$$Ad = b1 (Ac Z)^{b2} \quad (8)$$

$$Ke = Ad/g \quad (9)$$

where, Ad : design seismic acceleration (gal)
b1,b2 : rock coefficient
Ac : basic seismic acceleration (gal)
Ke : seismic coefficient
g : acceleration of gravity (=980 cm/sec2)
z : zoning coefficient

Condition of foundation	b1	b2
Rock	2.76	0.71
Diluvium	0.87	1.05
Alluvium	1.56	0.89
Soft alluvium	0.29	1.32

Return period(years)	Ac (gal :cm/sec2)
20	85
100	160
500	225
1000	275

According to the map of Indonesia earthquake zoning, the seismic coefficient,Ke at the project area for 100 years return period was calculated at 0.15 with conditions of z=1.56, Ac=160, b1=2.76 and b2=0.71.

4.4 Conclusions

From the above,the seismic coefficient for the preliminary design should be conservatively be taken as 0.15.

TABLES

Table C-1 (1) List of Earthquakes (Data from 1913 to 1989) (1/3)

No.	Date			Epicenter		Depth (km)	Magnitude	Distance from Site to Epicenter (km)	Intensity Felt Site	Acceleration (cm/sec2)
	Year	Month	Day	Latitude	Longitude					
1	1913	8	13	5.50 S	105.00 E	75.00	7.20	124.11	4.22	58.23
2	1931	2	10	5.25 S	102.50 E	0.00	7.10	397.14	1.20	1.79
3	1931	2	12	5.25 S	102.50 E	0.00	6.50	397.14	0.00	0.45
4	1931	2	14	5.00 S	102.75 E	0.00	6.00	377.33	0.00	0.45
5	1931	9	25	5.00 S	102.00 E	0.00	7.40	457.48	1.40	2.27
6	1932	4	22	4.50 S	103.00 E	80.00	6.50	372.34	0.17	0.55
7	1932	5	21	6.50 S	105.00 E	100.00	6.50	124.11	2.82	11.62
8	1932	7	5	6.00 S	103.50 E	80.00	6.00	277.33	0.00	0.45
9	1933	6	21	4.00 S	102.00 E	80.00	6.50	496.45	0.00	0.45
10	1933	6	24	5.50 S	104.75 E	0.00	7.50	149.42	4.41	71.85
11	1935	8	23	4.25 S	102.00 E	0.00	6.50	484.61	0.00	0.45
12	1936	1	22	4.00 S	103.00 E	80.00	6.30	400.40	0.00	0.45
13	1938	1	22	6.00 S	105.00 E	150.00	6.00	110.93	2.07	4.89
14	1938	8	18	4.00 S	103.00 E	100.00	6.90	400.40	0.78	1.10
15	1938	8	25	5.50 S	102.00 E	70.00	6.90	447.21	0.47	0.77
16	1941	4	13	5.00 S	103.50 E	0.00	6.30	298.84	0.35	0.67
17	1943	4	1	6.50 S	105.50 E	0.00	7.00	78.58	4.30	63.56
18	1949	6	24	5.00 S	106.50 E	60.00	7.00	124.37	3.82	36.54
19	1950	3	27	5.00 S	103.00 E	0.00	7.00	350.92	1.33	2.08
20	1954	7	3	6.50 S	105.50 E	100.00	6.90	78.58	4.10	50.49
21	1956	5	1	4.00 S	103.00 E	40.00	6.60	400.40	0.18	0.55
22	1957	4	16	4.50 S	107.50 E	600.00	7.50	235.73	3.34	20.97
23	1957	7	9	6.00 S	104.00 E	60.00	6.10	221.87	0.68	0.99
24	1957	7	31	6.50 S	105.00 E	100.00	5.60	124.11	1.02	1.46
25	1958	4	21	4.50 S	104.00 E	200.00	6.50	277.68	0.93	1.32
26	1959	7	19	6.50 S	105.00 E	0.00	5.80	124.11	1.42	2.32
27	1959	11	26	5.50 S	103.00 E	0.00	6.80	337.42	1.03	1.48
28	1960	10	3	5.50 S	104.00 E	51.00	5.30	228.74	0.00	0.45
29	1961	10	15	4.00 S	102.70 E	0.00	5.90	428.46	0.00	0.45
30	1963	4	7	5.50 S	104.00 E	100.00	6.30	228.74	1.01	1.44
31	1964	2	4	5.60 S	105.00 E	33.00	5.00	119.54	0.00	0.45
32	1964	2	10	6.10 S	104.10 E	126.00	5.50	211.07	0.00	0.45
33	1964	2	10	6.10 S	104.10 E	33.00	5.50	211.07	0.00	0.45
34	1964	3	25	5.80 S	104.00 E	33.00	5.40	222.98	0.00	0.45
35	1964	4	26	5.80 S	105.00 E	90.00	5.70	113.15	1.43	2.33
36	1964	6	10	6.16 S	104.80 E	48.00	5.70	134.31	1.05	1.50
37	1964	8	15	5.50 S	104.10 E	33.00	5.20	218.00	0.00	0.45
38	1964	8	15	4.80 S	104.60 E	49.00	4.60	204.85	0.00	0.45
39	1964	10	18	5.94 S	104.92 E	79.00	5.10	119.99	0.10	0.50
40	1964	11	21	4.90 S	103.60 E	33.00	5.40	293.05	0.00	0.45
41	1965	2	26	6.70 S	102.70 E	33.00	6.10	374.28	0.00	0.45
42	1965	4	4	7.20 S	104.90 E	33.00	6.20	180.93	1.37	2.17
43	1965	5	19	6.50 S	105.40 E	74.00	6.30	86.76	2.90	12.68
44	1965	7	12	4.60 S	103.20 E	80.00	5.30	347.52	0.00	0.45
45	1965	8	9	5.87 S	104.85 E	86.00	5.20	128.39	0.15	0.53
46	1965	8	9	5.90 S	104.80 E	75.00	5.20	133.58	0.06	0.48
47	1965	8	21	5.80 S	104.20 E	57.00	5.40	200.92	0.00	0.45
48	1965	8	30	6.40 S	104.80 E	81.00	6.10	140.37	1.75	3.37
49	1965	10	2	6.00 S	103.90 E	35.00	5.20	232.96	0.00	0.45
50	1965	10	8	6.00 S	103.90 E	66.00	5.50	232.96	0.00	0.45
51	1965	11	10	5.80 S	104.50 E	82.00	5.00	167.88	0.00	0.45
52	1965	11	28	4.90 S	103.20 E	85.00	5.90	333.88	0.00	0.45
53	1966	2	17	5.90 S	104.50 E	41.00	5.40	166.77	0.00	0.45
54	1966	6	7	5.70 S	105.50 E	40.00	5.30	64.74	0.90	1.27
55	1966	9	9	4.16 S	102.83 E	47.00	5.80	406.96	0.00	0.45
56	1967	3	29	4.77 S	103.20 E	83.00	5.40	339.45	0.00	0.45
57	1967	8	2	4.56 S	103.25 E	110.00	5.30	344.62	0.00	0.45

Table C-1 (2) List of Earthquakes (Data from 1913 to 1989) (2/3)

No.	Date			Epicenter		Depth (km)	Magnitude	Distance from Site to Epicenter (km)	Intensity Felt Site	Acceleration (cm/sec2)
	Year	Month	Day	Latitude	Longitude					
58	1968	6	11	5.80 S	103.90 E	60.00	5.40	234.02	0.00	0.45
59	1968	7	12	5.50 S	103.90 E	33.00	5.20	239.52	0.00	0.45
60	1968	8	17	4.80 S	103.30 E	89.00	5.40	327.96	0.00	0.45
61	1969	4	14	5.20 S	104.30 E	102.00	5.70	208.55	0.03	0.47
62	1969	4	19	6.20 S	103.90 E	40.00	5.70	234.02	0.00	0.45
63	1969	6	23	5.80 S	104.60 E	91.00	5.40	156.89	0.10	0.50
64	1969	8	2	5.60 S	104.50 E	79.00	5.40	172.25	0.00	0.45
65	1969	8	19	6.10 S	105.60 E	16.00	5.50	45.75	1.30	2.01
66	1969	8	27	4.30 S	104.60 E	188.00	5.60	244.81	0.00	0.45
67	1969	10	4	5.89 S	104.03 E	164.00	5.00	218.88	0.00	0.45
68	1969	10	4	5.70 S	104.10 E	88.00	5.10	213.40	0.00	0.45
69	1969	10	7	6.10 S	104.20 E	15.00	5.20	199.99	0.00	0.45
70	1969	11	7	6.30 S	105.30 E	52.00	5.80	84.53	1.90	4.01
71	1969	12	18	5.70 S	104.00 E	47.00	5.20	224.37	0.00	0.45
72	1970	2	12	6.13 S	104.60 E	83.00	5.20	155.98	0.00	0.45
73	1970	12	13	4.24 S	103.39 E	120.00	5.30	349.59	0.00	0.45
74	1971	4	7	5.94 S	104.33 E	89.00	5.40	185.38	0.00	0.45
75	1971	4	8	4.42 S	102.32 E	74.00	6.30	444.51	0.00	0.45
76	1971	5	4	6.54 S	105.37 E	46.00	5.90	92.18	2.10	5.05
77	1971	8	15	6.14 S	103.96 E	33.00	5.40	226.84	0.00	0.45
78	1972	3	26	5.78 S	104.46 E	94.00	5.10	172.58	0.00	0.45
79	1972	4	23	5.69 S	104.16 E	82.00	5.30	207.01	0.00	0.45
80	1972	5	8	5.03 S	103.48 E	33.00	5.20	299.68	0.00	0.45
81	1972	10	31	6.11 S	104.93 E	91.00	5.60	119.33	1.11	1.62
82	1973	3	17	5.17 S	103.21 E	66.00	5.50	323.00	0.00	0.45
83	1974	2	1	4.62 S	103.25 E	124.00	5.30	341.56	0.00	0.45
84	1974	2	2	6.12 S	104.17 E	63.00	5.30	203.45	0.00	0.45
85	1974	2	11	6.08 S	104.00 E	48.00	5.50	222.04	0.00	0.45
86	1974	8	27	4.59 S	103.53 E	116.00	5.00	315.78	0.00	0.45
87	1974	10	10	4.15 S	102.83 E	89.00	5.70	407.52	0.00	0.45
88	1974	11	9	6.44 S	105.38 E	55.00	6.10	84.44	2.50	8.00
89	1975	1	11	5.75 S	104.65 E	80.00	5.10	152.32	0.00	0.45
90	1975	10	1	4.83 S	102.24 E	47.00	6.00	436.97	0.00	0.45
91	1976	3	23	4.36 S	105.05 E	207.00	5.50	210.79	0.00	0.45
92	1976	10	6	5.83 S	104.11 E	69.00	4.90	210.52	0.00	0.45
93	1976	10	16	4.69 S	105.21 E	186.00	5.00	170.13	0.00	0.45
94	1976	11	19	5.00 S	104.13 E	114.00	4.90	235.43	0.00	0.45
95	1976	12	10	4.72 S	103.37 E	89.00	5.40	324.69	0.00	0.45
96	1977	2	27	6.39 S	104.84 E	68.00	5.40	135.81	0.42	0.73
97	1977	10	6	4.61 S	103.27 E	100.00	5.30	340.09	0.00	0.45
98	1977	11	17	6.16 S	104.68 E	47.00	5.40	147.51	0.24	0.59
99	1978	2	18	4.60 S	102.94 E	52.00	5.50	373.52	0.00	0.45
100	1978	4	29	5.91 S	103.92 E	54.00	5.90	230.96	0.19	0.56
101	1978	5	11	5.46 S	104.10 E	85.00	5.00	219.18	0.00	0.45
102	1978	6	24	5.05 S	102.38 E	37.00	5.90	415.27	0.00	0.45
103	1978	6	24	5.07 S	102.33 E	0.00	5.90	420.08	0.00	0.45
104	1979	4	7	6.13 S	104.69 E	80.00	5.20	146.04	0.00	0.45
105	1979	5	7	6.39 S	105.93 E	123.00	5.90	44.10	2.10	5.05
106	1979	5	22	5.68 S	104.51 E	76.00	5.00	169.08	0.00	0.45
107	1979	6	25	5.96 S	103.57 E	38.00	5.60	269.60	0.00	0.45
108	1979	9	28	5.93 S	104.47 E	95.00	5.20	169.91	0.00	0.45
109	1980	4	3	5.59 S	103.15 E	41.00	5.70	319.44	0.00	0.45
110	1980	5	10	5.83 S	104.64 E	104.00	4.90	152.05	0.00	0.45
111	1980	10	8	5.34 S	103.12 E	44.00	5.80	327.83	0.00	0.45
112	1981	1	24	5.38 S	102.95 E	41.00	5.60	345.31	0.00	0.45
113	1981	5	26	5.03 S	104.24 E	59.00	4.90	223.11	0.00	0.45
114	1982	4	15	4.74 S	103.16 E	73.00	5.50	344.86	0.00	0.45

Table C-1 (3) List of Earthquakes (Data from 1913 to 1989) (3/3)

No.	Date			Epicenter		Depth (km)	Magnitude	Distance from Site to Epicenter (km)	Intensity Felt Site	Acceleration (cm/sec2)
	Year	Month	Day	Latitude	Longitude					
115	1982	6	14	4.70 S	103.04 E	59.00	5.90	358.84	0.00	0.45
116	1982	6	14	4.71 S	103.06 E	56.00	5.90	356.36	0.00	0.45
117	1982	6	25	6.36 S	103.44 E	35.00	5.80	286.80	0.00	0.45
118	1982	8	10	6.16 S	104.21 E	63.00	5.40	199.37	0.00	0.45
119	1983	1	3	4.82 S	103.17 E	63.00	5.50	340.31	0.00	0.45
120	1983	1	22	6.67 S	103.03 E	40.00	6.00	337.81	0.00	0.45
121	1983	1	22	6.71 S	102.98 E	29.00	6.10	344.21	0.00	0.45
122	1983	2	23	5.48 S	103.91 E	60.00	4.90	238.97	0.00	0.45
123	1983	3	1	5.70 S	104.40 E	92.00	5.00	180.61	0.00	0.45
124	1983	5	30	4.74 S	103.03 E	63.00	5.60	358.08	0.00	0.45
125	1983	10	7	4.66 S	103.54 E	112.00	5.10	311.00	0.00	0.45
126	1983	10	10	5.80 S	103.20 E	31.00	5.60	311.41	0.00	0.45
127	1983	11	3	5.78 S	104.51 E	50.00	5.50	167.09	0.15	0.54
128	1984	2	25	7.40 S	103.40 E	45.00	6.30	327.84	0.11	0.51
129	1984	3	15	6.60 S	105.50 E	137.00	5.90	86.82	2.10	5.05
130	1984	4	26	6.32 S	106.07 E	78.00	5.90	36.46	2.10	5.05
131	1984	6	8	5.60 S	103.80 E	28.00	6.40	248.08	1.01	1.44
132	1984	6	8	5.88 S	104.06 E	55.00	5.00	215.62	0.00	0.45
133	1984	6	8	5.78 S	104.23 E	74.00	5.00	197.87	0.00	0.45
134	1984	9	7	5.97 S	104.97 E	107.00	5.10	114.31	0.21	0.57
135	1984	9	24	5.57 S	105.15 E	141.00	5.00	105.75	0.18	0.55
136	1984	10	30	4.84 S	104.39 E	75.00	5.00	220.39	0.00	0.45
137	1984	12	14	5.26 S	103.98 E	3.00	5.50	238.75	0.00	0.45
138	1985	1	22	5.91 S	104.56 E	33.00	5.60	160.06	0.45	0.75
139	1985	1	31	5.67 S	104.30 E	42.00	5.70	192.13	0.23	0.58
140	1985	2	11	5.61 S	104.89 E	33.00	5.60	130.56	0.91	1.28
141	1985	2	20	5.73 S	104.13 E	69.00	5.00	209.61	0.00	0.45
142	1985	2	20	4.97 S	105.28 E	49.00	5.50	139.73	0.56	0.86
143	1985	3	22	6.50 S	105.40 E	75.00	6.40	86.76	3.10	15.97
144	1985	8	9	5.43 S	104.82 E	33.00	5.10	145.47	0.00	0.45
145	1985	8	10	4.81 S	105.05 E	33.00	5.50	169.27	0.12	0.52
146	1985	9	9	5.92 S	104.91 E	87.00	5.30	121.24	0.48	0.78
147	1985	12	27	5.70 S	104.00 E	25.00	7.00	224.37	2.46	7.61
148	1985	12	27	5.71 S	104.27 E	58.00	5.00	194.61	0.00	0.45
149	1985	12	28	5.80 S	104.20 E	15.00	6.40	200.92	1.52	2.59
150	1985	12	29	5.52 S	104.47 E	33.00	6.00	177.94	1.00	1.43
151	1985	12	31	4.82 S	104.33 E	42.00	5.60	227.10	0.00	0.45
152	1986	2	5	5.76 S	104.27 E	18.00	5.10	193.77	0.00	0.45
153	1986	3	25	6.25 S	104.16 E	47.00	5.70	206.00	0.06	0.48
154	1986	5	21	4.76 S	103.15 E	73.00	5.30	344.98	0.00	0.45
155	1987	2	7	4.92 S	103.25 E	60.00	5.40	327.90	0.00	0.45
156	1987	10	12	5.69 S	103.91 E	33.00	5.00	234.40	0.00	0.45
157	1987	10	22	5.73 S	104.18 E	48.00	5.30	204.12	0.00	0.45
158	1987	10	22	5.32 S	104.72 E	33.00	4.80	160.91	0.00	0.45
159	1988	3	2	6.39 S	104.82 E	65.00	5.40	137.91	0.39	0.70
160	1988	7	18	4.64 S	103.38 E	99.00	5.50	327.71	0.00	0.45
161	1989	3	8	6.03 S	105.37 E	33.00	5.60	69.97	1.50	2.53

Table C-2 (1) Plotting Position for Seismic Records (1/4)

No.	Intensity Ij	Acceleration a (gal)	Date Occurred			Recurrence Interval TR (year)
			Year	Month	Day	
1	4.41	71.85	1933	6	24	77.00
2	4.30	63.56	1943	4	1	38.50
3	4.22	58.23	1913	8	13	25.67
4	4.10	50.49	1954	7	3	19.25
5	3.82	36.54	1949	6	24	15.40
6	3.34	20.97	1957	4	16	12.83
7	3.10	15.97	1985	3	22	11.00
8	2.90	12.68	1965	5	19	9.62
9	2.82	11.62	1932	5	21	8.56
10	2.50	8.00	1974	11	9	7.70
11	2.46	7.61	1985	12	27	7.00
12	2.10	5.05	1984	4	26	6.42
13	2.10	5.05	1984	3	15	5.92
14	2.10	5.05	1979	5	7	5.50
15	2.10	5.05	1971	5	4	5.13
16	2.07	4.89	1938	1	22	4.81
17	1.90	4.01	1969	11	7	4.53
18	1.75	3.37	1965	8	30	4.28
19	1.52	2.59	1985	12	28	4.05
20	1.50	2.53	1989	3	8	3.85
21	1.43	2.33	1964	4	26	3.67
22	1.42	2.32	1959	7	19	3.50
23	1.40	2.27	1931	9	25	3.35
24	1.37	2.17	1965	4	4	3.21
25	1.33	2.08	1950	3	27	3.08
26	1.30	2.01	1969	8	19	2.96
27	1.20	1.79	1931	2	10	2.85
28	1.11	1.62	1972	10	31	2.75
29	1.05	1.50	1964	6	10	2.66
30	1.03	1.48	1959	11	26	2.57
31	1.02	1.46	1957	7	31	2.48
32	1.01	1.44	1984	6	8	2.41
33	1.01	1.44	1963	4	7	2.33
34	1.00	1.43	1985	12	29	2.26
35	0.93	1.32	1958	4	21	2.20
36	0.91	1.28	1985	2	11	2.14
37	0.90	1.27	1966	6	7	2.08
38	0.78	1.10	1938	8	18	2.03
39	0.68	0.99	1957	7	9	1.97
40	0.56	0.86	1985	2	20	1.92
41	0.48	0.78	1985	9	9	1.88
42	0.47	0.77	1938	8	25	1.83
43	0.45	0.75	1985	1	22	1.79
44	0.42	0.73	1977	2	27	1.75
45	0.39	0.70	1988	3	2	1.71
46	0.35	0.67	1941	4	13	1.67
47	0.24	0.59	1977	11	17	1.64

Table C-2 (2) Plotting Position for Seismic Records (2/4)

No.	Intensity Ij	Acceleration a (gal)	Date Occurred Year	Month	Day	Recurrence Interval TR (year)
48	0.23	0.58	1985	1	31	1.60
49	0.21	0.57	1984	9	7	1.57
50	0.19	0.56	1978	4	29	1.54
51	0.18	0.55	1984	9	24	1.51
52	0.18	0.55	1956	5	1	1.48
53	0.17	0.55	1932	4	22	1.45
54	0.15	0.54	1983	11	3	1.43
55	0.15	0.53	1965	8	9	1.40
56	0.12	0.52	1985	8	10	1.37
57	0.11	0.51	1984	2	25	1.35
58	0.10	0.50	1964	10	18	1.33
59	0.10	0.50	1969	6	23	1.31
60	0.06	0.48	1986	3	25	1.28
61	0.06	0.48	1965	8	9	1.26
62	0.03	0.47	1969	4	14	1.24
63	0.00	0.45	1988	7	18	1.22
64	0.00	0.45	1987	10	22	1.20
65	0.00	0.45	1987	10	22	1.18
66	0.00	0.45	1987	10	12	1.17
67	0.00	0.45	1987	2	7	1.15
68	0.00	0.45	1986	5	21	1.13
69	0.00	0.45	1986	2	5	1.12
70	0.00	0.45	1985	12	31	1.10
71	0.00	0.45	1985	12	27	1.08
72	0.00	0.45	1985	8	9	1.07
73	0.00	0.45	1985	2	20	1.05
74	0.00	0.45	1984	12	14	1.04
75	0.00	0.45	1984	10	30	1.03
76	0.00	0.45	1984	6	8	1.01
77	0.00	0.45	1984	6	8	1.00
78	0.00	0.45	1983	10	10	0.99
79	0.00	0.45	1983	10	7	0.97
80	0.00	0.45	1983	5	30	0.96
81	0.00	0.45	1983	3	1	0.95
82	0.00	0.45	1983	2	23	0.94
83	0.00	0.45	1983	1	22	0.93
84	0.00	0.45	1983	1	22	0.92
85	0.00	0.45	1983	1	3	0.91
86	0.00	0.45	1982	8	10	0.90
87	0.00	0.45	1982	6	25	0.89
88	0.00	0.45	1982	6	14	0.87
89	0.00	0.45	1982	6	14	0.87
90	0.00	0.45	1982	4	15	0.86
91	0.00	0.45	1981	5	26	0.85
92	0.00	0.45	1981	1	24	0.84
93	0.00	0.45	1980	10	8	0.83
94	0.00	0.45	1980	5	10	0.82

Table C-2 (3) Plotting Position for Seismic Records (3/4)

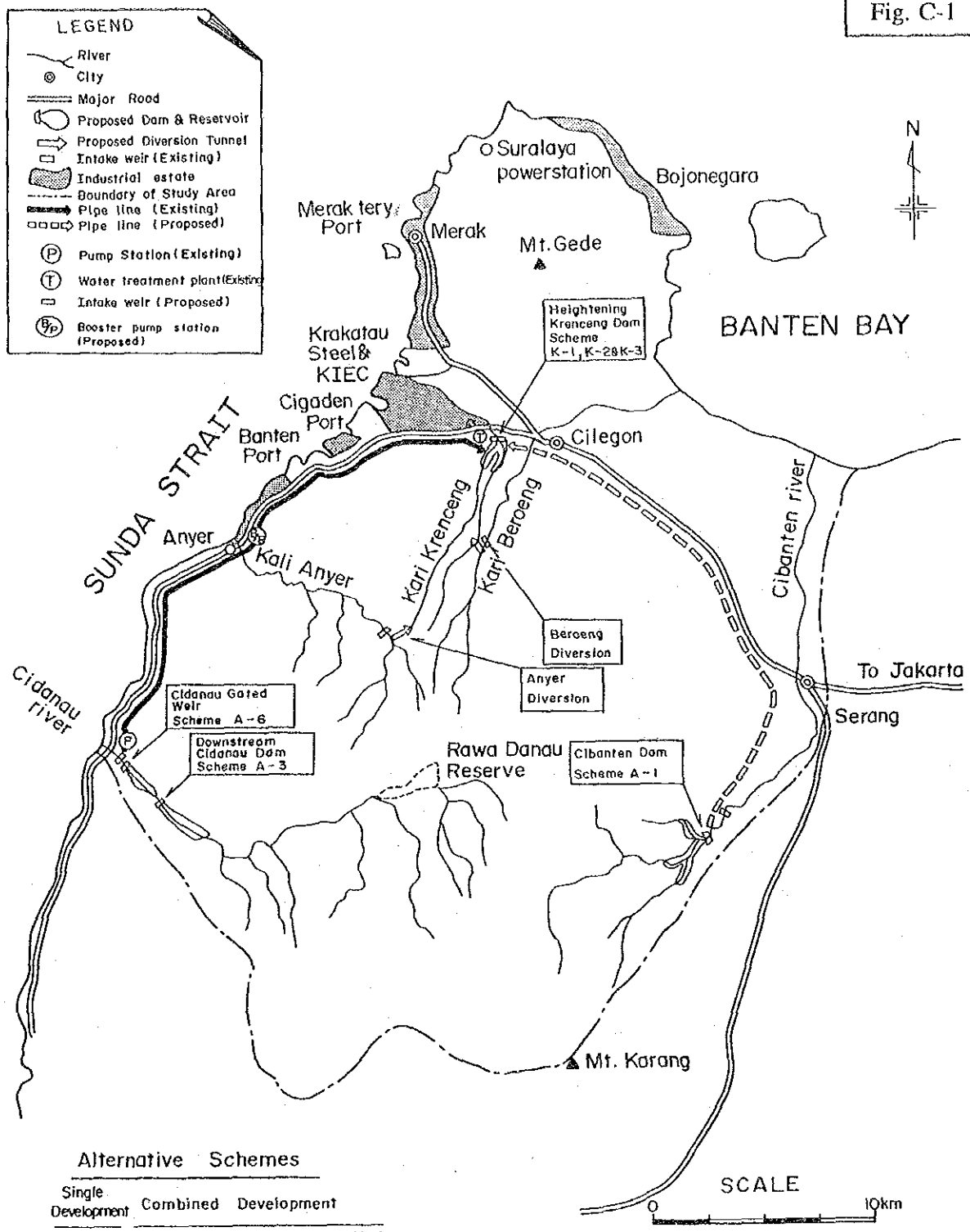
No.	Intensity Ij	Acceleration a (gal)	Date Occurred Year	Month	Day	Recurrence Interval TR (year)
95	0.00	0.45	1980	4	3	0.81
96	0.00	0.45	1979	9	28	0.80
97	0.00	0.45	1979	6	25	0.79
98	0.00	0.45	1979	5	22	0.79
99	0.00	0.45	1979	4	7	0.78
100	0.00	0.45	1978	6	24	0.77
101	0.00	0.45	1978	6	24	0.76
102	0.00	0.45	1978	5	11	0.75
103	0.00	0.45	1978	2	18	0.75
104	0.00	0.45	1977	10	6	0.74
105	0.00	0.45	1976	12	10	0.73
106	0.00	0.45	1976	11	19	0.73
107	0.00	0.45	1976	10	16	0.72
108	0.00	0.45	1976	10	6	0.71
109	0.00	0.45	1976	3	23	0.71
110	0.00	0.45	1975	10	1	0.70
111	0.00	0.45	1975	1	11	0.69
112	0.00	0.45	1974	10	10	0.69
113	0.00	0.45	1974	8	27	0.68
114	0.00	0.45	1974	2	11	0.68
115	0.00	0.45	1974	2	2	0.67
116	0.00	0.45	1974	2	1	0.66
117	0.00	0.45	1973	3	17	0.66
118	0.00	0.45	1972	5	8	0.65
119	0.00	0.45	1972	4	23	0.65
120	0.00	0.45	1972	3	26	0.64
121	0.00	0.45	1971	8	15	0.64
122	0.00	0.45	1971	4	8	0.63
123	0.00	0.45	1971	4	7	0.63
124	0.00	0.45	1970	12	13	0.62
125	0.00	0.45	1970	2	12	0.62
126	0.00	0.45	1969	12	18	0.61
127	0.00	0.45	1969	10	7	0.61
128	0.00	0.45	1969	10	4	0.60
129	0.00	0.45	1969	10	4	0.60
130	0.00	0.45	1969	8	27	0.59
131	0.00	0.45	1969	8	2	0.59
132	0.00	0.45	1969	4	19	0.58
133	0.00	0.45	1968	8	17	0.58
134	0.00	0.45	1968	7	12	0.57
135	0.00	0.45	1968	6	11	0.57
136	0.00	0.45	1967	8	2	0.57
137	0.00	0.45	1967	3	29	0.56
138	0.00	0.45	1966	9	9	0.56
139	0.00	0.45	1966	2	17	0.55
140	0.00	0.45	1965	11	28	0.55
141	0.00	0.45	1965	11	10	0.55

Table C-2 (4) Plotting Position for Seismic Records (4/4)

No.	Intensity Ij	Acceleration a (gal)	Date Occurred			Recurrence Interval TR (year)
			Year	Month	Day	
142	0.00	0.45	1965	10	8	0.54
143	0.00	0.45	1965	10	2	0.54
144	0.00	0.45	1965	8	21	0.53
145	0.00	0.45	1965	7	12	0.53
146	0.00	0.45	1965	2	26	0.53
147	0.00	0.45	1964	11	21	0.52
148	0.00	0.45	1964	8	15	0.52
149	0.00	0.45	1964	8	15	0.52
150	0.00	0.45	1964	3	25	0.51
151	0.00	0.45	1964	2	10	0.51
152	0.00	0.45	1964	2	10	0.51
153	0.00	0.45	1964	2	4	0.50
154	0.00	0.45	1961	10	15	0.50
155	0.00	0.45	1960	10	3	0.50
156	0.00	0.45	1936	1	22	0.49
157	0.00	0.45	1935	8	23	0.49
158	0.00	0.45	1933	6	21	0.49
159	0.00	0.45	1932	7	5	0.48
160	0.00	0.45	1931	2	14	0.48
161	0.00	0.45	1931	2	12	0.48

FIGURES

Fig. C-1



Alternative Schemes

Single Development	Combined Development	
	Scheme	Single scheme to be combined
Scheme	B-1	K-1 plus A-1
	B-2	K-1 plus A-3
	B-3	K-1 plus A-6
A-1	C-1	K-2 plus A-1
A-3	C-2	K-2 plus A-3
A-6	C-3	K-2 plus A-6
K-1 1)	D-1	K-3 plus A-1
K-2 2)	D-2	K-3 plus A-3
K-3 3)	D-3	K-3 plus A-6

Notes : 1) Without diversion
2) With Beroeng diversion
3) With Beroeng & Anyer diversions

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Location Map of Alternatives

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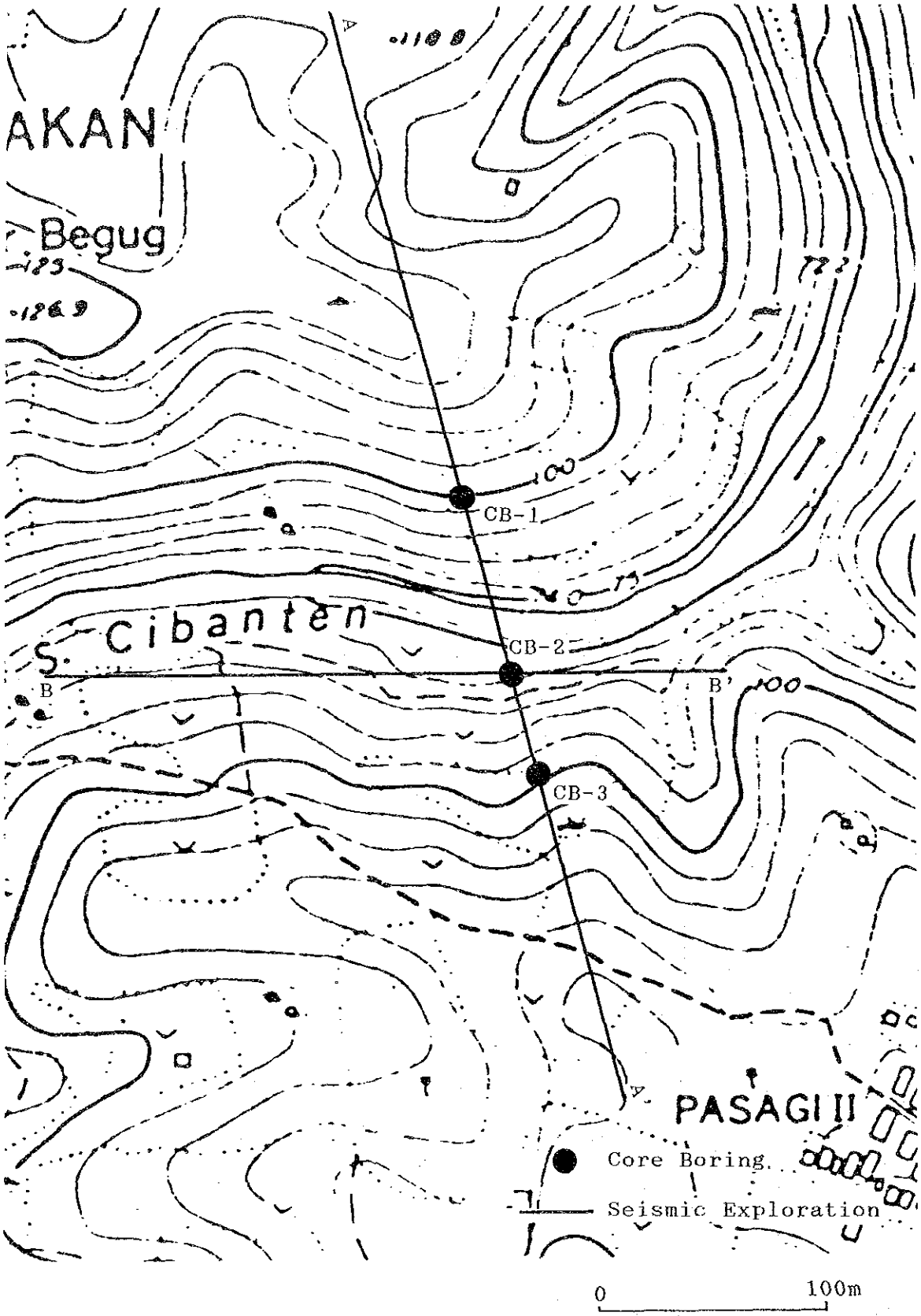
Fig. C-2



Location Map for Geological Investigation I.
CIBANTEN DAMSITE

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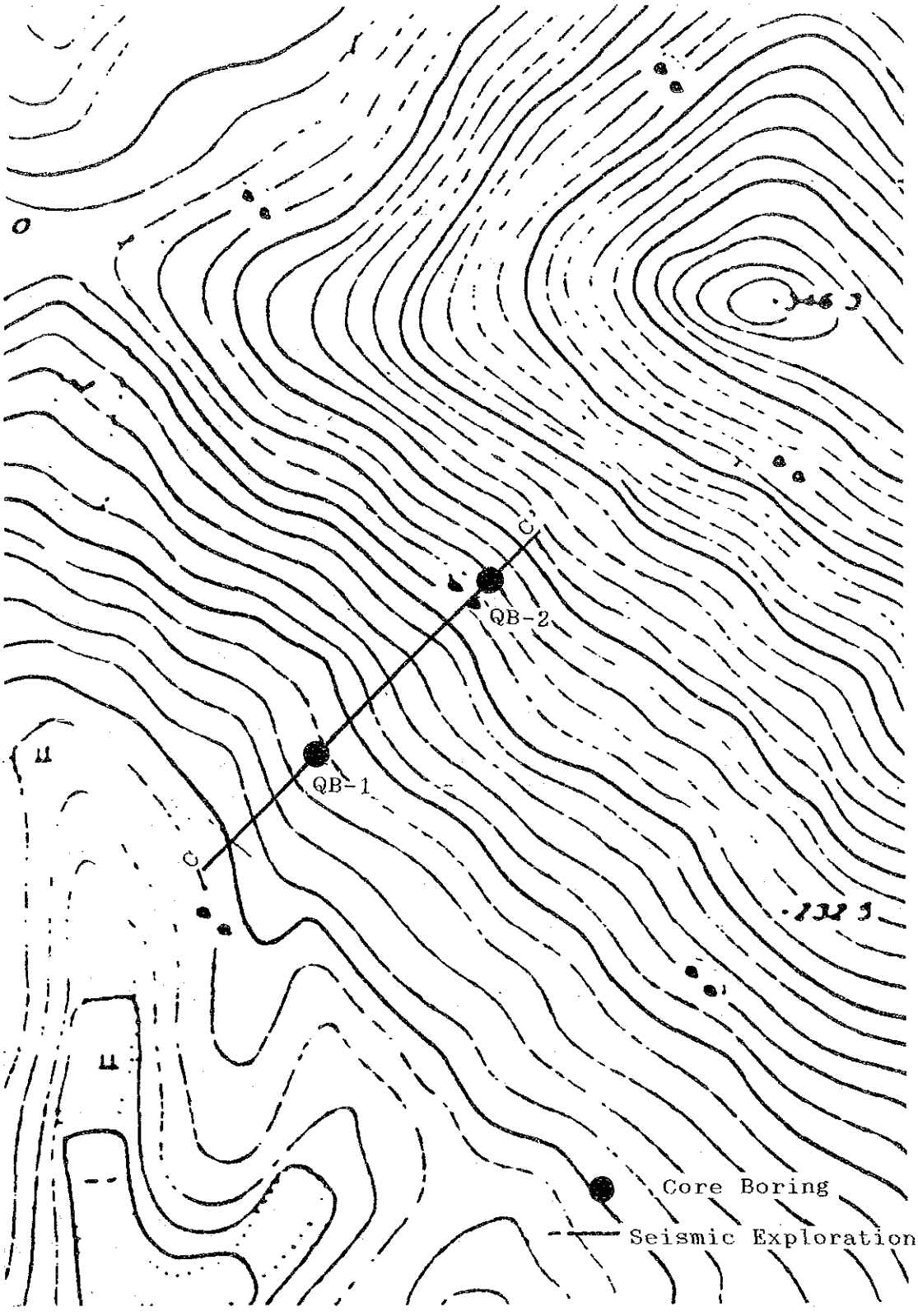
Fig. C-3



Location Map for Geological Investigation II.
CIBANTEN QUARRY SITE

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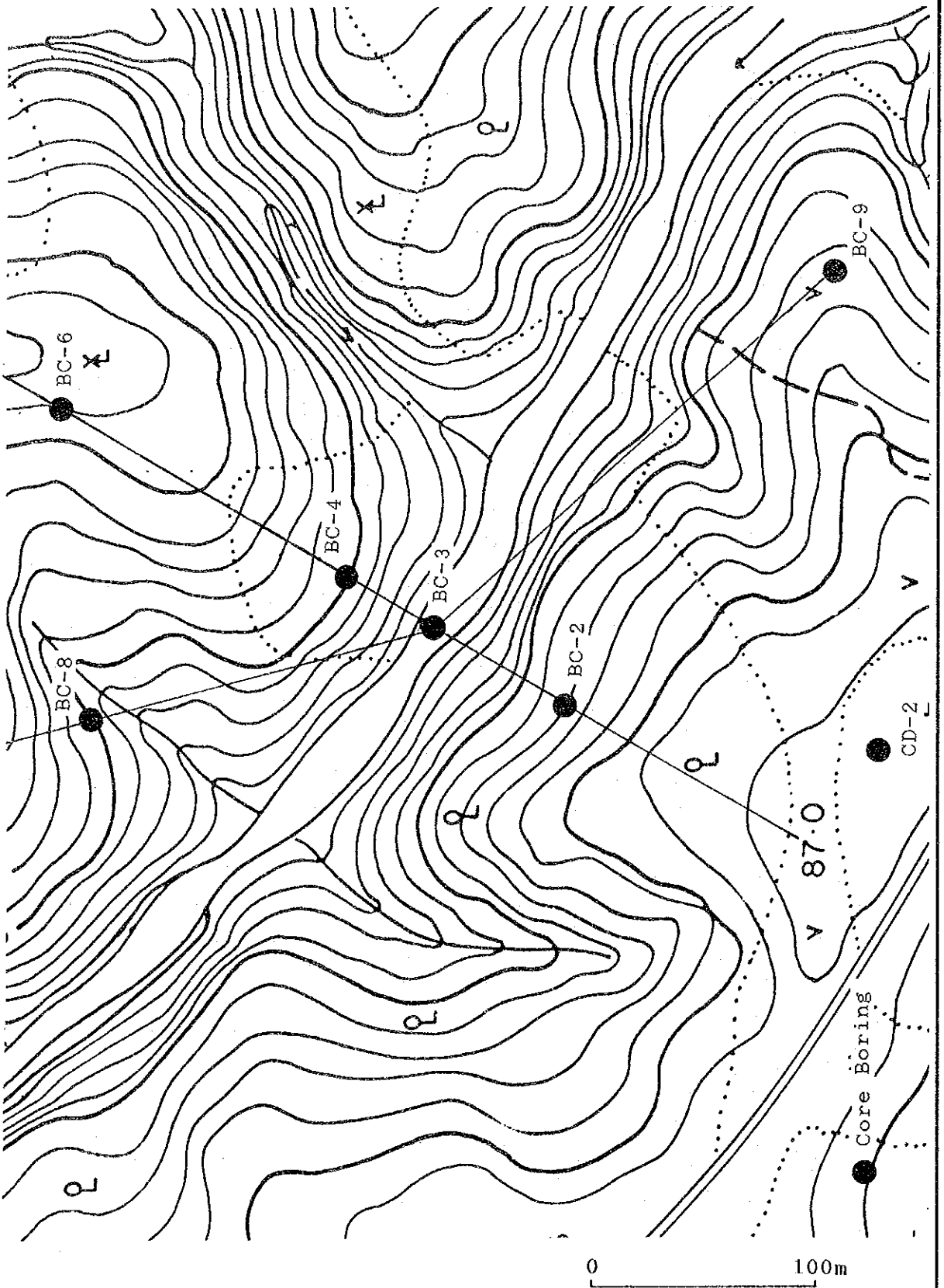
Fig. C-4



Location Map for Geological Investigation III
Middle Cidanau Damsite

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

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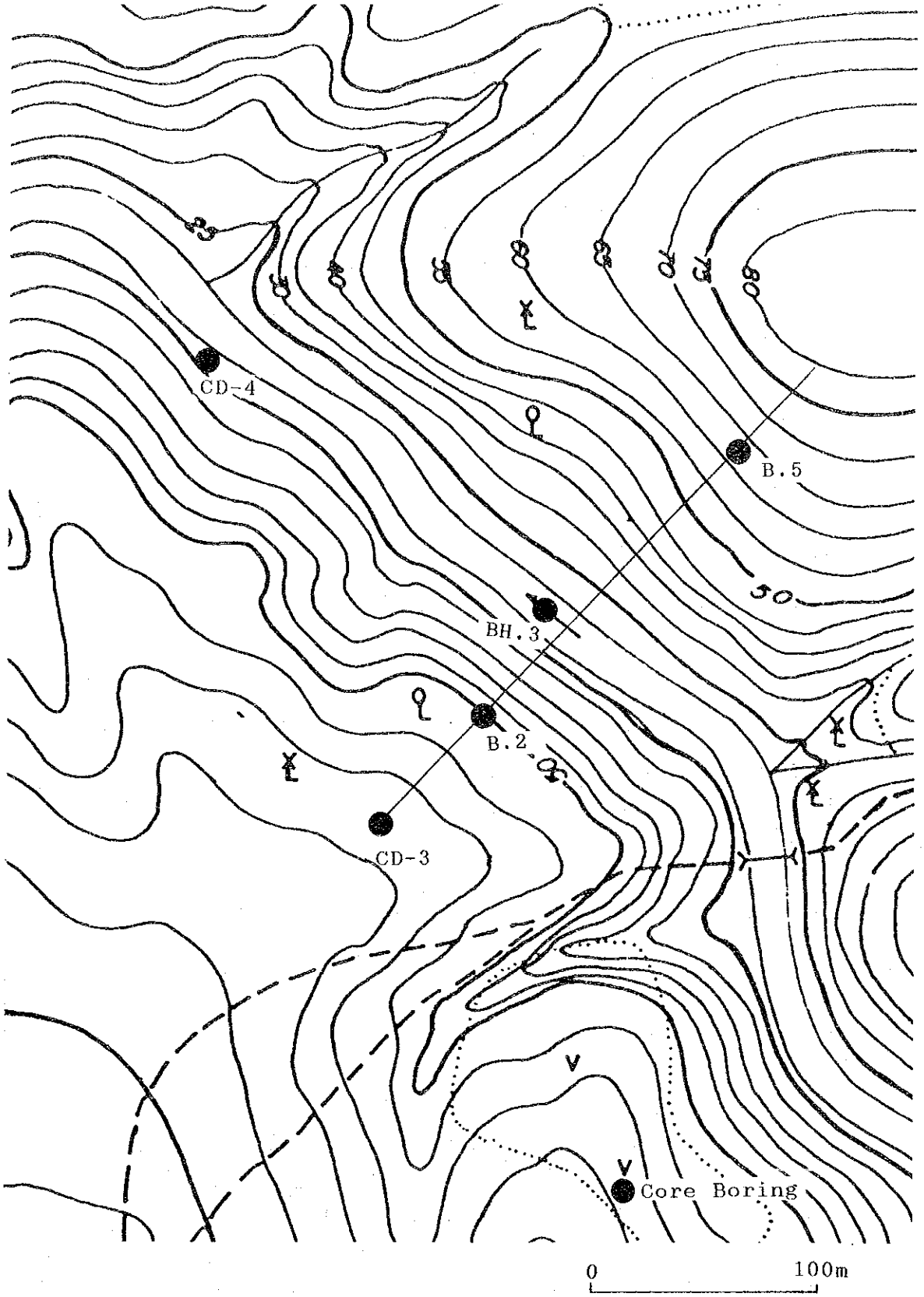
Fig. C-5



Location Map for Geological Investigation IV.
DOWNSTREAM CIDANAU DAMSITE

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN WATER RESOURCES DEVELOPMENT PROJECT

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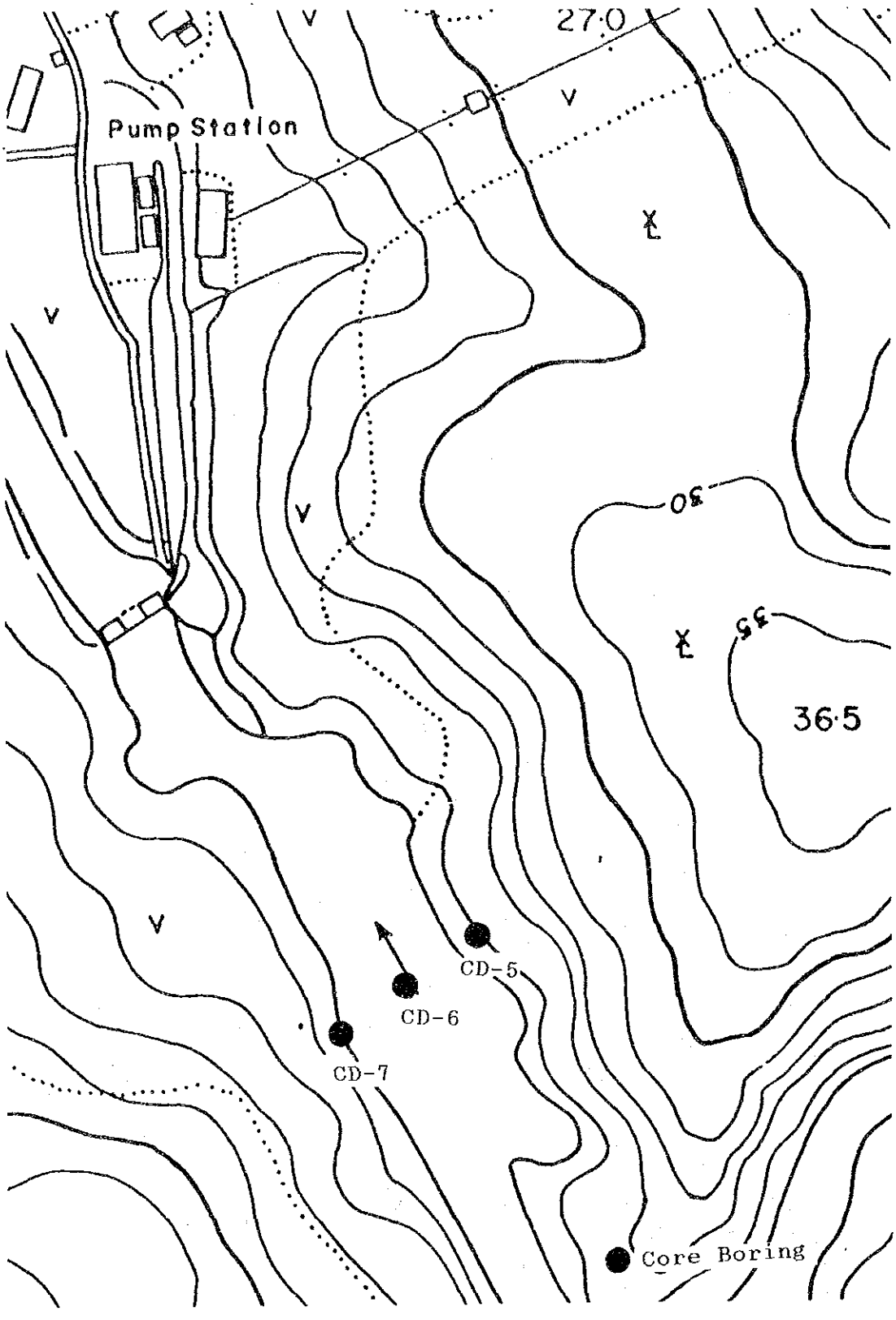
Fig. C-6



Location Map for Geological Investigation V
Cidanau Gated Weir Site

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

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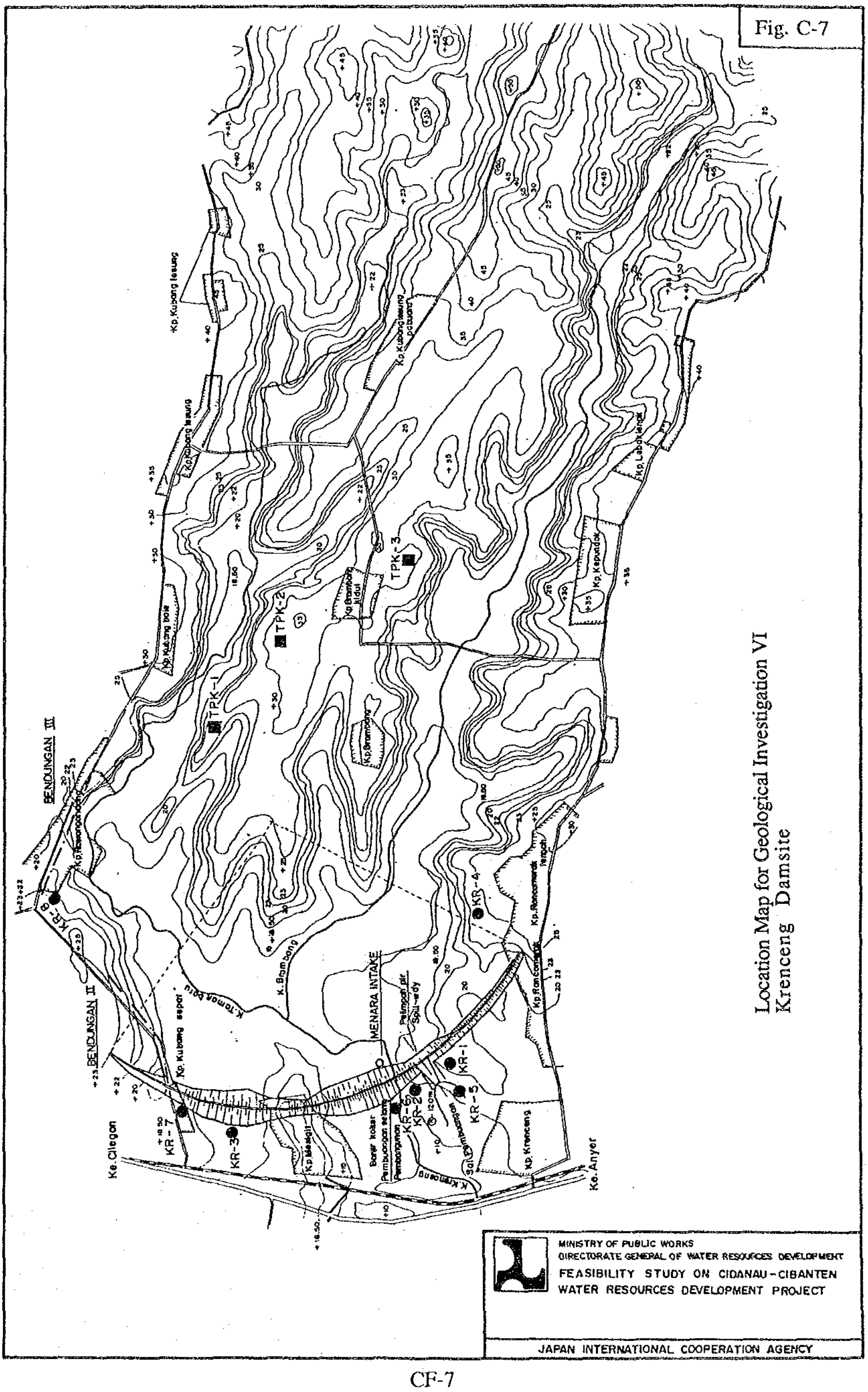
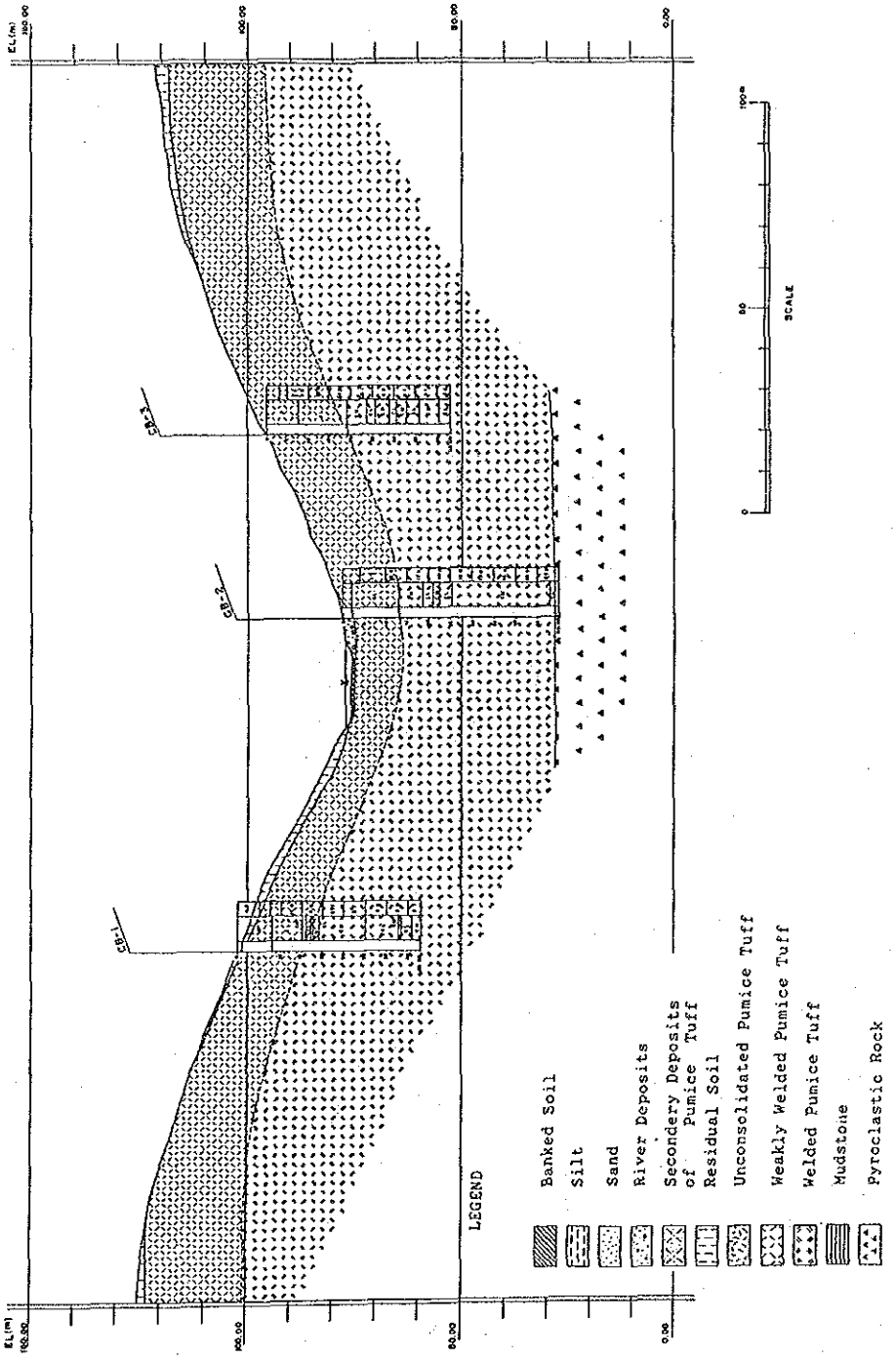
Fig. C-7



Location Map for Geological Investigation VI
Krenceng Damsite

Fig. C-8



Geological Profile of Cibanten Damsite

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WATER RESOURCES DEVELOPMENT PROJECT

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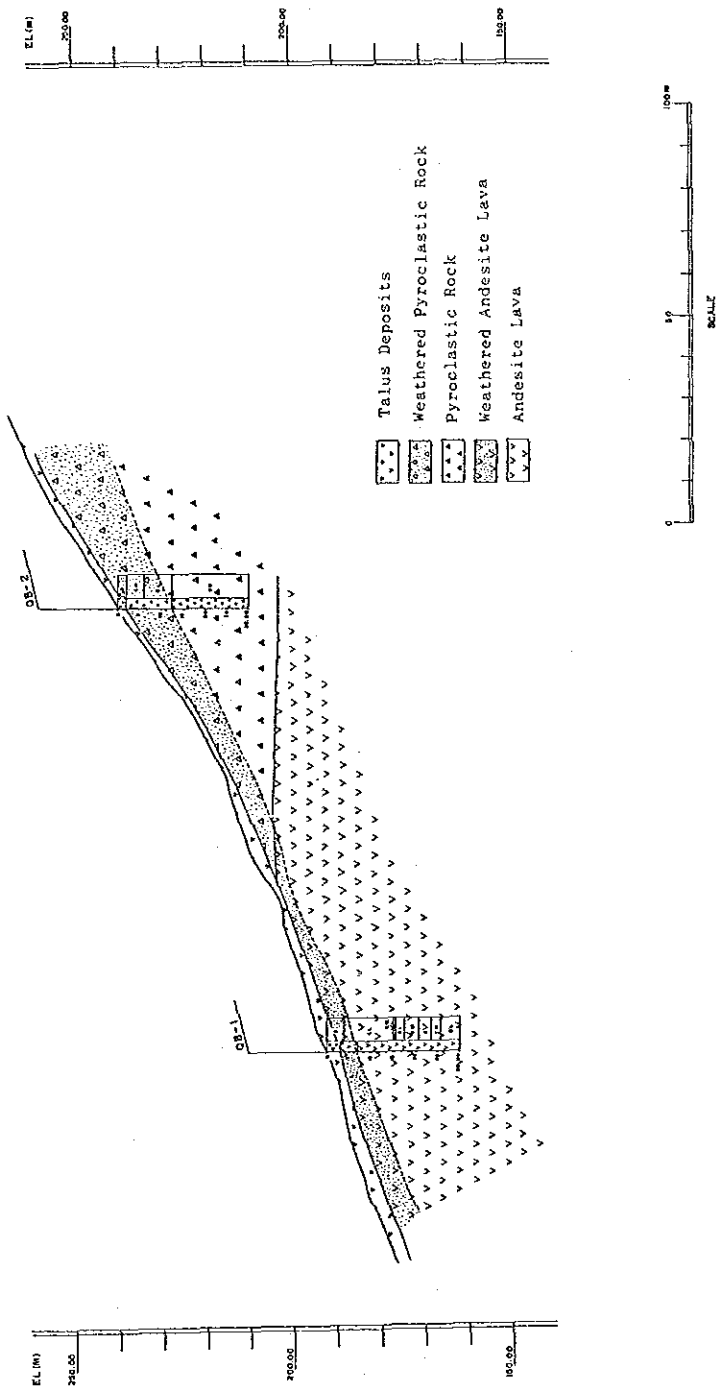
Fig. C-9



Geological Profile of Cibanten Quarry Site

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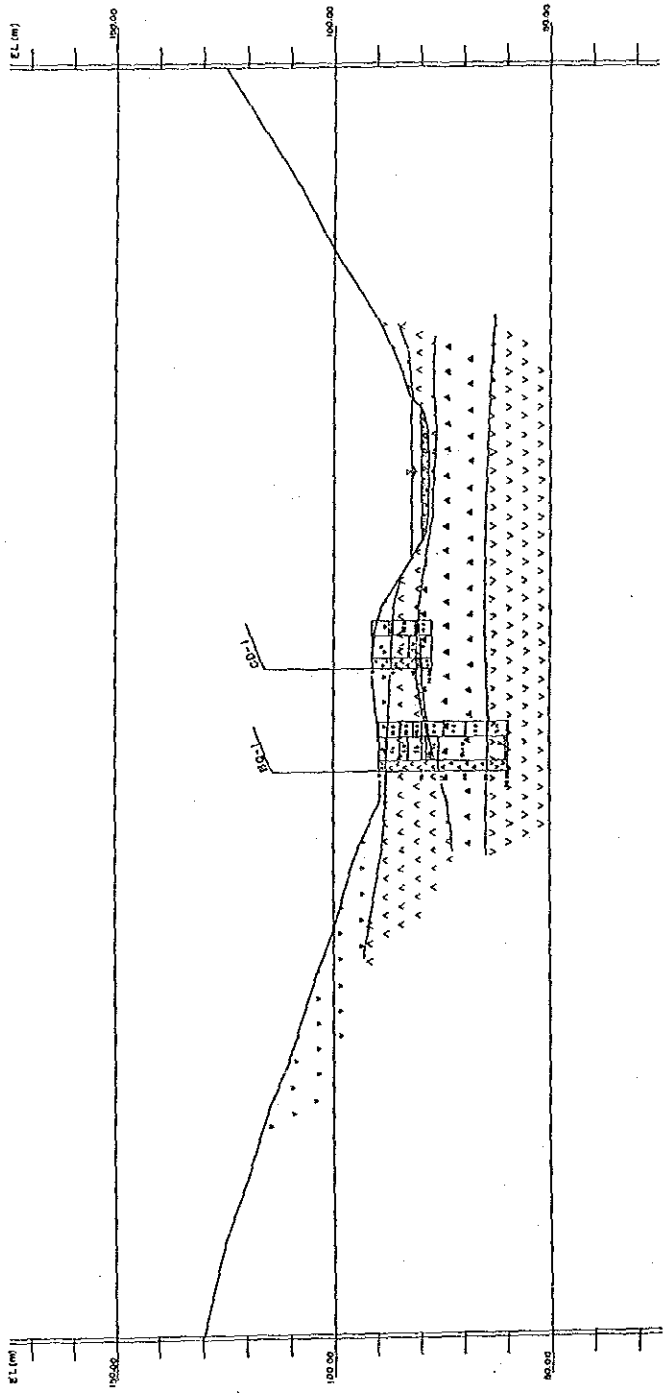
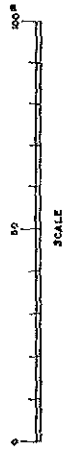
Fig. C-10





LEGEND

- River Deposits
- Talus Deposits
- Residual Soil
- Basalt Lava
- Pyroclastic Rock
- Andesite Lava

Geological Profile of Upstream Cidanau Damsite

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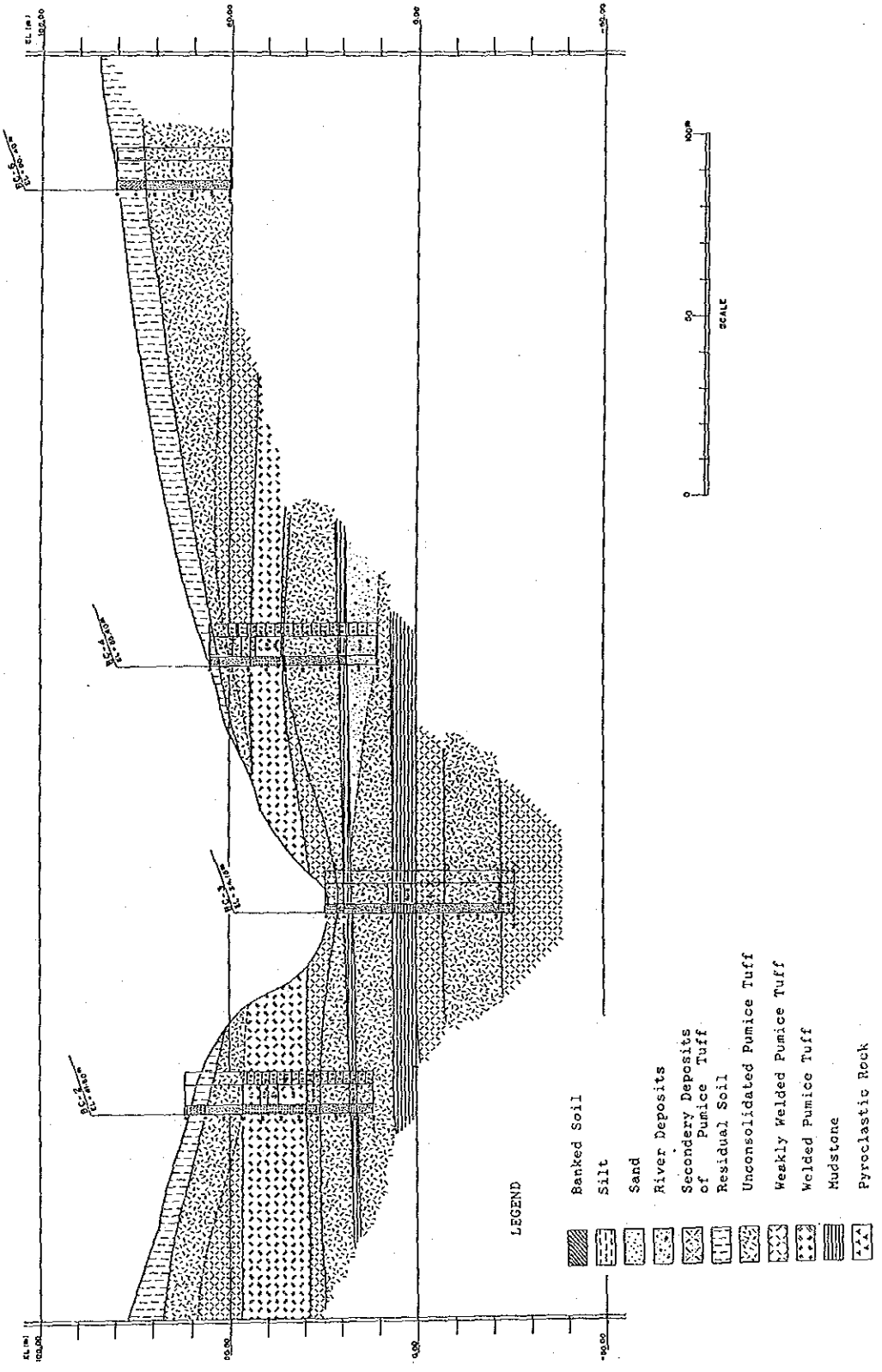
Fig. C-11



Geological Profile of Middle Cidanau Damsite

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WATER RESOURCES DEVELOPMENT PROJECT

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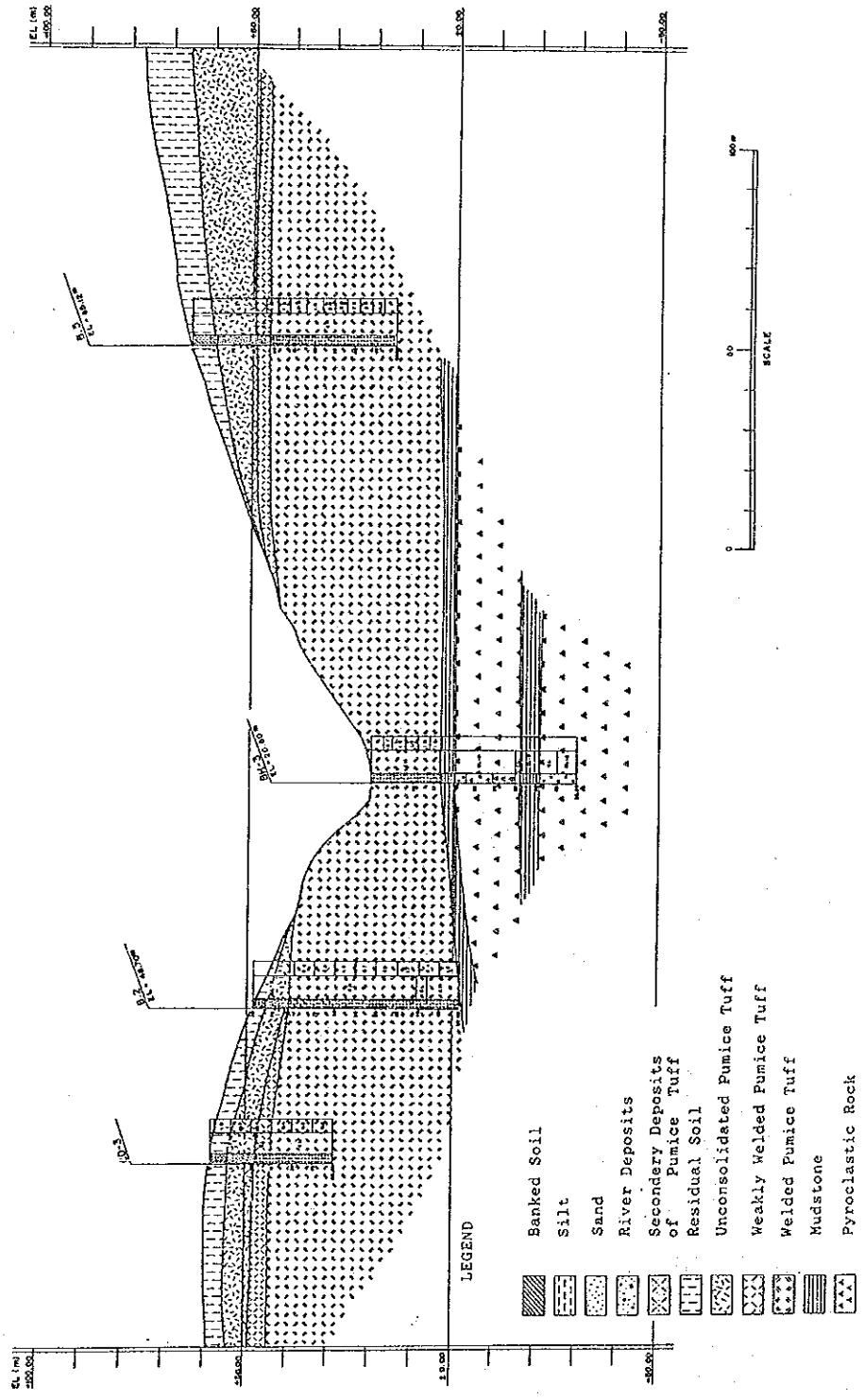
Fig. C-12 (1)



Geological Profile of Downstream Cidanau Damsite

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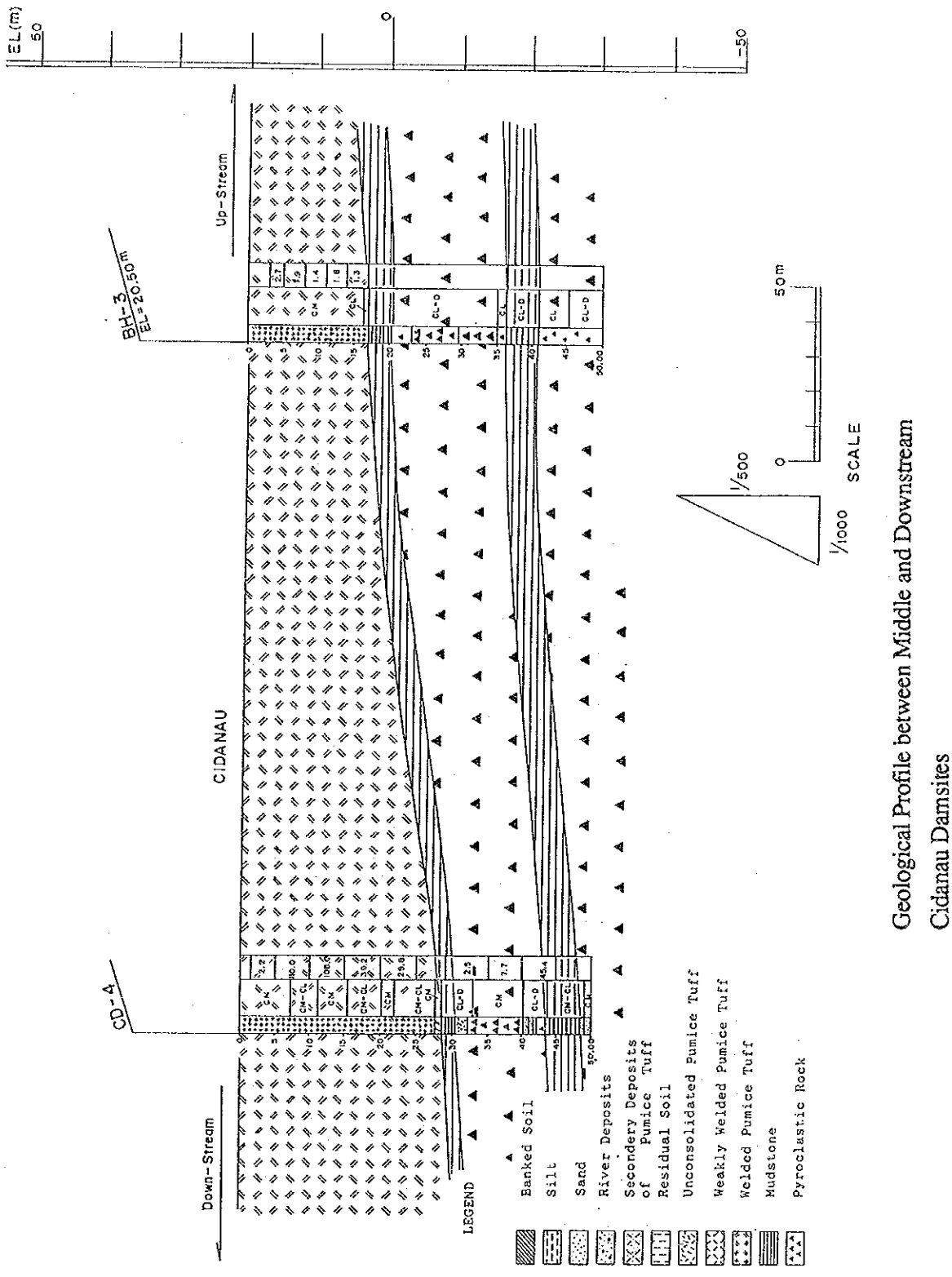
Fig. C-12 (2)



Geological Profile between Middle and Downstream Cidanau Damsites

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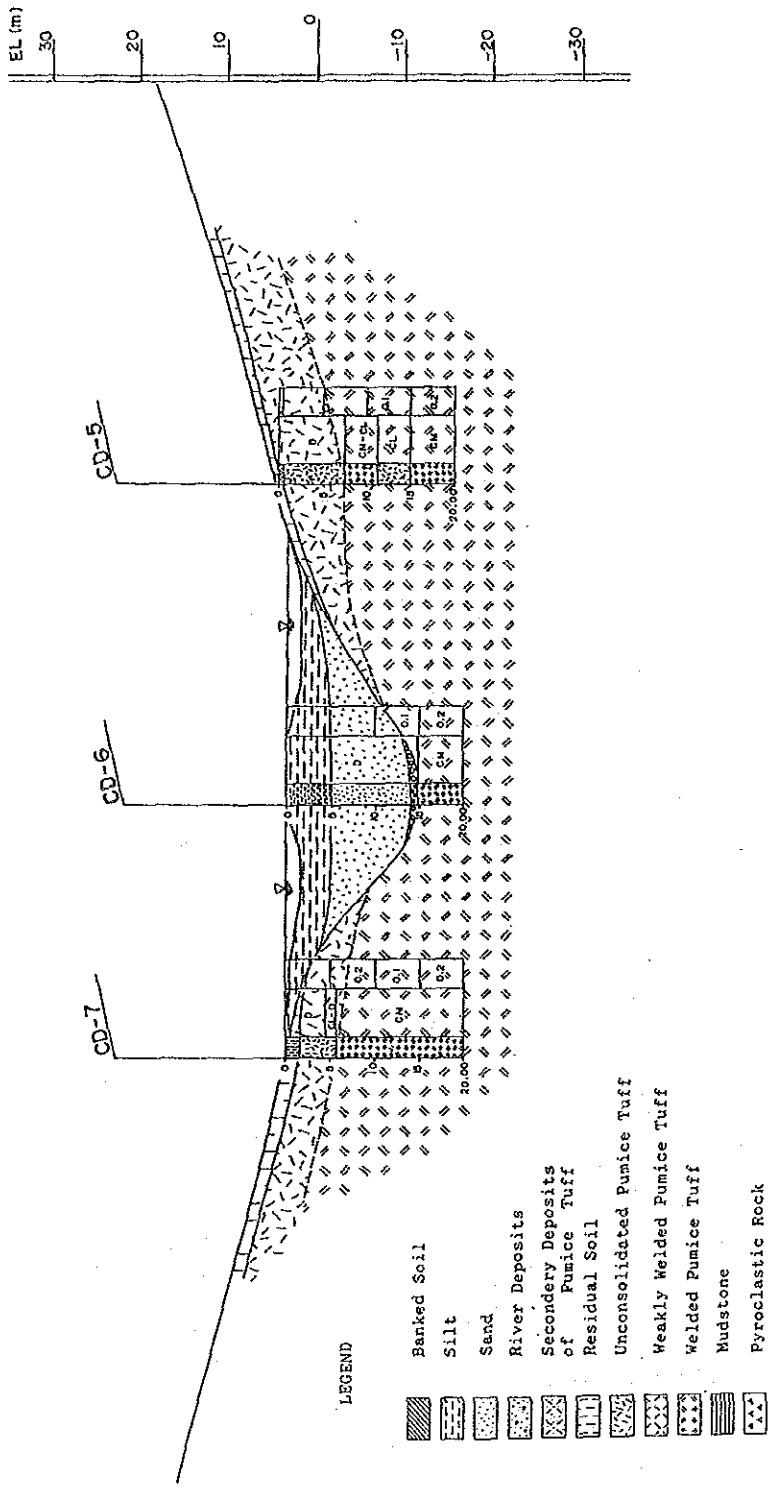
Fig. C-13



Geological Profile of Cidanau Gated Weir Site

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

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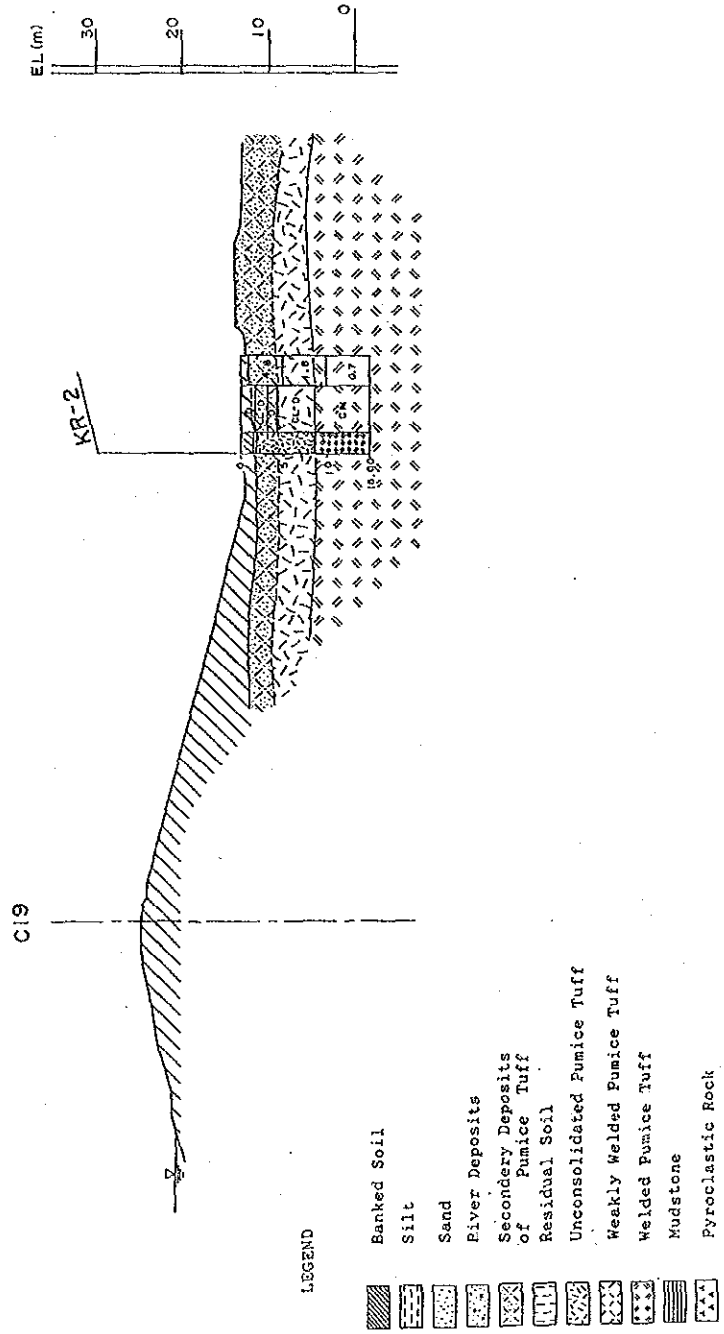
Fig. C-14 (1)



Geological Profile of Krenceng Damsite

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

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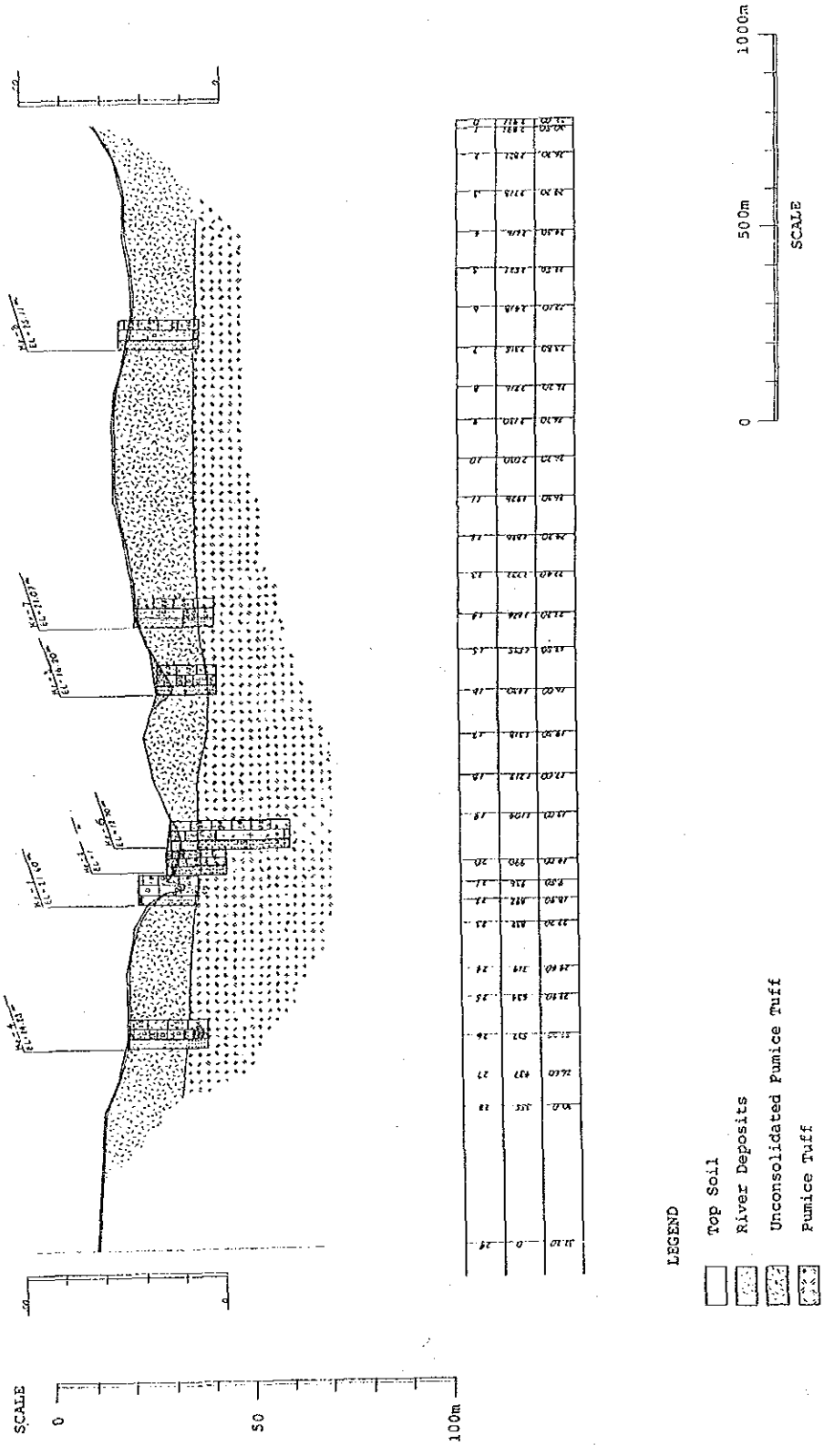
Fig. C-14 (2)



Geological Profile of Krenceng Damsite

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

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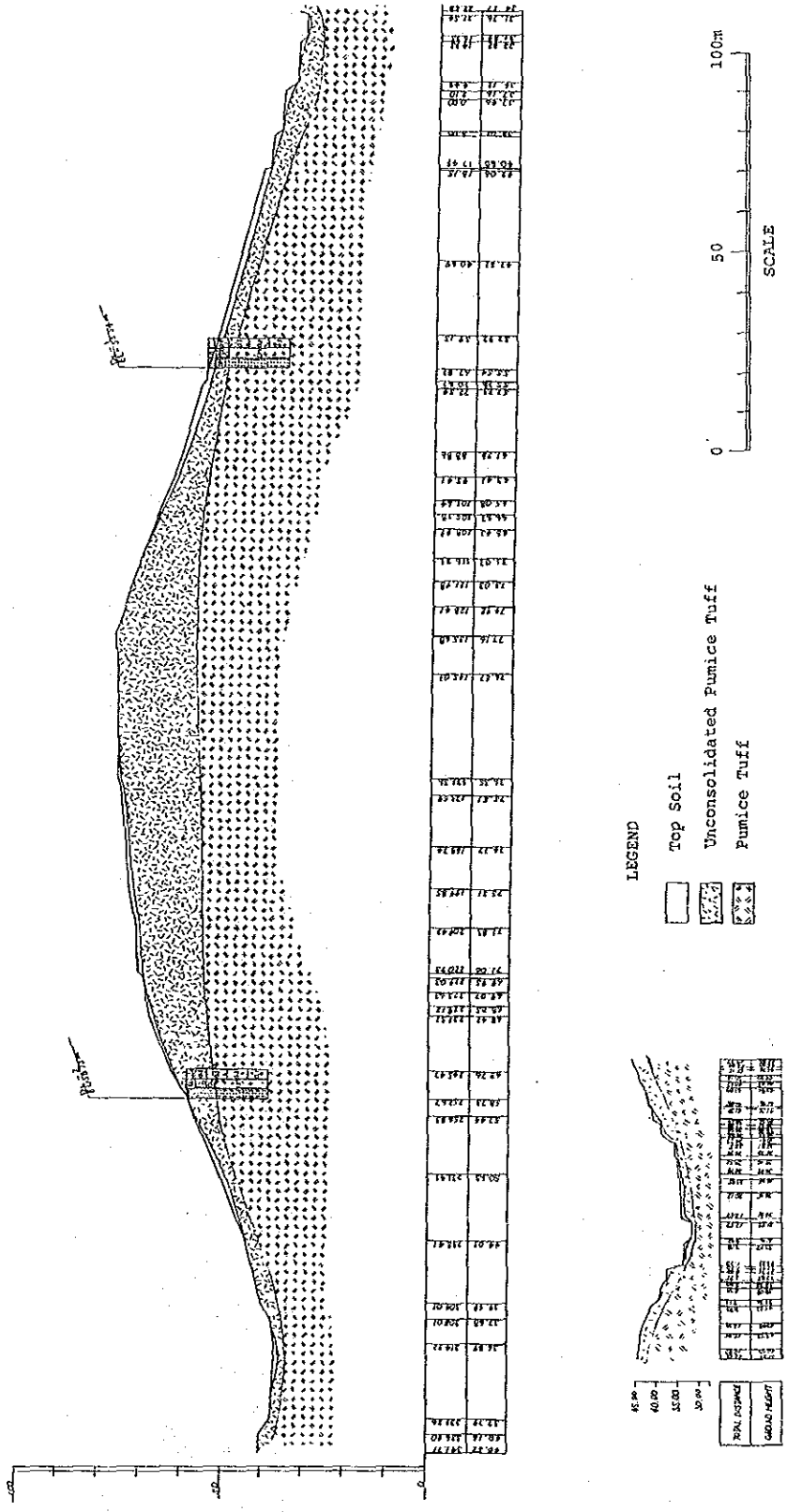
Fig. C-15



Geological Profile of Beroeng Diversion Tunnel Site

MINISTRY OF PUBLIC WORKS
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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. C-16 (1) Drill Log of Borehole CB-1 (1/2)

SITE	CIBANTEN DAMSITE	HOLE No.	CB-1
LATITUDE	LONGITUDE	ELEVATION	100.80m
DATE	From 11.Feb..1991 to 18.Feb..1991	DEPTH	43.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	N 0° / E 90° / S 180° / W 270°
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY (%)	R.Q.D (%)	WATER PRESSURE TEST
1	0.65	100.15	Quaternary	Top Soil			Dark grey humic soil, Grass roots are included.					
1	1.85	98.95		Weathered Pumice Tuff		D	Light brownish grey, moderately weathered welded tuff.					
2	2.65	98.15										
3	3.65	97.15										
4	4.65	96.15					From 3.7m to 8.0m, fragmental cores are recovered. Low core recovery. Rubbles of grey dacitic andesite are included.					
5	5.00	95.80										
6	6.00	94.80										
7	7.00	93.80										
7	7.50	93.30										
8	8.00	92.80										
8	8.00	92.80		Pumice Tuff			Below 8.0m, weakly weathered welded tuff. Some high-dip cracks with brown clay are from 8.1m to 19.2m. Up to 15.0m, short cylindric cores are recovered.					
9	9.00	91.80										
10	10.00	90.80										
11	11.00	89.80										
12	12.00	88.80				CL						
13	13.00	87.80										
14	14.00	86.80										
15	15.00	85.80										
15	15.15	85.65				CH						
16	15.60	81.80										
17	17.00	83.80				CL						
17	17.20	83.60										
18	17.90	83.10				CH						
18	19.00	82.90										
19	19.00	81.80				CL						
19	19.20	81.60										
20	20.00	80.80					Slightly weathered grey puniceous welded tuff. Comparatively softer than below 29.9m. Andesitic rubbles are included from 22.2m to 29.3m.					
21	21.00	79.80										
22	22.00	78.80										
23	23.00	77.80										
24	24.00	76.80										
25	25.00	75.80				CM						
26	26.00	74.80										
27	27.00	73.80										
28	28.00	72.80										
29	29.00	71.80										
30	29.90	70.90										

*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-16 (2) Drill Log of Borehole CB-1 (2/2)

SITE	CIBANTEN DAMSITE	HOLE No.	CB-1
LATITUDE	LONGITUDE	ELEVATION	100.80m
DATE	From 11.Feb..1991 to 18.Feb..1991	DEPTH	43.00m
ANGLE	UP 180° / DOWN 0° / 90°	DIRECTION	SLOPE / HORIZON 0°

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL
31	31.00	69.80	Quaternary	Pumice Tuff		CL	Light grey,fresh welded tuff. Cracky up to 35.8m. Cracks are coated with brown film.		
32	32.00	68.80							
33	33.00	67.80							
34	34.00	66.80							
35	35.00	65.80							
36	35.80 36.00	65.00 64.80				CM			
37	37.00	63.80							
38	37.80 38.00 38.40	63.00 62.80 62.40				CL	Cracky from 37.8m to 38.4m.		
39	39.00	61.80				CM	Vertical crack is from 41.0m to the bottom. Filled with yellowish brown clayey material.		
40	40.00	60.80							
41	41.00	59.80							
42	42.00	58.80				CL			
43	43.00	57.80							
44									
45									
46									
47									
48									
49									
50	50.00	50.80							
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

CORE RECOVERY %(m) 0 50 100 | R.Q.D %(m) 0 50 100 | WATER PRESSURE TEST 0 10 20 30 40 50

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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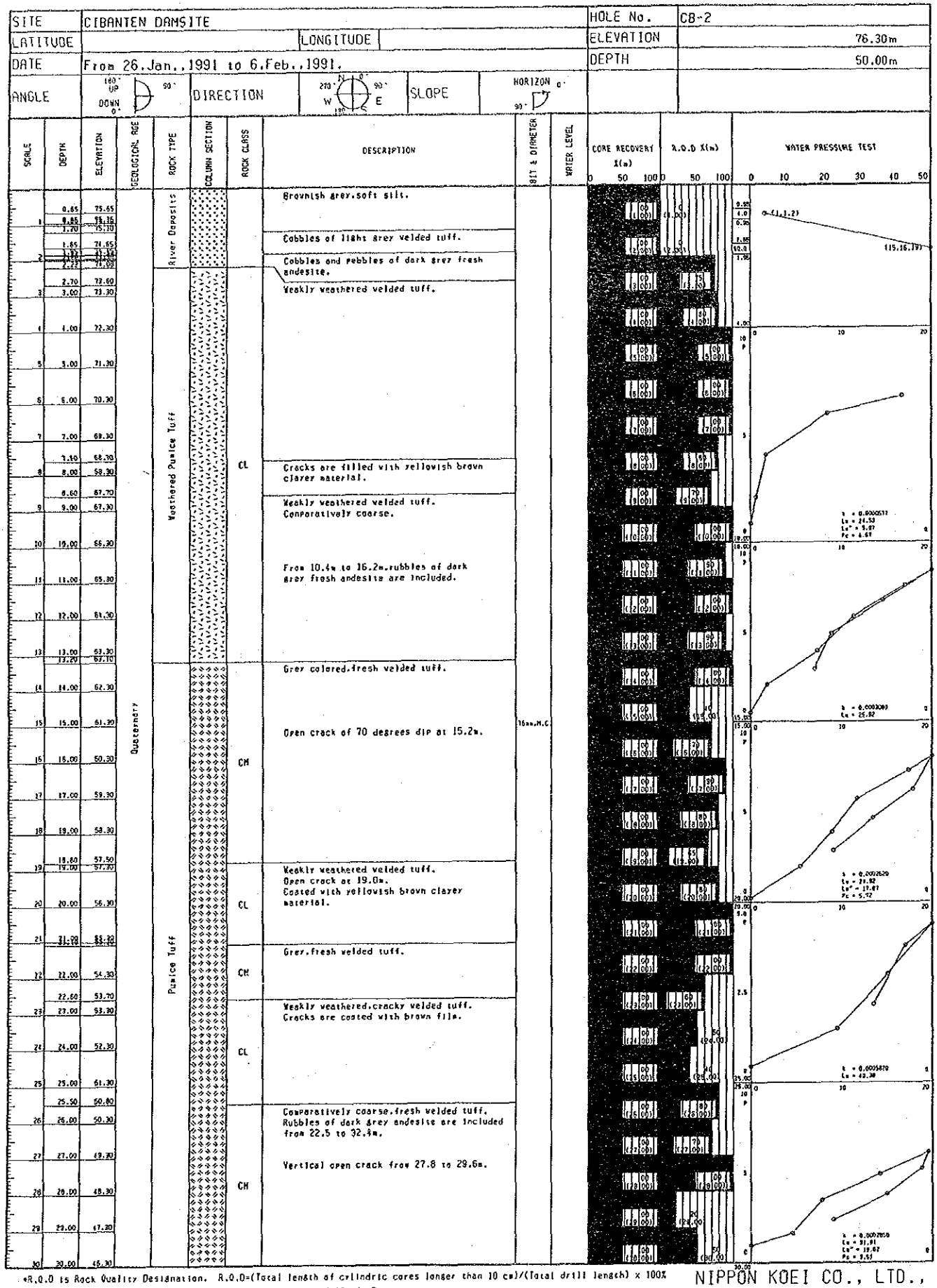
Fig. C-17 (1) Drill Log of Borehole CB-2 (1/2)



*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-17 (2) Drill Log of Borehole CB-2 (2/2)

SITE	CIBANTEN DAMSITE	HOLE No.	CB-2
LATITUDE	LONGITUDE	ELEVATION	76.30m
DATE	From 26.Jan.,1991 to 6.Feb.,1991.	DEPTH	50.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	N 0° / E 90° / S 180° / W 270°
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY X(%)	R.Q.D X(%)	WATER PRESSURE TEST
31	31.00	45.30	Quaternary	Pumice Tuff		CM	Comparatively coarse, fresh welded tuff. Some open cracks are from 30.0m to 35.8m.	15cm.N.C.				
32	32.00	44.30										
33	33.00	43.30										
34	34.00	42.30										
35	35.00	41.30										
36	36.00	40.30										
37	37.00	39.30										
38	38.00	38.30										
39	39.00	37.30										
40	40.00	36.30					Below 39.0m, weakly weathered welded tuff. Fine andesitic rubbles are included.					
41	41.00	35.30										
42	42.00	34.30										
43	43.00	33.30										
44	44.00	32.30										
45	45.00	31.30										
46	46.00	30.30										
47	47.00	29.30										
48	47.90	28.40					Cracky and weathered below 47.9m.					
49	48.90	27.40		Grave-ls		CL	Up to 49.6m, fine tuffaceous sand. Below 49.6m, cobbles of andesite are included in coarse tuffaceous sand. Rubbles of dark grey andesite are included.					
50	50.00	26.30										
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												

*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-18 (1) Drill Log of Borehole CB-3 (1/2)

SITE	CIBANTEN DAMSITE	HOLE No.	CB-3
LATITUDE	LONGITUDE	ELEVATION	94.20m
DATE	From 27.Jan..1991 to 5.Feb..1991	DEPTH	43.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	270° W / 90° E / 180° S / 0° N
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY % (m)	R.Q.D % (m)	WATER PRESSURE TEST
	0.00	94.20					Brown humic soil.					
1	0.65	93.55					Intensively weathered pumice tuff. Brownish grey,very soft.					
2	1.65	92.55										
3	2.80	91.40										
4	3.50	90.70				D	Moderately weathered welded tuff.					
5	4.50	89.70										
6	5.00	89.20										
7	6.00	88.20							29.Jan. 6.55			
8	6.55	87.65							5.Feb. 7.20			
9	7.00	87.20										
10	7.60	86.60										
11	8.00	86.20										
12	8.40	85.80										
13	9.00	85.20					Cracky from 9.0m to 11.1m. Cracks are stained with iron oxides.					
14	10.00	84.20										
15	11.00	83.20										
16	11.40	82.80										
17	12.00	82.20										
18	13.00	81.20										
19	14.00	80.20										
20	15.00	79.20										
21	15.50	78.70					Light grey,moderately weathered welded tuff. Rubbles of dark grey andesite are included from 15.5m to 26.3m.					
22	16.00	78.20				CL						
23	17.00	77.20										
24	18.00	76.20										
25	19.00	75.20										
26	19.20	75.00					Weakly weathered below 19.2m. Compact and hard.	76mm.H.C				
27	20.00	74.20										
28	21.00	73.20										
29	22.00	72.20										
30	23.00	71.20										
	23.60	70.60										
	23.80	70.40										
31	24.00	70.20										
	24.10	69.80										
32	25.00	69.20					Comparatively weakly weathered,welded tuff.					
	25.70	68.50										
33	26.00	68.20				CH						
34	27.00	67.20										
35	28.00	66.20										
36	29.00	65.20										
37	30.00	64.20										
	30.00	64.20					Vertical cracks from 23.8m to 24.4m					
	30.10	64.10										
38	31.00	63.20										
39	32.00	62.20										
40	33.00	61.20										
	33.50	60.70										
41	34.00	60.20										
42	35.00	59.20										
43	36.00	58.20										
44	37.00	57.20										
45	38.00	56.20										
46	39.00	55.20										
47	40.00	54.20										
48	41.00	53.20										
49	42.00	52.20										
50	43.00	51.20										
			Quaternary	Weathered Pumice Tuff		CL	Cracky.up to 25.7m. Below 25.7m,fresh and compact welded tuff.					
				Pumice Tuff			Crack of 70 to 80 degrees is at 30.0m, to 30.5m.					
							Open crack at 33.5m.					
						CH						
						CL						

*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-18 (2) Drill Log of Borehole CB-3 (2/2)

SITE	CIBANTEN DAMSITE	HOLE No.	CB-3
LATITUDE	LONGITUDE	ELEVATION	94.20m
DATE	From 27.Jan.,1991 to 5.Feb.,1991	DEPTH	43.00m
ANGLE	180° UP / DOWN 0°, 90°	DIRECTION	SLOPE / HORIZON 0°

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY Σ(m)	R.Q.D Σ(m)	WATER PRESSURE TEST
	30.60	63.60	Quaternary	Pumice Tuff		CL						
31	31.00	63.20										
						CH						
32	32.00	62.20										
33	33.00	61.20					Weakly weathered from 33.0m to 36.0m.					
34	34.00	60.20										
35	35.00	59.20				CL						
36	36.00	58.20					Below 36.0m.fresh,compact welded tuff.					
37	37.00	57.20						76mm,N.C				
38	38.00	56.20										
39	39.00	55.20				CH						
40	40.00	54.20										
	40.50	53.70										
41	41.00	53.20					Cracky below 40.5m. Cracks are coated with yellowish grey clayey powder.					
42	42.00	52.20				CL						
43	43.00	51.20										
44												
45												
46												
47												
48												
49												
50												
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-19 Drill Log of Borehole QB-1

SITE	CIBANTEN QUARRY SITE	HOLE No.	QB-1
LATITUDE	LONGITUDE	ELEVATION	193.00m
DATE	From 11,Feb.,1991 to 18,Feb.,1991	DEPTH	30.00m
ANGLE	180° UP DOWN 0° 90°	DIRECTION	270° N 0° W 90° E 180° S
SLOPE	HORIZON 0° 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY X(m)	R.Q.D X(m)	WATER PRESSURE TEST
1			Quaternary	Talus Deposits		D	Dark brownish grey soil. Fragments of weathered andesite are included.			0 50 100	0 50 100	0 10 20 30 40 50
2												
3	3.00	190.00										
4	3.90	189.10		Weathered Andesite			Light brownish grey,intensely weathered andesite.					
	4.40	188.60										
5							Light yellowish grey,moderately weathered andesite. Cracks are stained to brown.					
6												
7	7.00	186.00										
8				Andesite								
9												
10						CL						
11												
12												
13												
14	13.80	179.20					Intensely weathered,soft andesite.					
15	14.90	178.10										
	15.10	177.90				CH	Light reddish grey,porphyritic andesite.	NC,76mm				
16							Soft,altered andesite.					
17						CL						
	17.45	175.55	Tertiary									
18							Weakly weathered, greenish grey andesite.					
19						CH						
20												
	20.75	172.25										
21							Cracky below 20.75m. Cracks are stained to brown.					
22						CL						
23												
	23.50	169.50										
24							Brownish grey,porphyritic andesite. Cylindric cores are recovered.					
25						CH						
	25.55	167.45										
	25.80	167.20					Greenish grey altered andesite. Cracky, and argillized along cracks.					
26												
27												
28						CL						
29												
30	30.00	163.00										

*R.Q.D is Rock Quality Destination. R.Q.D=(total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-20 Drill Log of Borehole QB-2

SITE	CIBANTEN QUARRY SITE	HOLE No.	QB-2
LATITUDE	LONGITUDE	ELEVATION	239.00m
DATE	From 20.Mar..1991 to 25.Mar..1991	DEPTH	30.00m
ANGLE	180° UP / DOWN 0° — 90°	DIRECTION	SLOPE — HORIZON 0° / 90°

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT ø DIAMETER	WATER LEVEL	CORE RECOVERY X(m)	R.Q.D X(m)	WATER PRESSURE TEST
										0 50 100	0 50 100	0 10 20 30 40 50
1–2	2.00	237.00	Quaternary	Talus Deposits		D	Lov core recovery. Fragments of weathered tuff breccia are included.					
3–6	6.00	233.00	Tertiary	Weathered Tuff Breccia		CH	Comparatively hard,light brownish grey, andesitic tuff breccia. Cylindric cores are recovered.					
7–12	12.30	226.70	Tertiary	Weathered Tuff Breccia		CL						
13–16	16.20	222.80	Tertiary	Tuff Breccia		CH	Weakly altered-andesitic tuff breccia. Light brownish grey to reddish grey, moderate to hard.	ø86.75mm				
17–30	30.00	209.00	Tertiary	Tuff Breccia		CH						

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-21 Drill Log of Borehole CD-1

SITE	CIDANAU UPSTREAM	HOLE No.	CD-1
LATITUDE	LONGITUDE	ELEVATION	95.00m
DATE	From 22.Feb..1991 to 28.Feb..1991	DEPTH	14.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	N 0° / E 90° / S 180° / W 270°
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY X(m)	R.Q.D X(m)	WATER PRESSURE TEST
1	1.00	94.00	Quaternary	Talus Deposits		D	Talus deposits. Consists of basalt boulder. Matrix are washed out.					
2	2.00	93.00										
3	3.00	92.00										
4	4.00	91.00										
	4.55	90.45							24.Feb. 4.85			
5	5.00	90.00		Basalt		CL	Dark grey,microporphyritic basalt. Very hard. Cores are broken into thin fragments. with close platy joint.					
6	6.00	89.00										
	6.50	88.50										
7	7.00	88.00						76mm.H.C				
8	8.00	87.00										
	8.40	86.60										
	8.60	86.40				CN	Comparatively massive below 8.60m. Cracks are coated with greenish grey clay.					
9	9.00	86.00										
10	10.00	85.00										
	10.25	84.65										
11	11.00	84.00		Mudstone			Brownish grey,weakly consolidated mudstone.					
	11.70	83.30										
12	12.00	83.00		Agglomerate		D	Volcanic breccia. Rubbles of dark grey to reddish brown andesite are included in coarse sandy tuffaceous matrix.					
13	13.00	82.00										
14	14.00	81.00										
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-22 (1) Drill Log of Borehole CD-2 (1/2)

SITE	CIDANAU MIDDLESTREAM	HOLE No.	CD-2
LATITUDE	LONGITUDE	ELEVATION	87.00m
DATE	From 27.Feb. to 7.March.	DEPTH	45.00m
ANGLE	180° UP / DOWN 0° — 90°	DIRECTION	270° W / 0° N / 90° E / 180° S
SLOPE	HORIZON 0° / 40°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY % (n)	R.Q.D % (n)	WATER PRESSURE TEST
	0.20	86.80		ar Soil			Dark brownish grey humic soil.					
1	1.00	86.00					Reddish brown,lateritic residual soil. Very soft,clayey soil. Fragments of weathered tuffaceous rock are included.					
2	2.00	85.00										
3	3.00	84.00										
4	4.00	83.00				D						
5	5.00	82.00		Residual Soil								k = 0.0001018
6	6.00	81.00										
7	7.00	80.00										
8	8.00	79.00										
9	9.00	78.00										
10	9.80	77.20										k = 0.0000643
11	11.00	76.00					Unconsolidated, loose pumice-tuff. The color varies from pinkish grey to cream grey.					
12	12.00	75.00										
13	13.00	74.00										
14	14.00	73.00										
15	15.00	72.00	Quaternary					76mm.H.C				k = 0.0000473
16	16.00	71.00							3.Mar. 16.15			
	16.79	70.21										
17	17.00	70.00										
18	18.00	69.00					Light yellowish grey, unconsolidated pumice-tuff. Mineral grains of quartz and plagioclase are observable.					
19	19.00	68.00				CL						
20	20.00	67.00							7.Mar. 20.25			k = 0.0000209
	20.25	66.75										
21	21.00	66.00		Weathered Pumice Tuff								
22	22.00	65.00										
23	23.00	64.00										
24	24.00	63.00										
25	25.00	62.00										k = 0.0000228
26	26.00	61.00										
27	27.00	60.00										
28	28.00	59.00										
29	29.00	58.00										
30	30.00	57.00										k = 0.0000200

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter .
*DIAMETER is in millimeter

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Fig. C-22 (2) Drill Log of Borehole CD-2 (2/2)

SITE	CIDANAU MIDDLESTREAM	HOLE No.	CD-2
LATITUDE	LONGITUDE	ELEVATION	87.00m
DATE	From 27.Feb. to 7.March.	DEPTH	45.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	270° W / 90° E / 180° S
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY X(%)	R.Q.D X(%)	WATER PRESSURE TEST
31	31.00	56.00	Quaternary	Weathered Pumice Tuff		CL		76mm.N.C		0 50 100	0 50 100	0 10 20 30 40 50
32	31.60	55.40					Core loss.					
	32.00	55.00					Weakly welded pumice-tuff. Consists mostly of white pumice grain and contains some rock fragments of dark grey andesite.					
33	33.00	54.00										
34	34.00	53.00										
35	35.00	52.00										
36	35.80	51.20										
	36.00	51.00				CH						
37	37.00	50.00										
38	37.80	49.20										
	38.00	49.00				CL						
	38.40	48.60										
39	39.00	48.00		Pumice Tuff								
40	40.00	47.00										
41	41.00	46.00										
42	42.00	45.00				CH						
43	43.00	44.00										
44	44.00	43.00										
45	45.00	42.00										
46												
47												
48												
49												
50												
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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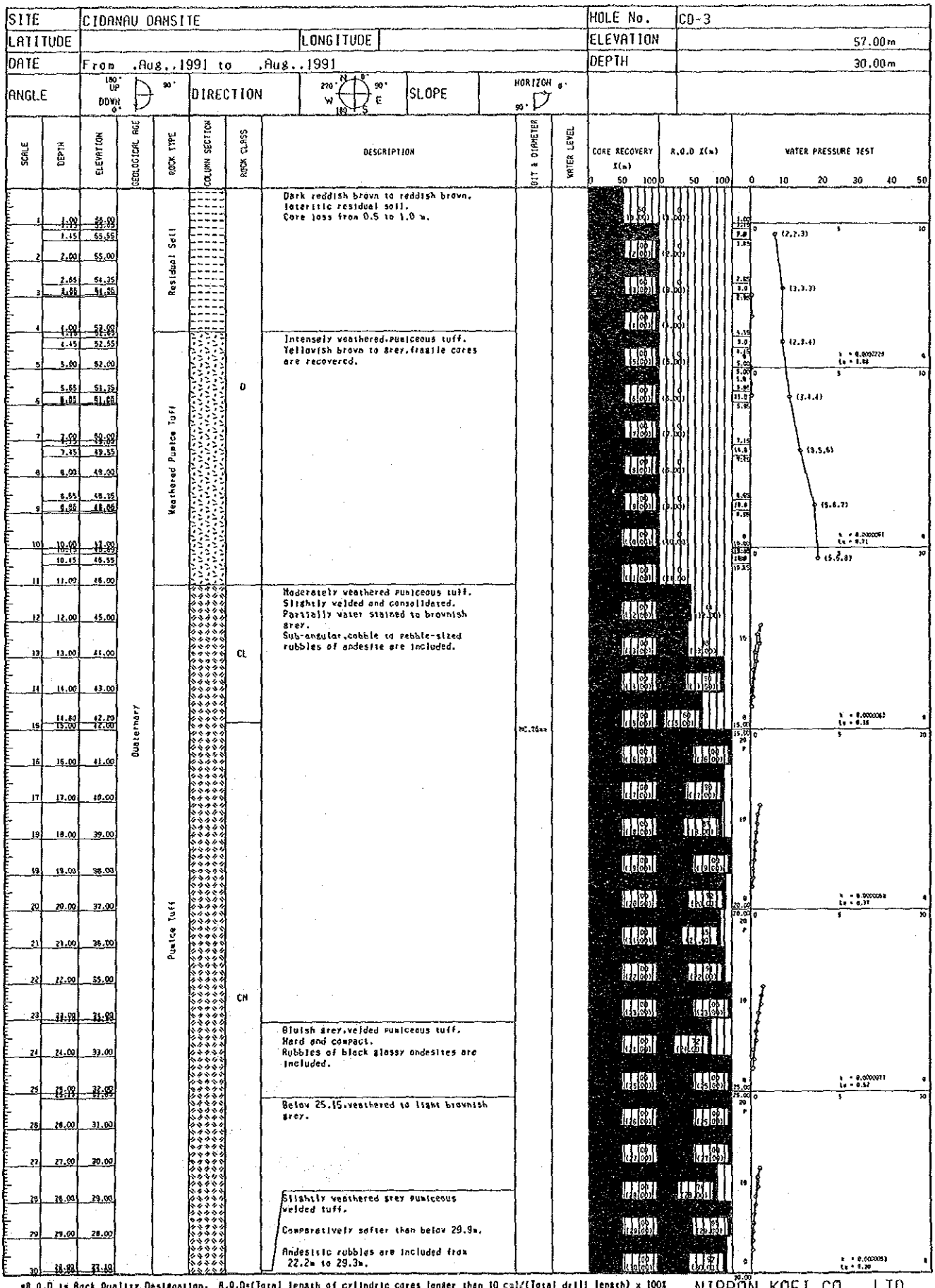
Fig. C-23 Drill Log of Borehole CD-3



*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-24 (1) Drill Log of Borehole CD-4 (1/2)

SITE	CIDANAU DAMSITE	HOLE No.	CD-4
LATITUDE	LONGITUDE	ELEVATION	20.00m
DATE	From .Aug..1991 to .Aug..1991	DEPTH	50.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	N 0° / E 90° / S 180° / W 270°
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT ϕ DIAMETER	WATER LEVEL
1	1.00	19.00	Quaternary	Pumice Tuff		CH	Hard and compact,welded tuff. Cracks are water-stained,and partially weathered to brownish grey.	76	
	1.50	18.50							
2	2.00	18.00							
3	3.00	17.00							
4	4.00	16.00							
5	5.00	15.00							
6	6.00	14.00							
7	7.00	13.00							
	7.80	12.20							
8	8.00	12.00				CH-CL			
9	9.00	11.00							
10	10.00	10.00							
11	11.00	9.00							
	11.30	8.70							
12	12.00	8.00				CH			
13	13.00	7.00							
14	14.00	6.00							
15	15.00	5.00							
	15.40	4.60							
16	16.00	4.00				CH-CL	Weakly to moderately weathered,pumice tuff. Partially chloritized.		
17	17.00	3.00							
18	18.00	2.00							
19	19.00	1.00							
20	20.00	0.00							
	20.20	-0.20							
21	21.00					CH	Fresh welded pumice tuff. Fragments of coalificated wood are included at 21.50m.		
22	22.00	-2.00							
23	23.00	-3.00				CH-CL	Pale green, welded pumice tuff. Slightly chloritized, and less cracky. Compact fine, laminated sandstone at 27.4 - 27.6m.		
24	24.00	-4.00							
25	25.00	-5.00							
26	26.00	-6.00							
27	27.00	-7.00							
	27.50	-7.50							
28	28.00	-8.00		Weathered Pumice Tuff		CL	Unconsolidated, chloritized pumice tuff.		
	28.50	-8.50							
29	29.00	-9.00		Mudstone		CL-O	Light brownish grey,slightly consolidated mudstone.		
30	30.00	-10.00							

CORE RECOVERY X(m) / R.Q.D X(m) / WATER PRESSURE TEST

*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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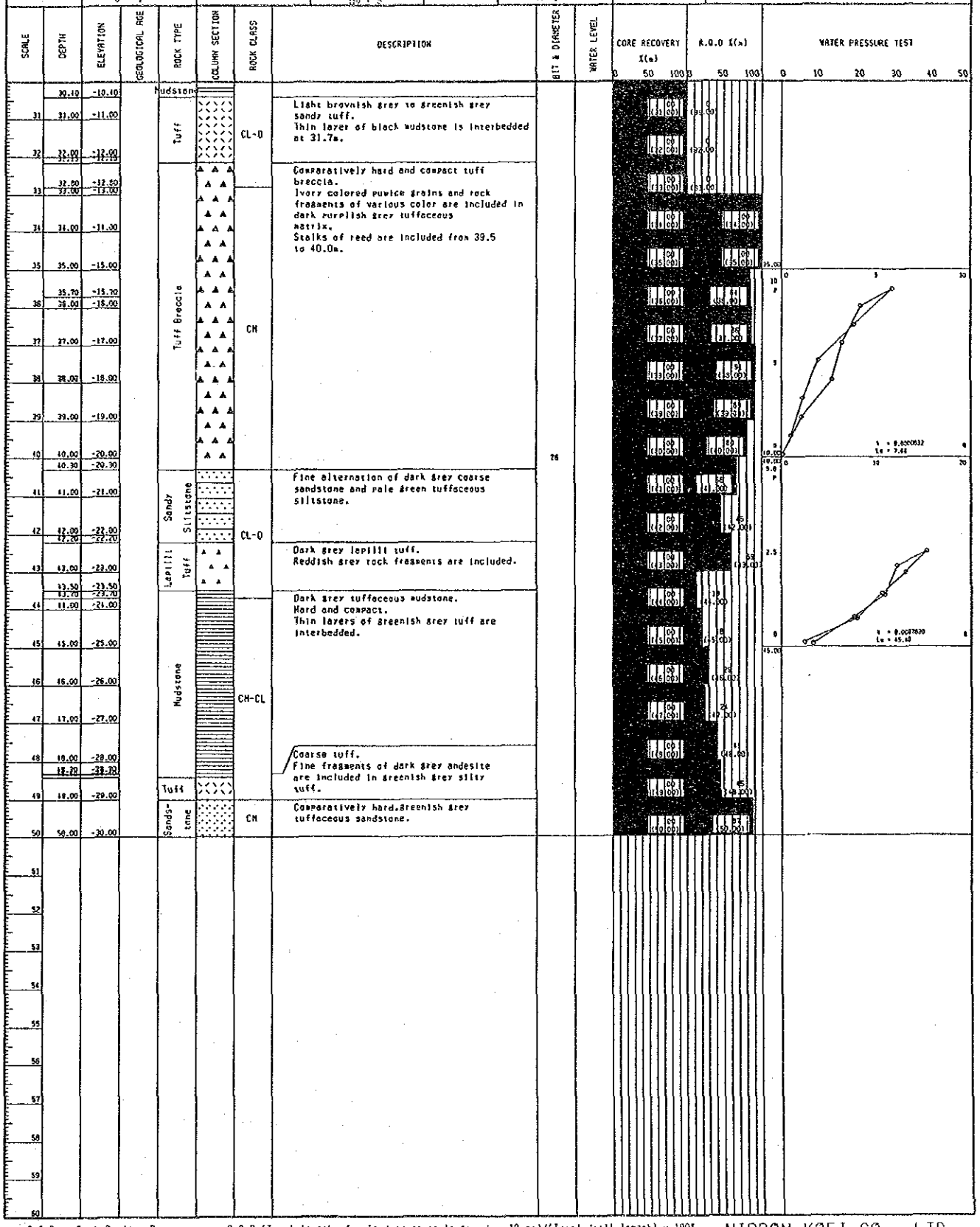
Fig. C-24 (2) Drill Log of Borehole CD-4 (2/2)

SITE	CIDANAU DAMSITE	HOLE No.	CD-4
LATITUDE	LONGITUDE	ELEVATION	20.00m
DATE	From .Aug..1991 to .Aug..1991	DEPTH	50.00m
ANGLE	UP 90° DOWN 0°	DIRECTION	SLOPE



*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-25 Drill Log of Borehole CD-5

SITE	CIDANAU DAMSITE	HOLE No.	CD-5
LATITUDE	LONGITUDE	ELEVATION	7.70m
DATE	From .Aug..1991 to .Aug..1991	DEPTH	30.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	270° W / 90° E / 180° S / 0° N
SLOPE	HORIZON 0° / 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL
	0.50	7.20	Quaternary	Residual Soil			Reddish grey residual soil.		
1	1.00	6.70		Weathered Pumice Tuff		D	Light yellowish grey to ivory colored, weathered pumice tuff. Clayey and soft.		
	1.45	6.25							
2	2.00	5.70							
	2.85	5.05							
3	3.00	4.70							
	4.00	3.70							
4	4.15	3.55							
	4.45	3.25							
5	5.00	2.70							
	5.85	2.05							
6	6.00	1.70							
	7.00	0.70							
7	7.15	0.55							
	7.45	0.25							
8	8.00	-0.30		Pumice Tuff		CM-CL	Welded pumice tuff. Weakly weathered. Sub-angular rubbles of dark grey andesite are included.		
9	9.00	-1.30							
10	10.00	-2.30							
	11.00	-3.30							
11	11.30	-3.60							
12	12.00	-4.30		Weathered Pumice Tuff		CL	Light yellowish grey, moderately weathered pumice tuff. Rubbles of dark grey andesite and ivory colored pumice are included.		
13	13.00	-5.30							
14	14.00	-6.30							
15	15.00	-7.30						76	
16	16.00	-8.30		Pumice Tuff		CM	Grey, moderately weathered pumice tuff. Weakly weathered, and comparatively hard. Rubbles of dark grey and reddish grey andesite are included.		
17	17.00	-9.30							
18	18.00	-10.30							
19	19.00	-11.30							
20	20.00	-12.30							
21									
22									
23									
24									
25									
26									
27									
28									
29									
30	30.00	-22.30							

CORE RECOVERY L(m) 0 50 100 | R.Q.D L(m) 0 50 100 | WATER PRESSURE TEST 0 10 20 30 40 50

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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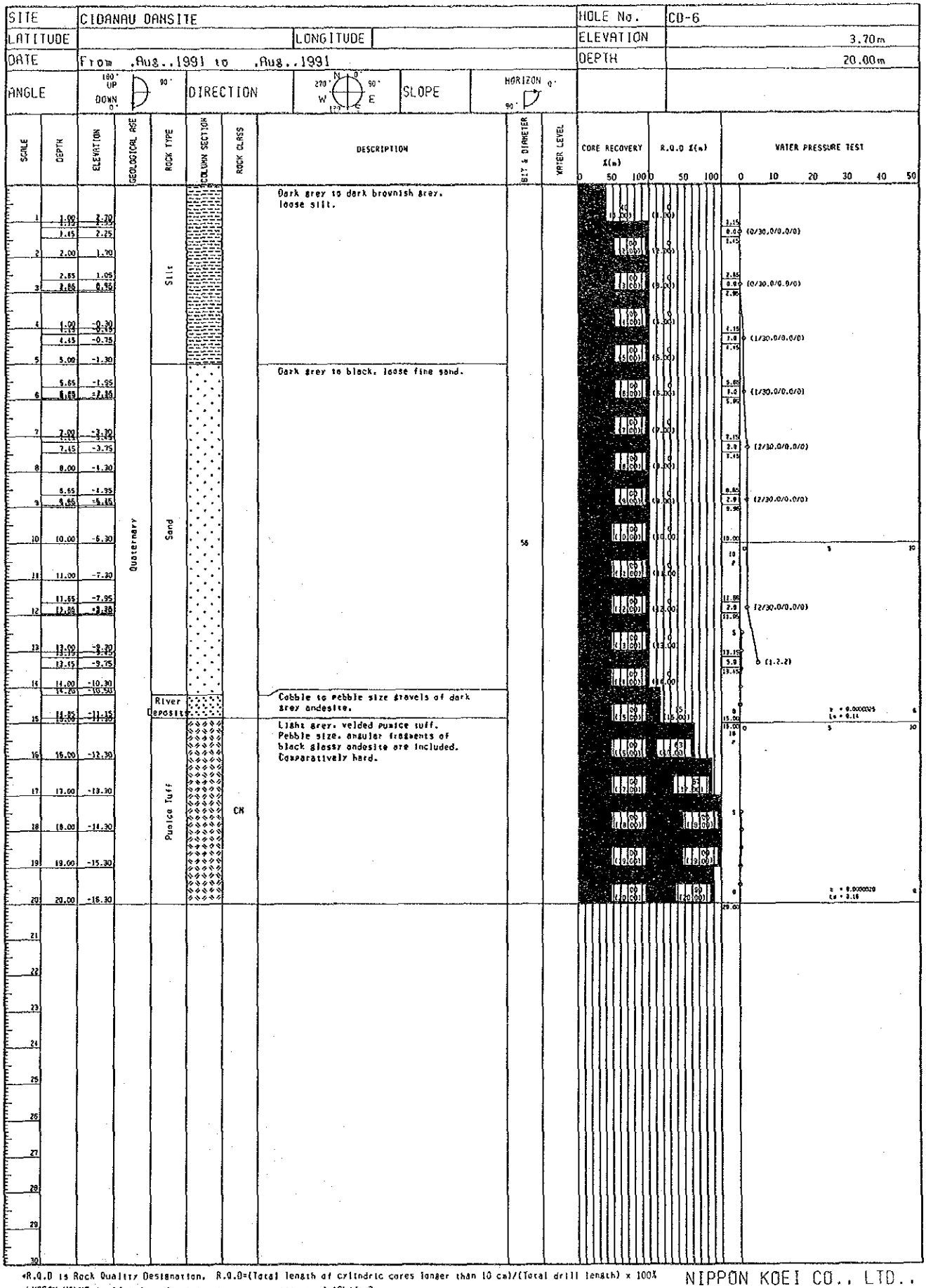
Fig. C-26 Drill Log of Borehole CD-6



*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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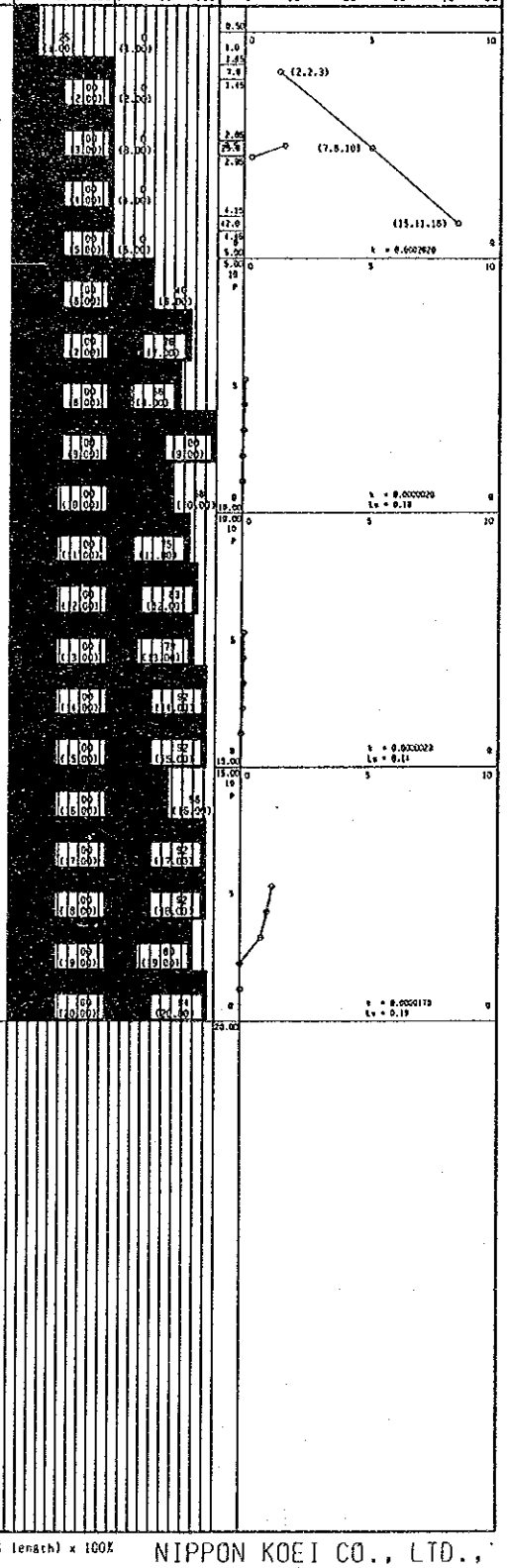
Fig. C-27 Drill Log of Borehole CD-7

SITE	CIDANAU DAMSITE	HOLE No.	CD-7
LATITUDE	LONGITUDE	ELEVATION	4.80m
DATE	From .Aug..1991 to .Aug..1991	DEPTH	20.00m
ANGLE	UP 90° / 00=N	DIRECTION	SLOPE / HORIZON 0°

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT ø DIAMETER	WATER LEVEL
	0.50	4.30	Quaternary	Residual Soil			Reddish grey residual soil.	56	
1	1.00	3.80							
	1.15	3.65							
2	2.00	2.80		Weathered Pumice Tuff		D	Light brownish grey to ivory colored, weathered pumice tuff. Clayey and soft.		
	2.65	2.15							
3	2.96	1.84							
4	4.00	0.80							
	4.15	0.65							
	4.45	0.35							
5	5.00	-0.20				CL-D	Welded pumice tuff. Moderately weathered and crocky. Water stained along cracks.		
	5.50	-0.80							
6	6.00	-1.20		Pumice Tuff		CH	Light grey welded pumice tuff. Rubbles of dark grey andesite and ivory colored pumice are included. Partially water stained.		
7	7.00	-2.20							
8	8.00	-3.20							
9	9.00	-4.20							
10	10.00	-5.20							
11	11.00	-6.20							
12	12.00	-7.20							
13	13.00	-8.20							
14	14.00	-9.20							
15	15.00	-10.20							
16	16.00	-11.20							
17	17.00	-12.20							
18	18.00	-13.20							
19	19.00	-14.20							
20	20.00	-15.20							
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

CORE RECOVERY Σ(cm) | R.Q.D Σ(cm) | WATER PRESSURE TEST



*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-28 Drill Log of Borehole KR-1

SITE	CIOANAU DANSITE	HOLE No.	KR-1
LATITUDE	LONGITUDE	ELEVATION	21.60m
DATE	From .Aug..1991 to .Aug..1991	DEPTH	15.00m
ANGLE	180° UP / DOWN 0°, 90°	DIRECTION	N 0°, E 90°, S 180°, W 270°
SLOPE	HORIZON 0°, 90°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT ø DIAMETER	WATER LEVEL
1	0.70	20.90	Quaternary	Top Soil		D	Brownish grey silty soil.	76	
	1.00	20.60							
	1.15	20.45							
	1.45	20.15					Light grey to ivory colored, weakly welded pumice tuff.		
2	2.00	19.60							
	2.65	18.95							
3	2.85	18.80							
4	4.00	17.60							
	4.15	17.45							
	4.45	17.15							
5	5.00	16.60							
	5.65	15.95					Comparatively hard below 5.1m.		
6	5.85	15.80		Weathered Pumice Tuff					
7	7.00	14.60							
	7.15	14.45							
	7.45	14.15							
8	8.00	13.60							
	8.65	12.95							
9	8.85	12.80							
10	10.00	11.60				CL-D			
	10.15	11.45							
	10.45	11.15							
11	11.00	10.60							
	11.65	9.95							
12	12.00	9.60							
13	13.00	8.60							
	13.15	8.45							
14	14.00	7.60							
	14.10	7.50							
	14.30	7.30							
15	15.00	6.60		Pumice Tuff		CH	Welded pumice tuff.		
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

CORE RECOVERY %(m) 0 50 100 | R.Q.D %(m) 0 50 100 | WATER PRESSURE TEST 0 10 20 30 40 50

*R.Q.D is Rock Quality Destanation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-29 Drill Log of Borehole KR-2

SITE	CIDANAU DAMSITE	HOLE No.	KR-2
LATITUDE	LONGITUDE	ELEVATION	14.00m
DATE	From .Aug..1991 to .Aug..1991	DEPTH	15.00m
ANGLE	180° UP / DOWN 0° / 90°	DIRECTION	N 0° / E 90° / S 180° / W 270°
SLOPE	HORIZON 0° / 50°		

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	BIT & DIAMETER	WATER LEVEL
1	1.00	13.00	Quaternary	Banked Soil		D	Light grey loose fine sandy tuff. Supposed to be banked soil.	76	
	1.45	12.55							
	1.80	12.20		Humic Soil			Dark brownish grey humic soil.		
2	2.00	12.00				CL-D	Light grey fine grained pumiceous tuff.		
	2.65	11.35							
3	3.05	11.05							
	3.20	10.80				D	Very loose from 3.2 to 4.3m.		
4	4.00	10.00							
	4.30	9.70							
5	5.00	9.00		Weathered Pumice Tuff		CL-D	Light grey to light brownish grey, pumiceous tuff. Partially consolidated.		
	5.65	8.35							
6	6.05	7.95							
7	7.00	7.00							
	7.45	6.55							
8	8.00	6.00							
	8.69	5.31							
9	8.85	5.15							
10	10.00	4.00		Pumice Tuff		CM	Welded pumice tuff. Comperatively hard. Pebble size andesitic rubbles are included.		
	10.45	3.55							
11	11.00	3.00							
	11.65	2.35							
12	12.00	2.00							
13	13.00	1.00							
	13.15	0.85							
14	14.00	0.00							
	14.59	-0.59							
15	15.00								

CORE RECOVERY Σ(m) 0 50 100 | R.Q.D Σ(m) 0 50 100 | WATER PRESSURE TEST 0 10 20 30 40 50

*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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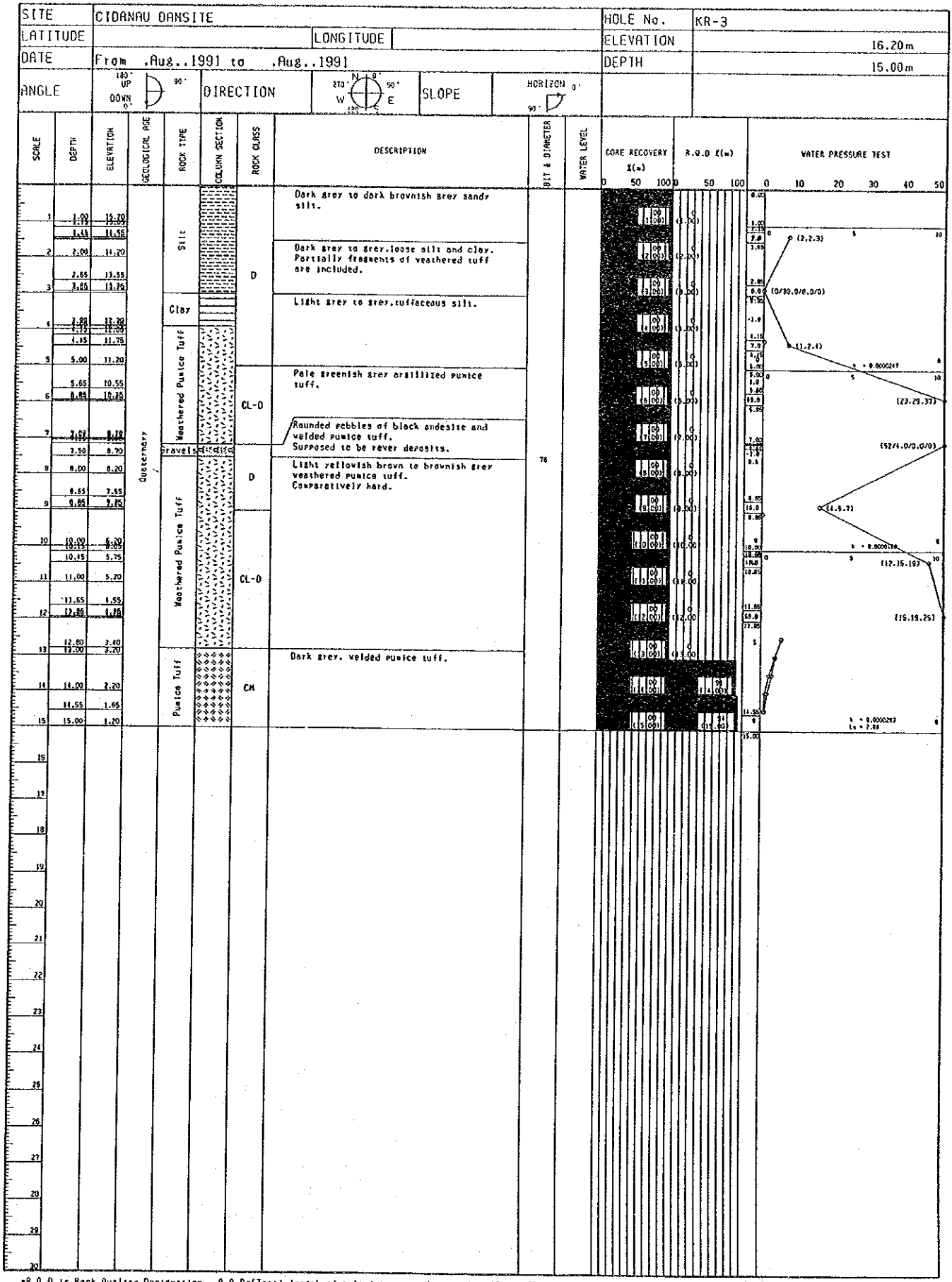
Fig. C-30 Drill Log of Borehole KR-3



*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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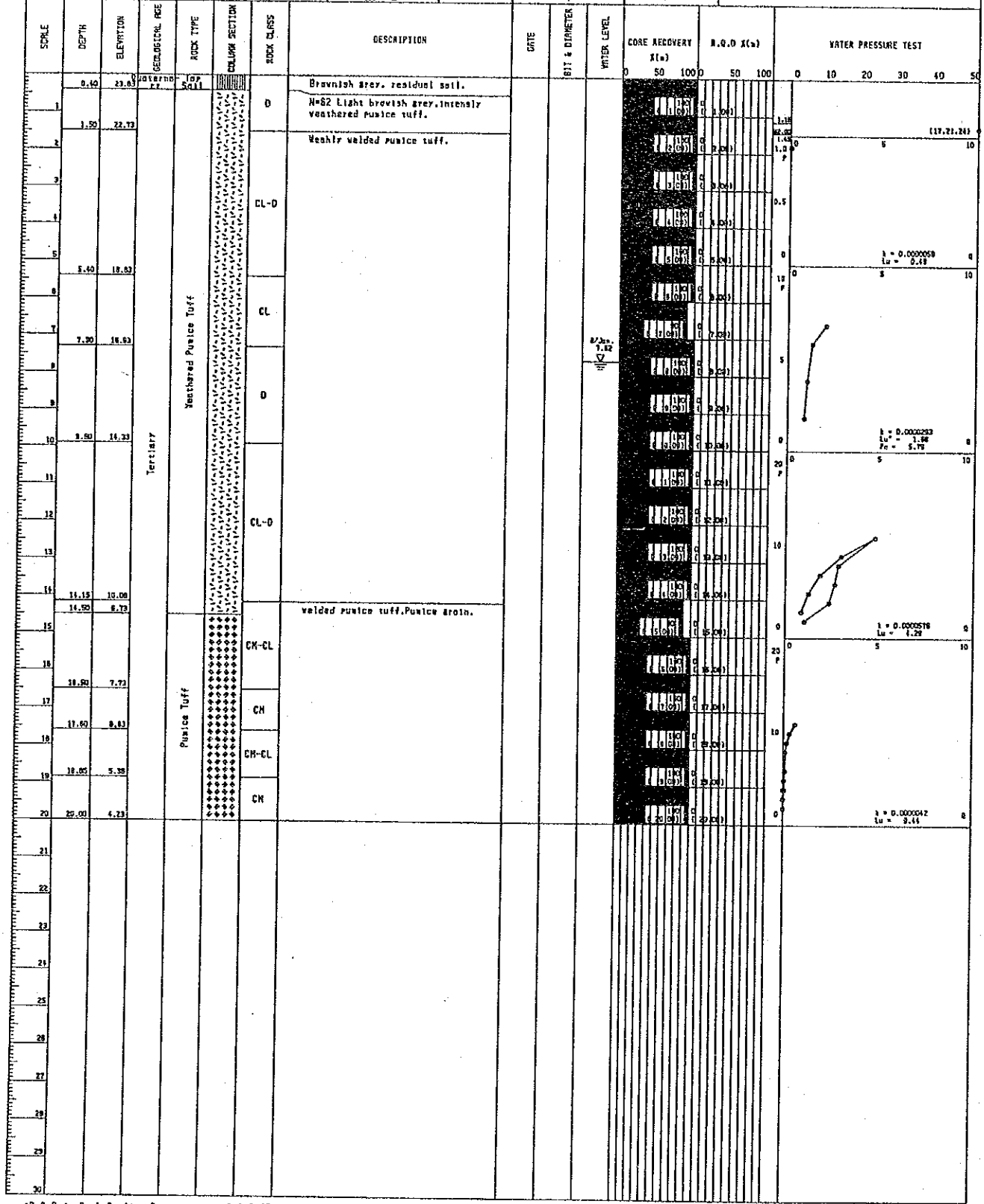
Fig. C-31 Drill Log of Borehole KR-4

SHEET NO.1 OF 1

SITE	KRENCENG DAMSITE	HOLE No.	Kr-4
LATITUDE	LONGITUDE	ELEVATION	24.23 m
DATE		DEPTH	-1.00 m
ANGLE	DIRECTION	SLOPE	DRILLED
		HORIZON	LOGGED



*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-32 Drill Log of Borehole KR-5

SHEET NO.1 OF 1

SITE	KRENCENG DAMSITE	HOLE No.	Kr-5
LATITUDE	LONGITUDE	ELEVATION	12.72 m
DATE		DEPTH	-1.00 m
ANGLE	180° UP DOWN 0° 90°	DIRECTION	270° W N 0° 90° E S 180°
SLOPE	HORIZON 0° 90°	DRILLED	
		LOGGED	

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	DATE	BIT & DIAMETER	WATER LEVEL
1	1.00	11.72	Quaternary	Top Soil			Very soft light brownish grey silty tuff(paciby field).			
2				Weathered Pumice Tuff		D	Grey brownish grey unconsolidatedsandy tuff, very loose			
3										
4										
5	8.50	8.22	Tertiary							
6				Pumice Tuff		CR	Comparatively hard,Brownish grey pumice tuff.			
7										
8										
9										
10	10.00	2.72								

CORE RECOVERY %(v) 0 50 100 | R.Q.D %(m) 0 50 100 | WATER PRESSURE TEST 0 10 20 30 40 50

(12.16.18) (11.16.17) (12.14.18) k = 0.0003500 Lu = 28.33 (12.14.18) k = 0.0000612 Lu = 4.79

*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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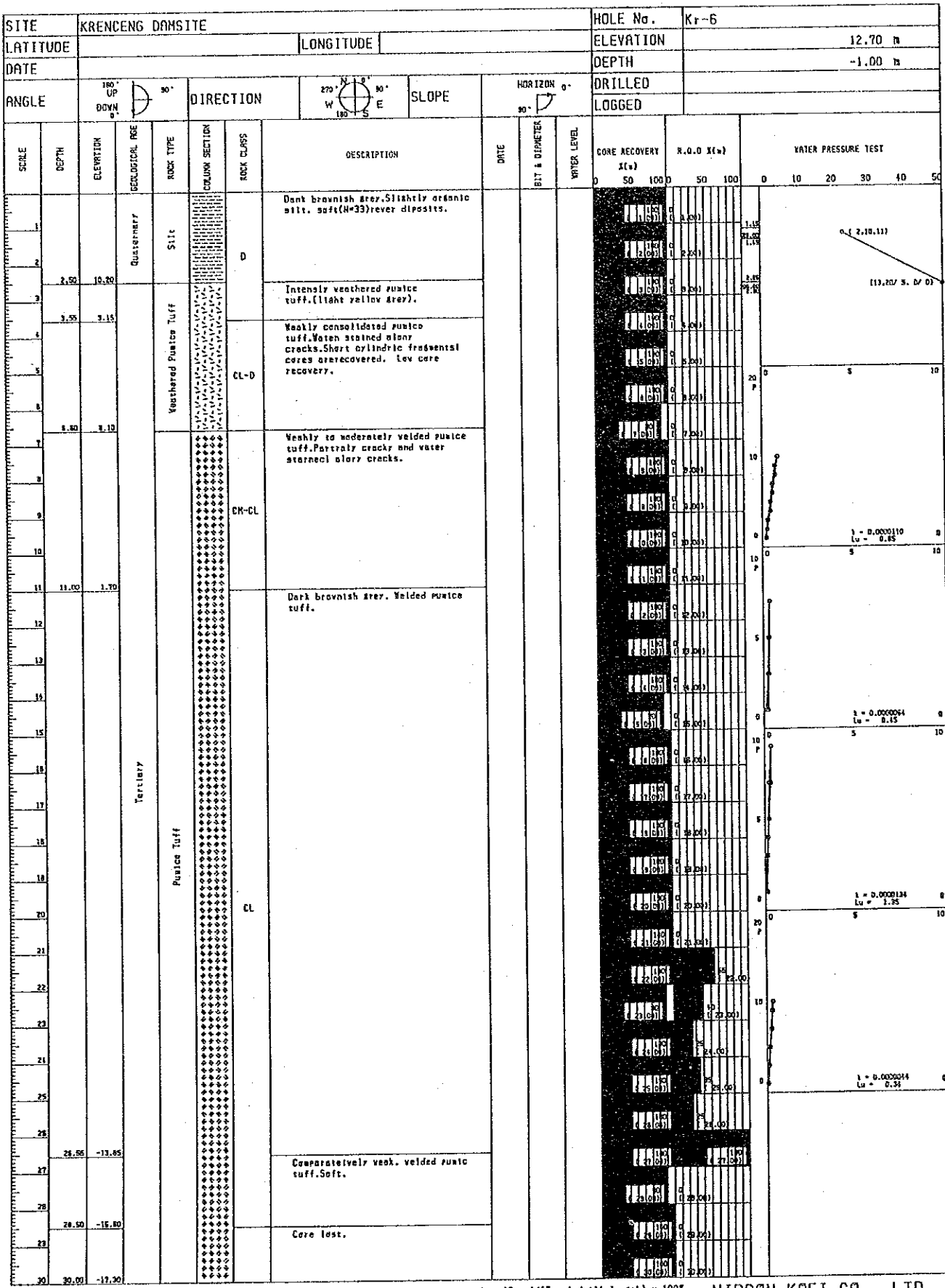
Fig. C-33 Drill Log of Borehole KR-6 SHEET NO.1 OF 1



*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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Fig. C-34 Drill Log of Borehole KR-7

SHEET NO.1 OF 1

SITE	KRENCENG DAMSITE	HOLE No.	Kr-7
LATITUDE	LONGITUDE	ELEVATION	21.07 m
DATE		DEPTH	-1.00 m
ANGLE	DIRECTION	SLOPE	DRILLED
			LOGGED

SCALE	DEPTH	ELEVATION	GEOLOGICAL AGE	ROCK TYPE	COLUMN SECTION	ROCK CLASS	DESCRIPTION	DATE	BIT & DIAMETER	WATER LEVEL	CORE RECOVERY X(%)	R.Q.D X(%)	WATER PRESSURE TEST
1	1.00	20.07	Quaternary	Top Soil		D	Dark reddish brown silty soil, very soft. Disturbed soil or banked soil.						
3							Grey pumice tuff. Weakly consolidated - unconsolidated, soft.						
4													
5										0.90			
6													
7				Weathered Pumice Tuff		CL-D							
8													
9													
10													
11			Tertiary										
12	12.50	8.57											
13							Moderately welded pumice tuff.						
14													
15						CH-CL							
16	18.10	4.97		Pumice Tuff									
17							Welded pumice tuff.						
18													
19						CH							
20	20.00	1.07											
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													

WATER PRESSURE TEST: (5,10.12), (12,11.16), (11,12.10), k = 0.0007750, Lu = 9.87; (12,13.14), (16,15.18), (10,13.15), k = 0.0000418, Lu = 3.15; k = 0.0000054, Lu = 0.13

*R.Q.D is Rock Quality Destination. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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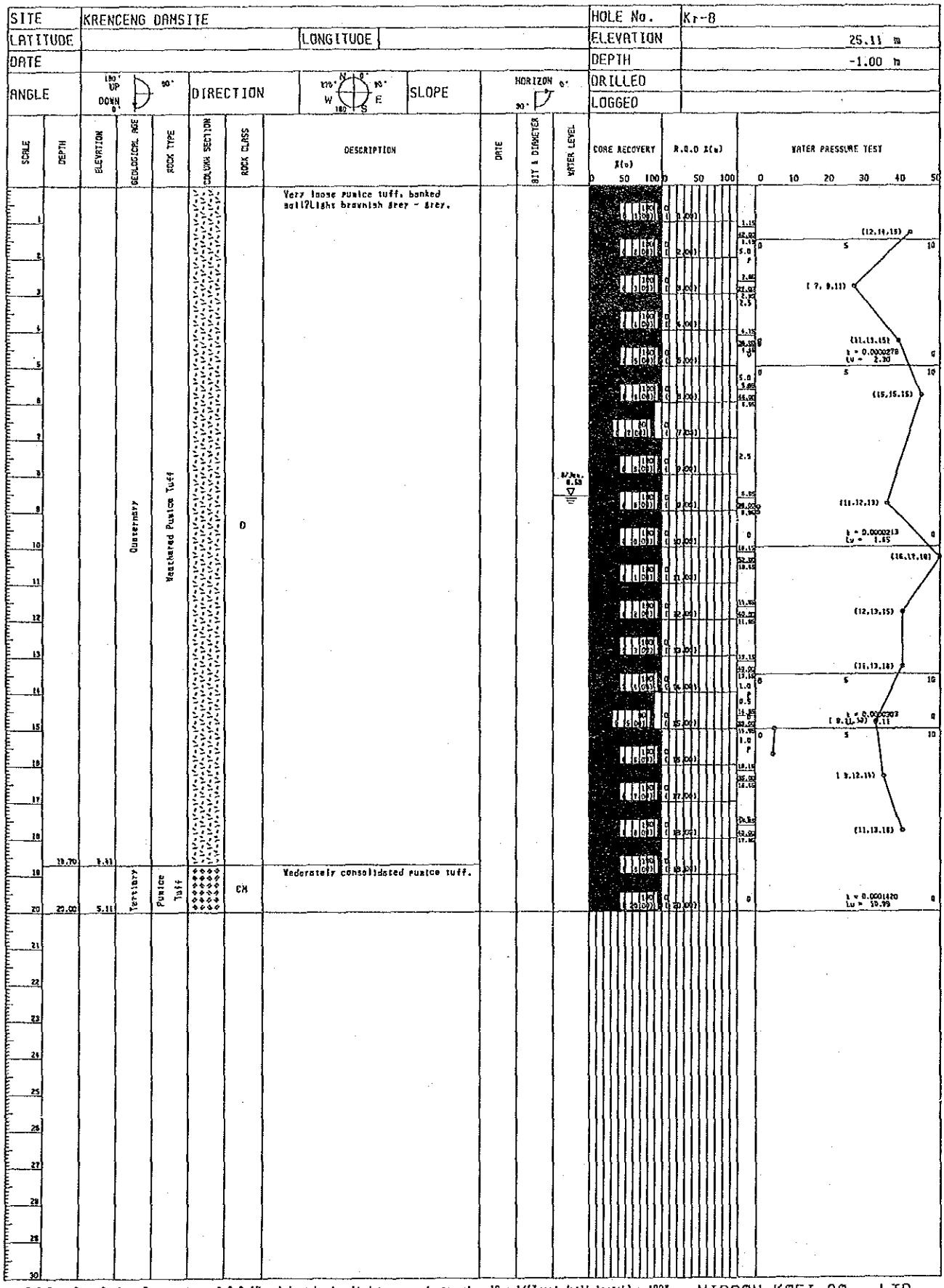
Fig. C-35 Drill Log of Borehole KR-8



*R.Q.D is Rock Quality Designation, R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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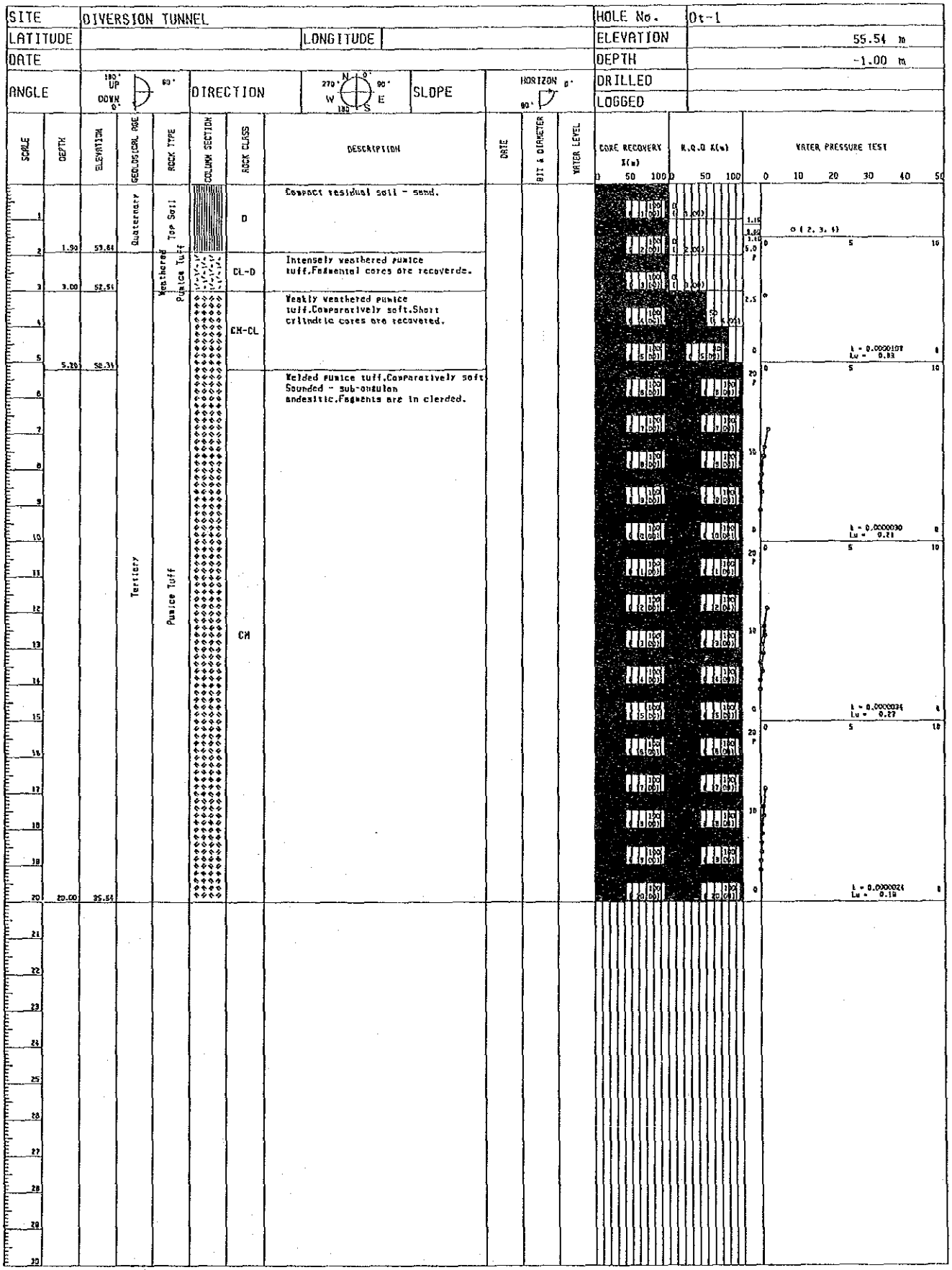
Fig. C-36 Drill Log of Borehole DT-1



*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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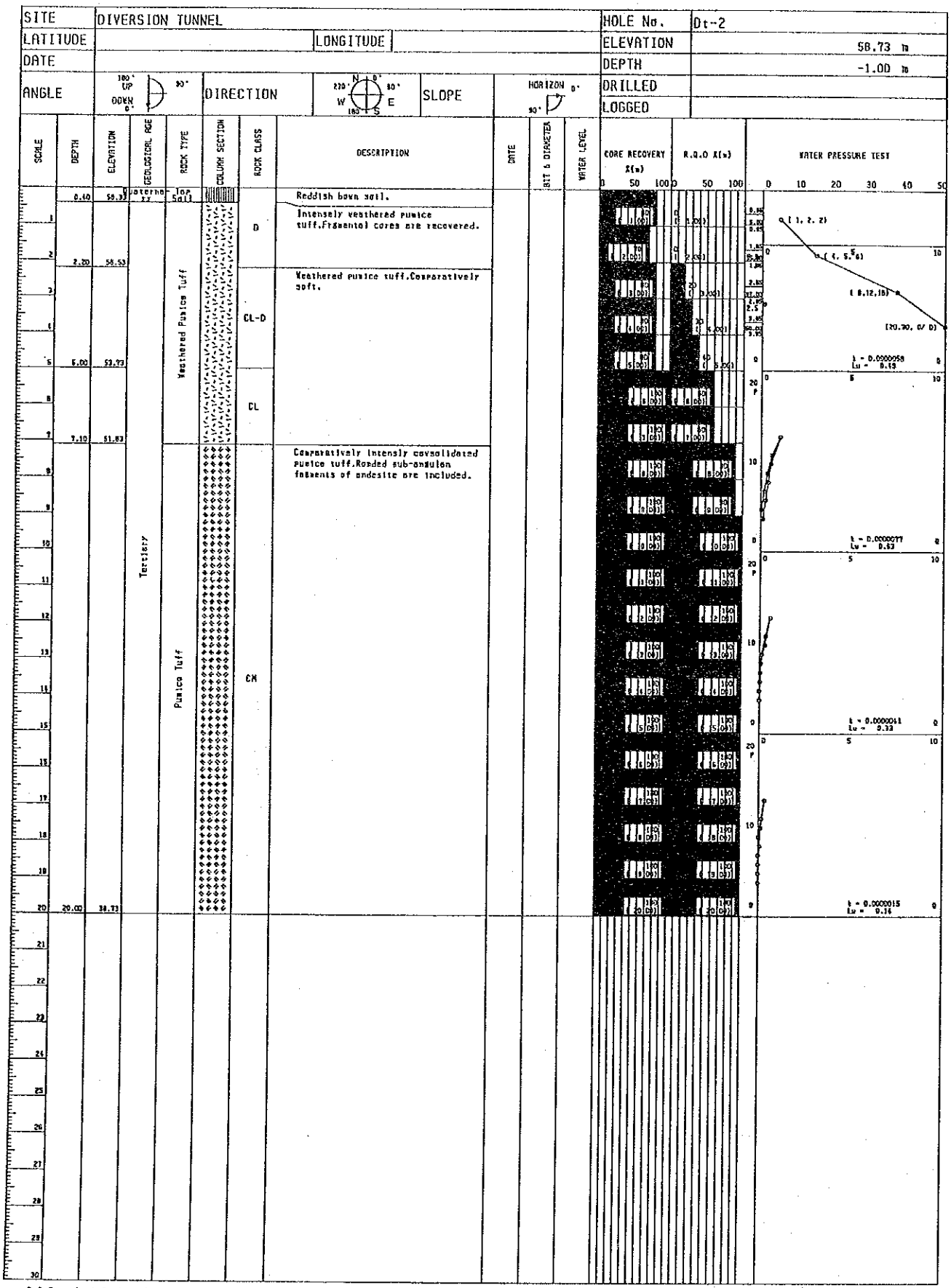
Fig. C-37 Drill Log of Borehole DT-2



*R.Q.D is Rock Quality Designation. R.Q.D=(Total length of cylindric cores longer than 10 cm)/(Total drill length) x 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10kg/cm2
*DEPTH and ELEVATION are in meter
*DIAMETER is in millimeter

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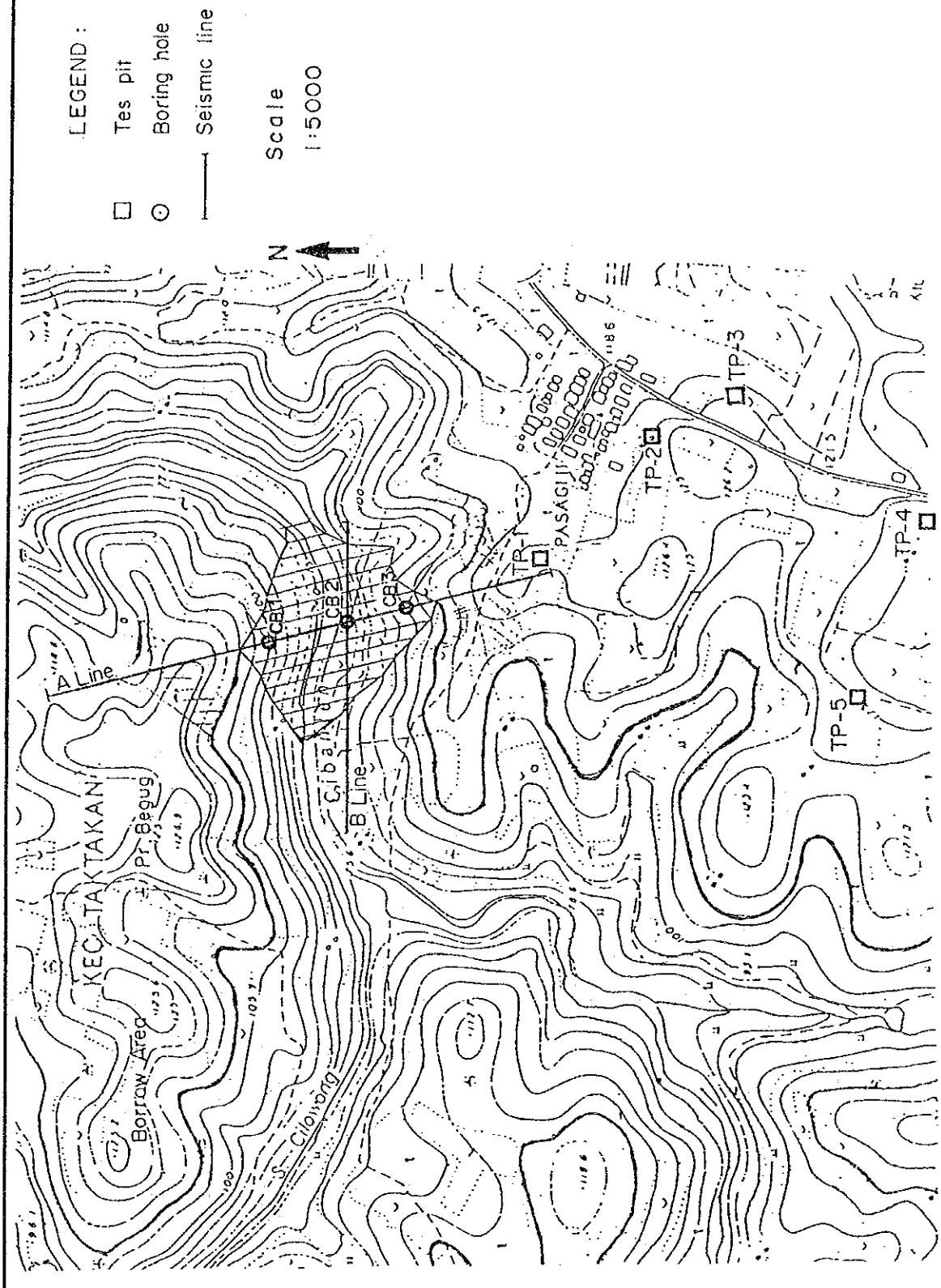
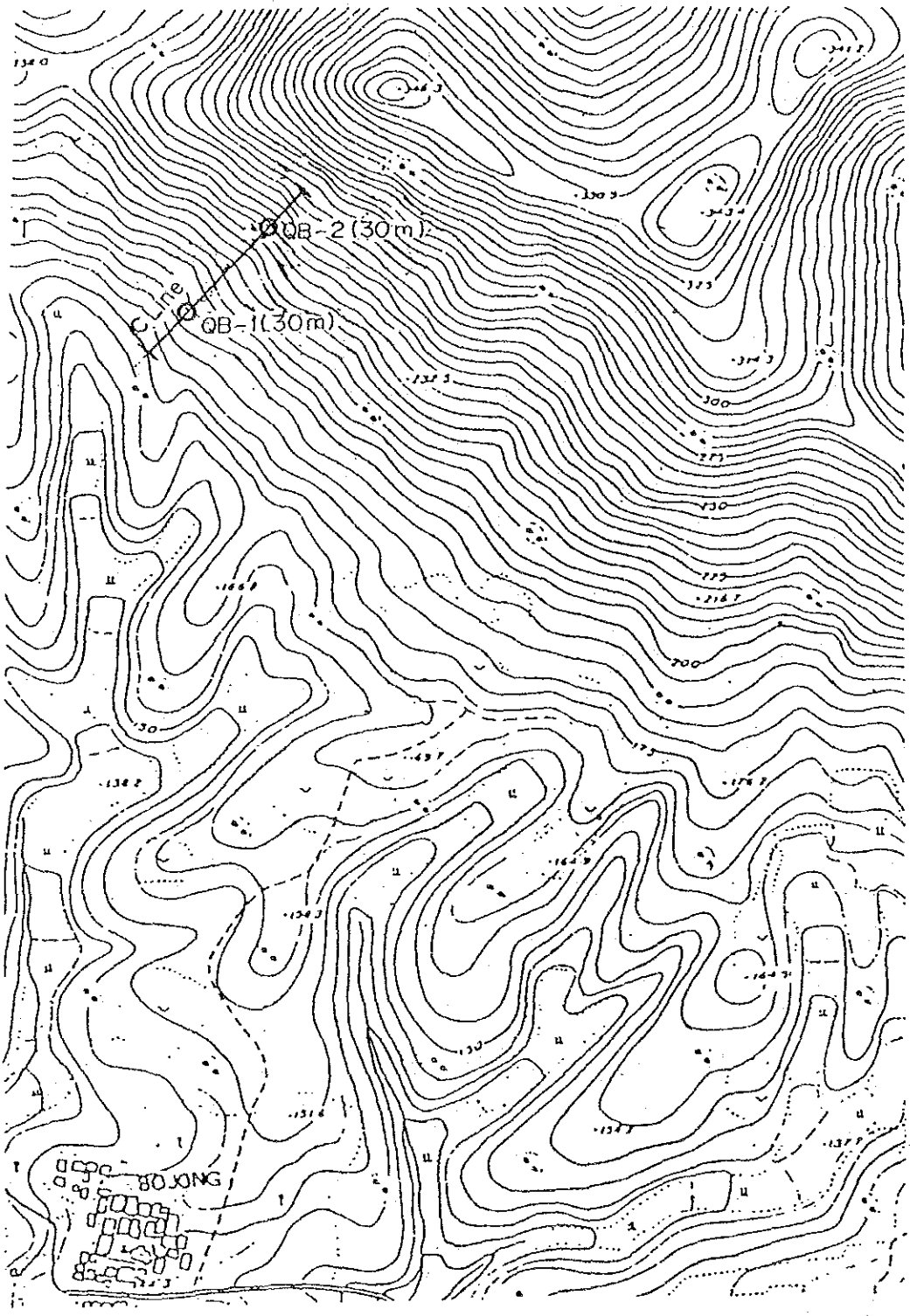
Fig. C-38 (1)



Location Map for Seismic Exploration

MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY



SCALE
1:5000

Location Map for Seismic Exploration

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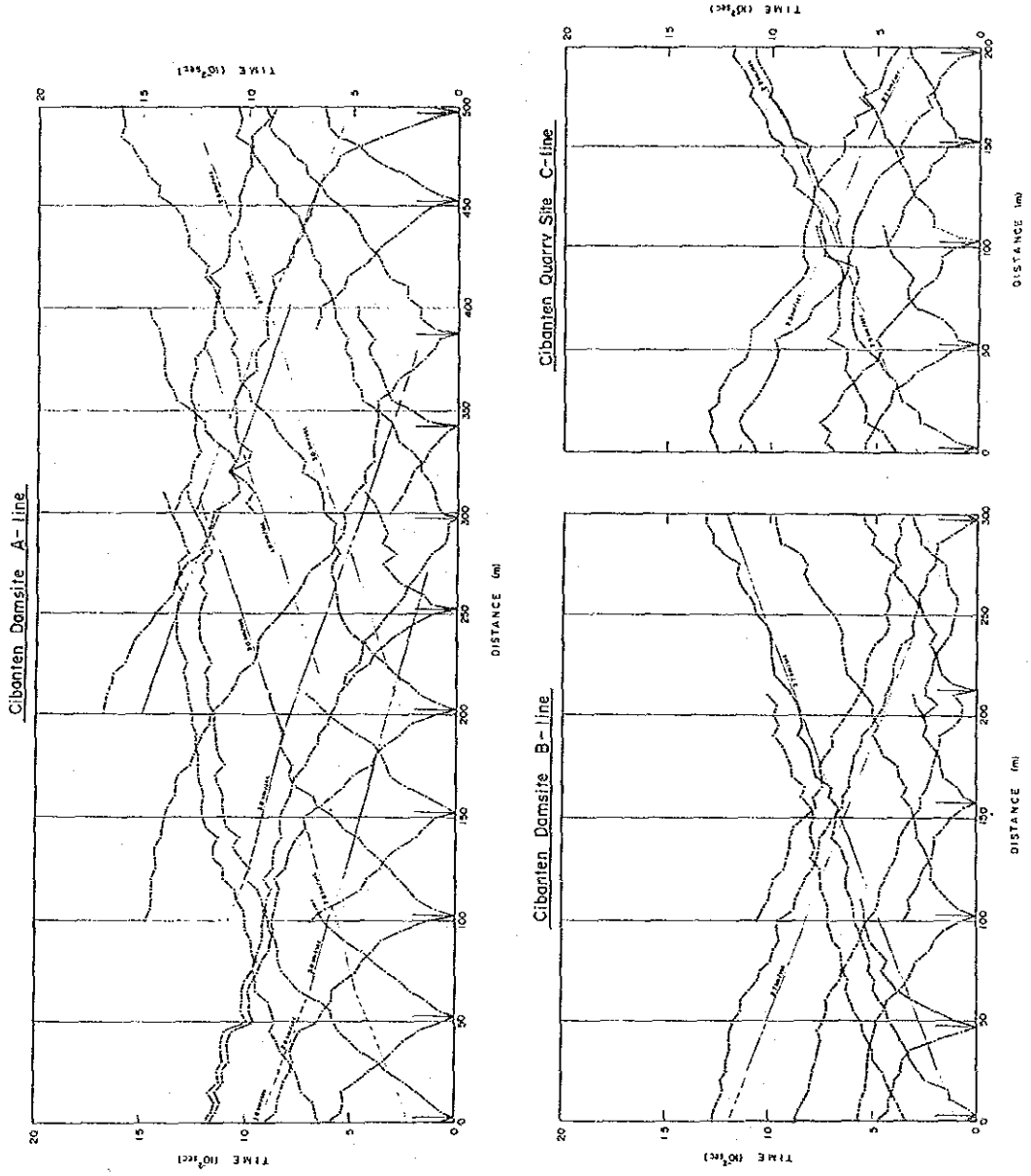
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY



Time-Distance Curve for Cibanten Damsite and Quarry Site

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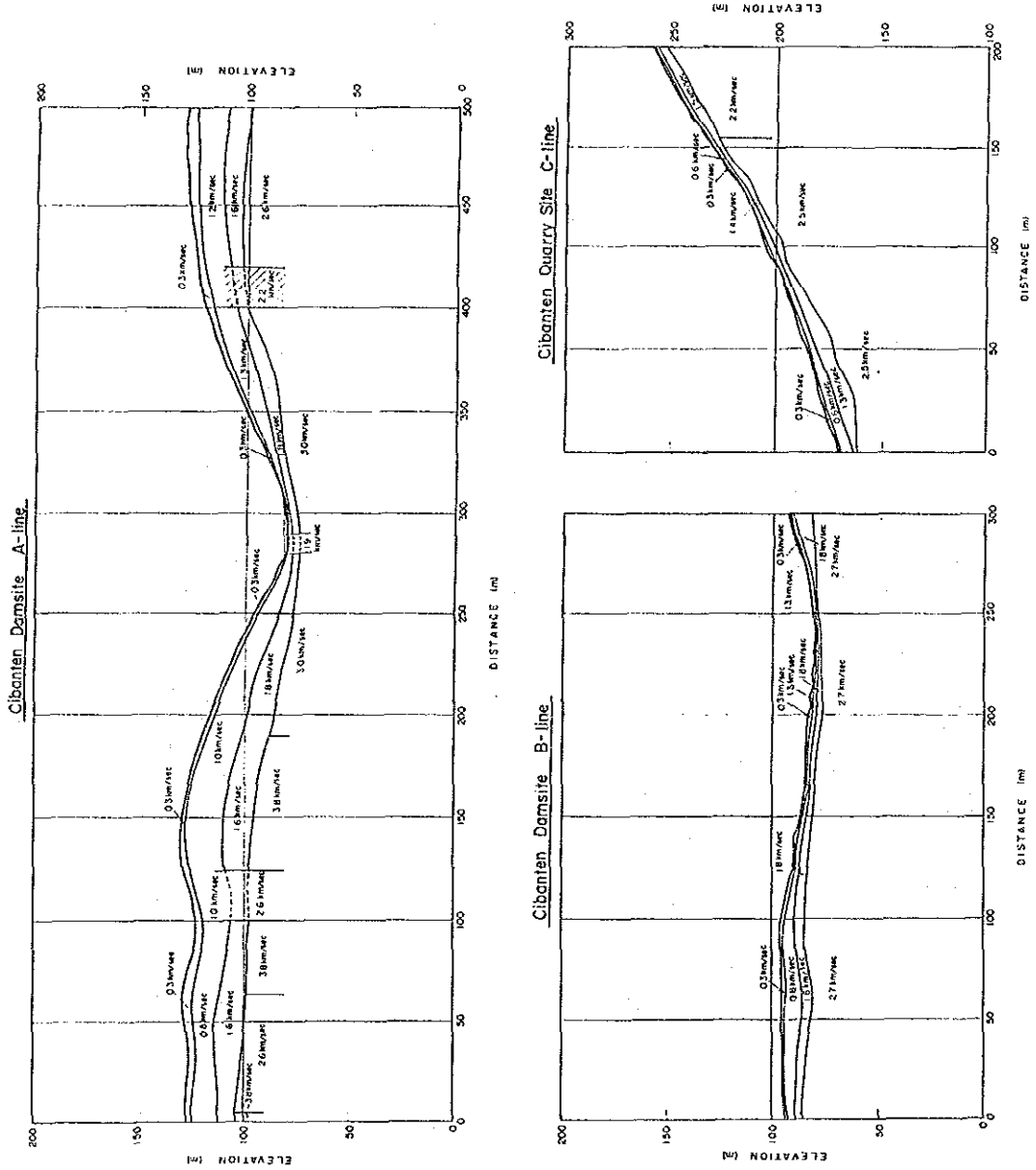
FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY



P-Wave Velocity Profile for Cibanten Damsite and Quarry Site

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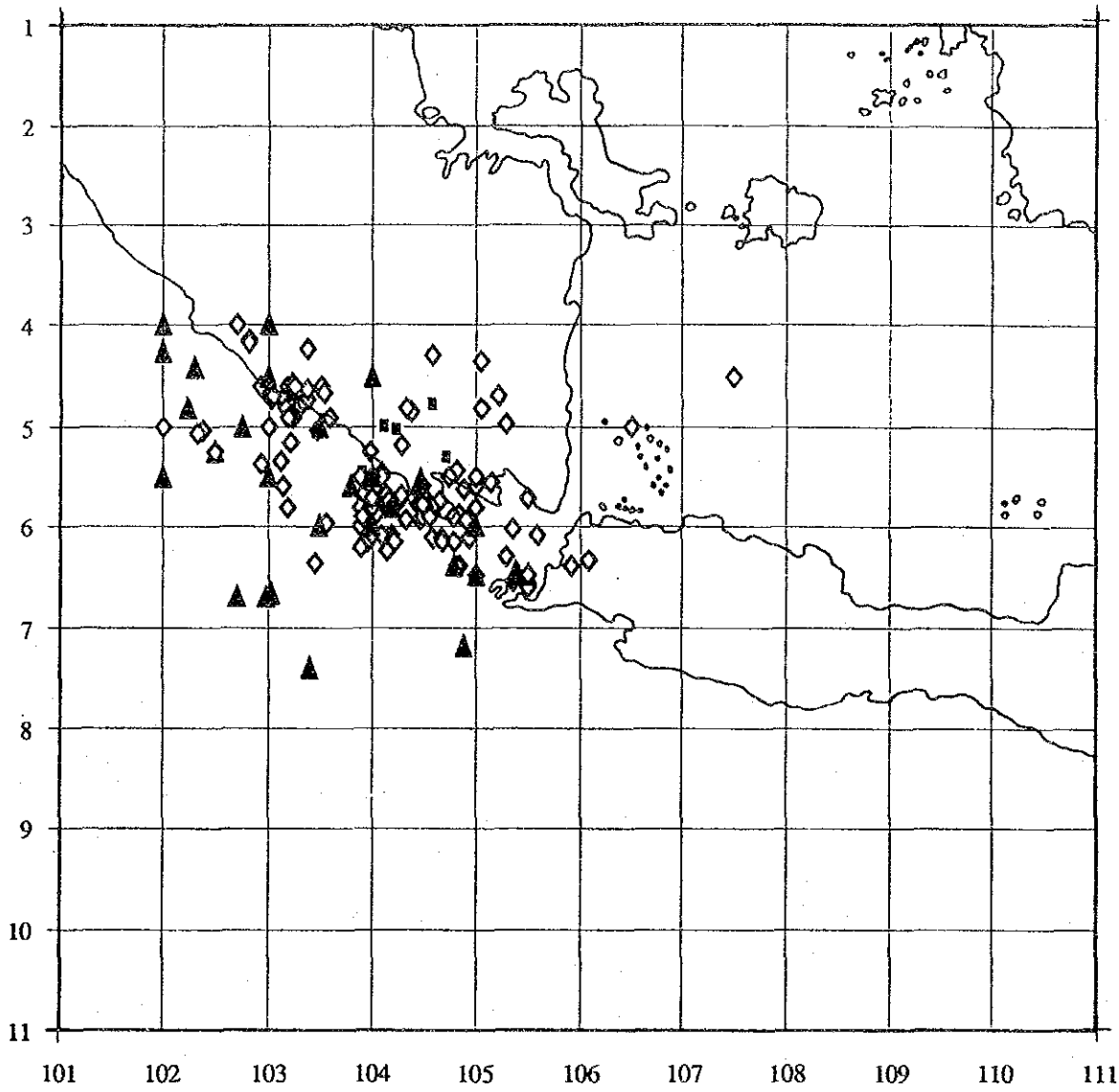
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
FEASIBILITY STUDY ON CIDANAU-CIBANTEN WATER RESOURCES DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. C-41



Legend:

- M < 5
- 5 ≤ M < 6
- 6 ≤ M < 7
- 7 ≤ M

Epicentral Map of Influential Earthquakes

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FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

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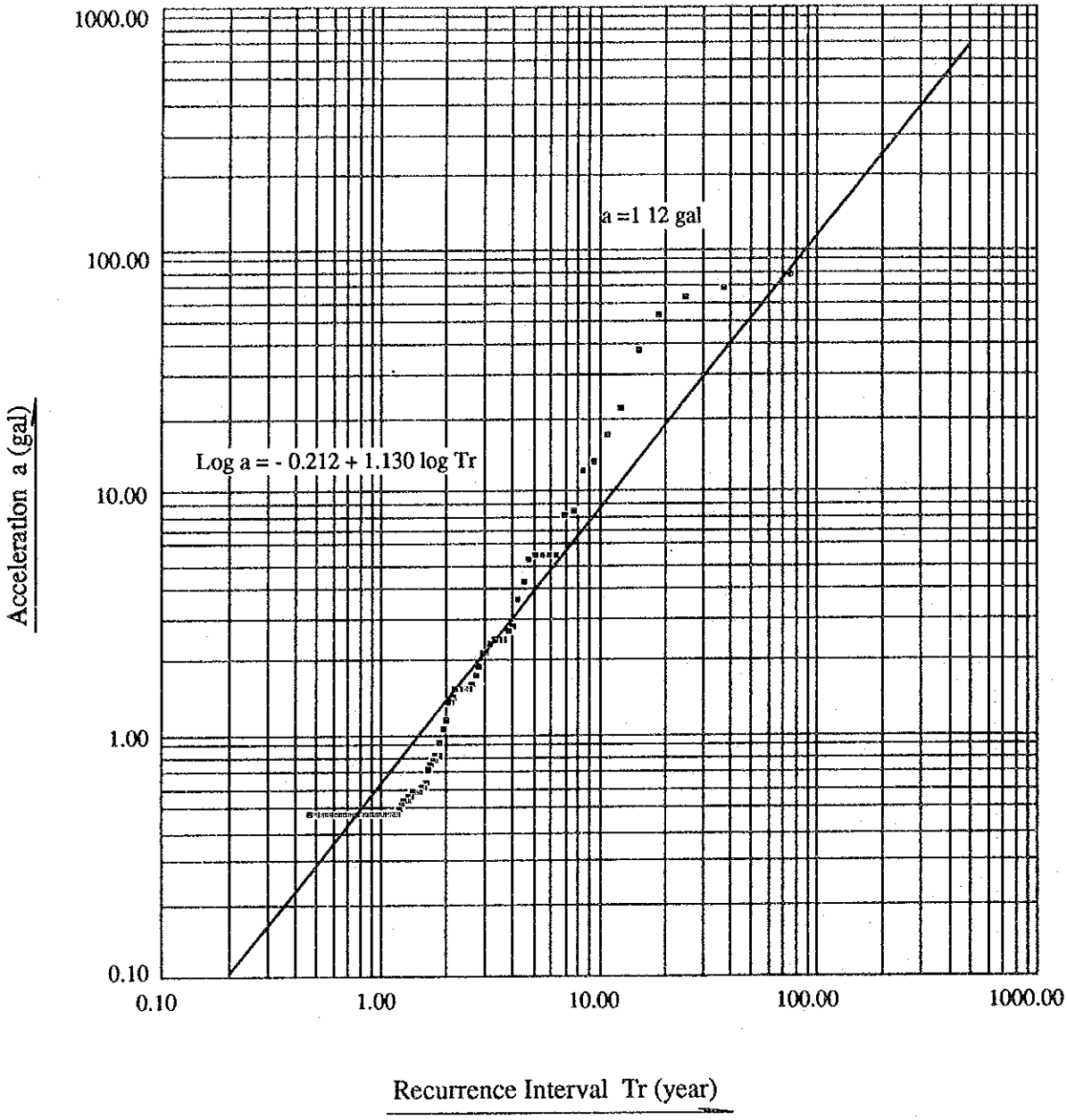
Fig. C-42

NO. of record : 161
(Magnitude > 4 , during 1913 to 1989 , ISC)



Seismic Recurrence Curve by Frequency Analysis

MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
FEASIBILITY STUDY ON CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

APPENDIX - D
CONSTRUCTION MATERIAL SURVEY

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CONSTRUCTION MATERIAL SURVEY

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1. General

The objectives of the construction material investigation were (1) to find adequate material sources of fill material for homogeneous earthfill and concrete aggregate, (2) to estimate available quantity, and (3) to evaluate quality of the construction materials for the Project.

The requirement of construction materials for the main structures is estimated as follows:

	Description	Unit	Heightening of Krenceng dam	Cidanau gated weir	Beroeng diversion tunnel
A)	Fill material				
	1) Earth	m^3	1060000	-	-
	2) Filter	m^3	150000	-	-
	3) Riprap	m^3	70000	-	-
B)	Concrete aggregate				
	1) Fine	m^3	4200	1100	11600
	2) Coarse	m^3	6900	1800	19400

Among the construction material investigations,the investigation results for the schemes as feasibility study are provided hereunder.

2. Construction Material Source

2.1 General

Taking into account the material requirement mentioned above, material investigation on fill material and concrete aggregate was carried out in the surrounding areas of the proposed damsites.

2.2 Borrow Area for Earth Material

Borrow areas were investigated for the possibility of earth material sources by reconnaissance, test pitting and laboratory tests.

It is located at 1-2 km south from the existing Krenceng dam or opposite site of Krenceng reservoir.

The material consists of sandy clay loam and weakly welded pumice tuff, D class.

2.3 Sand and Gravel Borrow Areas for Concrete Aggregate and Filter

The sand and gravel borrow areas were investigated for the possibility of filter material source by reconnaissance, test pitting and laboratory tests.

It is located at 5-6 km source in Anyer from the existing Krenceng dam but the quantity is not sufficient.

Therefore, concrete aggregate and filter material must be produced from quarried rock from the massive andesite in the quarry sites, Anyer and Bojonegara, which are located 5-6 km from the existing Krenceng dam.

2.4 Riprap

The riprap must be produced from quarried rock from the massive andesite in the quarry sites mentioned above.

2.5 Rock Materials

Laboratory tests of rock materials taken at the proposed quarry site for Cibanten Dam by core drilling QB-1 and QB-2 were carried out. In addition to the materials mentioned above, ten (10) samples of gravel and rock from five (5) locations were tested for coarse concrete aggregate.

3. Laboratory Tests

All samples taken at prospective borrow areas were tested in the Laboratory of PT Indra Karya, Indonesia, Malang during period mid February to mid March, 1991 and beginning to end January, 1992.

3.1 Test Method

In principle, the laboratory test was carried out in accordance with American Society for Testing and Materials (ASTM).