

Fig. 4 - 8

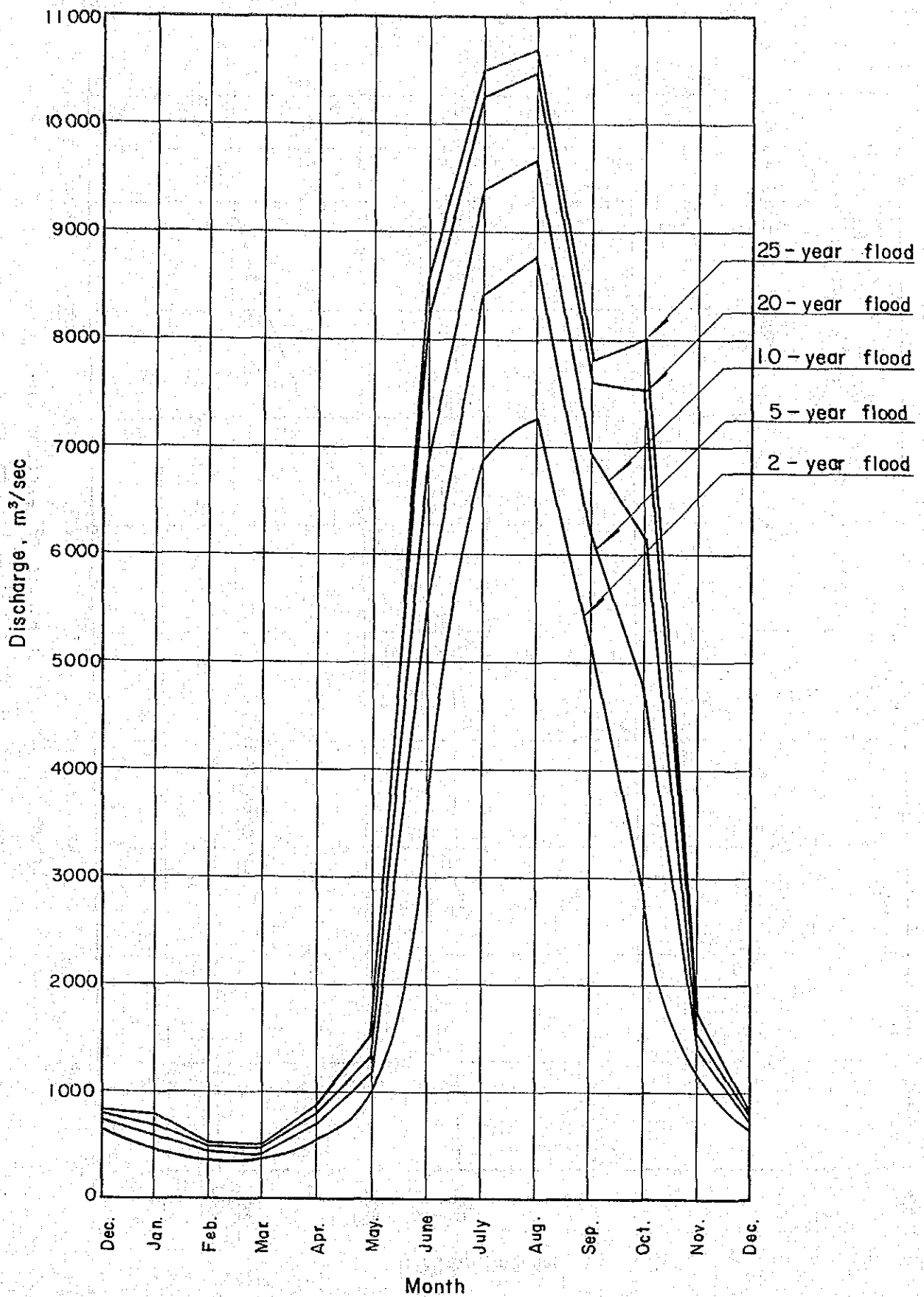


Figure 4-8 RECURRENCE INTERVAL OF DISCHARGE ON EACH MONTH

Fig. 4-9

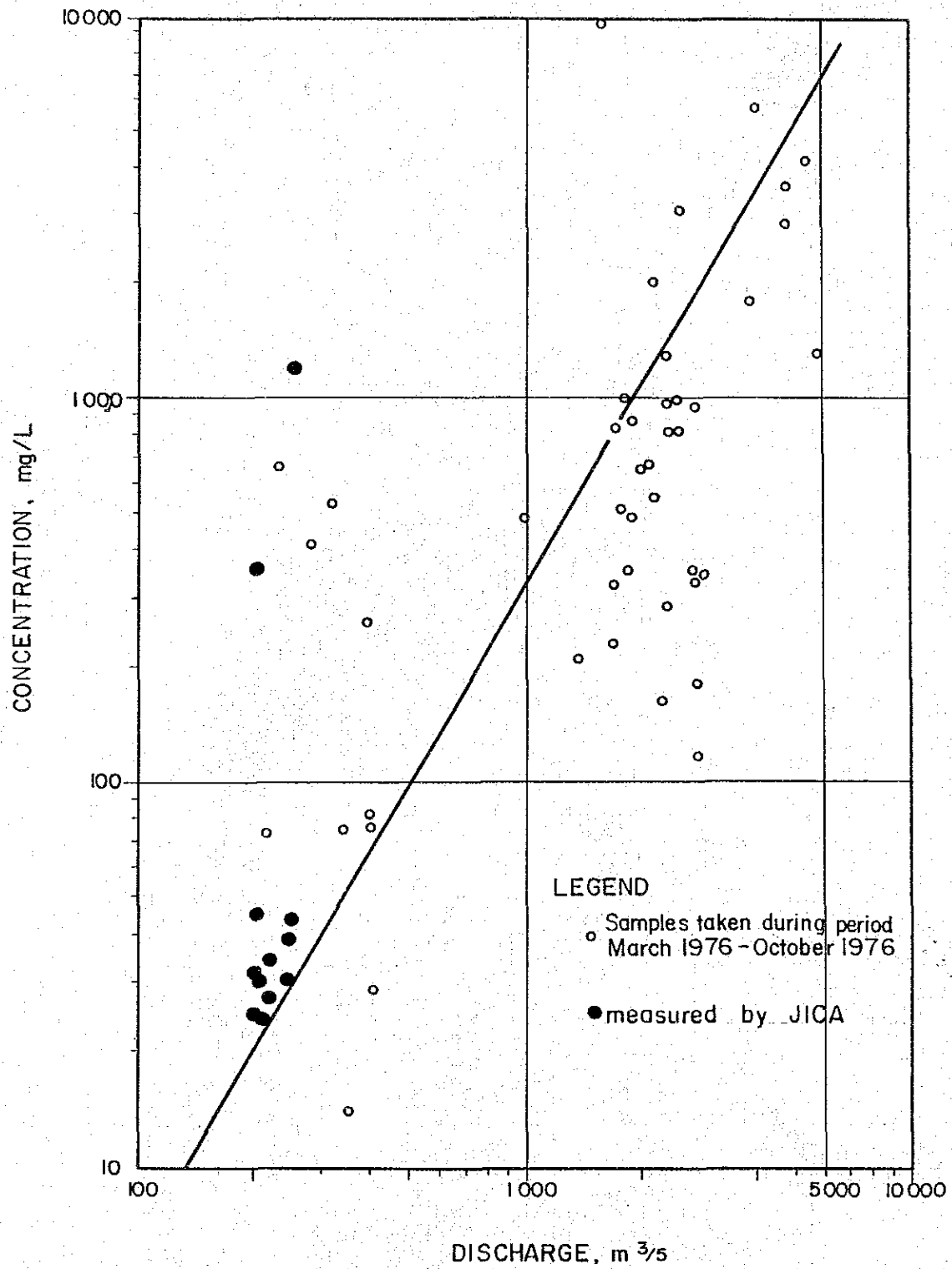
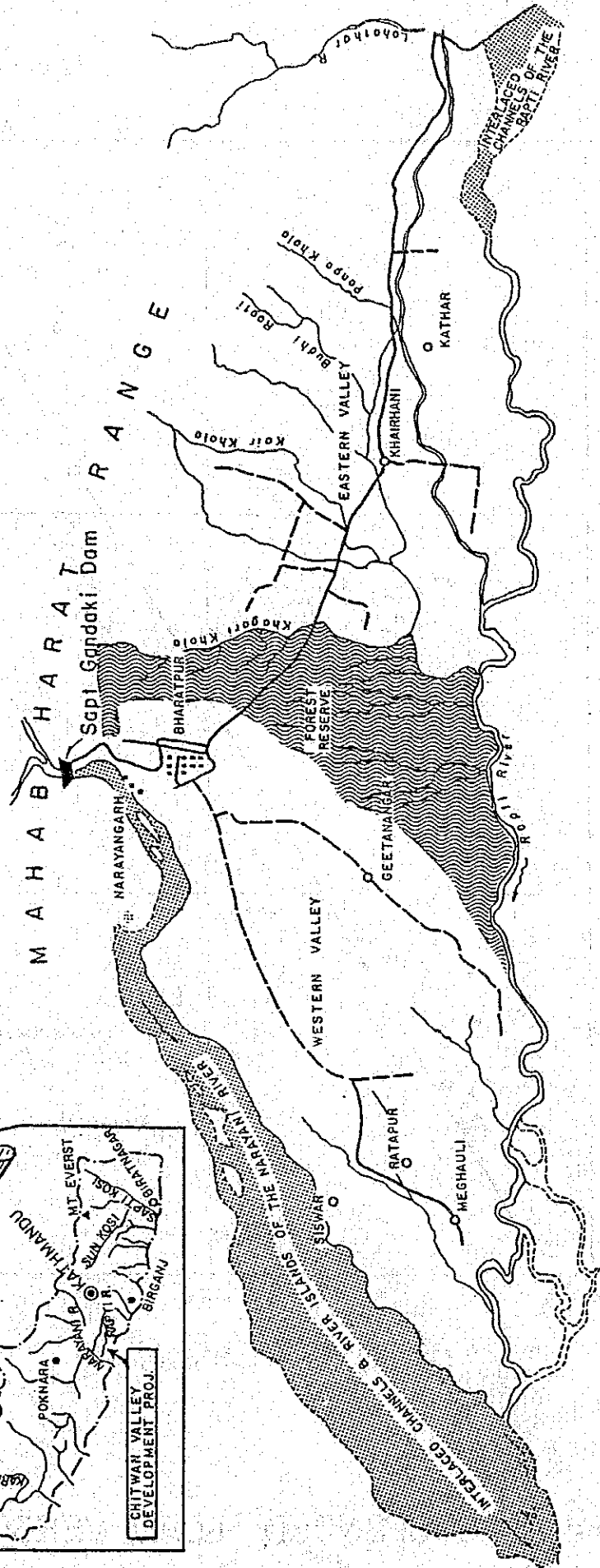
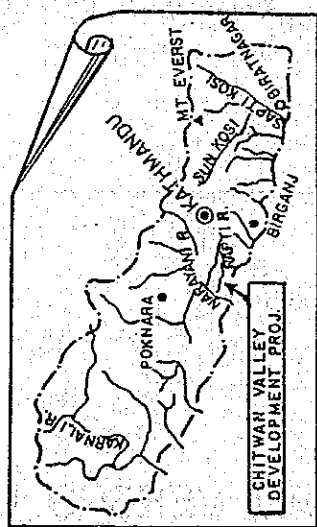
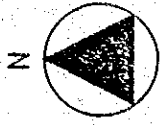


Figure 4-9 SUSPENDED LOAD VERSUS DISCHARGE

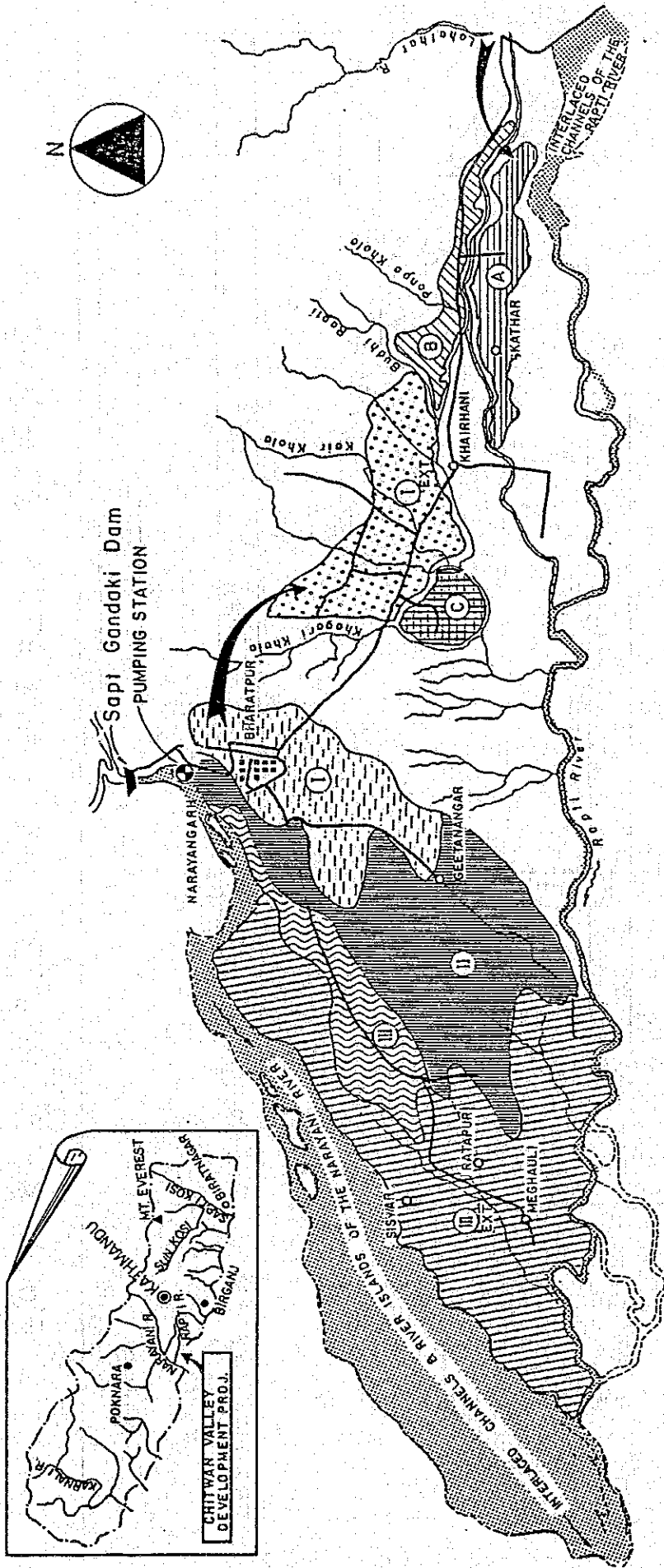


C H U R I A R R A N G E

Figure 4-10 CHITWAN VALLEY

== ROADS

Fig. 4-II



EASTERN ZONE		WESTERN ZONE		NARAYANI SYSTEM	
AREA NO.	N A M E	COMMANDED AREA (HA) NET AREA	AREA NO.	N A M E	COMMANDED AREA (HA) NET AREA
A	LOHATHAR	1,200	I	UPPER TERRACE	3,030
B	LOHATHAR SUPPLEMENT	700	II	MIDDLE TERRACE	5,570
I ^{EXT.}	UPPER TERRACE EXT.	2,300	III	LOWER TERRACE	1,940
C	KHAGERI	600	III ^{EXT.}	LOWER TERRACE EXT.	8,700

Figure 4-II CHITWAN VALLEY DEVELOPMENT PROJECT

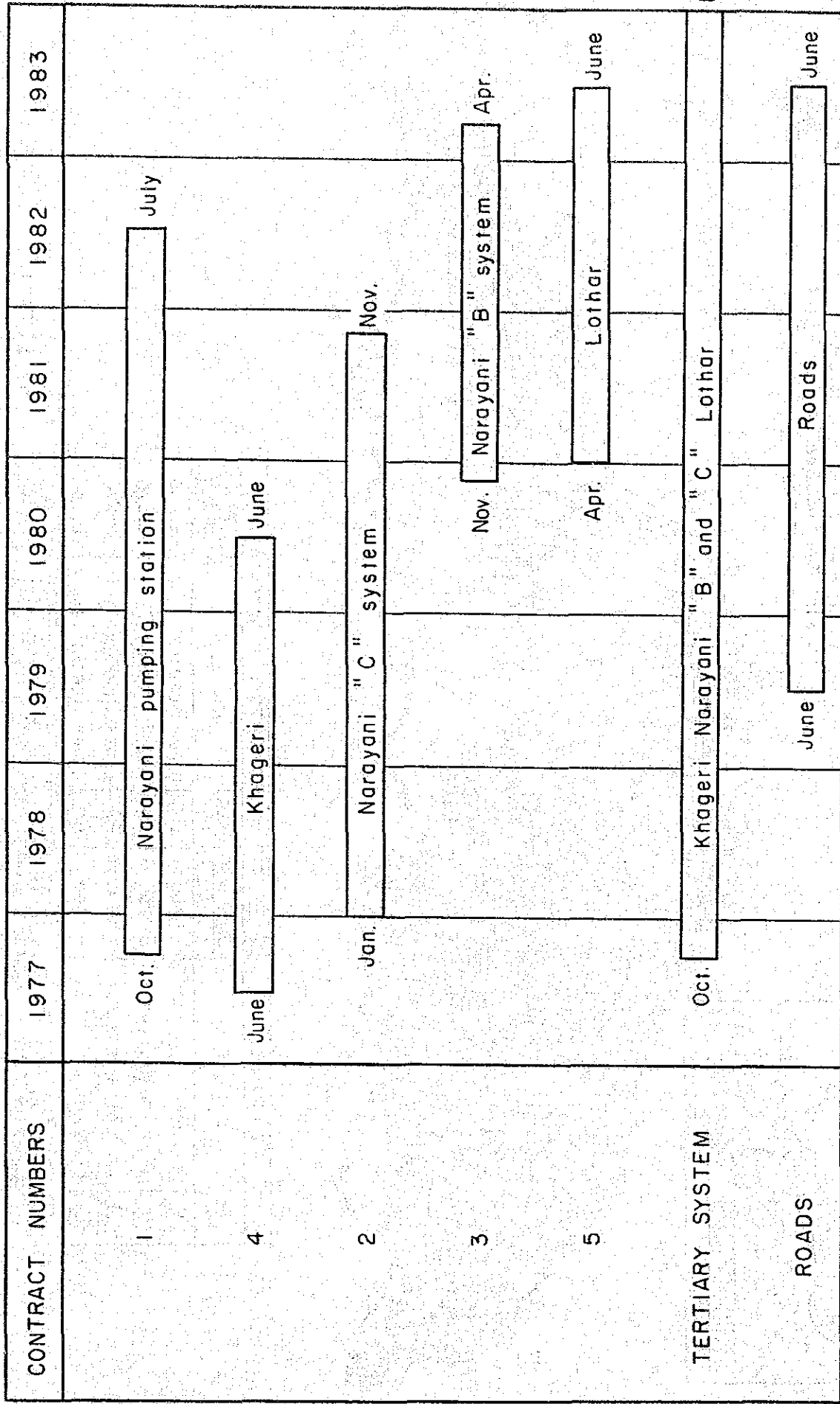


Figure 4-12 REVISED IMPLEMENTATION SCHEDULE OF CHITWAN VALLEY DEVELOPMENT PROJECT

Fig. 5-1

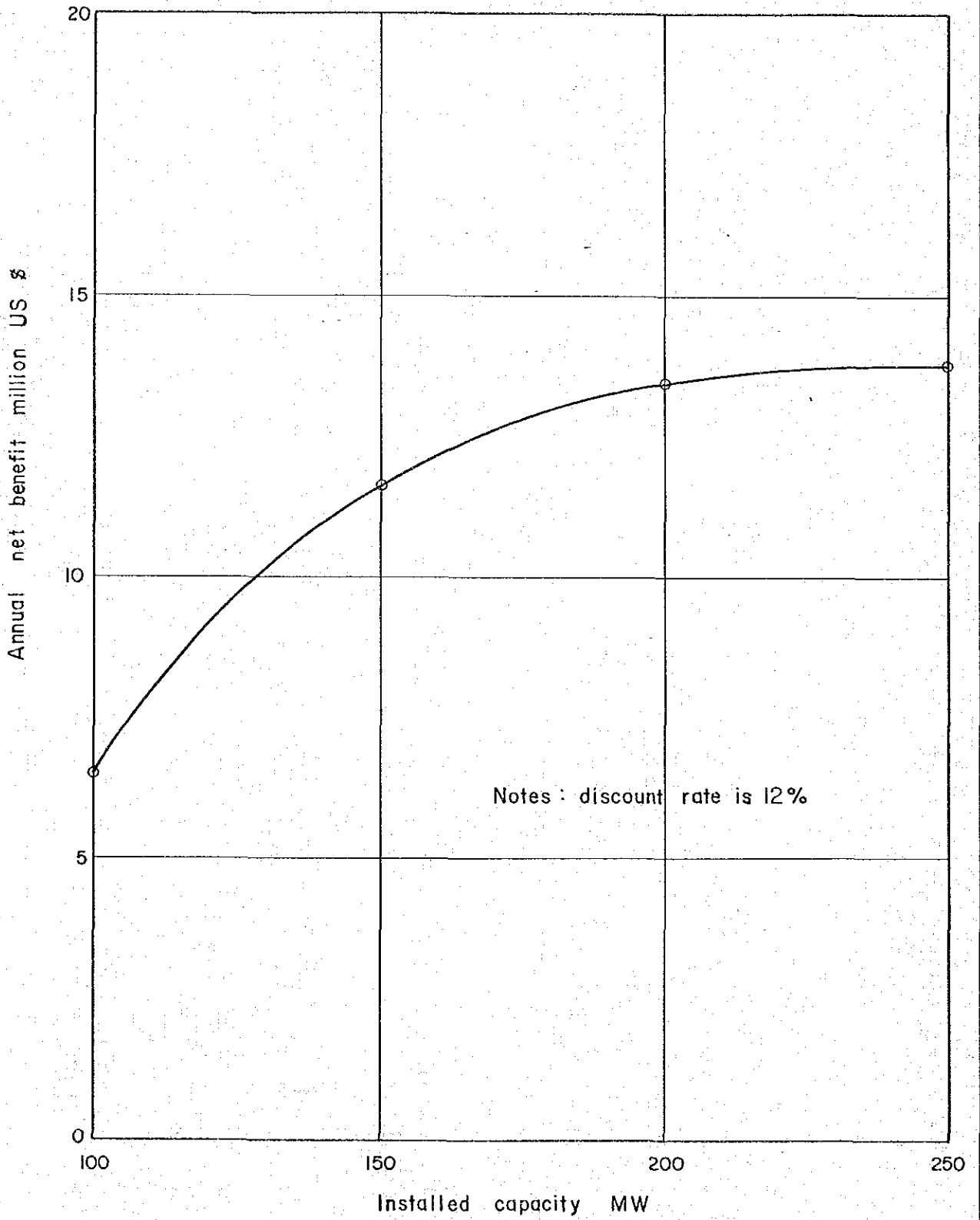
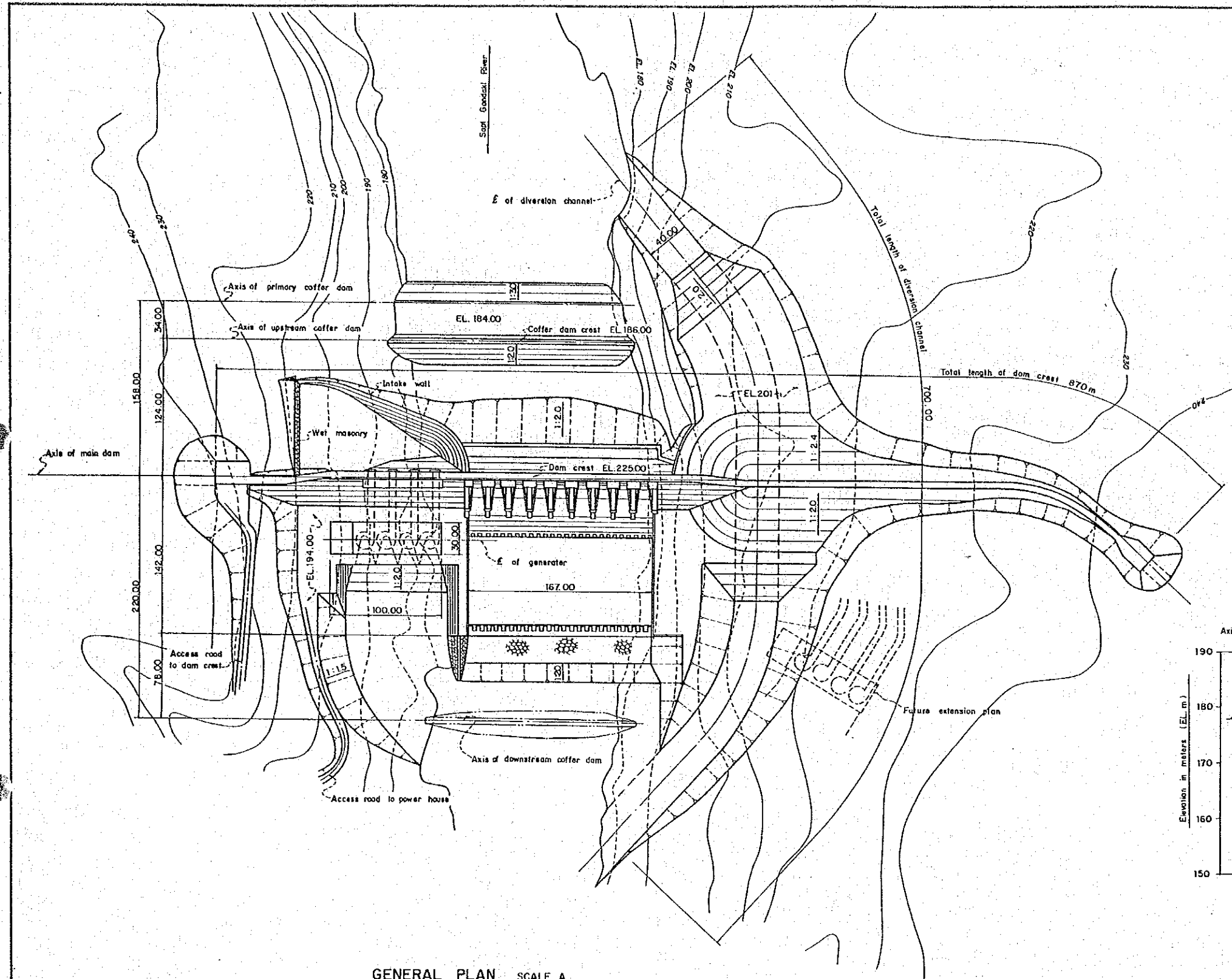
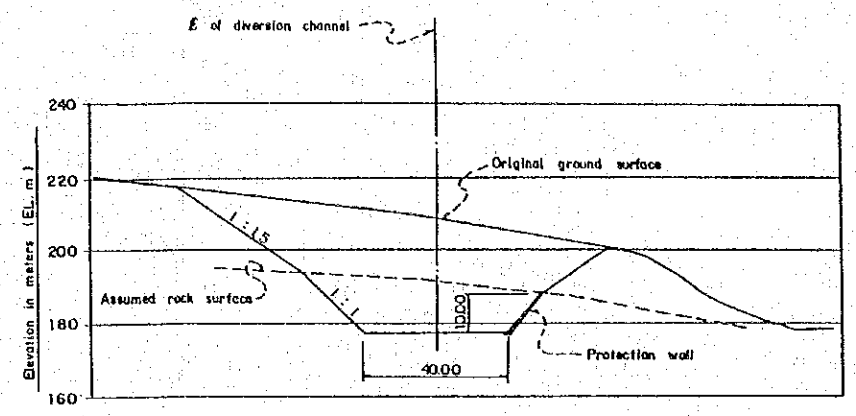


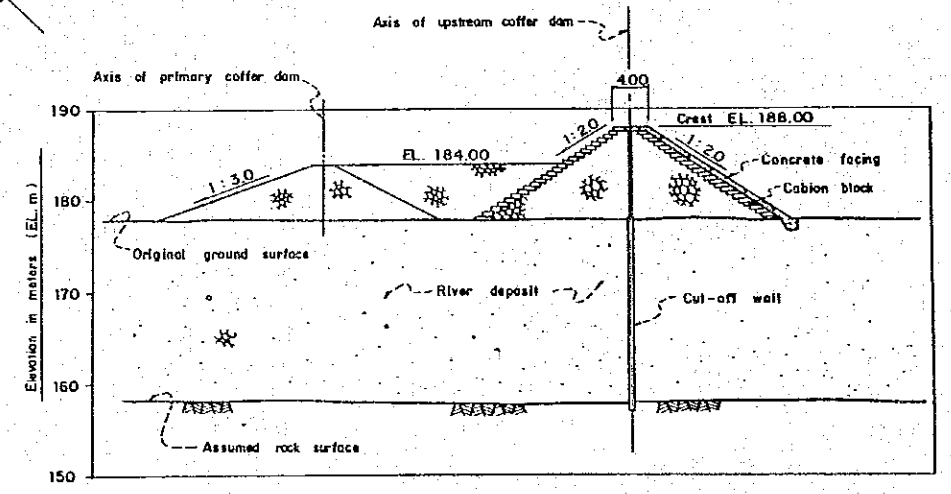
Figure 5-1 ECONOMIC NET BENEFIT



GENERAL PLAN SCALE A



TYPICAL SECTION OF DIVERSION CHANNEL SCALE B



TYPICAL SECTION OF UPSTREAM COFFER DAM SCALE C

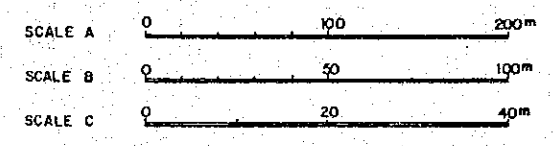
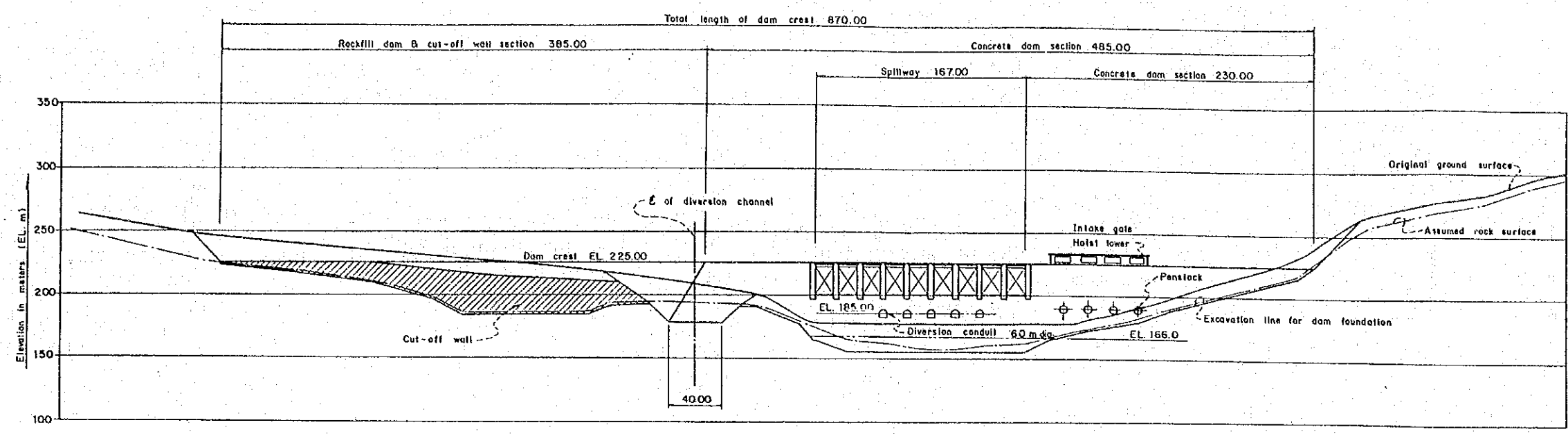
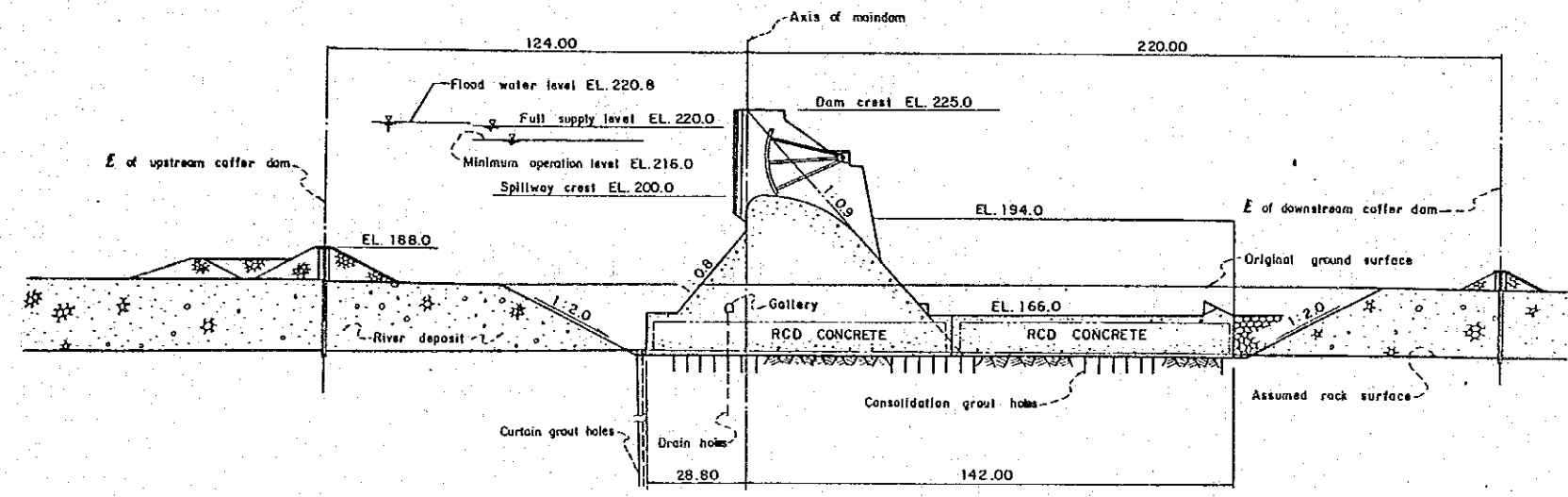


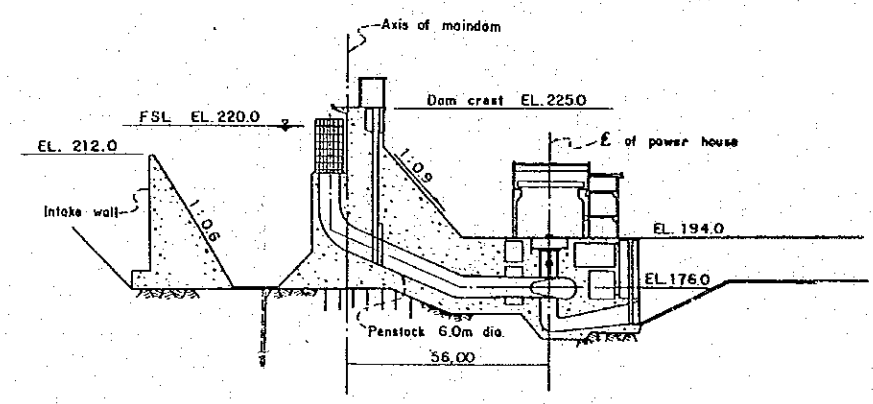
Figure 6 - 1 GENERAL PLAN OF DAM AND POWER PLANTS



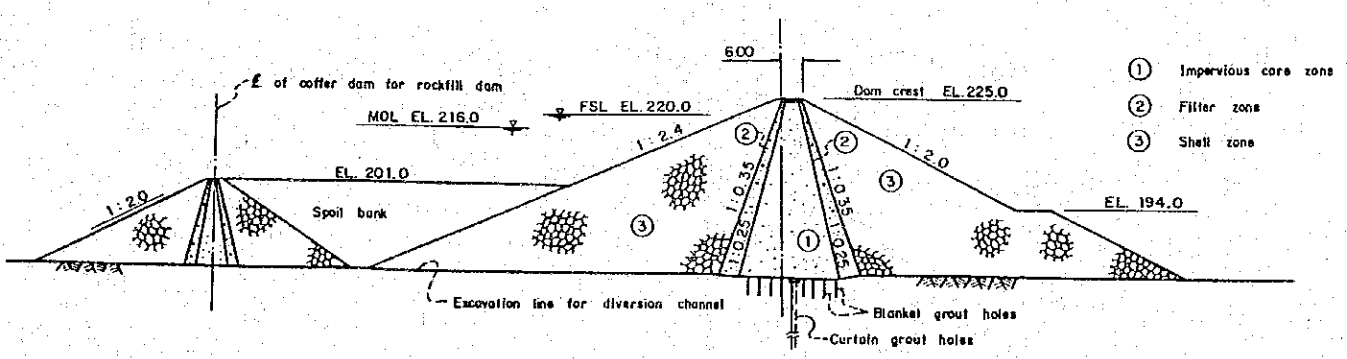
PROFILE SCALE A



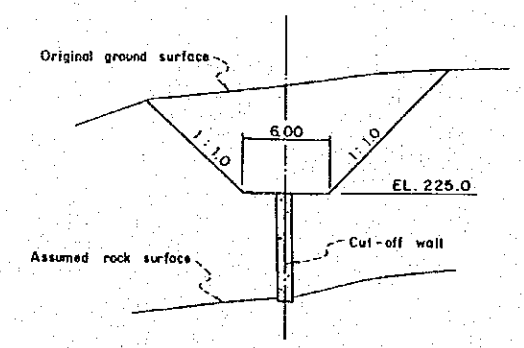
OVERFLOW SECTION OF CONCRETE DAM SCALE B



NONOVERFLOW SECTION OF CONCRETE DAM SCALE B



TYPICAL SECTION OF ROCKFILL DAM SCALE B



TYPICAL SECTION OF CUT OFF WALL SCALE C

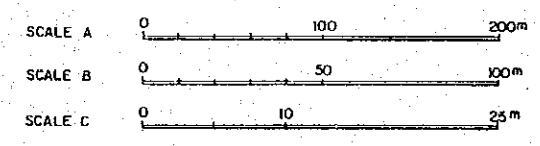
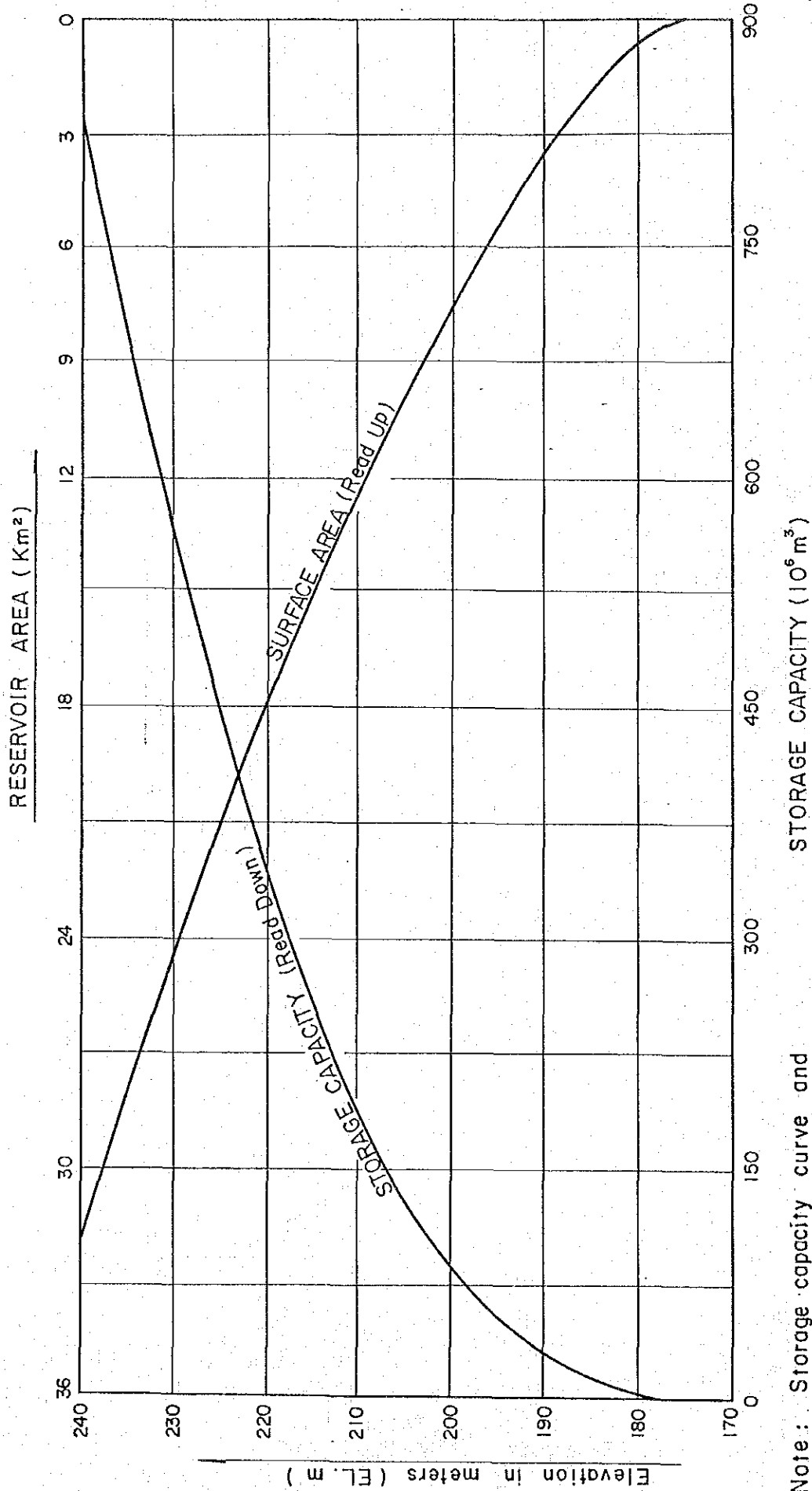


Figure 6-2 PROFILE AND CROSS SECTIONS OF DAM AND POWER PLANTS

Fig. 6-3



RESERVOIR AREA (Km^2)

STORAGE CAPACITY (10^6 m^3)

Elevation in meters (E.L.M.)

Note: Storage capacity curve and surface area are obtained from SMEC's preliminary feasibility report

Figure 6-3 RESERVOIR STORAGE CAPACITY

Fig. 6-4

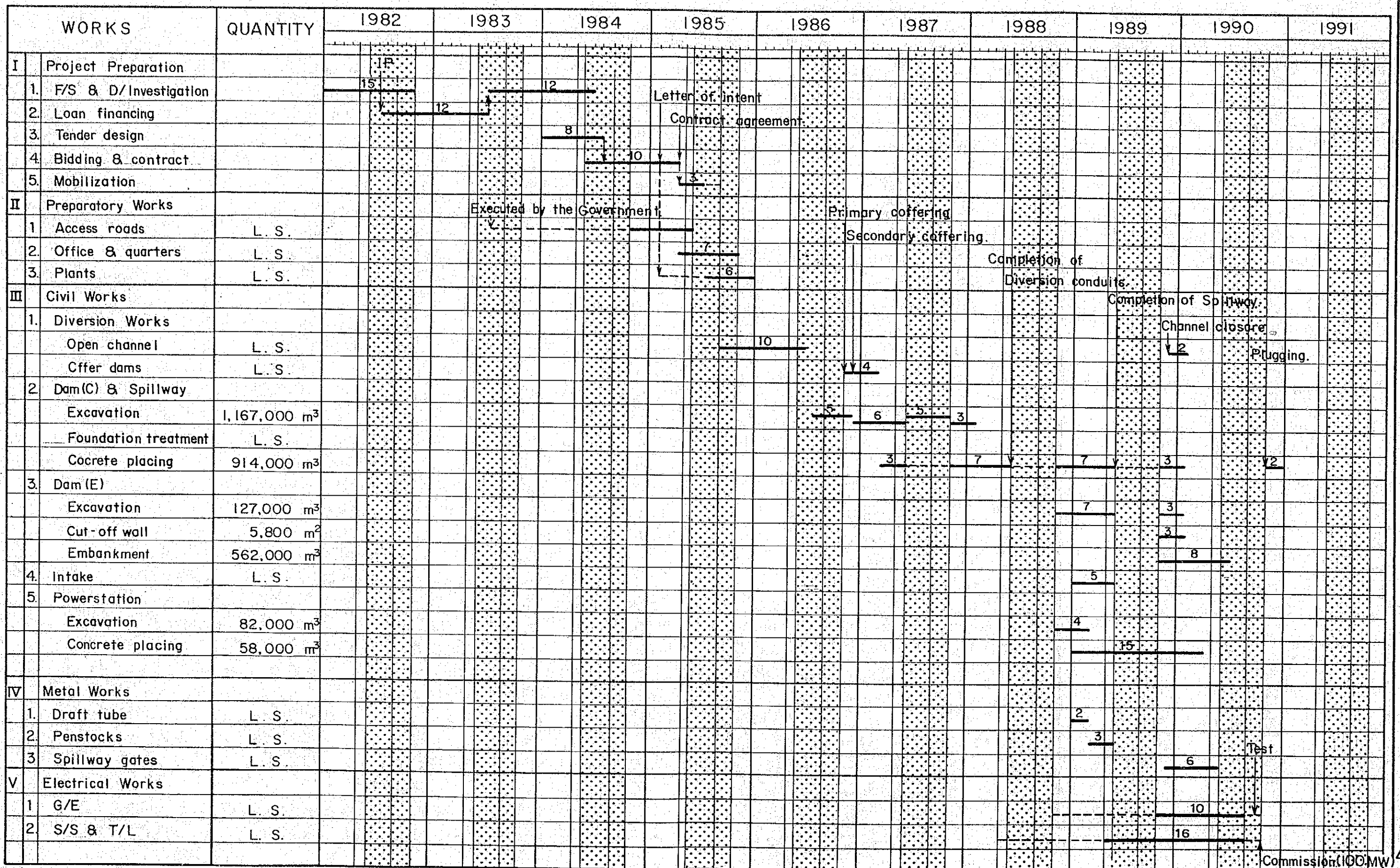
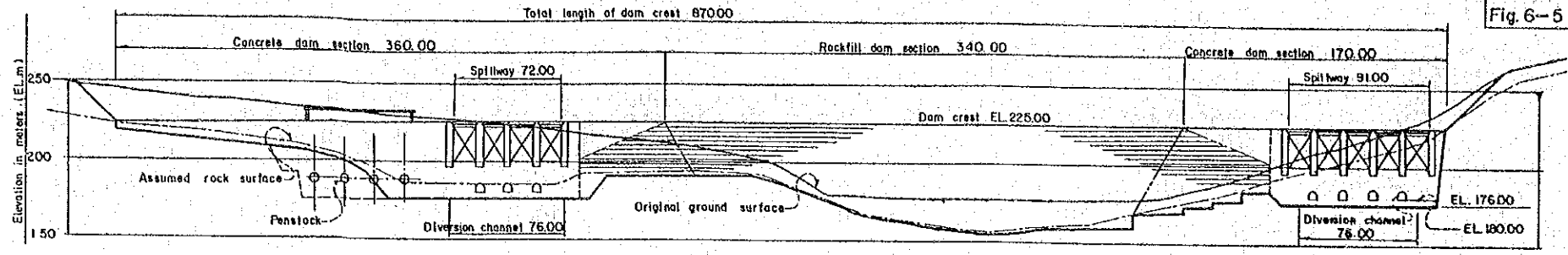
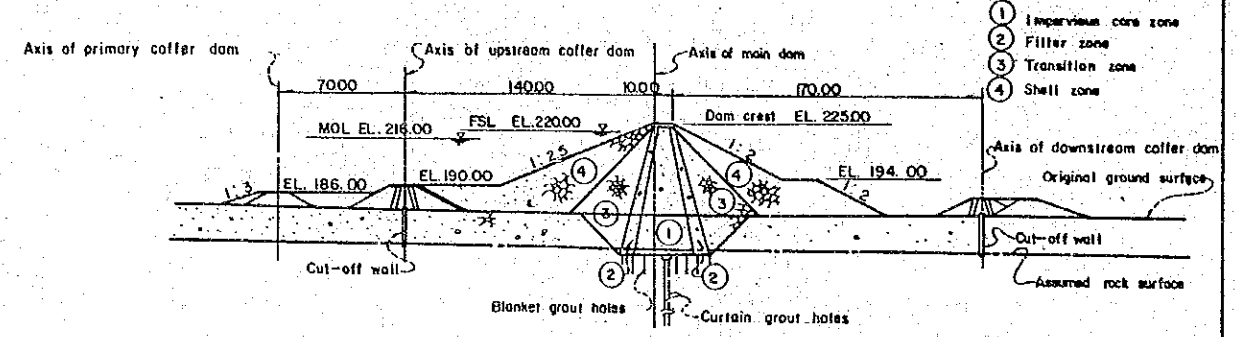


FIG 6.4 CONSTRUCTION TIME SCHEDULE OF SAPT GANDAKI PROJECT

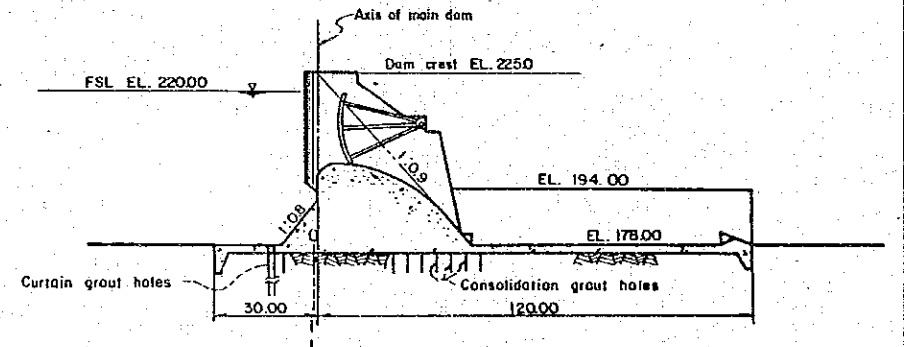
Δ Another 100 MW will be commissioned in 1994/95



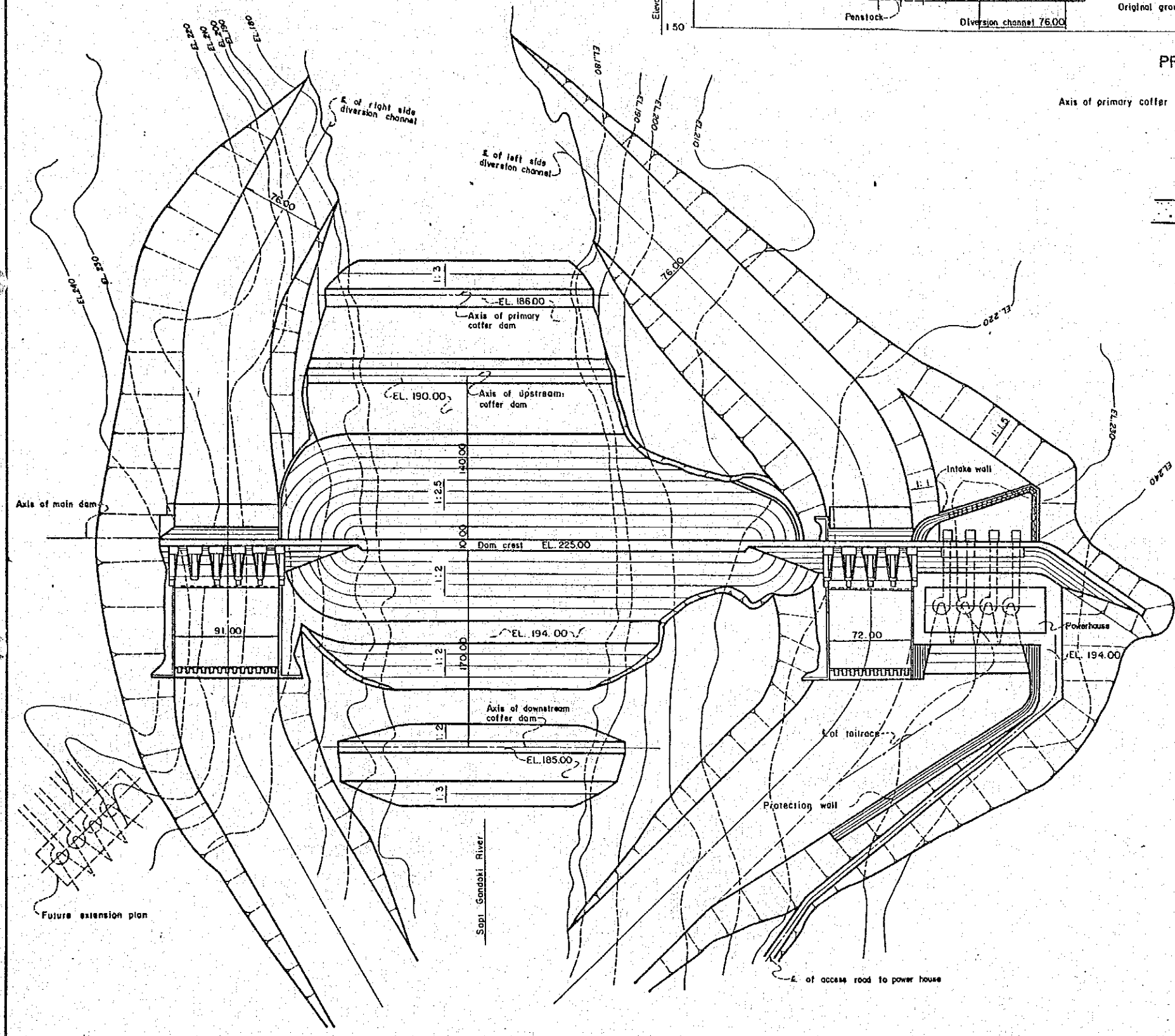
PROFILE SCALE A



TYPICAL SECTION OF ROCKFILL DAM SCALE A



OVERFLOW SECTION OF CONCRETE DAM SCALE B



GENERAL PLAN SCALE A

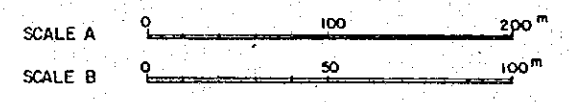


Figure 6-5 ALTERNATIVE PLAN

Fig. 7-1

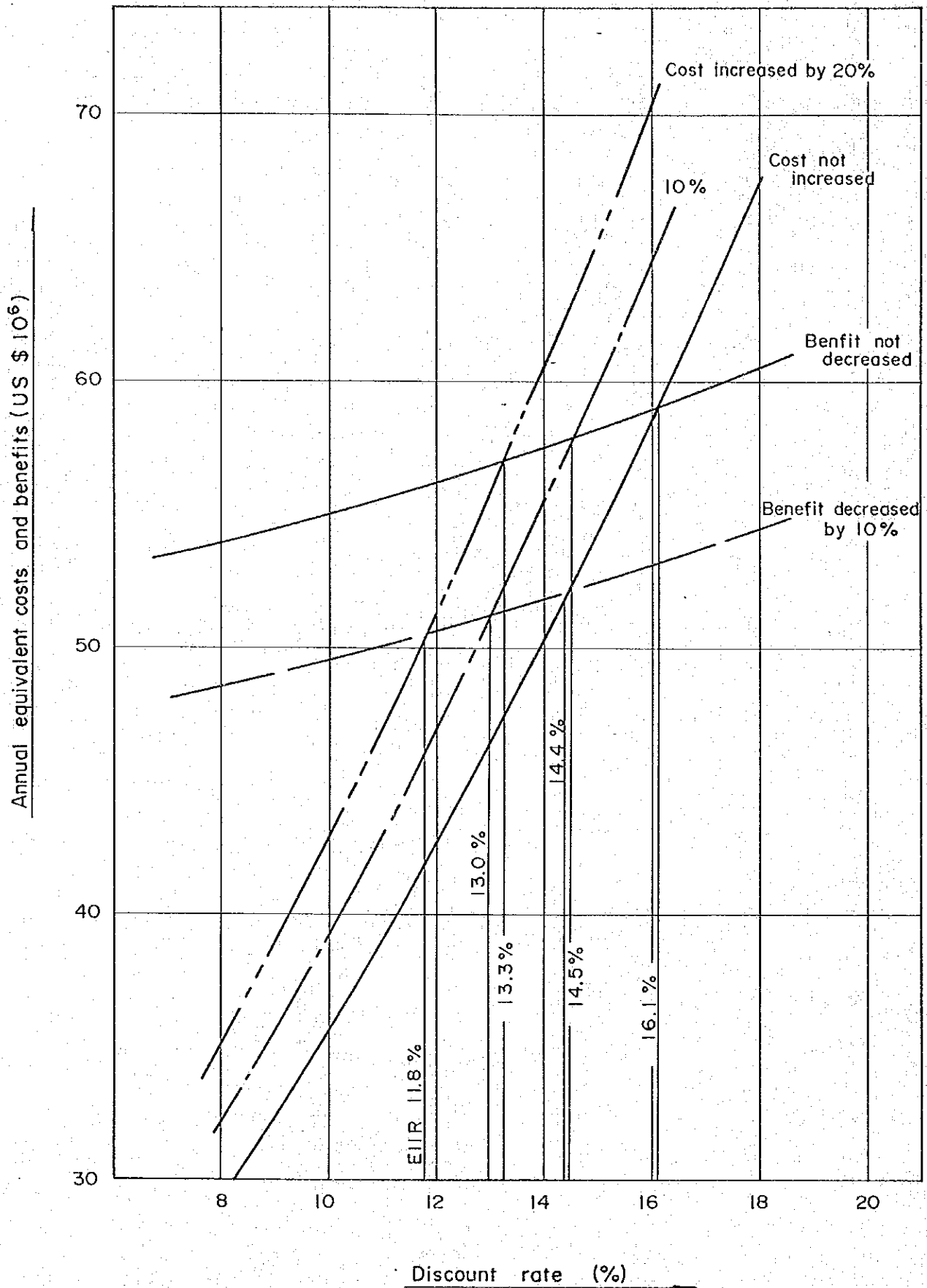
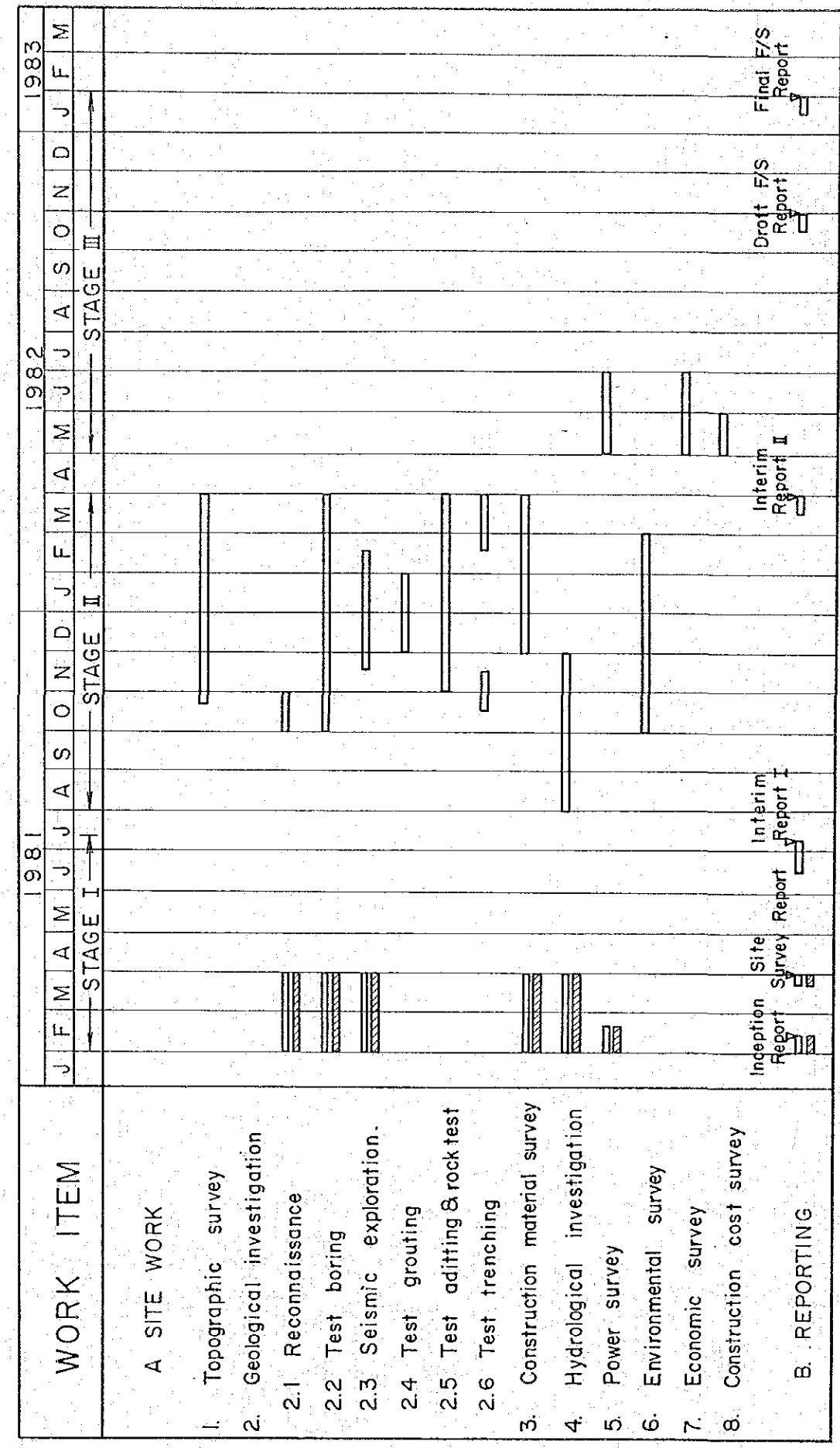


Figure 7-1 ECONOMIC INTERNAL RATE OF RETURN

Fig. 8-1




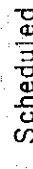
Note *  Scheduled  Progressed

Figure 8-1 SCHEDULE OF FIELD WORK OF FEASIBILITY STUDY

Fig. 8-2

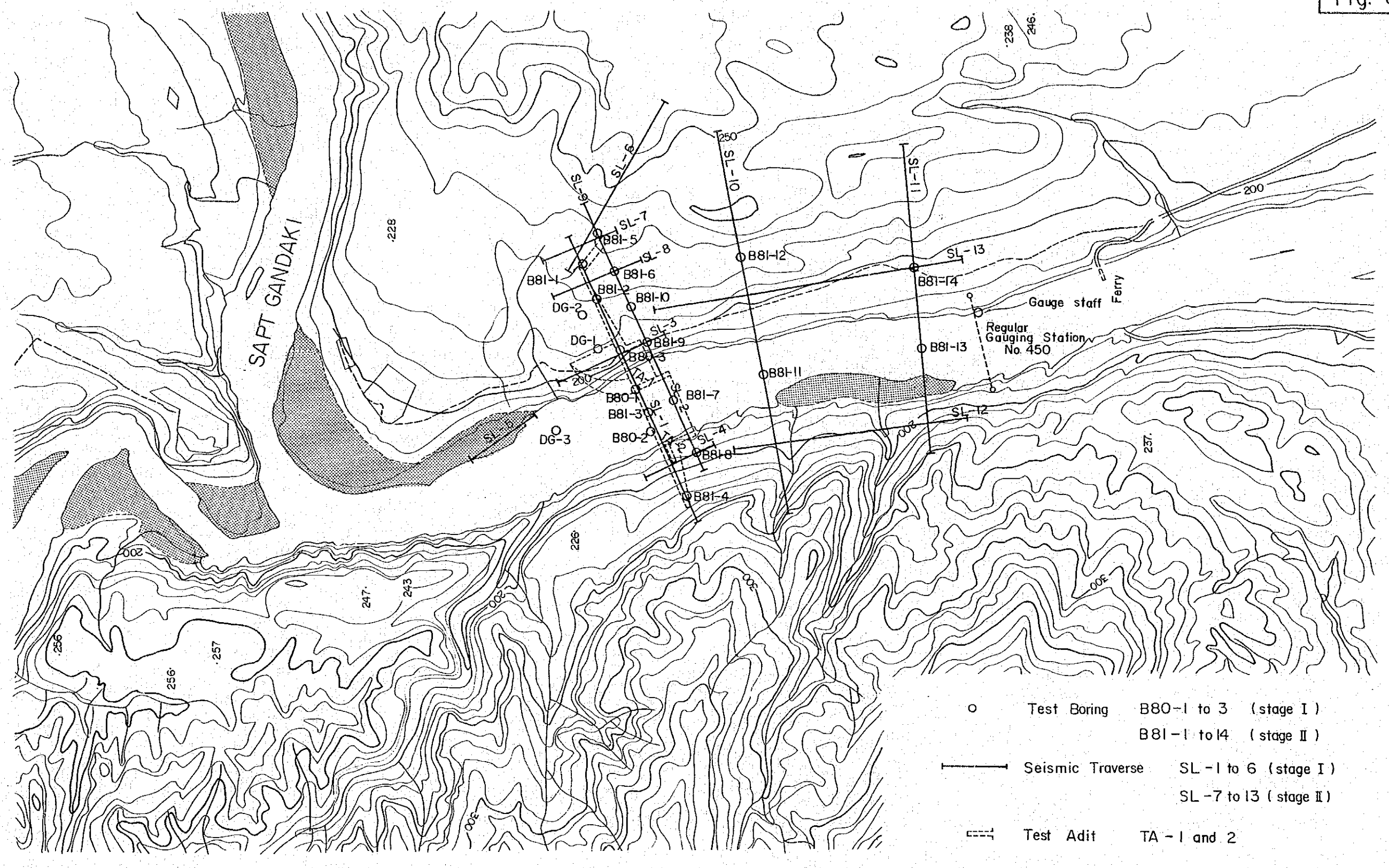
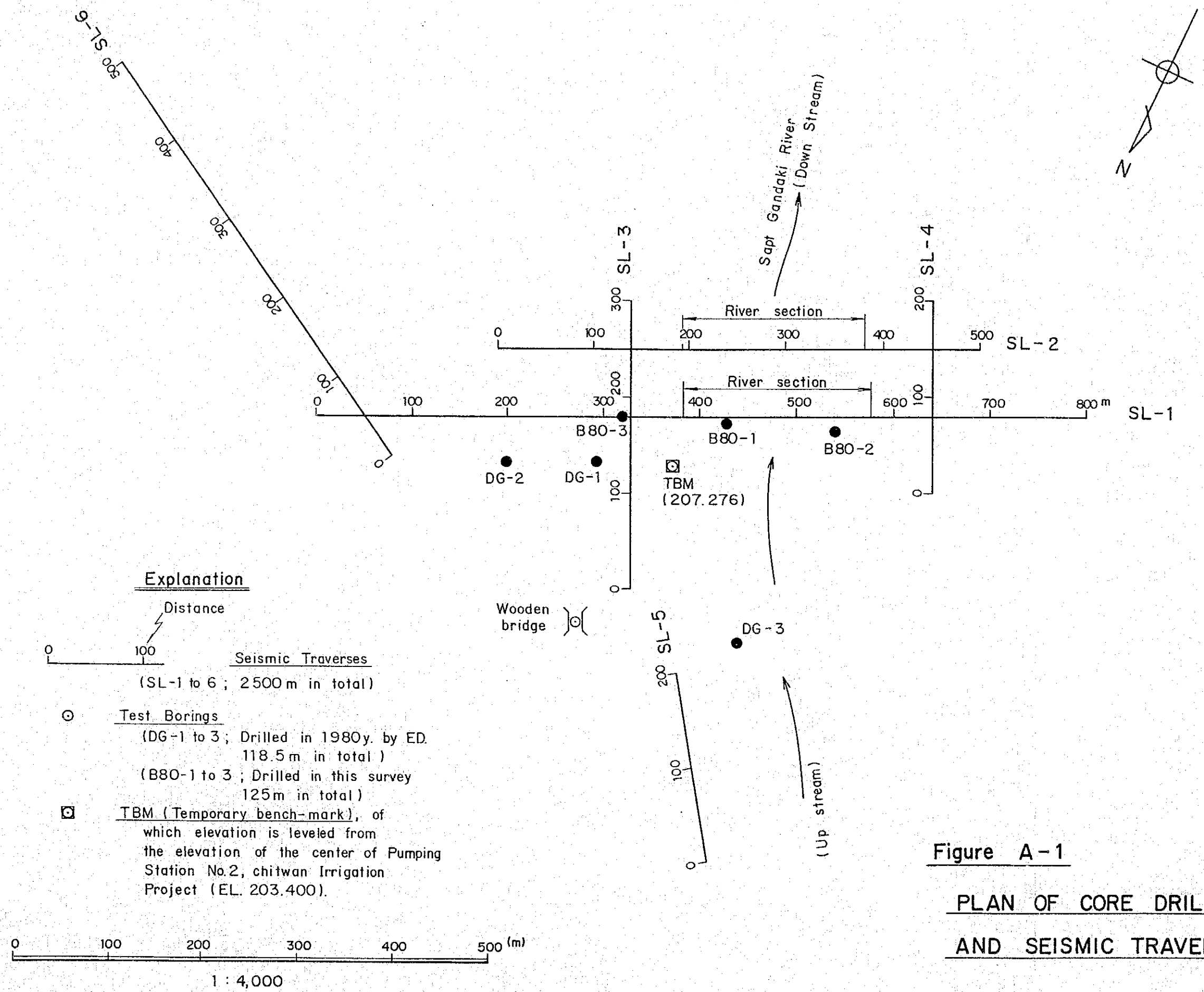


Figure 8-2 PLAN OF GEOLOGICAL INVESTIGATION

APPENDICES

APPENDIX A GEOLOGIC DATA

Figure A-1	PLAN OF CORE DRILLING POINTS AND SEISMIC TRAVERSES (1:4000)
Table A-1	RECORD OF CORE DRILLING PROGRESS
Table A-2	RECORD OF SEISMIC SURVEY PROGRESS
Table A-3	LIST OF CORE DRILLING HOLES AND SEISMIC TRAVERSES
Figures A-2 to 4	GEOLOGICAL RECORD OF DRILL HOLES: B80-1 to 3 AND DG-1 to 3
Tables A-4 to 6	RECORD OF WATER PRESSURE TEST: DRILL HOLE B80-1 to 3
Figures A-5 to 11	HEAD-FLOW PLOT OF WATER PRESSURE TEST (1) to (7)
Figures A-12 to 17	TIME-DISTANCE PLOT AND CROSS-SECTIONAL INTERPRETATION OF SEISMIC TRAVERSES SL-1 to 6



Explanation

Distance
 0 100
Seismic Traverses
 (SL-1 to 6 ; 2500 m in total)

- ⊙ Test Borings
 (DG-1 to 3 ; Drilled in 1980y. by ED.
 118.5 m in total)
 (B80-1 to 3 ; Drilled in this survey
 125m in total)
- ⊠ TBM (Temporary bench-mark), of
 which elevation is leveled from
 the elevation of the center of Pumping
 Station No.2, chitwan Irrigation
 Project (EL. 203.400).

0 100 200 300 400 500 (m)
 1 : 4,000

Figure A - 1

PLAN OF CORE DRILLING POINTS
 AND SEISMIC TRAVERSES

Table A-1 RECORD OF CORE DRILLING PROGRESS

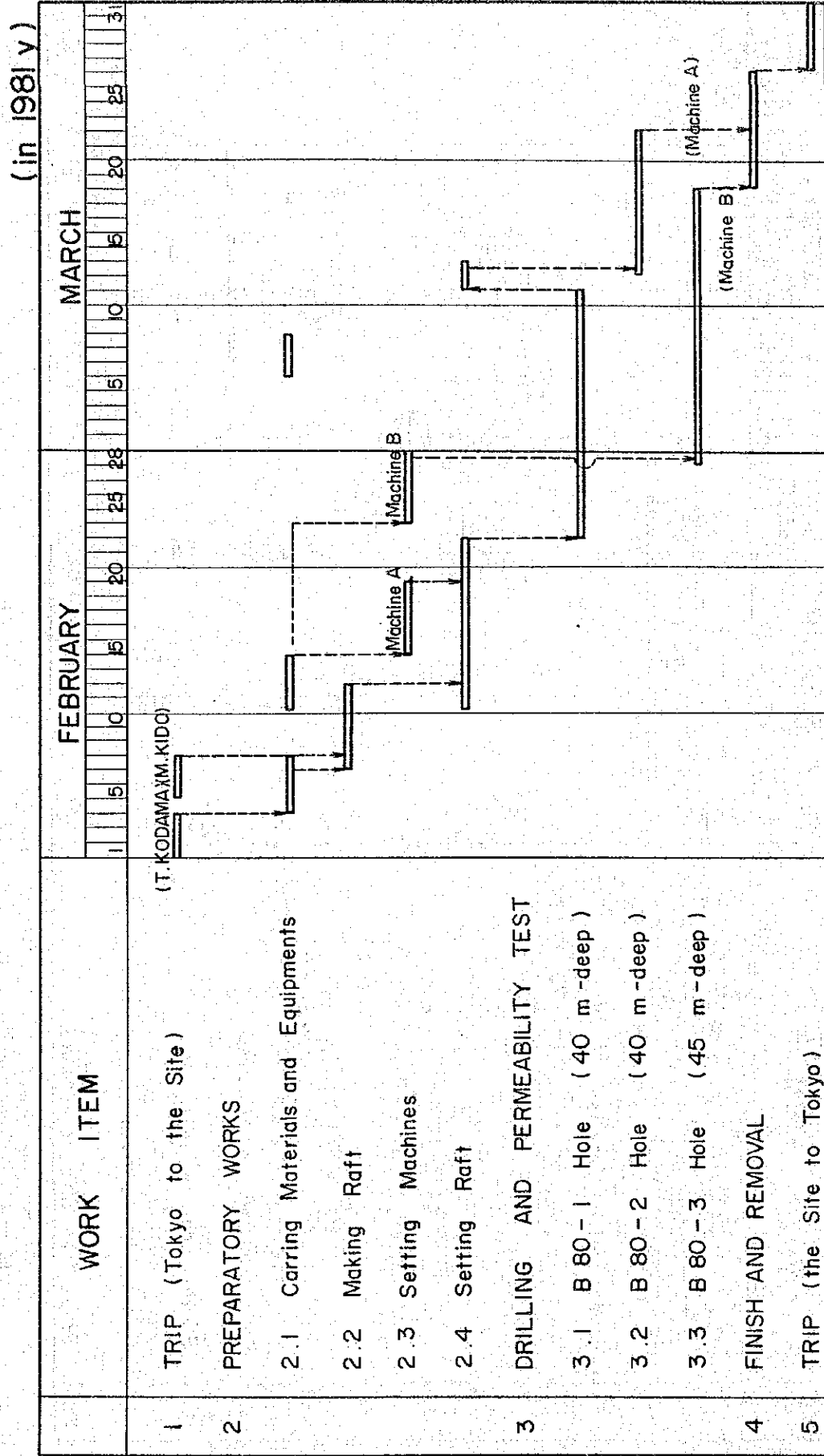


Table A-2 RECORD OF SEISMIC SURVEY PROGRESS

(in 1981 y)

WORK ITEM	FEBRUARY															MARCH															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1 Trip (Tokyo to the Site)	Equipment / Equipment / Dynamite arrived KTM/arrived at site/arrived at site																														
2 Preparatory Works																															
3 Investigation; Traverse SL-1	[Symbol]																														
4 SL-2	[Symbol]																														
5 SL-3	[Symbol]																														
6 SL-4	[Symbol]																														
7 SL-5	[Symbol]																														
8 SL-6	[Symbol]																														
9 Data Plotting and Analysis	[Symbol]																														
10 Survey and Levelling	[Symbol]																														
11 Finish and Removal	[Symbol]																														
12 Trip (the Site to Tokyo)	[Symbol]																														

Additional of SL-6 decided

- Line setting and preparation for observation
- Exploding and observation
- ~ Investigation of river section
- ▼ Event

Table A-3 LIST OF CORE DRILLING HOLES AND SEISMIC TRAVERSES

Core Drilling in the Damsite

Hole No.	Depth (m)	Permeability Test (times)	Date Drilled	Location
B80-1	40	3	Feb.23 to Mar.11	River-bed
B80-2	40	4	Mar.13 to Mar.22	River-bed
B80-3	45	6	Feb.28 to Mar.18	Left Bank
DG-1	37.2	-	(in 1980 Y.)	Left Bank
DG-2	50	-	(in 1980 Y.)	Left Bank
DG-3	31.3	-	(in 1980 Y.)	River-bed
Total	243.5	13		

- Note:
- 1) All holes were drilled in vertical direction.
 - 2) B80-1, B80-2 and B80-3 were drilled in this survey period by the Survey Team (125 m in total).
 - 3) DG-1, DG-2 and DG-3 have been drilled previously by ED and drilled core was checked and logged in this time by our geologist.

Lengths of Seismic Traverses

Traverse No.	Length (m.)	Location
SL-1	800	Dam Axis
SL-2	500	Downstream of Dam Axis
SL-3	300	Left bank
SL-4	200	Right bank
SL-5	200	Upstream riverbed
SL-6	500	Left bank abutment
Total	2,500	

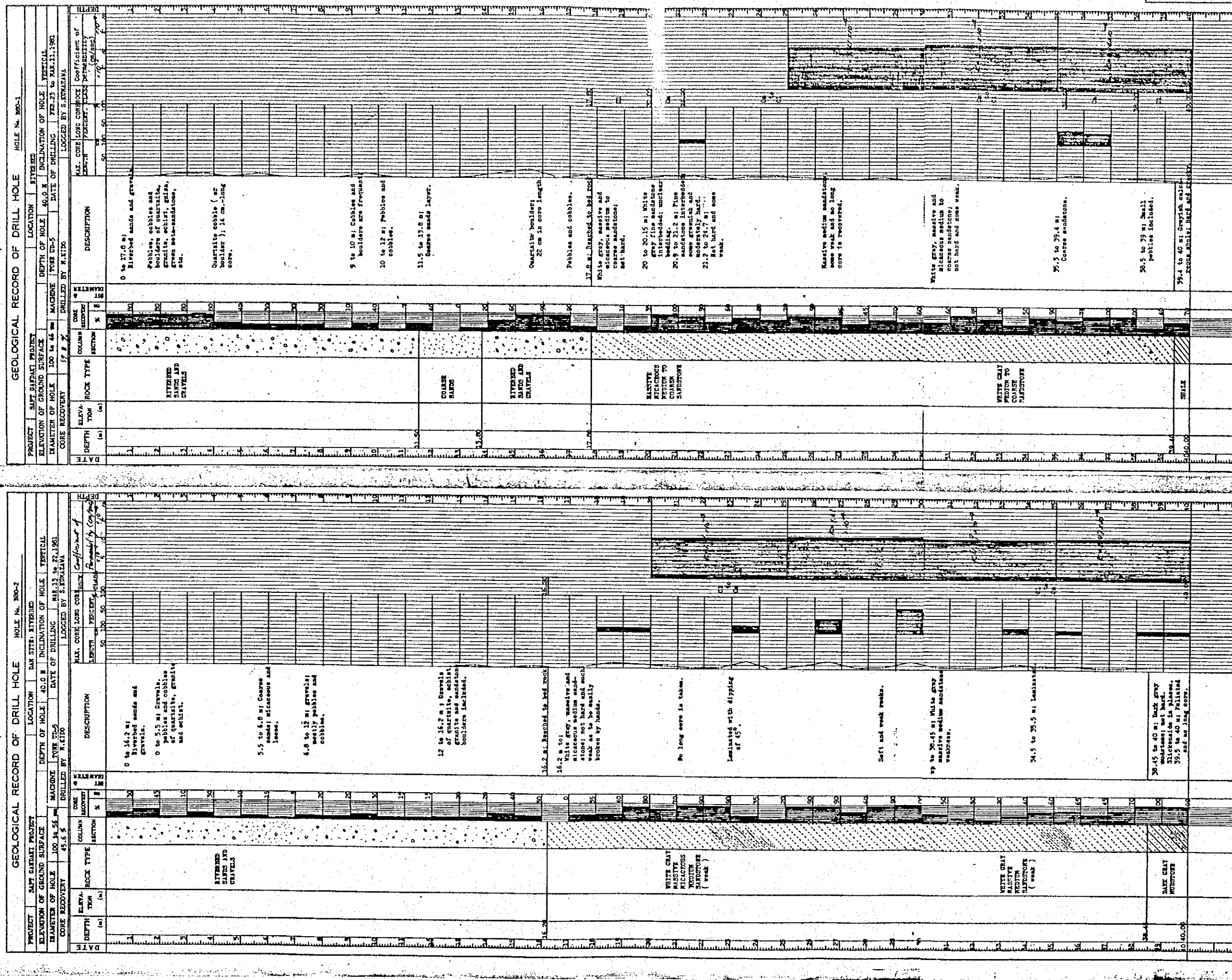


Figure A-2 GEOLOGICAL RECORD OF HOLE NOS. B 80-1 AND B 80-2

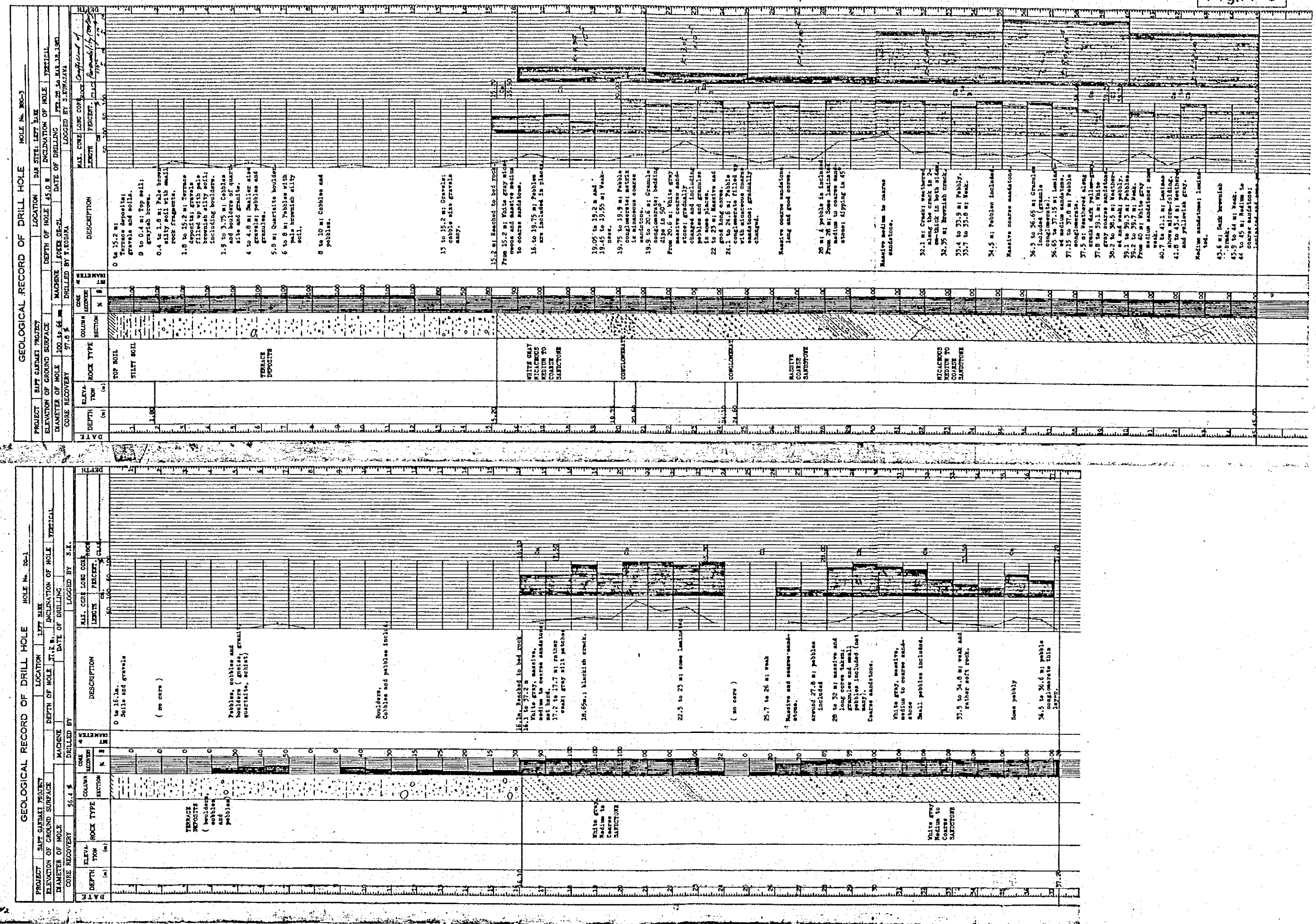


Figure A-3 GEOLOGICAL RECORD OF DRILL HOLE NOS. B80-3 AND DG-1

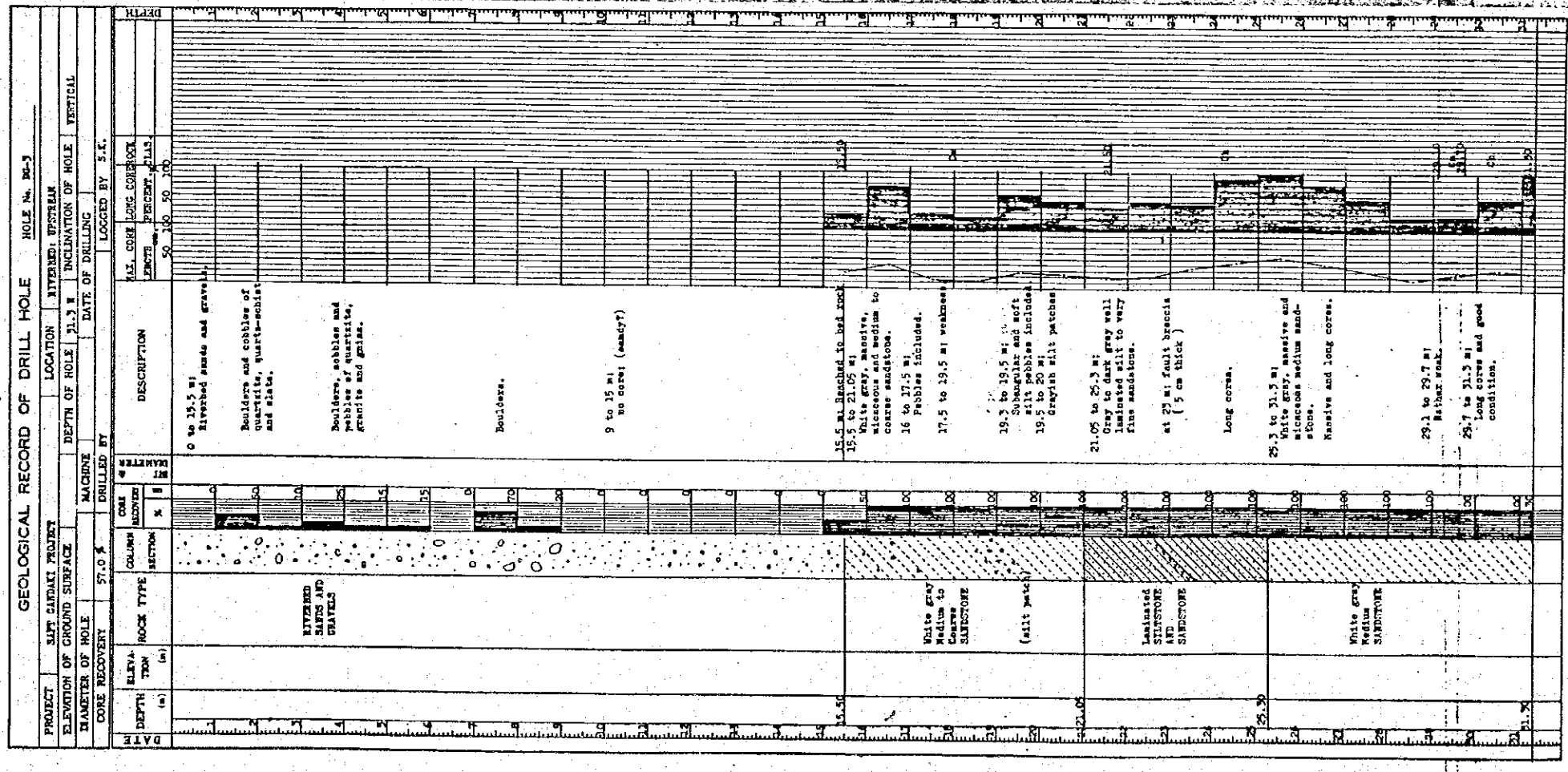
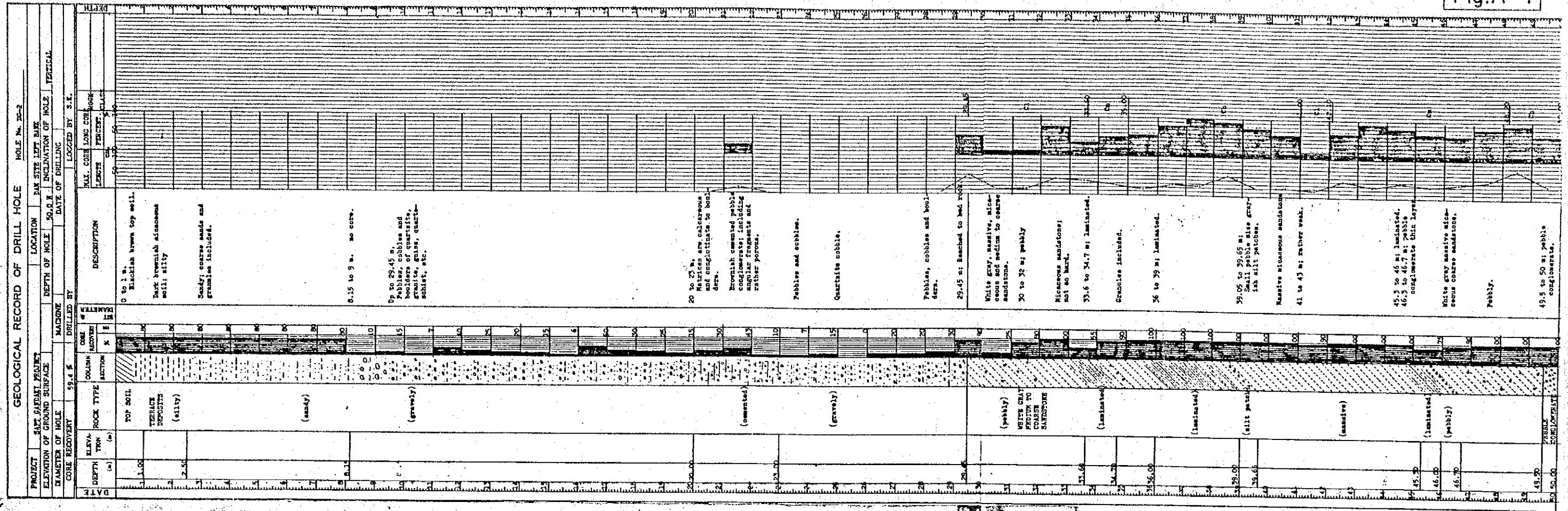


Figure A-4 GEOLOGICAL RECORD OF DRILL HOLE NOS. DG-2 AND DG-3

Table A-4

RECORD OF WATER PRESSURE TEST

PROJECT SAPT GANDAKI PROJECT
 BORE-HOLE No. B80-1

LOCALITY DAMSITE: RIVERBED
 GROUND WATER LEVEL (drilled in the Sapt Gandaki River)

DATE	DEPTH m - m	SECTION LENGTH L cm	HOLE RADIUS r cm	SUPPLIED WATER PRESSURE		STATIC HEAD IN HOLE Hs cm	PRESSURE GAUGE HEIGHT Hg cm	TOTAL HEAD Hp+Hs+Hg H cm	WATER LEAKAGE		CALCULATING CONST. $\frac{2.3}{2\pi} \times \frac{1}{60} \times \frac{1}{L} \log \frac{L}{r}$ C min/cm ² ·sec	Q H cm ² /min	COEFFICIENT OF PERMEABILITY K=Q/H×C cm/sec	LUGEON UNIT Lu=Q'/L·H×10 ⁶
				PRESSURE P kg/cm ²	HEAD Hp cm				Q' /min	Q cm ³ /min				
MAR.10	25.0 to 30.0	500	2.8	1	1,000	-170	250	1,080	4.44	4,440	2.75×10^{-5}	4.11	1.13×10^{-4}	
				3	3,000	-170	250	3,080	15.8	15,800	2.75×10^{-5}	5.13	1.41×10^{-4}	
				5	5,000	-170	250	5,080	16.6	16,600	2.75×10^{-5}	3.27	8.99×10^{-5}	
				7	7,000	-170	250	7,080	-	-		-		
				4	4,000	-170	250	4,080	32.5	32,500	2.75×10^{-5}	7.97	2.19×10^{-4}	
				2	2,000	-170	250	2,080	4.0	4,000	2.75×10^{-5}	1.92	5.28×10^{-5}	
MAR.11	30.0 to 35.0	500	2.8	1	1,000	-170	250	1,080	3.6	3,600	2.75×10^{-5}	3.33	9.16×10^{-4}	
				3	3,000	-170	250	3,080	25.8	25,800	2.75×10^{-5}	8.38	2.30×10^{-4}	
				5	5,000	-170	250	5,080	15.5	15,500	2.75×10^{-5}	3.05	8.39×10^{-5}	
				7	7,000	-170	250	7,080	15.0	15,000	2.75×10^{-5}	2.12	5.83×10^{-5}	
				10	10,000	-170	250	10,080	15.75	15,750	2.75×10^{-5}	1.56	4.29×10^{-5}	
				6	6,000	-170	250	6,080	15.2	15,200	2.75×10^{-5}	2.5	6.88×10^{-5}	
				4	4,000	-170	250	4,080	15.0	15,000	2.75×10^{-5}	3.68	1.01×10^{-4}	
				2	2,000	-170	250	2,080	17.3	17,300	2.75×10^{-5}	8.32	2.29×10^{-4}	
MAR.11	35.0 to 40.0	500	2.8	1	1,000	-170	250	1,080	2.75	2,750	2.75×10^{-5}	2.55	7.00×10^{-5}	
				3	3,000	-170	250	3,080	24.0	24,000	2.75×10^{-5}	7.79	2.14×10^{-4}	
				5	5,000	-170	250	5,080	23.75	23,750	2.75×10^{-5}	4.68	1.29×10^{-4}	
				7	7,000	-170	250	7,080	23.00	23,000	2.75×10^{-5}	3.25	8.94×10^{-5}	
				10	10,000	-170	250	10,080	-	-		-		

Table A-5

RECORD OF WATER PRESSURE TEST

PROJECT

SAPT GANDAKI PROJECT

LOCALITY

DAM SITE: RIVERBED

BORE-HOLE No.

B80-2

GROUND WATER LEVEL

(drilled in the Sapt Gandaki river)

DATE	DEPTH		SECTION LENGTH L cm	HOLE RADIUS r cm	SUPPLIED WATER PRESSURE		STATIC HEAD IN HOLE Hs cm	PRESSURE GAUGE HEIGHT Hg cm	TOTAL HEAD Hp+Hs+Hg H cm	WATER LEAKAGE		CALCULATING CONST. $\frac{2.3}{2\pi} \times \frac{1}{60} \times \frac{1}{L} \log \frac{L}{r}$ C min/cm·sec	$\frac{Q}{H}$ cm ² /min	COEFFICIENT OF PERMEABILITY K=Q/H×C cm/sec	LUGEON UNIT Lu=Q'/L·H×10 ⁶
	m	m			P kg/cm ²	Hp cm				Q' l/min	Q cm ³ /min				
MAR.21	25.0 to 30.0		500	2.8	1	1,000	-180	250	1,070	7	7,000	2.75×10^{-5}	6.54	1.80×10^{-4}	
					3	3,000	-180	250	3,070	18	18,000	2.75×10^{-5}	5.86	1.61×10^{-4}	
					5	5,000	-180	250	5,070	18.7	18,700	2.75×10^{-5}	3.69	1.01×10^{-4}	
					7	7,000	-180	250	7,070	19.6	19,600	2.75×10^{-5}	2.77	7.62×10^{-5}	
					10	10,000	-180	250	10,070	-					
MAR.21	20.0 to 30.0		1,000	2.8	1	1,000	-180	250	1,070	9.8	9,800	1.56×10^{-5}	9.16	1.43×10^{-4}	
					3	3,000	-180	250	3,070	22.8	22,800	1.56×10^{-5}	7.43	1.16×10^{-4}	
					5	5,000	-180	250	5,070	21.1	21,100	1.56×10^{-5}	4.16	6.49×10^{-5}	
					7	7,000	-180	250	7,070	21.9	21,900	1.56×10^{-5}	3.10	4.83×10^{-5}	
MAR.22	35.0 to 40.0		500	2.8	1	1,000	-180	250	1,070	4.2	4,200	2.75×10^{-5}	3.93	1.08×10^{-4}	
					3	3,000	-180	250	3,070	16.4	16,400	2.75×10^{-5}	5.34	1.47×10^{-4}	
					5	5,000	-180	250	5,070	16.8	16,800	2.75×10^{-5}	3.31	9.11×10^{-5}	
					7	7,000	-180	250	7,070	17.4	17,400	2.75×10^{-5}	2.46	6.77×10^{-5}	
MAR.22	30.0 to 40.0		1,000	2.8	1	1,000	-180	250	1,070	5.8	5,800	1.56×10^{-5}	5.42	8.46×10^{-5}	
					3	3,000	-180	250	3,070	21.4	21,400	1.56×10^{-5}	6.97	1.09×10^{-4}	
					5	5,000	-180	250	5,070	20.8	20,800	1.56×10^{-5}	4.10	6.40×10^{-5}	
					7	7,000	-180	250	7,070	24.4	24,400	1.56×10^{-5}	3.45	5.38×10^{-5}	
					10	10,000	-180	250	10,070	-					

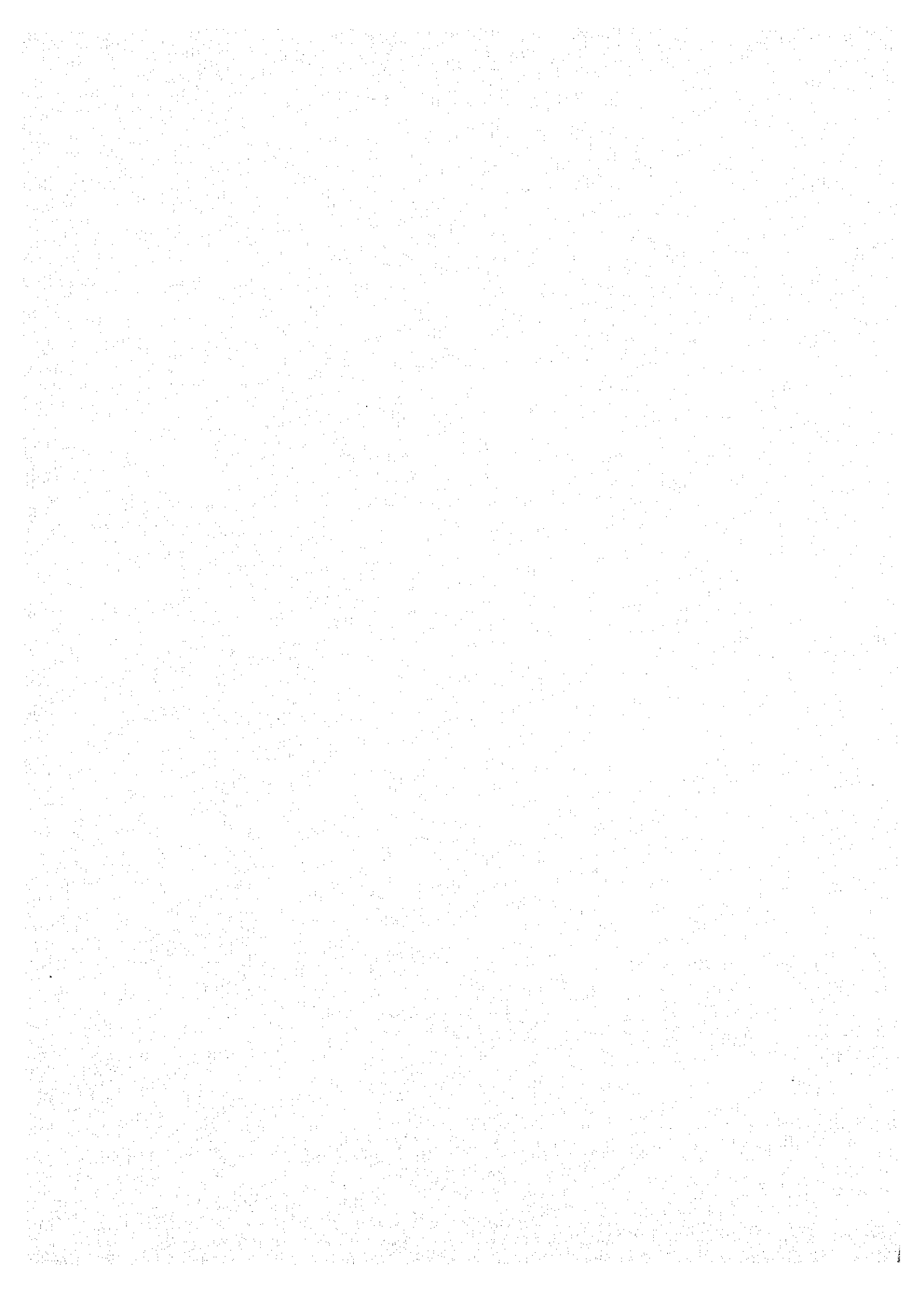


Figure A-5 HEAD-FLOW PLOT OF WATER PRESSURE TEST (1)

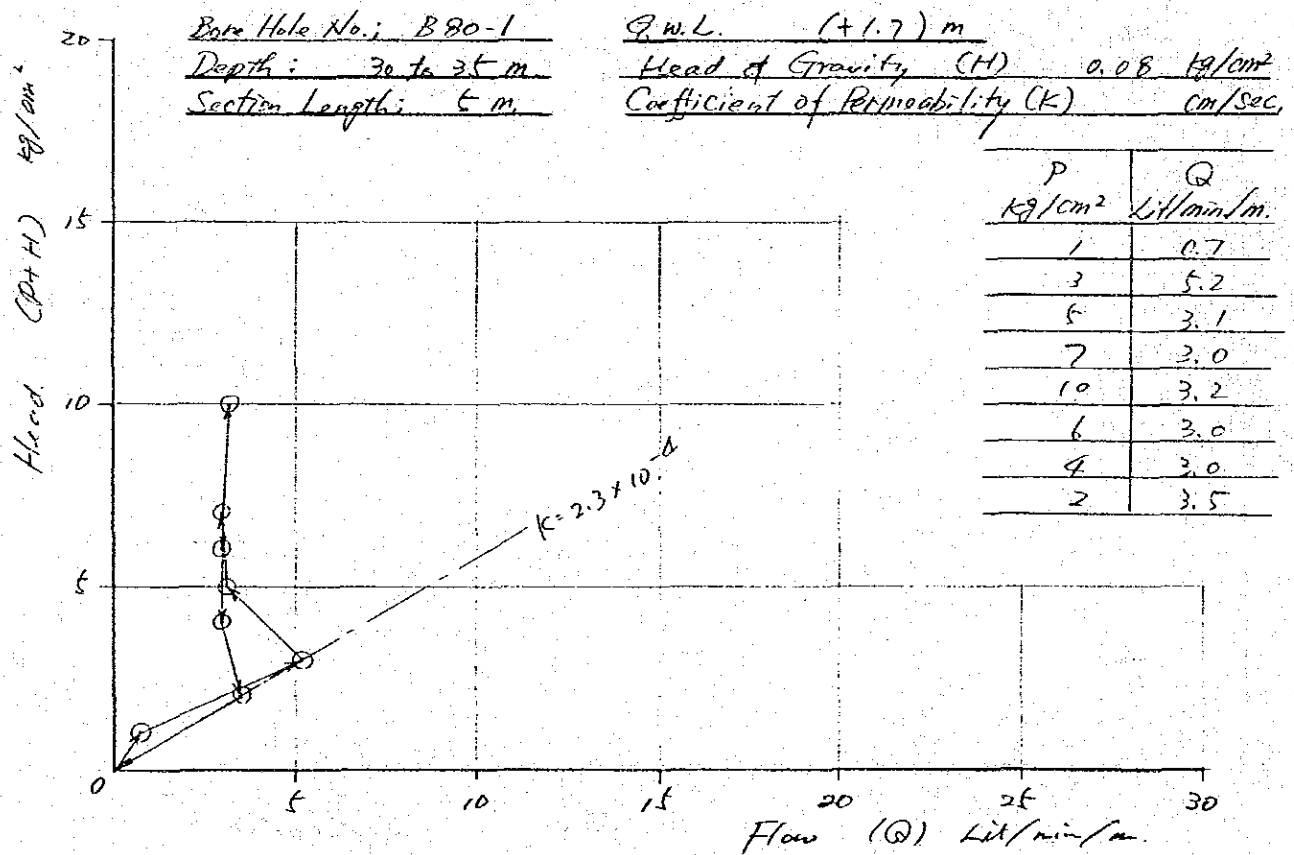
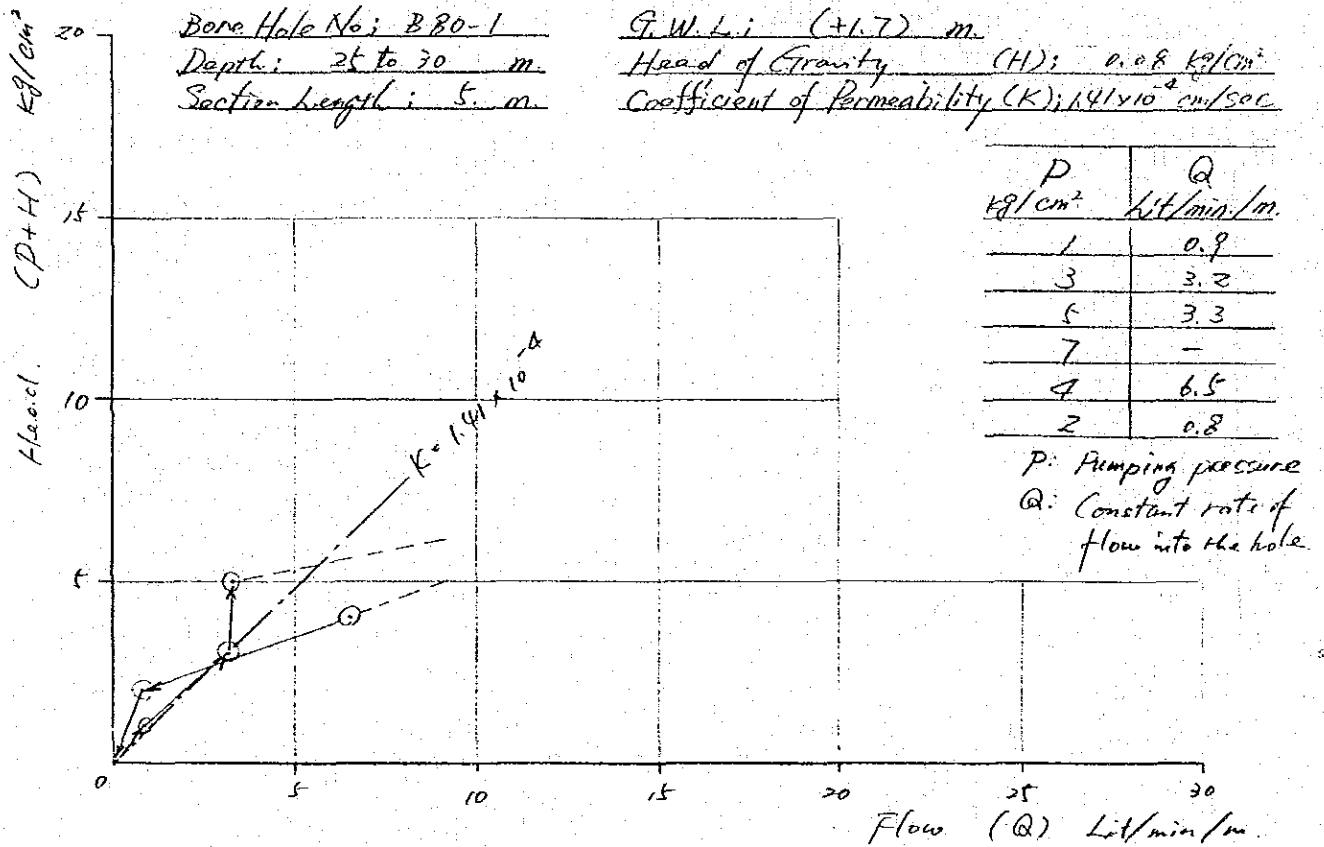


Figure A-6

HEAD-FLOW PLOT OF WATER PRESSURE TEST (2)

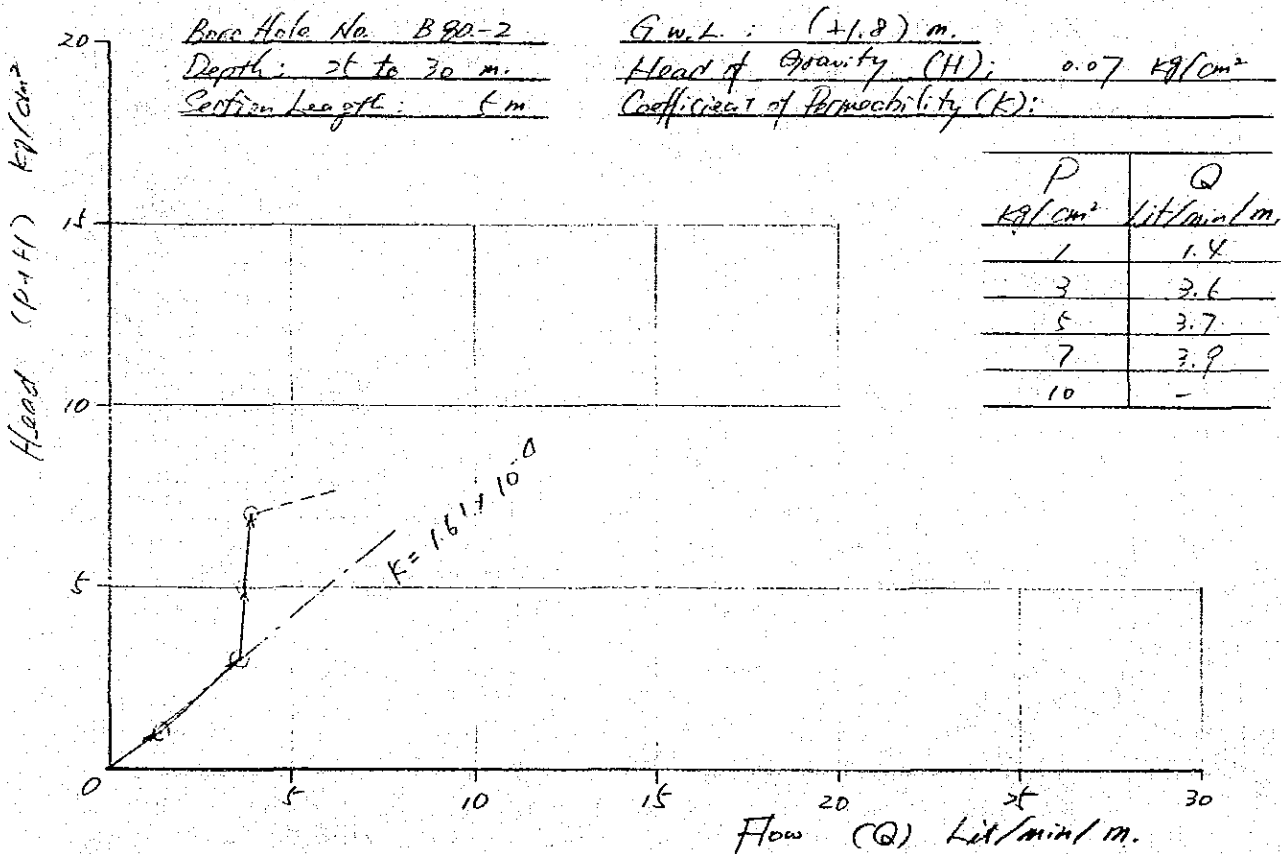
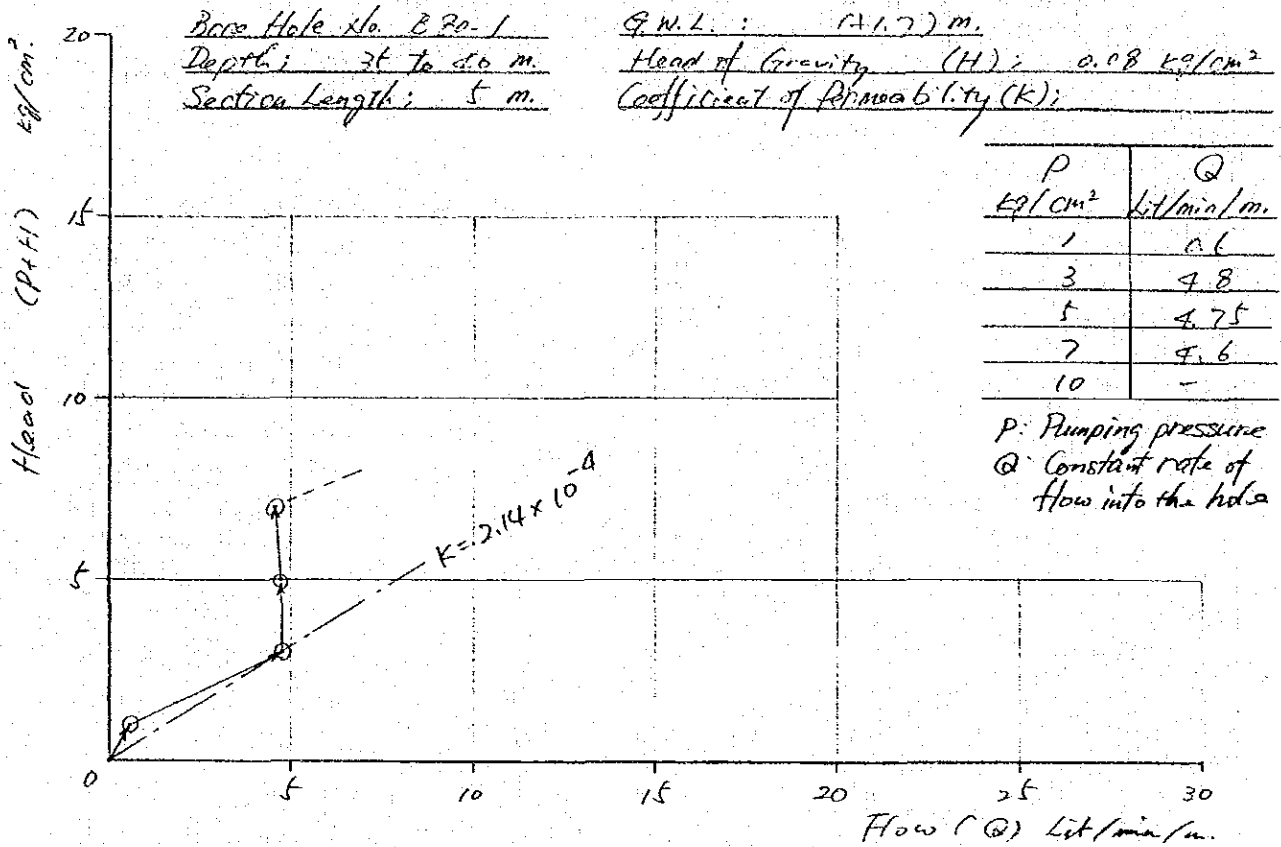


Figure A-7 HEAD-FLOW PLOT OF WATER PRESSURE TEST (3)

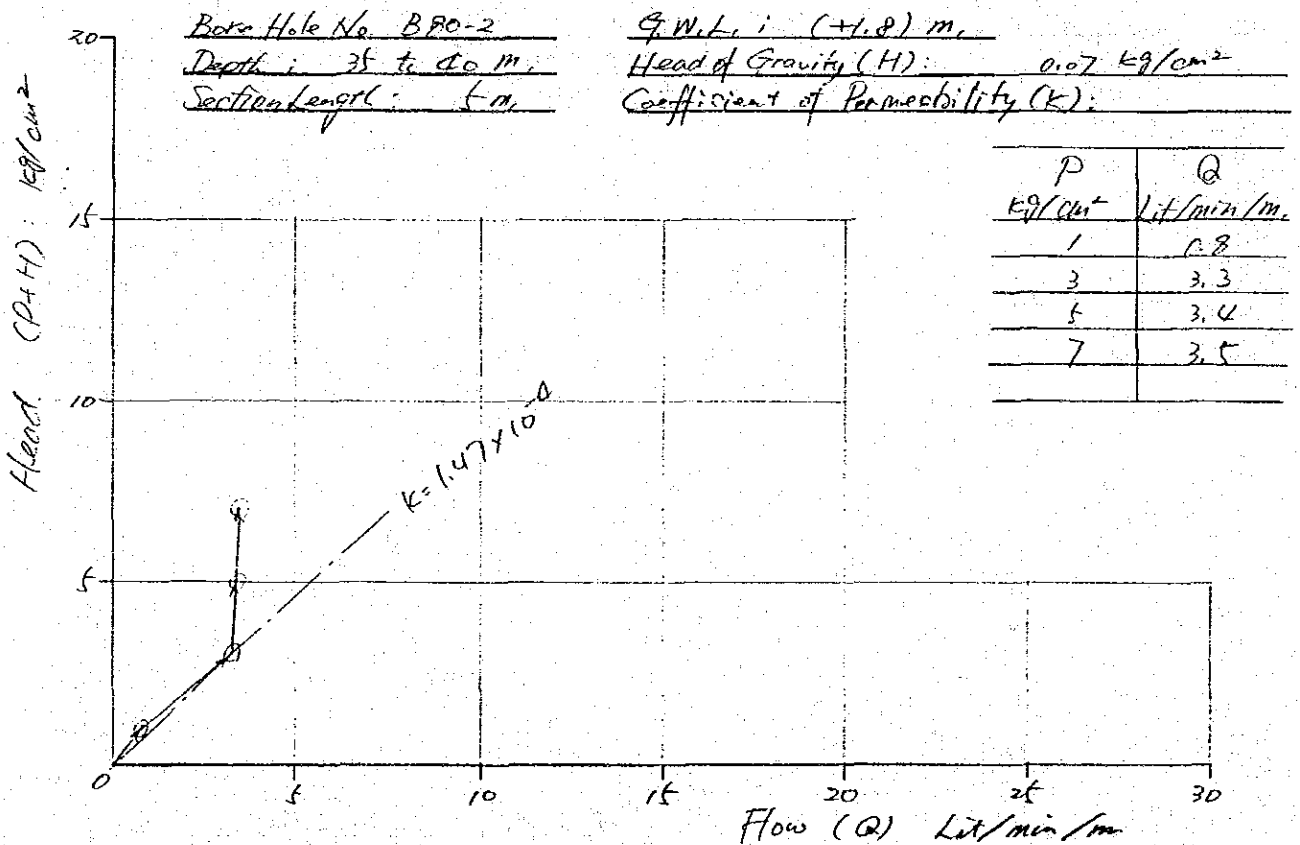
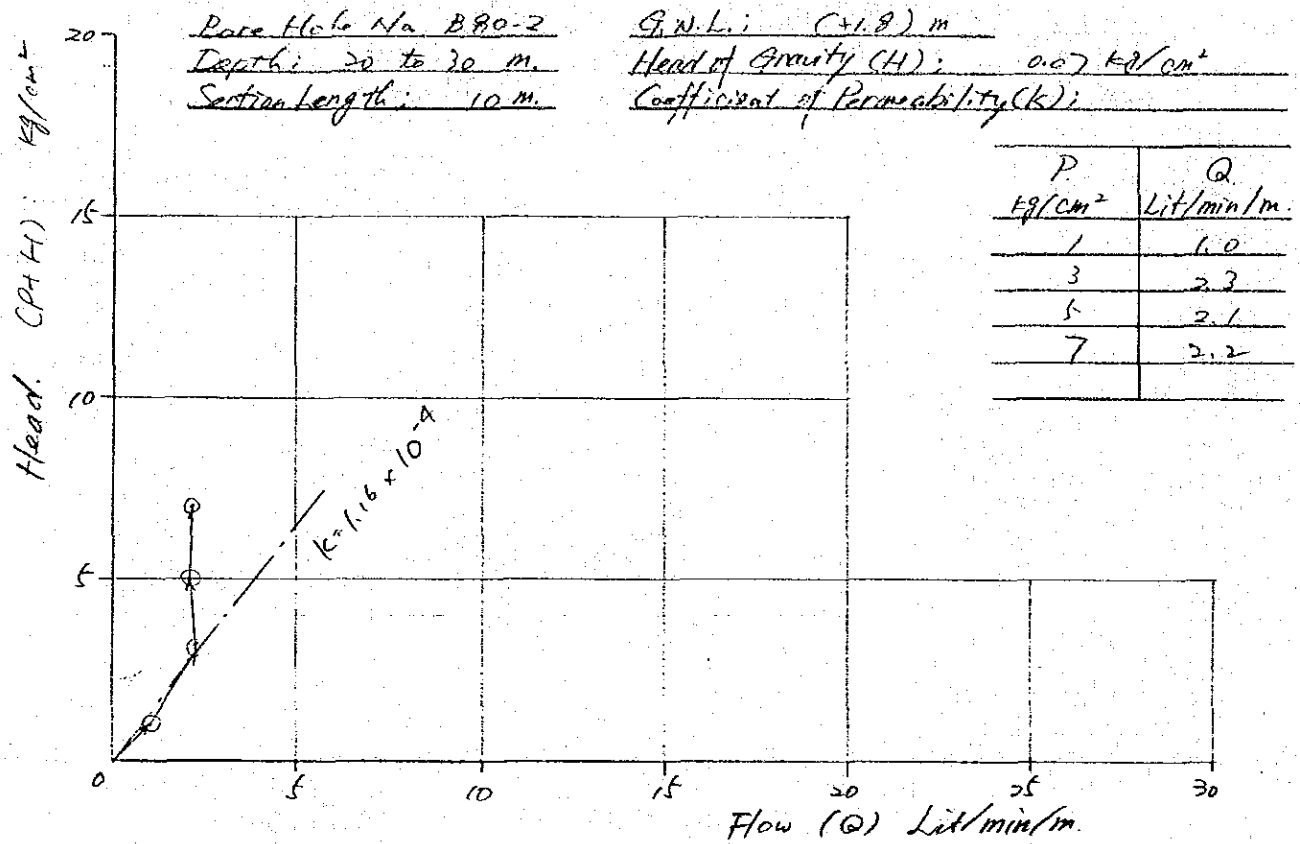


Figure A-8 HEAD-FLOW PLOT OF WATER PRESSURE TEST (4)

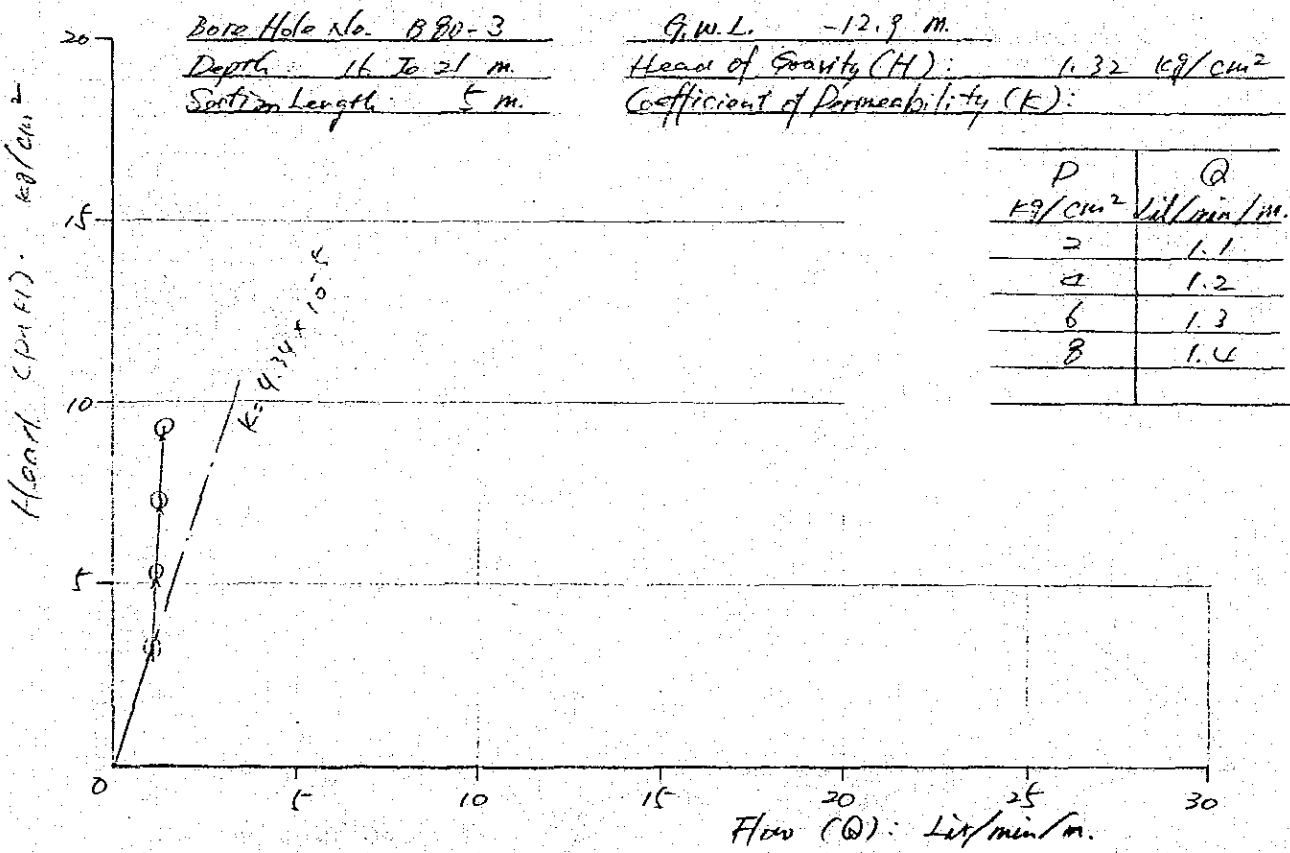
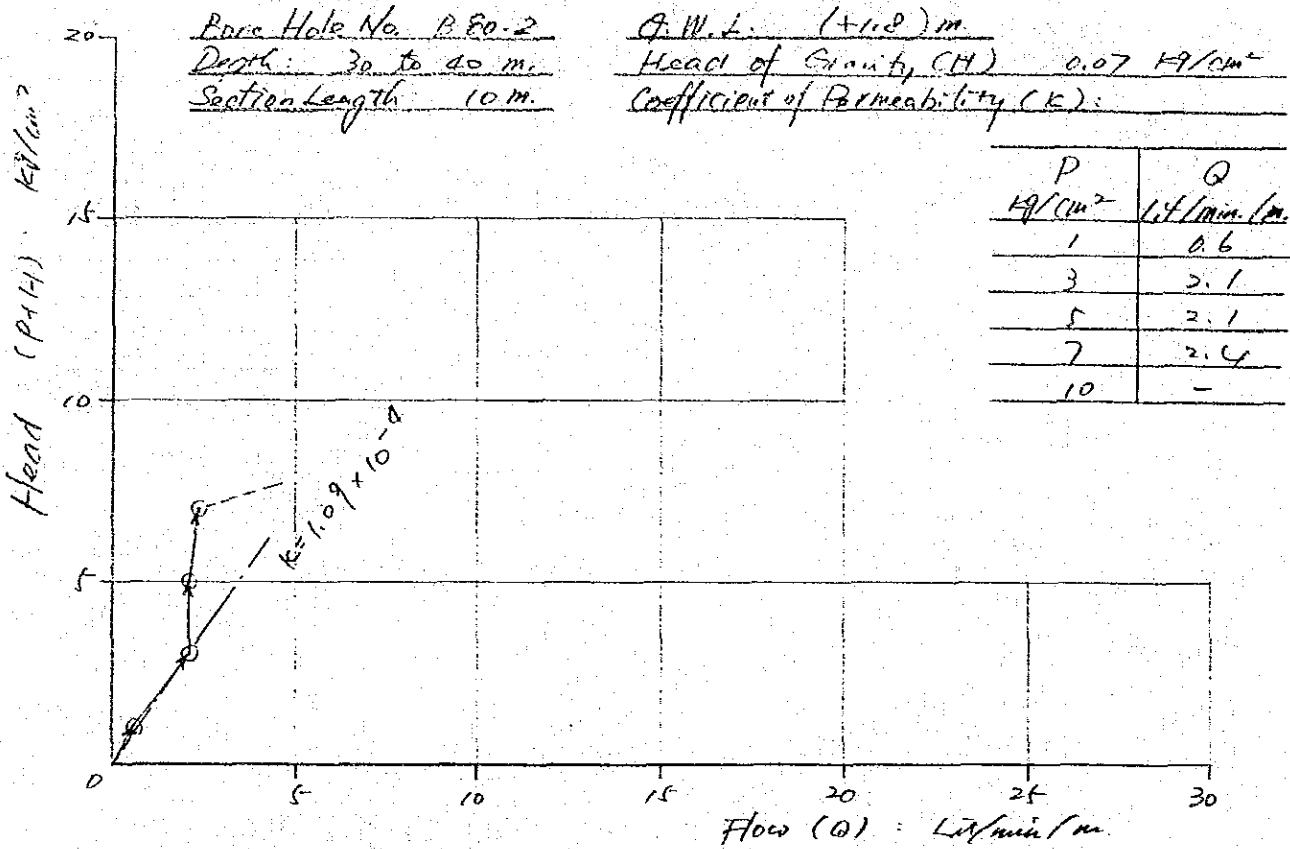


Figure A-9 HEAD-FLOW PLOT OF WATER PRESURE TEST (5)

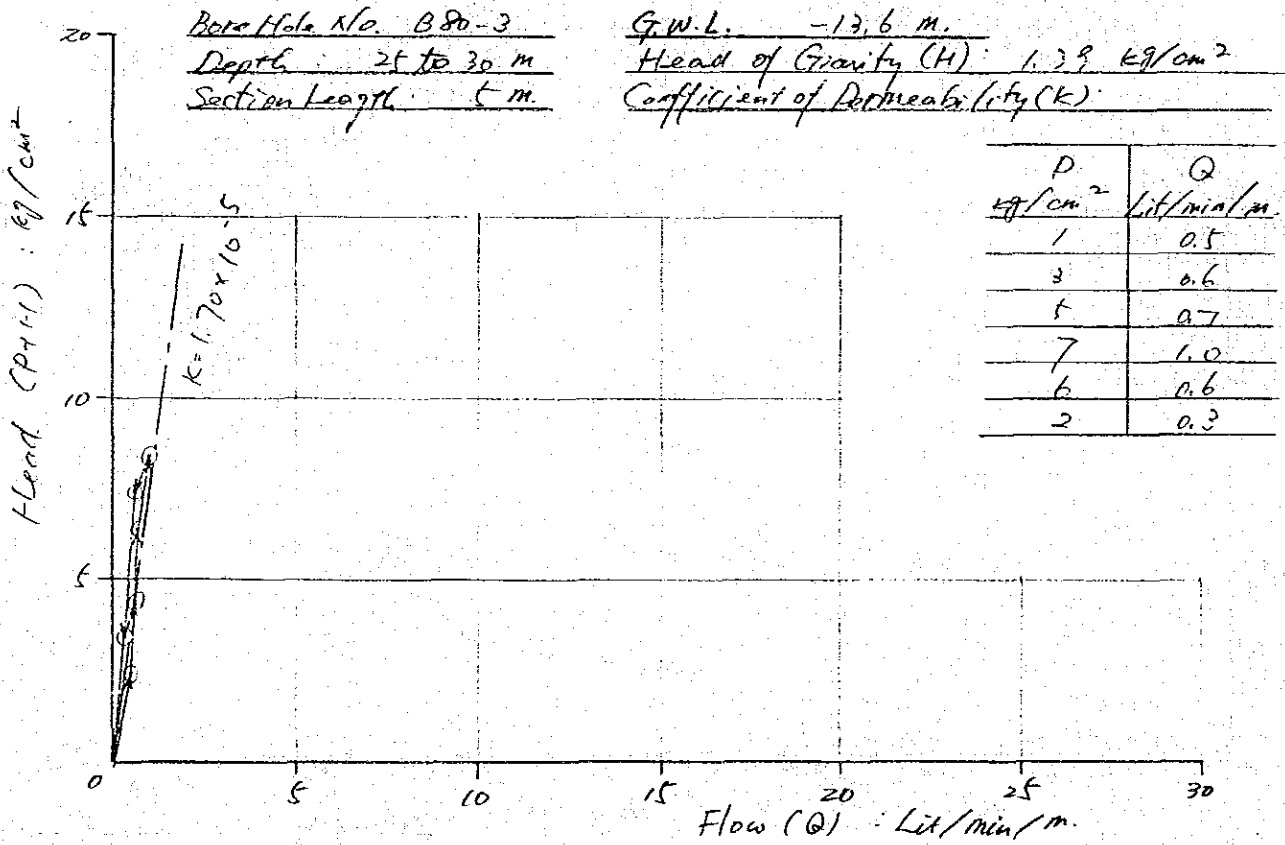
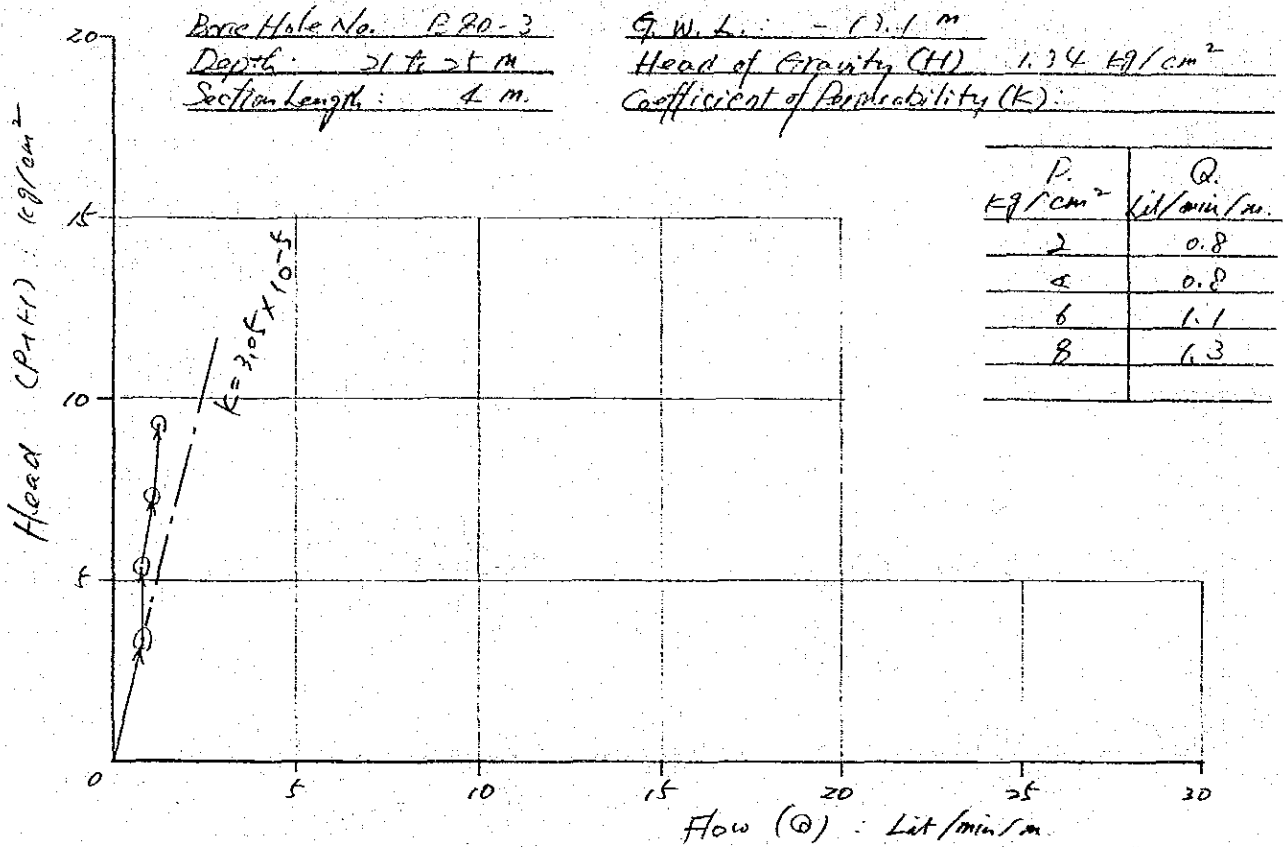


Figure A-10 HEAD-FLOW PLOT OF WATER PRESSURE TEST (6)

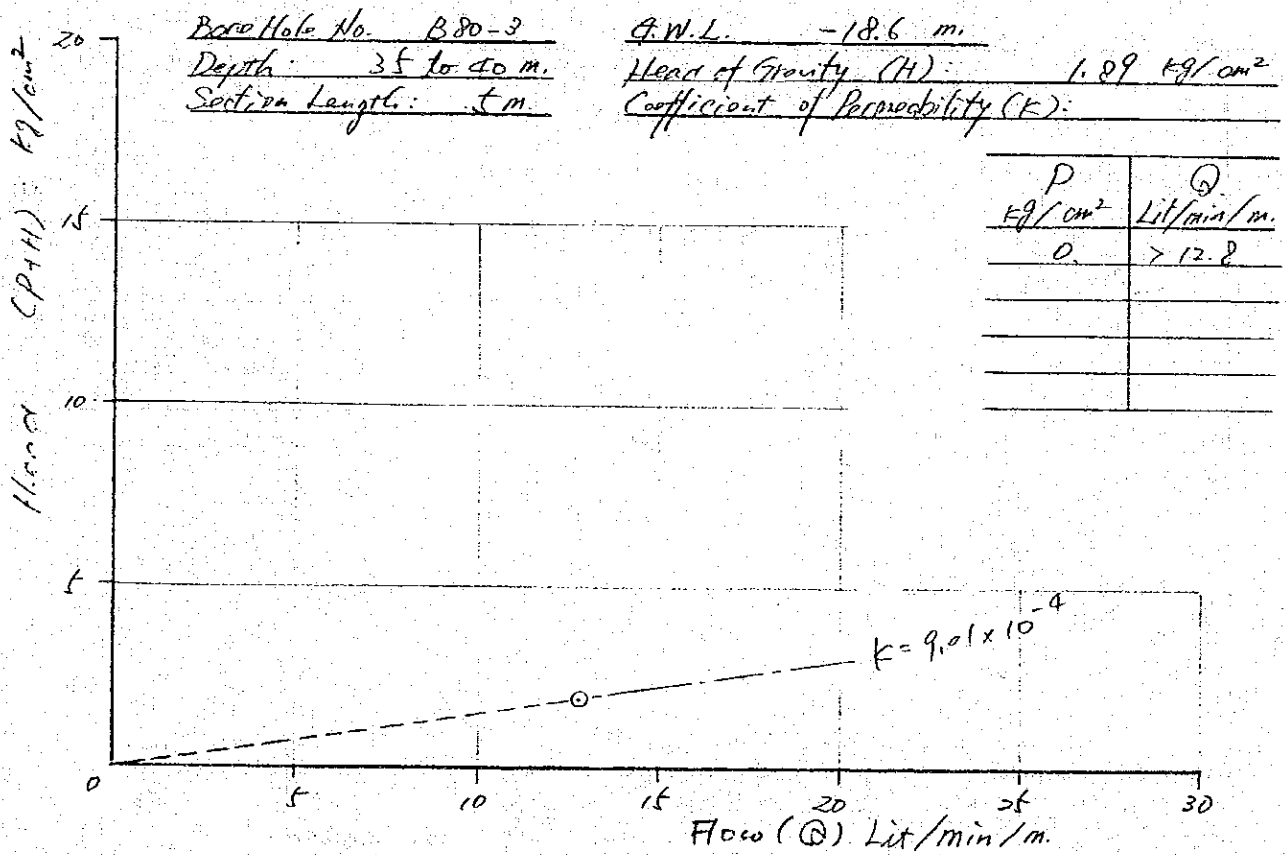
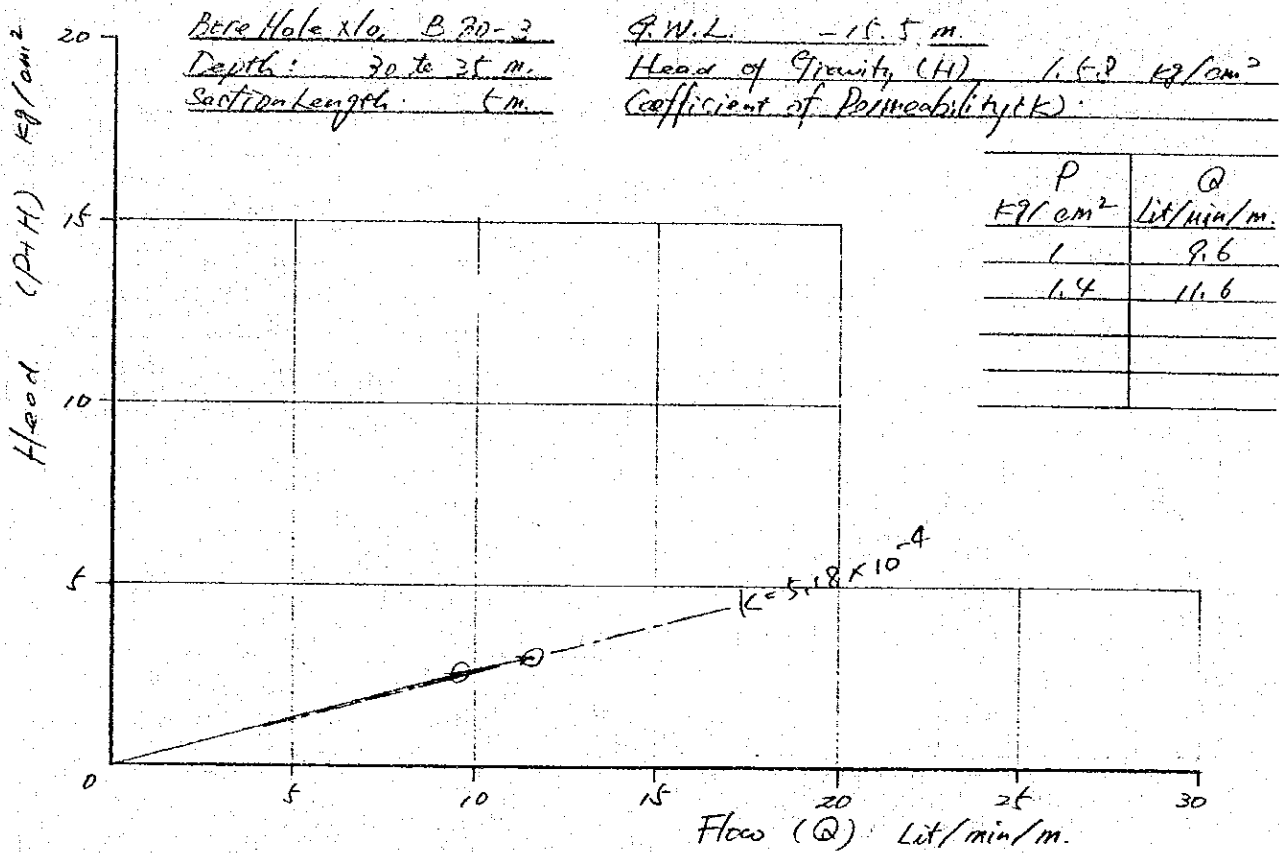
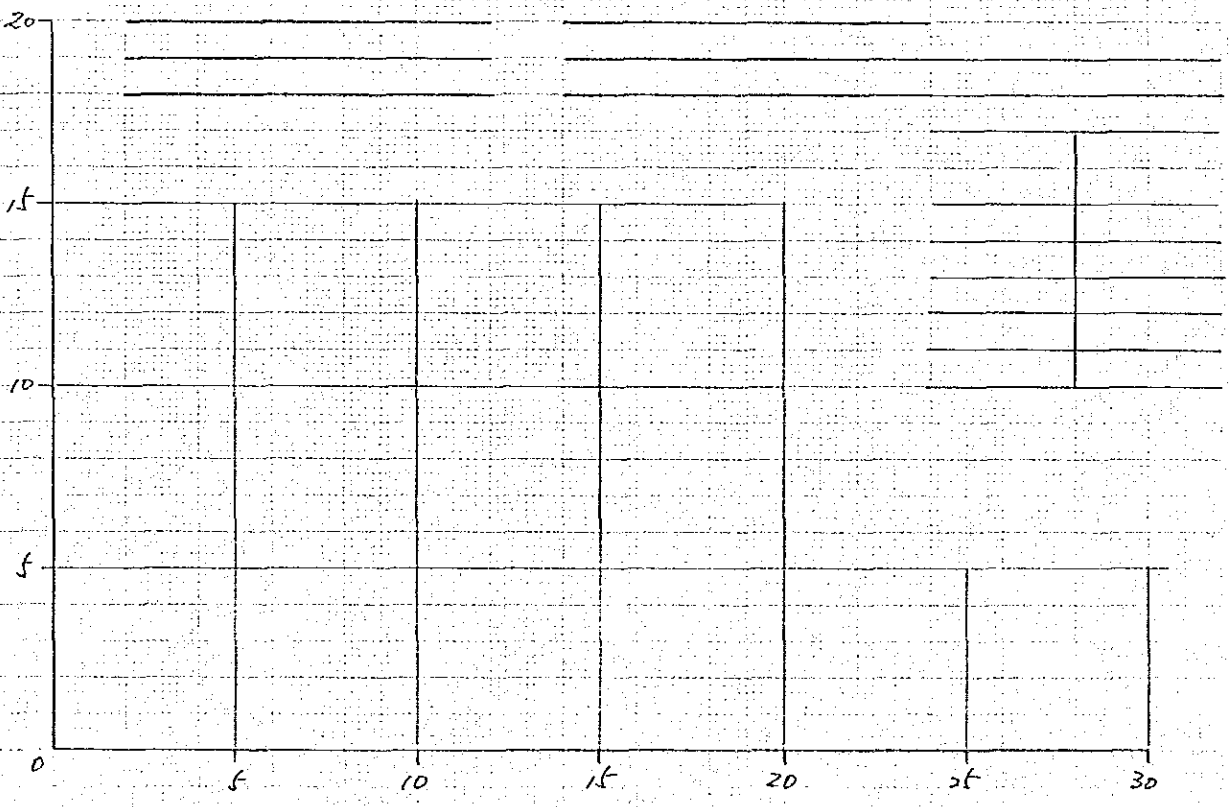
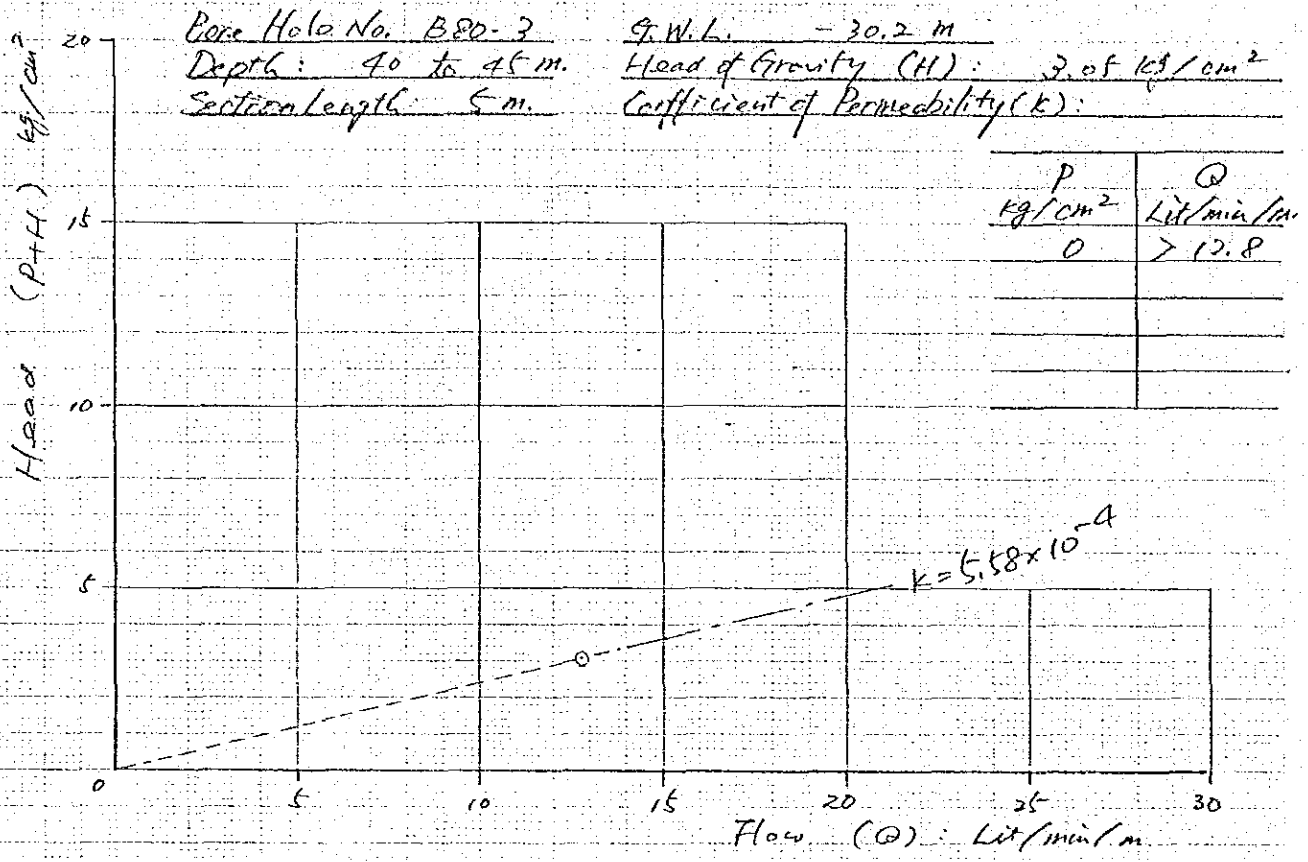
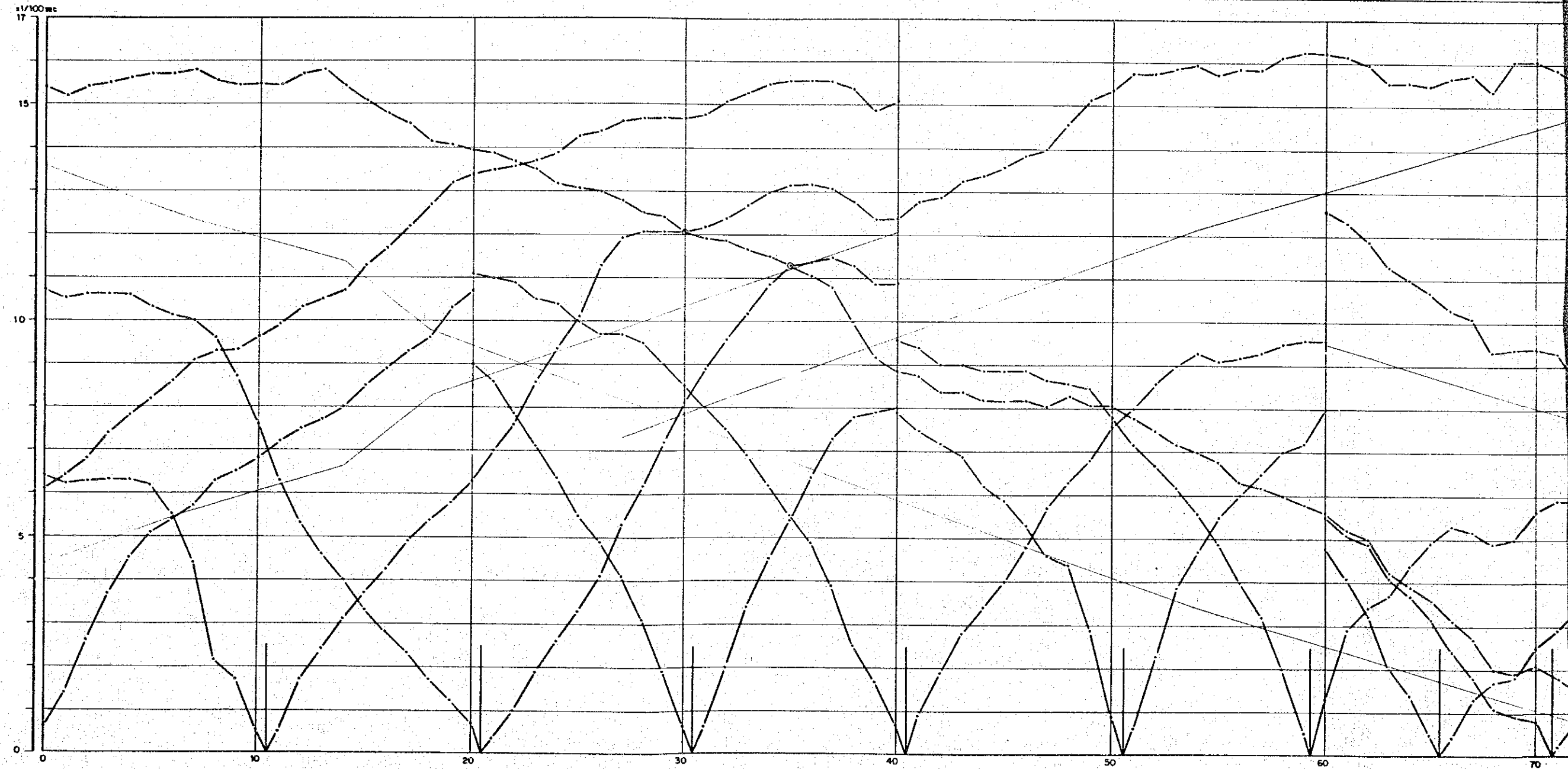
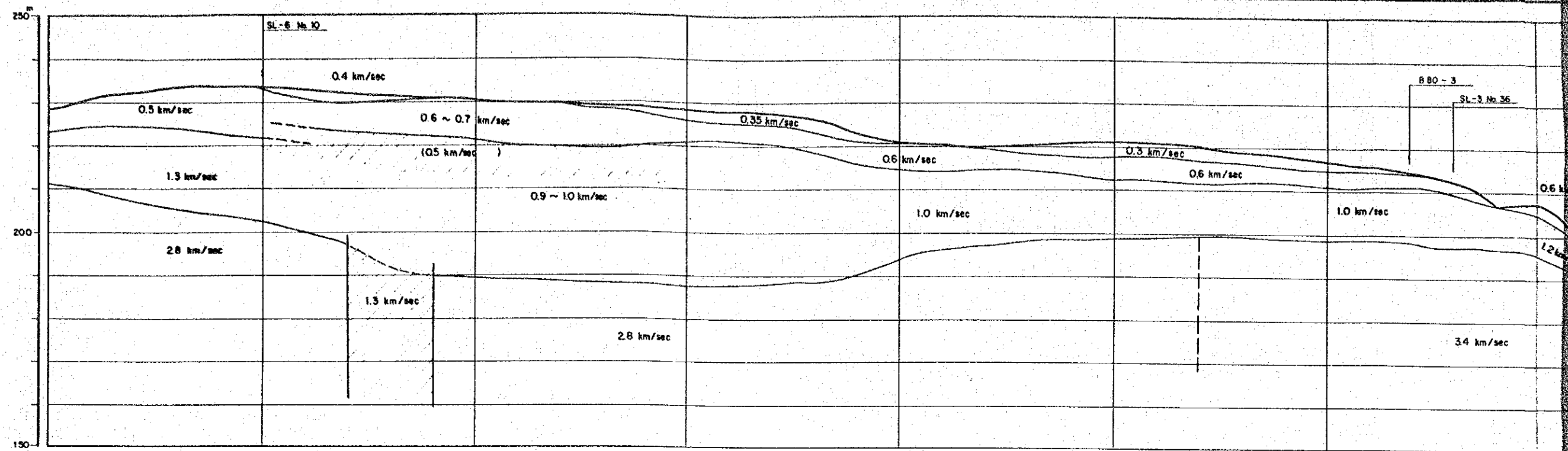
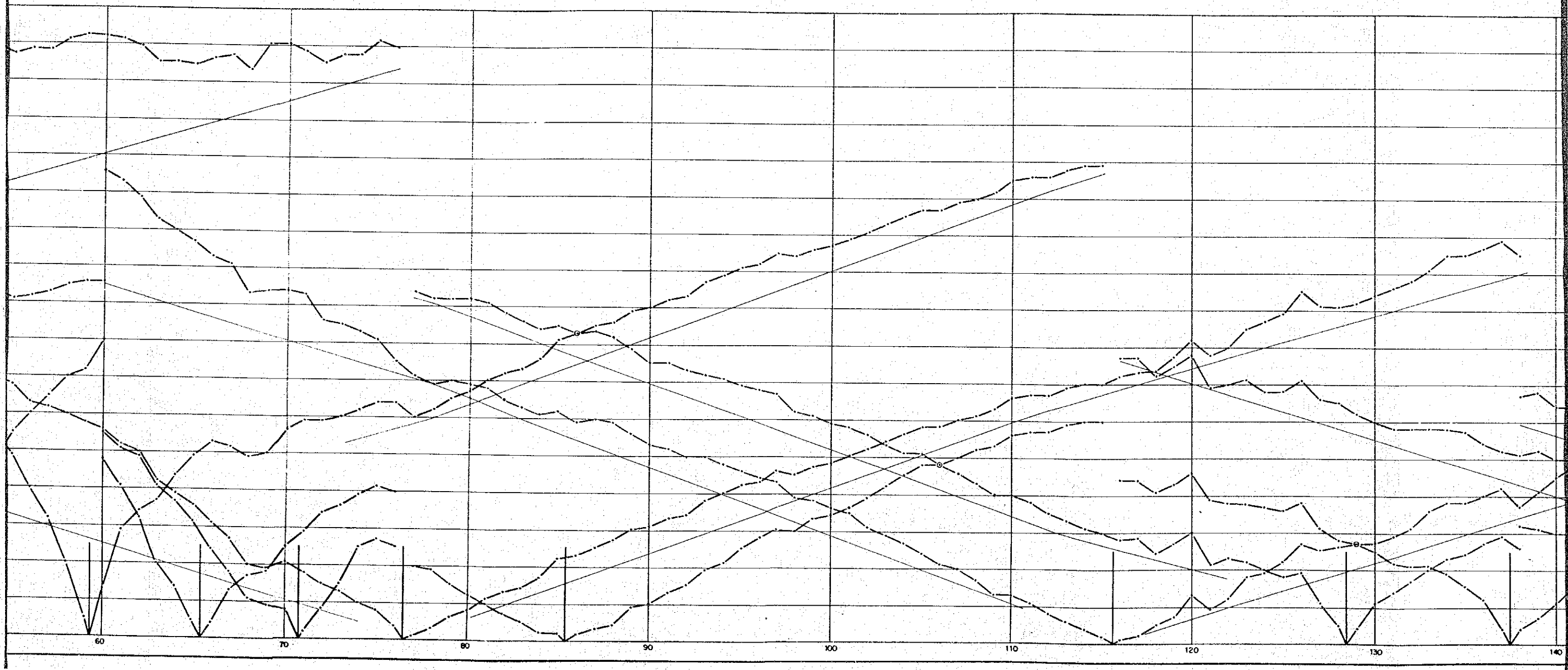
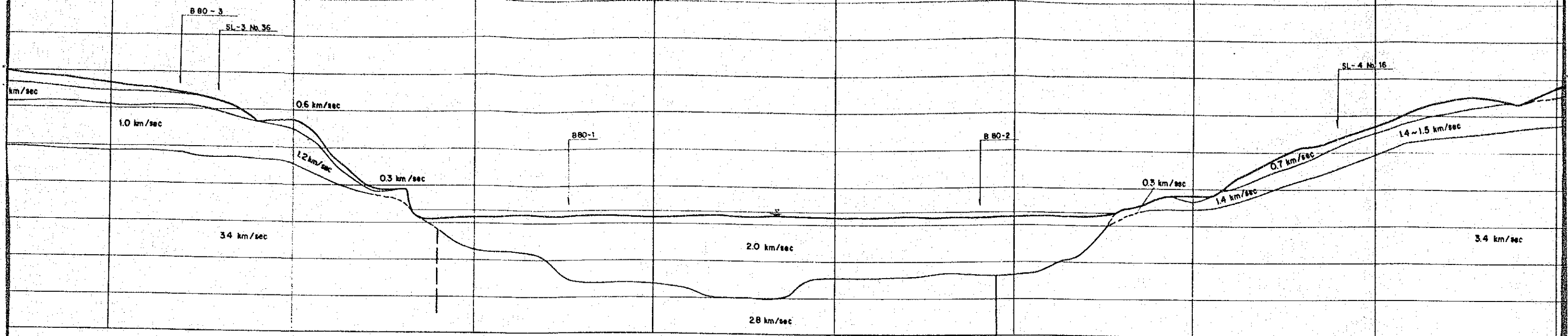


Figure A-11. HEAD-FLOW PLOT OF WATER PRESSURE TEST (7)





SL - 1



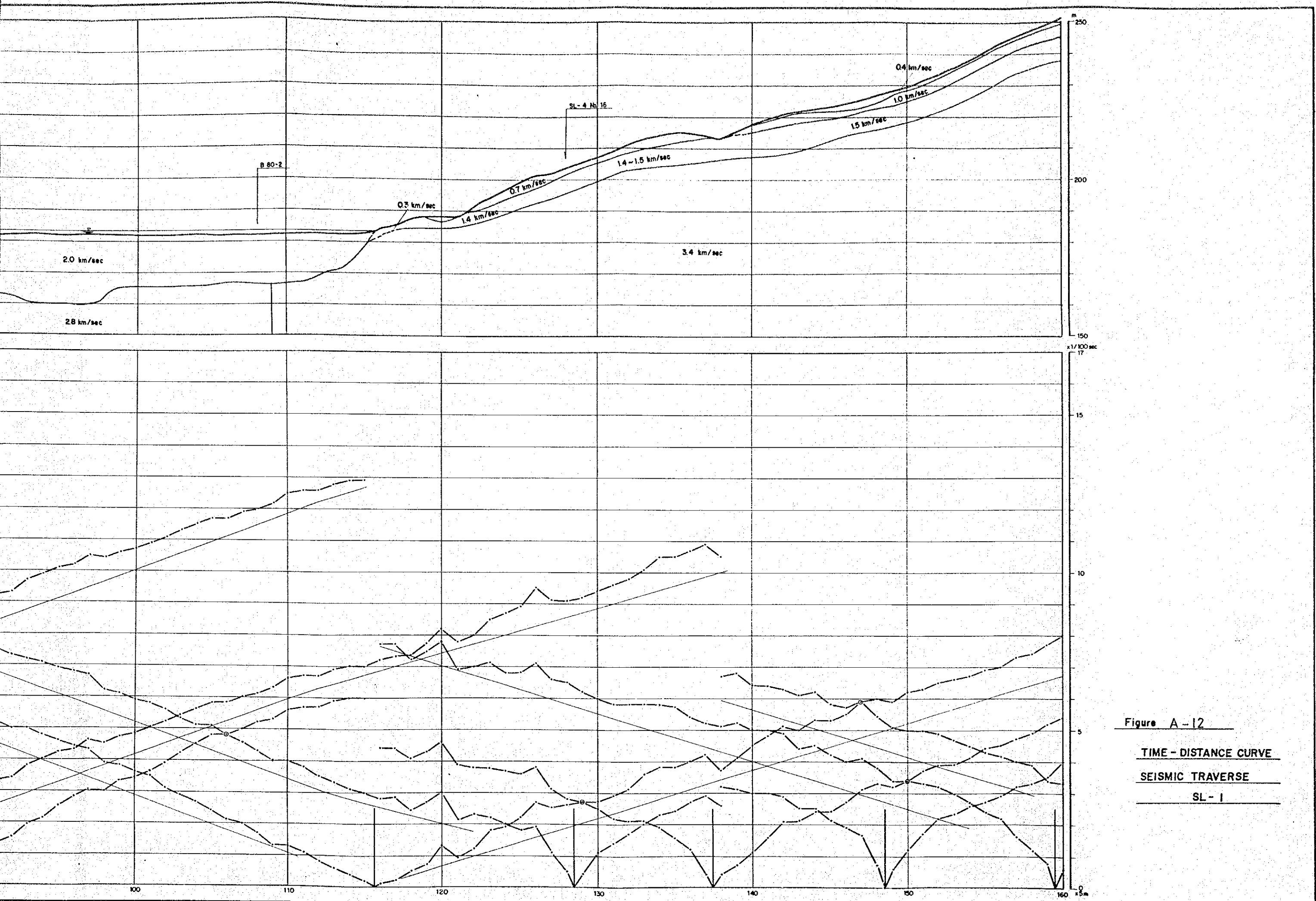
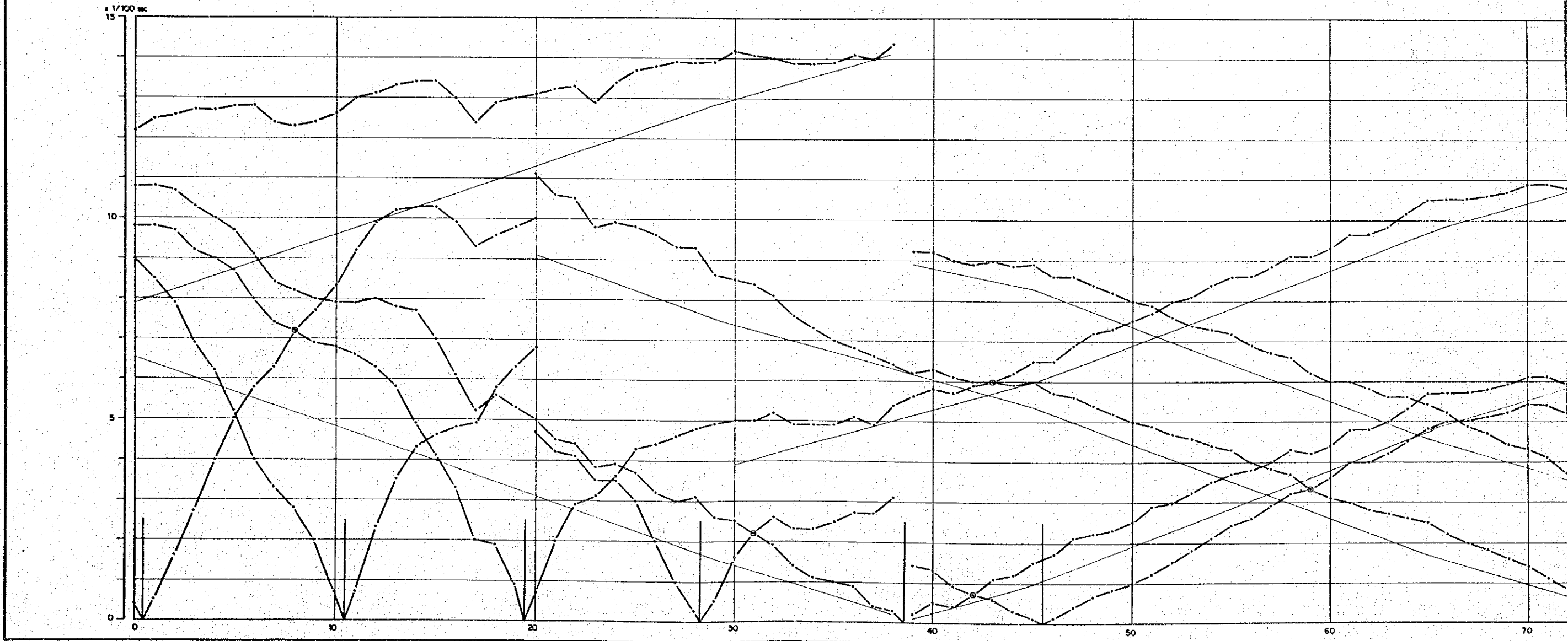
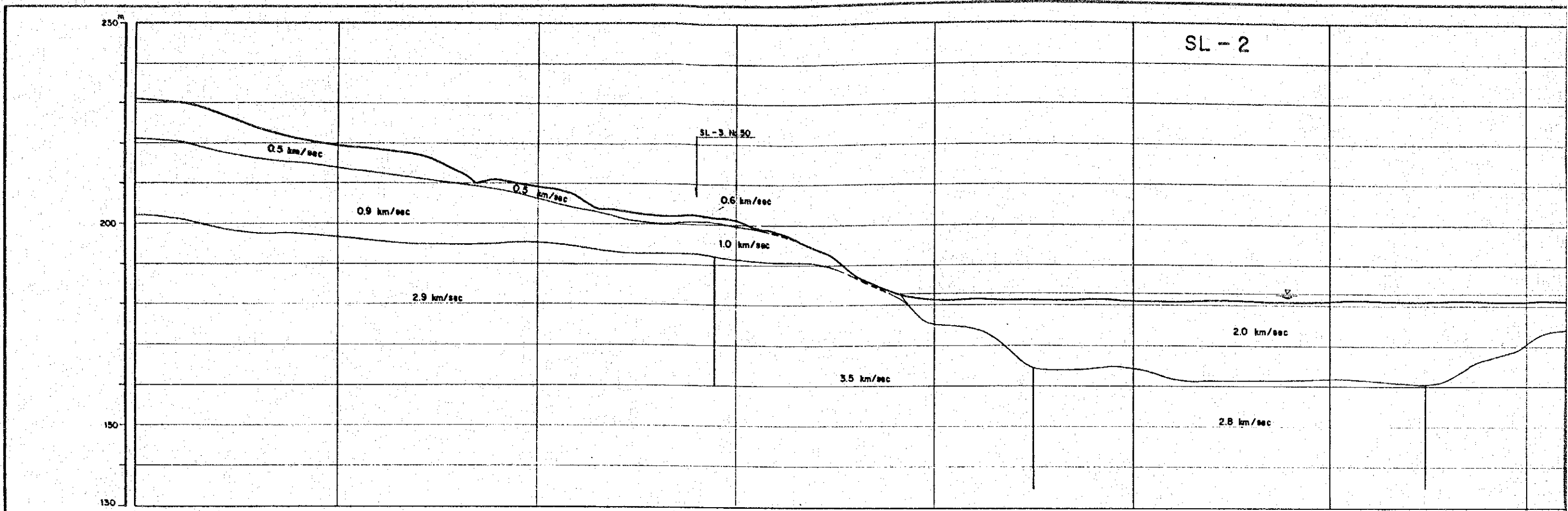
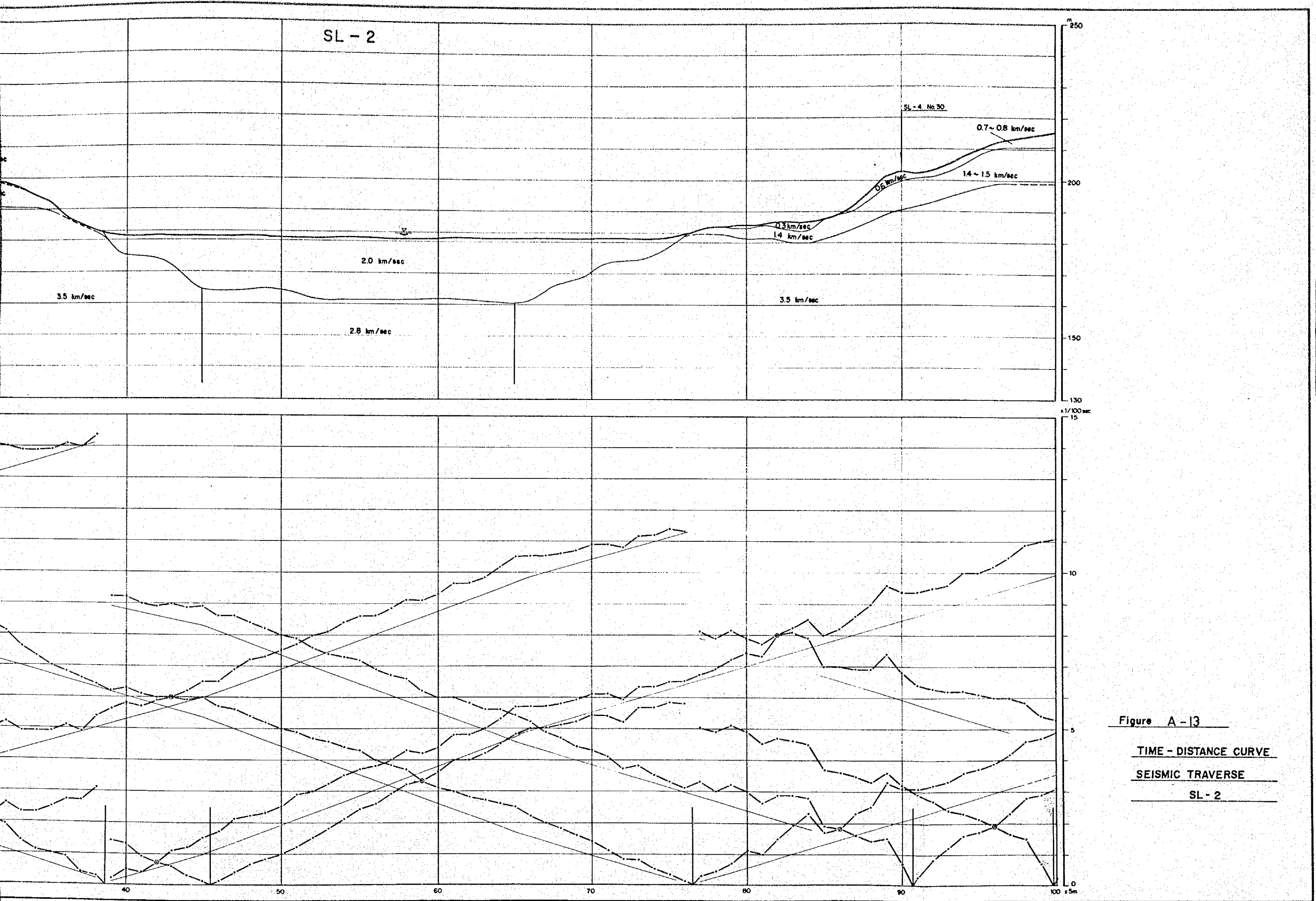


Figure A-12
 TIME - DISTANCE CURVE
 SEISMIC TRAVERSE
 SL - 1





SL - 2

SL - 4. No 30

Figure A - 13
 TIME - DISTANCE CURVE
 SEISMIC TRAVERSE
 SL - 2

SL - 3

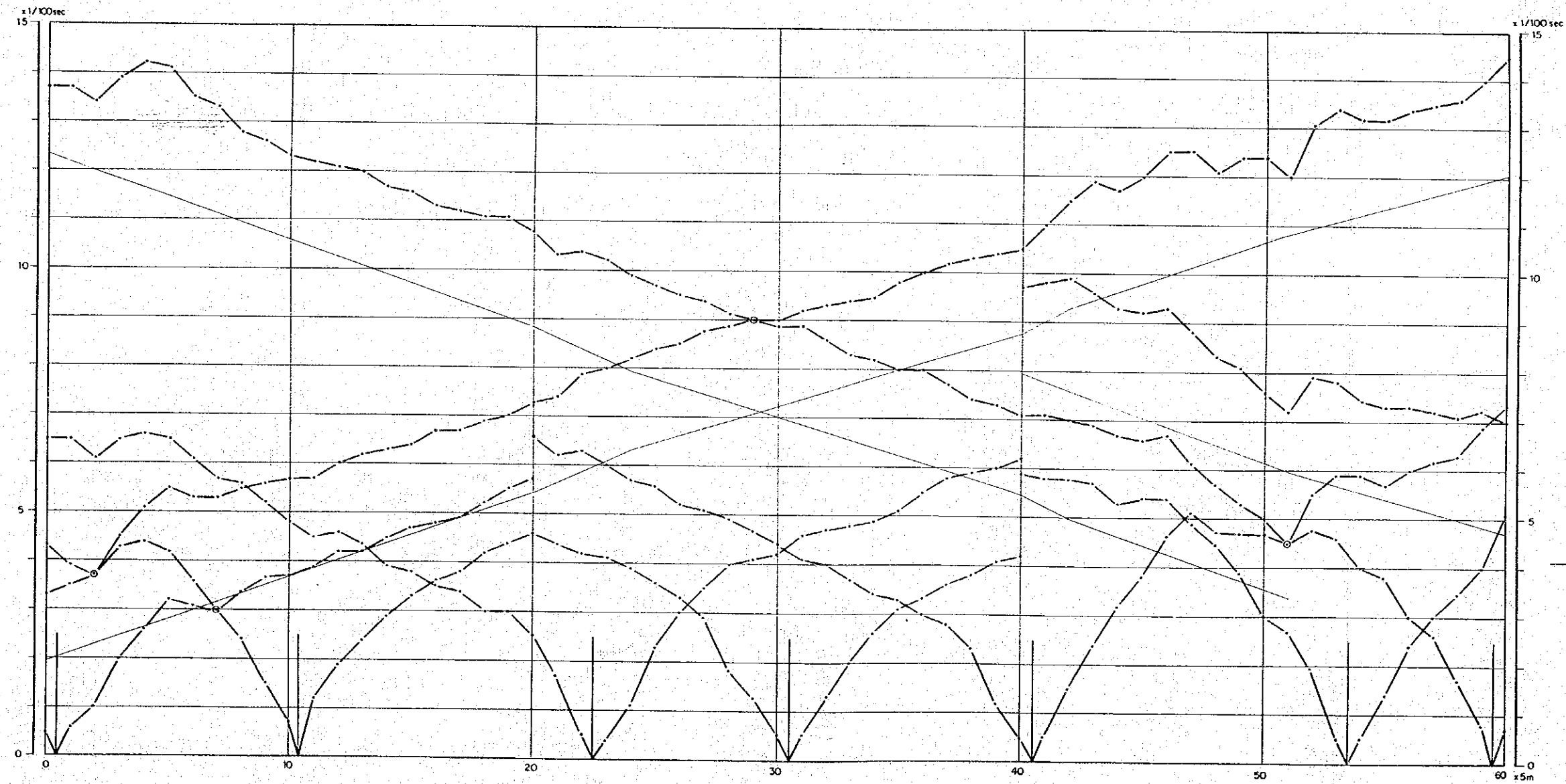
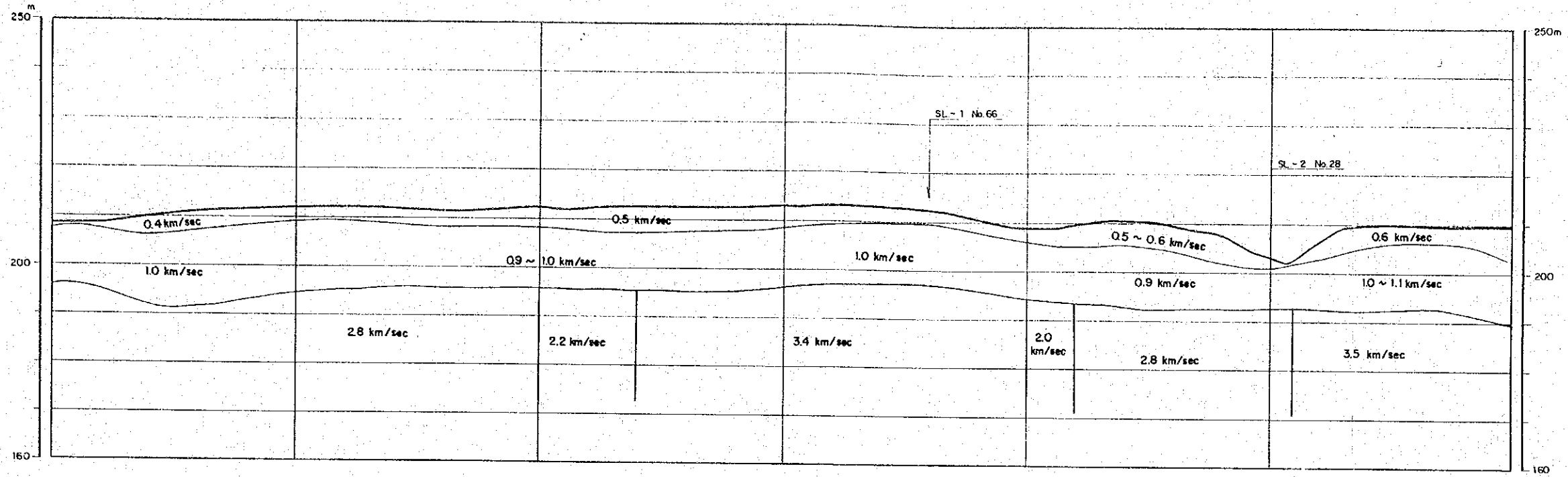


Figure A-14
TIME - DISTANCE CURVE
SEISMIC TRAVERSE
SL - 3

SL - 4

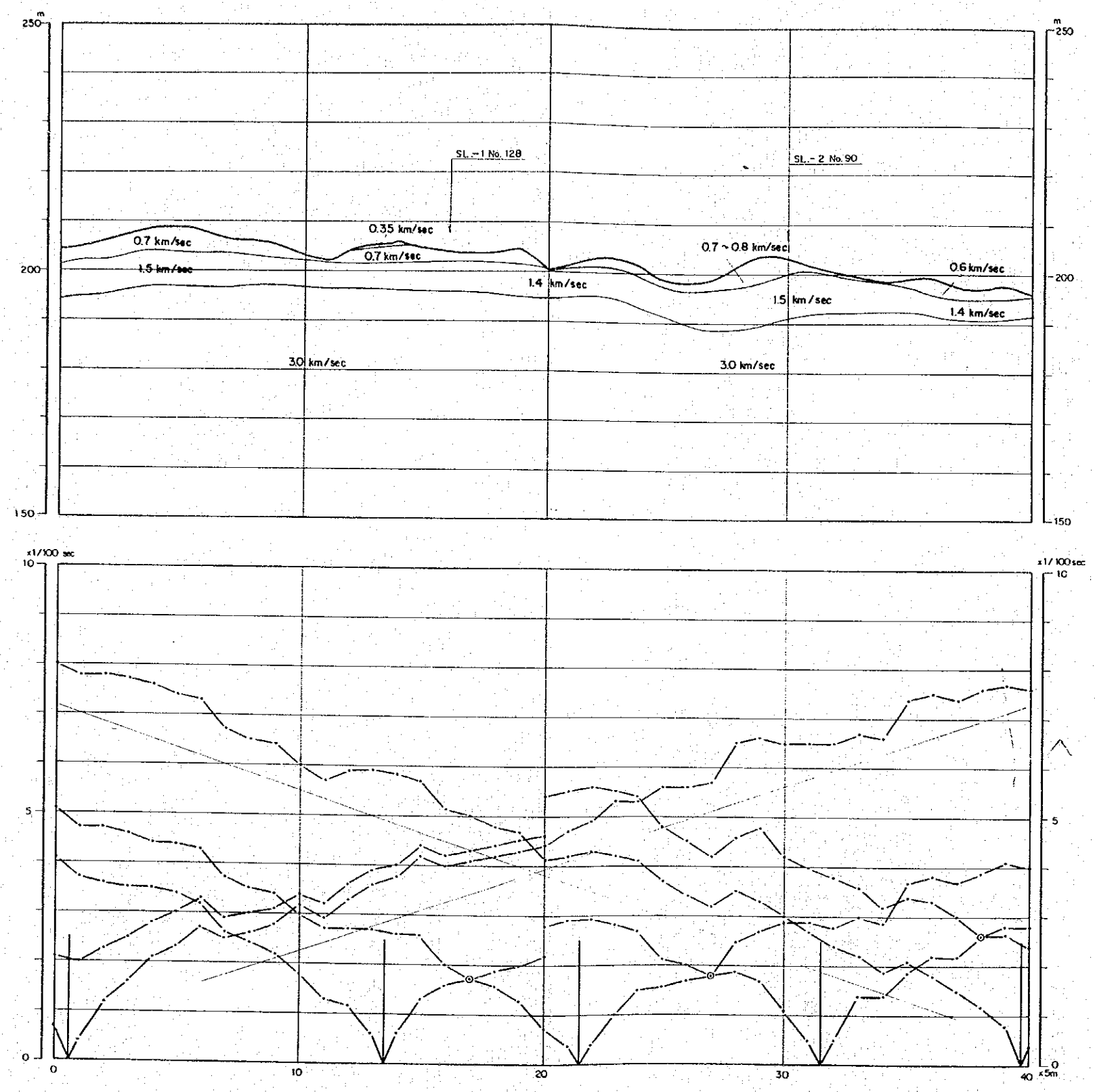


Figure A-15
 TIME - DISTANCE CURVE
 SEISMIC TRAVERSE
 SL - 4

SL - 5

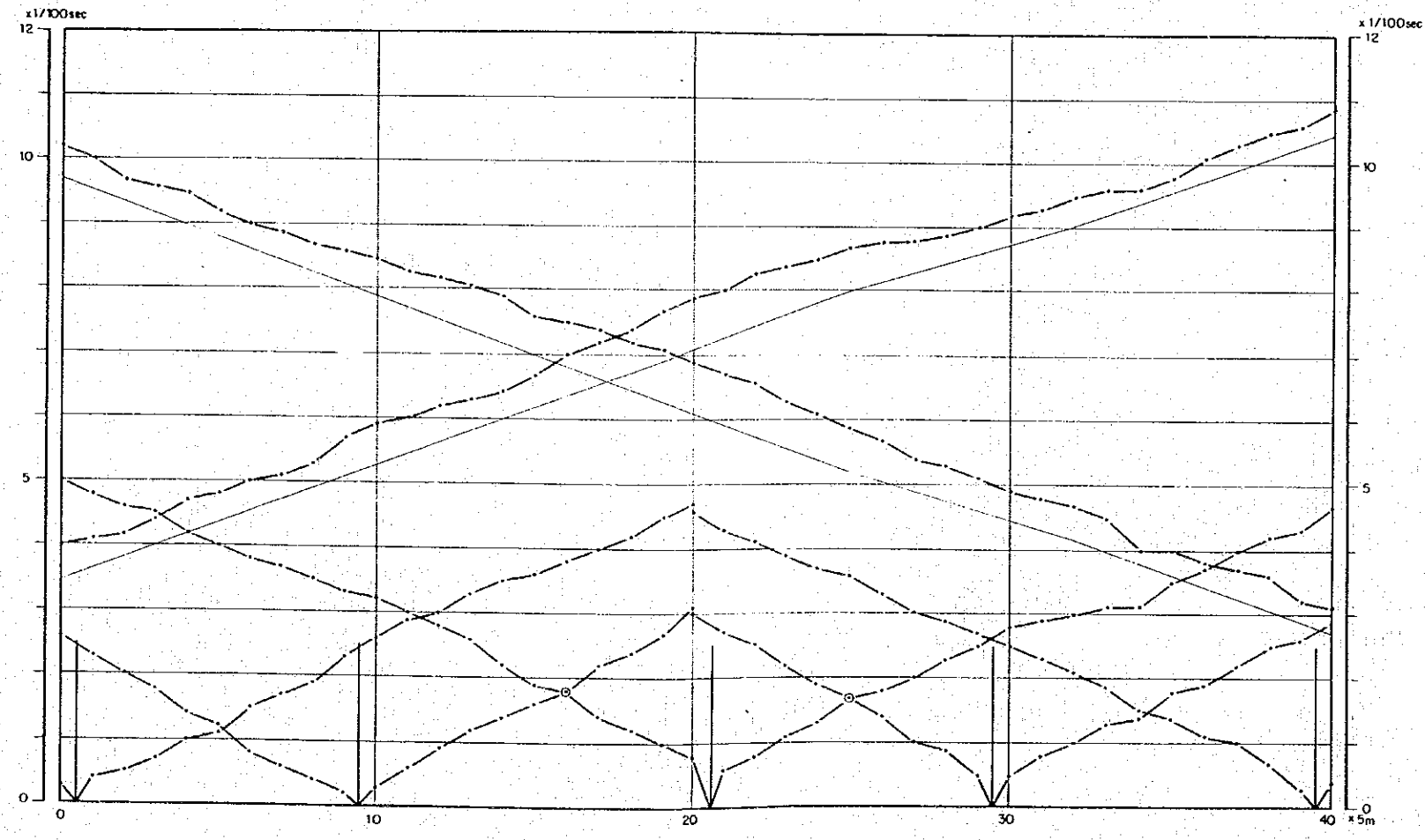
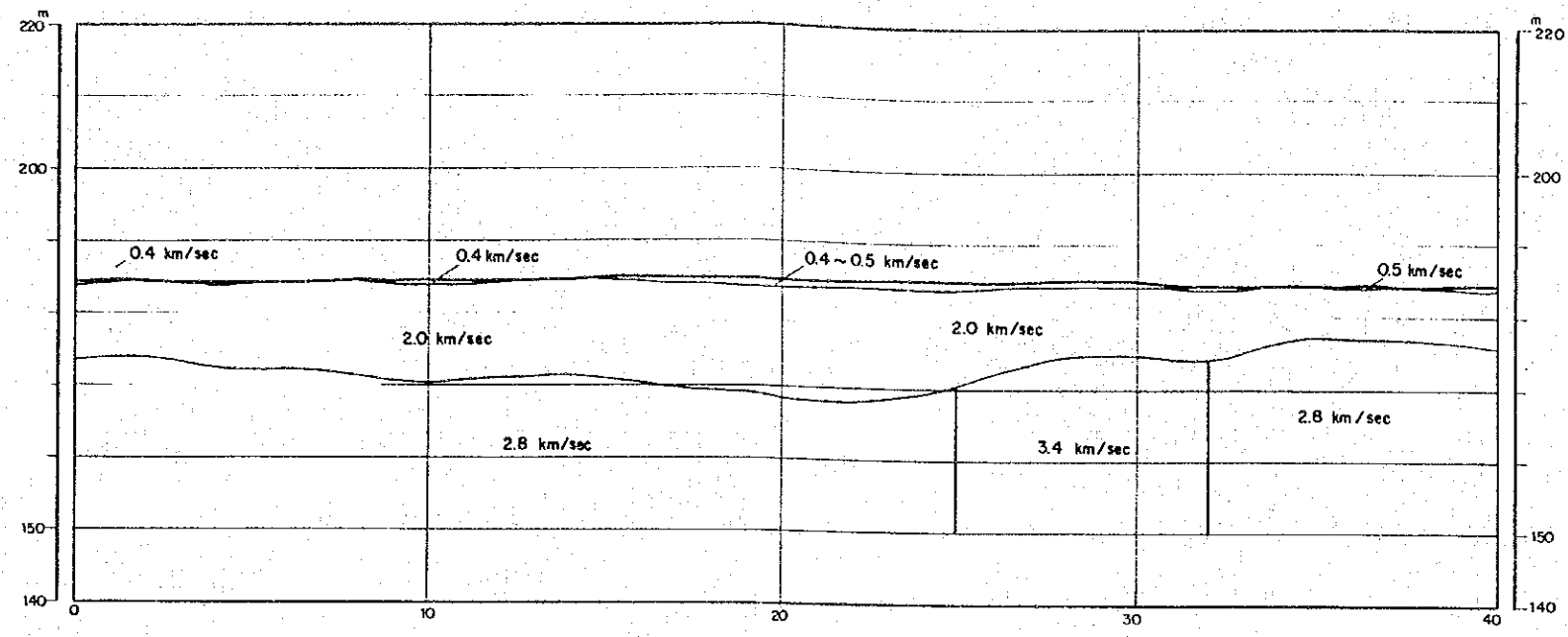


Figure A - 16
TIME - DISTANCE CURVE
SEISMIC TRAVERSE
SL - 5