トルコ共和国

オルトゥ川水力発電開発計画調査

最終報告書

付　　録

1992年10月

国 際 協 力 事 業 団

トルコ共和国

オルトゥ川水力発電開発計画調査

最終報告書

付　　録

1992年10月

国 際 協 力 事 業 団

Appendix

Contents

A-1 Power Demand Forecast and Supply Program

Development Plan of Electric Power of Turkey

Year	Hydroelectric Power Station			Thermal Power Station			Total	
	Project	MW	GWh	Project	MW	GWh	MW	GWh
1995		10,896	38,624		11,013	71,466	21,914	110,090
1996	—	—	—	Tunobilek A (L) Kangal 3 (L) Dogal (G)	▲ 129 0 450	▲ 900 1,000 3,150		
	Total	0	0	Total	321	3,250	(22,235) 321	3,250
1997				Elbistan A56 (L) Dogal (G)	2×340 2×450	2×2,380 2×3,150		
	Total	0	0	Total	1,580	11,060	(23,815) 1,580	11,060
1998	Kayraktepe Berke	431 510	991 1,663	Elbistan B1,2 (L) Dogal (G)	2×340 450	2×2,380 3,150		
	Total	941	2,659	Total	1,130	7,910	(25,886) 2,071	11,569
1999	Birecik Boyabat Yedigöze Alpaslan Alpaslan Cindere	672 513 300 160 40 27	2,516 1,468 969 567 238 88	Elbistan B3,4 (L)	2×340	2×2,380		
	Total	1,712	5,846	Total	680	4,760	(28,278) 2,392	10,606
2000	Akköpru Karkamcs	115 180	343 652	Cayirham 3,4 (L) Dogal (G)	2×150 3×450	2×1,050 3×3,150		
	Total	295	995	Total	1,650	11,550	(30,223) 1,945	12,545
2001	Ilisu	1,200	3,833	Dogal (G) Ithal Kömer (T)	2×450 2×500	2×3,150 2×3,500		
	Total	1,200	3,833	Total	1,900	13,300	(33,323) 3,100	17,133

Year	Hydroelectric Power Station			Thermal Power Station			Total	
	Project	MW	GWh	Project	MW	GWh	MW	GWh
2002	OF Solarli	380	1,000	Elbistan C1,2 (L)	2×340	2×2,380		
	Cizre	240	1,218	Adyaman (L)	150	1,050		
	Torul	103	322	Dogal (G)	2×450	2×3,150		
	Uzunçayir	72	317					
							(35,848)	
	Total	795	2,857	Total	1,730	12,110	2,525	14,967
2003	Deriner	670	2,118	Elbistan C3,4 (L)	2×340	2×2,380		
				Cayrham B1 (L)	340	2,380		
				Dogal (G)	2×450	2×3,150		
							(38,438)	
	Total	670	2,118	Total	4,920	13,440	2,590	15,558
2004	Borçka	300	1,039	Cayrham D2 (L)	340	2,380		
	Muratle	115	445	Anasra 1 (T)	300	2,100		
	Yusfeli	540	1,705	Dogal (G)	2×450	2×3,150		
				Ithal Kömer (T)	500	3,500		
							(41,433)	
	Total	955	3,189	Total	2,040	14,280	2,995	17,469
2005	Beskonak	201	660	Soma C1 (L)	165	1,155		
	Artvin	332	989	Amasra (T)	300	2,100		
				Dogal (G)	2×450	2×3,150		
				Ithal Kömer (T)	2×500	2×3,500		
							(44,131)	
	Total	533	1,649	Total	2,365	16,555	2,698	18,204
2006	Dilek-Gorolik	135	511	Dogal (G)	2×450	2×3,150		
	Göktas	270	1,160	Ithal Kömer (T)	4×500	4×4,500		
							(47,436)	
	Total	405	1,671	Total	2,900	20,300	3,305	21,971
2007	Sanliurfa	50	124	Soma C2 (L)	165	1,155		
	Aslancik	90	349	Dogal (G)	450	3,150		
	Konaktepe	210	694	Ithal Kömer (T)	4×500	4×3,500		
	Ulubat-Çinarcik	120	548					
	Camlica 1	131	515					
							(50,652)	
	Total	601	2,230	Total	2,615	18,305	3,216	20,535

Year	Hydroelectric Power Station			Thermal Power Station			Total	
	Project	MW	GWh	Project	MW	GWh	MW	GWh
2008	Ermenek	320	742	Seyitomer B1,2 (L)	2×150	2×1,050		
	Hakkari	322	1,043	Bolu (L)	150	1,050		
				Dogal (G)	3×450	3×3,150		
				Ithal Kömer (T)	3×500	3×3,500		
							(54,594)	
	Total	642	1,785	Total	3,300	23,100	3,942	24,885
2009	Alkumru	176	807	Beysehir (L)	340	2,380		
	Çetin	244	1,100	Dogal (G)	2×450	2×3,150		
	Penbelik	100	313	Ithal Kömer (T)	2×500	2×3,500		
	Dalaman-Bezkese	50	205	Nuclear (N)	1,066	7,460		
							(58,470)	
	Total	570	2,425	Total	3,306	23,140	3,876	25,565
2010	Özköy	156	182	Bolu Göynük 2 (L)	150	1,050		
	Gürsögot	242	276	Dogal	2×450	2×3,150		
	other 21	762	3,370	Ithal Kömer	3×500	3×3,500		
				Nuclear	1,066	7,460		
							(63,286)	
	Total	1,200	3,828	Total	3,616	25,310	4,816	29,138

A-2 Meteorological and Hydrological Data

Appendix: List of Figure

Appendix: List of Tables

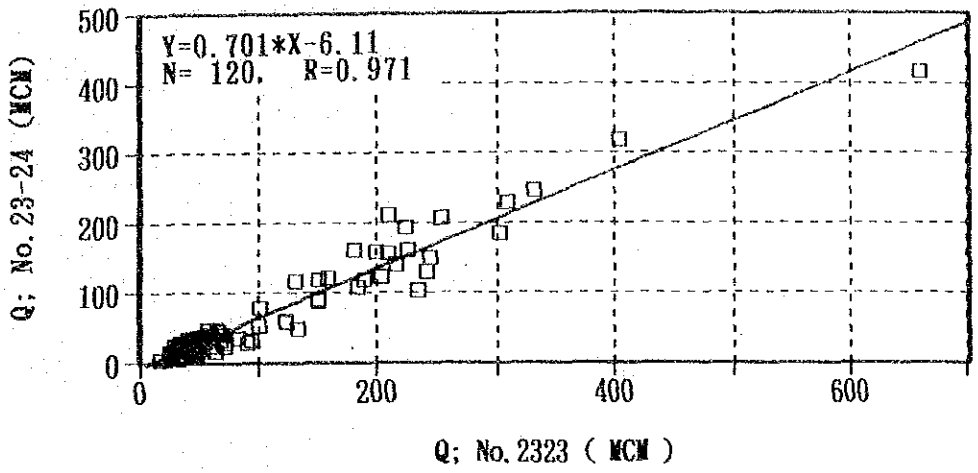


Fig. A-2-1(a) Correlation Analysis between Nos.23-24 and 2323 Gauging Station

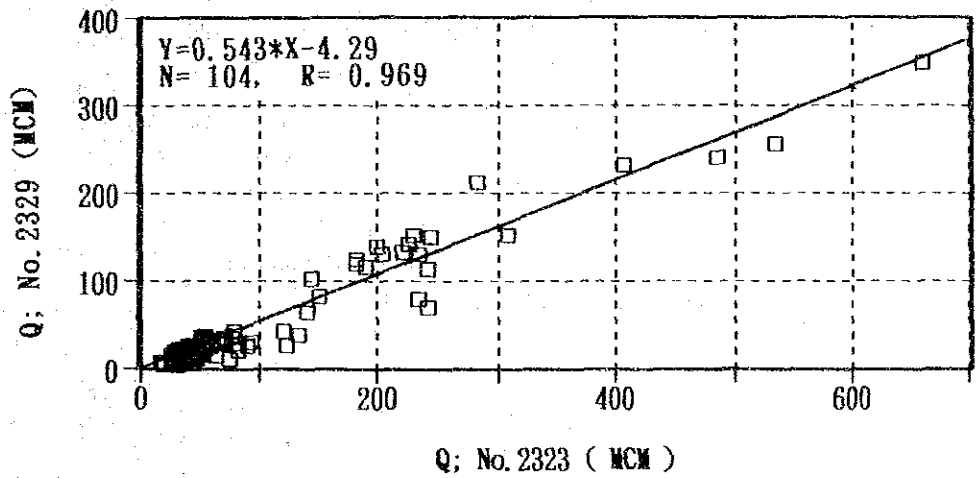


Fig. A-2-1(b) Correlation Analysis between Nos.2329 and 2323 Gauging Station

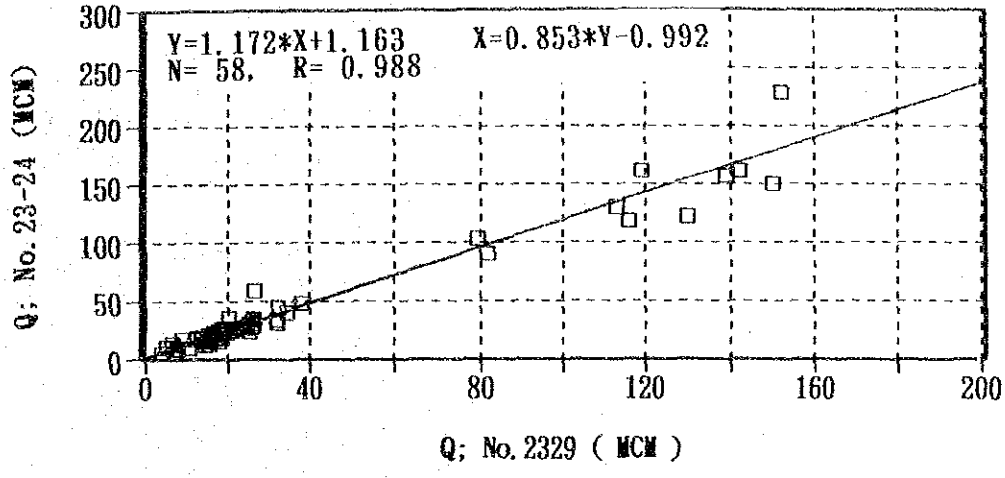


Fig. A-2-2(a) Correlation Analysis between Nos.23-24 and 2329 Gauging Station

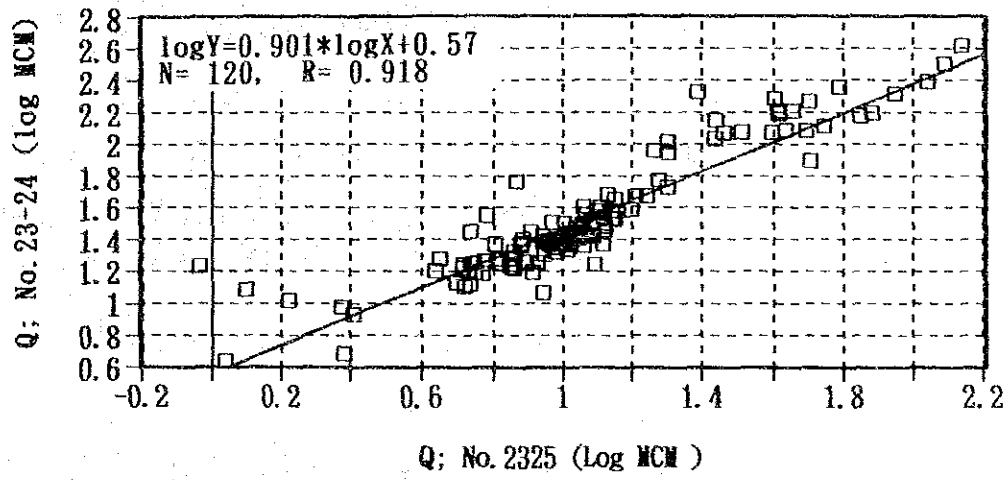


Fig. A-2-2(b) Correlation Analysis between Nos.23-24 and 2325 Gauging Station

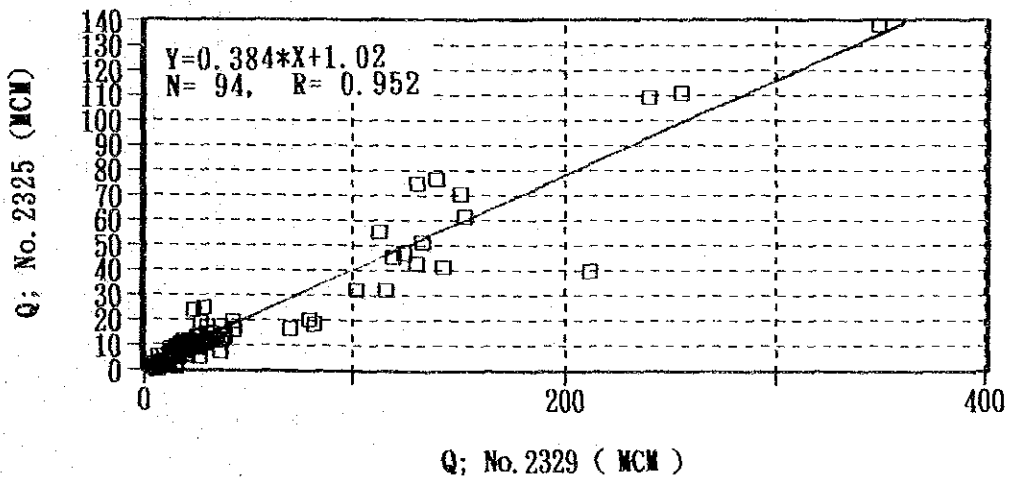


Fig. A-2-2(c) Correlation Analysis between Nos.2325 and 2329 Gauging Station

Table A-2-6 Estimated Monthly Temperatures at Tortum Power Station

(unit ; 'C)

Year	Jan	Fev	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1977	-4.9	3.0	2.9	10.4	14.7	18.2	22.5	23.3	18.9	8.1	7.0	-1.8	10.2
1978	-2.5	1.2	4.5	7.8	14.2	17.9	25.3	22.2	19.6	12.9	1.3	2.1	10.5
1979	0.3	3.0	5.0	10.0	14.9	17.6	21.5	25.4	20.1	11.4	6.6	0.3	11.3
1980	-0.7	2.0	4.0	9.0	15.7	20.7	25.4	22.1	17.5	10.6	6.9	2.5	11.3
1981	0.9	1.9	5.1	8.2	12.2	18.7	24.6	22.4	19.7	13.2	4.2	3.8	11.2
1982	-1.1	-2.6	1.7	10.5	14.8	20.0	22.2	22.3	18.4	11.1	2.6	0.4	10.0
1983	-1.3	-0.8	3.4	10.4	14.6	18.6	24.3	22.8	17.6	11.1	6.9	0.8	10.7
1984	0.8	0.3	5.0	8.8	12.9	18.8	22.2	20.1	17.1	10.9	5.9	2.8	10.5
1985	0.3	-0.1	-0.1	10.7	17.1	20.7	22.1	24.7	17.2	9.6	7.2	-0.1	10.8
1986	-0.8	-0.6	2.6	11.6	11.3	18.3	25.4	25.3	20.1	11.8	2.4	-1.9	10.5
1987	0.4	0.7	-0.9	6.7	16.5	19.8	23.3	21.6	17.1	9.7	3.2	-0.7	9.8
1988	-3.6	-1.0	2.1	9.4	13.7	18.0	22.5	21.6	17.0	11.3	1.9	0.4	9.4
1989	-5.7	-3.5	5.1	13.3	15.4	20.6	24.2	24.6	17.4	10.7	4.7	-2.8	10.3
1990													
Ave	-1.4	0.3	3.1	9.8	14.5	19.1	23.5	23.0	18.3	11.0	4.7	0.4	10.5

Note: X>0 Y(Tortum p/s) = 1.136(Tortum) + 0.83
X<0 Y(Tortum p/s) = 0.8803(Tortum) + 0.83

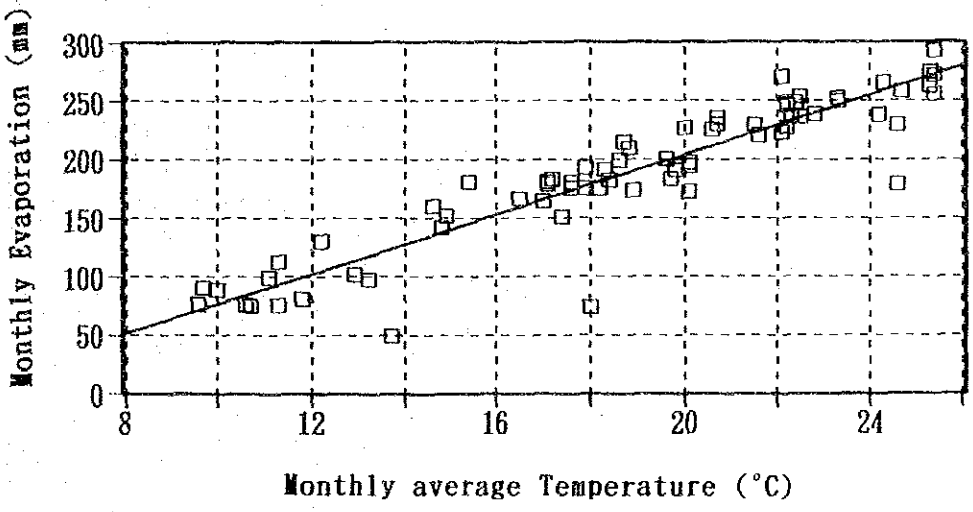


Fig. A-2-3 Relation between Monthly Average Temperatures and Monthly Evaporation of Tortum Power station

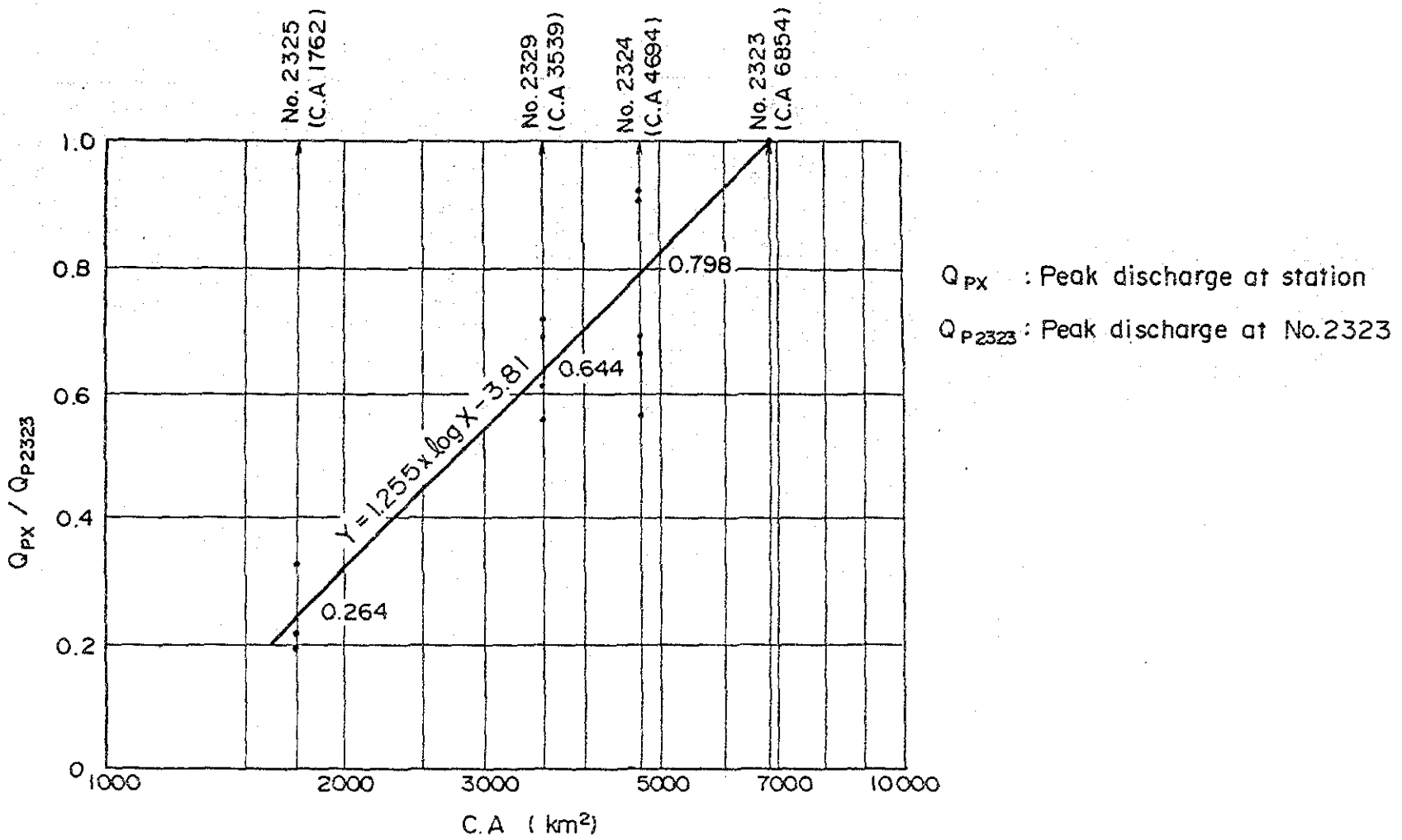


Fig. A-2-4 Relation between Coefficient for Peak Discharges and Catchment Area of any site

Table A-2-1(a) Natural Flow at No.2323 Gauging Station

(C.A = 6,854.0 km²)

(Unit: MCM)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	(m³/s/100km²)
1941	71.6	67.4	59.8	54.9	53.6	78.9	249.0	499.0	179.0	98.5	60.8	46.4	1518.9	0.70
1942	65.9	99.1	67.0	59.7	59.1	88.8	198.0	639.0	322.0	128.0	70.4	58.3	1855.3	0.86
1943	68.3	66.0	61.9	55.0	49.5	57.1	125.0	310.0	151.0	86.7	55.1	39.8	1125.4	0.52
1944	50.2	56.0	51.7	48.8	48.5	85.3	181.0	531.0	224.0	121.0	70.5	58.1	1526.1	0.71
1945	62.2	64.4	53.5	51.4	45.1	53.6	102.0	303.0	287.0	102.0	56.3	44.2	1224.7	0.57
1946	50.5	52.7	50.0	48.3	44.5	55.9	124.0	378.0	417.0	157.0	114.0	76.2	1568.1	0.73
1947	100.0	83.3	70.5	67.0	60.5	104.0	177.0	175.0	143.0	87.8	46.4	48.4	1162.9	0.54
1948	53.2	71.8	57.0	51.6	47.1	49.7	140.0	368.0	388.0	109.0	69.0	69.7	1474.1	0.68
1949	63.4	59.0	55.8	49.1	44.3	55.5	88.8	396.0	192.0	66.2	49.0	46.2	1165.3	0.54
1950	55.6	50.9	47.8	45.3	43.7	67.4	180.0	393.0	221.0	97.4	57.2	45.2	1304.5	0.60
1951	74.0	63.2	57.5	55.1	48.4	74.7	155.0	336.0	257.0	105.0	61.7	68.1	1355.7	0.63
1952	108.0	80.5	69.7	63.2	63.1	70.3	246.0	407.0	282.0	140.0	77.8	62.6	1670.2	0.77
1953	59.9	59.4	60.8	56.7	52.7	62.3	147.0	388.0	277.0	126.0	78.4	58.5	1426.7	0.66
1954	57.7	59.3	56.2	54.0	51.2	73.4	147.0	438.0	397.0	257.0	103.0	74.3	1768.1	0.82
1955	73.9	65.5	61.9	54.6	47.5	58.4	106.0	282.0	145.0	43.6	28.8	28.4	995.6	0.46
1956	41.4	42.7	47.6	44.4	49.8	59.6	126.0	225.0	235.0	115.0	66.1	56.2	1108.8	0.51
1957	64.4	56.0	55.7	52.4	51.7	82.7	167.0	277.0	215.0	105.0	54.3	52.8	1234.0	0.57
1958	61.0	65.2	58.5	54.4	48.8	61.4	103.0	207.0	203.0	92.1	53.9	53.6	1061.9	0.49
1959	56.2	52.2	50.6	51.2	43.6	61.3	146.0	331.0	216.0	90.1	73.9	64.0	1236.1	0.57
1960	75.4	75.7	63.9	59.8	59.9	74.4	195.0	340.0	191.0	129.0	86.1	64.8	1415.0	0.65
1961	47.4	43.5	43.8	39.1	35.3	39.5	69.3	136.0	76.7	27.9	20.1	17.7	596.3	0.28
1962	27.8	32.0	36.5	32.3	30.8	52.7	118.0	225.0	124.0	64.5	34.6	29.8	808.0	0.37
1963	30.2	33.5	31.6	34.1	31.2	39.8	223.0	537.0	377.0	210.0	145.0	57.7	1750.1	0.81
1964	86.2	75.7	57.6	47.9	41.5	62.4	215.0	444.0	312.0	99.1	46.0	42.3	1529.7	0.71
1965	44.2	42.5	43.4	36.2	33.3	73.1	178.0	238.0	154.0	90.6	52.0	40.3	1025.6	0.47
1966	66.7	50.6	48.6	49.3	46.4	57.1	181.0	324.0	109.0	46.1	32.8	37.3	1048.9	0.49
1967	44.7	41.2	37.5	35.9	30.2	38.4	79.7	373.0	148.0	163.0	80.9	50.7	1123.2	0.52
1968	54.9	53.6	52.7	47.7	43.1	76.1	536.0	601.0	329.0	119.0	65.5	55.3	2033.9	0.94
1969	58.9	64.0	50.5	41.2	36.2	67.0	240.0	454.0	113.0	44.1	42.9	40.3	1252.1	0.58
1970	60.8	47.1	48.0	41.7	37.2	52.4	192.0	160.0	61.7	51.3	32.2	36.0	820.4	0.38
1971	40.6	37.3	32.3	31.8	26.5	44.5	97.2	290.0	142.0	36.8	72.1	30.1	881.2	0.41
1972	39.2	41.0	40.9	36.3	37.1	45.4	185.0	250.0	192.0	74.9	41.0	52.8	1035.6	0.48
1973	57.1	53.6	46.1	44.5	46.8	53.1	132.0	262.0	191.0	75.6	30.7	35.4	1027.9	0.48
1974	52.8	50.1	38.7	33.1	31.3	48.8	79.5	268.0	90.8	35.0	33.3	52.9	814.3	0.38
1975	33.2	34.1	39.2	37.5	30.5	42.7	126.0	151.0	97.5	44.1	26.5	32.7	695.0	0.32
1976	43.6	41.3	29.1	32.0	31.2	61.4	182.0	428.0	220.0	102.0	51.0	49.6	1271.2	0.59
1977	56.8	47.0	42.0	35.5	32.3	53.1	151.0	331.0	151.0	66.9	46.1	41.4	1054.1	0.49

Table A-2-1(b) Natural Flow at No.2323 Gauging Station

(Unit: MCM)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	($m^3/s/100km^2$)
1978	44.9	40.2	35.1	35.3	40.7	56.4	159.0	404.0	185.0	70.8	41.9	31.3	1144.6	0.53
1979	43.8	41.1	43.8	38.6	38.2	44.4	131.0	224.0	216.0	123.0	39.4	32.5	1015.8	0.47
1980	57.2	100.0	55.5	45.7	41.2	63.8	253.0	302.0	93.6	47.0	32.8	24.1	1115.9	0.52
1981	42.0	37.4	37.2	40.1	32.4	40.4	101.0	210.0	210.0	71.2	41.0	46.1	908.8	0.42
1982	47.9	45.1	48.6	49.6	34.6	39.0	182.0	308.0	123.0	40.1	25.6	37.9	981.4	0.45
1983	39.6	38.8	38.1	31.8	29.7	34.6	64.2	151.0	133.0	43.3	30.7	43.8	678.6	0.31
1984	42.2	51.1	45.5	44.3	39.9	51.1	182.0	533.0	242.0	93.1	49.8	43.0	1417.0	0.66
1985	37.6	39.8	31.0	32.0	28.1	38.8	200.0	190.0	90.0	41.8	16.5	25.3	770.9	0.36
1986	38.8	38.0	39.3	38.7	41.9	69.2	226.0	244.0	241.0	57.9	43.1	42.9	1120.8	0.52
1987	59.7	53.5	44.4	38.6	44.1	55.1	204.0	660.0	234.0	81.5	62.7	37.6	1575.2	0.73
1988	44.5	53.2	47.8	41.8	45.6	67.1	234.0	485.0	282.0	144.0	68.3	55.8	1569.1	0.73
1989	53.1	70.1	53.5	46.9	41.9	77.5	221.0	120.0	74.2	34.8	19.1	27.6	839.7	0.39
1990	41.6	32.4	50.7	41.5	36.6	76.1	230.0	407.0	141.0	80.7	46.3	45.3	1229.2	0.57
Ave	55.0	54.4	48.9	45.2	42.2	59.9	169.5	338.7	201.9	90.7	54.1	46.2	1206.6	0.56

Note : (1) 1940/10---1963/ 9 : log Y = 0.088 * X(No.2302) + 0.704

Table A-2-2 Natural Flow at No.23-24 Gauging Station

(C.A = 4,693.6 km²)

(Unit: MCM)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	(m³/s/100km²)
1977	39.9	35.7	34.0	25.2	26.5	37.6	118.0	246.0	87.9	32.2	17.5	24.6	725.1	0.49
1978	29.6	27.0	23.9	23.7	28.5	46.8	121.0	318.0	108.0	23.4	13.4	16.6	779.9	0.53
1979	23.4	24.8	24.4	23.4	24.1	32.3	117.0	193.0	140.0	57.9	17.2	15.9	693.4	0.47
1980	38.6	53.2	38.0	31.3	27.5	47.2	207.0	185.0	31.7	11.6	17.8	15.4	704.3	0.48
1981	21.8	20.8	20.2	18.9	17.5	24.8	78.3	156.0	211.0	27.9	18.9	17.9	634.0	0.43
1982	22.3	26.3	23.0	21.0	18.0	23.8	161.0	229.0	59.1	17.5	9.4	18.4	628.8	0.42
1983	21.0	18.8	17.8	16.8	16.7	22.8	44.8	90.4	47.8	8.5	4.8	13.1	323.3	0.22
1984														
1985	27.1	30.2	25.5	26.7	24.5	33.7	157.0	118.0	28.2	12.2	4.3	12.7	500.1	0.34
1986	26.7	24.2	24.5	23.0	25.0	40.1	161.0	150.0	130.0	23.5	10.4	18.0	656.4	0.44
1987	33.7	31.2	26.0	26.2	31.6	34.5	122.0	416.0	103.0	35.3	15.5	15.6	890.6	0.60
1988														
1989														
1990														
Ave	28.4	29.2	25.7	23.6	24.0	34.4	128.7	210.1	94.7	25.0	12.9	16.8	653.6	0.44

Table A-2-3 Natural Flow at No.2329 Gauging Station

(C.A = 3,538.8 km²) (Unit: MCM)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	($m^3/s/100km^2$)
1977														
1978														
1979														
1980														
1981														
1982			19.5	15.2	12.4	17.6	119.0	152.0	26.5	9.0	10.6	13.7		
1983	16.4	15.1	14.8	13.4	12.1	16.5	32.3	81.7	38.2	7.7	4.0	6.5	258.7	0.23
1984	20.1	34.2	22.1	19.2	16.0	28.5	124.0	256.0	70.0	30.0	35.9	24.5	680.5	0.61
1985	23.0	25.1	22.0	19.1	19.0	26.1	139.0	116.0	26.0	14.3	7.0	15.4	452.0	0.40
1986	24.7	18.9	20.8	18.0	18.8	34.5	142.0	150.0	113.0	25.2	5.2	17.1	588.2	0.53
1987	31.8	31.9	21.5	18.5	25.8	26.1	130.0	349.0	79.3	20.1	15.0	17.7	766.7	0.69
1988	20.4	23.3	18.6	17.3	19.6	30.6	130.3	240.6	212.2	102.0	29.9	28.2	873.1	0.78
1989	36.9	27.9	23.1	19.0	15.2	42.2	132.5	42.6	11.2	5.9	5.1	9.2	370.7	0.33
1990	23.8	22.0	22.9	14.6	13.3	37.5	151.5	232.1	64.0	28.5	11.7	13.4	635.1	0.57
Ave	24.6	24.8	20.6	17.1	16.9	28.8	122.3	180.0	71.2	27.0	13.8	16.2	578.1	0.52

Table A-2-4 Natural Flow at No.2325 Gauging Station

(C.A = 1,762 km^2)

(unit ; MCM)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	total	(m^3/s/100km^2)
1974	14.00	13.70	11.00	9.19	8.40	20.90	26.70	44.30	12.50	2.36	5.85	12.30	181.20	0.33
1975	7.89	6.83	7.79	7.04	6.12	13.50	25.20	41.60	17.80	3.51	1.51	7.06	145.35	0.26
1976	16.30	8.90	9.30	12.00	7.64	14.70	73.50	94.40	38.20	14.10	5.37	9.36	303.77	0.55
1977	12.90	11.70	14.20	10.50	8.73	12.60	39.30	110.00	20.20	9.32	12.40	9.22	271.07	0.49
1978	11.00	10.40	9.20	7.55	13.20	16.20	49.20	123.00	27.30	6.34	4.95	7.21	285.55	0.51
1979	10.30	9.71	9.60	9.07	9.12	12.10	28.80	40.00	27.40	7.31	0.92	4.34	168.67	0.30
1980	15.80	20.10	13.90	11.40	10.70	17.50	89.00	50.40	13.20	8.73	5.42	5.85	262.00	0.47
1981	10.30	9.61	8.79	7.01	7.24	10.60	50.80	40.90	24.50	8.04	4.45	5.53	187.77	0.34
1982	9.34	12.20	11.50	9.45	8.43	9.88	45.20	61.50	18.90	5.17	2.37	5.96	199.90	0.36
1983	7.19	6.43	6.57	7.06	5.17	7.51	14.20	18.40	13.50	2.57	2.41	5.38	96.39	0.17
1984	8.82	11.90	9.36	8.19	7.81	11.00	47.00	111.00	16.80	12.40	7.25	8.86	260.39	0.47
1985	10.50	13.30	11.10	10.30	8.70	13.20	76.30	32.20	5.41	1.25	1.09	5.20	188.55	0.34
1986	10.10	8.94	10.00	7.51	7.60	11.50	41.30	70.50	55.40	13.10	1.67	7.84	245.46	0.44
1987	14.00	12.20	11.70	11.50	10.10	13.20	42.90	138.00	20.10	6.03	5.58	8.17	293.48	0.53
1988	9.85	10.96	10.26	10.37	9.69	14.70	74.80	109.00	39.80	32.10	17.20	10.20	348.93	0.63
1989	12.00	24.90	24.00	9.02	7.14	19.44	51.40	16.10	1.76	0.20	0.55	3.20	169.71	0.31
1990														
Ave	11.27	11.99	11.14	9.20	8.49	13.66	48.48	68.83	22.05	8.28	4.94	7.23	225.54	0.41

Table A-2-5 Observed Monthly Temperatures at Oltu Station

(unit ; 'C)

Year	Jan	Fev	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
1968	-4.9	-3.5	2.0	11.6	15.3	16.6	22.5	20.7	18.3	12.5	6.8	-1.3	9.7
1969	-4.4	-4.3	4.1	7.7	15.9	20.4	21.2	23.4	16.5	9.9	5.0	1.4	9.7
1970	0.4	2.4	6.1	13.0	14.6	18.8	22.3	20.7	16.9	10.3	7.4	-3.5	10.8
1971	-2.1	-0.9	5.0	9.6	14.9	16.9	24.5	19.9	20.5	9.7	4.5	-3.2	9.9
1972	-9.4	-5.0	2.1	11.5	12.5	17.4	22.8	23.0	17.6	13.7	3.3	-3.4	8.8
1973	-6.4	-0.1	2.5	8.9	14.4	16.1	21.8	22.6	18.4	12.2	0.6	-1.8	9.1
1974	-7.8	-3.5	3.7	6.3	15.7	20.7	22.2	20.9	15.8	15.5	5.4	-0.2	9.6
1975	-2.5	-2.7	1.9	12.6	14.1	20.0	23.7	23.4	17.2	10.1	4.0	-5.0	9.7
1976	-5.6	-9.5	0.9	8.7	13.7	18.0	20.9	23.3	16.8	11.6	6.1	0.5	8.8
1977	-5.7	1.2	4.1	10.0	14.1	16.5	21.0	22.0	18.1	7.8	6.2	-2.5	9.4
1978	-4.9	0.4	5.9	8.4	13.8	16.9	24.0	21.5	19.5	12.5	1.8	0.7	10.0
1979	0.3	2.9	4.9	9.7	14.4	17.1	20.8	24.5	19.5	11.0	6.4	0.3	11.0
1980	-0.7	1.9	3.9	8.7	15.2	20.0	24.5	21.3	16.9	10.3	6.6	2.5	10.9
1981	-0.2	2.2	5.3	8.1	11.5	18.1	23.4	22.2	19.1	12.9	3.9	3.5	10.8
1982	-0.3	-1.2	2.9	10.8	14.6	18.6	20.7	21.3	17.5	10.4	2.5	-0.5	9.8
1983	-3.2	0.1	4.5	10.6	14.5	17.6	22.8	21.9	16.9	10.4	6.1	1.4	10.3
1984	0.9	0.4	5.4	9.1	12.3	18.5	22.4	19.4	19.0	10.8	5.0	-0.8	10.2
1985	-0.5	-2.9	1.8	11.0	16.5	19.7	21.0	24.3	17.9	9.5	6.5	-1.7	10.3
1986	-3.0	-1.7	3.3	11.5	11.3	17.0	23.8	24.4	19.1	11.0	3.2	-2.3	9.8
1987	-0.7	0.8	0.5	7.8	16.0	18.3	22.7	20.9	16.2	9.6	3.1	-1.3	9.5
1988	-6.4	-1.6	3.0	10.0	13.5	17.1	21.5	20.5	16.6	10.5	2.1	-0.6	8.9
1989	-8.2	-4.9	6.0	13.2	15.1	19.4	23.3	24.5	18.1	10.7	5.2	-4.0	9.9
1990													
Ave	-3.4	-1.3	3.6	9.9	14.3	18.2	22.4	22.1	17.8	11.0	4.6	-1.0	9.9

Deficit data 1973/6--12, 1974/3--9, 11,12, 1975/1--10, 1977/10, 1979/1--1980/12,

; X>0 Y(Oltu) = 1.096 * X(Tortum) + 0.83

; X<0 Y(Oltu) = 0.912 * X(Tortum) + 0.83

Table A-2-7 Sediment Yield from Calculation for 16 years (No.2325; C.A = 1,762 km^2)

(unit : ton)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	ton/km^2
1974	7,015	6,777	4,357	3,011	2,787	16,776	28,244	74,809	13,717	308	4,659	6,141	168,601	95.69
1975	2,266	1,776	2,339	1,821	1,524	7,205	23,107	66,418	26,952	920	472	2,763	137,563	78.07
1976	12,119	2,935	3,145	5,178	2,326	8,629	266,326	307,466	57,488	7,189	1,100	3,622	677,523	384.52
1977	5,790	4,998	7,009	4,002	3,002	5,746	52,977	556,295	15,136	3,826	16,973	3,175	678,929	385.32
1978	4,303	3,811	3,034	2,116	7,242	9,180	88,328	588,747	28,812	1,712	923	1,966	740,174	420.08
1979	3,958	3,522	3,269	2,930	3,287	5,138	29,566	54,248	26,294	5,933	36	951	139,132	78.96
1980	8,709	14,780	6,730	4,678	4,350	11,270	393,102	82,480	8,013	2,801	2,115	1,819	540,847	306.95
1981	3,843	3,383	2,772	1,776	2,084	4,092	96,345	55,099	21,536	3,189	823	1,350	196,292	111.40
1982	3,143	5,541	4,645	3,208	2,795	3,488	85,360	120,676	21,600	1,675	219	1,454	253,804	144.04
1983	1,897	1,554	1,569	1,818	1,089	2,049	7,918	11,866	12,046	254	269	1,413	43,742	24.83
1984	2,779	5,142	3,151	2,399	2,328	4,279	84,360	578,234	14,306	6,957	2,103	3,084	709,122	402.45
1985	3,986	6,347	4,319	3,783	2,980	7,248	230,765	55,938	1,748	65	48	1,697	318,924	181.00
1986	3,704	2,948	3,592	2,049	2,360	4,652	65,355	158,814	103,700	10,224	110	2,622	360,130	204.39
1987	6,852	5,395	4,882	4,667	3,965	6,116	68,246	894,502	15,687	1,469	1,163	2,519	1,015,463	576.31
1988	3,456	4,364	3,737	3,798	3,573	7,799	233,059	379,230	56,889	35,614	10,937	3,777	746,233	423.51
1989	5,088	22,541	19,379	3,332	2,097	13,136	94,899	15,779	233	2	15	663	177,164	100.55
Ave	4,932	5,988	4,871	3,160	2,987	7,300	115,497	250,038	26,510	5,134	2,623	2,439	431,478	244.88

Table A-2-8(a) Sediment Yield from Calculation for 50 years (No.2325; C.A = 1,762 km^2)

(unit : ton)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	(ton/km^2)	Q (MCM)
1941	9,362	8,198	6,281	5,179	4,902	11,557	123,293	487,066	63,533	18,544	6,519	3,505	747,939	424.5	413.5
1942	7,797	18,785	8,092	6,258	6,116	14,893	77,879	790,324	205,506	32,027	9,019	5,932	1,182,628	671.2	515.0
1943	8,439	7,827	6,786	5,200	4,082	5,658	30,499	190,624	44,967	14,151	5,220	2,426	325,879	185.0	294.8
1944	4,217	5,418	4,510	3,949	3,889	13,666	64,982	550,186	99,784	28,515	9,046	5,889	794,051	450.7	415.7
1945	6,860	7,411	4,882	4,453	3,279	4,902	19,960	182,196	163,595	19,960	5,484	3,127	426,109	241.8	324.7
1946	4,273	4,714	4,177	3,853	3,175	5,393	29,995	282,114	342,338	48,688	25,192	10,716	764,628	434.0	428.4
1947	19,149	12,987	9,046	8,092	6,447	20,793	62,112	60,694	40,232	14,531	3,505	3,871	261,459	148.4	306.1
1948	4,819	9,417	5,640	4,494	3,631	4,119	38,516	267,581	297,016	22,942	8,630	8,824	675,629	383.4	400.0
1949	7,157	6,094	5,372	4,003	3,143	5,306	14,893	309,219	73,194	7,877	3,985	3,471	443,714	251.8	306.8
1950	5,331	4,355	3,759	3,315	3,042	8,198	64,256	304,630	97,129	18,117	5,683	3,295	521,110	295.8	348.8
1951	10,056	7,109	5,751	5,220	3,871	10,265	47,429	223,580	131,329	21,216	6,735	8,387	480,948	273.0	364.3
1952	22,503	12,066	8,824	7,109	7,081	8,993	120,352	326,367	157,963	38,516	11,207	6,958	727,939	413.1	459.2
1953	6,303	6,187	6,519	5,573	4,714	6,887	42,568	297,016	152,461	31,007	11,397	5,976	576,608	327.3	385.7
1954	5,794	6,165	5,460	4,986	4,411	9,878	42,568	377,049	310,764	131,329	20,381	10,146	928,931	527.2	488.7
1955	10,028	7,694	6,786	5,114	3,706	5,954	21,643	157,963	41,388	3,026	1,056	1,015	265,373	150.6	255.6
1956	2,672	2,877	3,724	3,159	4,137	6,236	31,007	100,681	109,836	25,655	7,852	5,460	303,296	172.1	289.8
1957	7,411	5,418	5,348	4,652	4,510	12,785	55,204	152,461	91,910	21,216	5,050	4,737	370,702	210.4	327.5
1958	6,569	7,615	5,976	5,070	3,949	6,665	20,381	85,176	81,901	16,092	4,966	4,902	249,262	141.5	275.6
1959	5,460	4,613	4,292	4,411	3,026	6,638	41,976	217,047	92,772	15,357	10,028	7,309	412,929	234.4	328.2
1960	10,475	10,562	7,285	6,281	6,303	10,175	75,526	228,869	72,437	32,547	13,941	7,513	481,914	273.5	382.2
1961	3,689	3,010	3,057	2,323	1,801	2,384	8,714	36,292	10,872	967	360	231	73,700	41.8	135.1
1962	957	1,398	1,959	1,434	1,264	4,714	27,063	100,681	29,995	7,435	1,712	1,157	179,769	102.0	199.0
1963	1,201	1,576	1,354	1,648	1,308	2,426	98,904	562,437	280,663	87,669	41,388	5,794	1,086,368	616.6	483.3
1964	13,974	10,562	5,773	3,779	2,687	6,907	91,910	387,274	193,057	18,785	3,437	2,815	740,960	420.5	416.8
1965	3,127	2,846	2,991	1,918	1,551	9,790	62,815	112,651	46,805	15,536	4,571	2,503	267,104	151.6	264.7
1966	8,011	4,292	3,910	4,042	3,505	5,658	64,982	208,049	22,942	3,454	1,492	2,067	332,404	188.7	271.7
1967	3,211	2,639	2,096	1,878	1,201	2,221	11,810	274,824	43,154	52,552	12,200	4,314	412,100	233.9	294.1
1968	5,179	4,902	4,714	3,741	2,942	10,687	560,381	701,083	214,452	27,543	7,694	5,265	1,548,583	878.9	568.9
1969	6,072	7,309	4,273	2,639	1,918	8,092	114,557	404,599	24,739	3,108	2,911	2,503	582,720	330.7	333.0
1970	6,519	3,631	3,797	2,717	2,054	4,652	73,194	50,598	6,735	4,430	1,421	1,893	161,641	91.7	202.7
1971	2,546	2,067	1,434	1,376	838	3,175	18,035	167,001	39,647	1,999	9,504	1,189	248,811	141.2	221.1
1972	2,337	2,610	2,595	1,933	2,039	3,331	67,915	124,286	73,194	10,327	2,610	4,737	297,914	169.1	267.7
1973	5,658	4,902	3,454	3,175	3,579	4,796	34,123	136,454	72,437	10,537	1,254	1,813	282,182	160.2	265.3
1974	7,015	6,777	4,357	3,011	2,787	16,776	28,244	74,809	13,717	308	4,659	6,141	168,601	95.7	181.2
1975	2,266	1,776	2,339	1,821	1,524	7,205	23,107	66,418	26,952	920	472	2,763	137,563	78.1	145.9

Table A-2-8(b) Sediment Yield from Calculation for 50 years

(unit : ton)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	(ton/km²)	Q (MCM)
1976	12,119	2,935	3,145	5,178	2,326	8,629	266,326	307,466	57,488	7,189	1,100	3,622	677,523	384.5	303.8
1977	5,790	4,998	7,009	4,002	3,002	5,746	52,977	556,295	15,136	3,826	16,973	3,175	678,929	385.3	271.1
1978	4,303	3,811	3,034	2,116	7,242	9,180	88,328	588,747	28,812	1,712	923	1,966	740,174	420.1	285.6
1979	3,958	3,522	3,269	2,930	3,287	5,138	29,566	54,248	26,294	5,933	36	951	139,132	79.0	168.7
1980	8,709	14,780	6,730	4,678	4,350	11,270	393,102	82,480	8,013	2,801	2,115	1,819	540,847	307.0	262.0
1981	3,843	3,383	2,772	1,776	2,084	4,092	96,345	55,099	21,536	3,189	823	1,350	196,292	111.4	187.8
1982	3,143	5,541	4,645	3,208	2,795	3,488	85,360	120,676	21,600	1,675	219	1,454	253,804	144.0	199.9
1983	1,897	1,554	1,569	1,818	1,089	2,049	7,918	11,866	12,046	254	269	1,413	43,742	24.8	96.4
1984	2,779	5,142	3,151	2,399	2,328	4,279	84,360	578,234	14,306	6,957	2,103	3,084	709,122	402.5	260.4
1985	3,986	6,347	4,319	3,783	2,980	7,248	230,765	55,938	1,748	65	48	1,697	318,924	181.0	188.6
1986	3,704	2,948	3,592	2,049	2,360	4,652	65,355	158,814	103,700	10,224	110	2,622	360,130	204.4	245.5
1987	6,852	5,395	4,882	4,667	3,965	6,116	68,246	894,502	15,687	1,469	1,163	2,519	1,015,463	576.3	293.5
1988	3,456	4,364	3,737	3,798	3,573	7,799	233,059	379,230	56,889	35,614	10,937	3,777	746,233	423.5	348.9
1989	5,088	22,541	19,379	3,332	2,097	13,136	94,899	15,779	233	2	15	663	177,164	100.6	169.7
1990															
Ave	6,246	6,185	4,854	3,746	3,304	7,441	83,824	262,401	84,753	18,118	6,274	3,852	490,998	278.7	302.9

(1) RivNote :(1) River Discharge 1940/10---1973/ 9 : Q=0.3844*X(No.2329)+1.02
1973/10---1989/ 9 : No.2325
(2) Suspended S(2) Suspended Sediments Discharge
1940/10---1973/ 9 : LogQs=1.928*LogX(No.2325)+1.69
1973/10---1989/ 9 : Sediment Yield from Calculation for 16 Years

Table A-2-9(a) Flood Peak Discharges

(unit ; m^3/sec)

No.2323			No.23-24		
Date	Discharge		Date	Discharge	
	Peak	Maximam		Peak	Maximam
18 Apr 1965	154		1965	(123)	
2 May 1966	191		1966	(152)	
13 May 1967	249		1967	(199)	
18 Apr 1968	472		1968	(377)	
30 Apr 1969	378		1969	(302)	
15 Apr 1970	146		1970	(117)	
17 May 1971	165		1971	(132)	
1 May 1972	174		1972	(139)	
12 May 1973	205		1973	(164)	
13 Apr 1974	231		1974	(184)	
15 May 1975	99.8		1975	(79.6)	
21 May 1976	227		1976	(181)	
14 May 1977	220		7 May 1977	210	
18 May 1978	295		18 May 1978	270	
14 Jun 1979	230		14 Jun 1979	210	
11 Apr 1980	263		11 Apr 1980	290	
5 Jun 1981	196		5 Jun 1981	110	
19 May 1982	224	191	2 May 1982	170	
18 May 1983	97.8	89.7	18 May 1983	68.0	
20 May 1984	504	476	12 May 1984	112	
23 Apr 1985	250	189	23 Apr 1985	150	135
16 Apr 1986	233	179	16 Apr 1986	155	125
21 May 1987	377	356	10 May 1987	270	260
19 May 1988 *	320	286	1988	(255)	
15 Apr 1989 *	186	150	1989	(148)	
28 Apr 1990 *	374	341	1990	(299)	

Note ; 1) Figurs with * are calculated by correlation analysis between daily maximum discharge and peak discharge.

$Qp = 0.984 * Qmax + 38.1$

2) Figurs is ( ) are calculated by relation between peak discharge rate and catchment area.

$Qp(No.23-24) = 0.798 * Qp(No.2323)$

Table A-2-9(b) Flood Peak Discharges

(unit ; m^3/sec)

No.2329			No.2325		
Date	Discharge		Date	Discharge	
	Peak	Maximam		Peak	Maximam
1965	(99.2)				
1966	(123)				
1967	(160)				
1968	(304)				
1969	(243)				
1970	(94.0)				
1971	(106)				
1972	(112)				
1973	(132)				
1974	(149)		22 Aug 1974	94.5	36.5
1975	(64.3)		19 Jun 1975	130	45.8
1976	(146)		29 Apr 1976	146	110
1977	(142)		1 May 1977	157	114
1978	(190)		6 May 1978	140	105
1979	(148)		4 Jul 1979	134	23.1
1980	(169)		11 Apr 1980	148	123
1981	(126)		10 Apr 1981	27.7	27.1
27 Apr 1982	* 129	104	23 Apr 1982	31.2	28.1
16 May 1983	70.6	62.0	12 Jun 1983	37.3	19.1
20 May 1984	309	259	20 May 1984	162	143
23 Apr 1985	174	136	15 Apr 1985	69.1	60.2
16 Apr 1986	149	113	15 Apr 1986	45.1	34.0
1 May 1987	250	223	7 May 1987	196	172
21 May 1988	* 268	227	19 May 1988	* 68.8	53.7
15 Apr 1989	* 104	82.5	13 Apr 1989	* 42.0	30.8
28 Apr 1990	* 268	227			

Note ; 1) Figurs with * are calculated by correlation analysis between daily maximum discharge and peak discharge.

(No.2329) $Qp = 1.131 * Qmax + 11.13$

(No.2325) $Qp = 1.168 * Qmax + 6.04$

2) Figurs is ( ) are calculated by relation between peak discharge rate and catchment area.

$Qp(No.2329) = 0.644 * Qp(No.2323)$

A-3 Geology and Construction Materials

APPENDIX-3 GEOLOGY

Contents

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-214 — (SHEET 1 of 5)

LOCATION	DAM SITE(RIVER BED)	DEPTH OF HOLE	99.50 m	COMMENCED	90-08-21
ELEVATION	1025.08 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-24
COORDINATE	X:4511918.62	CORE RECOVERY	%	DRILLED BY	Kaya-Celik
	Y:515742.32	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	L O G	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	0m			0 ➡ 100%								Kgf/cm²						%		0m
1025.08		Alluvial Deposit								Open Excavation: silty, fine sand with plant roots										
	1																			1
	2																		2.00m (Final)	2
	3									Cobbles and gravels:										3
	4									Gravel : 80%										4
	5									Cobble : 20%										5
	6									Max.cobble size:13cm										6
	7									Cobbles and gravels are originated from granite, dacite,granodiorite, basalt,diabase, and limestone. Gravels are rounded and subrounded; pinkish brown,grey,greenish grey. Grey is predominant among the other colours.										7
	8																			8
	9																			9
	10																			10
	11																			11
	12									Silty,sandy gravel with cobbles:										12
	13									Silty sand : 20%										13
	14									Cobble : 15%										14
	15									Gravel : 65%										15
	16									Max. cobble size : 14cm										16
	17																			17
	18																			18
	19																			19
1005.08	20																			20

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (subetick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-214 — (SHEET 2 of 5)

LOCATION	DAM SITE(RIVER BED)	DEPTH OF HOLE	99.50 m	COMMENCED	90-08-21
ELEVATION	1025.08 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-24
COORDINATE	X:4511918.62	CORE RECOVERY	%	DRILLED BY	Kaya-Celik
	Y:515742.32	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	20m			0 ⇔ 100%								Kgf/cm²						%		20m
1006.08	0	Alluvial Deposit								Silty,gravelly sand : Silt : 10% Fine gravel : 15-20% Sand : 70% Less amount of coarse gravel.										0
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
	30																			30
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
965.08	40																			40

core loss
RQD

▸driller's note◂
1(stick), 2(substick), 3(gravel), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC | GD
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-214 — (SHEET 3 of 5)

LOCATION	DAM SITE(RIVER BED)	DEPTH OF HOLE	99.50 m	COMMENCED	90-08-21
ELEVATION	1025.08 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-24
COORDINATE	X:4511918.62	CORE RECOVERY	%	DRILLED BY	Kaya-Celik
	Y:515742.32	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.m)	DEPTH
	40m			0 ⇒ 100%								Kgf/cm²						%		40m
985.08		Alluvial Deposit								Silty,sandy gravel : Silt-sand : 20-25% Gravel : 80%	—	—								
		Granite Porphyry			Pinkish brown	3	3	4		Fractured zone,oxidized (brown)joint surfaces, alteration in minerals is not distinct.	Lu=32									
						1		3												
						4		1												
								4												
						3		2 ~ 3			Lu=7									
					Pinkish grey	2	2	2		Several feather joints, fresh joint surfaces, occasional calcite and clay infillings.	Lu=8									
								1			Lu<1			10						
								1			Lu=6									
								1			Lu=8									
								2												
								1			Lu=17									
965.08	60							3												60

core loss
RQD

• driller's note •
1 (stiff), 2 (subvertical), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-214 — (SHEET 4 of 5)

LOCATION	DAM SITE(RIVER BED)	DEPTH OF HOLE	99.50 m	COMMENCED	90-08-21
ELEVATION	1025.08 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-24
COORDINATE	X:4511918.62	CORE RECOVERY	%	DRILLED BY	Kaya-Celik
	Y:515742.32	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	60m			0 ⇒ 100%								Kgf/cm²						%		60m
965.08		Granite Porphyry			Pinkish grey	2	2	3		59.50-61.15: Vertical joint with oxidized surface	Lu<1	10								
	1						1	1												1
	2						1	1		Several feather joints	Lu=4									2
	3						2	2												3
	4										Lu<1									4
	5							3												5
	6						2													6
	7						1	2		Fractured zone, oxidized joint surfaces, 2mm clay infilling	Lu<1									7
	8					2	3	1												8
	9							3												9
	70						2				Lu<1									70
	1							2												1
	2									Occasional feather joints	Lu=1.2									2
	3						2	2												3
	4							1												4
	5							3			Lu=2.5									5
	6																			6
	7							3												7
	8	Db			灰白	2	2				Lδ=2									8
		Gp			灰白	1	1	2		Fractured zone										
	9	Db			灰白	3	3	1			Lu=1.2									9
945.08	80	Gp				2	1	3												80
								1~2												

core loss
RQD

▸driller's note◂
1(stick), 2(substick), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-214 — (SHEET 5 of 5)

LOCATION	DAM SITE(RIVER BED)	DEPTH OF HOLE	99.50 m	COMMENCED	90-08-21
ELEVATION	1025.08 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-24
COORDINATE	X:4511918.62	CORE RECOVERY	%	DRILLED BY	Kaya-Celik
	Y:515742.32	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	80m			0 ⇒ 100%								Kgf/cm²						%		80m
945.09	0	Gp	+		Greenish grey	2	1	1		Hard, sound	Lu=1.2	10								0
	1		+					1												1
	2		+					1												2
		Db	⊥			2~3	2	2		Oxidized joint surface	Lu<1									
	3	Granite Porphyry	+																	3
	4		+				1													4
	5		+				2	2~3			Lu<1									5
	6		+			2	1	1			Lu=1.3									6
	7		+																	7
	8	Diabase	⊥								Lu=2									8
	9	Granite Porphyry	+				2~3	3		Occasional shattered zones.										9
	90		+					2~3			Lu<1									90
	1		+				1	1												1
	2		+				2~3	2~3		Fractured zone	Lu<1									2
	3		+								Lu=1.2									3
	4		+																	4
	5	Db	±			1														5
	6	Granite Porphyry	+				1	1		Feather joints	Lu=1.6									6
	7		+																	7
	8		+								Lu=1.1									8
	9		+																	9
925.58										End of the Borehole										
925.08	100																			100

core loss
RQD

» driller's note «
1 (stick) 2 (substick) 3 (piece) 4 (fragment) 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 6 (decomposed)

EPDC | ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. NiA-218 — (SHEET 1 of 3)

LOCATION	DAM SITE (RIVER BED)	DEPTH OF HOLE	52.65 m	COMMENCED	91-07-11
ELEVATION	1026.10 m	DIRECTION OF HOLE	90°	COMPLETED	91-09-02
COORDINATE	X:4511807.45	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515786.68	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	0m			0 ⇒ 100%								Kgf/cm²						%		0m
1026.10		Alluvial Deposit								Silt and fine sand, containing roots 1.5-21.0m Mainly φ=5-15cm gravels and φ=1-5mm coarse sands. Shape of sands is angular to subangular.				6.20m N=22 7.60m N>50 9.20m N=7 10.60m N=21 12.20m N=27 13.60m N=25					1.40m (Final)	
1006.10	20																			

driller's note: 1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain); 1 (hard) - 5 (soft); 1 (fresh) - 5 (decomposed); core loss; RQD

EPDC | ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. NiA-218 — (SHEET 2 of 3)

LOCATION	DAM SITE (RIVER BED)	DEPTH OF HOLE	52.65 m	COMMENCED	91-07-11
ELEVATION	1026.10 m	DIRECTION OF HOLE	90°	COMPLETED	91-09-02
COORDINATE	X:4511807.45	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515786.68	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH (20m)	ROCK NAME	LOG	CORE RECOVERY (0→100%)	COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	LUGEON	Pmax (Kgf/cm²)	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN (%)	G.W.L. (Dpt.H)	DEPTH (20m)
1006.10	20–25.6	Alluvial Deposit								21.0-21.45 Mainly fine sand, containing 10% gravel N=27 Mainly Coarse sand (φ=1-5mm) containing fine sand and gravels(φ=1-3cm) 24.0-24.45m N=42 Coarse sand and gravels. N= Same to 1.5-21.0m				21.00m / N=27 24.00m / N=42						20–25
	25.6–34.2	Rhyolite			Brown to Brownish grey	3	3	4; 3~4; 4		Slime and Fragments Mainly sharp edged fragments 3-5cm fragments only										
	30.6–31.4						2~3	3		Mainly 5-10cm Core										30
	31.4–34.2						3	4~3		Mainly Fragments and some pieces. Rock is hard but cracky. Crack surface are brown.										
	34.2–37.8				Grey	2~3	2	2~3		Hard substick core, but crack surface is oxidated and brown. 36.0-37.0m,Cracky C=3-4										
986.10	37.8–40					3	3	4		Mainly Vertical and cross joints. Crack surface is strongly weatherd, brownish.										40

Legend: RQD; core loss; 1 (fresh) ~ 5 (decomposed); 1 (hard) ~ 5 (soft); 1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain); ▸ driller's note ◂

EPDC — ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. NiA-218 — (SHEET 3 of 3)

LOCATION DAM SITE (RIVER BED) — DEPTH OF HOLE 52.65 m — COMMENCED 91-07-11

ELEVATION 1026.10 m — DIRECTION OF HOLE 90° — COMPLETED 91-09-02

COORDINATE X:4511807.45 — CORE RECOVERY % — DRILLED BY M.Celik

Y:515786.68 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	40m			0 → 100%								Kgf/cm						%		40m
986.10	0	Rhyolite			Grey to dark grey	3	3	4 1 3												0
	1																			1
	2					3~4	3~4	4		Fragments only										2
	3							3 1 4		5cm core and fragments										3
	4																			4
	5					3	3			Mainly Fragments and some pieces of core. Crack surfaces are sharp but weathered(brown) 45.0-45.9m Granite Porphyry										5
	6							4												6
	7	Granite Porphyry			Grey		2	3												7
	8					2		3 1 4		Somewhat cracky, but fracture surfaces are fresh. 48.9-49.0m,sheared zone.										8
	9						3													9
	50																			50
	1									Fresh and hard, stick core.										1
973.45	2					2	2	2												2
	3									End of the Borehole										3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
966.10	60																			60

core loss
RQD

▸driller's note◂
1(stick), 2(substick), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. N1-219 — (SHEET 1 of 4)

LOCATION	DAM SITE (RIVER BED)	DEPTH OF HOLE	62.00 m	COMMENCED	91-11-01
ELEVATION	1025.48 m	DIRECTION OF HOLE	90°	COMPLETED	91-12-30
COORDINATE	X:4511997.36	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515737.56	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH (0m)	ROCK NAME	LOG	CORE RECOVERY (0→100%)	COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	LUGEON	Pmax (Kgf/cm²)	Pc	DEPTH RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN (%)	G.W.L. (Dpt.H)	DEPTH (0m)
1025.48	0	Alluvial Deposit								0.0-43.0 Alluvium 0.0-1.5 Open excavation Silty sand										0
	2									Silty,sandy gravel : Silt-sand : 15-20% Gravel : 80% Gravels are fine,medium, and coarse in size,sub-rounded and angular in shape and originated from granite,diabase, rhyolite and limestone. Fine particles are washed away. 10cm block (granite) is encountered between 3.0-4.5m.									1.80m (Final)	2
	6									Rhyolite block Silty,sandy gravel : Silt-sand : 15% Gravel : 85% Characteristics of gravel are as it is mentioned above. Fine particles are completery washed away.										6
	9													9.20m N=43						9
	10									Silty,sandy gravel : Silt-sand : 20-25% Gravel : 75-80% Characteristics of gravel are as it is mentioned above. Fine particles are washed away.				11.60m N>50	φ86mm	φ4"				10
	13									13cm diabase block										13
	15																		1.50m (15.00m)	15
1005.48	20																			20

core loss — RQD

▸ driller's note ◂ 1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)

1 (hard) - 5 (soft)

1 (fresh) - 5 (decomposed)

EPDC — ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. Ni-219 — (SHEET 2 of 4)

LOCATION	DAM SITE (RIVER BED)	DEPTH OF HOLE	62.00 m	COMMENCED	91-11-01
ELEVATION	1025.48 m	DIRECTION OF HOLE	90°	COMPLETED	91-12-30
COORDINATE	X:4511997.36	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515737.56	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	20m			0 → 100%								Kgf/cm²						%		20m
1005.48		Alluvial Deposit								Clayey, silty, sandy gravel: Gravels are mostly fine in size ; occasionally medium gravels are encountered. Certain amount of fine particles are washed away. Fine material contains less percentage of clay. Fine material: 65% Gravel : 35%				24.10m N=20 25.10m N=37 27.10m N=30	φ86mm	φ4"				
										Silty,sandy gravel: Gravels are generally fine and medium in size; less amount of coarse gravels are encountered in place. Fine material: 25% Gravel : 75%										
										9cm rhyolite block between 33.0-33.45m. Silty sandy gravel : Fine material: 40-45% Gravel : 50-55% Gravels are generally fine in size ; occasionally 2-3cm gravels are also encountered.				36.10m N=31 37.70m N=38						
985.48	40									Silty, sandy gravel : Gravels are generally fine; less amount of medium gravels are encountered in place ; gravels are originated from granite. Fines are washed away. Fine material: 25% Gravel : 75%										

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

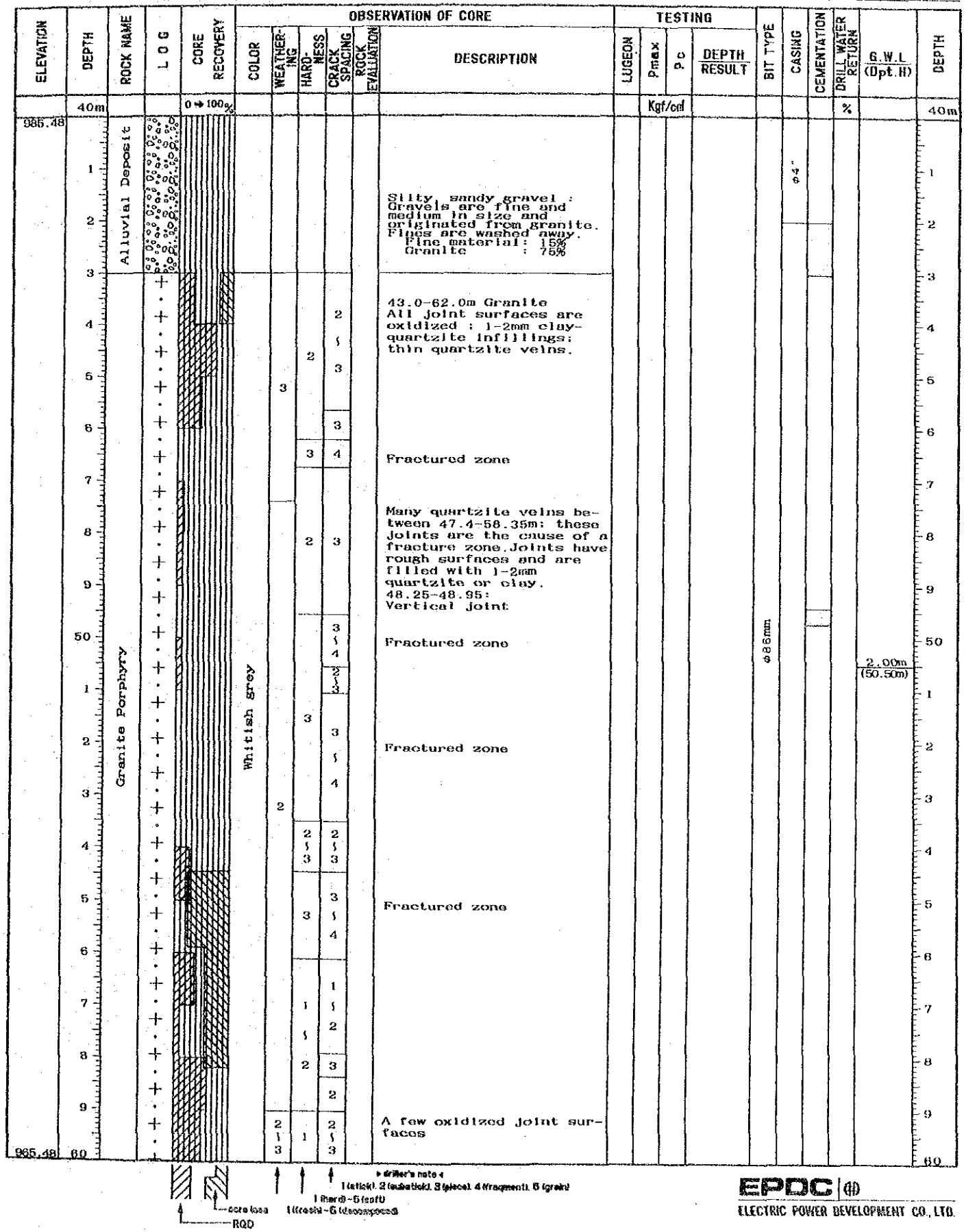
EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. NI-219 — (SHEET 3 of 4)

LOCATION	DAM SITE (RIVER BED)	DEPTH OF HOLE	62.00 m	COMMENCED	91-11-01
ELEVATION	1025.48 m	DIRECTION OF HOLE	90°	COMPLETED	91-12-30
COORDINATE	X:4511997.36	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515737.56	DRILLING MACHINE		LOGGED BY	I.Vardal



EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. Ni-219 — (SHEET 4 of 4)

LOCATION	DAM SITE (RIVER BED)	DEPTH OF HOLE	62.00 m	COMMENCED	91-11-01
ELEVATION	1025.48 m	DIRECTION OF HOLE	90°	COMPLETED	91-12-30
COORDINATE	X:4511997.36	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515737.56	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	60m			0 → 100%								Kgf/cm						%		60m
965.48	0	Gp	+ · + · + ·		Whitish grey	2	1	2 ~ 3		Very hard and sound					φ66mm					0
	1					1 ~ 3		1												1
963.48	2									End of the borehole										2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
	70																			70
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
945.48	80																			80

core loss
RQD

▸driller's note◂
1 (stick) 2 (substick) 3 (piece) 4 (fragment) 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-210 — (SHEET 1 of 7)

LOCATION DAM SITE (LEFT BANK) — DEPTH OF HOLE 127.00 m — COMMENCED 90-06-05

ELEVATION 1085.22 m — DIRECTION OF HOLE 90° — COMPLETED 90-10-04

COORDINATE X:4511879.04 — CORE RECOVERY % — DRILLED BY N.Cakir

Y:515613.04 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	0m			0 ⇒ 100%								Kgf/cm						%		0m
1085.22		Diabase			br	5	5	5		Strongly weathered 0-0.8m open excavation	—	—								
	1																			1
	2						3	4												2
	3						2	3												3
	4																			4
	5					3		3		Crack surface is oxidized										5
	6						3	3 4												6
	7							4												7
	8						2	3												8
	9				Dark Green		3	3 4			Lu=35	10								9
	10						2 1 3	3												10
	1						2	2		Crack surface is oxidized	Lu=9	10								1
	2					3		2												2
	3						2 1 3	1 3			Lu=28.5	10								3
	4						3	4		Fragments										4
	5							2			Lu=24.7	10								5
	6	Rhyolite			Pinkish White	3	3	4		Cracky along the contact										6
	7					2 1 3	2 1 3	2 1 3		17.00-17.25m Cracky	Lu=40.7	10								7
	8																			8
	9	Diabase				2 1 3	2 1 3	2 1 3		18.40-18.70m Cracky	Lu=40.1	10								9
1065.22	20																			20

core loss

RQD

> driller's note <
1 laticki, 2 laubatick, 3 piseci, 4 fragmenti, 5 grain)
1 (hardi - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC 69
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-210 — (SHEET 2 of 7)

LOCATION DAM SITE (LEFT BANK) — DEPTH OF HOLE 127.00 m — COMMENCED 90-06-05

ELEVATION 1085.22 m — DIRECTION OF HOLE 90° — COMPLETED 90-10-04

COORDINATE X:4511879.04 — CORE RECOVERY % — DRILLED BY N.Cakir

Y:515613.04 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	20m			0 ➡ 100%								Kgf/cm²						%		20m
1065.22		Diabase			Brownish Green, Grey	2~3	2~3	2~3			Lu=40	10								
	1						2~3	2												1
							3	4		Shear zone (20deg)										
	2					3	2	2		Vertical Joint	Lu'=43.6	8								2
							1~3	1~3												
	3						3	3												3
	4	Rhyolite			Light Grey						Lu'=46	8								4
	5																			5
	6									Crack surface is oxidized										6
	7					1	1	1			Lu=13	10								7
	8					1~2	1~2													8
	9										Lu=38	10								9
	30					2	2													30
	1										Lu=45	10								1
	2							2												2
	3										Lu'=40.5	3								3
	4					3	2	2~3		33.80-34.20 dinbase (30deg)										4
	5	Diabase			Dark Green			2~3			Lu=35	10								5
	6						2	4		Cracky zone	—	—								6
	7							2												7
						3				39.0-39.4m Cracky zone Crack surface is strongly oxidized. Many vertical Joints										
	8						3	3			Lu=4	10								8
1045.22	40																			40

core loss

RQD

▸driller's note◂
1(stick) 2(substick) 3(piece) 4(fragment) 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC | ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-210 — (SHEET 3 of 7)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	127.00 m	COMMENCED	90-06-05
ELEVATION	1085.22 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-04
COORDINATE	X;4511879.04	CORE RECOVERY	%	DRILLED BY	N.Cakir
	Y;515613.04	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	40m			0 → 100%								Kgf/cm²						%		40m
1045.22					Dark Green	3	3	3			Lu=1.3	10								
	1							3												1
	2							2			Lu=3	10								2
	3							3												3
	4						2			Calcite along crack surface	Lu<1	10								4
	5							2												5
	6										Lu<1	10								6
	7					2														7
	8						3	4			Lu=3	10								8
	9									48.80-49.00m Fragments										9
	50	Diabase				1	2	2												50
	1									Cracky	Lu<1	10								1
	2						2 ↓ 3	2 ↓ 3												2
	3					3		2			Lu<1	10								3
	4							2												4
	5							3		56.00-56.20m Fragment.	Lu<1	10								5
	6						2													6
	7							1		Crack surface is slightly oxidized.	Lu<1	10								7
	8							↓												8
	9							2			Lu<1	10							58.80m (Final)	9
1025.22	60																			60

core loss / RQD

▸driller's note◂ 1(tight) 2(substight) 3(piece) 4(fragment) 5(grain)

1(hard)~5(soft) 1(fresh)~5(decomposed)

EPDC ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-210 (SHEET 4 of 7)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	127.00 m	COMMENCED	90-06-05
ELEVATION	1085.22 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-04
COORDINATE	X:4511879.04	CORE RECOVERY	%	DRILLED BY	N.Cakir
	Y:515613.04	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	60m			0 → 100%								Kgf/cm						%		60m
1025.22		Diabase			Dark Grey	2	2	1 / 2			Lu<1	10								
								2			Lu<1	10								
							2 / 3	3			Lu=3	10								
						2	3	4		Slickenside observed on crack surface, Shear zone.	Lu=7	10								
						3	2 / 3	3 / 4		Shear zone Some part is silty.	Lu<1	10								
							3	4			Lu<1	10								
										Slime										
		Diabase			Dark Green			2		Slickenside on crack surface, slighty oxidized	Lu=4	10								
								4												
						2	2	2		74.9-75.0m Small fragment	Lu<1	10								
								3												
								2			Lu<1	10								
						1 / 2	1 / 2	1 / 2			Lu<1	10								
1005.22	80																			80

core loss
RQD

▸driller's note◂
1(fissile), 2(subfissile), 3(platy), 4(fragment), 5(grain)
1(hard)-5(soft)
1(fresh)-6(decomposed)

EPDC | 69
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. SK-210 — (SHEET 5 of 7)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	127.00 m	COMMENCED	90-06-05
ELEVATION	1085.22 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-04
COORDINATE	X:4511879.04	CORE RECOVERY	%	DRILLED BY	N.Cakir
	Y:515613.04	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	80m			0 → 100%								Kgf/cm						%		80m
1005.22		Diabase			Dark Green	1	1	1		Crack surface is not oxidized (fresh). Calcite on crack surface	Lu<1	10								
	1					1	1	2												1
	2					1	1	2												2
	3					2	2	1			Lus4.6	10								3
	4					2	2	1												4
	5					2	2	1			Lus2	10								5
	6					2	3	3		Vertical Joint										6
	7					1 2	1 2	2		Vertical Joint	Lu<1	10								7
	8	Rhyolite			Pinkish White	2	2	2			Lus4	10								8
	9					1 3	2 3	4												9
	90						2	2												90
	1	Diabase			Dyn	2 1 3	2	2			Lu<1	10								1
	2	Rhyolite			White-Pinkish White	2 1 3	2	2 3 2			Lu<1	10								2
	3																			3
	4						3	3												4
	5					3	3 4	3		HTA red color. Easily broken by finger in some part.	Lu<1	10								5
	6																			6
	7					3	3	3			Lu=0	10								7
	8																			8
	9										Lu<1	10								9
985.22	100							4		Small hard fragments										100

core loss
RQD

▸driller's note◂
1(stick), 2(substation), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~6(decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-210 — (SHEET 6 of 7)

LOCATION DAM SITE (LEFT BANK) — DEPTH OF HOLE 127.00 m — COMMENCED 90-06-05

ELEVATION 1085.22 m — DIRECTION OF HOLE 90° — COMPLETED 90-10-04

COORDINATE X:4511879.04 — CORE RECOVERY % — DRILLED BY N.Cakir

Y:515613.04 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	100m			0 → 100%								Kgf/cm						%		100m
985.22	0	Rhyolite			White-Pinkish White	3	3	4		HTA light grey, easily broken by finger in some place.	Lu=2	10								0
	1							3												1
	2							3			Lu<1	10								2
	3							4												3
	4						3	3												4
	5						5	5			Lu=1.2	10								5
	6						4	4												6
	7	Diabase			Dark Green	2	2	2		Calcite vein along cracks 106.4-106.6m HTA Somewhat soft	Lu<1	10								7
	8																			8
	9										Lu<1	10								9
110	10							2												10
	1							5			Lu<1	10								1
	2							3												2
	3	Rhyolite			White-Pinkish White	2	2	2			Lu<1	10								3
	4																			4
	5							4			Lu=1.3	10								5
	6									117.6-117.8m Cracky										6
	7							2			Lu<1	10								7
	8					4	4	5		HTA										8
	9									118.4-118.8m Diabase substic core	Lu<1	10								9
965.22	120					3	3	4			Lu=2									120

core loss

ROD

> driller's note <
1 (fetish), 2 (substick), 3 (piscal), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 6 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-210 — (SHEET 7 of 7)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	127.00 m	COMMENCED	90-06-05
ELEVATION	1085.22 m	DIRECTION OF HOLE	90°	COMPLETED	90-10-04
COORDINATE	X:4511879.04	CORE RECOVERY	%	DRILLED BY	N.Cakir
	Y:515613.04	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	120m			0 → 100%								Kgf/cm						%		120m
965.22	0	Rhyolite			Pinkish White	3	3	4		Mainly fragmental Somewhat HTA	Lu=2	10								0
	1																			1
	2										Lu=3									2
	3											10								3
	4	Gp				3	3	4			Lu=6.5									4
	5					3	3	3				10								5
	6	Ry				3	2 1 3	2			Lu=5.1	10								6
958.22	7									End of the Borehole										7
	8																			8
	9																			9
	130																			130
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
945.22	140																			140

core loss
RQD

▸ Driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 1 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	0m			0 ➡ 100%								Kgf/cm²						%		0m
1125.97		Diabase			Brown	4	4	4		Surfaces of fragments are strongly oxidized.	—	—			φ86mm					
	1																			1
	2						3	2												2
	3							5		Small fragments, partially soil										3
	4						4													4
	5							4												5
	6				Dark Green					6-7cm fractured zone at 6.9m (clay and breccia)										6
	7						2	2												7
	8					3					Lu=19	10								8
	9						2	2		Generally substick core										9
	10						1	1												10
	1						3	3		Generally substick core	Lu=25.2	10								1
	2									Crack surfaces are oxidized (brown color)										2
	3					2					Lu=10	10								3
	4						2	2												4
	5					1					Lu=12	10								5
	6						2													6
	7					3		3			Lu=17	10								7
	8							2												8
	9									Contact of diabase and dacite is adherent.	Lu=32	10								9
1105.97	20	Ry				3	3	4												20

▸driller's note◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)
core loss
RQD

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 2 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.m)	DEPTH
	20m			0 ⇒ 100%								Kgf/cm						%		20m
1105.97		Rhyolite			Light Green-Greenish Grey	3	2	2		Crack surfaces are oxidized (brownish color)	Lu=34	10								
											Lu=10	10								
											Lu'=42	5								
											Lu=30.5	10								
							3	3		28.4-34.0 vertical joints are predominant.	Lu'=46	2								
	30					3	3 ↓ 4	4		Crack surface is oxidized but no infilling along the crack surface.	Lu'=48	0								
						1														
						4	3	3			Lu'=49	0								
		Diabase			Dark Green			2		Crack surface is oxidized and 2-5mm calcite veins.	Lu=7	10								
						3	2				Lu<1	10								
								3												
								2			Lu<1	10								
1085.97	40																			40

core loss
RQD

▸driller's note◂
1 (stick), 2 (subangular), 3 (piece), 4 (fragment), 5 (grain)
1 (hard)~6 (soft)
1 (fresh)~5 (decomposed)

EPDC | 69
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 3 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.m)	DEPTH
	40m			0 ⇒ 100%								Kgf/cm²						%		40m
1085.97		Diabase			Dark Green	3	2	2		41-42m nearly vertical joints. Joints surfaces are brown.	Lu<1	10			ϕ86mm					
	1																			1
	2										Lu=1.6	10								2
	3																			3
	4					2	2	1		Stick core	Lu<1	10								4
	5																			5
	6									46.0-46.5m vertical joint										6
	7					3	2	2			Lu=4.9	10								7
	8																			8
	9					2 1 3	2	2			Lu<1	10								9
	50									50.0-50.3, 51.0-51.3m fragments										50
	1					3	3	3			Lu=11.5	10								1
	2																			2
	3					2				53.15-53.3m fragments Cracks are oxidized										3
	4					1 3	2	2			Lu<1	10								4
	5																			5
	6										—	—								6
	7									56.2-57.0m continuous lots of Quartz										7
	8					3	2	3			Lu=3.8	10								8
	9						4	5		Small brownish fragments										9
	60						2	3			Lu=1.7	10								60
1065.97						2	2	2												

core loss
RQD

▸driller's note◂
1 (stick), 2 (subetick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 4 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L. (Dpt.H)	DEPTH
	60m			0 ⇒ 100%								Kgf/cm						%		60m
1065.97							2	2		Sheared zone (consolidated)										
	1						4	3			Lu<1	10								1
								1												
	2					2														2
							2				Lu<1	10								
	3							2												3
	4					3	2	2			Lu=4.1	10								4
								1												
	5							3												5
	6																			6
	7									Fresh and hard stick core	Lu<1	10								7
	8									Cracks are slightly weathered.										8
	9					2	2	1			Lu<1	10								9
	70																			70
	1										Lu<1	10								1
	2									72.0-72.4m calcite vein (1cm)										2
	3					3	2	2			Lu<1	10								3
						2	2	2												
	4							4		Fragments	Lu<1	10							73.90m (Ftnal)	4
	5					3	2	2		Crack surfaces are brownish										5
							1	1			Lu<1	10								
	6						3	3												6
	7									77.0-77.2 somewhat cracky	Lu<1	10								7
						2		2												
	8					1	2													8
								3		Cracks are brown.	Lu<1	10								
	9					3														9
								2												
1045.97	80																			80

Diabase — Dark Green — φ86mm

core loss — RQD

▸driller's note◂ 1(stick), 2(substick), 3(piece), 4(fragment), 5(grain)

1(hard)~5(soft)

1(fresh)~5(decomposed)

EPDC | GD

ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 5 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH/RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	80m			0 ⇒ 100%								Kgf/cm²						%		80m
1045.97		Diabase			Dark Green	3	2	3		Fragments in some places. Surfaces of fragments are brown.	Lu=2	10			ϕ86mm					
	1						1	1												1
	2						3	4			Lu<1	10								2
	3					2	2	2												3
	4										Lu<1	10								4
	5																			5
	6					3~2	2	3			Lu<1	10								6
	7																			7
	8									Fresh and hard stick core	Lu<1	10								8
	9					2	2	2												9
	90										Lu<1	10								90
	1																			1
	2										Lu<1	10								2
	3							2		92.5m, 2cm sheared zone. (consolidated)										3
	4						2				Lu<1	10								4
	5					3	1	3		Mainly fragmental. Surfaces of fragments are brown.										5
	6						3	4			Lu=0	10								6
	7																			7
	8						3	4		Crack surfaces are fresh below 97.6m depth.										8
	9					2	2	3			Lu=0	10								9
1025.97	100							2		97.8-98.0m sheared zone. Fragments										100

core loss
RQD

▸ driller's note ◂
1(stick), 2(substick), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~6(decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 6 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	100m			0 → 100%								Kgf/cm						%		100m
1025.97		Diabase			Dark Green	2	2	2		Fragment surfaces are slightly weathered.	Lu=0	10			φ88mm					
	1						3	4												1
	2									100.4~100.6 silicified	Lu<1	10								2
	3							2												3
	4										Lu=0	10								4
	5									Calcite along cracks										5
	6							3												6
	7					1					Lu=0	10								7
	8							1												8
	9					1	2	1		Fresh and hard, stick to substick core	Lu<1	10								9
	110							2												110
	1										Lu<1	10								1
	2					2														2
	3										Lu=0	10								3
	4							2												4
	5									115.1~115.5m cracky Slickenside along crack surface.	Lu=1.3	10								5
	6																			6
	7					3	3	3		Vertical joint	Lu=1.5	10								7
	8					1				Silicified (30deg)										8
	9					1 2	2	2			Lu=0	10								9
1005.97	120																			120

core loss
RQD

* driller's note *
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard)~5 (soft)
1 (fresh)~5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 7 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir,Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH/RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.m)	DEPTH
	120m			0 ⇒ 100%								Kgf/cm						%		120m
1005.97		Diabase			Dark Green	2	2	2			Lu<1	10								
	1							3												1
								2												
	2					3	3	3~4		Sheared zone (40deg) Fragment	Lu=1.2	10								2
	3																			3
	4																			4
	5					2	2	2		125.5-125.6m cracky	Lu=1.3	10								5
	6																			6
	7										Lu<1	10								7
	8	Rhyolite			Grey	3	3	3		Many Qz(2-3mm,diameter)										8
	9					2	2	2		Partially fragmental	Lu=1.1	10								9
	130					2 1 3	2	3												130
		Db			D.grn	3	3	3		Dark green										
	1							2 1 3			Lu=7	10								1
	2									Crack surface is slightly reddish brown.	Lu<1	10								2
	3					1	1	1												3
	4																			4
	5					1	1			Flow structure	Lu=1.8	10								5
	6					2	2	2												6
	7										Lu<1	10								7
	8																			8
	9					2	2	3		Fragments in some place	Lu<1	10								9
985.97	140																			140

core loss
RQD

▸driller's note◂
1(soft) 2(subsoft) 3(plasel) 4(fragment) 5(gravel)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC | 40
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-212 — (SHEET 8 of 8)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	160.00 m	COMMENCED	90-10-31
ELEVATION	1125.97 m	DIRECTION OF HOLE	90°	COMPLETED	91-03-09
COORDINATE	X:4511856.03	CORE RECOVERY	%	DRILLED BY	Cakir.Celi
	Y:515565.43	DRILLING MACHINE		LOGGED BY	

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	140m			0 ⇒ 100%								Kgf/cm²						%		140m
985.97		Rhyolite				2	2	3												
	1						1			Some vertical joints	Lu=0	10								1
	2					2	2	2												2
	3						2				Lu=0	10								3
	4					3	3	4		Fragments Slickenside of calcite on crack surface										4
	5										Lu<1	10								5
	6							2												6
	7							3			Lu<1	10								7
	8							2												8
	9						2			Calcite on crack surface	Lu=2.3	10								9
150								1												150
	1									Calcite on crack surface	Lu<1	10								1
	2	Diabase			Dark Green	2		2							φ86mm					2
	3						2	3			Lu<1	10								3
	4																			4
	5						2	2			Lu<1	10								5
	6																			6
	7						3	3 4		Fragments	Lu<1	10								7
	8					2	2	2												8
	9					1 3	3	3 4		Fragments and 5-10cm core vertical joint.	Lu=0	10								9
965.97	160									End of the Borehole										160

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 6 (decomposed)

EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SKE-216 (SHEET 1 of 3)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	50.00 m	COMMENCED	91-05-07
ELEVATION	1048.3 m	DIRECTION OF HOLE	45°	COMPLETED	91-06-11
COORDINATE	X:4511845.76	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515663.26	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	0m			0 ⇒ 100%								Kgf/cm						%		0m
1048.30		Granite Porphyry			Pinkish Brown	3	3	4		Generally fractured; all joint surfaces are oxidized; mostly no alteration in minerals, occasional feather joints	Lu=34									
							1													
							4													
						3		3												
							3	2 ~ 3												
								3												
								2												
						5		1												
								3												
								3			Lu=29									
							1													
						4		2 ~ 3												
							3				Lu=33									
							1													
							4													
								4			Lu=34.6									
		Db			D.gr	3	2	2												
		Gp			p.tr	2	3	3		Fractured zone, oxidized joint surfaces										
		Diabase			Dark Grey			1			Lu=4.8									
						3	2			Oxidized joint surfaces	Lu=11									
								2		Hard, sound										
								1												
								3			Lu=12									
1028.30	20							2												20

10

▸ driller's note ◂
1 (stick) 2 (submatch) 3 (piece) 4 (fragment) 5 (grain)

1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

core loss
RQD

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. SKE-216 (SHEET 2 of 3)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	50.00 m	COMMENCED	91-05-07
ELEVATION	1048.3 m	DIRECTION OF HOLE	45°	COMPLETED	91-06-11
COORDINATE	X:4511845.76	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y:515663.26	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	20m			0 → 100%								Kgf/cm²						%		20m
1028.30	0	Diabase			Dark Grey	3	2	1			Lu=10									0
	1							1												1
	2							1												2
	3							2			Lu=4.8									3
	4							2												4
	5							2~3			Lu=10.1									5
	6	Granite Porphyry			Pinkish Brown	3	2	2		Oxidized joint surfaces, feather joints in place.										6
	7							1			Lu=9.9									7
	8							3												8
	9	Diabase			Dark Grey	3	2	2			Lu=4.7									9
	30																			30
	1										Lu=3.6									1
	2							2												2
	3					3	3	1			Lu<1									3
	4	Granite Porphyry			Pinkish Brown			3		Fractured zone, oxidized joint surfaces										4
	5							4												5
	6					3		2			Lu=6.7									6
	7					1	2	2			Lu=4.4									7
	8					4		3												8
	9						3	3		Fractured zone	Lu=9.8									9
1008.30	40							3~4												40

10

core loss
RQD

▸driller's note◂
1(stick), 2(subtick), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC (40)
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SKE-216 — (SHEET 3 of 3)

LOCATION	DAM SITE (LEFT BANK)	DEPTH OF HOLE	50.00 m	COMMENCED	91-05-07
ELEVATION	1048.3 m	DIRECTION OF HOLE	45°	COMPLETED	91-06-11
COORDINATE	X;4511845.76	CORE RECOVERY	%	DRILLED BY	M.Celik
	Y;515663.26	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L. (Dpt.H)	DEPTH
	40m			0 ⇒ 100%								Kgf/cm²						%		40m
1008.30		Granite Porphyry			Pinkish Brown		3	2		Feather joints	Lu=20	10								
	1							3												1
	2						3	3		Fractured zone, oxidized joint surfaces	Lu=1.9									2
	3					3	4	4												3
	4						3	2			Lu=4.5									4
	5					5														5
	6						3	3		Fractured zone, oxidized joint surfaces	Lu=8.9									6
	7					4	5	5												7
	8						4	4			Lu=8									8
	9																			9
938.30	50									End of the Borehole										50
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
938.30	60																			60

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-211 — (SHEET 1 of 8)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	150.00 m	COMMENCED	90-11-15
ELEVATION	1103.87 m	DIRECTION OF HOLE	90°	COMPLETED	91-04-04
COORDINATE	X:4511860.16	CORE RECOVERY	%	DRILLED BY	H.Basaran
	Y:515884.19	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.M)	DEPTH
	0m			0 → 100%								Kgf/cm²						%		0m
1103.87										Open excavation										
	1	Granite Porphyry			Pinkish brown					Slime										1
	2					4	3	4		Highly weathered Fragments	—	—								2
	3							3												3
	4																			4
	5					3	3	2		1-2cm thick diabase dikes have intruded along joints between 0.0-20.0m. Frequent feather joints, alteration in minerals, oxidation in joint surfaces, 5.9-6.2m, 6.6-6.8m Cracky C=4-3	Lu=42.3									5
	6							1												6
	7							3			Lu=39									7
	8																			8
	9					3		3		9.4-9.6m, 10.3-10.8m Fragments	Lu=35.6									9
	10					1 4	3	1 4												10
	1							2			Lu=50									1
	2							1 3				10								2
	3						2			Fairly hard and substick core, but many hair cracks.	Lu=44									3
	4					3	1													4
	5						3	2		1-2cm thick diabase intrudes along vertical joints.	Lu=9									5
	6																			6
	7										Lu=22									7
	8					3	3 1 4	3 1 4		Fractured zone fragments and piece core.										8
	9					4	3	2 1 3		Highly weathered Vertical joint from 18.8m to 19.9m.	Lu=7.6									9
1083.87	20																			20

core loss
RQD

> driller's note <
1(stick), 2(substick), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-211 (SHEET 2 of 8)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	150.00 m	COMMENCED	90-11-15
ELEVATION	1103.87 m	DIRECTION OF HOLE	90°	COMPLETED	91-04-04
COORDINATE	X:4511860.16	CORE RECOVERY	%	DRILLED BY	H.Basaran
	Y:515884.19	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	20m			0 ⇒ 100%								Kgf/cm						%		20m
1083.87		Granite Porphyry			Pinkish brown	3	3	2 \ 3		Cracky zone : oxidized joint surfaces	Lu=24.8	10			ϕ86mm					
	1																			1
	2							3			Lu=30.7									2
	3					3	3			Mainly fragments										3
	4					3 \ 4	3 \ 4	4			Lu=58.4									4
	5									Many cross hair cracks 25.5-26.0m, 27.0-27.2m, 27.7-28.3m Cracky C=4										5
	6							3			Lu=18									6
	7					3	3	\												7
	8							4			Lu=17.5									8
	9																			9
	30									Cracky zone : oxidized joint surfaces, alteration in minerals. Mainly small fragments 32.6-33.1m piece core										30
	1										Lu=1.1									1
	2					3	3													2
	3					\	\	4			Lu=5.9									3
	4					4	4													4
	5										Lu=4.8									5
	6						3	2		Vertical and high angle Joints are predominant.										6
	7						3 \ 4	4			Lu=8.2									7
	8					3		2 \ 3			—									8
	9						3 \ 4	4												9
1063.87	40																			40

core loss
RQD

▸driller's note◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)

1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-211 — (SHEET 3 of 8)

LOCATION DAM SITE (RIGHT BANK) — DEPTH OF HOLE 150.00 m — COMMENCED 90-11-15

ELEVATION 1103.87 m — DIRECTION OF HOLE 90° — COMPLETED 91-04-04

COORDINATE X:4511860.16 — CORE RECOVERY % — DRILLED BY H.Basaran

Y:515884.19 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	40m			0 ⇔ 100%								Kgf/cm²						%		40m
1063.87		Granite Porphyry			Pinkish brown	3 1 4	3 1 4	4		Fractured zone, oxidized joint surfaces.	Lu=4									
	1						3	3												1
	2									Hard substick core, partially fragments.	—									2
	3					3	2	2												3
							1	1												
	4						3	3												4
	5						3	3			—									5
	6									Many vertical joints	Lu=1.3									6
	7					3	3	3												7
	8					1	1	1		Extremely shattered zone, oxidized joint surfaces, frequent feather joints.	Lu=1.5								48.60m (Final)	8
	9					4	4	4												9
	50											10			φ86mm					50
		Db				3 4	3 4	3		Diabase										
	1	Granite Porphyry			Pinkish brown					Fracture surfaces are strongly oxidated.	—									1
						3	3	3												
	2					1	1	1												2
						4	4	4			Lu=1.9									
	3																			3
	4									Hard substick core.										4
	5							2												5
	6					2	2	1			Lu<1									6
	7					1				Oxidized joint surfaces, occasional feather joints.										7
								3												
	8					3					Lu<1									8
	9						3	4		Cracked zone										9
1043.87	60						1 4													60

core loss
RQD

▸driller's note◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard)~5 (soft)
1 (fresh)~5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. SK-211 — (SHEET 4 of 8)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	150.00 m	COMMENCED	90-11-15
ELEVATION	1103.87 m	DIRECTION OF HOLE	90°	COMPLETED	91-04-04
COORDINATE	X:4511860.16	CORE RECOVERY	%	DRILLED BY	H.Basaran
	Y:515884.19	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	60m			0 → 100%								Kgf/cm²						%		60m
1043.87							3~4	4		Fractured zone										
	1	Diabase	⊥		p.br	3					Lu<1									1
			⊥				2	2		Hard, sound										
	2		⊥																	2
			+				2			63.4-63.6m Cracky, C=4										
	3		+			3	1	3			Lu=1.6									3
			+				3													
	4		+																	4
			+							Mainly sharp edged fragments										
	5		+								Lu=4.6									5
			+					4												
	6		+							Fractured zone, oxidized joint surfaces, alteration in minerals.										6
			+			3														
	7		+								Lu=2.1									7
			+																	
	8		+			1	3			Sharp edged fragments and pieces of core										8
			+					3												
	9		+								Lu=1.8									9
			+			4		1												
	70		+																	70
			+					4		70.3-70.4m Highly weathered along the joint										
	1		+								Lu<1									1
			+									10								
	2	Db	⊥		D.gr	3~4	3	3~4							ø86mm					2
	3	Gp	+		P.gr	3~4	3	3~4		Granite porphyry	Lu<1									3
		Db	⊥		D.gr	3~4	3	3~4												
	4		+							Sharp edged fragments Crack surfaces are strong oxidated.										4
			+			3		4												
	5		+			1	3	1			Lu<1									5
			+			4		3												
	6		+																	6
		Granite Porphyry	+		Pinkish grey															
	7		+			2	1	1		Some oxidized joint surfaces.	Lu<1									7
			+				1	1												
	8		+			1	2	2												8
			+			3														
	9		+																	9
			+				2	3		Hard, sound	Lu<1									
1023.87	80		+				3	4												80

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (pieces), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 6 (decomposed)

EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

QLUR PROJECT — HOLE No. SK-211 — (SHEET 5 of 8)

LOCATION DAM SITE (RIGHT BANK) — DEPTH OF HOLE 150.00 m — COMMENCED 90-11-15

ELEVATION 1103.87 m — DIRECTION OF HOLE 90° — COMPLETED 91-04-04

COORDINATE X:4511860.16 — CORE RECOVERY % — DRILLED BY H.Basaran

Y:515884.19 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	80m			0 ⇒ 100%								Kgf/cm						%		80m
1023.87		Granite Porphyry			Pinkish grey	2	2	3		Cracky; some crack surfaces are oxidized.	Lu<1	10			φ86mm					
	1					1	3	4												1
						3														
	2						2	1		Hard, sound										2
							3	2												
	3							4		Fractured zone, oxidized joint surfaces	Lu<1									3
						3	3	1												
	4							3												4
	5					2		1		Fresh and hard stick to substick core.	Lu<1									5
						1	1	1												
	6					3		2												6
							2	2												
	7						3	3		Cracky but not oxidated	Lu<1									7
	8																			8
								2												
	9						2	1		Hard, sound, some oxidized joint surfaces, feather joints in place.	Lu<1									9
	90					2		3												90
	1										Lu<1									1
							1	1												
	2						1	1												2
	3						2	2			Lu<1									3
	4																			4
	5									95.0-95.7m, 95.6-95.8m Craky, C=4	Lu<1									5
	6					2		2												6
	7						2	1			Lu=0									7
	8					3		3												8
	9										Lu'=43.25	3								9
1003.87	100					3	2~3	3												100

▸driller's note◂
1(stick), 2(substick), 3(piece), 4(fragment), 6(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

core loss
RQD

EPDC | 電発
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-211 (SHEET 6 of 8)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	150.00 m	COMMENCED	90-11-15
ELEVATION	1103.87 m	DIRECTION OF HOLE	90°	COMPLETED	91-04-04
COORDINATE	X:4511860.16	CORE RECOVERY	%	DRILLED BY	H.Basaran
	Y:515884.19	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	100m			0 → 100%								Kgf/cm²						%		100m
1003.87		Granite Porphyry			Pinkish grey	3	2 ~ 3	3 ~ 4		Crack surfaces are strongly oxidated.	Lu=40	8			ϕ86mm					
	1							2 ~ 3		oxidized joint surfaces (brown in colour)										1
	2					2 ~ 3	2				Lu'=42.6	5								2
	3							2												3
	4						2 ~ 3	3		Vertical joints										4
	5										Lu=0	10								5
	6						1													6
	7					2	~	1		Hard, sound, no oxidation	Lu=0									7
	8						2				Lu=2.3									8
	9																			9
	110										Lu=2.2									110
	1							4												1
	2						2				Lu=2.1	10								2
	3							3		Fractured zone, oxidized joint surfaces 112.5-112.7m, 113.6-113.9m 114.3-114.5m, 114.9-115.0m 115.3-115.5m Cracky, C=4										3
	4						~													4
	5					3	3	4			Lu=1.8									5
	6																			6
	7										Lu=22.9									7
	8						2	2												8
	9						2 ~ 3	3 ~ 4		Cores are broken into fragment because of brown	Lu=18.1									9
983.87	120					3~5	2	2		Vertical joints										120

core loss / RQD

▸ driller's note ◂
1(stick), 2(subetick), 3(pieces), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. SK-211 — (SHEET 7 of 8)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	150.00 m	COMMENCED	90-11-15
ELEVATION	1103.87 m	DIRECTION OF HOLE	90°	COMPLETED	91-04-04
COORDINATE	X:4511860.16	CORE RECOVERY	%	DRILLED BY	H.Basaran
	Y:516884.19	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	120m			0 → 100%								Kgf/cm²						%		120m
983.87		Granite Porphyry			Pinkish grey	2	2	2 / 3		Fractured zone, oxidized joint surfaces	Lu=16.7									
	1																			1
	2						2	2												2
	3					2		3 / 4			Lu=18.2									3
	4						2													4
	5					1	1 / 3	1 / 2			Lu<1									5
	6					3														6
	7									Many vertical joints.	Lu<1									7
	8						3	3		Crack surfaces are not oxidated.										8
	9										Lu<1									9
130		Rhyolite			Grey	1 / 2	1 / 2	2												130
	1										Lu<1									1
	2	Gp			Pinkish grey	1 / 2	1 / 2	2		Hard and sound substick core		10			φ86mm					2
	3										Lu<1									3
	4	Rhyolite			Grey	1 / 2	1 / 2	1 / 2												4
	5										Lu<1									5
	6																			6
	7	Granite Porphyry			Pinkish grey	1 / 2	1 / 2	1 / 2			Lu=0									7
	8						4	3		Fractured zone no oxidation, weathering										8
	9					2	1	1 / 2			Lu=0									9
963.87	140																			140

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-211 — (SHEET 8 of 8)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	150.00 m	COMMENCED	90-11-15
ELEVATION	1103.87 m	DIRECTION OF HOLE	90°	COMPLETED	91-04-04
COORDINATE	X:4511860.16	CORE RECOVERY	%	DRILLED BY	H.Basaran
	Y:515884.19	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	140m			0 → 100%								Kgf/cm						%		140m
963.87	0	Granite Porphyry	+		Pinkish grey	1	2	1		Generally hard and sound, frequent feather joints.	Lu<1	10			φ86mm					0
	1		+					1												1
	2		+					2												2
	3		+			1		1			Lu<1									3
	4		+					1												4
	5		+			1	1	2			Lu<1									5
	6		+				1													6
	7		+			2		1			Lu<1									7
	8		+				2	3												8
	9		+					1			Lu=0									9
953.87	150									End of the Borehole										150
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
943.87	160																			160

core loss
RQD
▸ driller's note ◂
1 (alluvial), 2 (substratum), 3 (placer), 4 (fragment), 5 (gravel)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SKE-213 — (SHEET 1 of 3)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	50.00 m	COMMENCED	91-05-21
ELEVATION	1069.72 m	DIRECTION OF HOLE	45°	COMPLETED	91-07-03
COORDINATE	X;4511859.04	CORE RECOVERY	%	DRILLED BY	E.Gur
	Y;515843.87	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	0m			0 ➡ 100%								Kgf/cm						%		0m
1069.72										0-40cm slope wash										
	1					3				Mainly 1-5cm gravelly cores, brown weathering remarkable.										1
	2					1	3	4												2
						4														
	3																			3
	4									Many tight hair cracks in stick core. Remarkable brn.weathering along open cracks, generally cracks incline to vertical. 6.50-7.0m remarkable vertical crack with black coloured hematite.	—	—								4
	5					3		2												5
	6																			6
	7					1	2	1												7
	8					2		1												8
	9	Granite Porphyry			Milky White						Lu=14	10.6								9
	10					3	2	3		Many brown cracks.										10
	1					2		2		Generally good cores, but cracks brown, 10.95-11.45 somewhat cracky C=3	Lu=14	10.8								1
						1	2	1												
	2					3														2
	3					2	2	1		Good cores, but cracks brn cracks dip less than 45deg some tight hair cracks in stick cores.	Lu=18	10.9								3
	4																			4
	5									Generally good cores. incline to vertical cracks remarkable all cracks to vertical, all cracks brown to black. 16.0-16.50, 18.00-18.50m somewhat cracky, C=3 17.00-18.00m vertical crack. Other cracks dip steeper than 45deg	Lu=1.2	11.1								5
	6							2												6
	7					2	2	1			Lu=12	11.2								7
	8							3												8
	9										Lu=8.4	11.3								9
1049.72	20																			20

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

EPDC | 中部
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

OLUR PROJECT — HOLE No. SKE-213 — (SHEET 2 of 3)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	50.00 m	COMMENCED	91-05-21
ELEVATION	1069.72 m	DIRECTION OF HOLE	45°	COMPLETED	91-07-03
COORDINATE	X:4511859.04	CORE RECOVERY	%	DRILLED BY	E.Gur
	Y:515843.87	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Opt.H)	DEPTH
	20m			0 ➡ 100%								Kgf/cm²						%		20m
1049.72		Granite Porphyry			Milky White	3	2 1 3	2 1 3		Generally good cores, but cracks brown. 20.35-21.15 Horizontal cracks. Other cracks steeper than 45deg	Lu=0.9	11.5								
	1																			1
	2										Lu=2.1	11.6								2
	3									Good cores, but all cracks brown, cracks generally steeper than 45deg 24.70-24.80 C=3-4 28.60-28.80 C=3-4 29.70-30.00 C=3										3
	4										Lu=0.1	11.8								4
	5							2												5
	6					2	2	1			Lu=7.2	11.8								6
	7																			7
	8							3			Lu=8.3	11.8								8
	9																			9
	30									Cracky zone, all cracks brown remarkably, Cracks vertical to steeper than 45deg 30.35-30.70 C=2 31.00-31.45 C=2 32.70-33.00 C=2										30
	1										Lu=5.3	11.8								1
	2							3												2
	3					3	2	1			Lu=24	11.8								3
	4							2												4
	5						2			Somewhat cracky, hair cracks remarkable, vertical to steeper than 45deg, slickenside at 35m.	Lu=25	11.8								5
	6					3	1 3	2												6
	7	Diabase			Dark Grey					Generally good, but cracks brown. 39.80-40.00 C=3-4 hair cracks remarkable	Lu=3.5	11.8								7
	8							2												8
	9					3	2	1												9
1029.72	40							3			Lu=8.9	11.8								40

core loss
RQD

➤ driller's note ◀
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) - 5 (soft)
1 (fresh) - 5 (decomposed)

EPDC | 40
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SKE-213 — (SHEET 3 of 3)

LOCATION DAM SITE (RIGHT BANK) — DEPTH OF HOLE 50.00 m — COMMENCED 91-05-21

ELEVATION 1069.72 m — DIRECTION OF HOLE 45° — COMPLETED 91-07-03

COORDINATE X:4511859.04 — CORE RECOVERY % — DRILLED BY E.Gur

Y:515843.87 — DRILLING MACHINE — LOGGED BY I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	40m			0 ➡ 100%								Kgf/cm						%		40m
1029.72	0	Granite Porphyry & Diabase			Milky White to Grey					Good cores,but cracks brown.Cracks generally 45deg dip to steeper. Contacts between G.P and Diabase are generally tight, but at 41m,44m and 50m, opened slicken with remarkable oxidation. 43.80-44.00 C=3-4 45.80 C=3-4	Lu=17	11.8								0
	1																			1
	2																			2
	3							1			Lu=1.1	11.8								3
	4																			4
	5					2	2	1			Lu=2.0	11.8								5
	6																			6
	7							2			Lu=0.6	11.8								7
	8																			8
	9										Lu=0.3	11.8								9
1019.72	50									End of the Borehole										50
	1																			1
	2																			2
	3																			3
	4																			4
	5																			5
	6																			6
	7																			7
	8																			8
	9																			9
1009.72	60																			60

core loss

RQD

▸ driller's note ◂
1 (stick), 2 (subastick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard)~5 (soft)
1 (fresh)~5 (decomposed)

EPDC | ED
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-215 — (SHEET 1 of 4)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	80.00 m	COMMENCED	91-07-05
ELEVATION	1069.66 m	DIRECTION OF HOLE	90°	COMPLETED	91-12-09
COORDINATE	X;4511856.14	CORE RECOVERY	%	DRILLED BY	Gur.Basara
	Y;515844.34	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	0m			0 ➡ 100%								Kgf/cm²						%		0m
1069.66										0.0-1.5 Open excavation										
	1																			1
	2	Granite Porphyry			Yellowish dirty white	3	3	3		GP.Cores wethered,and all cracks brown. Many tight hair cracks in stick cores.										2
	3										—	—								3
	4					3	3	2		Generally good,but brown cracks remarkable and many hair cracks 4.40-4.50 C=4 4.85-4.95 C=4 5.50-5.60 C=4										4
	5							1												5
	6							3												6
	7									Good stick cores recovered, but weathering along cracks remarkable. Cracks generally-dip to vertical or steeper than 45deg. Many tight hair cracks. Stick cores between 13m to 14m somewhat sheared. Cracks at 8m,11.5-12m and 13m C=3-4	Lu'=5	6								7
	8																			8
	9							2			Lu'=56.25	8								9
	10					3	3	1												10
	1										Lu=37.83									1
	2							3												2
	3										Lu=36									3
	4					3	3	3		Brown weathered cracks remarkable major cracks dip to vert.										4
	5										Lu=43	10								5
	6					3	3	2		All cracks brown. Cracks dip to vertical hair cracks remarkable.										6
	7					3		1		Good stick cores recovered,but tight hair cracks remarkable. Generally, cracks dip to less than 45deg.Cracks weathered to brown color.	Lu=31.28									7
	8					1	2	1												8
	9					2		2			Lu=6.6									9
1049.66	20																			20

core loss
RQD

▸ driller's note ◂
1 (stick), 2 (substick), 3 (piece), 4 (fragment), 5 (grain)
1 (hard) ~ 5 (soft)
1 (fresh) ~ 5 (decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.

GEOLOGIC LOG OF DRILL HOLE

Page

OLUR PROJECT — HOLE No. SK-215 — (SHEET 2 of 4)

LOCATION	DAM SITE (RIGHT BANK)	DEPTH OF HOLE	80.00 m	COMMENCED	91-07-05
ELEVATION	1069.66 m	DIRECTION OF HOLE	90°	COMPLETED	91-12-09
COORDINATE	X:4511856.14	CORE RECOVERY	%	DRILLED BY	Gur.Basara
	Y:515844.34	DRILLING MACHINE		LOGGED BY	I.Vardal

ELEVATION	DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK EVALUATION	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	DEPTH / RESULT	BIT TYPE	CASING	CEMENTATION	DRILL WATER RETURN	G.W.L (Dpt.H)	DEPTH
	20m			0 → 100%								Kgf/cm²						%		20m
1049.66		Granite Porphyry			Yellowish dirty white	3		1		Good cores recovered. Core conditions same with depth between 16m to 20m.	Lu<1									
	1																			1
	2					1	2	1			Lu<1									2
	3																			3
	4					2		2		Cracky zone at 25m, C=3.	Lu=4.8									4
	5																			5
	6																			6
	7					3~4	3~2	4~3		3 parallel oblique joints Joint surfaces oxidized.	Lu=4.8									7
	8					3	1~2	2~3												8
						3~4	2~3	3~4												
	9							2			Lu=3.55									9
								1												
	30							3												30
	1					3	1	1			Lu=1.3									1
							2					10								
	2							2			Lu=3									2
	3							1												3
	4							3			—									4
								2												
	5						1	2												5
	6					3	1	3			Lu=1.3									6
								1												
	7						2	2												7
								3												
	8							1												8
	9					3~4	2~3	3~4		Fractured zone	Lu=2.16									9
						2	2	2												
						1~2	2	2~3												
1029.66	40					1	1	1												40

core loss
RQD

▸driller's note◂
1(stick), 2(substick), 3(piece), 4(fragment), 5(grain)
1(hard)~5(soft)
1(fresh)~5(decomposed)

EPDC
ELECTRIC POWER DEVELOPMENT CO., LTD.