNICAL SPECIFICATIONS FOR STEEL STORAGE TANKS

1. SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals necessary to construct steel storage tanks complete with all appurtenances as shown on the drawings and as specified herein. This specification shall apply to all steel tanks to be furnished except as otherwise specified in the Supplemental Specifications.

2. WORK SPECIFIED ELSEWHERE

Steel pressure tanks for compressed air and vacuum systems are specified under Section entitled "Vacuum and Compressed Air Systems" of Division

Welding of steel tanks shall confirm to applicable sections of Section titled "Metal Fobrication" of Division

Field painting and interior protective linings are specified in Division

Pipe connections to tank shall conform to Section titled "Piping" of Division

Structural steel shall conform to "Structural Steelwork" Division

Concrete foundations shall conform to provisions in Section titled "Concrete" of Division

3. GENERAL SPECIFICATIONS

The general arrangement, materials and methods of fabrication of steel tanks and their supports and accessories shall confirm to the applicable portions of JIS B8501, "Welded Oil Storage Tanks" except as

otherwise specified herein. All accessories for the tanks shall conform to the applicable sections of the above speciciations. Accessories not included above shall conform to applicable sections of AWWA D100, "Steel Tanks - Standpipes, REservoirs and Elevated Tanks - For Water Storage".

The tanks shall be fabricated of steel conforming to ASTM A36 - Structural Steel, A283 "Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality" Grade B; or JIS G3101 "Rolled Steel for General Structures" Class 2. Steel shall be free from laminations and imperfections.

Tanks shall have the capacity and be applicable for the service indicated on the drawings.

All storage is to be at ambient temperatures, unless noted otherwise. Each tank shall be of welded construction throughout unless noted otherwise. With the exception of structural steel shopes, all parts of steel tanks, except as specified otherwise shall be at least 6.00 mm thick.

Lap welded joints shall consist of minimum lap of metal of 2.54 cms (1 inch) at all points. Butt welds, with complete penetration and fusion, shall be used for all joints in the shell plates. All full penetration manual butt welded joints in plates greater than 8.0 mm (5/16-in) thickness shall have bevelled plate edges in accordance with joint designs recommended by the SAA Code for Welding in Building. All lap joints shall be fillet welded on both sides, one side of which may be seal weld only. Fillet weldments on both the outside and inside of the tank shall be continuous so as to eliminate crevices which prevent adequate painting or inside lining and contribute to early rusting and staining.

4. SHOP DRAWINGS

The Contractor shall prepared and submit to the Engineer for approval, complete shop drawings and engineering data for all steel tanks.

The shop drawings shall show all details of construction and erection including all welded joint details. The final locations of inspection manholes, ladders, pipe outlets, vents, will be made by the Engineer when the shop drawings are approved.

5. CLEANING AND PAINTING

For tank interiors no painting will be required unless required in the Supplemental Specifications. The representative of the Engineer will inspect the interior of tanks afterfabrication and testing to insure that they are cleaned out of all debris, dirt, scale and rust.

After the steel has been shop fabricated, the exterior surface of all steel plates and other parts of sections of the tanks shall be thoroughly cleaned in the shop and painted as specified in Division

After tanks have been erected and tested and are in readness for field painting, the exterior surfaces shall be cleaned of all dirt, rust, and foreign materials. After each section of tank has been installed and cleaned and before any surface rusting or spoiling occurs, such portion shall be spot primed.

Field painting shall be in accordance with the Standard Specification titled "Painting" of Division

F - 2 Alternative Planning with Pipeline for Limau Sundai

In this section an alternative study is carried out as a model case in Limau Sundai.

The purpose of this study is to analyze the technic and economic considerations related to alternative development of a pump/motor equipped deep well facility and a pipeline system for water supply to the neighboring Lorongs.

General layout of the alternative design in Limau Sundai is shown in Fig. F-3, and the facilities required for the alternative design are tabulated in a table in Fig. F-4. Cost estimates of the alternative design are made roughly and shown in Table F-3, as a reference to the original design compiled in the main body of this report.

Fig. F – 3 General Map of Alternative Study in Limau Sundai

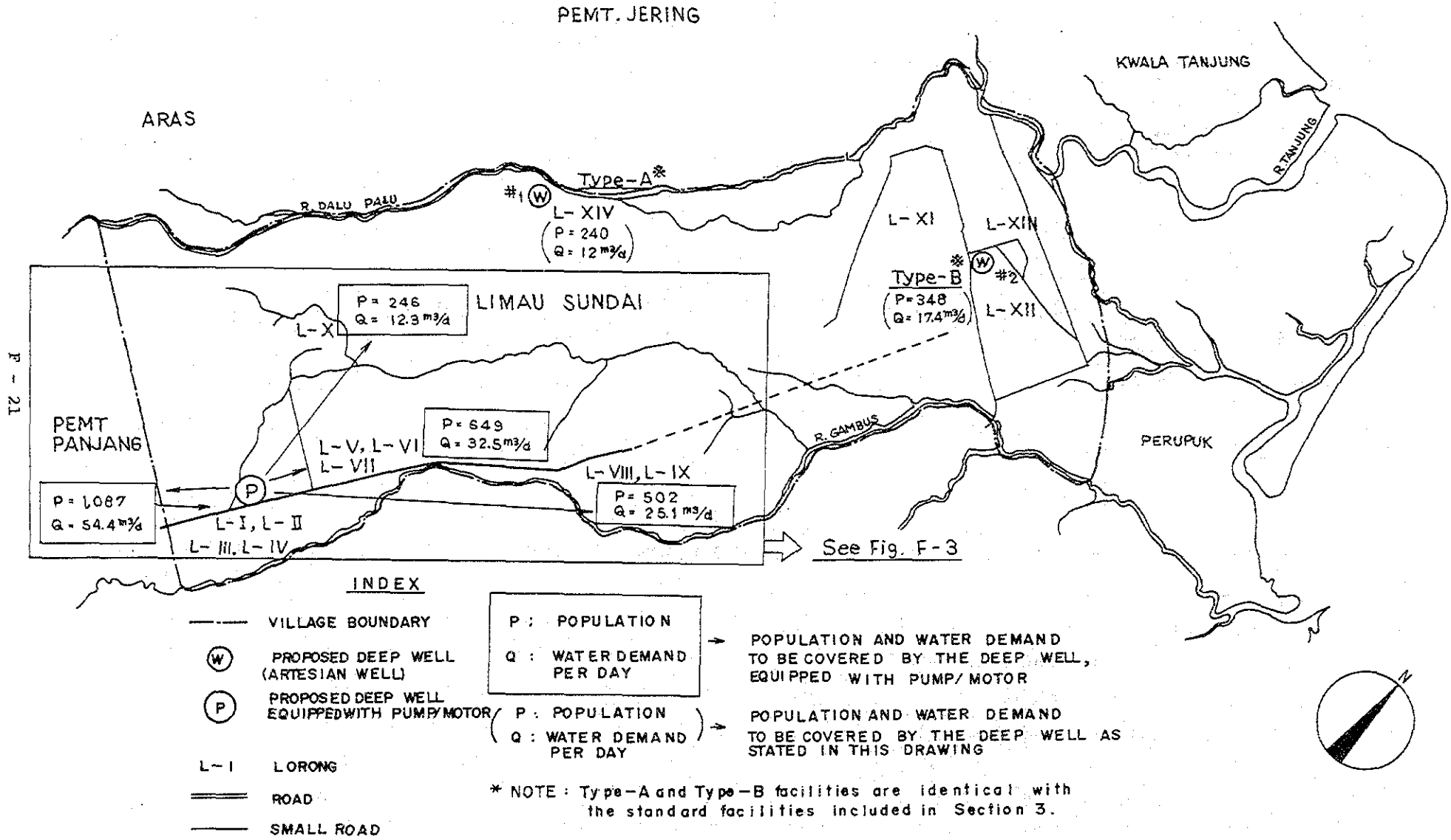
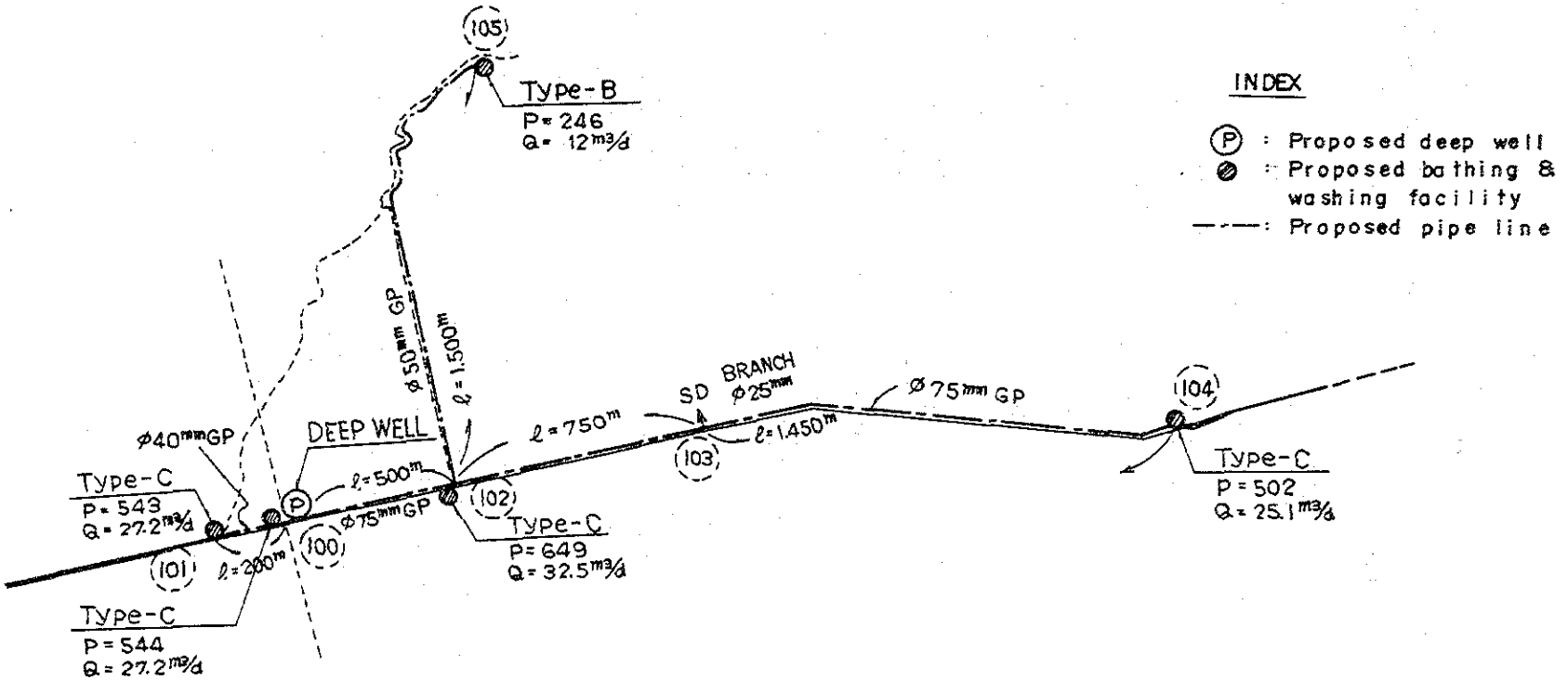


Fig. F — 4 Alternative Study Facility Design



DISCHARGE POINT NO	COVERING LORONG/ POPULATION	WATER DEMAND (cub M / day)	TYPE OF FACILITY REQUIRED
100	L-1, 2, 3, and 4 / 544	27.2	Type-C, with deep well, pump/motor
101	L-1, 2, 3, and 4 / 543	27.2	Type-C, without deep well
102	L-5, 6, and 7 / 649	32.5	-ditto-
103	Primary school	-	ø 25 mm Branch with two ø 13 mm taps
104	L-8 and 9 / 502	25.1	Type-C, without deep well
105	L-10 / 246	12.0	Type-B, without deep well
Total	2,484	124.0 cub M	

Table F - 2 Hydraulic Check of the Pipeline

Discharge points	L (m)	D (mm)	Q (l/sec)	I (o/oo)	Δh (m)
100 - 101	200	40	0.76	17	3.4
100 - 102	500	75	1.93	6	3.0
102 - 103	750	50	0.70	5	3.75
103 - 104	1,450	50	0.70	5	7.25
102 - 105	1,500	40	0.33	4	6.0
ΣΔh (100 through 104)					14.0 m

NOTE

L : Pipe length in meter

D : Pipe diameter in milimeter

Q : Flow rate in pipes in liters per second

I : Hydraulic gradient in permili

Δh : Loss of head in meter

In the above head loss calculation, G.S. Williams & A. Hazen's formula is adopted for the pipe of Ø75 mm and Weston's formula for Ø40 mm and Ø50 mm pipes.

Flow rate is calculated on the assumption that the water supply will be made within 10 hours a day, e.g. 7 o'clock to 17 o'clock.

The total demand of 124.0 cub.m per day will be:
124 cub.m per 10 hours = 12.4 m^3/hr = 0.207 m^3/min = 207 l/min.

F - 2.2 Cost Estimates of the Alternative Study

Table F - 3 Cost Estimates

Description of Works	Quantity	Cost (Thousand Rp.)
1. Type-C facility with deep well and submersible vertical turbin pump/motor, ø65 mm x 0.225 cub. m/min x 32 m x 3.7 kw.	1 unit	14,000
2. Type-C facility, water tank, bathing and washing space, without deep well.	3 units	3,900
3. Type-B facility, water tank, bathing and washing space, without deep well.	1 unit	970
4. ø75 mm pipe installation including valves, specials and fittings.	500 m	1,650
5. ø50 mm pipe installation including valves, specials and fittings.	2,200 m	5,050
6. ø40 mm pipe installation including valves, specials and fittings	1,700 m	2,890
7. Generator facility for pump/ motor, with capacity of 5 kw including oil storage tank and the power house.	1 L.S.	1,500
Total 1 through 7		29,960
8. Type-A facility, complete.	1 unit	4,000
9. Type-B facility, complete.	1 unit	9,900
Grand Total		Rp. 43,860

F-3. TECHNICAL SPECIFICATIONS (EXAMPLE)

SUBMERSIBLE VERTICAL TURBINE PUMPS

1. General

The Supplier shall furnish and deliver submersible vertical turbine type pumping unit(s) to the city of Each pumping unit shall be close coupled to an electric motor designed for sustained and continuous operation under water.

2. Performance and Dimensional Requirements

The pumping units shall meet the operating and dimensional requirements as shown in the following table.

Description	Schedule (1)	Schedule (2)
Number of Unit	1	
Power (min nameplate ratings) HP	4.7	
" (")KW	3.5	
Min cap at design head (litter/min)	36	
Design head -- TDH (meters)	25	
Well casing diameter (mm)	150	
Discharge diameter (mm)	32	
Length vertical discharge pipe (meters)	20	

3. Pump Construction

(a) General - Submersible pumping units shall conform to the requirements of JIS B8324 - Submersible Motor - Pump for Deep Well or "American Standards for Submersible Vertical Turbine Pumps" (AWWA Designation E101, Part B) and the following:

(b) Pump Bowl Assembly - The pump bowl assembly shall be equipped with cast-iron bowls and bronze impellers. The impellers shall be of cast bronze, smoothly finished and dynamically balanced. All bronze components shall conform to the requirements of ASTM Specification B62 or B145 or JIS H5111, BC-2 or BC-6. The bowls shall be of close grained cast-iron having a minimum tensile strength of 2,100 kg/cm^2, shall be free of blow holes, sand holes, and all other faults, and shall be accurately machined and fitted to close dimensions. The pump bowls shall be lined with porcelain enamel or epoxy. A pump bowl strainer of bronze shall be provided.

(c) Vertical discharge Column - The column pipe shall conform to the "Specifications for Wrought-Steel and Wrought-Iron Pipe" (ASA Designation B36.10) schedule 30 steel pipe or JIS G3454, STPG38, schedule 40 pipe, with threaded sleeve couplings. The column pipe shall be sandblasted and coated internally and externally with coaltar epoxy or a 250 micron vinyl system.

(d) Submersible Cable - The electric cable shall be sized in accordance with AWWA E1-1, Table 6. The cable shall be supported from the discharge column by non-magnetic stainless steel bands a minimum of every five (5) meters. A steel cable guard shall protect the cables where they pass the bowl assembly.

(e) Discharge Heads - The discharge head shall be of the surface plate type with with flanged elbow, of cast iron and dimensions according to the Table shown in subsection 2. The heads shall be designed to support the entire weight of the suspended parts. After fabrication the discharge heads shall be sandblasted and primed with one coat of red lead primer. The interior waterways shall be coated with epoxy or a 250-micron vinyl system. Anchor bolts shall also be furnished by the Supplier.

(f) Pump-Motor Coupling - The pump-motor coupling shall be of stainless steel and designed to transmit the total torque and thrust of the unit in either direction.

4. Motors

The motors shall be of the squirrel cage induction type, suitable for across-the-line starting and shall be capable of reduced-voltage starting. The motor shall be suitable for 220-volt, single-phase 50-hertz A.C. and capable of continuous operation under water. The motor temperature shall conform to the latest NEMA, JIS, JEC or JEM standards for submersible motors.

SHOP DRAWINGS

Working or shop drawings prepared by the Contractor for any item shall consist of such detailed plans as may be required for the prosecution of the works. They shall include but not limited to shop details, installation methods, erection plans, exact layout diagrams and diagrams showing location, size, details and connections for all equipment and materials and must be approved by the Engineer before any work involving these shop drawings is performed. Shop drawings shall incorporate complete lists of spare parts, special tools, and other materials stocks to be furnished for proper maintenance and operation of the equipment, as required by the Contract Documents. If no spare parts, special tools, or other items are to be furnished, the shop drawings shall specifically so state.

It is expressly understood that approval of the shop drawings by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval shall not be construed as permitting departure from the Contract requirements. Approval of such shop drawings will not relieve the Contractor of the responsibility for only error which may exist, as the Contractor shall be responsible for the dimensions and detailing of adequate connections details of mutual agreement of dimensions and details and satisfactory construction of all works. It is mutually agreed that the Contractor shall be responsible for agreement and conformity of his working drawings with the Contract drawings and specifications.

The Contractor shall submit to the Engineer three (3) complete sets of all working and shop drawings. These working and shop drawings shall be complete and shall contain all required detailed information. If approved by the Engineer each copy of the working and shop drawings will be identified by the Engineer as having received such approval by being so stamped and dated. The Contractor shall make any corrections required by the Engineer and resubmit six corrected copies for approval.

A title block shall be located in the lower right hand corner of each drawing. The title block shall display the following:

a. Number and title of drawing
b. Date of drawing or revision
c. Name of project structure of facility
d. Name of Contractor submitting drawing
e. Clear identify of contents and location of the works, specification, title and number

The size of working and shop drawings shall be the same size or half size of the Contract drawings. The size of small drawings and schedules may be either letter size (21.5 cm. by 28 cm.) or legal size (21.5 cm. by 33 cm.)

Drawings and schedules shall be checked and coordinated with the work of all descriptions involved before they are submitted for the approval to the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings submitted without this stamp of approval may be returned to the Contractor for resubmission.

The Contractor shall submit all drawings sufficiently in advance of construction requirements to permit no less than thirty (30) working days for checking and appropriate action. Additional time may be necessary for checking certain submittions and if necessary this is noted in the Supplemental Specifications. If the shop drawings are not approved then new submissions shall be prepared by the Contractor. The stated number of days for checking and action is required for each submission until approval is given.

If drawings show variations from the Contract requirements because of standard shop practice or for other reasons the Contractor shall describe such variations in his letter of transmittal. If acceptable the Engineer may approve any or all such variations subject to proper adjustment in the Contract requirements. If the Contractor fails to describe such variations he shall not be relieved of the responsibility for execution of the work in accordance with the Contract, even though such drawings have been approved.

If the drawings or schedules as submitted show a departure from the Contract requirements which the Engineer finds to be in the interest of the Authority and to be so minor as not to involve change in the Contract Price or time for completion the Engineer may approve the drawings.

One set of approved working and shop drawings will be returned to the Contractor. If the Contractor desires more than one set the requirements of quantity submitted shall be increased accordingly.

Upon approval of shop drawings, the Contractor shall furnish three (3) prints of each drawing and one (1) reverse reading, reproducible tracing of each drawing to the Engineer for his use.

The Contact Price shall include the cost of furnishing all working, shop and As-Built drawings and the Contractor will be allowed no extra compensation for such drawings.

Before final payment is made the Contractor shall furnish to the Engineer on original set of As-Built working and shop drawings clearly revised, completed and brought up-to-date showing the permanent construction as actually made.

These As-Built drawings shall be either drawn with plastic pencil on film base or reproduced by photographic process on film base from which clear prints can be made.