

TABLES

CHAPTER 5

GEOLOGY

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Table 5.1.1 (1/2) WORK QUANTITIES OF GEOLOGICAL SURVEY AT DAMSITE

(DRILLING WORK)

Stage	Hole No.	Hole Diameter (mm)	Ground Elevation (m)	depth (m)	Lugeon-test (times)	Loading Test in Boreholes (times)	Coordinate		
							X	Y	
Phase I	B-4	86	137.77	95	17		428,237.753	9,222,232.940	
	B-5	86	88.57	100	18		428,304.925	9,222,232.535	
	B-6	86	148.10	130	24		428,352.984	9,222,196.636	
	B-7	66	90.42	70	13		428,257.687	9,222,170.483	
	B-8	66	87.17	70	13		428,296.050	9,222,281.423	
	B-9	66	170.99	90	15		428,090.750	9,222,307.094	
	B-10	66	178.12	90	16		428,178.438	9,222,268.797	
	B-11	66	188.91	100	17		428,491.528	9,222,133.311	
	B-12	66	137.07	80	15		428,326.556	9,222,194.498	
	B-13	66	148.47	80	14		428,374.956	9,222,255.730	
	B-14	66	196.26	85	11		427,806.500	9,222,449.500	
	B-15	66	185.75	60	9		428,597.783	9,221,889.908	
	B-16	66	126.05	30			428,115.560	9,222,186.588	
	B-17	66	131.45	40			428,335.838	9,222,467.660	
	B-18	66	136.08	80	14		428,213.456	9,222,177.350	
	B-19	66	147.48	80	14		428,324.282	9,222,132.942	
	B-20	66	139.37	80	14		428,260.416	9,222,309.886	
	B-21	66	92.96	20	3		428,208.826	9,222,060.330	
	B-22	66	83.61	20	3		428,358.238	9,222,392.018	
	B-23	66	158.15	40			428,157.131	9,222,227.643	
	B-24	66	156.47	40			428,205.189	9,222,322.208	
	B-25	66	122.56	81			428,309.834	9,222,405.566	
	B-26	66	133.17	50			428,391.625	9,222,366.069	
	B-27	66	136.65	88	15		428,150.248	9,222,084.714	
	Sub Total				1,699	245	0		
	Phase 2	B-28	66	128.774	115	19		428,218.310	9,222,152.634
		B-29	66	93.752	80	11		428,241.604	9,222,110.179
B-30		66	134.949	125	22		428,290.243	9,222,122.153	
B-31		66	147.380	65			428,242.766	9,222,025.286	
B-32		66	171.143	85		15	428,399.885	9,222,172.417	
B-33		66	88.096	33		5	428,278.790	9,222,208.195	
Sub Total				505	52	20			
Total				2,204	297	20			

(LABORATORY TEST OF CORE SAMPLE)

Stage	Item	Quantities (samples)	remarks
Phase I	Physical Property Test Density, Absorption Ratio and Effective Porosity	27	
	Unconfined Compression Test	27	

(SEISMIC PROSPECTING)

Stage	Location	Quantities (m)	remarks
Phase I	Dam Axis	800	
	Riverbed	500	
Total		1,300	

Table 5.1.1 (2/2) WORK QUANTITIES OF GEOLOGICAL SURVEY AT DAMSITE

(ADIT EXCAVATION WORK)

Stage	Adit No.	Ground Elevation (m)	Length (m)	Shear-test (times)	Coordinate	
					X	Y
Phase 1	T-1	92.75	20	8	428269.507	9222209.61
	T-2	117.87	30	0	428262.655	9222231.955
	T-3	140.03	30	4	428236.147	9222243.54
	T-4	138.97	30	0	428333.837	9222200.843
Total			110	12		

(TRENCH EXCAVATION WORK)

Stage	Trench No	Length (m)	Point	Coordinate		
				X	Y	Z
Phase 1	CL-R	114.00	Top	428405.849	9222169.366	173.511
			Bottom	428304.799	9222213.533	132.057
	CL-L	114.00	Top	428181.099	9222267.601	178.274
			Bottom	428256.721	9222234.548	124.999
	DS-R	101.00	Top	428436.334	9222221.262	177.067
			Bottom	428347.041	9222260.29	132.886
	DS-L	74.00	Top	428219.069	9222318.524	152.164
			Bottom	428283.962	9222290.161	119.217
	US-R	130.00	Top	428421.585	9222097.009	187.136
			Bottom	428305.765	9222147.633	137.3
	US-L	115.00	Top	428155.442	9222213.575	151.007
			Bottom	428238.037	9222177.473	120.646
Total		648.00				

(IN-SITU SHEARING TEST)

Stage	Adit No.	Depth (m)	Quantities		remarks
			Rock Shear Test (point)	lock Shear Tes (point)	
Phase 1	T-1	5.5m , 7.5m , 11.5m , 14.0m	4	4	Left Bank
	T-3	9.5m , 14.0m , 17.5m , 21.5m		4	Left Bank
Total	Total		4	8	

(IN-SITU PLATE LOADING TEST)

Stage	Adit No.	Depth (m)	Quantities	remarks
			(point)	
Phase 2	T-1	7.5m , 13.5m	2	Left Bank
	T-3	11.0m , 19.0m	2	Left Bank
	T-4	21.5m , 27.0m	2	Right Bank
Total	Total		6	

Table 5.1.2 GEOLOGICAL STRATA AT DAMSITE

Age		Formation and Stratum Name	Symbol	Description	
Quaternary	Holocene	Riverbed deposit	rd	Riverbed deposit consists of gravel, sand and clay. And it contains the huge fallen rocks at the gorge area, which was made by Kreo river.	
		Talus deposit	Td	Talus deposit consists of collapse soil and sand, detritus, fallen rocks. And it is accumulated on the foot of mountainside slope and cliff.	
Tertiary ~ Quaternary	Pliocene ~ Pleistocene	Damar	Upper Sedimentary Rock Unit	Su	The unit mainly consists of alternation of conglomerate, conglomeratic sandstone, tuffaceous sandstone and sandstone, and contains partly mafic tuff, volcanic conglomerate and volcanic breccia. The grain size of sandstone vary widely, and lamina is formed partly. The matrix of conglomerate consists of same material of sandstone, and gravel consists of andesite and pumice, and diameter of gravel is smaller than 50cm generally. Cracks hardly develop in the bedrock, and the degree of cementation of conglomerate, tuffaceous sandstone, sandstone and tuff is comparatively low, and lower cementation layer is formed partly in sandstone, conglomerate. Weathering zone of mother-rock is comparatively thick at a ridge of the left bank.
			Upper Pyroclastic Rock Unit	Pu	The unit mainly consists of volcanic breccia, and partly contains mafic tuff and andesite lava. The volcanic breccia contains fragments of andesite and pumice, and matrix consists of mafic tuff. Cracks hardly develop in the bedrock, and the hardness of rock is comparatively high.
			Middle Sedimentary Rock Unit	Sm	The unit mainly consists of alternation of conglomerate, conglomeratic sandstone, sandstone and tuffaceous sandstone, and partly contains mafic tuff. The facies of each rock and conditions of bedrock are almost same as the upper sedimentary rock unit. But mother-rock is almost fresh.
			Lower Pyroclastic Rock Unit	Pl	The unit mainly consists of volcanic breccia, and partly contains conglomerate, sandstone and mafic tuff. The facies of volcanic breccia is almost same as the upper pyroclastic rock unit, but partly contains organic material. Cracks hardly develop in the bedrock, and the hardness of rock is low in comparison with the upper pyroclastic rock unit.
			Lower Sedimentary Rock Unit	Sl	The unit mainly consists of alternation of conglomerate and sandstone, and partly contains siltstone, tuffaceous sandstone and mafic tuff. The degree of cementation of rocks is comparatively low, and lower cementation layer is formed in sandstone, conglomerate.

Table 5.1.3 PHYSICAL AND MECHANICAL PROPERTIES OF CORE SAMPLE AT DAMSITE

Bore Hole No. and Sampling Depth (m)	Rock	Rock Classification	Physical Property					Mechanical Property		
			Natural Density gf/cm ³	Saturated Surface Dry Density gf/cm ³	Oven Dry Density gf/cm ³	Natural Water Content %	Absorption Ratio %	Porosity %	Unconfined Compressive Strength kgf/cm ²	
B-5 (84.82 - 85.00)	Tuff	CL	1.28	1.66	1.06	20.57	56.48	59.76	5.84	
B-5 (69.45 - 69.62)	Tuff	CM-L	0.86	1.46	0.81	6.27	79.58	64.50	10.28	
B-13 (27.15 - 27.40)	Tuff	CM-L	1.00	1.51	0.86	16.86	76.66	65.64	13.48	
B-18 (35.40 - 35.56)	Tuff	CM-L	1.28	1.63	1.01	26.88	61.58	62.12	20.68	
B-18 (37.15 - 37.35)	Tuff	CM-L	1.62	1.87	1.36	18.68	76.66	65.64	13.48	
B-19 (23.90 - 24.30)	Tuff	CM-L	1.31	1.58	0.95	38.43	66.51	63.13	26.66	
B-19 (56.25 - 56.45)	Tuff	CM-L	1.67	1.98	1.48	12.62	33.23	49.30	27.46	
B-20 (40.05 - 40.20)	Tuff	CM-L	0.95	1.45	0.72	31.65	101.33	72.79	17.46	
B-18 (34.78 - 35.00)	Tuffaceous Sandstone	CM-L	1.22	1.67	1.07	14.08	55.75	59.67	35.39	
B-18 (50.34 - 50.56)	Tuffaceous Sandstone	CM-L	1.42	1.70	1.11	28.07	52.79	58.63	7.51	
B-20 (51.26 - 51.46)	Tuffaceous Sandstone	CM-L	1.40	1.68	1.08	29.47	55.70	60.08	13.87	
B-5 (89.69 - 89.88)	Sandstone	CL	0.94	1.48	0.77	21.82	91.23	70.39	11.39	
B-19 (58.50 - 58.67)	Sandstone	CM-L	1.29	1.59	0.96	34.72	65.60	62.94	18.51	
B-18 (40.09 - 40.32)	Conglomeratic Sandsto	CM-L	1.92	2.15	1.81	6.19	18.96	34.26	64.73	
B-18 (41.72 - 41.93)	Conglomeratic Sandsto	CM-L	1.50	1.88	1.36	10.77	38.33	51.95	45.44	
B-19 (29.29 - 29.40)	Conglomeratic Sandsto	CM-L	1.75	2.01	1.54	13.49	30.13	46.45	42.91	
B-20 (35.20 - 35.40)	Conglomeratic Sandsto	CM-L	1.67	1.96	1.47	13.88	33.53	49.16	56.09	
B-20 (48.40 - 48.60)	Conglomeratic Sandsto	CM-L	1.34	1.66	1.04	28.58	59.80	62.24	9.52	
B-20 (43.45 - 43.65)	Conglomeratic Sandsto	CM-H	2.06	2.14	1.76	17.09	21.60	38.03	42.91	
B-20 (45.55 - 45.70)	Conglomeratic Sandsto	CM-H	1.45	1.83	1.28	13.84	43.11	54.98	63.80	
B-19 (22.10 - 22.40)	Conglomerate	CM-H	2.39	2.45	2.24	6.72	9.38	20.97	55.48	
B-18 (22.70 - 22.90)	Volcanic Breccia(upper	CM-H	2.40	2.44	2.24	6.87	8.99	20.16	92.36	
B-19 (38.70 - 39.00)	Volcanic Breccia(upper	CM-H	2.20	2.24	1.97	11.81	13.58	26.76	98.48	
B-20 (33.30 - 33.45)	Volcanic Breccia(upper	CM-H	2.11	2.19	1.88	12.20	16.05	30.24	66.37	
B-18 (69.10 - 69.32)	Volcanic Breccia(lower	CM-H	2.00	2.06	1.67	19.57	23.41	39.11	27.70	
B-19 (75.25 - 75.45)	Volcanic Breccia(lower	CM-H	1.72	1.94	1.47	16.47	31.70	46.70	21.19	
B-20 (64.80 - 65.00)	Volcanic Breccia(lower	CM-H	1.80	2.01	1.58	14.16	26.95	42.57	29.09	

Table 5.1.4 RESULT OF SHEARING TEST IN ADITS AT DAMSITE

Adit	Rock Kind	Rock Classification	No. (Location*)	Initial Vertical Load P(tf)	Maximum Shear Load S(tf)	Vertical Stress (P+S x sin 15°) / A (tf/m ²)	Shear Stress S x cos 15° / A (tf/m ²)	Note
T-1	Conglomeratic Sandstone	CM-H	T-1-1 (5.5m)	20.00	38.00	82.90	102.00	The fracture was found along the contact plane with the concrete and the rock.
			T-1-2 (7.5m)	10.00	26.00	46.50	69.80	
	Fine Sandston	CM-L	T-1-3 (11.5m)	20.00	29.00	76.40	77.80	
			T-1-4 (14.0m)	10.00	25.00	45.80	67.10	
T-3	Tuffaceous Sandstone	CL	T-3-1 (9.5m)	10.00	18.00	40.70	48.30	
			T-3-2 (13.5m)	20.00	27.00	75.00	72.50	
			T-3-3 (17.5m)	20.00	42.00	85.80	112.70	
			T-3-4 (21.5m)	10.00	33.00	51.50	88.60	
T-1	Conglomeratic Sandstone	CM-H	T-1-1 (5.5m)	12.00	46.00	149.50	277.70	
			T-1-2 (7.5m)	6.00	24.00	76.40	144.90	
	Fine Sandston	CM-L	T-1-3 (11.5m)	6.00	15.00	61.80	90.60	
			T-1-4 (14.0m)	12.00	8.00	104.10	108.70	

Note

: Shear Area of Block Shear Test A=0.6m x 0.6m

: Shear Area of Rock Shear Test A=0.4m x 0.4m

* : Location express a distance from the entrance of adits.

Concrete block was broken by shear load.

Table 5.1.5 RESULT OF PLATE LOADING TEST IN ADITS AT DAMSITE

Test Point		Condition			Result of Test						Note
Adit No.	Distance from the (m)	Point No.	Target Layer	Rock Classification	Elastic Modulus (kgf/cm ²)	Deformation Modulus (kgf/cm ²)	Critical Point (kgf/cm ²)	Strain at the Critical (mm)	Maximum Stress of the Test (kgf/cm ²)	Strain at the Maximum Stress (mm)	
T1	13.5	T 1-1	Fine Sandstone	CM-L	9,300	5,600	---	---	35.0	1.28	0.65
	7.5	T 1-2	Conglomeratic Sandstone	CM-H	13,200	6,100	---	---	35.3	1.21	0.94
T3	19.0	T 3-1	Tuffaceous Sandstone	CL	8,600	6,300	---	---	35.3	1.11	0.56
	11.0	T 3-2	Tuffaceous Sandstone	CL	2,900	2,100	18.3	1.63	35.3	8.56	9.68
T4	27.0	T 4-1	Fine Sandstone with Gravel	CL	7,500	1,800	---	---	34.5	4.00	3.83
	21.5	T 4-2	Fine Sandstone with Tuff	CL	4,200	2,000	29.9	3.47	35.6	4.94	7.63

* Strain and Displacement are shown with the average value of four test values of strain sensor.

Table 5.1.6 RESULT OF LOADING TEST IN BOREHOLES

Test Point		Condition		Result of Test							Note
Bore hole No.	Depth (m)	Point No.	Target Layer	Rock Classification	Elastic Modulus (kgf/cm ²)	Deformation Modulus (kgf/cm ²)	Critical Point (kgf/cm ²)	Yield Point (kgf/cm ²)	Maximum Stress of the Test (kgf/cm ²)	Radius at the Maximum Stress (mm)	
B-32	9.7	B32-1	Tuffaceous Sandstone	CL	1,100	500	12	17	18	40.0	37.4
	13.0	B32-2	Sandstone	CL	1,500	600	12	25	25	41.5	37.9
	19.0	B32-3	Tuffaceous Sandstone	CL	1,400	700	13	30	30	41.7	37.2
	23.8	B32-4	Tuff	CL	600	400	16	30	32	43.4	38.8
	28.5	B32-5	Tuff	CL	5,800	3,400	26	60	60	40.6	38.4
	33.0	B32-6	Volcanic	CM-H	7,700	4,200	70	95	100	39.4	38.4
	37.8	B32-7	Volcanic	CM-H	33,100	14,200	---	---	100	38.6	38.4
	45.9	B32-8	Tuff	CM-L	7,500	2,800	55	75	80	42.6	40.8
	53.1	B32-9	Sandstone	CM-L	17,200	9,700	55	90	100	42.1	40.1
	58.0	B32-10	Volcanic	CL	4,700	2,700	45	70	80	43.0	39.3
	63.5	B32-11	Volcanic	CM-H	8,000	4,300	60	100	100	40.7	39.2
	68.6	B32-12	Fine Sandstone	CM-L	50,000	15,000	---	---	100	38.6	38.5
	73.5	B32-13	Sandstone	CM-L	4,300	2,700	30	45	60	44.6	39.3
	77.0	B32-14	Fine Sandstone	CM-L	11,200	7,600	40	65	70	39.7	38.6
	84.0	B32-15	Coarse Sandstone	CM-L	11,000	6,200	55	90	100	39.4	38.1
B-33	16.5	B33-1	Volcanic	CM-H	11,000	4,300	70	90	100	38.9	38.3
	21.8	B33-2	Volcanic	CM-H	7,200	4,700	No Data	No Data	No Data	No Data	38.5
	25.8	B33-3	Volcanic	CM-H	6,400	3,800	70	90	100	39.9	38.7
	29.5	B33-4	Volcanic	CM-H	2,200	1,500	70	95	100	40.6	38.6
	34.5	B33-5	Volcanic	CM-H	9,200	7,600	80	---	100	39.3	38.8

* The second stage of Loading Test at the B33 was stopped by an explosion of the probe. Therefore, the pressure data of the critical point and the yield point could not be gotten.

Table 5.1.7 (1/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B - 4	1	10.15 - 15.00	4.85	Upper Sedimentary Rock	CM-L	2.80	3.33	0.71	6.27	22.06	
	2	15.15 - 20.00	4.85	Upper Sedimentary Rock	CM-I	4.29	3.85	0.76	7.50	21.28	
	3	20.15 - 25.00	4.85	Upper Pyroclastic Rock	CM-H	1.86	10.01	1.86	12.00	2.95	
	4	25.15 - 30.00	4.85	Upper Pyroclastic Rock	CM-H	0.75	4.95	0.40	12.06	1.28	
	5	30.15 - 35.00	4.85	Middle Sedimentary Rock	CM-L	1.70	8.57	3.16	7.26	22.19	
	6	35.15 - 40.00	4.85	Middle Sedimentary Rock	CM-L	3.93	7.49	1.72	12.14	8.87	
	7	40.15 - 45.00	4.85	Middle Sedimentary Rock	CM-H	3.08	7.55	1.08	9.89	22.56	
	8	45.15 - 50.00	4.85	Middle Sedimentary Rock	CM-L	1.95	9.38	4.54	11.75	15.09	
	9	50.15 - 55.00	4.85	Middle Sedimentary Rock	CM-L	5.12			12.55	10.76	
	10	55.15 - 60.00	4.85	Lower Pyroclastic Rock	CM-H	0.08			13.51	0.32	
	11	60.15 - 65.00	4.85	Lower Pyroclastic Rock	CM-H	1.13			13.51	0.45	
	12	65.15 - 70.00	4.85	Lower Pyroclastic Rock	CM-H	6.27	9.19	5.44	12.41	9.94	
	13	70.15 - 75.00	4.85	Lower Pyroclastic Rock	CM-H	0.47			13.51	0.68	
	14	75.15 - 80.00	4.85	Lower Pyroclastic Rock	CM-H	0.85	9.52	0.81	13.49	1.79	
	15	80.15 - 85.00	4.85	Lower Pyroclastic Rock	CM-H	0.89			13.50	1.54	
	16	85.15 - 90.00	4.85	Lower Pyroclastic Rock	CM-H	1.34			13.47	1.89	
	17	90.15 - 95.00	4.85	Lower Pyroclastic Rock	D	3.43	6.49	1.65	11.21	12.29	
B - 5	1	10.15 - 15.00	4.85	Lower Pyroclastic Rock	D	105.40			2.34	18.76	
	2	15.15 - 20.00	4.85	Lower Pyroclastic Rock	CM-H	5.51			10.06	5.53	
	3	20.15 - 25.00	4.85	Lower Pyroclastic Rock	CM-H	5.68			10.03	5.69	
	4	25.15 - 30.00	4.85	Lower Pyroclastic Rock	CM-H	5.73			10.00	5.73	
	5	30.15 - 35.00	4.85	Lower Pyroclastic Rock	CM-H	1.06			10.15	1.07	
	6	35.15 - 40.00	4.85	Lower Pyroclastic Rock	CM-H	1.30			10.15	1.32	
	7	40.15 - 45.00	4.85	Lower Sedimentary Rock	D	71.31			1.63	20.87	
	8	45.15 - 50.00	4.85	Lower Sedimentary Rock	CM-L	105.24			1.08	21.03	
	9	50.15 - 55.00	4.85	Lower Sedimentary Rock	D	>100			-1.70	21.07	
	10	55.15 - 60.00	4.85	Lower Sedimentary Rock	D	>100			-2.60	20.91	
	11	60.15 - 65.00	4.85	Lower Sedimentary Rock	D	Spring : 56 l/min - 1.8 Kg/cm ²					
	12	65.15 - 70.00	4.85	Lower Sedimentary Rock	CL	>100			-1.86	14.10	
	13	70.15 - 75.00	4.85	Lower Sedimentary Rock	CL	162.70			0.28	17.24	
	14	75.15 - 80.00	4.85	Lower Sedimentary Rock	CL	1.35			10.14	1.36	
	15	80.15 - 85.00	4.85	Lower Sedimentary Rock	D	32.49	4.23	11.59	4.57	15.96	
	16	85.15 - 90.00	4.85	Lower Sedimentary Rock	CL	57.10			2.38	16.04	
	17	90.15 - 95.00	4.85	Lower Sedimentary Rock	CL	71.91			4.49	15.79	
	18	92.15 - 100.00	4.85	Lower Sedimentary Rock	D	19.03			5.00	10.50	

Table 5.1.7 (2/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B - 6	1	8.15 - 10.00		1.85	Upper Sedimentary Rock	CM-L	22.72			5.87	13.15
	2	10.15 - 15.00		4.85	Upper Sedimentary Rock	CM-L	30.72	2.25	7.09	7.06	25.03
	3	15.15 - 20.00		4.85	Upper Sedimentary Rock	CL	12.94	6.49	8.45	9.34	21.63
	4	20.15 - 25.00		4.85	Upper Sedimentary Rock	CM-L	12.56	6.48	8.00	9.57	17.57
	5	25.15 - 30.00		4.85	Upper Sedimentary Rock	CL	8.44	7.20	5.94	10.49	13.81
	6	30.15 - 35.00		4.85	Upper Pyroclastic Rock	CM-H	3.42			11.24	3.84
	7	35.15 - 40.00		4.85	Upper Pyroclastic Rock	CM-H	3.10			11.24	3.51
	8	40.15 - 45.00		4.85	Middle Sedimentary Rock	CM-L	3.80	4.33	1.44	10.45	11.30
	9	45.15 - 50.00		4.85	Middle Sedimentary Rock	CM-L	6.92			10.93	7.59
	10	50.15 - 55.00		4.85	Middle Sedimentary Rock	CM-L	4.60			13.46	6.93
	11	55.15 - 60.00		4.85	Middle Sedimentary Rock	CM-L	5.33			13.31	7.67
	12	60.15 - 65.00		4.85	Middle Sedimentary Rock	CL	9.51	9.21	8.45	10.16	19.18
	13	65.15 - 70.00		4.85	Middle Sedimentary Rock	CL	8.65	9.18	7.63	11.23	15.30
	14	70.15 - 75.00		4.85	Lower Pyroclastic Rock	CM-H	9.44	8.17	7.26	10.31	14.43
	15	75.15 - 80.00		4.85	Lower Pyroclastic Rock	CM-H	4.09			13.44	6.19
	16	80.15 - 85.00		4.85	Lower Pyroclastic Rock	CM-H	4.11			12.59	5.48
	17	85.15 - 90.00		4.85	Lower Pyroclastic Rock	CM-H	2.55			12.99	3.63
	18	90.15 - 95.00		4.85	Lower Pyroclastic Rock	CM-H	2.74			12.80	3.88
	19	95.15 - 100.00		4.85	Lower Pyroclastic Rock	CM-H	1.24			12.95	1.72
	20	100.15 - 105.00		4.85	Lower Sedimentary Rock	CL	4.08			12.53	5.44
	21	105.15 - 110.00		4.85	Lower Sedimentary Rock	CL	4.48			13.08	6.39
	22	110.15 - 115.00		4.85	Lower Sedimentary Rock	CL	12.36	5.59	3.92	7.08	19.13
	23	115.15 - 120.00		4.85	Lower Sedimentary Rock	CL	14.79	4.05	5.98	-3.75	20.51
	24	120.15 - 125.00		4.85	Lower Sedimentary Rock	CL	0.86	7.40	0.46	12.16	7.84
B - 7	1	5.00 - 10.00		5.00	Middle Sedimentary Rock	CL	55.78			2.52	20.44
	2	10.00 - 15.00		5.00	Lower Pyroclastic Rock	CM-H	3.61	3.19	1.56	9.98	9.36
	3	15.00 - 20.00		5.00	Lower Pyroclastic Rock	CM-H	4.58	4.19	2.16	10.04	7.04
	4	20.00 - 25.00		5.00	Lower Pyroclastic Rock	CM-H	3.30			10.18	3.38
	5	25.00 - 30.00		5.00	Lower Pyroclastic Rock	CM-H	2.53			10.19	2.57
	6	30.00 - 35.00		5.00	Lower Pyroclastic Rock	CM-H	1.80			9.20	1.63
	7	35.00 - 40.00		5.00	Lower Pyroclastic Rock	CM-H	2.10	4.19	0.81	10.12	3.20
	8	40.00 - 45.00		5.00	Lower Sedimentary Rock	D	176.30	0.55	19.76	0.55	19.76
	9	45.00 - 50.00		5.00	Lower Sedimentary Rock	CM-L	29.12	2.91	13.92	3.06	20.20
	10	50.00 - 55.00		5.00	Lower Sedimentary Rock	CL	35.29			5.62	17.04
	11	55.00 - 60.00		5.00	Lower Sedimentary Rock	CL	45.33			3.59	19.60
	12	60.00 - 65.00		5.00	Lower Sedimentary Rock	CL	36.69	2.01	14.52	2.16	19.36
	13	66.00 - 70.00		5.00	Lower Sedimentary Rock	CL	48.99			1.48	13.80

Table 5.1.7 (3/9) RESULT OF LUIGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B - 8	1	5.00	10.00	5.00	Middle Sedimentary Rock	CL	47.90	1.61	8.40	1.90	14.04
	2	10.00	15.00	5.00	Lower Pyroclastic Rock	CM-H	9.20	5.16	5.20	9.92	11.08
	3	15.00	20.00	5.00	Lower Pyroclastic Rock	CM-H	11.80			9.77	11.52
	4	20.00	25.00	5.00	Lower Pyroclastic Rock	CM-H	6.10			10.07	6.12
	5	25.00	30.00	5.00	Lower Pyroclastic Rock	CM-H	2.50		3.23	10.09	5.28
	6	30.00	35.00	5.00	Lower Pyroclastic Rock	CM-H	1.70		3.23	10.11	4.48
	7	35.00	40.00	5.00	Lower Pyroclastic Rock	CM-H	1.40			10.22	1.47
	8	40.00	45.00	5.00	Lower Pyroclastic Rock	CM-H	58.90			2.94	14.68
	9	45.00	50.00	5.00	Lower Sedimentary Rock	D	67.60	0.48	10.55	0.07	15.71
	10	50.00	55.00	5.00	Lower Sedimentary Rock	CL	65.10			5.24	19.07
	11	55.00	60.00	5.00	Lower Sedimentary Rock	D	25.80			5.90	15.40
	12	60.00	65.00	5.00	Lower Sedimentary Rock	CL	17.90			6.27	13.64
	13	66.00	70.00	5.00	Lower Sedimentary Rock	CL	21.00		2.66	5.92	18.92
B - 9	1	16.10	20.00	3.90	Upper Sedimentary Rock	CM-L	17.06	7.51	13.44	10.97	21.28
	2	20.10	25.00	4.90	Upper Sedimentary Rock	CM-L	11.14	8.00	8.94	11.49	14.49
	3	25.10	30.00	4.90	Upper Sedimentary Rock	CM-L	7.13			12.39	9.43
	4	30.10	35.00	4.90	Upper Sedimentary Rock	CM-L	7.96		5.02	3.14	20.61
	5	35.10	40.00	4.90	Upper Sedimentary Rock	CM-L	6.89		6.71	3.43	12.11
	6	40.10	45.00	4.90	Upper Sedimentary Rock	CM-L	15.75		6.82	8.24	9.23
	7	45.10	50.00	4.90	Upper Sedimentary Rock	CM-L	4.57		6.63	2.04	13.40
	8	50.10	55.00	4.90	Upper Pyroclastic Rock	CM-H	13.91		7.22	7.35	10.25
	9	55.10	60.00	4.90	Upper Pyroclastic Rock	CM-H	2.44		6.72	1.22	13.81
	10	60.10	65.00	4.90	Upper Pyroclastic Rock	CM-H	2.90			14.37	5.47
	11	65.10	70.00	4.90	Upper Pyroclastic Rock	CM-L	2.96			14.48	5.92
	12	70.10	75.00	4.90	Middle Sedimentary Rock	CM-H	1.37		8.89	1.00	13.88
	13	75.10	80.00	4.90	Middle Sedimentary Rock	CM-H	0.49		12.97	0.86	13.59
	14	80.10	85.00	4.90	Middle Sedimentary Rock	CM-L	0.33		7.96	0.31	13.64
	15	85.10	90.00	4.90	Lower Pyroclastic Rock	CL	2.54		8.90	1.93	12.93

Table 5.1.7 (4/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B - 10	1	11.10 -	15.00	3.90	Upper Sedimentary Rock	CM-H	2.90	4.30	1.10	8.53	23.64
	2	15.10 -	20.00	4.90	Upper Sedimentary Rock	CM-L	4.76			11.34	5.43
	3	20.10 -	25.00	4.90	Upper Sedimentary Rock	CL	5.36			9.89	5.31
	4	25.10 -	30.00	4.90	Upper Sedimentary Rock	CM-L	16.95	3.59	6.08	6.92	19.96
	5	30.10 -	35.00	4.90	Upper Sedimentary Rock	CL	15.21	3.60	5.47	6.44	20.37
	6	35.10 -	40.00	4.90	Upper Sedimentary Rock	CM-H	4.80	4.42	2.12	6.61	21.22
	7	40.10 -	45.00	4.90	Upper Sedimentary Rock	CM-H	9.11	6.95	5.10	9.36	19.71
	8	45.10 -	50.00	4.90	Upper Sedimentary Rock	CM-L	20.81	5.65	11.76	8.98	21.71
	9	50.10 -	55.00	4.90	Upper Sedimentary Rock	CL	9.36	5.97	5.59	9.41	20.86
	10	55.10 -	60.00	4.90	Upper Sedimentary Rock	CM-L	6.52	11.22	7.59	12.55	11.27
	11	60.10 -	65.00	4.90	Upper Pyroclastic Rock	CM-H	4.65			13.47	6.90
	12	65.10 -	70.00	4.90	Upper Pyroclastic Rock	CM-H	2.31			15.27	4.69
	13	70.10 -	75.00	4.90	Upper Pyroclastic Rock	CM-H	1.75			15.41	3.27
	14	75.10 -	80.00	4.90	Middle Sedimentary Rock	CM-L	7.42	7.16	5.92	12.16	16.29
	15	80.10 -	85.00	4.90	Middle Sedimentary Rock	CM-H	1.68			15.40	2.44
	16	85.10 -	90.00	4.90	Middle Sedimentary Rock	CM-H	3.56	8.72	3.16	15.55	9.26
B - 11	1	17.00 -	20.00	3.00	Upper Sedimentary Rock	CM-L	4.80	7.98	3.60	9.85	10.87
	2	20.00 -	25.00	5.00	Upper Sedimentary Rock	CM-L	4.20	5.38	2.20	7.70	20.12
	3	24.50 -	30.00	4.50	Upper Sedimentary Rock	CM-L	3.60	6.85	2.16	11.92	12.55
	4	30.00 -	35.00	5.00	Upper Sedimentary Rock	CM-L	3.50	6.38	1.64	12.36	13.20
	5	35.00 -	40.00	5.00	Upper Sedimentary Rock	CL	2.90	6.90	1.65	12.63	13.64
	6	40.00 -	45.00	5.00	Upper Sedimentary Rock	CM-H	1.20	6.91	0.50	13.77	4.28
	7	45.00 -	50.00	5.00	Upper Sedimentary Rock	CM-L	1.80	6.91	0.85	13.45	7.36
	8	50.00 -	55.00	5.00	Upper Sedimentary Rock	CM-L	2.80	6.56	1.29	13.18	6.48
	9	55.00 -	60.00	5.00	Upper Sedimentary Rock	CM-L	4.30	5.56	1.33	12.25	11.36
	10	60.00 -	65.00	5.00	Upper Pyroclastic Rock	CM-H	1.80			13.49	2.90
	11	65.00 -	70.00	5.00	Upper Pyroclastic Rock	CM-H	3.30			13.25	5.16
	12	70.00 -	75.00	5.00	Upper Pyroclastic Rock	CM-H	3.60			13.23	5.72
	13	75.00 -	80.00	5.00	Middle Sedimentary Rock	CM-L	2.30	6.64	1.07	12.98	7.00
	14	80.00 -	85.00	5.00	Middle Sedimentary Rock	CM-L	3.60			12.99	7.48
	15	85.00 -	90.00	5.00	Middle Sedimentary Rock	CM-L	5.60			12.74	8.24
	16	90.00 -	95.00	5.00	Lower Pyroclastic Rock	CM-H	6.18	9.36	5.68	11.90	11.00
	17	95.00 -	100.00	5.00	Lower Pyroclastic Rock	CM-H	2.50			13.70	3.90

Table 5.1.7 (5/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B - 12	1	5.10 -	10.00	4.90	Upper Sedimentary Rock	CM-H	26.40	1.72	4.55	3.07	23.22
	2	10.10 -	15.00	4.90	Upper Sedimentary Rock	CM-L	36.29	2.78	15.43	4.01	24.33
	3	15.10 -	20.00	4.90	Upper Sedimentary Rock	CM-L	76.42			3.05	25.10
	4	20.10 -	25.00	4.90	Upper Sedimentary Rock	CL	35.88	3.29	15.24	3.91	24.00
	5	25.10 -	30.00	4.90	Upper Pyroclastic Rock	CM-H	6.30	6.18	3.22	11.50	12.37
	6	30.10 -	35.00	4.90	Middle Sedimentary Rock	CM-L	7.07	6.18	3.76	11.40	12.45
	7	35.10 -	40.00	4.90	Middle Sedimentary Rock	CM-L	3.30	5.65	1.51	11.92	10.73
	8	40.10 -	45.00	4.90	Middle Sedimentary Rock	CM-L	3.81	6.61	1.92	12.83	10.57
	9	45.10 -	50.00	4.90	Middle Sedimentary Rock	CM-L	7.57	5.79	5.96	11.57	13.67
	10	50.10 -	55.00	4.90	Middle Sedimentary Rock	CL	14.12			10.98	16.00
	11	55.10 -	60.00	4.90	Lower Pyroclastic Rock	CM-H	2.54			13.35	3.63
	12	60.10 -	65.00	4.90	Lower Pyroclastic Rock	CM-H	2.56			13.45	3.67
	13	65.10 -	70.00	4.90	Lower Pyroclastic Rock	CM-H	5.18			13.01	7.27
	14	70.10 -	75.00	4.90	Lower Pyroclastic Rock	CM-H	1.03			13.64	1.58
	15	75.10 -	80.00	4.90	Lower Pyroclastic Rock	CM-H	0.11			13.67	0.19
B - 13	1	11.10 -	15.00	3.90	Upper Sedimentary Rock	CM-L	130.84	1.40	25.49	1.40	25.49
	2	15.10 -	20.00	4.90	Upper Sedimentary Rock	CM-L	52.30			3.18	20.78
	3	20.10 -	25.00	4.90	Upper Sedimentary Rock	CM-L	2.38	5.05	1.27	10.98	16.90
	4	25.40 -	30.00	4.60	Upper Sedimentary Rock	CM-L	3.43	5.75	1.70	11.05	13.13
	5	30.10 -	35.00	4.90	Upper Pyroclastic Rock	CM-H	3.52	4.31	1.18	11.61	11.43
	6	35.10 -	40.00	4.90	Upper Pyroclastic Rock	CM-H	4.09	5.80	1.59	12.06	10.98
	7	40.10 -	45.00	4.90	Upper Pyroclastic Rock	CM-H	3.78	5.79	1.88	11.78	12.08
	8	45.10 -	50.00	4.90	Middle Sedimentary Rock	CM-L	8.26			12.12	10.37
	9	50.10 -	55.00	4.90	Middle Sedimentary Rock	CM-L	9.27			11.94	11.35
	10	55.10 -	60.00	4.90	Middle Sedimentary Rock	CM-L	7.52			11.93	10.82
	11	60.10 -	65.00	4.90	Middle Sedimentary Rock	CM-L	7.30			11.81	11.18
	12	65.10 -	70.00	4.90	Lower Pyroclastic Rock	CM-H	8.04			11.66	11.35
	13	70.10 -	75.00	4.90	Lower Pyroclastic Rock	CM-H	0.29			13.17	0.45
	14	75.10 -	80.00	4.90	Lower Pyroclastic Rock	CM-H	1.59	7.17	0.84	12.91	4.50

Table 5.1.7 (6/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								P_c (kg/cm ²)	Q_c (m/m)	P_m (kg/cm ²)	Q_m (l/m/m)
B - 14	1	30.10 - 35.00		4.90	Upper Sedimentary Rock	CM-L	2.20	9.34	1.95	13.19	5.67
	2	35.10 - 40.00		4.90	Upper Sedimentary Rock	D	1.85	9.79	1.78	13.34	8.61
	3	40.10 - 45.00		4.90	Upper Sedimentary Rock	CL	0.82	10.07	0.83	13.98	3.49
	4	45.10 - 50.00		4.90	Upper Sedimentary Rock	CL	0.94	6.52	0.38	13.27	12.45
	5	50.10 - 55.00		4.90	Upper Sedimentary Rock	CL	1.44	7.24	0.51	13.69	13.18
	6	55.10 - 60.00		4.90	Upper Sedimentary Rock	CL	1.34	9.71	1.25	13.85	13.88
	7	60.10 - 65.00		4.90	Upper Sedimentary Rock	CL	0.41	8.09	0.36	15.58	6.94
	8	65.10 - 70.00		4.90	Upper Sedimentary Rock	CM-L	0.95	11.69	1.28	15.41	5.16
	9	70.10 - 75.00		4.90	Upper Sedimentary Rock	D	7.65	7.20	5.51	14.26	13.71
	10	75.10 - 80.00		4.90	Upper Sedimentary Rock	CL	1.21			13.78	3.27
	11	80.60 - 85.00		4.40	Upper Pyroclastic Rock	CM-H	0.52			15.91	1.05
B - 15	1	15.00 - 20.00		5.00	Upper Sedimentary Rock	CM-H	2.05	4.90	1.44	11.65	8.88
	2	20.00 - 25.00		5.00	Upper Sedimentary Rock	CM-L	6.06			12.17	7.56
	3	25.00 - 30.00		5.00	Upper Sedimentary Rock	CM-L	6.10			12.49	7.80
	4	30.00 - 35.00		5.00	Upper Sedimentary Rock	CL	4.91			11.57	6.04
	5	35.00 - 40.00		5.00	Upper Sedimentary Rock	CM-H	4.87			11.37	5.76
	6	40.00 - 45.00		5.00	Upper Sedimentary Rock	CM-L	1.05	6.59	0.62	11.34	5.71
	7	45.00 - 50.00		5.00	Upper Sedimentary Rock	CM-L	2.11	8.85	1.77	11.66	5.02
	8	50.00 - 55.00		5.00	Upper Sedimentary Rock	CM-H	2.30	8.80	1.92	12.59	5.08
	9	55.00 - 60.00		5.00	Upper Sedimentary Rock	CM-L	1.90	6.74	1.35	12.34	6.41
B - 18	1	12.10 - 15.00		2.90	Upper Sedimentary Rock	CM-L	2.14	4.41	0.85	10.52	33.38
	2	15.10 - 20.00		4.90	Upper Pyroclastic Rock	CM-H	1.01			10.51	1.07
	3	20.10 - 25.00		4.90	Upper Pyroclastic Rock	CM-H	1.29			11.55	1.51
	4	25.10 - 30.00		4.90	Middle Sedimentary Rock	CM-H	1.09			11.60	1.29
	5	30.10 - 35.00		4.90	Middle Sedimentary Rock	CM-L	0.91	7.78	0.70	11.49	7.35
	6	35.10 - 40.00		4.90	Middle Sedimentary Rock	CM-L	1.20	9.83	1.18	10.82	1.86
	7	40.10 - 45.00		4.90	Middle Sedimentary Rock	CM-L	1.38	7.89	1.04	11.63	6.12
	8	45.10 - 50.00		4.90	Middle Sedimentary Rock	CM-L	1.09	5.94	0.46	10.82	11.84
	9	50.10 - 55.00		4.90	Lower Pyroclastic Rock	CM-L	2.65			12.18	3.33
	10	55.10 - 60.00		4.90	Lower Pyroclastic Rock	CM-H	2.56			12.08	3.18
	11	60.10 - 65.00		4.90	Lower Pyroclastic Rock	CM-H	0.63	10.21	0.65	12.18	1.75
	12	65.10 - 70.00		4.90	Lower Pyroclastic Rock	CM-H	0.63			12.01	0.80
	13	70.10 - 75.00		4.90	Lower Pyroclastic Rock	CM-H	0.38	7.99	0.27	11.88	3.08
	14	75.10 - 80.00		4.90	Lower Pyroclastic Rock	CM-H	0.10	10.00	0.10	11.99	0.94

Table 5.1.7 (7/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)	Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
							Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B - 19	1	10.00 - 15.00	5.00	Upper Sedimentary Rock	CM-H	32.03			4.87	15.08
	2	15.00 - 20.00	5.00	Upper Sedimentary Rock	CM-L	75.64			2.54	20.32
	3	20.00 - 25.00	5.00	Upper Sedimentary Rock	CM-H	14.77	4.28	6.32	6.71	13.12
	4	25.00 - 30.00	5.00	Upper Sedimentary Rock	CM-L	2.50	4.21	1.01	11.30	13.32
	5	30.00 - 35.00	5.00	Upper Pyroclastic Rock	CM-H	9.36			10.89	10.37
	6	35.00 - 40.00	5.00	Upper Pyroclastic Rock	CM-H	34.63	2.13	7.36	1.81	19.72
	7	40.00 - 45.00	5.00	Middle Sedimentary Rock	CM-L	58.63	3.02	17.68	2.57	22.32
	8	45.00 - 50.00	5.00	Middle Sedimentary Rock	CM-L	7.51			13.57	12.44
	9	50.00 - 55.00	5.00	Middle Sedimentary Rock	CM-L	9.09			13.05	14.00
	10	55.00 - 60.00	5.00	Middle Sedimentary Rock	CM-L	13.89	8.12	11.08	9.76	23.28
	11	60.00 - 65.00	5.00	Lower Pyroclastic Rock	CM-L	17.53	6.64	7.60	9.86	18.33
	12	65.00 - 70.00	5.00	Lower Pyroclastic Rock	CM-H	0.47			15.43	0.88
	13	70.00 - 75.00	5.00	Lower Pyroclastic Rock	CM-H	1.64			15.47	2.65
	14	75.00 - 80.00	5.00	Lower Pyroclastic Rock	CM-H	1.04			15.01	1.60
B - 20	1	12.60 - 15.00	2.40	Upper Sedimentary Rock	CL	49.34	4.09	24.42	6.42	41.63
	2	15.60 - 20.00	4.40	Upper Sedimentary Rock	CL	5.05	3.83	1.95	9.16	16.52
	3	21.60 - 25.00	3.40	Upper Pyroclastic Rock	CL	1.36	3.95	0.26	4.68	11.71
	4	25.10 - 30.00	4.90	Upper Pyroclastic Rock	CM-H	3.12	5.95	1.63	10.93	14.73
	5	30.10 - 35.00	4.90	Upper Pyroclastic Rock	CM-H	1.93	4.96	0.55	10.78	14.57
	6	35.10 - 40.00	4.90	Middle Sedimentary Rock	CM-L	3.06	5.95	1.38	10.60	14.57
	7	40.10 - 45.00	4.90	Middle Sedimentary Rock	CM-L	2.46	5.97	1.22	11.55	7.67
	8	45.10 - 50.00	4.90	Middle Sedimentary Rock	CM-H	2.04	9.99	2.04	11.83	4.94
	9	50.10 - 55.00	4.90	Middle Sedimentary Rock	CM-L	1.40	5.12	0.46	11.23	9.96
	10	55.10 - 60.00	4.90	Lower Pyroclastic Rock	CM-H	3.00	10.49	3.20	12.39	4.53
	11	60.10 - 65.00	4.90	Lower Pyroclastic Rock	CM-H	0.52			12.64	0.65
	12	65.10 - 70.00	4.90	Lower Pyroclastic Rock	CM-H	0.69			12.64	0.91
	13	70.10 - 75.00	4.90	Lower Pyroclastic Rock	CM-H	2.06	6.62	1.39	11.39	6.28
	14	75.10 - 80.00	4.90	Lower Pyroclastic Rock	CM-H	0.02			12.66	0.00
B - 21	1	5.00 - 15.00	10.00	Lower Pyroclastic Rock	CM-H	12.30			7.45	9.40
	2	10.00 - 15.00	5.00	Lower Pyroclastic Rock	CM-H	7.80			10.03	7.84
	3	15.00 - 20.00	5.00	Lower Pyroclastic Rock	CM-H	1.19	3.18	0.64	9.12	4.12
B - 22	1	5.00 - 10.00	5.00	Lower Pyroclastic Rock	CM-H	27.40	2.10	6.60	4.44	21.28
	2	10.00 - 15.00	5.00	Lower Pyroclastic Rock	CM-H	2.70			10.13	3.76
	3	15.00 - 20.00	5.00	Lower Pyroclastic Rock	CM-H	7.90			9.96	7.83

Table 5.1.7 (8/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								$P_c(\text{kg}/\text{cm}^2)$	$Q_c(\text{m}/\text{m})$	$P_m(\text{kg}/\text{cm}^2)$	$Q_m(\text{m}/\text{m})$
B - 27	1	11.10	15.00	3.90	Upper Sedimentary Rock	CM-L	185.66			1.68	25.23
	2	15.10	20.00	4.90	Upper Pyroclastic Rock	CM-H	2.69	2.80	0.49	10.45	10.78
	3	20.10	25.00	4.90	Upper Pyroclastic Rock	CM-H	1.23	8.38	0.97	9.65	13.76
	4	25.10	30.00	4.90	Middle Sedimentary Rock	CM-L	3.41	6.33	1.71	9.85	10.20
	5	30.10	35.00	4.90	Middle Sedimentary Rock	CM-L	1.31	4.19	0.55	4.56	21.71
	6	35.10	40.00	4.90	Middle Sedimentary Rock	CM-H	2.22	11.05	2.57	12.78	6.91
	7	40.10	45.00	4.90	Middle Sedimentary Rock	CM-H	2.15	9.79	2.07	10.52	17.84
	8	45.10	50.00	4.90	Middle Sedimentary Rock	CM-L	1.15	7.97	0.72	11.43	17.71
	9	50.10	55.00	4.90	Lower Pyroclastic Rock	CM-H	0.31	7.26	0.21	12.38	14.49
	10	55.10	60.00	4.90	Lower Pyroclastic Rock	CM-H	1.88	10.24	1.95	13.80	8.62
	11	60.10	65.00	4.90	Lower Pyroclastic Rock	CM-H	3.34	7.38	2.37	13.60	8.86
	12	65.10	70.00	4.90	Lower Pyroclastic Rock	CM-H	0.25	10.26	0.25	14.01	4.69
	13	70.10	75.00	4.90	Lower Pyroclastic Rock	CM-H	0.35			14.30	0.61
	14	75.10	80.00	4.90	Lower Pyroclastic Rock	CM-H	0.59			14.28	0.90
	15	80.10	85.00	4.90	Lower Pyroclastic Rock	CM-H	0.82			14.23	1.47
B-28	1	5.00	10.00	5.00	Upper Sedimentary Rock	CM-L	26.37			6.55	13.56
	2	10.00	15.00	5.00	Upper Pyroclastic Rock	CM-H	2.48	4.30	1.00	11.26	4.48
	3	15.00	20.00	5.00	Upper Pyroclastic Rock	CM-H	4.79	4.49	1.47	11.00	12.52
	4	20.00	25.00	5.00	Middle Sedimentary Rock	CM-L	5.12	5.57	2.80	11.18	10.24
	5	25.00	30.00	5.00	Middle Sedimentary Rock	CM-L	12.35	3.74	4.38	10.33	17.52
	6	30.00	35.00	5.00	Middle Sedimentary Rock	CM-H	2.87	5.75	1.40	11.40	7.88
	7	35.00	40.00	5.00	Middle Sedimentary Rock	CM-L	3.98	6.45	2.57	12.11	7.62
	8	40.00	45.00	5.00	Middle Sedimentary Rock	CM-L	3.10	5.39	1.09	12.08	6.51
	9	45.00	50.00	5.00	Lower Pyroclastic Rock	CM-H	5.20	4.38	1.32	11.95	7.32
	10	50.00	55.00	5.00	Lower Pyroclastic Rock	CM-H	0.10			12.39	0.77
	11	55.00	60.00	5.00	Lower Pyroclastic Rock	CM-H	8.33			11.77	8.85
	12	60.00	65.00	5.00	Lower Pyroclastic Rock	CM-H	1.20			12.53	1.94
	13	65.00	70.00	5.00	Lower Pyroclastic Rock	CM-H	0.01	10.58	0.00	12.52	2.30
	14	70.00	75.00	5.00	Lower Pyroclastic Rock	CM-H	1.72			12.30	2.31
15	75.00	80.00	5.00	Lower Pyroclastic Rock	CM-H	1.56			12.55	1.90	
16	80.00	85.00	5.00	Lower Sedimentary Rock	CL	>100			5.48	10.12	
17	95.00	100.00	5.00	Lower Sedimentary Rock	CL	5.97	5.32	4.87	11.30	9.14	
18	100.00	105.00	5.00	Lower Sedimentary Rock	CL	>100			2.78	6.84	
19	110.00	115.00	5.00	Lower Sedimentary Rock	CL	0.38	6.54	0.35	9.95	5.48	

Table 5.1.7 (9/9) RESULT OF LUGEON TEST AT DAMSITE

Bore Hole Number	Stage Number	Depth of Test (m)		Stage Length (m)	Geological Unit	Rock Classification	Lu	Critical Point		Max Point	
								Pc(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
B-29	1	5.00 - 10.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	41.53			6.52	20.00
	2	10.00 - 15.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	3.99	8.07	3.32	9.97	7.56
	3	15.00 - 20.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	17.40			9.53	13.40
	4	20.00 - 25.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	12.27			9.79	8.28
	5	25.00 - 30.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	0.27	8.07	0.21	10.06	1.20
	6	30.00 - 35.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	4.09			10.01	3.14
	7	35.00 - 40.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	1.19			10.06	1.00
	8	40.00 - 45.00	5.00	5.00	Lower Sedimentary Rock	CL	41.59			7.69	17.76
	9	45.00 - 50.00	5.00	5.00	Lower Sedimentary Rock	CM-L	3.55	6.05	2.07	9.83	7.43
	10	50.00 - 55.00	5.00	5.00	Lower Sedimentary Rock	CM-L	0.09	3.07	0.02	3.61	5.98
	11	55.00 - 60.00	5.00	5.00	Lower Sedimentary Rock	CM-L	11.27			9.78	5.72
B-30	1	5.00 - 10.00	5.00	5.00	Upper Sedimentary Rock	CM-H	8.26	2.81	3.19	9.98	24.24
	2	10.00 - 15.00	5.00	5.00	Upper Sedimentary Rock	CM-L	6.68	3.32	1.14	10.14	22.60
	3	15.00 - 20.00	5.00	5.00	Upper Sedimentary Rock	CM-L	7.32	4.31	2.16	8.48	16.28
	4	20.00 - 25.00	5.00	5.00	Upper Pyroclastic Rock	CM-L	7.39	5.23	2.60	9.70	25.12
	5	25.00 - 30.00	5.00	5.00	Upper Pyroclastic Rock	CM-H	2.41	2.91	0.62	8.53	21.96
	6	30.00 - 35.00	5.00	5.00	Middle Sedimentary Rock	CM-L	18.00	5.25	3.40	8.51	22.00
	7	35.00 - 40.00	5.00	5.00	Middle Sedimentary Rock	CM-H	4.15	6.39	1.96	7.71	16.00
	8	40.00 - 45.00	5.00	5.00	Middle Sedimentary Rock	CM-L	4.48	7.99	3.34	7.06	19.96
	9	45.00 - 50.00	5.00	5.00	Middle Sedimentary Rock	CM-L	5.99	8.24	4.60	6.34	22.00
	10	50.00 - 55.00	5.00	5.00	Lower Pyroclastic Rock	CM-L	6.94			13.29	10.84
	11	55.00 - 60.00	5.00	5.00	Lower Pyroclastic Rock	CM-L	0.80	10.80	0.90	12.75	2.38
	12	60.00 - 65.00	5.00	5.00	Lower Pyroclastic Rock	CM-L	4.27	5.75	2.14	10.79	9.56
	13	65.00 - 70.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	3.16	9.86	3.09	13.48	6.42
	14	70.00 - 75.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	0.31	9.97	0.31	13.93	1.67
	15	75.00 - 80.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	0.63	10.23	0.66	14.20	1.78
	16	80.00 - 85.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	1.16			9.90	1.32
	17	85.00 - 90.00	5.00	5.00	Lower Pyroclastic Rock	CM-H	0.86			8.87	0.52
	18	90.00 - 95.00	5.00	5.00	Lower Sedimentary Rock	CM-L	1.69	7.47	1.06	7.47	1.06
	19	95.00 - 100.00	5.00	5.00	Lower Sedimentary Rock	CL	1.21	9.66	1.14	9.66	1.14
	20	100.00 - 105.00	5.00	5.00	Lower Sedimentary Rock	CL	0.64	11.67	0.80	11.67	0.80
	21	105.00 - 110.00	5.00	5.00	Lower Sedimentary Rock	CL	1.77	7.37	1.30	9.21	3.00
	22	110.00 - 115.00	5.00	5.00	Lower Sedimentary Rock	CL	18.87	4.10	1.30	4.04	2.87

Table 5.2.1 WORK QUANTITIES OF GEOLOGICAL SURVEY AT RESERVOIR AREA

(DRILLING WORK)

Hole No.	Hole Diameter (mm)	Ground Elevation (m)	depth (m)	Lugeon-test (times)	S.P.T* (times)	Coordinate	
						X	Y
RA-1	66	165.94	30	5		428575.699	9221554.590
RA-2	66	176.36	35	6		428534.944	9221471.492
RA-3	66	163.78	30	5		428624.547	9221654.218
RA-4	66	181.96	40	7		428709.088	9221827.654
RA-5	66	166.99	30	5		428670.089	9221747.091
RA-6	66	146.72	20		20	428538.689	9221684.341
RA-7	66	150.33	20		20	428764.492	9221668.156
RI-1	66	165.43	30		30	428428.009	9221519.380
RI-2	66	153.79	20		20	428407.231	9221658.000
RI-3	66	150.33	30		30	428491.635	9221501.728
RI-4	66	170.19	30		30	428508.559	9221568.052
RO-1	66	187.34	30		30	428672.370	9221450.722
RO-2	66	162.34	30		30	428673.241	9221551.054
RRD-3	66	140.31	30		30	428152.841	9221511.174
RRD-4	66	143.95	30		30	428117.302	9221605.982
RRD-5	66	169.08	40		40	428187.560	9221419.522
Total			475	28	310		

(Note) S.P.T* : Standard Penetration Test

(TRENCH EXCAVATION WORK)

Trench No	Length (m)	Point	Coordinate		
			X	Y	Z
FS-1	150	Northern end	428566.9982	9221797.111	172.144
		Southern end	428530.6103	9221654.48	149.151
FS-2	52	Southern end	428337.638	9221757.841	132.882
		Northern end	428317.334	9221704.785	134.318
FS-3	114	Northern end	428806.734	9221813.545	163.703
		Southern end	428822.211	9221673.55	146.599
SS-1	130	Southern end	428672.3695	9221450.722	187.338
		Northern end	428673.459	9221576.233	158.264
SS-2	150	Southern end	428169.1204	9221468.199	163.945
		Northern end	428117.3023	9221604.982	143.953
SS-3	100	Southern end	428420.5387	9221569.191	165.433
		Northern end	428405.7176	9221668.096	153.791
SS-4	70	Southern end	428491.6352	9221501.728	180.824
		Northern end	428508.56	9221568.053	170.545
Total	766				

Table 5.2.2 GEOLOGICAL STRATA AT JATIBARANG RESERVIOR AREA

Age	Formation and Stratum Name		Symbol	Description		
Quaternary	Holocene	Riverbed deposit	rd	The deposit is distributed at the existing riverbed and the flood plain. It mainly consists of gravel, sand and clay, and it contains the huge fallen rocks in the gorge area, which was formed by Kreo River.		
		Talus deposit	td	The deposit is distributed at the skirt of the mountainside slope. It consists of failure soil and sand, detritus and fallen rocks.		
		Terrace deposit	tr	The deposit forms the terrace plain along the riverbed, and the relative height of the plain is less than 3 m from the riverbed. Terrace deposit can be divided into two layers, the upper layer mainly consists of silt, and the lower layer mainly consists of sand and gravel.		
Tertiary ~ Quaternary	Pliocene ~ Pleistocene	Kaligetas	Sedimentary Rock Unit	Ks	Kaligetas formation is distributed at the south side of a fault, which located 400m southwest of the damsite. This fault has direction from east to northwest and forms a boundary between Damar formation and Kerek and Kaligetas formations. Sedimentary rock unit is formed by complicated alternation which mainly consists of conglomerate, conglomeratic sandstone, tuffaceous sandstone and sandstone. Cracks hardly develop in the bedrock, and the degree of cementation and the hardness of rock are comparatively low.	
		Damar				Damar formation is distributed at the north side of the above-mentioned fault.
				Sedimentary Rock Unit	Ds	Sedimentary rock unit is formed by complicated alternation which mainly consists of tuffaceous sandstone, conglomeratic sandstone and volcanic conglomerate. Cracks hardly develop in the bedrock, and the degree of cementation and the hardness of rock are comparatively low.
		Pyroclastic Rock Unit	Dp	Pyroclastic rock unit mainly consists of volcanic breccia, and partly contains mafic tuff and andesite lava. The volcanic breccia contains fragments of andesite and pumice, and matrix consists of mafic tuff. Cracks hardly develop in the bedrock, but the hardness of rock is comparatively high.		
Tertiary	Miocene ~ Pliocene	Kerek	Sedimentary Rock Unit	Km	Kerek formation is distributed at the south side of the above-mentioned fault. Sedimentary rock unit mainly consists of siltstone whose color is greenish dark gray, and partly contains coral limestone. The hardness of siltstone is comparatively low, and slickenside develops around the fault.	

Table 5.2.3 RESULT OF LUGEON TEST AT RESERVOIR

Bore Hole Number	Stage Number	Depth of Test (m)	Stage Length (m)	Rock	Rock Classification	Lu	Critical Point		Max Point	
							Pe(kg/cm ²)	Qc(l/m/m)	Pm(kg/cm ²)	Qm(l/m/m)
RA - 1	1	5.00 - 10.00	5.00	Siltstone	CL	32.11			1.23	3.96
	2	10.00 - 15.00	5.00	Siltstone	CL	4.50	3.48	1.06	4.44	4.10
	3	15.00 - 20.00	5.00	Siltstone	CL	4.28	2.51	0.50	4.05	12.28
	4	19.00 - 25.00	6.00	Siltstone	CL	0.23	2.51	0.03	3.79	11.43
	5	24.00 - 30.00	6.00	Siltstone	CL	0.97	3.58	0.23	4.15	11.70
RA - 2	1	5.00 - 10.00	5.00	Siltstone	CL	42.40			2.54	18.80
	2	10.00 - 15.00	5.00	Siltstone	CL	5.10	1.54	0.78	2.58	14.48
	3	15.00 - 20.00	5.00	Siltstone	CL	4.34	2.54	0.51	4.08	12.28
	4	20.00 - 25.00	5.00	Siltstone	CL	3.29	1.58	0.52	3.25	14.52
	5	25.00 - 30.00	5.00	Siltstone	CL	0.27	1.58	0.04	3.34	7.10
	6	30.00 - 35.00	5.00	Siltstone	CL	0.40	2.61	0.05	4.30	7.40
RA - 3	1	5.00 - 10.00	5.00	Siltstone	CL	80.10			1.15	9.25
	2	10.00 - 15.00	5.00	Siltstone	CL	28.52	2.94	12.16	3.54	18.12
	3	15.00 - 20.00	5.00	Siltstone	CL	>100			1.44	16.40
	4	20.00 - 25.00	5.00	Siltstone	CL	0.06	3.27	0.02	4.26	1.28
	5	25.00 - 30.00	5.00	Siltstone	CL	2.05	2.32	0.31	5.88	9.56
RA - 4	1	5.00 - 10.00	5.00	Tuffaceous Sandstone	CL	4.10	1.84	0.76	2.66	11.20
	2	10.00 - 15.00	5.00	Tuffaceous Sandstone	CL	93.54			1.97	19.28
	3	15.00 - 20.00	5.00	Tuffaceous Sandstone	CL	1.71	4.04	0.52	4.36	19.16
	4	20.00 - 25.00	5.00	Tuffaceous Sandstone	D	5.74	3.00	1.10	3.56	18.80
	5	25.00 - 30.00	5.00	Tuffaceous Sandstone	CL	3.57	2.88	0.32	4.17	12.00
	6	37.00 - 40.00	3.00	Volcanic Conglomerate	CM-L	1.50			11.00	1.60
RA - 5	1	8.40 - 10.00	1.60	Siltstone	CL	26.24			5.88	15.21
	2	10.00 - 15.00	5.00	Siltstone	CL	23.19			2.33	5.40
	3	15.00 - 20.00	5.00	Volcanic Conglomerate	CL	0.85	4.75	0.44	5.60	7.00
	4	20.00 - 25.00	5.00	Tuffaceous Sandstone	CL	0.60	6.25	0.34	8.12	5.68
	5	25.00 - 30.00	5.00	Tuffaceous Sandstone	CL	1.38	4.15	0.55	6.04	4.86

Table 5.3.1 WORK QUANTITIES OF GEOLOGICAL SURVEY AT QUARRY SITE

(DRILLING WORK)

Stage	Hole No.	Hole Diameter (mm)	Ground Elevation (EL.m)	Depth (m)	Coordinate	
					X	Y
Phase 1	A-1	66	571.511	100	436,932.016	9,207,800.189
	A-2	66	563.482	90	437,030.778	9,207,808.231
	A-3	66	554.988	80	437,129.317	9,207,817.536
	A-4	66	520.844	50	437,249.498	9,207,828.517
	A-5	66	498.254	30	437,320.527	9,207,834.885
	A-6	66	540.245	70	436,942.249	9,207,700.785
	A-7	66	539.589	70	437,036.773	9,207,710.026
	A-8	66	525.464	50	437,136.266	9,207,721.155
	A-9	66	500.165	40	437,259.474	9,207,730.286
	A-10	66	507.931	40	436,948.624	9,207,605.872
	A-11	66	493.879	30	437,046.314	9,207,614.359
	A-12	66	498.38	30	437,145.159	9,207,621.448
	A-13	66	486.567	30	437,267.859	9,207,637.294
	Total			710		

(SEISMIC PROSPECTING)

Stage	Line Name	Location	Quantities (m)	remarks
Phase 1	S-1	Ridge Part	460	
	S-2	Slope Part	340	
	S-3	Slope Part	300	
	S-4	Slope Part	300	
	S-5	Slope Part	300	
	Total		1,700	

(LABORATORY TEST)

Stage	Work Items		Quantities (samples)	remarks
Phase 1	Alkali-Aggregate Reaction Test	Microscope Observation, X-ray Analysis, Chemical Method and Mortar Bar	5	
	Physical Property Test	Density, Absorption Ratio and Effective	35	
	Unconfined Compression Test		20	

Table 5.3.2 (1/2) WORK QUANTITIES OF GEOLOGICAL SURVEY AT BORROW AREA

(DRILLING WORKS AT BORROW AREA A)

Stage	Hole No.	Hole Diameter (mm)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	BA-1	66	214.231	10	427,577.519	9,220,655.936
	BA-2	66	218.607	10	427,777.668	9,220,657.043
	BA-3	66	216.462	10	427,578.654	9,220,454.723
	BA-4	66	216.204	10	427,777.668	9,220,456.538
	BA-5	66	198.518	10	427,580.020	9,220,252.949
	BA-6	66	215.990	10	427,790.818	9,220,257.887
Total				60		

(TEST PIT EXCAVATION WORK AT BORROW AREA A)

Stage	Pit No.	Sampling Depth (m)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	TPA-1	2.50,4.50	216.650	5.00	427,656.365	9,220,605.249
	TPA-2	2.00,4.00	216.213	5.00	427,656.365	9,220,505.249
	TPA-3	2.00,4.00	214.095	5.00	427,683.448	9,220,403.383
	TPA-4	1.50,3.00	213.239	4.40	427,686.341	9,220,304.287
Total						

(DRILLING WORKS AT BORROW AREA B)

Stage	Hole No.	Hole Diameter (mm)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	B-1	66	186.79	10	427,460.992	9,222,588.124
	B-2	66	183.14	10	427,760.989	9,222,839.989
	B-3	66	170.76	10	427,995.240	9,223,002.648
	B-4	66	190.28	10	427,613.491	9,222,495.177
	B-5	66	187.24	10	427,884.216	9,222,688.538
	B-6	66	187.36	10	428,130.924	9,222,865.362
	B-7	66	189.40	10	427,630.907	9,222,746.571
	B-8	66	177.06	10	427,883.660	9,222,932.872
	B-9	66	185.17	10	427,745.882	9,222,577.891
	B-10	66	182.18	10	427,998.339	9,222,769.092
	B-11	66	180.23	10	428,231.731	9,222,951.623
	B-12	66	177.24	10	428,354.873	9,223,037.841
	B-13	66	172.72	10	428,177.338	9,223,035.381
	B-14	66	181.89	10	428,287.646	9,222,868.725
Total	Total			140		

Table 5.3.2 (2/2) WORK QUANTITIES OF GEOLOGICAL SURVEY AT BORROW AREA

(TEST PIT EXCAVATION WORK AT BORROW AREA B)

Stage	Pit No.	Sampling Depth (m)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	TPB-1	2.00,4.50	190.46	4.90	427,565.923	9,222,573.977
	TPB-2	2.00,4.00	187.15	4.50	427,688.264	9,222,659.597
	TPB-3	2.00,4.00	183.00	4.80	428,169.273	9,222,909.494
	TPB-4	2.50,4.00	178.71	4.60	428,293.494	9,222,994.857
	TPB-5	2.00,4.60	172.26	4.60	428,297.075	9,223,123.024
	TPB-6	3.00,5.00	181.08	5.00	428,349.404	9,222,911.969
Total	Total					

(DRILLING WORK AT BORROW AREA C)

Stage	Hole No.	Hole Diameter (mm)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	BC-1	66	122.081	10	427,726.689	9,221,666.600
	BC-2	66	121.515	10	427,758.630	9,221,600.360
	BC-3	66	124.355	10	427,756.739	9,221,500.378
	BC-4	66	125.484	10	427,754.848	9,221,400.396
	BC-5	66	127.822	10	427,752.957	9,221,300.414
	BC-6	66	122.529	10	427,658.290	9,221,602.111
	BC-7	66	124.184	10	427,657.011	9,221,398.701
	B-34	66	100.958	10	428,103.083	9,222,162.478
B-35	66	150.163	20	428,281.104	9,222,050.469	
Total				100		

(TEST PIT EXCAVATION WORK AT BORROW AREA C)

Stage	Pit No.	Sampling Depth (m)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	TPC-1	1.50	121.380	2.20	427,660.320	9,221,702.146
	TPC-2	2.00	121.137	3.20	427,722.967	9,221,600.405
	TPC-3		126.680	4.00	427,860.461	9,221,394.423
	TPC-4	2.50	122.180	5.00	427,758.724	9,221,720.230
	TPC-5		123.120	2.40	427,958.721	9,221,800.512
	TPC-6	2.50	123.008	3.20	427,559.878	9,221,698.820
	TPC-7		124.184	2.50	427,556.060	9,221,398.647
	TPC-8		129.402	3.40	427,655.301	9,221,196.295
Total	Total					

(TEST PIT EXCAVATION WORK AT BORROW AREA D)

Stage	Pit No.	Sampling Depth (m)	Ground Elevation (m)	depth (m)	Coordinate	
					X	Y
Phase 2	TPD-1	2.50,4.50	150.131	4.80	428228.059	9222305.693
	TPD-2	2.00,3.50	139.759	4.90	428258.511	9222352.942
Total	Total					

Table 5.3.3 PHYSICAL AND MECHANICAL PROPERTIES OF CORE SAMPLE AT QUARRY SITE

Bore Hole and Sampling Depth (m)	Rock Classification	Physical Property			Absorption Ratio %	Porosity %	Mechanical Property Unconfined Compressive Strength kgf/cm ²
		Saturated Surface Dry Density gf/cm ³	Oven Dry Density gf/cm ³				
A-1 (11.80 - 12.00)	CL	2.18	1.95	11.87	23.12	46.15	
A-4 (12.50 - 12.65)	CL	1.76	1.53	15.11	23.13	28.30	
A-8 (7.45 - 7.60)	CL	2.00	1.72	16.58	28.51	30.72	
A-6 (12.30 - 12.60)	CL	2.45	2.30	6.50	14.97	171.48	
A-6 (35.00 - 35.35)	CL	2.47	2.33	6.06	14.11	463.83	
A-6 (58.00 - 58.25)	CL	2.49	2.38	4.73	11.25	484.08	
A-7 (67.20 - 67.45)	CL	2.40	2.20	8.78	19.33	164.90	
A-10 (24.00 - 24.20)	CL	2.34	2.19	6.78	14.85	231.57	
A-4 (15.50 - 15.70)	CM	2.35	2.17	8.24	17.88	102.83	
A-1 (26.00 - 26.30)	CM	2.42	2.25	7.52	16.90	303.95	
A-2 (8.10 - 8.35)	CM	2.50	2.38	4.95	11.77	408.03	
A-3 (37.00 - 37.20)	CM	2.67	2.62	1.87	4.91	863.92	
A-3 (61.60 - 61.80)	CM	2.60	2.53	2.70	6.84	391.35	
A-7 (39.80 - 40.00)	CM	2.75	2.73	0.62	1.69	432.99	
A-8 (21.00 - 21.25)	CM	2.60	2.55	2.03	5.17	770.46	
A-10 (32.35 - 32.50)	CM	2.45	2.35	4.27	10.02	451.61	
A-11 (21.00 - 21.20)	CM	2.74	2.65	3.64	9.17	649.96	
A-2 (36.00 - 36.30)	CH	2.70	2.64	2.21	5.84	1,068.56	
A-9 (25.75 - 26.00)	CH	2.73	2.69	1.67	4.47	580.87	
A-12 (17.00 - 17.20)	CH	2.66	2.62	1.52	3.97	580.22	

Table 5.3.4 (1/2) RESULT OF LABORATORY TEST FOR NON-MIXED IMPERVIOUS MATERIAL
(PHYSICAL PROPERTY TEST)

Location	Sample No.	Basic Condition		PHYSICAL PROPERTIES											USCS *
				Grain Size							Consistency				
		Gs	Wn (%)	Proportion				Index				LL (%)	PL (%)	PI	Soil Classification
				GRAVEL >2.00mm (%)	SAND 2.00-0.075mm (%)	SILT 0.075-0.005mm (%)	CLAY <0.005mm (%)	Dmax (mm)	D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)				
AREA A	TPA-1U	2.720	41.11	-	4	27	69	2.000	-	-	-	77.00	45.75	31.25	
	TPA-1L	2.695	43.96	-	7	44	49	2.000	-	-	0.009	81.40	45.53	35.87	MH
	TPA-2U	2.708	36.19	-	4	31	65	2.000	-	-	0.004	79.23	36.07	43.16	CH
	TPA-2L	2.645	36.68	-	5	29	66	2.000	-	-	0.004	81.89	36.72	45.17	CH
	TPA-3U	2.608	40.50	-	5	25	70	2.000	-	-	-	88.10	37.31	50.79	CH
	TPA-3L	2.818	29.29	68	8	6	18	19.100	-	1.800	5.500	83.60	30.77	52.83	GC
	TPA-4U	2.625	42.38	-	3	36	61	2.000	-	-	0.005	84.60	38.07	46.53	CH
	TPA-4L	2.668	40.59	11	10	27	52	19.100	-	-	0.011	79.30	35.44	43.86	CH
AREA B	TPB-1U	2.612	41.62	-	1	26	73	2.000	-	-	-	95.46	37.51	57.95	CH
	TPB-1L	2.578	45.16	-	4	20	76	2.000	-	-	-	95.29	40.40	54.89	CH
	TPB-2U	2.611	40.73	-	2	27	71	2.000	-	-	0.002	102.87	35.49	67.38	CH
	TPB-2L	2.722	45.91	-	7	25	68	2.000	-	-	0.003	92.75	39.80	52.95	CH
	TPB-3U	2.681	34.71	-	4	40	56	2.000	-	-	0.007	94.04	34.30	59.74	CH
	TPB-3L	2.679	34.47	-	10	43	47	2.000	-	-	0.011	89.93	37.50	52.43	CH
	TPB-4U	2.690	37.59	-	6	47	47	2.000	-	-	0.015	89.57	34.70	54.87	CH
	TPB-4L	2.750	43.16	-	5	36	59	2.000	-	-	0.005	99.51	34.70	64.81	CH
	TPB-5U	2.680	39.64	-	3	41	56	2.000	-	-	0.007	95.20	36.08	59.12	CH
	TPB-5L	2.630	51.12	-	14	65	21	2.000	-	0.010	0.048	83.44	37.15	46.29	CH
	TPB-6U	2.761	42.45	-	3	36	61	2.000	-	-	0.005	102.92	48.01	54.91	MH
	TPB-6L	2.758	43.50	-	6	36	58	2.000	-	-	0.006	96.01	45.58	50.43	MH
AREA D	TPD-1U	2.719	34.86	-	6	52	42	2.000	-	0.001	0.033	83.11	33.71	49.40	CH
	TPD-1L	2.696	43.67	-	9	66	25	2.000	-	0.006	0.035	77.84	37.06	40.78	MH
	TPD-2U	2.686	41.12	-	11	55	34	2.000	-	0.004	0.019	92.19	38.04	54.15	CH
	TPD-2L	2.676	37.10	-	9	55	36	2.000	-	0.002	0.040	65.39	31.11	34.28	CH

Note USCS* : Unified Soil Classification System

Table 5.3.4 (2/2) RESULT OF LABORATORY TEST FOR NON-MIXED IMPERVIOUS MATERIAL
(MECHANICAL PROPERTY TEST)

Location	Sample No.	MECHANICAL PROPERTIES										
		Proctor Compaction		Shear Strength						Permeability		
		γ _{dmax} (g/cm ³)	w _{opt} (%)	D95:Wet Side		CU				D95:Wet Side		Falling Head Method
				γ _d (g/cm ³)	w (%)	C (kg/cm ²)	φ (°)	C' (kg/cm ²)	φ' (°)	γ _d (g/cm ³)	w (%)	k (cm/sec)
AREA A	TPA-1U	1.253	39.5									
	TPA-1L	1.195	43.4									
	TPA-2U	1.306	35.8									
	TPA-2L	1.293	36.0									
	TPA-3U	1.238	39.0									
	TPA-3L	1.576	26.6									
	TPA-4U	1.254	38.3	1.191	43.0	0.42	8.26	0.38	20.89	1.191	43.0	1.92E-07
	TPA-4L	1.310	37.2	1.244	41.5	0.35	10.24	0.25	19.36	1.244	41.5	3.67E-06
AREA B	TPB-1U	1.258	38.7									
	TPB-1L	1.212	42.0									
	TPB-2U	1.252	38.5									
	TPB-2L	1.198	43.3									
	TPB-3U	1.264	37.3									
	TPB-3L	1.236	39.7									
	TPB-4U	1.286	36.7	1.222	41.0	0.21	11.61	0.12	24.68	1.222	41.0	3.58E-06
	TPB-4L	1.191	42.9	1.131	48.0	0.46	9.69	0.28	18.64	1.131	48.0	1.32E-07
	TPB-5U	1.230	39.6									
	TPB-5L	1.095	49.2									
AREA D	TPD-1U	1.285	38.2	1.220	43.0	0.25	10.70	0.17	23.52	1.222	43.0	1.19E-07
	TPD-1L	1.192	42.8	1.192	47.6	0.43	9.40	0.42	17.44	1.132	47.6	2.00E-07
	TPD-2U	1.226	41.3									
	TPD-2L	1.266	39.1									

Table 5.3.5

GEOLOGICAL STRATA AT BORROW AREA C

Age		Formation and Stratum Name	Symbol	Description	
Quaternary	Holocene	Topsoil	Ts	The topsoil is distributed at the surface of terrace deposit. It consists of loose soil, and contains organic material and many roots of plants.	
		Riverbed deposit	Rd	The deposit is distributed at the present riverbed and the flood plain. It mainly consists of boulder, cobble, pebble and sand, and it contains silt and clay with small quantity. But the deposit contains the gravel of siltstone, which has soft quality and is crushed easily, the total rate of fine material may be more than 10 % of the deposit.	
		Talus deposit	Td	The deposit is distributed at the skirt of the mountainside slope. It consists of failure soil and sand, detritus and fallen rocks, and the total rate of fine material is more than 50 % of the deposit.	
		Terrace deposit	Upper Layer	Tu	The deposit forms the terrace plain along the riverbed, and the relative height of the plain is less than 3 m from the riverbed. The upper layer of terrace deposit mainly consists of silt, and contains sand and gravel with small quantity.
			Lower Layer	Tl	The lower layer of terrace deposit mainly consists of boulder, cobble, pebble and sand, and it contains more quantities of silt and clay than riverbed deposit. The deposit contains the gravel of siltstone, which has soft quality and is crushed easily, the total rate of fine material may be more than 20 % of the deposit.
Tertiary	Miocene ~ Pliocene Kerek	Siltstone	Km	Kerek formation is distributed under the secondary deposits which include all layers in Quaternary, and it forms the bedrock of this area. It consists of siltstone whose color is greenish dark gray, and partly contains coral limestone. The hardness of siltstone is comparatively low.	

Table 5.3.6 RESULT OF LABORATORY TEST FOR NON-MIXED SEMI-PERVIOUS MATERIAL
(PHYSICAL PROPERTY TEST)

Location and Material	Sample and Case No.	Moisture Contents Wn (%)	PHYSICAL PROPERTIES										USCS *						
			Passing				Grain Size				Index				Specific Gravity and Absorption				
			D 0.075mm (%)	D 2.00mm (%)	D 4.75mm (%)	D 19.0mm (%)	Dmax (mm)	D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	Cu	Cc		Oven Dry Density (Gb) (gf/cm ³)	Saturated Surface-Dry Density (gf/cm ³)	Dry Density Apparent (Gg) (gf/cm ³)	Absorptio (%)		
Borrow Area C	TPC-1	10.15	6	29	34	52	77.0	0.43	2.50	22.00	51.8	0.7	2.498	2.588	2.748	3.609	G-F		
	TPC-2	20.23	21	63	68	74	75.0	-	0.26	1.40	-	-	2.388	2.522	2.757	5.618	SF		
	TPC-4	20.23	15	26	29	36	145.0	-	7.00	48.00	-	-	2.494	2.627	2.724	5.319	GF		
	TPC-6	26.38	18	44	50	65	95.0	-	0.500	15.00	-	-	2.500	2.595	2.765	3.794	GF		
Crushed Rock	Maximum 19.0 mm (A)	0.77	0	0	4	100	19.1	6	9	13	2.2	1.0	2.593	2.650	2.749	2.194	G		
	Maximum 19.0 mm (B)	0.77	0	0	4	100	19.1	6	9	13	2.2	1.0	2.593	2.650	2.752	2.199	G		
	Maximum 4.75 mm	0.74	1	60	100	100	4.75	0.35	0.8	2	5.7	0.9	2.559	2.631	2.758	2.819	S		
Natural Sand	Muntilan	0.63	7	79	90	100	25.4	0.12	0.32	0.9	7.5	0.9	2.603	2.645	2.721	1.635	SF		

Note USCS* : Unified Soil Classification System

Table 5.3.7 (1/2) RESULT OF LABORATORY TEST FOR PERVIOUS MATERIAL AT QUARRY SITE
(PHYSICAL PROPERTY AND RELATIVE DENSITY TESTS)

Sample	Adjustment of Gradation (Crushed Material)	Physical Property						Relative Density									
		Moisture Content (%)		Density		Passing		Grain Size			Compaction Time (sec)	Wet Density γ_t (gf/cm ³)	Dry Density γ_d (gf/cm ³)	Void Ratio e			
		Oven Dry (G _b) (gf/cm ³)	Saturated Surface Dry (G _s) (gf/cm ³)	Dry Apparent (G _g) (gf/cm ³)	.075 m (%)	2.00 m (%)	4.75 m (%)	19.0 m (%)	D10 (mm)	D30 (mm)					D60 (mm)	Cu	Cc
Coarser Rock	63.0 - 53.0 mm												0	1.572	1.560	0.631	
	53.0 - 37.5 mm												5	1.822	1.808	0.407	
	37.5 - 26.5 mm												15	1.876	1.861	0.367	
	26.5 - 19.0 mm	0.80	2.544	2.629	2.780	0	10	32	68	2.0	4.2	14.0	7.0	0.6	1.904	1.889	0.347
	19.0 - 9.50 mm												60	1.936	1.921	0.325	
	9.50 - 4.75 mm												120	1.962	1.946	0.307	
	4.75 - 2.00 mm												300	1.998	1.982	0.283	
2.00 mm >	10%																
Finer Rock	63.0 - 53.0 mm																
	53.0 - 37.5 mm																
	37.5 - 26.5 mm																
	26.5 - 19.0 mm	0.80	2.544	2.629	2.780	0	20	32	68	1.3	3.8	14.0	10.8	0.8	2.040	2.024	0.257
	19.0 - 9.50 mm																
	9.50 - 4.75 mm																
	4.75 - 2.00 mm																
2.00 mm >	20%																

Table 5.3.7 (2/2) RESULT OF LABORATORY TEST FOR PERVIOUS MATERIAL AT QUARRY SITE
(TRIAxIAL COMPRESSION AND PERMEABILITY TESTS)

Sample and Test Condition	CASE 1				CASE 2				CASE 3				CASE 4				
	Coarser Rock : eb=0.325(60sec)				Coarser Rock : eb=0.283(300sec)				Finer Rock : eb=0.257(60sec)				Finer Rock : eb=0.221(300sec)				
Specimen No.	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
Physical Property	Moisture Content (%)	0.8				0.8				0.8				0.8			
	Specific Gravity G _b	2.544				2.544				2.544				2.544			
	0.075 mm (%)	0				0				0				0			
	2.00 mm (%)	10				10				20				20			
Grain Size	4.75 mm (%)	32				32				32				32			
	19.0 mm (%)	68				68				68				68			
	D ₁₀ (mm)	2.0				2.0				1.3				1.3			
Index	D ₃₀ (mm)	4.2				4.2				3.8				3.8			
	D ₆₀ (mm)	14.0				14.0				14.0				14.0			
	Dry Density γ _d (g/cm ³)	1.921	1.921	1.921	1.921	1.983	1.983	1.983	1.983	2.024	2.024	2.024	2.024	2.084	2.084	2.084	2.084
Specimen Condition	Void Ratio e	0.325	0.325	0.325	0.325	0.283	0.283	0.283	0.283	0.257	0.257	0.257	0.257	0.221	0.221	0.221	0.221
	After Consolidation	0.315	0.314	0.312	0.306	0.275	0.274	0.272	0.27	0.252	0.247	0.238	0.231	0.216	0.213	0.206	0.200
CD Test	Confining Pressure σ ₃ (kgf/cm ²)	0.5	1.0	3.0	6.0	0.5	1.0	3.0	6.0	0.5	1.0	3.0	6.0	0.5	1.0	3.0	6.0
	Principal Stress Difference σ ₁ -σ ₃ (kgf/cm ²)	9.638	12.500	21.112	30.635	10.675	12.625	20.447	32.129	8.365	10.598	19.615	33.142	9.225	11.546	20.858	34.787
	Volume Strain ν (%)	-1.07	-1.38	-0.62	1.19	-2.85	-1.15	-0.34	0.53	-1.58	-1.26	-0.23	1.23	-1.72	-1.38	-0.84	0.06
Shear Strength	C (kgf/cm ²)	1.94				1.97				1.29				1.45			
	φ (°)	40.92				41.38				43.87				44.35			
Specimen Condition	Dry Density γ _d (g/cm ³)	1.982				1.982				2.024				2.084			
	Void Ratio e	0.284				0.284				0.257				0.221			
	Saturation Ratio	7.3				7.3				7.8				8.9			
Permeability Test	Before Test (%)	46.1				46.1				63.6				80.7			
	After Test (%)	7.13E-02				7.13E-02				5.41E-02				8.00E-03			

Table 5.3.8 (1/2) RESULT OF LABORATORY TEST FOR MIXED IMPERVIOUS MATERIAL
(PHYSICAL PROPERTY AND COMPACTION TESTS)

Case	Adjustment of Gradation	Basic Condition				Physical Property						Compaction				
		Moisture Content Wn (%)	Specific Gravity Gg (gf/cm ³)	Passing			Water Content W (%)	Wet Density γt (gf/cm ³)	Dry Density γd (gf/cm ³)	Void Ratio e	γdmax (gf/cm ³)	Optimum Moisture Content Wopt (%)	Grain Size			
				0.075 m (%)	2.00 mm (%)	4.75 mm (%)							D10 (mm)	D30 (mm)	D60 (mm)	
1	Fine Material : 50% (TPD-1U)	17.49	2.733	0.075 m	2.00 mm	4.75 mm	11.48	1.687	1.513	0.806	1.674	1.798	13.80			
	44			78	86	0.52										
2	Fine Material : 35% (TPD-1U)	13.95	2.737	0.075 m	2.00 mm	4.75 mm	7.35	1.745	1.625	0.684	1.699	1.736	16.50			
	29			71	79	0.004								0.09	1.0	
3	Fine Material : 25% (TPD-1U)	8.11	2.739	0.075 m	2.00 mm	4.75 mm	8.07	1.868	1.729	0.584	1.729	1.934	13.80			
	28			73	79	0.004								0.12	0.9	
4	Fine Material : 27% (TPD-1U)	11.65	2.732	0.075 m	2.00 mm	4.75 mm	5.69	1.708	1.616	0.691	1.660	1.865	14.80			
	26			64	71	0.003								0.13	1.4	
5	Fine Material : 35% (TPB-4U)	12.58	2.716	0.075 m	2.00 mm	4.75 mm	6.64	1.724	1.616	0.681	1.640	1.830	15.50			
	29			72	80	0.005								0.10	1.0	

Table 5.3.8 (2/2) RESULT OF LABORATORY TEST FOR MIXED IMPERVIOUS MATERIAL (TRIAxIAL COMPRESSION AND PERMEABILITY TESTS)

Case No.	CASE 1				CASE 2				CASE 3				CASE 4				CASE 5			
	Fine Material:50%(TPD-1U) Coarse Material : 50% (19.0 - 4.75 mm Crushed Rock : 20 %) (Natural Sand : 80%)				Fine Material:35%(TPD-1U) Coarse Material : 65% (19.0 - 4.75 mm Crushed Rock : 20 %) (Natural Sand : 80%)				Fine Material:25%(TPD-1U) Coarse Material : 75% (19.0 - 4.75 mm Crushed Rock : 35 %) (Natural Sand : 65%)				Fine Material:27%(TPD-1U) Coarse Material : 73% (19.0 - 4.75 mm Crushed Rock : 65%) (Natural Sand : 65%)				Fine Material:35%(TPB-4U) Coarse Material : 65% (19.0 - 4.75 mm Crushed Rock : 20 %) (Natural Sand : 80%)			
Adjustment of Gradation	17.47				13.95				8.11				11.65				12.58			
	Moisture Content (%)				2.733				2.737				2.739				2.732			
Physical Property	0.075 mm (%)				29				28				26				29			
	2.00 mm (%)				71				73				64				72			
	4.75 mm (%)				86				79				79				80			
Grain Size	D10 (mm)				0.004				0.004				0.003				0.005			
	D30 (mm)				0.09				0.12				0.13				0.10			
	D60 (mm)				0.52				1.0				1.4				0.95			
Specimen Condition	D95 Dry Density γ_d (g/cm ³)				1.590				1.708				1.838				1.771			
	Moisture at D95 (%)				24.25				20.04				17.03				13.64			
	Confining Pressure σ_3 (kgf/cm ²)				1.0				2.0				4.0				6.0			
CU Test	Principal Stress Difference $\sigma_1 - \sigma_3$ (kgf/cm ²)				1.663				5.169				2.108				3.092			
	Pore Pressure at $(\sigma_1 - \sigma_3)$ Peak (kgf/cm ²)				0.440				0.520				0.560				0.450			
	C (kgf/cm ²)				0.34				0.19				0.18				0.47			
Shear Strength	ϕ (°)				15.89				21.02				16.08				12.21			
	C' (kgf/cm ²)				0.27				0.12				0.09				0.39			
	ϕ' (°)				25.63				31.37				30.49				20.39			
Specimen Condition	Maximum Dry Density (g/cm ³)				1.673				1.798				1.934				1.864			
	Moisture at O.M.C (%)				20.50				16.49				13.81				14.81			
	Permeability k (cm/sec)				2.29E-07				6.39E-06				1.04E-05				9.62E-06			
Permeability Test	D95 Dry Density γ_d (g/cm ³)				1.591				1.708				1.837				1.771			
	Moisture at D95 Wet Sid (%)				24.31				20.06				17.00				17.78			
	Permeability k (cm/sec)				1.00E-05				1.92E-05				3.01E-05				2.47E-05			

Table 5.3.9 (1/2) RESULT OF LABORATORY TEST FOR MIXED SEMI-PERVIOUS MATERIAL
(PHYSICAL PROPERTY AND RELATIVE DENSITY TESTS)

Case	Adjustment of Gradation	Moisture Content (%)	Density			Physical Property				Grain Size			Relative Density				
			Oven Dry (g/cm ³)	Saturated Surface Dry (g/cm ³)	Dry Apparent (g/cm ³)	Passing			D10 (mm)	D30 (mm)	D60 (mm)	Cu	Cc	* Energy	Wet Density (g/cm ³)	Dry Density (g/cm ³)	Void Ratio
						0.075 m (%)	2.00 mm (%)	4.75 mm (%)									
1	Crushed Rock 19.0 - 4.75mm : 30% 4.75mm under : 70%	0.59	2.573	2.638	2.752	0	32	66	0.6	1.8	4.0	6.7	1.4	0.0	1.453	1.412	0.82
2	Crushed Rock 19.0 - 4.75mm : 60% 4.75mm under : 40%	0.39	2.583	2.644	2.750	0	16	36	1.3	3.6	10.0	7.7	1.0	0.0	1.482	1.450	0.78
3	Crushed Rock 19.0 - 4.75mm : 30% Natural Sand : 70%	0.75	2.600	2.647	2.728	4	54	64	0.15	0.55	3.5	23.3	0.6	0.0	1.664	1.653	0.57
4	Crushed Rock 19.0 - 4.75mm : 60% Natural Sand : 40%	0.59	2.598	2.649	2.738	2	33	41	0.23	1.5	10.0	43.5	1.0	0.0	1.574	1.563	0.66

Note * Energy 1 : 5.6 cm³-kgf/cm³

Table 5.3.9 (2/2) RESULT OF LABORATORY TEST FOR MIXED SEMI-PERVIOUS MATERIAL (TRIAxIAL COMPRESSION AND PERMEABILITY TESTS)

Case No.	CASE 1				CASE 2				CASE 3				CASE 4							
	Crushed Material 19.0 - 4.75mm : 30% 4.75mm under : 70%				Crushed Material 19.0 - 4.75mm : 60% 4.75mm under : 40%				Crushed Material 19.0 - 4.75mm : 30% Natural Sand : 70%				Crushed Material 19.0 - 4.75mm : 60% Natural Sand : 40%							
Physical Property	Condition of Testing				Condition of Testing				Condition of Testing				Condition of Testing							
	Specimen No.				Specimen No.				Specimen No.				Specimen No.							
Adjustment of Gradation	Moisture Content (%)				0.39				0.75				0.59							
	Specific Gravity G _b				2.573				2.600				2.598							
Grain Size	Passing				0				4				2							
	2.00 mm (%)				32				54				33							
	4.75 mm (%)				66				64				41							
Index	D ₁₀ (mm)				0.6				1.3				0.23							
	D ₃₀ (mm)				1.8				3.6				1.5							
	D ₆₀ (mm)				4.0				10.0				10.0							
CD Test	Dry Density γ _d (g/cm ³)				1.853 1.853 1.853 1.853				1.831 1.830 1.831 1.831				2.108 2.107 2.107 2.106				2.026 2.026 2.026 2.026			
	Void Ratio Before Consolidation				0.386 0.386 0.386 0.387				0.409 0.409 0.408 0.409				0.234 0.234 0.234 0.235				0.282 0.282 0.282 0.282			
	Void Ratio After Consolidation				0.390 0.386 0.385 0.387				0.430 0.477 0.432 0.425				0.265 0.258 0.250 0.254				0.285 0.282 0.282 0.282			
	Confining Pressure σ ₃ (kgf/cm ²)				0.5 1.0 3.0 6.0				0.5 1.0 3.0 6.0				0.5 1.0 3.0 6.0				0.5 1.0 3.0 6.0			
Principal Stress Difference σ ₁ -σ ₃ (kgf/cm ²)	1.493 2.656 7.438 17.200				1.093 2.945 10.271 17.037				1.759 2.698 7.941 15.822				1.801 4.462 10.320 18.370							
	Volume Strain v (%)				0.42 0.64 0.79 0.92				0.64 0.51 1.19 1.24				0.48 0.82 0.85 0.85				0.82 0.48 0.81 0.84			
Shear Strength	C (kgf/cm ²)				0.02				0.03				0.02				0.07			
	φ (°)				35.68				35.46				34.24				36.60			
Permeability Test	Dry Density γ _d (g/cm ³)				1.854				1.831				2.105				2.023			
	Void Ratio e				0.386				0.408				0.255				0.284			
	Saturation Ratio				Before Test 19.5 After Test 95.2				Before Test 14.3 After Test 78.5				Before Test 7.3 After Test 100.0				Before Test 7.0 After Test 75.3			
Permeability k (cm/sec)				4.09E-03				1.14E-02				1.36E-04				2.72E-03				

FIGURES

CHAPTER 5

GEOLOGY

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