

III-3. Ilog No.1 Upper Dam Site, Borehole No.3

BORING LOG (BORING NO.)

LOG - HILARANGAN PROJECT

Boring No. II-3 (1/2)
 Longitude _____
 Latitude _____
 Collar Elevation 48.0 m
 Direction - Dip _____

Location Right Abutment, Dam Axis
 Drilling from 10/24 up to 10/31
 Last Ground Water Level in Hole 35.0 m
 Last Hole Diameter 7.6 cm
 Geologist Crispin Leyva

Total Drilling Length 40.00 m
 Total Core Length 35.6 m
 Total Core Recovery 96 %
 Driller Machine TOHO
 Pump _____

Scale m	Elevation m	Depth m	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Classification Code	Core Hardness	Core Shape	Weathering	Core Recovery			Rugosity Value	Coefficient of Per- meability	Ground Water Level in Hole	Date	Scale m
											Max. Core Length	Core Recovery %	Core Recovery %					
1						No cores												1
2																		2
3		3.0																3
4		5.0	gray	SS		Fine-grained	C _L 2	V	D		10	10	80					4
6							C _L 3	VI			22	12	74					6
7		7.0					C _L to 2	III	C		40	23	98					7
8						Generally pea-sized components, fractures at 9.0-10 m.	C _M 3	II	B		99	37	99	2				8
9								I			82	51	96					9
11						7m. - 40 m.		II			42	22	100					11
12						Pea to pebble-sized components w/ fracturing at section 26.86 to 27.63 m.		I			97	97	97					12
13								II			90	62	93					13
14								II			97	26	97	2				14
15				Tuff				I	A		87	37	93					15
16				Breccia			C _M	II			98	66	98			15.0		16
17								II			92	36	93			15.2		17
18			gray				2	I			95	95	95					18
19								I			98	79	98	1				19
20								II			100	100	100					20
21								I			72	36	89					21
22								I			98	51	99					22
23								II			97	58	98	5				23
24								II			97	38	100					24
25								I			91	38	100					25
26								I			00	90	100					26
27		26.8						II			88	33	88					27
28		28.0					C _L to C _M	II			82	44	97					28
29							C _M	I			65	20	99	6				29
30								I			86	74	100					30
											00	60	00					31

BORING LOG (BORING NO.)

ILOG - HILABANGAN PROJECT

Boring No. II-3 (2/2)
 Longitude _____
 Latitude _____
 Collar Elevation _____
 Direction - Dip _____

Location _____
 Drilling term from _____ up to _____
 Last Ground Water Level in Hole _____ m
 Last Hole Diameter _____ cm
 Geologist _____

Total Drilling Length _____ m
 Total Core Length _____ m
 Total Core Recovery _____ %
 Drilling Machine _____
 Pump _____

#	Scale	Elevation	Depth	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Core Hardness	Core Shape	Weathering	R Q D %	Core Length	Core Recovery	Rugose Value	Coefficient of Permeability	Ground Water Level in Hole	Date	Scale
31							Pea to pebble-sized components w/ fracturing at section 38.58-38.84 m.		I		97	51	97					31
32									II		87	40	96					32
33					Tuff			2	I		100	51	100	3				33
34					Breccia			1	I	A	85	49	100					34
35				Gray					I		93	93	93					35
36									I		97	67	97					36
37									II		100	46	99	3				37
38									I		89	45	00					38
39									I		99	65	99					39
40																		40

FIELD PERMEABILITY TEST BY OPEN END METHOD

Dam site : Ilog 1
 Hole No.: DDH-3
 Depth: 0.0m - 5.0m
 Radius of casing: 7.6 cm
 Water level: 3,500.0 cm.
 Height of Casing: 10.0 cm
 H= 510.0 cm
 Q(ccu/cm/min)= 9,350.0 cm³/min
 K(cm/sec)= 0.0073099

Time (min)	Seepage Amount per min(l/min)
1	11
2	10
3	11
4	11
5	10
6	8
7	9
8	8
9	9
10	10
11	11
12	9
13	9
14	6
15	9
16	8
17	10
18	10
19	9
20	9

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FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING LOG - 1

No. DDH-3 5.0 m ~ 10.0 m

Lugeon Value 2 Lu Lu'

Critical Press. > 10.8 kg/cm² Ground Water Level 35.0 m

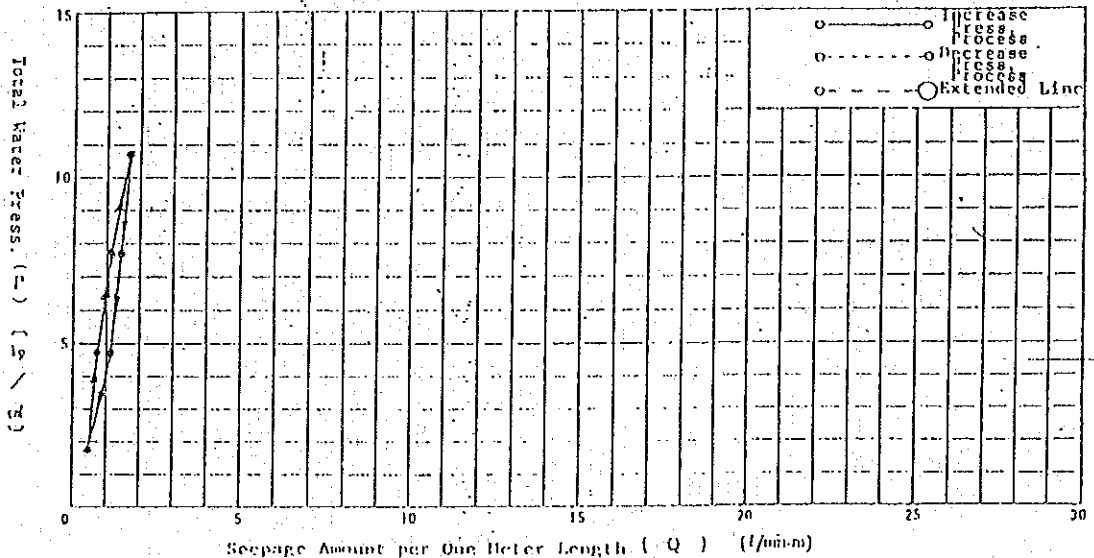
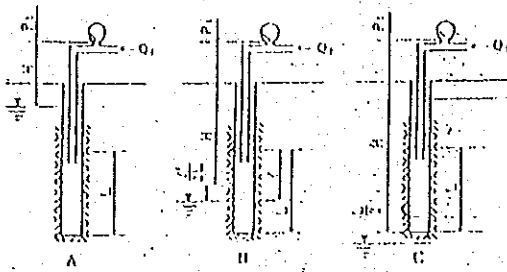
Date 10-24-90 Length of Tested Stage (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.35 m

Vol. of Spring Water l/min Type of Packer SINGLE



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Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min-m)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
	6	7	8	9	10					
1	2	2	3	3	3	2.7	0.5	0.0	0.79	1.79
4	3	3	3	4	4	3.5	0.7	0.0	0.79	4.79
7	4	3	4	3	4	5.5	1.1	0.0	0.79	7.79
10	5	5	5	6	6	8.5	1.7	0.0	0.79	10.79
7	8	8	8	8	8	6.9	1.4	0.0	0.79	7.79
4	7	7	7	7	7	5.5	1.1	0.0	0.79	4.79
1	6	6	5	5	5	2.5	0.5	0.0	0.79	1.79
	3	3	3	3	3					
	2	2	2	2	2					

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x2) x 10⁻⁵ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING LOG - 1
No. DDH-3 10.0 m ~ 15.0 m

Lugeon Value 2 LU LU'

Critical Press. > 11.3 kg/cm² Ground Water Level 35.0 m

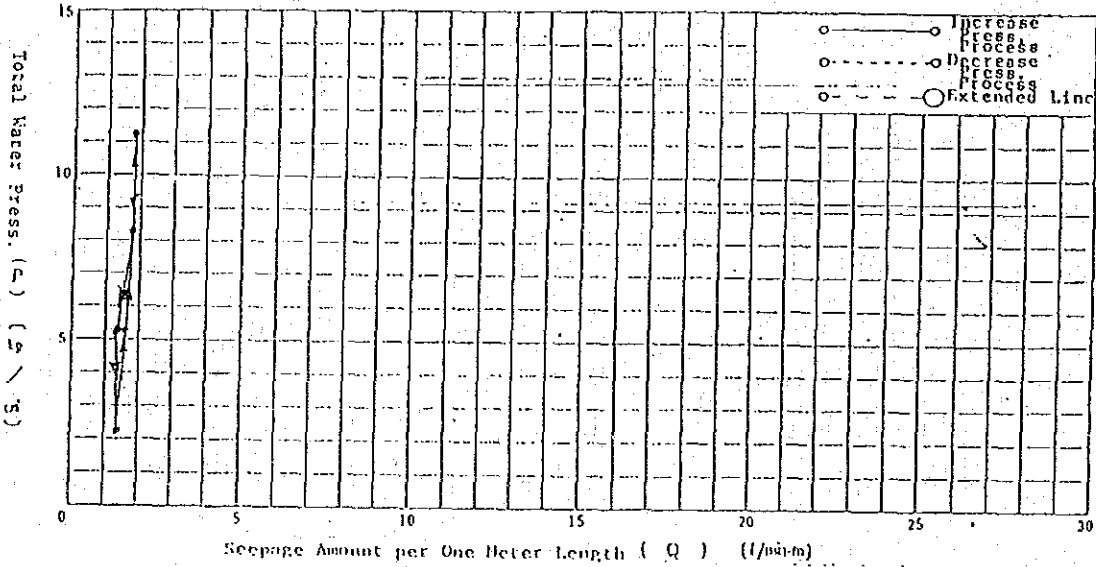
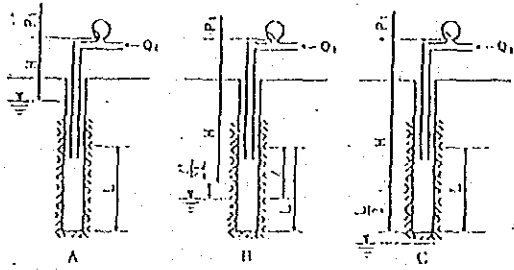
Date 10-25-90 Length of tested stage (L) 5.0 m

Injection Type (L) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.35 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Excess (P) (kg/cm ²)
	1	2	3	4	5					
1	7	7	7	7	7	7.0	1.4	0.0	1.29	2.29
4	8	8	8	8	8	8.0	1.6	0.0	1.29	5.29
7	9	9	9	9	9	9.0	1.8	0.0	1.29	8.29
10	9	9	9	9	9	9.0	1.8	0.0	1.29	11.29
7	8	8	8	8	8	8.0	1.6	0.0	1.29	8.29
4	7	7	7	7	7	7.0	1.4	0.0	1.29	5.29
1	7	7	7	7	7	7.0	1.4	0.0	1.29	2.29

Note: Loss Water Press. (P₂) [kg/cm²] = (0.187) x 10⁻⁶ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

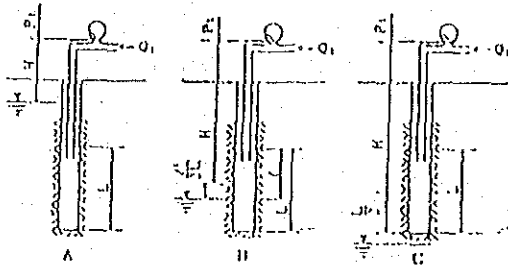
FIELD PERMEABILITY TEST
(LUGEON TEST)

NORTH LOG - 1

No. DDH-3

15.0m ~

20.0m



Lugeon Value

1 Lu

Lu'

Critical Press. > 11.8 kg/cm²

Ground Water Level 35.0 m

Date 10-25-90

Length of Cased (L) 5.0 m

Length of Injection Pipe (L_i)

Hole Diameter 76 mm

Depth of Spring Water

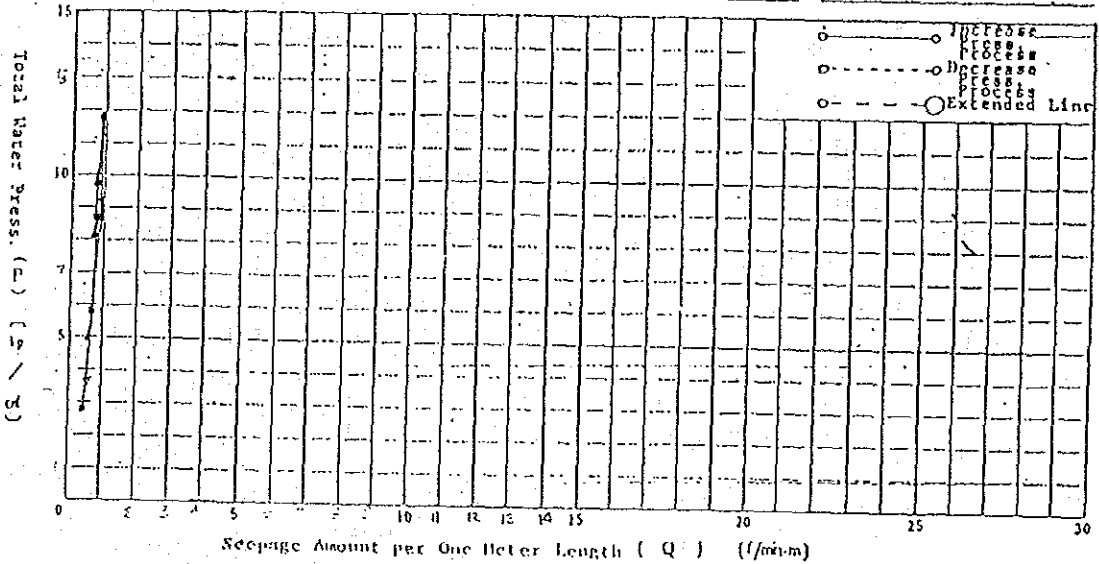
Dip Vertical

Press. of Spring Water

Height of Press. Gauge 0.35 m

Vol. of Spring Water

Type of Packer



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
1	2	2	2	2	2	2.0	0.4	0.0	1.79	2.79
4	3	3	3	3	3	3.0	0.6	0.0	1.79	5.79
7	3	3	3	3	3	3.0	0.6	0.0	1.79	8.79
10	4	4	4	5	5	4.5	0.9	0.0	1.79	11.79
7	4	4	4	4	4	3.5	0.7	0.0	1.79	8.79
4	3	3	3	3	3	3.0	0.6	0.0	1.79	5.79
1	2	2	2	2	2	2.0	0.4	0.0	1.79	2.79

Note: Loss Water Press. (P₂) [kg/cm²] = (H) × 10⁻³ × Average Seepage Amount (Q₁)² [l/min] × Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING LOG - 1

No. DDH-3 20.0 m ~ 25.0 m

Lugeon Value 5 LU LU

Critical Press. 9.3 kg/cm² Ground Water Level 35.0 m

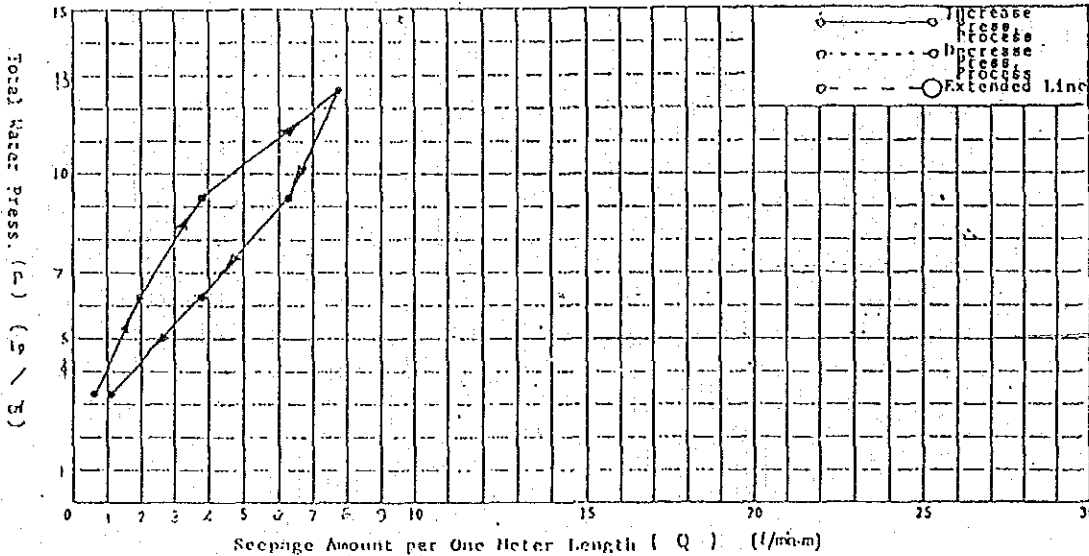
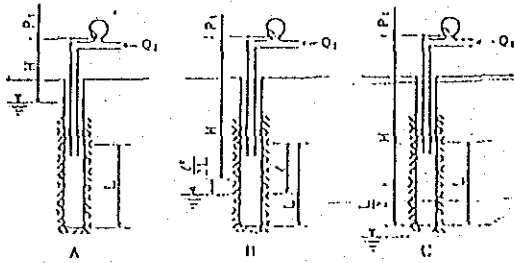
Date 10-26-90 Length of Stage (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.35 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	1	2	3	4	5	Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
1	6	7	8	9	10	3.0	0.6	0.0	2.29	3.29
4	11	10	10	11	10	10.0	2.0	0.0	2.29	6.29
7	18	19	19	19	20	19.3	3.9	0.0	2.29	9.29
10	38	38	39	39	39	39.1	7.8	0.0	2.29	12.29
7	32	32	32	31	31	31.1	6.2	0.0	2.29	9.29
4	20	20	20	20	19	19.5	3.9	0.0	2.29	6.29
1	6	6	5	5	6	5.5	1.1	0.0	2.29	3.29

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1 x 10⁻²) x Average Seepage Amount (Q₁) [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING LOG -1

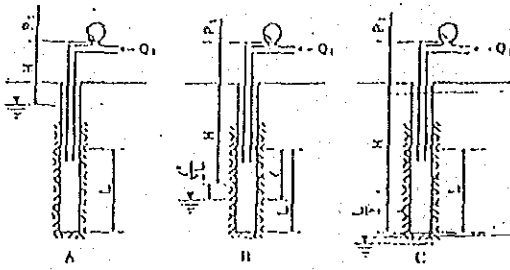
No. DDH-3

25.0 m ~ 30.0m

Lugeon Value

6 Lu

Lu'



Critical Press. 9.8 kg/cm²

Ground Water Level 35.0m

Date 10-29-90.

Length of (Tested) Stage (L) 5.0 m

Length of Injection Pipe (L_i) m

Hole Diameter 76 mm

Depth of Spring Water m

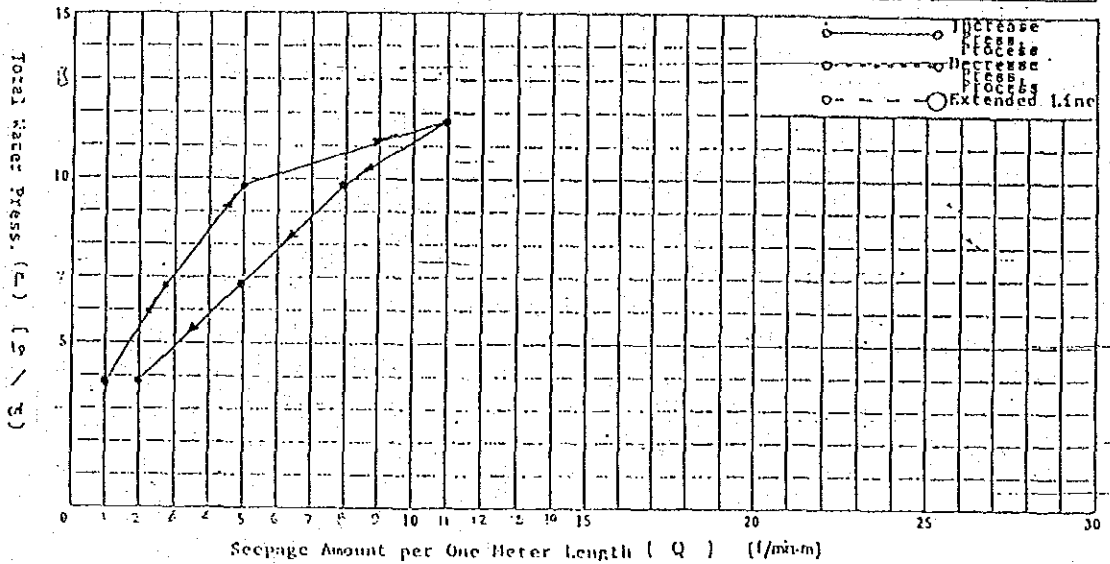
Dip Vertical

Press. of Surface Water kg/cm²

Height of Press. Gauge 0.35 m

Vol. of Spring Water /min

Type of Packer SINGLE



Gauge Press. (P ₁) [kg/cm ²]	Seepage Amount per min. [l/min]					Average Seepage Amount (Q ₁) [l/min]	Seepage Amount per one Meter (Q) [l/min-m]	Loss Water Press. (P ₂) [kg/cm ²]	Hydrostatic Press. (H) [kg/cm ²]	Total Water Press. (P) [kg/cm ²]
	1	2	3	4	5					
1	5	5	5	5	5	5.0	1.0	0.0	2.79	3.79
4	13	13	14	13	14	13.5	2.7	0.0	2.79	6.79
7	24	24	25	25	26	25.0	5.0	0.0	2.79	9.79
10	54	55	55	55	55	55.1	11.0	0.0	2.79	12.79
7	42	42	41	40	40	40.1	8.0	0.0	2.79	9.79
4	26	25	26	25	25	25.2	5.0	0.0	2.79	6.79
1	11	11	11	10	10	10.1	2.0	0.0	2.79	3.79

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1 x D) x 10⁻² x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

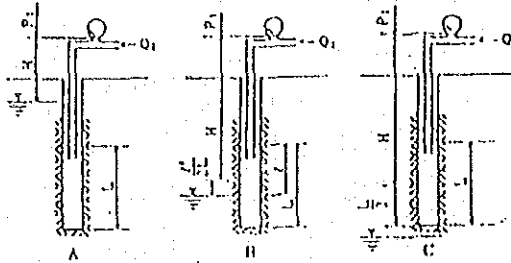
BORING LOG - 1

No. DDH-3

30.0m ~ 35.0m

Lugeon Value

3 Lu Lu'



Critical Press. 7.3 kg/cm²

Ground Water Level 35.0m

Date 10-30-90.

Length of Section 5.0 m

Length of Injection Pipe (lt) m

Hole Diameter 76 mm

Depth of Spring Water m

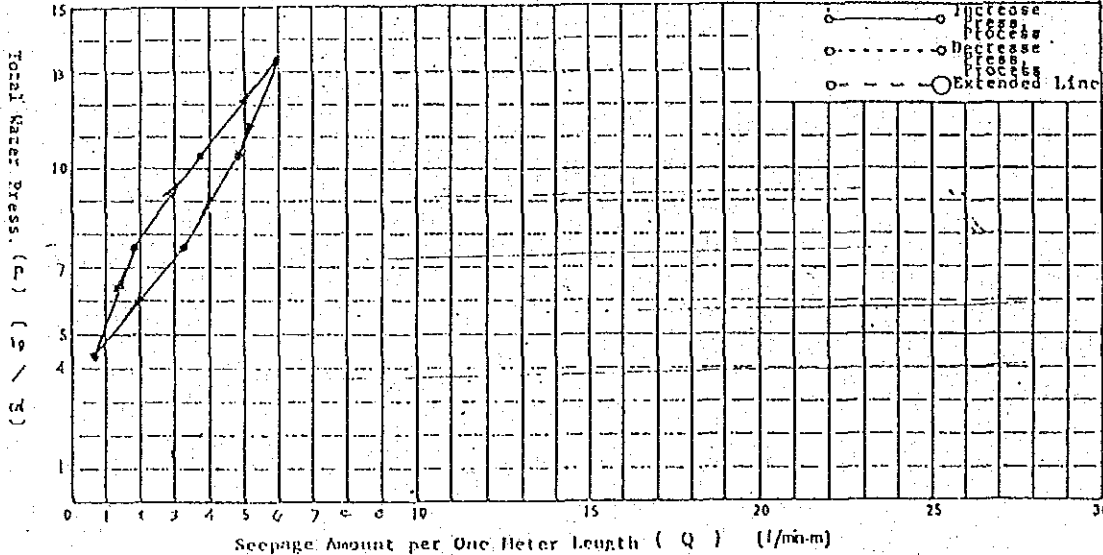
Dip Vertical

Press. of Spring Water kg/cm²

Height of Press. Gauge 0.35 m

Vol. of Spring Water l/min

Type of Packer SINGLE



33

Gauge Press. (P ₁) (kg/cm²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q ₁) (l/min-m)	Loss Water Press. (P ₂) (kg/cm²)	Hydrostatic Press. (P ₃) (kg/cm²)	Total Water Press. (P ₁) (kg/cm²)
1	4	4	4	4	4	4.0	0.8	0.0	3.29	4.29
4	9	10	9	10	10	9.5	1.9	0.0	3.29	7.29
7	18	18	18	18	18	18.0	3.6	0.0	3.29	10.29
10	29	29	29	30	30	29.8	6.0	0.0	3.29	13.29
7	25	25	25	25	25	24.5	4.9	0.0	3.29	10.29
4	17	16	16	15	17	16.2	3.2	0.0	3.29	7.29
1	5	5	4	4	3	4.2	0.8	0.0	3.29	4.29

Note: Loss Water Press. (P₂) [kg/cm²] = (Q₁ / 2) × 10⁻⁵ × Average Seepage Amount (Q₁)² [l/min] × Length of Injection Pipe (L) [m]

Total Water Press. (P₁) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (P₃) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING ILOG-1

No. DDH-3 35.0 m ~ 40.0 m

Lugeon Value 3 LU LU'

Critical Press. > 13.5 kg/cm² Ground Water Level 35.0 m

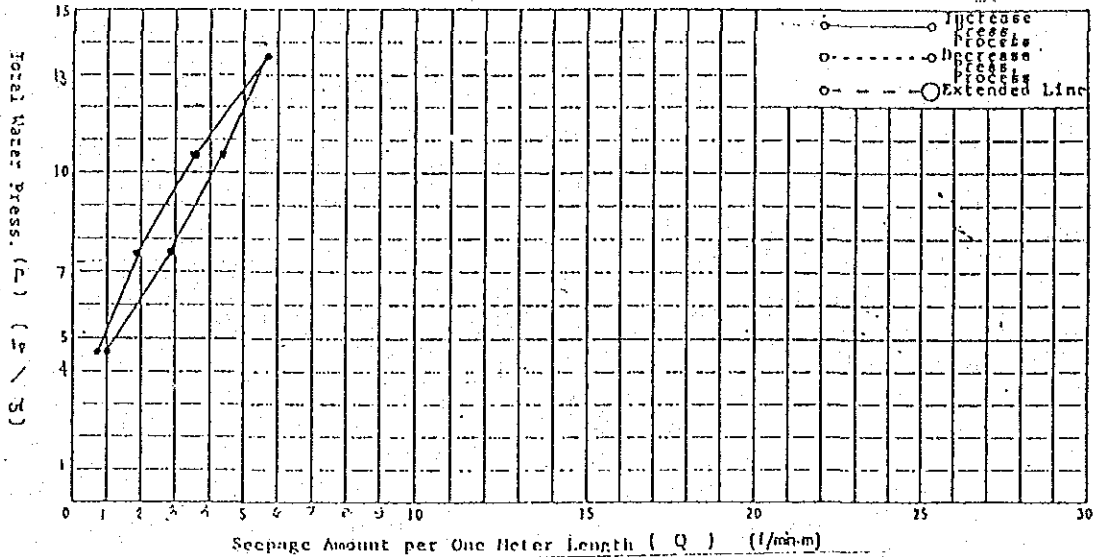
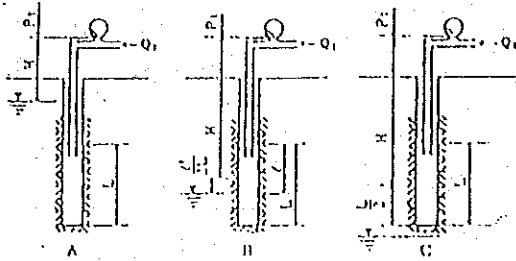
Date 10-30-90 Length of 5.0 m

Length of Injection Pipe (L) 76 cm

Depth of Spring Water Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.35 m

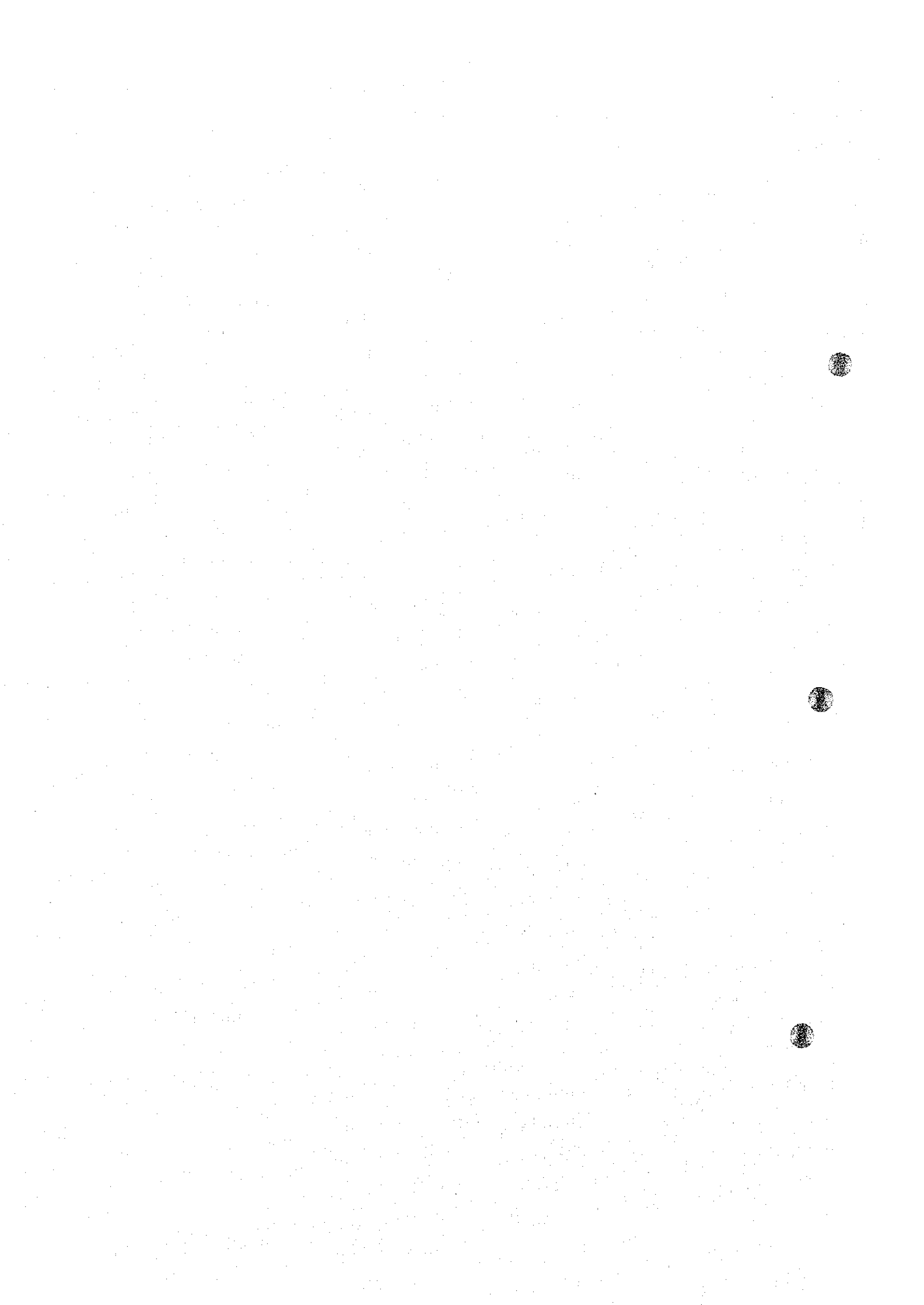
Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (Q) (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
	6	7	8	9	10					
1	3	3	4	3	4	3.8	0.8	0.0	3.54	4.54
4	9	9	9	9	9	9.3	1.9	0.0	3.54	7.54
7	17	17	17	18	17	17.6	3.5	0.0	3.54	10.54
10	27	28	28	29	29	28.4	5.7	0.0	3.54	13.54
7	24	23	23	23	22	22.2	4.4	0.0	3.54	10.54
4	15	14	15	15	14	14.5	2.9	0.0	3.54	7.54
1	6	6	5	5	5	5.1	1.0	0.0	3.54	4.54

Note: Loss Water Press. (H) [kg/cm²] = (P₁ - P₂) x 10⁻² x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]

Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]



III-4. Hilabangan No.1 Dam Site, Borehole No.1

BORING LOG (BORING NO.)

ILOG - HILABANGAN PROJECT

Boring No. H1-1 (1/2)
 Longitude _____
 Latitude _____
 Collar Elevation 90.0 m.
 Direction - Dip _____

Location Right Abutment, Dam Axis
 Drilling Term from 12/1/90 up to 12/4/90
 Last Ground Water Level in Hole 6.5 m
 Last Hole Diameter 7.6 cm
 Geologist Crispin Leyva

Total Drilling Length 40.00 m
 Total Core Length 36.9 m
 Total Core Recovery 94.6 %
 Drilling Machine TONE TAS
 Pump Bean Royal Triplex 35

Scale m	Elevation m	Depth m	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Core Hardness Mohs	Core Shape	Weathering	Core Recovery %	R Q D %	Max. Core Length cm	Core Recovery %	Water in drill bit Casing	Rugose Value	Coefficient of Per- meability	Ground Water Level in Hole	Date	Scale m
1				Sand		Medium Grained													1
2			Gray	Tuff	▲	Pea to Pebble sized components	C ₁	4	II	44	24	100	NW 7.6 cm.						2
3		Breccia		III					13	13	80	3							
4	4.4			D					30	15	90	4							
5		Pumice Tuff		V					0	6	41	5							
6		6.8	Gray		▲		C ₁	5	II	37	21	70							6
7				V		0			5	70	7								
8				C to		81			41	90	8								
9				II B		47			24	100	9								
10						62			21	100	10								
11				Tuff		III			64	31	100	11							
12				Breccia					84	38	100	12							
13									76	29	100	13							
14						II A			77	24	100	14							
15									77	17	100	15							
16					78	24	100	16											
17					75	23	100	17											
18					45	18	100	18											
19					59	13	100	19											
20					34	12	100	20											
21					58	20	100	21											
22		21.5	Gray		▲		C ₁	6	II	67	41	100							22
23				Tuff		II			78	29	96	23							
24									93	36	100	24							
25						I			94	54	100	25							
26									80	28	100	26							
27						II			58	16	93	27							
28									84	29	99	28							
29									54	21	100	29							
30		30.0			59	17	100	30											

BORING LOG (BORING NO.)

ILOG - HILABANGAN PROJECT

Boring No. H1-1 (2/2)
 Longitude _____
 Latitude _____
 Collar Elevation _____
 Direction - Dip _____

Location _____
 Drilling Turn Iron _____ up to _____
 Last Ground Water Level in Hole _____ m
 Last Hole Diameter _____ cm
 Geologist _____

Total Drilling Length _____ m
 Total Core Length _____ m
 Total Core Recovery _____ %
 Drilling Machine _____
 Pump _____

#	Scale	Elevation	Depth	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Weathering	Core Hardness	Core Shape	Weathering	Core Recovery			Rugosem Value	Coefficient of Permeability	Ground Water Level in Hole	Date	#	Scale
												X	R	D						
31					Tuff Breccia	▲▲▲	Pea to pebble-sized components	CI				45	16	100					31	
32			32.2			▲▲▲						38	14	100					32	
33						▲			III			52	15	100	8				33	
34						▲▲	Fine to medium-grained					58	18	94					34	
35					Tuff	▲▲		CI	3	A		46	16	94					35	
36						▲▲						72	21	100					36	
37						▲		CI		II		42	17	100					37	
38						▲						84	35	100	8	37.8			38	
39						▲						13	13	85		38.0			39	
40			40.0			▲			III			36	15	85					40	

FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1
 Hole No.: DDH-1
 Depth: 0.0m - 5.0m
 Radius of casing: 7.6 cm
 Water level: 650.0 cm.
 Height of Casing: 10.0 cm
 H= 510.0 cm
 Q(ccu.cm/min)= 14,650.0 cm³/min
 k(cm/sec)= 0.0114535

37

Time (min)	Seepage Amount per min(l/min)
1	14
2	14
3	13
4	14
5	15
6	15
7	15
8	15
9	15
10	15
11	14
12	15
13	14
14	15
15	15
16	16
17	15
18	15
19	15
20	14

293

FIELD PERMEABILITY TEST BY OPEN END METHOD

Dam site : Hilabangan 1
 Hole No. : DDH-1
 Depth : 5.0m - 10.0m
 Radius of casing : 7.6 cm
 Water level : 650.0 cm.
 Height of Casing : 100.0 cm
 H = 750.0 cm
 Q (cu. cm/min) = 14,050.0 cm³/min
 k (cm/sec) = 0.0074694

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Time (min)	Seepage Amount per min (l/min)
1	13
2	13
3	13
4	14
5	14
6	14
7	14
8	14
9	14
10	14
11	13
12	14
13	15
14	15
15	15
16	15
17	15
18	15
19	13
20	14

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FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING

No. DDH-1 10.0m~ 15.0m

Lugeon Value 7 Lu Lu'

Critical Press. 4.7 kg/cm² Ground Water Level 6.5 m

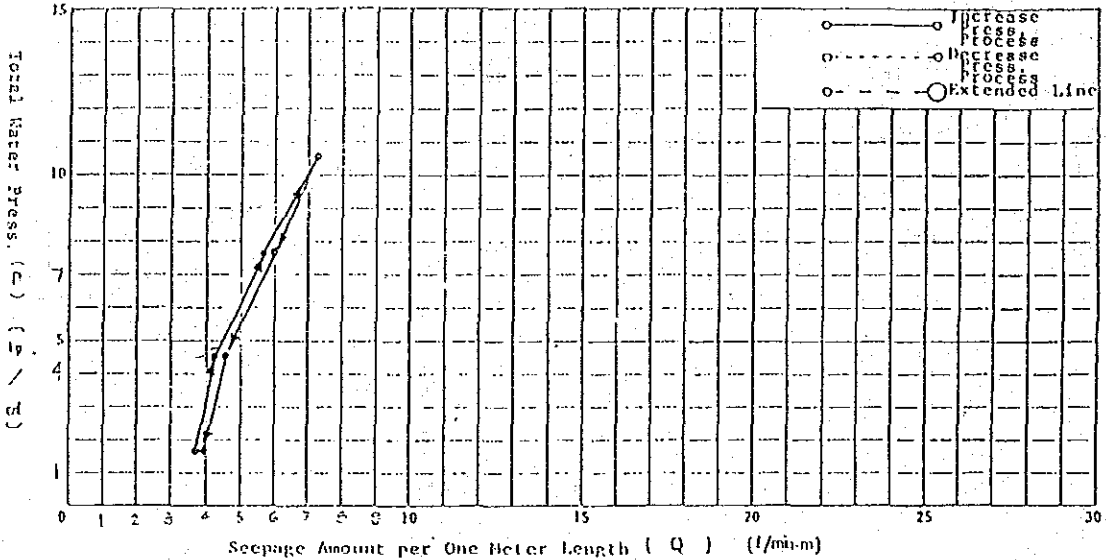
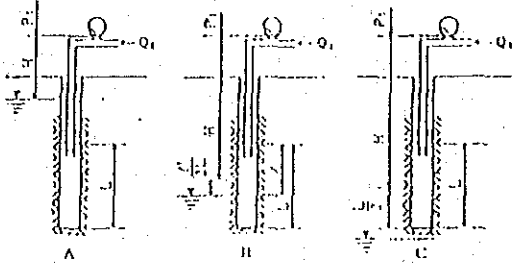
Date 12-02-90 Length of tested store (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.15 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	19	19	19	19	19	18.9	3.8	0.0	0.67	1.67
4	21	21	21	22	21	21.2	4.2	0.0	0.67	4.67
7	28	28	28	28	29	28.5	5.7	0.0	0.67	7.67
10	35	35	35	36	36	35.4	7.1	0.0	0.67	10.67
7	30	30	30	30	29	29.8	6.0	0.0	0.67	7.67
4	22	22	22	22	22	22.4	4.5	0.0	0.67	4.67
1	20	20	20	19	19	20.0	4.0	0.0	0.67	1.67

Note: Loss Water Press. (P₂) [kg/cm²] = (H) (x) x 10⁻³ x Average Seepage Amount (Q₁) [l/min] x Length of Injection Pipe (L_i) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

HORING

No. DDH 1 15.0 m ~ 20.0 m

Lugeon Value 7 Lu Lu'

Critical Press. 4.7 kg/cm² Ground Water Level 6.5 m

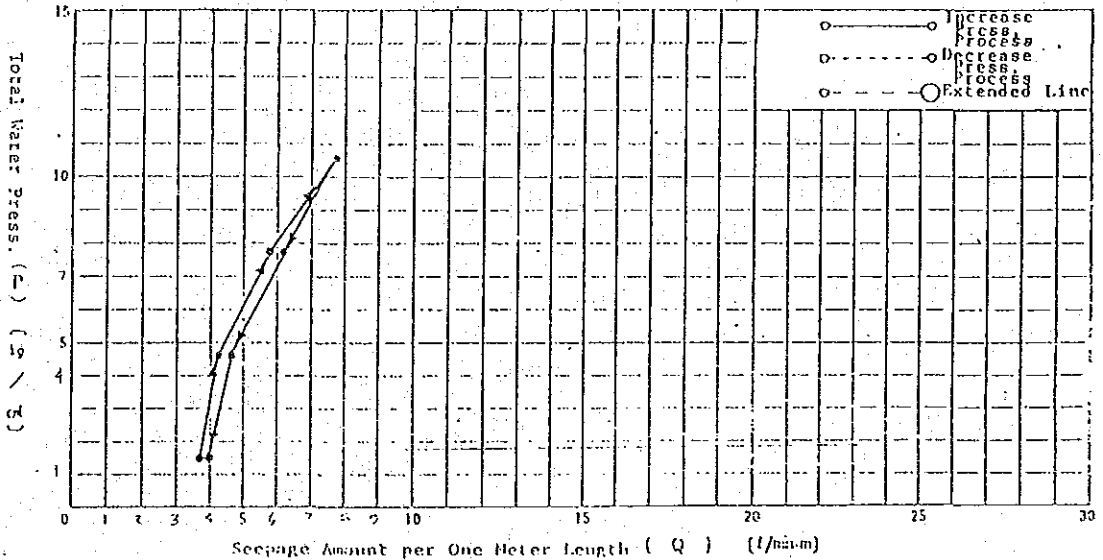
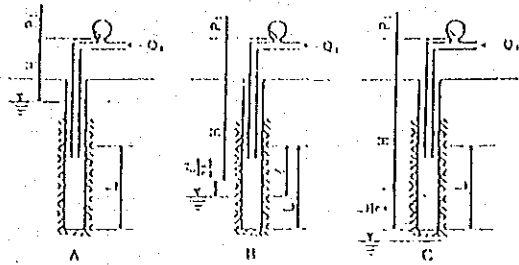
Date 12-02-90 Length of Test (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.15 m

Vol. of Spring Water l/min Type of Packer SINGLE

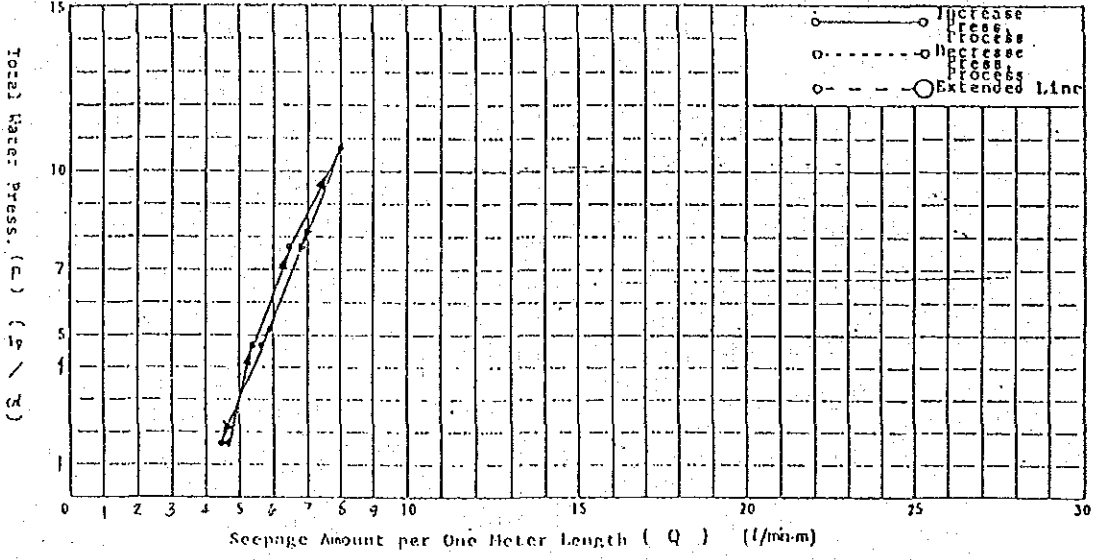
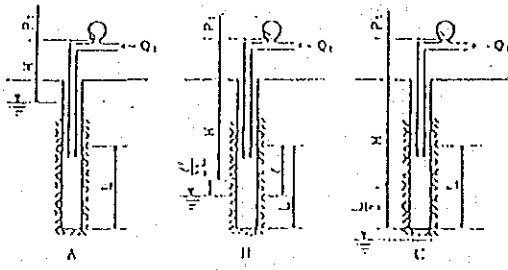


Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	19	19	19	19	18	18.8	3.8	0.0	0.67	1.67
4	20	21	20	21	21	20.8	4.2	0.0	0.67	4.67
7	29	30	30	29	30	29.7	5.9	0.0	0.67	7.67
10	38	38	39	38	39	38.8	7.8	0.0	0.67	10.67
7	31	31	31	30	30	30.8	6.2	0.0	0.67	7.67
4	23	23	23	23	23	23.0	4.6	0.0	0.67	4.67
1	20	20	20	20	20	20.2	4.0	0.0	0.67	1.67

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x2) x 10⁻² x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

NO. DDH 1 20.0 m ~ 25.0 m
 Lugeon Value 8 Lu Lu'
 Critical Press. 4.7 kg/cm² Ground Water Level 6.5 m
 Date 12-03-90 Length of Cased (L) 5.0 m
 Length of Injection Pipe (L_i) m Hole Diameter 76 mm
 Depth of Spring Water m Dip Vertical
 Press. of Spring Water kg/cm² Height of Press. Gauge 0.15 m
 Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1 6	2 7	3 8	4 9	5 10					
1	25	23	23	23	23	23.0	4.6	0.0	0.67	1.67
4	27	27	27	26	27	26.8	5.4	0.0	0.67	4.67
7	33	33	33	33	33	32.7	6.5	0.0	0.67	7.67
10	40	40	40	39	40	39.8	8.0	0.0	0.67	10.67
7	34	34	34	34	34	34.2	6.8	0.0	0.67	7.67
4	28	28	28	28	28	27.9	5.6	0.0	0.67	4.67
1	22	22	23	23	23	22.7	4.5	0.0	0.67	1.67

Notes: Loss Water Press. (P₂) [kg/cm²] = (Q₁)² × 10⁻³ × Average Seepage Amount (Q₁)² [l/min] × length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING No. DDH 1 25.0 m ~ 30.0 m

Lugeon Value 1 Lu Lu'

Critical Press. >10.7 kg/cm² Ground Water Level 6.5 m

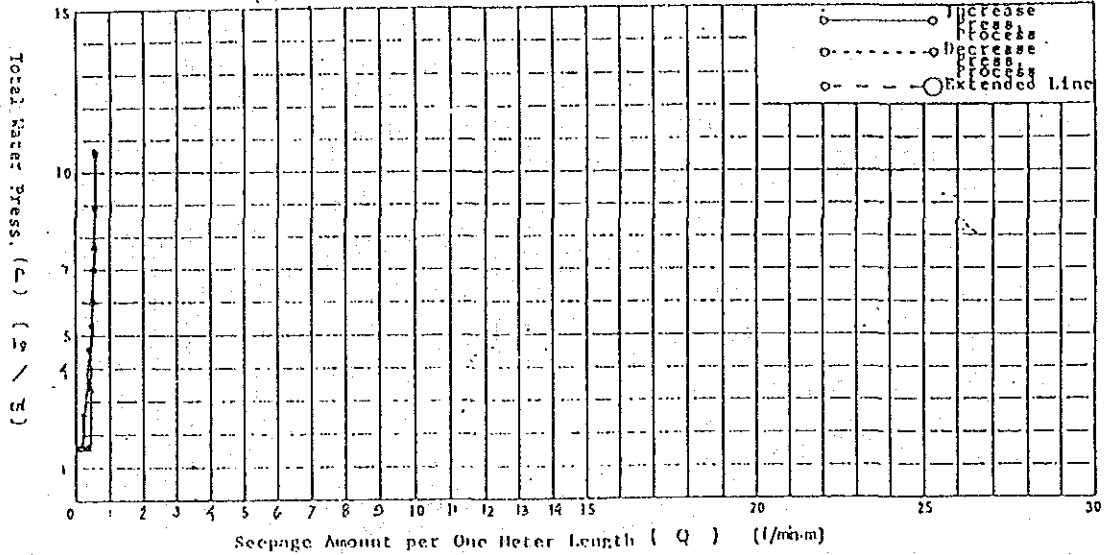
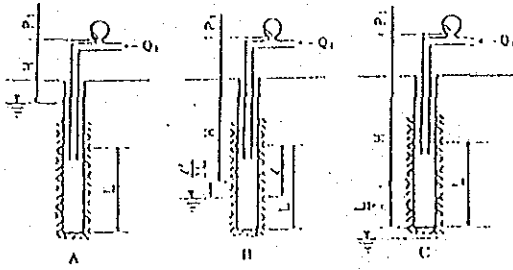
Date 12-03-90 Length of tested pipe 5.0 m

Length of Injection Pipe (L) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.15 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one meter (Q) (l/min-m)	Inn. Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1 6	2 7	3 8	4 9	5 10					
1	1.0	1.0	1.0	2.0	2.0	1.7	0.3	0.0	0.67	1.67
4	2.0	2.0	2.0	2.0	2.0	2.2	0.4	0.0	0.67	4.67
	2.0	2.0	3.0	2.0	3.0					
7	2.0	3.0	3.0	3.0	3.0	2.7	0.5	0.0	0.67	7.67
	2.0	2.0	3.0	3.0	3.0					
10	3.0	3.0	3.0	3.0	2.0	2.6	0.5	0.0	0.67	10.67
	2.0	2.0	3.0	2.0	3.0					
7	3.0	3.0	3.0	3.0	3.0	2.7	0.5	0.0	0.67	7.67
	3.0	3.0	2.0	2.0	2.0					
4	3.0	3.0	2.0	2.0	2.0	2.2	0.4	0.0	0.67	4.67
	2.0	2.0	2.0	2.0	2.0					
1	2.0	2.0	2.0	2.0	1.0	1.5	0.3	0.0	0.67	1.67
	1.0	1.0	2.0	1.0	1.0					

Note: Inn. Water Press. (P₂) [kg/cm²] = (G) × 10 × Average Seepage Amount (Q₁)² [l/min] × Length of Injection Pipe (L) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Inn. Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING

No. DPH 1 30.0 m ~ 35.0 m

Lugeon Value 8 Lu Lu'

Critical Press. 4.7 kg/cm² Ground Water Level 6.5 m

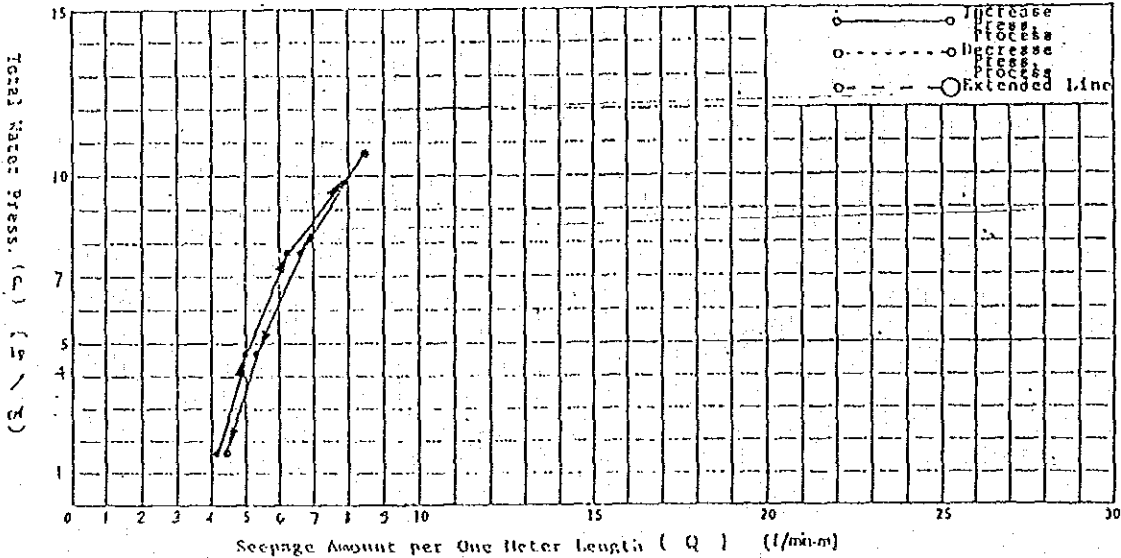
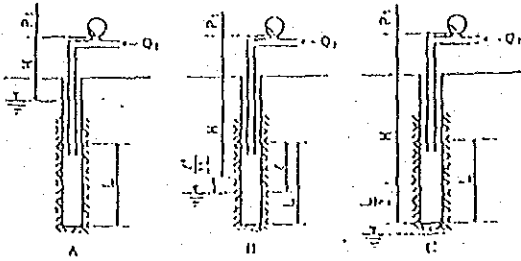
Date 12-04-90. Length of Core (L) 5.0 m

Length of Injection Pipe (lit) m Hole Diameter 76 mm

Press. of Spring Water m Dip Vertical

Vol. of Spring Water kg/cm² Height of Press. Gauge 0.15 m

Type of Packer SINGLE



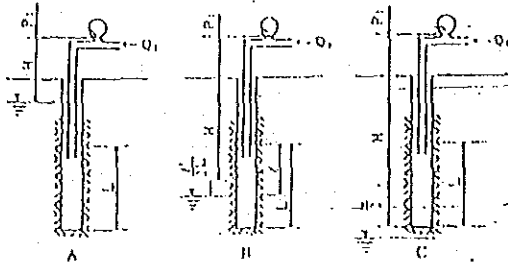
Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P ₂) (kg/cm ²)
	1	2	3	4	5					
1	21	20	21	21	21	20.8	4.2	0.0	0.67	1.67
4	25	25	25	25	25	24.8	5.0	0.0	0.67	4.67
7	31	32	32	32	32	31.9	6.4	0.0	0.67	7.67
10	43	42	42	42	42	42.4	8.5	0.0	0.67	10.67
7	32	33	33	33	33	32.8	6.6	0.0	0.67	7.67
4	27	27	27	27	27	27.1	5.4	0.0	0.67	4.67
1	22	22	22	22	22	22.1	4.4	0.0	0.67	1.67

Note: Loss Water Press. (P₂) [kg/cm²] = (Q₁ - Q) × 10⁻³ × Average Seepage Amount (Q₁)² [(l/min) × Length of Injection Pipe (L)] [m]
Total Water Press. (P₂) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

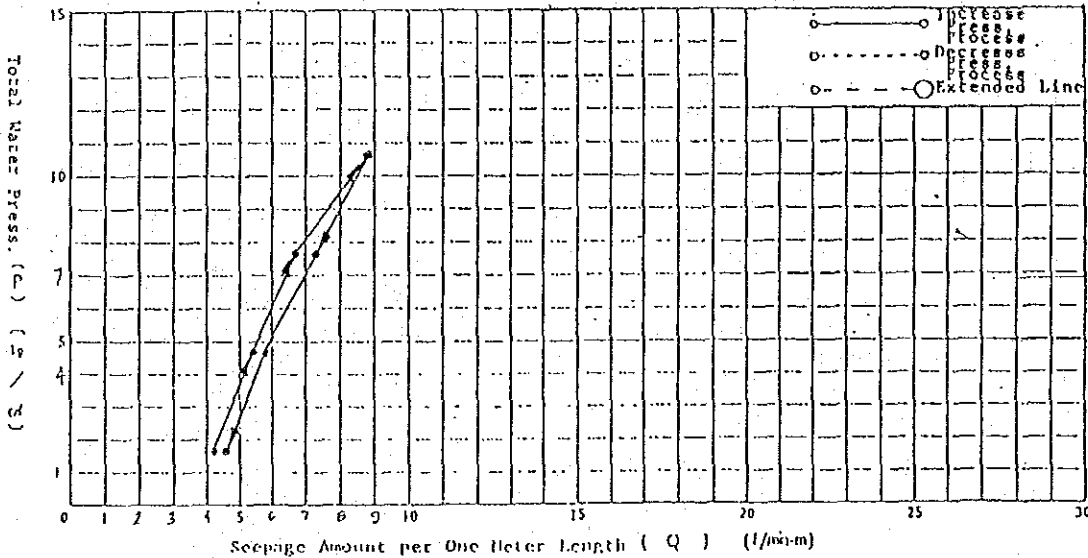
FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING No. DDH 1 35.0m - 40.0m

Lugeon Value 8 Lu Lu'

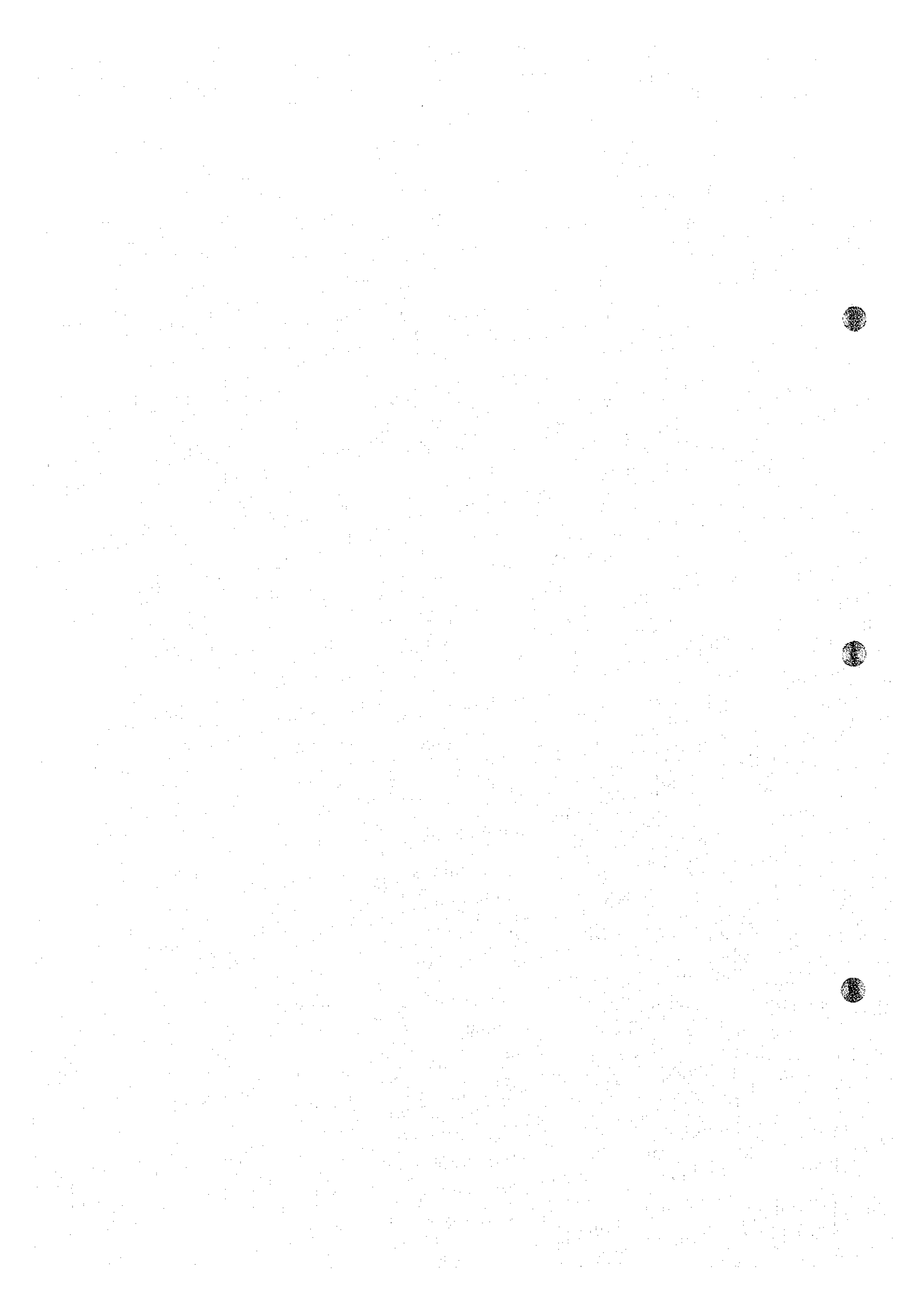


Critical Press. 7.7 kg/cm² Ground Water Level 6.5 m
 Date 12-04-90 Length of Cased Pipe (L) 5.0 m
 Length of Injection Pipe (L_i) m Hole Diameter 76 mm
 Depth of Spring Water m Dip Vertical
 Press. of Spring Water kg/cm² Height of Press. Gauge 0.15 m
 Vol. of Spring Water l/min Type of Packer Single



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
	6	7	8	9	10					
1	23	21	21	21	21	21.2	4.2	0.0	0.67	1.67
4	27	27	27	28	27	27.1	5.4	0.0	0.67	4.67
7	32	34	34	35	35	34.1	6.8	0.0	0.67	7.67
10	45	45	45	45	43	44.6	8.9	0.0	0.67	10.67
7	36	36	36	37	37	36.6	7.3	0.0	0.67	7.67
4	29	29	30	30	30	29.6	5.9	0.0	0.67	4.67
1	23	23	23	23	23	22.9	4.6	0.0	0.67	1.67

Note: Loss Water Press. (P₂) [kg/cm²] = (H₁ - H₂) x 10⁻² x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]



III-5. Hilabangan No.1 Dam Site, Borehole No.2

BORING LOG (BORING NO.)

LOG- HILABANGAN PROJECT

Boring No. H1-2 (2/3)
 Longitude
 Latitude
 Collar Elevation
 Direction - Dip

Location
 Drilling Term from up to
 Last Ground Water Level in Hole m
 Last Hole Diameter cm
 Geologist

Total Drilling Length m
 Total Core Length m
 Total Core Recovery %
 Drilling Machine
 Pump

46

#	Scale	Elevation	Depth	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Core Hardness	Core Shape	Weathering	Core Recovery %	R	Max. Core Length	Core Recovery %	Rugosity Value	Coefficient of Recovery	Ground Water Level in Hole	Date	#	Scale
31																			31	
32																			32	
33		33.6					Generally pea to pebble-sized clastic components; heavily fractured/fractured at sections 31-32m. & 46-47m.								6				33	
34																			34	
35																			35	
36																			36	
37					Tuff														37	
38															4				38	
39																			39	
40					Breccia														40	
41																			41	
42		42.8		gray															42	
43															4				43	
44																			44	
45																			45	
46		46.0																	46	
47		47.0																	47	
48															4				48	
49																			49	
50																			50	
51		51.0																	51	
52															4				52	
53																			53	
54																			54	
55																55.0			55	
56																55.3			56	
57																			57	
58															4				58	
59																			59	
60																			60	

BORING LOG (BORING NO.)
ILOG - HILABANGAN PROJECT

Boring No. H1-2 (3/3)
 Location _____
 Longitude _____
 Latitude _____
 Collar Elevation _____
 Direction - Dip _____

Location _____
 Drilling Term from _____ up to _____
 Last Ground Water Level in Hole _____ m
 Last Hole Diameter _____ cm
 Geologist _____

Total Drilling Length _____ m
 Total Core Length _____ m
 Total Core Recovery _____ %
 Drilling Machine _____
 Pump _____

H Scale	Elevation	Depth	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Diameter (cm)	Core Recovery	Core Shape	Weathering	R			Rugose Value	Coefficient of Permeability	Ground Water Level in Hole	Date	H Scale
											Q	D	%					
61												61	36	99				61
62												70	25	98				62
63				Tuff		Pea to pebble-sized clastic components sheared zone: 69.2-70.6m.			II			61	32	99	4			63
64				Breccia								87	33	100				64
65												68	25	100				65
66												73	41	97				66
67												76	28	100				67
68												72	26	95	4			68
69	69.2								A			93	45	100				69
70	70.6											79	19	98				70
71									III			57	15	95				71
72												41	26	91				72
73	73.4											53	37	100	5			73
74									II			71	23	100				74
75												83	33	98				75
76												58	44	100				76
77									I			99	61	100	4			77
78												92	56	100				78
79									II			91	38	100				79
80												74	28	100				80

FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1
 Hole No.: DDH-2
 Depth: 0.0m - 5.0m
 Radius of casing: 7.6 cm
 Water level: 300.0 cm.
 Height of Casing: 10.0 cm
 H= 310.0 cm
 Q(cu.cm/min)= 3,950.0 cm³/min
 k(cm/sec)= 0.0050805

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Time (min)	Seepage Amount per min(l/min)
1	3
2	3
3	4
4	3
5	3
6	3
7	3
8	4
9	4
10	5
11	4
12	5
13	4
14	4
15	5
16	4
17	4
18	4
19	5
20	5
	79

FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1
 Hole No.: DDH-2
 Depth: 5.0m - 10.0m
 Radius of casing: 7.6 cm
 Water level: 300.0 cm.
 Height of Casing: 100.0 cm
 H= 310.0 cm
 Q(cu.cm/min)= 3,900.0 cm³/min
 k(cm/sec)= 0.0050162

49

Time (min)	Seepage Amount per min(1/min)
1	3
2	3
3	5
4	5
5	4
6	4
7	4
8	5
9	4
10	3
11	3
12	3
13	4
14	5
15	4
16	4
17	3
18	4
19	4
20	4
	78

FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan I 50
 Hole No.: DDH-2
 Depth: 10.0m - 15.0m
 Radius of casing: 7.6 cm
 Water level: 300.0 cm.
 Height of Casing: 15.0 cm
 H= 315.0 cm
 Q(cu.cm/min)= 3,800.0 cm³/min
 k(cm/sec)= 0.0048100

Time (min)	Seepage Amount per min(l/min)
1	4
2	4
3	3
4	3
5	4
6	5
7	4
8	4
9	5
10	3
11	4
12	4
13	4
14	3
15	3
16	4
17	4
18	4
19	4
20	3

FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1 5/
 Hole No.: DDH-2
 Depth: 15.0m - 20.0m
 Radius of casing: 7.6 cm
 Water level: 300.0 cm.
 Heigt of Casing: 100.0 cm
 H= 400.0 cm
 Q(ccu.cm/min)= 3,650.0 cm³/min
 k(cm/sec)= 0.0036383

Time (min)	Seepage Amount per min(l/min)
1	5
2	5
3	4
4	4
5	4
6	3
7	3
8	4
9	4
10	3
11	4
12	3
13	3
14	3
15	3
16	4
17	4
18	3
19	3
20	4

73

FIELD PERMEABILITY TEST
(EDGEQUI TEST)

BORING: HILABANGAN

No. DDH-2 20.0m ~ 25.0m

Lugeon Value 6 Lu Lu'

Critical Press 4.3 kg/cm² Ground Water Level 3.0m

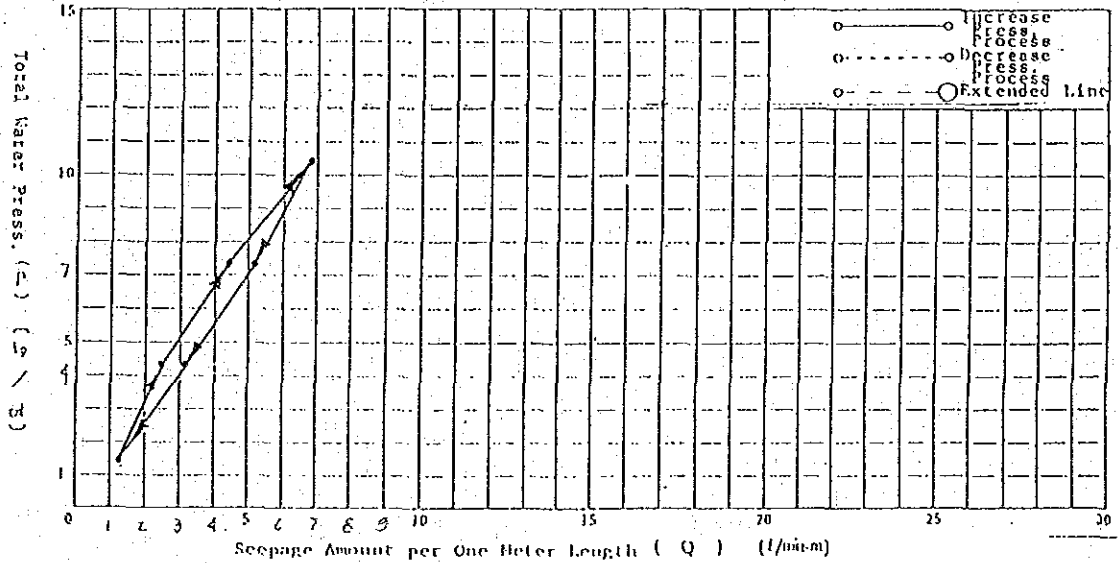
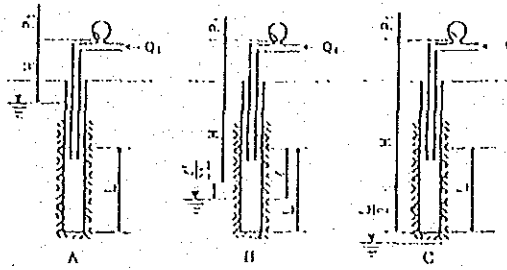
Date 11-21-90 Length of tested stage (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m

Vol. of Spring Water l/min Type of Packer Single

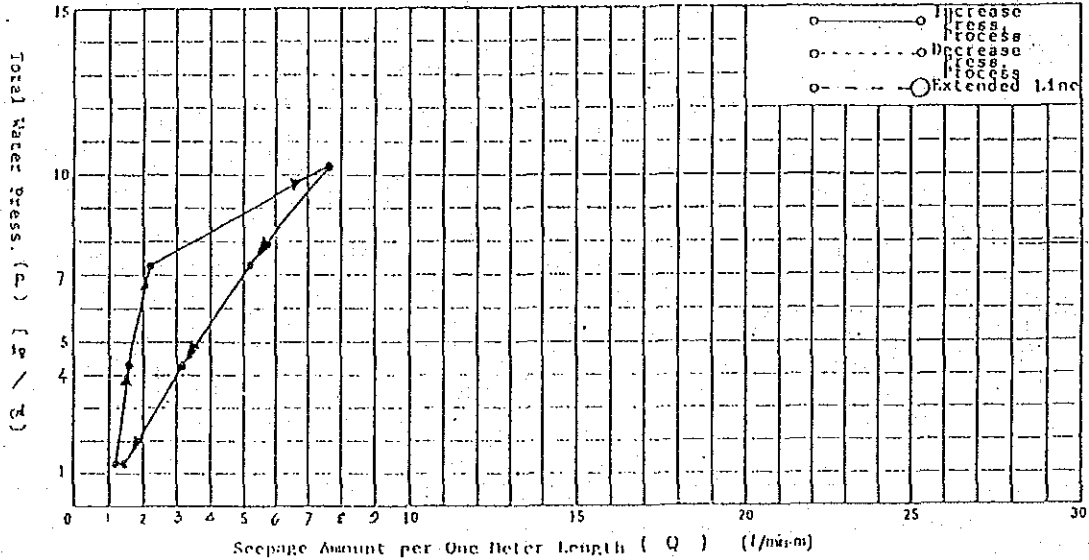
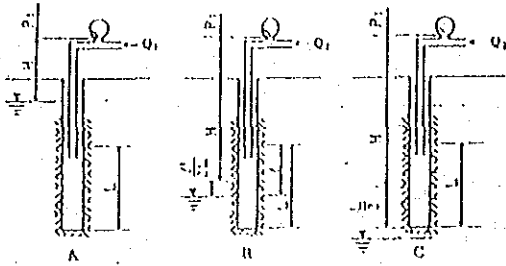


Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min-m)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
	6	7	8	9	10					
1	7	6	7	7	6	6.8	1.4	0.0	0.33	1.33
4	6	7	7	7	8					
	13	12	12	12	13	12.4	2.5	0.0	0.33	4.33
	23	22	21	23	23					
7	22	23	21	22	23	22.3	4.5	0.0	0.33	7.33
	24	35	35	35	36					
10	33	33	33	35	34	34.3	6.9	0.0	0.33	10.33
	25	25	26	26	26					
7	25	25	25	26	26	25.5	5.1	0.0	0.33	7.33
	15	15	16	16	16					
4	15	15	15	15	15	15.3	3.1	0.0	0.33	4.33
	7	7	8	8	8					
1	6	6	7	7	7	7.1	1.4	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1 x 7) x 10⁻⁵ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

NORTH: HILABANGAN - 1
 No. DDH-2 25.0 m - 30.0 m
 Lugeon Value 7 Lu Lu'
 Critical Press. 7.3 kg/cm² Ground Water Level 3.0 m
 Date 11/21-22-90 Length of Cased Hole (L) 5.0 m
 Length of Injection Pipe (L_i) m Hole Diameter 76 mm
 Depth of Spring Water m Dip Vertical
 Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m
 Vol. of Spring Water l/min Type of Packer SINGLE



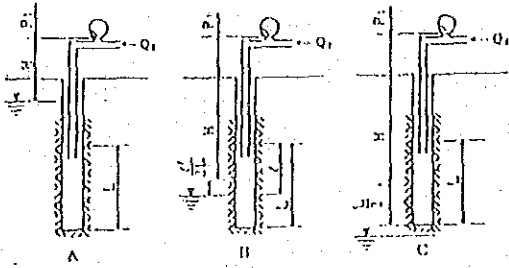
Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	6	7	7	7	6	6.7	1.3	0.0	0.33	1.33
4	8	8	9	8	7	7.8	1.6	0.0	0.33	4.33
7	10	12	11	12	10	10.5	2.1	0.0	0.33	7.33
10	38	38	39	39	39	38.7	7.7	0.0	0.33	10.33
7	25	25	26	26	26	25.5	5.1	0.0	0.33	7.33
4	15	15	16	16	16	15.3	3.1	0.0	0.33	4.33
1	7	7	7	8	8	7.1	1.4	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x7) x 10⁻⁵ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

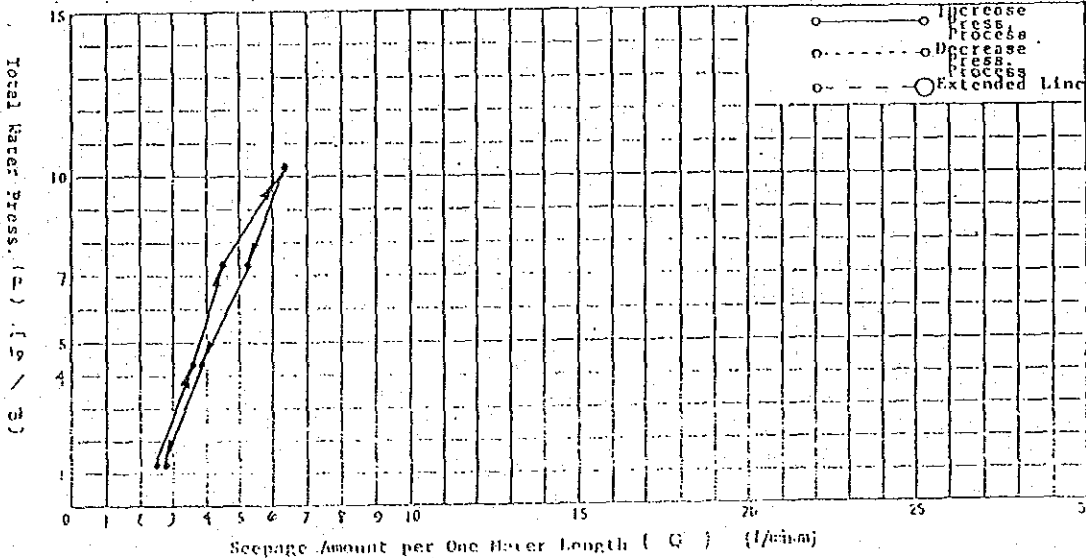
FIELD PERMEABILITY TEST
(LUGEON TEST)

ROUTING HILABANGAN-1
No. DDH-2 30.0m ~ 35.0m

Lugeon Value 6 LU Lu'



Critical Press. 7.3 kg/cm² Ground Water Level 3.0 m
Date 11/2-1-22/90 Length of tested Stage (L) 5.0 m
Length of Injection Pipe (L) m Hole Diameter 76 mm
Depth of Spring Water m Dip Vertical
Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m
Vol. of Spring Water (data) Type of Packer



Gauge Press. (P ₁) (kg/cm ²)	1	2	3	4	5	Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (P ₃) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
1	12	12	13	12	13	12.5	2.5	0.0	0.33	1.33
4	12	12	13	13	13	18.2	3.6	0.0	0.33	4.33
7	19	19	18	17	18	22.5	4.5	0.0	0.33	7.33
10	22	22	22	23	23	32.1	6.4	0.0	0.33	10.33
7	23	23	22	23	22	26.0	5.2	0.0	0.33	7.33
4	20	20	21	21	20	19.7	3.9	0.0	0.33	4.33
1	13	13	14	14	13	13.5	2.7	0.0	0.33	1.33

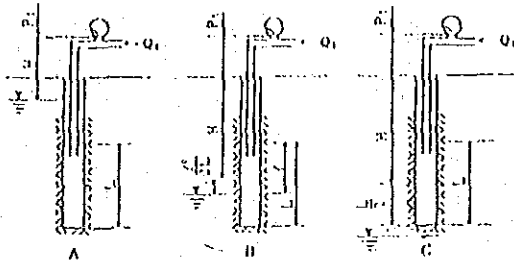
Note: Loss Water Press. (P₂) [kg/cm²] = (Q₁ × 10⁻³) × Average Seepage Amount (Q₁)² [l/min] × Length of Injection Pipe (L) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (P₃) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

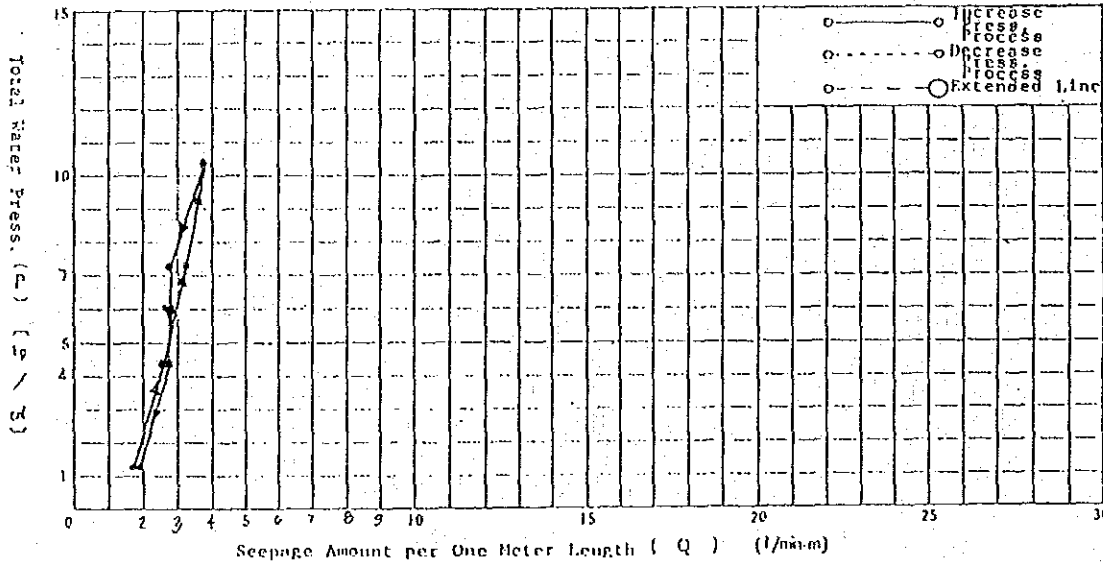
BORING HUABANGAN

No. DDH-2 35.0 m ~ 40.0 m

Lugeon Value 4 Lu Lu'



Critical Press. > 10.3 kg/cm² Ground Water Level 3.0 m
 Date 11-22-90 Length of Tested Stare (L) 5.0 m
 Length of Injection Pipe (L_i) m Hole Diameter 76 mm
 Depth of Spring Water m Dip Vertical
 Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m
 Vol. of Spring Water (l/min) Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min-m)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	8	9	8	8	8	8.5	1.7	0.0	0.33	1.33
4	13	12	15	13	13	13.1	2.6	0.0	0.33	4.33
7	15	15	16	16	16	15.8	3.2	0.0	0.33	7.33
10	19	20	19	19	19	19.2	3.8	0.0	0.33	10.33
7	15	15	15	15	13	14.4	2.9	0.0	0.33	7.33
4	13	13	14	14	13	13.4	2.7	0.0	0.33	4.33
1	10	10	10	11	10	9.7	1.9	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1 x L) x 10⁻⁵ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

NORTHC HILABANGAN-1

No. DDH-2 40.0m~ 45.0m

Lugeon Value 4 LU LU'

Critical Press. $> 10.3 \text{ kg/cm}^2$ Ground Water Level 3.0 m

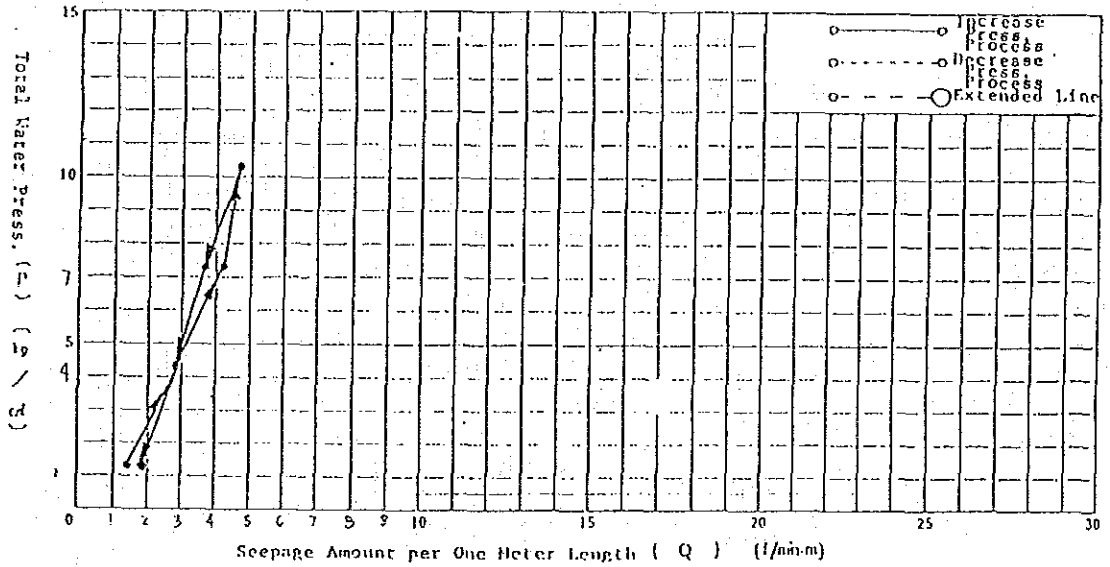
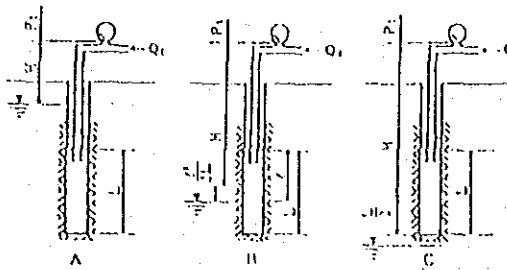
Date 11-22-90 Length of Test (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm^2 Height of Press. Gauge 0.30 m

Vol. of Spring Water l/min Type of Packer SINGLE

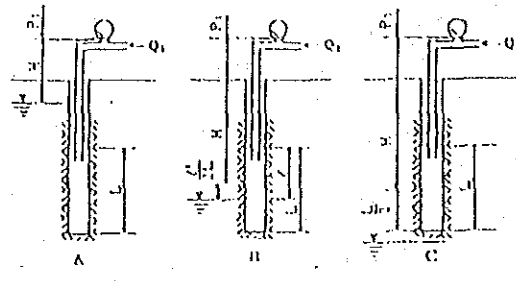


Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	TOTAL Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	6	7	8	9	10	7.1	1.4	0.0	0.33	1.33
4	13	13	15	15	15	14.3	2.9	0.0	0.33	4.33
7	20	22	21	20	20	20.7	4.1	0.0	0.33	7.33
10	23	23	22	21	24	22.8	4.6	0.0	0.33	10.33
7	18	18	19	19	18	18.7	3.7	0.0	0.33	7.33
4	15	15	14	14	14	14.3	2.9	0.0	0.33	4.33
1	9	10	9	9	8	9.1	1.8	0.0	0.33	1.33

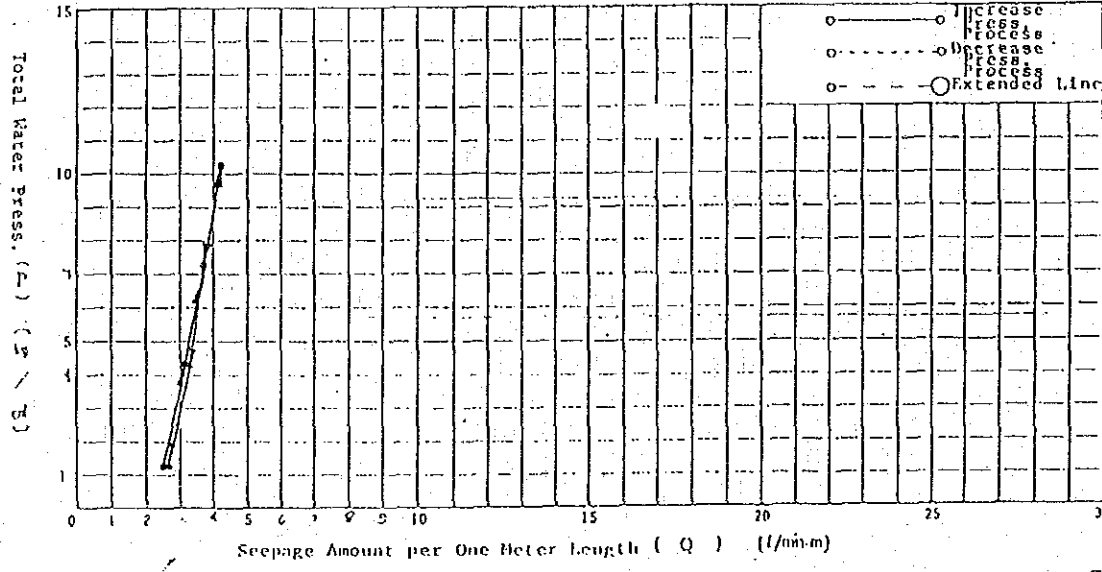
Note: Loss Water Press. (P₂) [kg/cm²] = (H x 2) x 10⁻² x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

NORING: HILABANGAN I
No. DDH-2 45.0 m ~ 50.0m



Lugeon Value 4 Lu Lu'
Critical Press. > 10.3 kg/cm² Ground Water Level 3.0 m
Date 11/22-23/90 Length of tested core 5.0 m
Length of Injection Pipe (L) m Hole Diameter 76 mm
Depth of Spring Water m Dip Vertical
Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m
Vol. of Spring Water l/min Type of Packer SINGLE



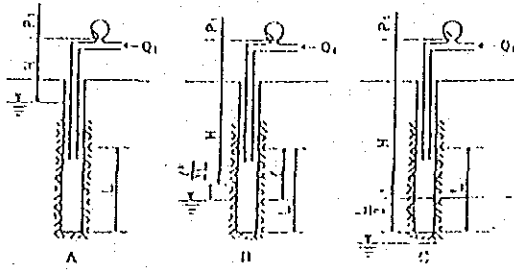
Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
	6	7	8	9	10					
1	12	12	12	12	13	12.3	2.5	0.0	0.33	1.33
4	15	15	15	16	16	15.4	3.1	0.0	0.33	4.33
7	18	19	19	19	19	18.9	3.8	0.0	0.33	7.33
10	22	20	21	21	22	21.0	4.2	0.0	0.33	10.33
7	18	18	19	20	19	19.0	3.8	0.0	0.33	7.33
4	16	16	16	17	17	16.2	3.2	0.0	0.33	4.33
1	13	13	12	13	13	12.9	2.6	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x7) x 10⁻² x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] - Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

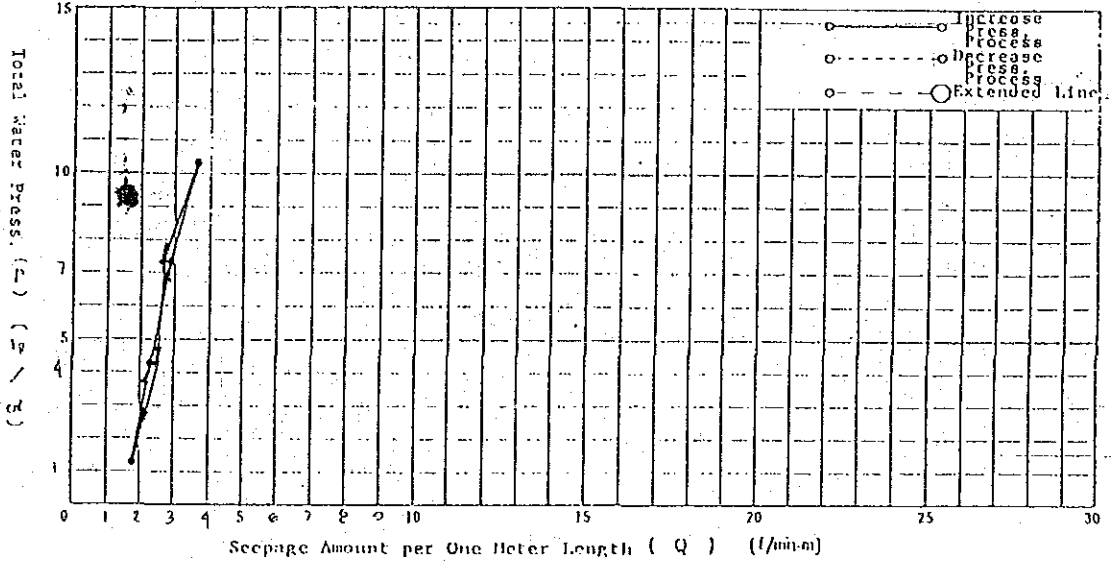
FIELD PERMEABILITY TEST
(LUGDON TEST)

BORING HILABANGAN-1

No. DDH-2 50.0m ~ 55.0m



Lugdon Value	4 Lu	Lu'
Critical Press. > 10.3 kg/cm ²	Ground Water Level 3.0 m	
Date 11/22-23/90	Length of tested stage (L) 5.0 m	
Length of Injection Pipe (L _i) m	Hole Diameter 76 mm	
Spring Water	Dip Vertical	
Press. of Spring Water kg/cm ²	Height of Press. Gauge 0.30 m	
Vol. of Spring Water l/min	Type of Packer SINGLE	



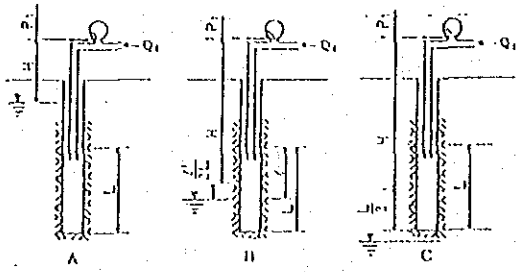
Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	9	10	8	9	9	9.0	1.8	0.0	0.33	1.33
4	9	9	9	9	9					
4	11	11	12	11	13	11.8	2.4	0.0	0.33	4.33
70	12	12	12	12	12					
10	14	15	15	15	15	14.6	2.9	0.0	0.33	7.33
10	15	14	15	14	14					
7	18	18	18	18	19	18.1	3.6	0.0	0.33	10.33
7	18	18	18	18	18					
7	14	14	14	14	14	14.2	2.8	0.0	0.33	7.33
4	14	14	14	15	15					
4	12	13	14	13	13	12.5	2.5	0.0	0.33	4.33
4	12	12	12	12	12					
1	9	9	9	9	10	9.1	1.8	0.0	0.33	1.33
1	9	9	9	9	9					

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1 x 7) x 10⁻⁵ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L_i) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] - Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

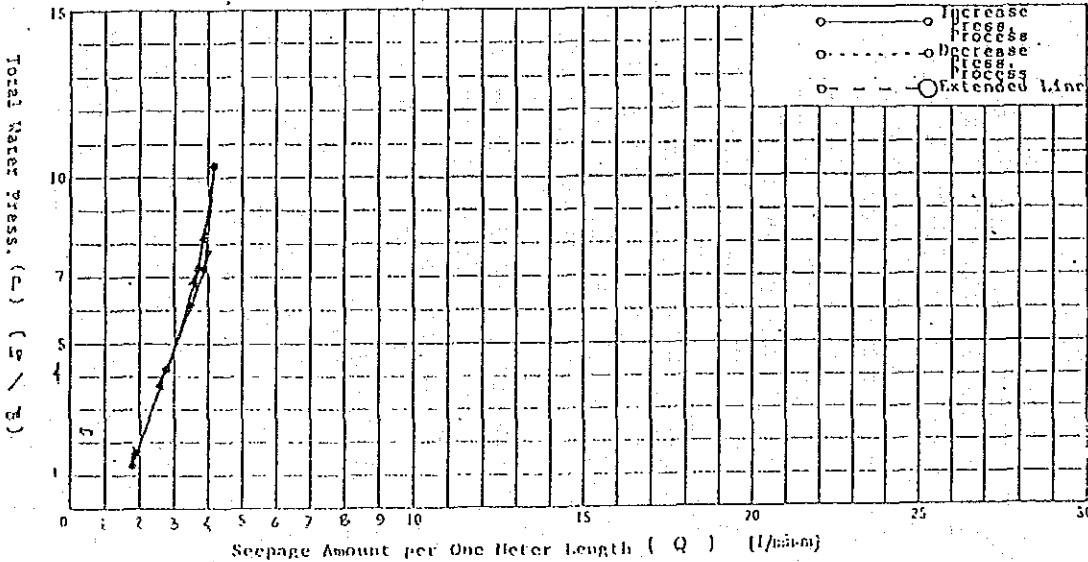
FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING HILABANGAN -1
No. DDH-2 55.0 m ~ 60.0 m

Lugeon Value 4 LU



Critical Press. > 10.3 kg/cm² Ground Water Level 3.0 m
Date 11-23-90. Length of tested (L) 5.0 m
Length of Injection Pipe (L.I.) m Hole Diameter 76 mm
Depth of Spring Water m Dip Vertical
Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m
Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	1	2	3	4	5	Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
10	8	10	9	10	9.1	1.8	0.0	0.33	1.33	
4	14	14	14	14	14.1	2.8	0.0	0.33	4.33	
7	18	18	19	19	18.6	3.7	0.0	0.33	7.33	
10	20	21	21	20	20.3	4.1	0.0	0.33	10.33	
7	19	19	19	18	18.8	3.8	0.0	0.33	7.33	
4	14	13	14	14	13.8	2.8	0.0	0.33	4.33	
1	9	9	9	10	9.2	1.8	0.0	0.33	1.33	

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x) x 10⁻² x Average Seepage Amount (Q₁) [l/min] x Length of Injection Pipe (L) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING HILABANGAN-1

No. DOH-2 60.0 m 65.0 m

Lugeon Value 4 Lu Lu'

Critical Press. >10.3 kg/cm² Ground Water Level 3.0 m

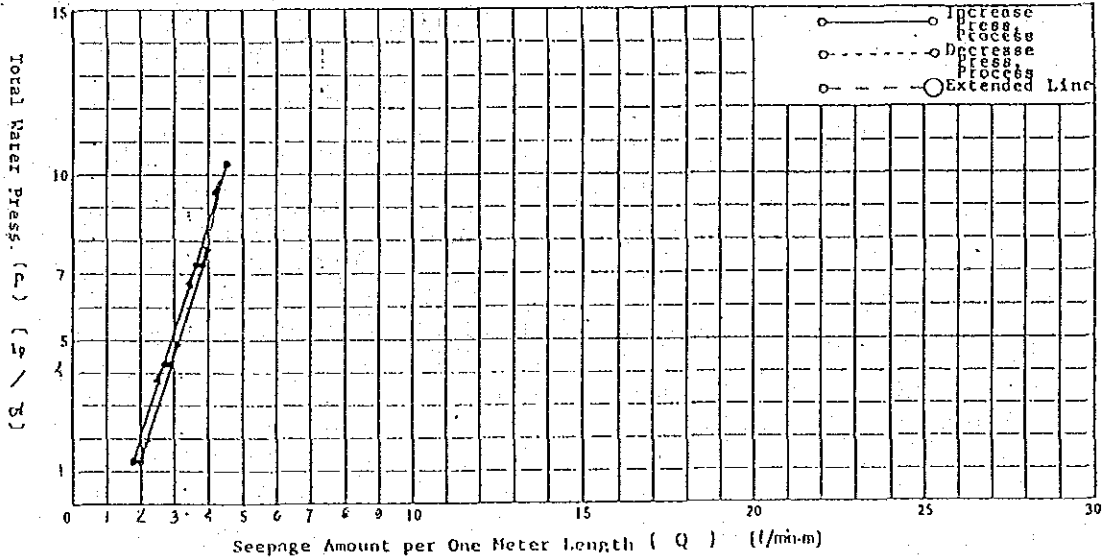
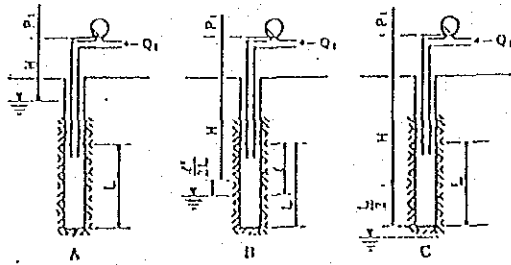
Date 11-23-90 Length of Stage (L) 5.0 m

Length of Injection Pipe (lt) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	9	9	10	9	9	9.2	1.8	0.0	0.33	1.33
4	13	13	13	14	14	13.6	2.7	0.0	0.33	4.33
7	17	17	18	19	19	18.2	3.6	0.0	0.33	7.33
10	22	22	23	22	22	22.4	4.5	0.0	0.33	10.33
7	19	18	19	19	19	18.8	3.8	0.0	0.33	7.33
4	14	14	13	15	15	14.6	2.9	0.0	0.33	4.33
1	11	10	10	10	10	10.1	2.0	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1 x 7) x 10⁻⁵ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (lt) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] - Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

HORTIC HILABANGAN-1

No. DDH-2 65.0m~ 70.0m

Lugeon Value 4 Lu Lu'

Critical Press. >10.3 kg/cm² Ground Water Level 3.0 m

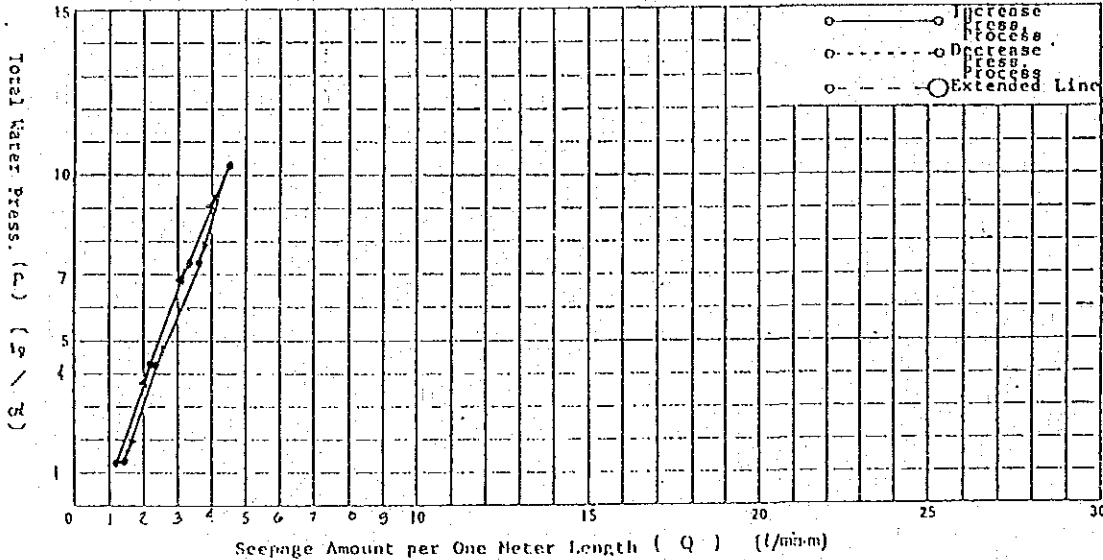
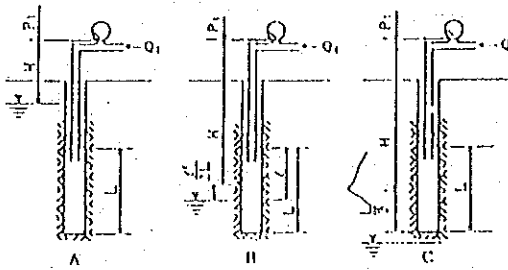
Date 11/23-24/90 Length of Tested Stage (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
1	5	6	6	5	6	5.8	1.2	0.0	0.33	1.33
4	11	10	11	10	11	10.8	2.2	0.0	0.33	4.33
7	16	16	17	18	17	17.1	3.4	0.0	0.33	7.33
10	23	23	22	23	22	22.3	4.5	0.0	0.33	10.33
7	19	19	18	18	18	18.0	3.6	0.0	0.33	7.33
4	12	12	13	12	12	11.6	2.3	0.0	0.33	4.33
1	8	7	7	7	7	6.7	1.3	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x7) x 10⁻⁵ x Average Seepage Amount (Q₁) [l/min] x Length of Injection Pipe (L_i) [m]
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] - Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING HILABANGAN-1

No. DDH-2 70.0m~ 75.0m

Lugeon Value 5 Lu Lu'

Critical Press. 7.3 kg/cm² Ground Water Level 3.0 m

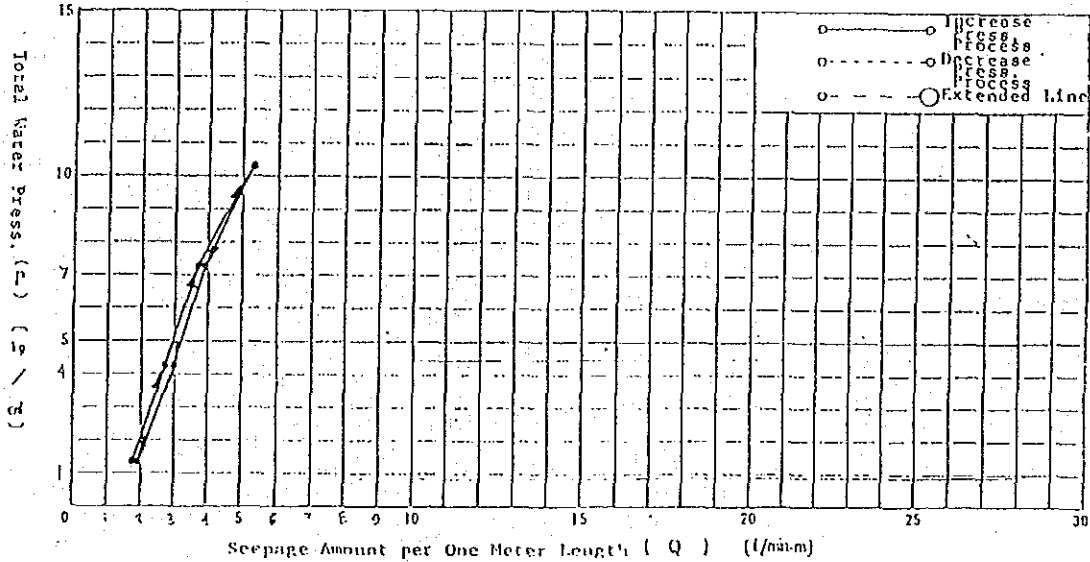
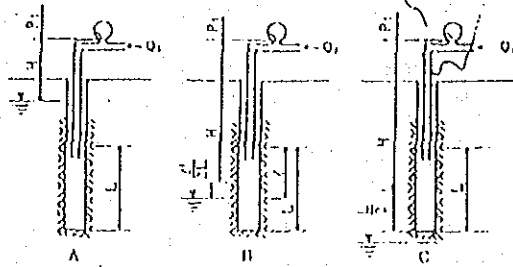
Date 11-24-90 Length of tested (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.30 m

Vol. of Spring Water l/min Type of Packer SINGLE



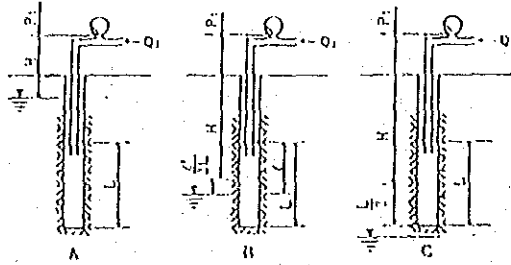
Gauge Press. (P ₁) [kg/cm ²]	Seepage Amount per min. (l/min)					Average Seepage amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₁) (kg/cm ²)	Hydrostatic Press. (P ₂) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
1	8	9	8	8	9	8.9	1.8	0.0	0.33	1.33
4	13	14	13	13	13	13.2	2.6	0.0	0.33	4.33
7	18	18	18	18	18	18.3	3.7	0.0	0.33	7.33
10	24	25	25	26	27	26.7	5.3	0.0	0.33	10.33
7	22	20	18	20	20	19.6	3.9	0.0	0.33	7.33
4	15	15	15	15	15	14.8	3.0	0.0	0.33	4.33
1	10	10	10	9	9	9.3	1.9	0.0	0.33	1.33

Note: Loss Water Press. (P₁) [kg/cm²] = (0.1 x 7) x 10⁻³ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m].
Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₁) [kg/cm²] + Hydrostatic Press. (P₂) [kg/cm²]

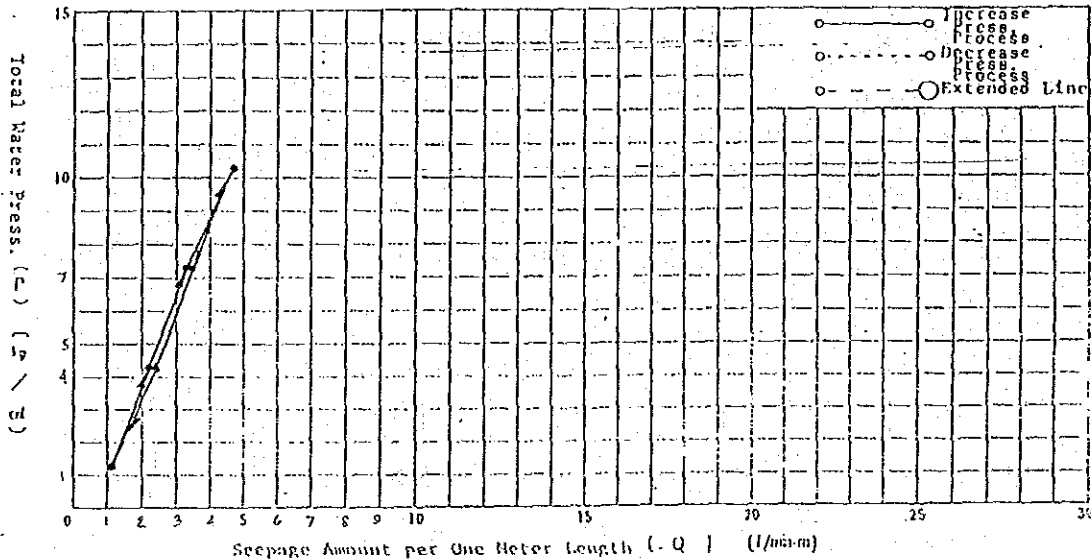
FIELD PERMEABILITY TEST
(LUGEON TEST)

NORING HKABANGAN-1

No. DDH-2 75.0 m ~ 80.0 m



Lugeon Value	4 Lu	Lu'
Critical Press.	7.3 kg/cm ²	Ground Water Level
Date	11-25-90	Length of tested stage
Length of ?		m
Injection Type (I.P.)	m	Hole Diameter
Depth of Sprung Water	m	Dip
Press. of Sprung Water	kg/cm ²	Height of Press. Gauge
Vol. of Sprung Water	l/min	Type of Packer



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min)	Seepage Amount per one Meter (Q) (l/min-m)	Loss Water Press. (P ₂) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P) (kg/cm ²)
	1	2	3	4	5					
	6	7	8	9	10					
1	5	4	5	5	6	5.3	1.1	0.0	0.33	1.33
4	10	11	12	11	11	10.8	2.2	0.0	0.33	4.33
7	16	16	16	16	17	16.6	3.3	0.0	0.33	7.33
10	23	23	24	25	24	23.4	4.7	0.0	0.33	10.33
7	17	17	17	17	17	17.6	3.5	0.0	0.33	7.33
4	13	13	12	12	13	12.2	2.4	0.0	0.33	4.33
1	7	7	7	6	5	5.7	1.1	0.0	0.33	1.33

Note: Loss Water Press. (P₂) [kg/cm²] = (0.1x7) x 10⁻⁴ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
 Total Water Press. (P) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₂) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

III-6. Hilabangan No.1 Dam Site, Borehole No.3

BORING LOG (BORING NO.)

HLOG -- HILABANGAN PROJECT

Boring No. H1-3 (1/2)
 Longitude _____
 Latitude _____
 Collar Elevation 120 m.
 Direction - Dip _____

Location Left Abutment, Dam Axis
 Drilling from 11/8 to 11/12
 Last Ground Water Level in Hole 13.50m
 Last Hole Diameter 7.6 cm
 Geologist Crispin Leyva

Total Drilling Length 40.00 m
 Total Core Length 26.6 m
 Total Core Recovery 70 %
 Drilling Machine TONE TAS
 Name Bean Royal Triplex 64

#	Scale	Elevation	Depth	Core Color	Geologic Unit	Core Description and Drilling Conditions	Geologic Column	Core Hardness	Core Shape	Weathering	R		Max. Core Length	Core Recovery %	Moisture Content	Region Value	Coefficient of Permeability	Ground Water	Date	Scale	
											Q	D									
1				Brown	Sandy Clay	Medium to high plasticity w/ some gravels															1
2			2.0																		2
3												10	10	70							3
4					Tuff	Pea to pebble-sized conglomerate boulder & fine-grained sandstone boulders			V	D		10	10	66							4
5												12	12	60							5
6									II			41	30	70							6
7			7.0						III	C		15	15	69							7
8						Fine to medium grained			IV			0	5	55							8
9				Gray to light gray	Tuff					B		0	4	30							9
10												0	5	40							10
11			11.5						III	A		47	17	47							11
12												77	22	94							12
13									II			79	38	98							13
14												54	19	95							14
15										B		65	19	95							15
16			16.5			Generally pea to pebble-sized clastic components; heavily fractured fragmented at 19.0-40.0 m depth.			II			51	19	92							16
17									3			40	20	90							17
18					Tuff				II			78	29	95							18
19									II			35	15	97							19
20					Breccia				IV			12	12	87							20
21				Gray		Note: cannot build up pressure for WPT, conducted open-end method instead.			V			15	15	80							21
22									IIIA			0	0	48							22
23												22	12	42							23
24												-0	0	31							24
25									V			0	0	32							25
26									IV			10	10	36							26
27									VI			0	0	29							27
28									V			0	0	30							28
29									VI			0	0	74							29
30												0	0	44							30

BORING LOG (BORING NO.)

ILOG - HILABANGAN PROJECT

Boring No. H1-3 (2/2)
 Longitude _____
 Latitude _____
 Collar Elevation _____
 Direction - Dip _____

Location _____
 Drilling from _____ up to _____
 Last Ground Water Level in Hole _____ m
 Last Hole Diameter _____ cm
 Geologist _____

Total Drilling Length _____ m
 Total Core Length _____ m
 Total Core Recovery _____ %
 Drilling Machine _____
 Pump _____

Elevation	Depth	Core Color	Geologic Unit	Geologic Column	Core Description and Drilling Conditions	Diameter of Core	Core Hardness	Core Shape	Weathering	R		Max. Core Length	Core Recovery	Mud-bit with Air Casing	Pugon Value	Coefficient of Permeability	Ground Water Level in Hole	Date
										Q	H							
31						D	5	VI		0	0	94						31
32					Pea to pebble-sized components fragmented w/ some calcite veinlets at 31-32 m.		4			22	12	94						32
33							3	III		47	16	90						33
34			Tuff				C	4	IV	A	34	14	95					34
35			Breccia				D	4			14	14	90					35
36		Gray						3	III		0	8	100					36
37											0	7	97					37
38										0	8	99					38	
39							4	V		0	3	37					39	
40										0	7	67					40	

FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1 66
 Hole No.: DDH-3
 Depth: 0.0m - 5.0m
 Radius of casing: 7.6 cm
 Water level: 1,350.00 cm.
 Height of Casing: 10.00 cm
 H= 510.00 cm
 Q(cu.cm/min)= 11,050.00 cm³/min
 k(cm/sec)= 0.0086390

Time (min)	Seepage Amount per min(l/min)
1	12
2	12
3	11
4	11
5	12
6	11
7	12
8	10
9	11
10	12
11	10
12	10
13	12
14	10
15	11
16	10
17	11
18	11
19	11
20	11

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FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1
 Hole No.: DDH-3
 Depth: 5.0m - 10.0m
 Radius of casing: 7.6 cm
 Water level: 1,350.0 cm
 Height of Casing: 100.0 cm
 H= 1,100.0 cm
 Q(cu.cm/min)= 7,800.0 cm³/min
 k(cm/sec)= 0.0028273

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Time (min)	Seepage Amount per min(l/min)
1	8
2	8
3	8
4	7
5	8
6	8
7	7
8	7
9	8
10	8
11	9
12	9
13	9
14	8
15	8
16	7
17	7
18	7
19	8
20	7

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FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1
 Hole No.: DDH-3 68
 Depth: 20.0m - 25.0m
 Radius of casing: 7.6 cm
 Water level: 1,350.0 cm.
 Height of Casing: 15.0 cm
 H= 1,565.0 cm
 Q(cu.cm/min)= 7,150.0 cm³/min
 k(cm/sec)= 0.0020885

Time (min)	Seepage Amount per min(l/min)
1	9
2	9
3	8
4	7
5	7
6	7
7	7
8	6
9	7
10	7
11	6
12	6
13	7
14	7
15	8
16	7
17	7
18	7
19	7
20	7

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FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan 1
 Hole No.: DDH-3
 Depth: 30.0m - 35.0m
 Radius of casing: 7.6 cm
 Water level: 1,350.0 cm.
 Height of Casing: 110.0 cm
 H= 1,460.0 cm
 Q(cu.cm/min)= 8,850.0 cm³/min
 k(cm/sec)= 0.0024169

69

Time (min)	Seepage Amount per min(l/min)
------------	-------------------------------

1	8
2	8
3	8
4	8
5	9
6	10
7	10
8	10
9	9
10	9
11	8
12	9
13	8
14	7
15	9
16	8
17	9
18	10
19	10
20	10

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FIELD PERMEABILITY TEST BY OPEN END METHOD

Damsite : Hilabangan I 70
 Hole No.: DDH-3
 Depth: 35.0m - 40.0m
 Radius of casing: 7.6 cm
 Water level: 1,350.0 cm.
 Height of Casing: 110.0 cm
 H= 1,460.0 cm
 Q(cu.cm/min)= 8,100.0 cm³/min
 k(cm/sec)= 0.0022120

Time (min)	Seepage Amount per min(l/min)
1	7
2	7
3	7
4	8
5	8
6	9
7	9
8	8
9	8
10	8
11	8
12	7
13	9
14	8
15	8
16	9
17	8
18	8
19	9
20	9

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FIELD PERMEABILITY TEST
(Lugeon Test)

Given Data:

A= Gauge Pressure Densite: Hilabangan 1
 B= 1,250.0 ca. Hole No.: DDH-3
 C= 20.0 ca. Depth: 10.0m - 15.0m

71

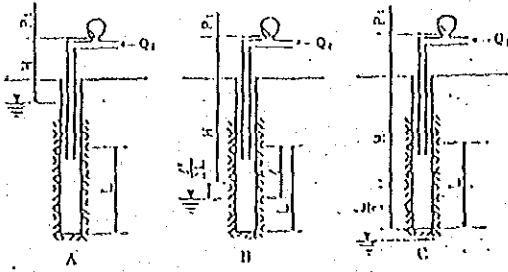
Gauge (P) (kg/cm ²)	Seepage Amount per min. (li/min)					Average Seepage (Q1) (li/min)	Seepage per meter (Q) (li/min-m)	Loss Static Pressure (kg/cm ²)	Hydro Static Pressure (kg/cm ²)	Total Water Pressure (kg/cm ²)	Lugeon Value
	1	2	3	4	5						
8.0	5.0	5.0	5.0	6.0	6.0	5.6	1.1	0.0	1.27	2.27	
	6.0	5.0	6.0	6.0	6.0						
4.0	17.0	17.0	17.0	18.0	18.0	17.7	3.5	0.0	1.27	5.27	
	18.0	18.0	18.0	18.0	18.0						
7.0	20.0	20.0	21.0	21.0	20.0	20.3	4.1	0.0	1.27	8.27	
	20.0	21.0	20.0	20.0	20.0						
10.0	23.0	24.0	24.0	25.0	24.0	23.9	4.8	0.0	1.27	11.27	4
	24.0	23.0	24.0	24.0	24.0						
7.0	23.0	23.0	23.0	22.0	22.0	22.8	4.6	0.0	1.27	8.27	
	23.0	23.0	23.0	23.0	23.0						
4.0	18.0	18.0	17.0	17.0	17.0	17.1	3.4	0.0	1.27	5.27	
	17.0	17.0	17.0	16.0	17.0						
1.0	7.0	7.0	6.0	6.0	6.0	6.1	1.2	0.0	1.27	2.27	
	6.0	5.0	7.0	6.0	5.0						

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING HILABANGAN 1

No. DDH-3 10.0m ~ 15.0m

Lugeon Value 4 Lu Lu'



Critical Press. 11.3 kg/cm² Ground Water Level 13.5 m

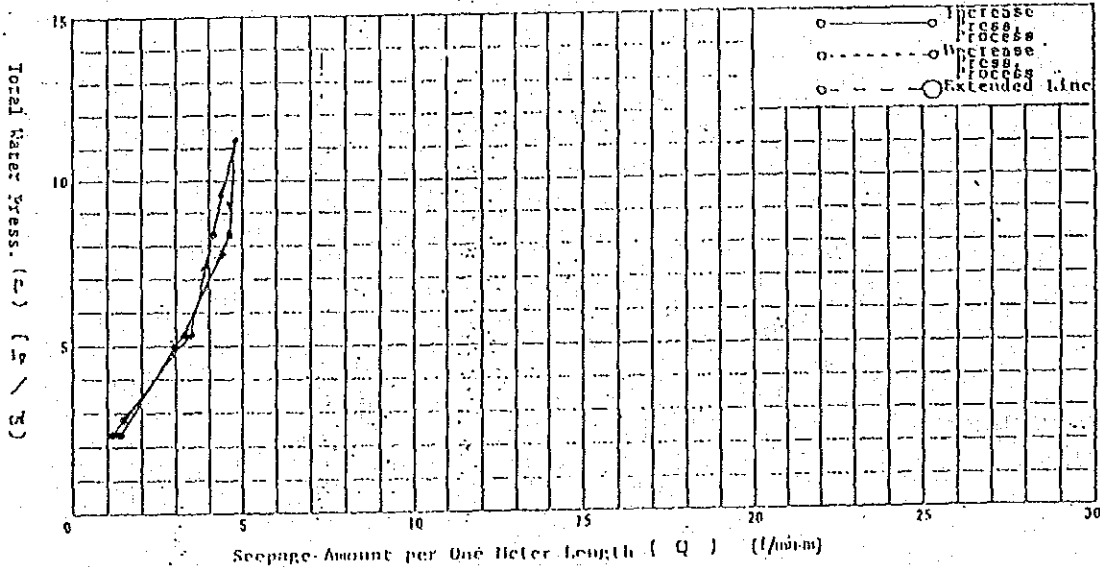
Date 11-10-90 Length of Packed Stone (L) 5.0 m

Injection Pipe (I.A) in Hole Diameter 76 mm

Depth of Spring Water in Dip Vertical

Press. of Spring Water kg/cm² Height of Press. Gauge 0.20 m

Vol. of Spring Water l/min Type of Packer SINGLE



Gauge Press. (P1) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q) (l/min)	Seepage Amount per one Meter (Q) (l/min)	Loss Water Press. (P2) (kg/cm ²)	Hydrostatic Press. (H) (kg/cm ²)	Total Water Press. (P1) (kg/cm ²)
	1	2	3	4	5					
1	5	5	5	6	6	5.6	1.1	0.0	1.27	2.27
4	17	17	17	18	18	17.7	3.5	0.0	1.27	5.27
7	20	20	21	21	20	20.3	4.1	0.0	1.27	8.27
10	23	24	24	25	24	23.9	4.8	0.0	1.27	11.27
7	23	23	23	23	22	22.8	4.6	0.0	1.27	8.27
4	17	17	17	17	17	17.1	3.4	0.0	1.27	5.27
1	6	5	7	6	5	6.1	1.2	0.0	1.27	2.27

Note: Loss Water Press. (P2) [kg/cm²] = (0.127) x Average Seepage Amount (Q) [l/min] x Length of Injection Pipe (L) [m]
 Total Water Press. (P1) [kg/cm²] = Gauge Press. (P1) [kg/cm²] + Loss Water Press. (P2) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]

FIELD PERMEABILITY TEST
(LUGEON TEST)

BORING HILABANGAN-1

No. DDH-3 15.0 m ~ 20.0 m

Lugeon Value 8 Lu Lu'

Critical Press. 5.4 kg/cm² Ground Water Level 13.5 m

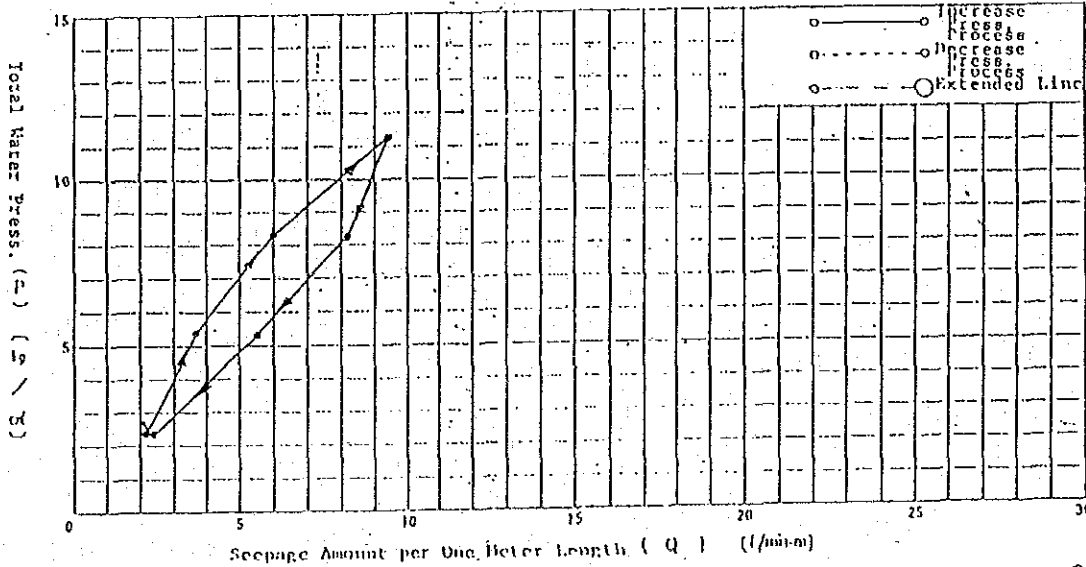
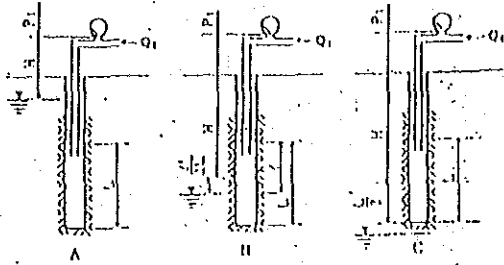
Date 11-10-90 Length of Cased Pipe (L) 5.0 m

Length of Injection Pipe (L_i) m Hole Diameter 76 mm

Depth of Spring Water m H_{sp} Vertical

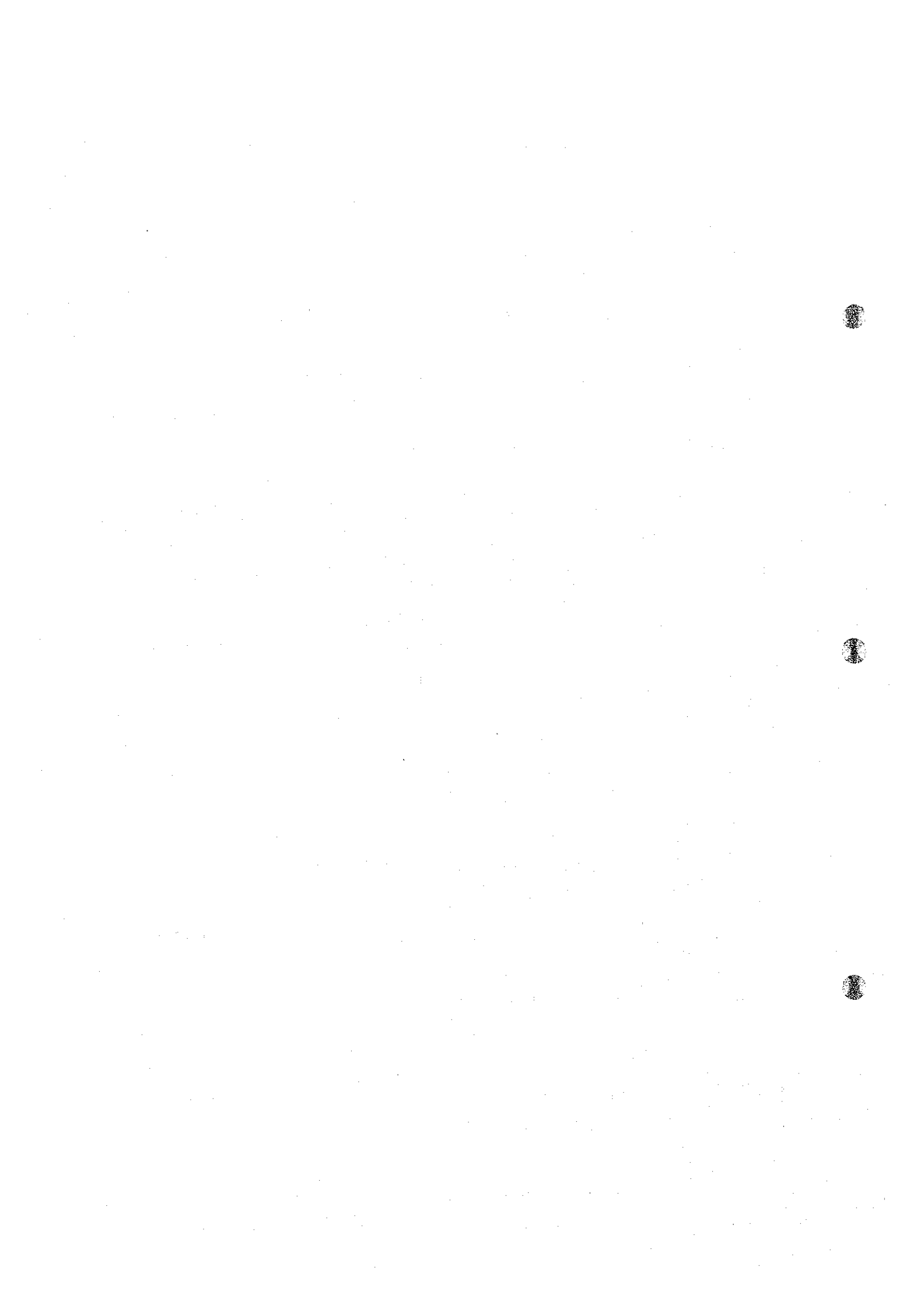
Press. of Spring Water kg/cm² Height of Press. Gauge 0.20 m

Vol. of Spring Water l/min Type of Packer



Gauge Press. (P ₁) (kg/cm ²)	Seepage Amount per min. (l/min)					Average Seepage Amount (Q ₁) (l/min-m)	Seepage Amount per one Meter. (Q)	Loss Water Press. (P ₁) (kg/cm ²)	Hydrostatic Press. (H)	Total Water Press. (P ₂) (kg/cm ²)
	1	2	3	4	5					
1	10	11	11	12	10	10.7	2.1	0.0	1.37	2.37
4	17	17	18	18	19	18.0	3.6	0.0	1.37	5.37
7	29	29	30	31	30	29.9	6.0	0.0	1.37	8.37
10	45	46	47	48	48	47.0	9.4	0.0	1.37	11.37
7	41	41	40	40	41	40.5	8.1	0.0	1.37	8.37
4	29	28	28	27	27	27.4	5.5	0.0	1.37	5.37
1	12	12	11	11	11	11.2	2.2	0.0	1.35	2.37

Note: Loss Water Press. (P₁) [kg/cm²] = (0.127) x 10⁻³ x Average Seepage Amount (Q₁)² [l/min] x Length of Injection Pipe (L) [m]
 Total Water Press. (P₂) [kg/cm²] = Gauge Press. (P₁) [kg/cm²] + Loss Water Press. (P₁) [kg/cm²] + Hydrostatic Press. (H) [kg/cm²]



**IV. UNCONFINED COMPRESSION TEST
OF BORING CORES**

DATA BOOK: IV.UNCONFINED COMPRESSION TEST OF BORING CORES

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IV-1. Ilog No.1 Upper Dam Site, Borehole No.1

UNCONFINED COMPRESSION TEST REPORT

PROJECT: IL06-HILABANGAN

DATE: 2-2-91

BOREHOLE No.: II-I

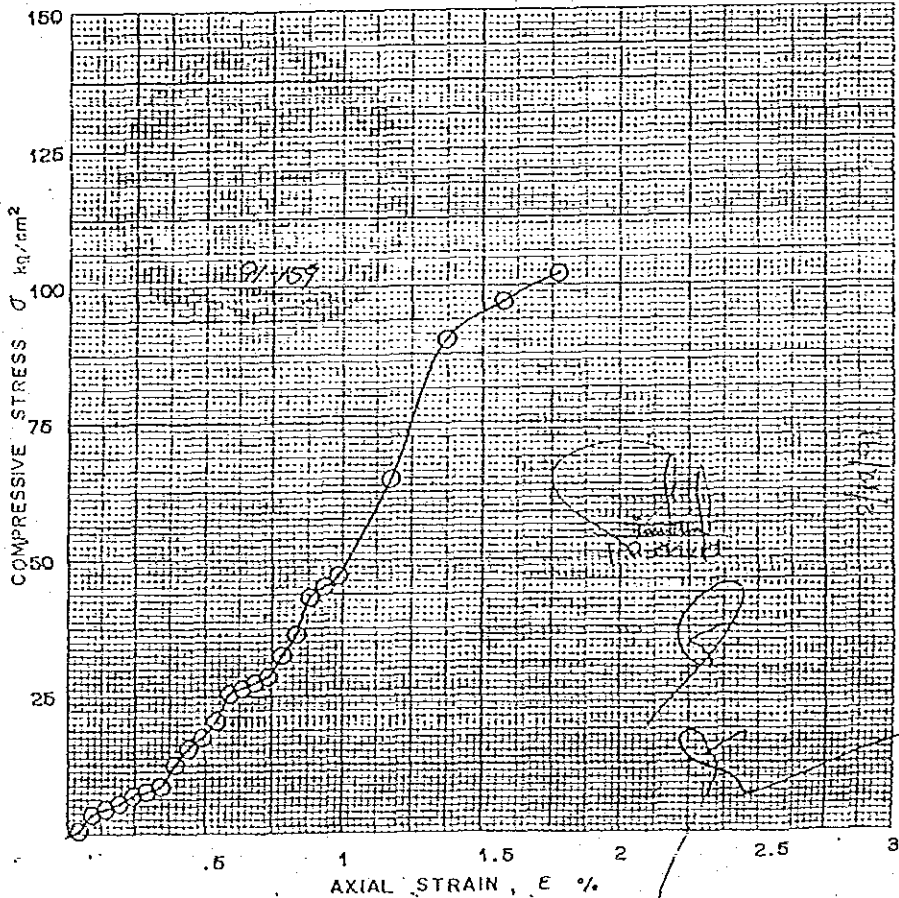
DEPTH: 16.00 - 17.00 M.

TESTED BY: F.A.DAVID

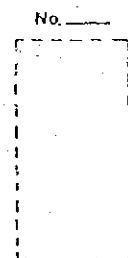
SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_1 (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT H(cm)	DIAMETER ϕ (cm)					
1	CS	10.86	5.44	3.87	2.30	101.8	1.80	

REMARKS:

CORE DESCRIPTION



SPECIMEN AT ULTIMATE FAILURE



EMILIO M. MORALES, MSCE
CIVIL ENGINEER



Construction & Drilling Specialists, Inc.

Room 250 Cityland Condominium IV
124 Valero St., Salcedo Village
Makati, Metro Manila
Tel. No. 817-97-24; 817-45-98

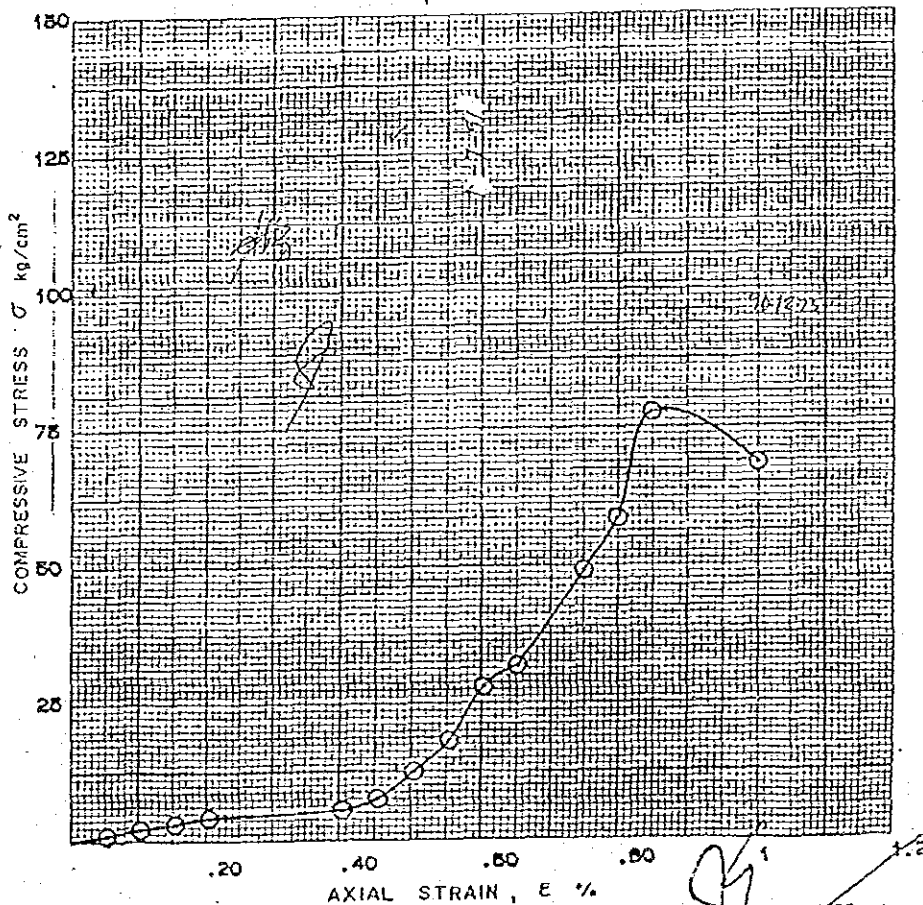
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT DATE: 01-02-01
 BOREHOLE No.: I1-1 DEPTH: 16.50 - 16.70 TESTED BY: F.T./A.V.Z.

SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_t (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_f
		HEIGHT H (cm)	DIAMETER ϕ (cm)					
1	CS	10.60	5.48	5.8	1.49	78.48	.850	

REMARKS:

AREA: ILOG RIVER

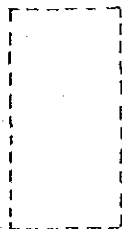


SPECIMEN AT ULTIMATE FAILURE

No. _____



No. _____



EMILIO M. MORALES, MSCE
 CIVIL ENGINEER
 PRC REG. NO. 11234

Construction & Drilling Specialists, Inc.
 Room 250 Cityland Condominium IV
 124 Valero St., Salcedo Village
 Makati, Metro Manila
 Tel. No. 817-97-24; 817-45-98





IV-2. Ilog No.1 Upper Dam Site, Borehole No.2

UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT

DATE: 01-02-91

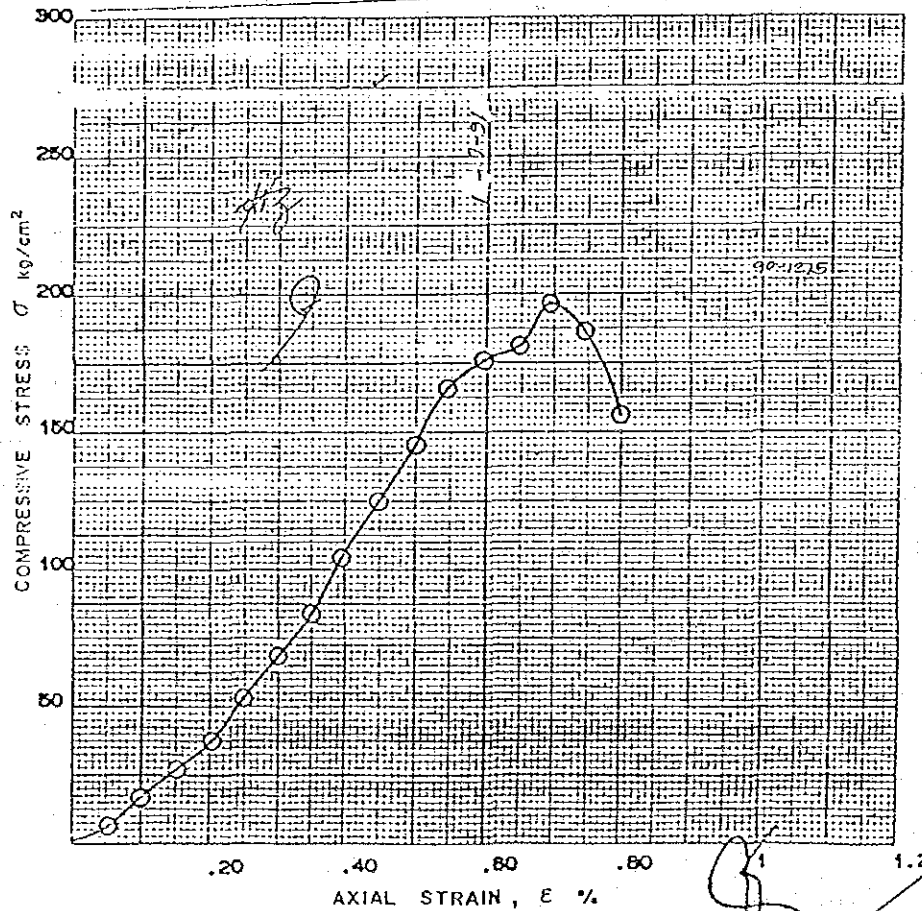
BOREHOLE No. IL-2 DEPTH: 2.00 - 2.20

TESTED BY: F.T./A.V.Z.

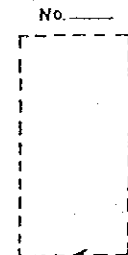
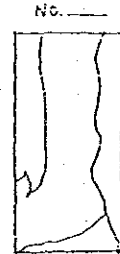
SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_1 (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT h (cm)	DIAMETER ϕ (cm)					
1	CS	15.35	7.51	4.9	2.30	194.8	.697	

REMARKS

AREA : ILOG RIVER



SPECIMEN AT ULTIMATE FAILURE



EMILIO M. MORALES, MSCE
CIVIL ENGINEER
PRO REG NO. 11236



Construction & Drilling Specialists, Inc.
Room 250 Cityland Condominium IV
124 Valero St., Salcedo Village
Makati, Metro Manila
Tel. No. 817-97-24; 817-45-98

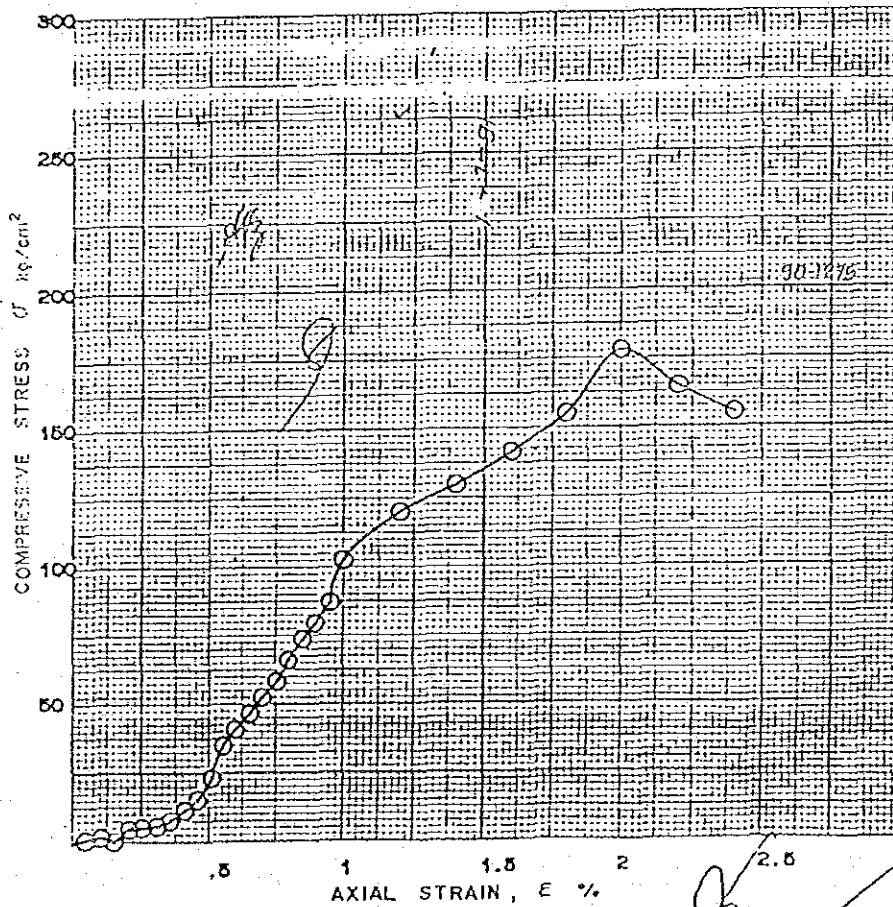
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT DATE: 01-02-91
 BOREHOLE No. JL-2 DEPTH: 4.20 - 4.50 TESTED BY: F.T./A.V.Z.

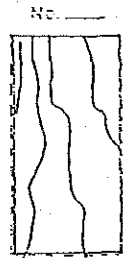
SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT w (%)	WET DENSITY γ_s (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S _v
		HEIGHT H (cm)	DIAMETER ϕ (cm)					
2	CS	10.92	5.48	2.4	2.22	178.1	2	

REMARKS:

ARE : ILOG RIVER



SPECIMEN AT ULTIMATE FAILURE



EMILIO M. MORALES, MSCE
CIVIL ENGINEER

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 Room 250 Cityland Condominium IV
 124 Valero St., Salcedo Village
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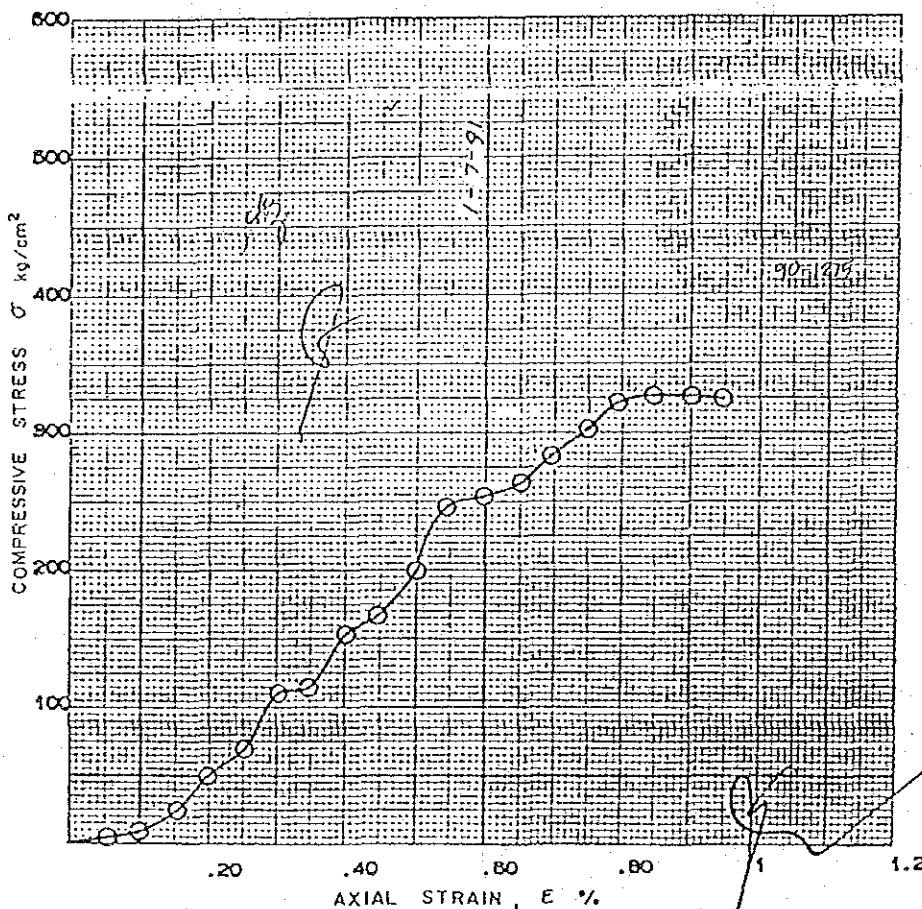
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT DATE: 01-02-91
 BOREHOLE No: 11-2 DEPTH: 19.00 - 19.20 TESTED BY: F.T./A.V.Z.

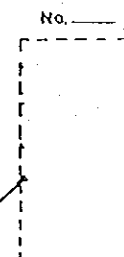
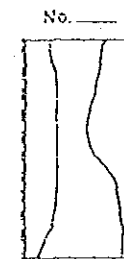
SPECIMEN No	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_s (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT H(cm)	DIAMETER ϕ (cm)					
3	US	11.17	5.48	3.4	2.31	323.7	.850	

REMARKS:

AREA : ILOG RIVER



SPECIMEN AT ULTIMATE FAILURE



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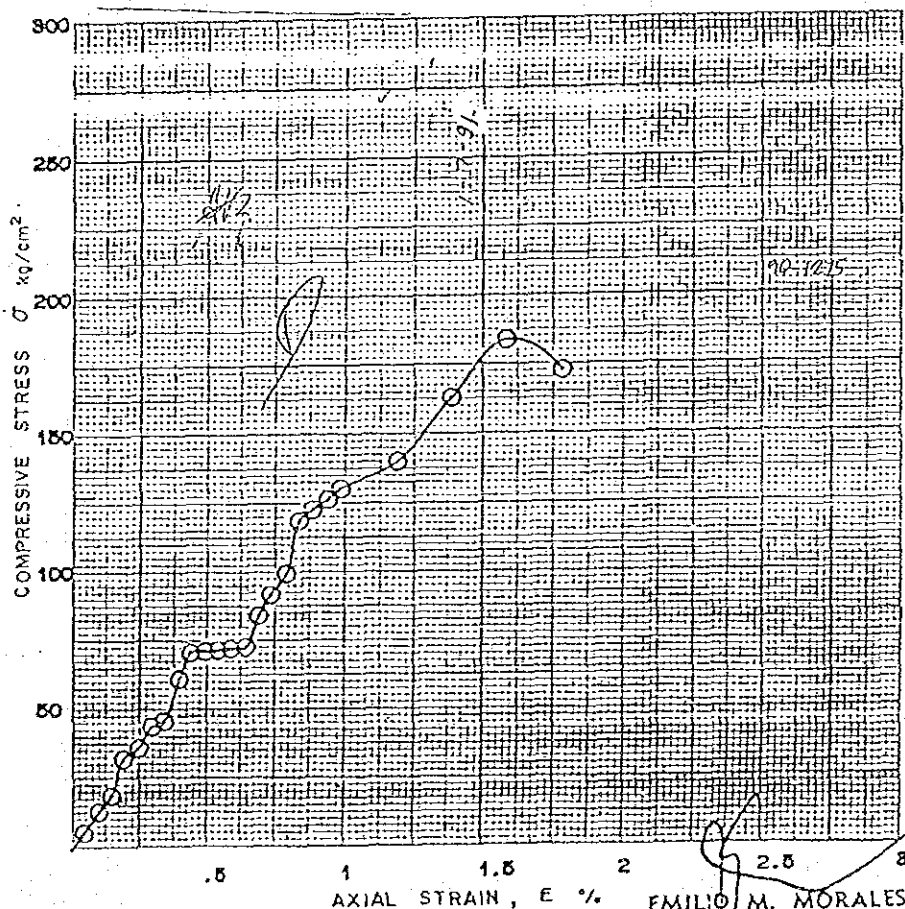
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG -- HILABANGAN PROJECT DATE: 01-02-91
 BOREHOLE No: 11-2 DEPTH: 31.10 - 31.30 TESTED BY: F.T./A.V.Z.

SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT "W" (%)	WET DENSITY γ_t (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT H(cm)	DIAMETER ϕ (cm)					
4	CS	10.71	5.48	1.5	2.18	183.7	1.80	

REMARKS:

AREA : ILOG RIVER

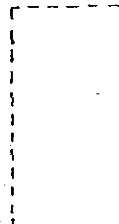


SPECIMEN AT ULTIMATE FAILURE

No. _____



No. _____



EMILIO M. MORALES, MSCE
 CIVIL ENGINEER

PRC REG. NO. 11236



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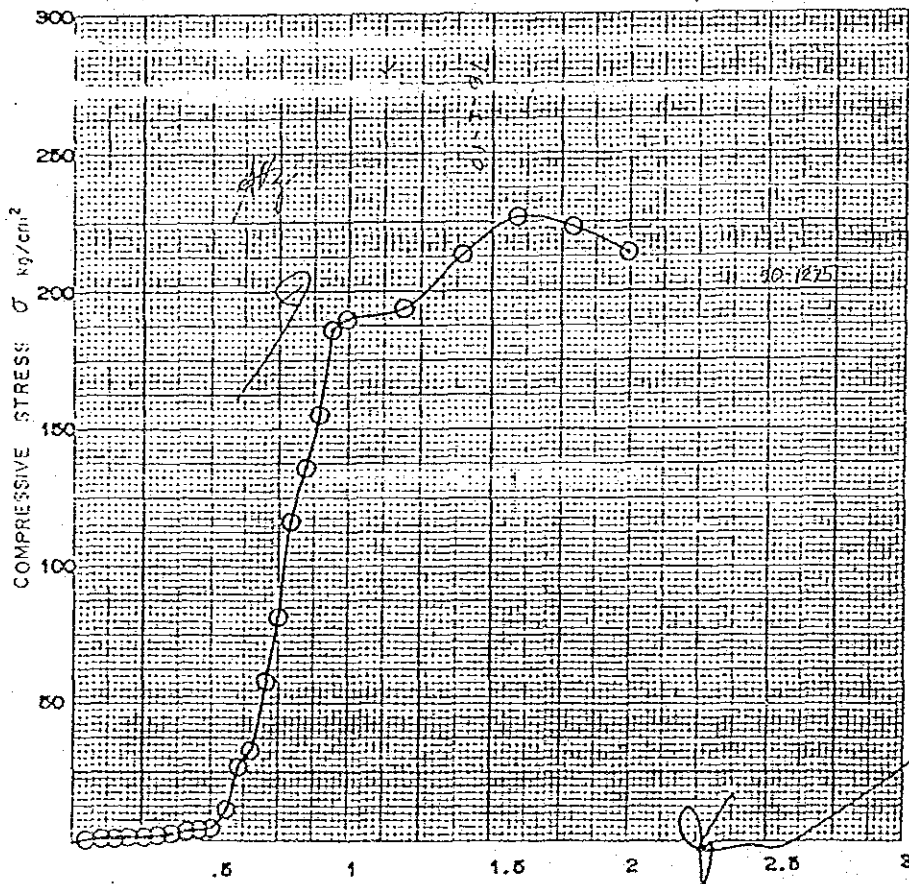
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOS - HILABANGAN PROJECT DATE: 01-02-91
 BOREHOLE No: 11-2 DEPTH: 40.30 - 40.50 TESTED BY: F.T./A.V.Z

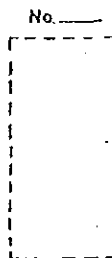
SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_1 (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT H(cm)	DIAMETER ϕ (cm)					
5	CS	10.68	5.44	2.8	2.27	227.8	1.80	

REMARKS:

AREA : ILOG RIVER



SPECIMEN AT ULTIMATE FAILURE



EMILIO M. MORALES, MSCE
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IV-3. Ilog No.1 Upper Dam Site, Borehole No.3

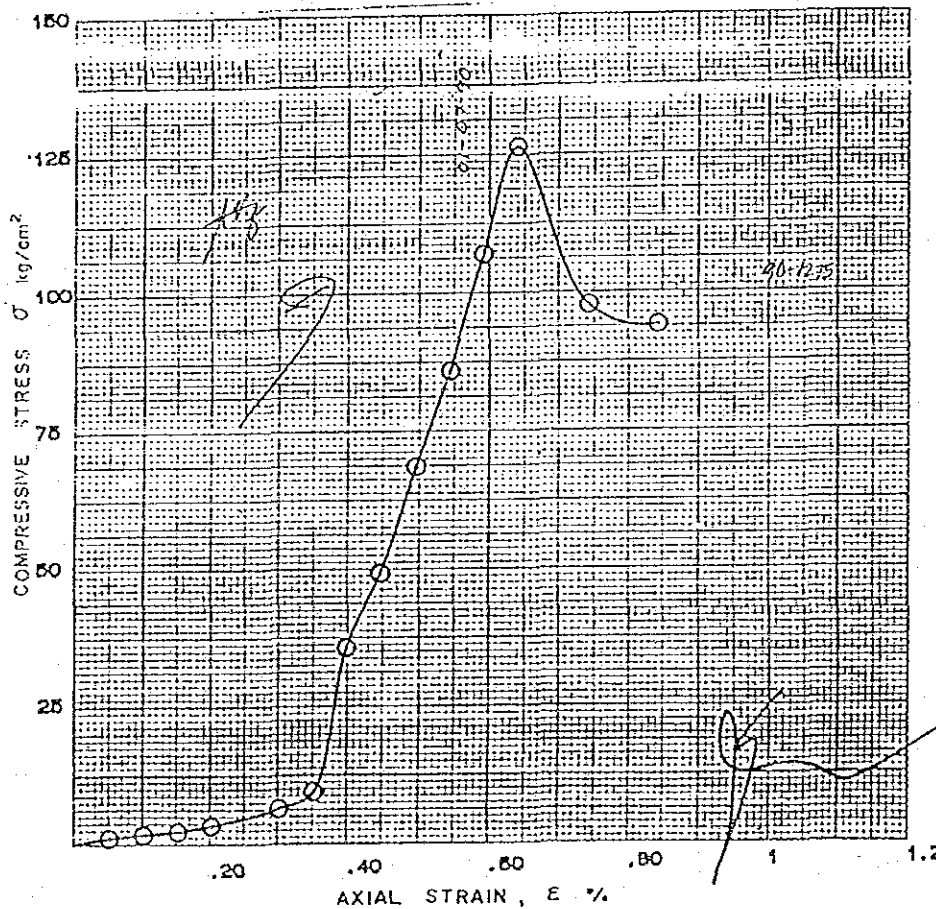
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT DATE: 01-02-01
 BOREHOLE No: 11-3 DEPTH: 5.80 - 6.00 TESTED BY: F.T./A.V.Z.

SPECIMEN No	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_s (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT H (cm)	DIAMETER ϕ (cm)					
1	CS	10.85	5.48	2.4	2.54	125.8	.649	

REMARKS:

AREA : ILOG RIVER

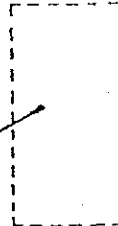


SPECIMEN AT ULTIMATE FAILURE

No. _____



No. _____



Construction & Drilling Specialists, Inc.
 Room 250 Cityland Condominium IV
 124 Valero St., Salcedo Village
 Makati, Metro Manila
 Tel. No. 817-97-24; 817-45-98

UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT

DATE: 01-02-91

BOREHOLE No: 11-3

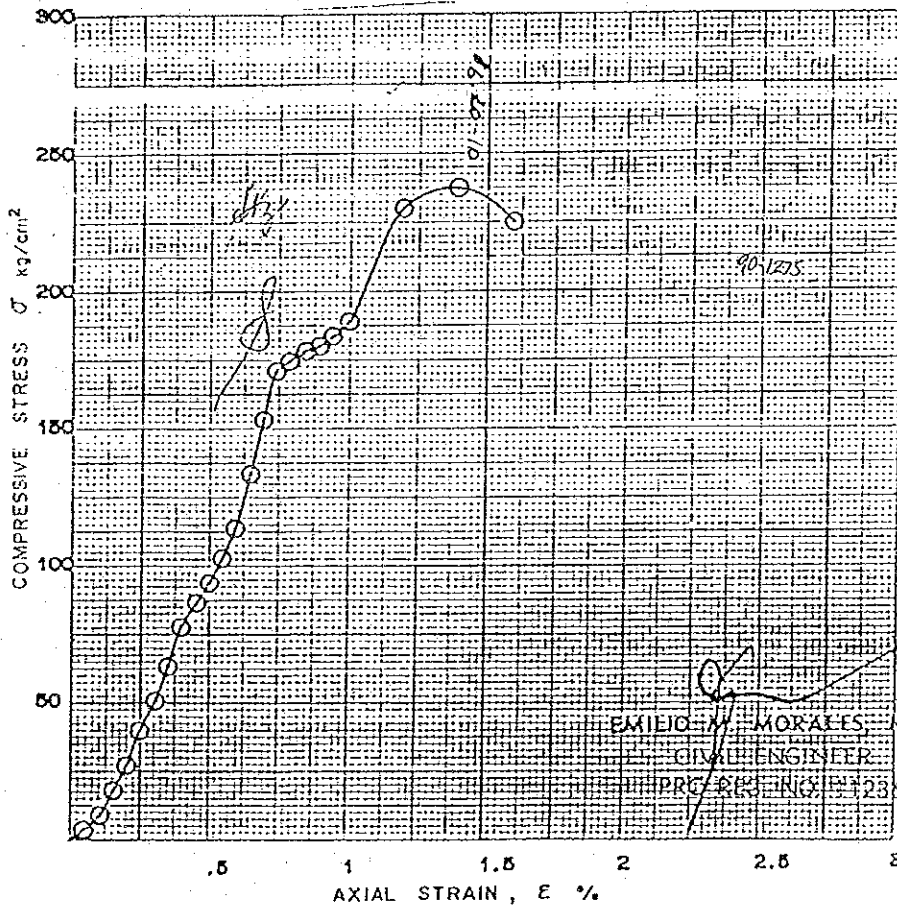
DEPTH: 15.00 - 15.20

TESTED BY: F.T./A.V.Z.

SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY δ_1 (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY S_1
		HEIGHT H(cm)	DIAMETER ϕ (cm)					
2	CS	10.58	5.63	1.8	2.14	238.0	1.39	

REMARKS:

AREA : ILOS RIVER



SPECIMEN AT



No. _____

EMILIO MORALES MSCE
CIVIL ENGINEER
PREPARED BY: 1236



Construction & Drilling Specialists, Inc.

Room 250 Cityland Condominium IV
124 Valero St., Salcedo Village
Makati, Metro Manila
Tel. No. 817-97-24; 817-45-98

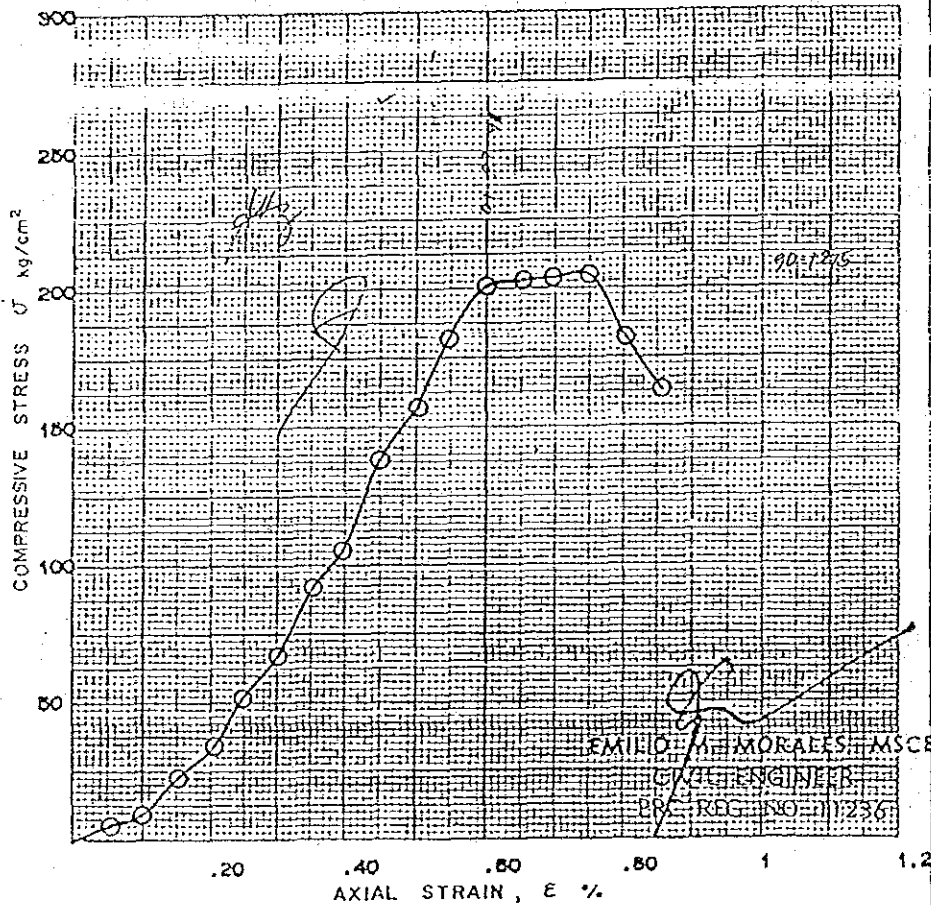
UNCONFINED COMPRESSION TEST REPORT

PROJECT: ILOG - HILABANGAN PROJECT DATE: 01-02-91
 BOREHOLE No: 11-3 DEPTH: 30.00 - 30.20 TESTED BY: F.T./A.V.Z.

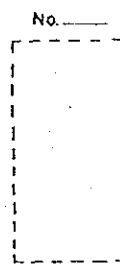
SPECIMEN No.	SPECIMEN CONDITION	DIMENSION OF SPECIMEN		MOISTURE CONTENT W (%)	WET DENSITY γ_1 (g/cm ³)	UNCONFINED COMPRESSIVE STRENGTH q_u (kg/cm ²)	FAILURE STRAIN E (%)	SENSITIVITY RATIO S_1
		HEIGHT H(cm)	DIAMETER ϕ (cm)					
3		11.34	5.48	2.0	2.22	205.6	.75	

REMARKS:

AREA : ILOG RIVER



SPECIMEN AT ULTIMATE FAILURE



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