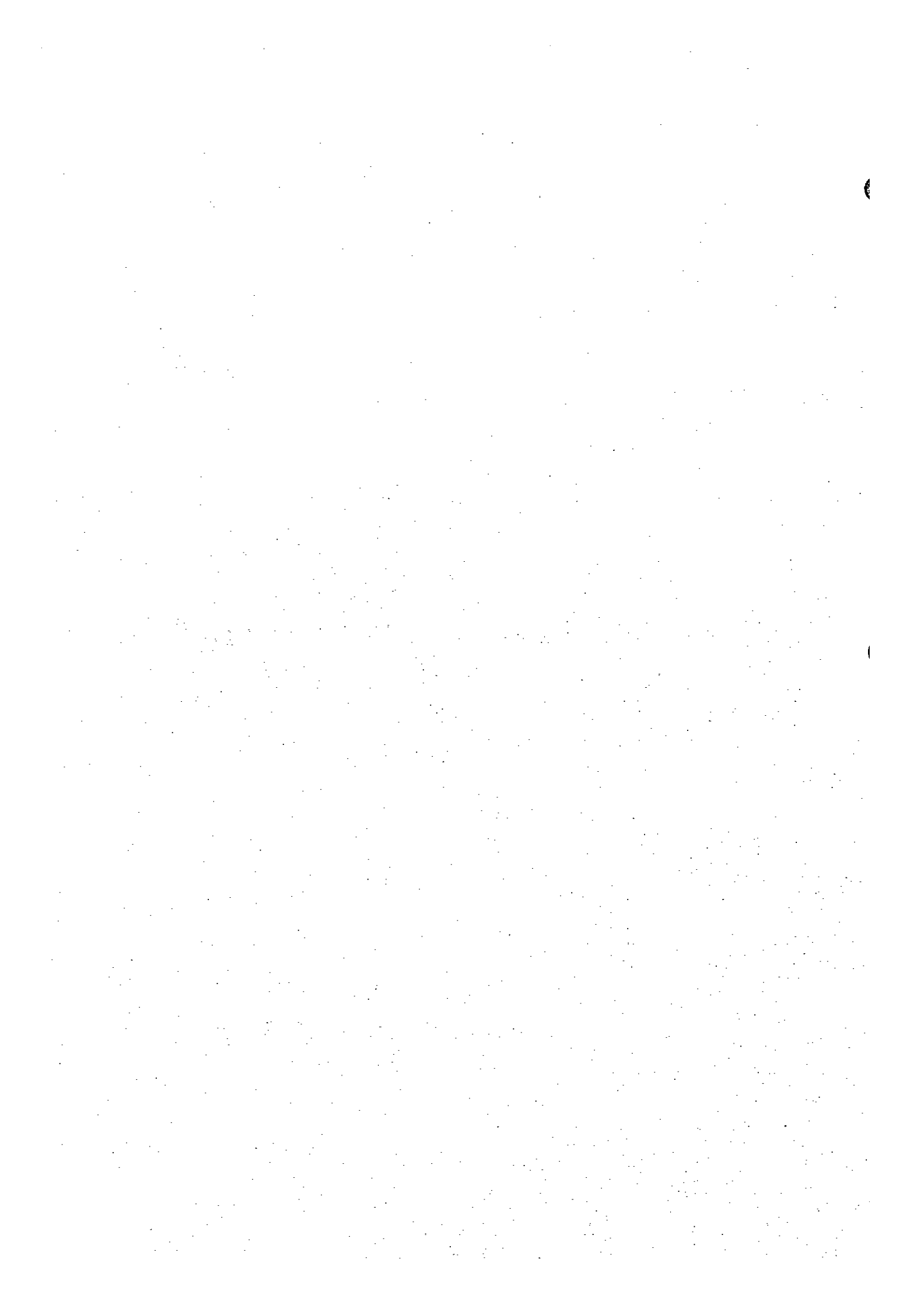


GE2.

WATER PRESSURE TEST DATA



List of Borehole Water Tests (1)

Depth (m)	Average Lugeon Value							
	M98-1	M98-2	M98-3	M98-4	M98-5	M98-6	M98-7	M98-8
					$k = 5 \times 10^{-5}$ to 1×10^{-2} cm/sec			
2 - 7	128	112	68	5		8	41	38
5 - 10	110	65	13	0		1	78	41
10 - 15	79	36	7	11	1	1	105	19
15 - 20	42	0	4	9	0	1	4	1
20 - 25	8	1	6	0	0	1	0	9
25 - 30	11	1	5	0	0	0	0	11
30 - 35	14	9	1	1		1	0	32
35 - 40	12	1	1	1		0	1	9
40 - 45	11	0	3	1		0	1	4
45 - 50	9	2	0	2		2	0	46
50 - 55	15	0	0	2		2	0	2
55 - 60	18	0	0	1		1	0	1
60 - 65	20	0	1	2		1	0	0
65 - 70	0	0	0	1		1	0	0
70 - 75		0	1				0	
75 - 80		0	0				0	
80 - 85		0	0				0	
85 - 90		0	0				0	
90 - 95		0	0				0	
95 - 100		0	0				0	

List of Borehole Water Tests (2)

Depth (m)	Average Lugeon Value							
	M98-9	M98-10	M98-11	M98-12	M98-13	M98-14	M98-15	M98-16
			$k = 5 \times 10^{-2}$ to 6.2×10^{-2} cm/sec.					
2 -- 7	20	20		1	27	53	68	105
5 -- 10	9	54	241	1	24	1	75	35
10 -- 15	4	10	1	43	19	2	14	34
15 -- 20	0	5	2	1	24	1	5	13
20 -- 25	8	2	0	1	1	0	20	3
25 -- 30	5	4	0	3	2	0	24	13
30 -- 35						0	0	28
35 -- 40						0	0	1
40 -- 45						0	0	1
45 -- 50						0	5	2
50 -- 55						0	0	1
55 -- 60						1	0	1
60 -- 65						1	0	0
65 -- 70						1	0	0
70 -- 75						0	0	
75 -- 80						0	0	
80 -- 85						0	0	
85 -- 90						0	0	
90 -- 95						0	0	
95 -- 100						0	0	
100 -- 105						0		
105 -- 110						0		
110 -- 115						0		
115 -- 120						0		
120 -- 125						0		
125 -- 130						0		
130 -- 135						0		
135 -- 140						0		
140 -- 145						0		
145 -- 150						0		
150 -- 155						0		
155 -- 160						0		
160 -- 165						0		
165 -- 170						0		
170 -- 175						0		
175 -- 180						0		

List of Borehole Water Tests (3)

Depth (m)	Average Lugeon Value						
	M98-17	M98-18	M98-19	M98-20	Qs-1	Qs-2	
				$k = 2 \times 10^{-2}$ to 6×10^{-3} cm/sec.			
2 -- 7	74	73	40		84	8	
5 -- 10	22	49	9	5	68	33	
10 -- 15	23	18	5	1	33	0	
15 -- 20	23	4	8	12	29	2	
20 -- 25	25	0	214	11	3	2	
25 -- 30	6	1	14	0	36	1	
30 -- 35	7		129		43	3	
35 -- 40	1		5		35	1	
40 -- 45	0		18		32	1	
45 -- 50	3		0		7	1	
50 -- 55	2		0			2	
55 -- 60	0		1			1	
60 -- 65			0			2	
65 -- 70			0			2	
70 -- 75						24	
75 -- 80						3	
80 -- 85						5	
85 -- 90						4	
90 -- 95						3	
95 -- 100						12	

Water Pressure Test

Hole No.: M98-1 Stages: 1/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (P_f): 1x10⁻⁴ x Q^{1.71} Date: 3/December/1998

Ground elevation: EL		Groundwater level (L _g): Nil		Gauge height (L _g): 0.73 m			
Pipe length from gauge to borehole mouth: (L _p)= 7.60 m		Depth of test section: 2 m to (L _g)= 7 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	13:16	13:29	13:41				
Q (m ³ /min)	34,313	35,582	41,340				
1	34,410	35,720	41,475				
2	34,495	35,869	41,559				
3	34,579	36,029	41,646				
4	34,667	36,193	41,732				
5	34,750	36,365	41,820				
6	34,838	36,548	41,907				
7	34,923	36,713	42,000				
8	35,007	36,886	42,083				
9	35,090	37,059	42,168				
10	35,176	37,229	42,258				
11							
12							
13							
14							
15							
Total lit.	863	1,687	918	Q=1	Q=2	Q=3	Q=4
Average lit./min	57.5	111.7	61.2	Q=1	Q=2	Q=3	Q=4
Friction loss (P _f)	0.63	2.31	0.71	Q=5	Q=6	Q=7	Q=7

Calculation of Lugeon value					
P _a -P _b =0.1(sin(a) L _s +L _p)-P _f [kg/cm ²], q=Q _s /L _s [lit/min/m]					
P ₁ =	0.9	q ₁ =	17.3		
P ₂ =	2.2	q ₂ =	33.3		
P ₃ =	0.3	q ₃ =	13.4		
P ₄ =		q ₄ =			
P ₅ =		q ₅ =			
P ₆ =		q ₆ =			
P ₇ =		q ₇ =			

Water Injection Ratio (q) : lit./min/m

Lugeon value : (128) Lu'
 Critical Pressure: >2.2 kg/cm²

Remarks : Pressure could not built at 7 kg/cm² and 10 kg/cm² due to at 4 kg/cm² water take more than 150 lit./min.

Water Pressure Test

Hole No.: M98-1 Stages: 2/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (P_f): 1x10⁻⁴ x Q^{1.71} Date: 4/December/1998

Ground elevation: EL		Groundwater level (L _g): Nil		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _p)= 7.76 m		Depth of test section: 5 m to (L _g)= 10 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	10:04	10:35	12:00	12:11	12:22		
Q (m ³ /min)	49,372	51,421	55,757	57,644	59,248		
1	49,464	51,570	55,927	57,792	59,330		
2	49,540	51,734	56,100	57,959	59,412		
3	49,619	51,869	56,270	58,087	59,496		
4	49,697	52,019	56,445	58,233	59,578		
5	49,775	52,166	56,621	58,386	59,663		
6	49,853	52,318	56,799	58,532	59,756		
7	49,931	52,459	56,979	58,688	59,833		
8	50,013	52,605	57,138	58,844	59,922		
9	50,091	52,750	57,314	59,003	60,016		
10	50,168	52,900	57,485	59,160	60,109		
11							
12							
13							
14							
15							
Total lit.	796	1,479	1,728	1,516	861	Q=1	Q=7
Average lit./min	79.6	147.9	172.8	151.6	86.1	Q=1	Q=7
Friction loss (P _f)	0.71	2.42	3.29	2.54	0.83	Q=5	Q=6

Calculation of Lugeon value					
P _a -P _b =0.1(sin(a) L _s +L _p)-P _f [kg/cm ²], q=Q _s /L _s [lit/min/m]					
P ₁ =	1.1	q ₁ =	15.9		
P ₂ =	2.4	q ₂ =	29.6		
P ₃ =	2.8	q ₃ =	34.6		
P ₄ =	2.3	q ₄ =	30.3		
P ₅ =	1.0	q ₅ =	17.2		
P ₆ =		q ₆ =			
P ₇ =		q ₇ =			

Water Injection Ratio (q) : lit./min/m

Lugeon value : (110) Lu'
 Critical Pressure: >2.8 kg/cm²

Remarks : At 7 and 10 kg/cm², pressure could not built.

Note : Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute

Prepared by : Azhar Ms. & A. Gill

Inspected by : M. Supa

Note : Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute

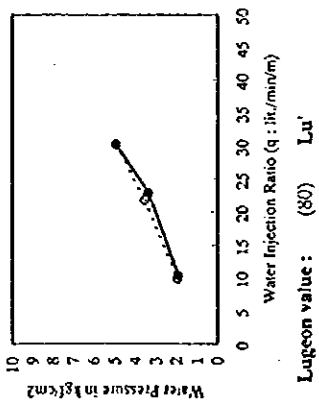
Prepared by : Azhar

Inspected by : A. Gill

Water Pressure Test

Hole No.: M98-1 Stage: 3/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁶ x Q^{1.75} Date: 8/December/1998

Ground elevation: EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 7.20 m		Depth of test section: 10 m to (L _g) = 15 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge # (kg/cm ²)	P ₀₁	P ₀₂	P ₀₃	P ₀₄	P ₀₅	P ₀₆	P ₀₇
Start time	14:51	15:14	15:36	15:50	16:05		
Q (mm)	77,259	78,226	79,620	81,226	82,492		
1	77,215	78,351	79,770	81,359	82,544		
2	77,366	78,466	79,926	81,469	82,593		
3	77,425	78,579	80,075	81,586	82,639		
4	77,479	78,695	80,225	81,700	82,687		
5	77,537	78,809	80,375	81,815	82,747		
6	77,589	78,923	80,526	81,928	82,803		
7	77,642	79,038	80,676	82,036	82,862		
8	77,690	79,149	80,827	82,138	82,912		
9	77,734	79,264	80,976	82,231	82,949		
10	77,781	79,378	81,131	82,327	82,989		
11							
12							
13							
14							
15							
Total lit.	572	1,142	1,511	1,091	497		
Average lit./min	57.2	114.2	151.1	109.1	49.7		
Finish time	15:31	15:24	15:36	16:03	16:15		
(P ₀)	0.62	1.96	3.41	1.79	0.38		
Friction Loss (P _f) = p _f (L _p + L _s) [kg/cm ²]							



Calculation of Lugeon value
 $P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \cdot P_f$ (kg/cm²), $q = Q_s / L_s$ (lit/min/m)
 P₁ = 1.9 q₁ = 10.44
 P₂ = 3.4 q₂ = 22.84
 P₃ = 4.9 q₃ = 30.22
 P₄ = 3.5 q₄ = 21.82
 P₅ = 1.9 q₅ = 9.94
 P₆ =
 P₇ =

Lugeon value: (80) **L_u'**
 Critical Pressure: >4.9 kg/cm²

Remarks: Due to very high loss of water, pressure did not developed beyond 7 kg/cm².

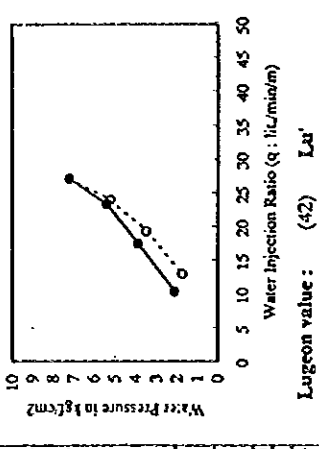
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute

Prepared by: A. Hamid & Azhar Inspected by: A. Gill

Water Pressure Test

Hole No.: M98-1 Stage: 4/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁶ x Q^{1.75} Date: 17/December/1998

Ground elevation: EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 9.34 m		Depth of test section: 14.5 m to (L _g) = 20 m		Length of section (L _s): 5.5 m			
Reading of flow meter							
Gauge # (kg/cm ²)	P ₀₁	P ₀₂	P ₀₃	P ₀₄	P ₀₅	P ₀₆	P ₀₇
Start time	15:15	15:30	15:45	16:00	16:15	16:30	16:50
Q (mm)	98,290	99,080	200	2,000	3,660	5,100	6,250
1	98,359	99,092	327	2,141	3,792	5,206	6,321
2	98,416	99,192	454	2,298	3,923	5,312	6,393
3	98,473	99,297	583	2,448	4,057	5,418	6,464
4	98,528	99,383	713	2,601	4,186	5,524	6,535
5	98,584	99,479	839	2,746	4,320	5,629	6,606
6	98,638	99,575	969	2,896	4,452	5,735	6,678
7	98,694	99,671	1,099	3,045	4,584	5,841	6,749
8	98,750	99,767	1,228	3,194	4,716	5,947	6,822
9	98,805	99,863	1,356	3,345	4,846	6,053	6,894
10	98,862	99,959	1,485	3,493	4,979	6,159	6,966
11							
12							
13							
14							
15							
Total lit.	572	959	1,285	1,493	1,319	1,059	716
Average lit./min	57.2	95.9	128.5	149.3	131.9	105.9	71.6
Finish time	15:25	15:40	15:55	16:10	16:25	16:40	17:00
(P ₀)	0.70	1.93	3.43	4.61	3.61	2.34	1.08
Friction Loss (P _f) = p _f (L _p + L _s) [kg/cm ²]							



Calculation of Lugeon value
 $P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \cdot P_f$ (kg/cm²), $q = Q_s / L_s$ (lit/min/m)
 P₁ = 2.1 q₁ = 10.4
 P₂ = 3.9 q₂ = 17.4
 P₃ = 5.4 q₃ = 23.4
 P₄ = 7.2 q₄ = 27.1
 P₅ = 5.2 q₅ = 24.0
 P₆ = 3.5 q₆ = 19.3
 P₇ = 1.7 q₇ = 13.0

Lugeon value: (42) **L_u'**
 Critical Pressure: >7.2 kg/cm²

Remarks:

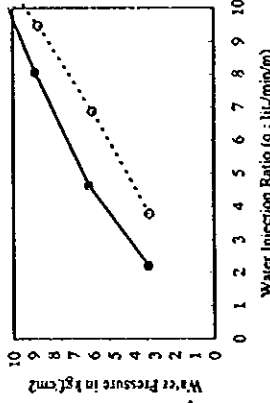
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute

Prepared by: Farhat M. Shah Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-1 Stage: 5/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁶ x Q^{1.75} m Date: 1/January/1998

Ground elevation: EL		Groundwater level (L _g):		NII		Gauge height (L _g):		0.73 m	
Pipe length from pressure gauge to borehole mouth: (L _g) = 9.30 m		Depth of test section: (L _g) = 20 m		to (L _g) = 25 m		Length of section (L _g) = 5 m			
Reading of flow meter									
Gauge P.	Pa1	Pa2	Pa3	Pa4	Pa5	Pa6	Pa7	Pa8	Pa9
Start time	11:35	11:48	12:06	12:13	12:35	12:47	13:00		
Q (m ³ /min)	37.970	38.120	38.410	38.910	39.610	40.130	40.500		
1	37.981	38.149	38.450	38.970	39.657	40.164	40.518		
2	37.994	38.167	38.490	39.028	39.705	40.198	40.536		
3	38.006	38.191	38.530	39.087	39.753	40.232	40.554		
4	38.017	38.213	38.570	39.146	39.801	40.266	40.578		
5	38.028	38.236	38.611	39.205	39.847	40.301	40.591		
6	38.039	38.260	38.651	39.265	39.894	40.335	40.610		
7	38.049	38.282	38.691	39.325	39.942	40.370	40.630		
8	38.059	38.305	38.731	39.386	39.990	40.404	40.650		
9	38.070	38.328	38.771	39.447	40.037	40.438	40.669		
10	38.080	38.351	38.812	39.500	40.084	40.473	40.689		
11									
12									
13									
14									
15									
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7		
Ill.	237	362	344	710	602	454	290		
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7		
Ill./min	23.7	36.2	34.4	71.0	60.2	45.4	29.0		
Remarks	11:35	11:58	12:10	12:35	12:50	13:05	13:20		
Friction Loss (P _f) = p(L _g + L)	0.17	0.40	0.90	1.51	1.09	0.63	0.26		
Calculation of Lugeon value									
P = P ₀ + 0.1(sin α) L _g + L _g P _r [kg/cm ²], q = Q _g / L _g [lit/min/m]									
P ₁	3.3	q ₁	2.2						
P ₂	6.2	q ₂	4.6						
P ₃	8.9	q ₃	8.0						
P ₄	11.4	q ₄	11.8						
P ₅	8.7	q ₅	9.5						
P ₆	6.0	q ₆	6.9						
P ₇	3.2	q ₇	3.8						



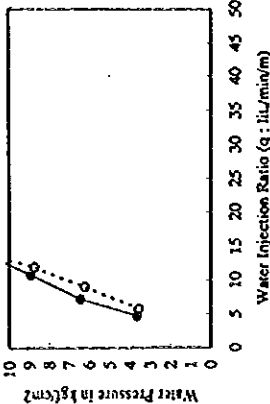
Lugeon value: 7.1 kg/cm²
 Critical Pressure: 7.1 kg/cm²

Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the just previous one minute.
 Prepared by: A. Hamid Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-1 Stage: 6/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁶ x Q^{1.75} m Date: 2/January/1998

Ground elevation: EL		Groundwater level (L _g):		NII		Gauge height (L _g):		0.73 m	
Pipe length from pressure gauge to borehole mouth: (L _g) = 8.90 m		Depth of test section: (L _g) = 25 m		to (L _g) = 30 m		Length of section (L _g) = 5 m			
Reading of flow meter									
Gauge P.	Pa1	Pa2	Pa3	Pa4	Pa5	Pa6	Pa7	Pa8	Pa9
Start time	11:45	11:58	12:10	12:25	12:48	12:55	13:10		
Q (m ³ /min)	45.385	45.710	46.190	46.870	47.700	48.410	48.910		
1	45.419	45.746	46.246	46.938	47.750	48.456	48.938		
2	45.433	45.783	46.302	47.006	47.820	48.501	48.967		
3	45.456	45.819	46.357	47.076	47.880	48.546	48.996		
4	45.481	45.855	46.412	47.157	47.940	48.592	49.025		
5	45.505	45.892	46.466	47.217	48.000	48.637	49.054		
6	45.528	45.928	46.520	47.288	48.061	48.688	49.083		
7	45.552	45.964	46.573	47.361	48.121	48.728	49.112		
8	45.576	46.000	46.626	47.434	48.181	48.779	49.141		
9	45.600	46.039	46.682	47.506	48.242	48.818	49.170		
10	45.622	46.072	46.734	47.580	48.302	48.864	49.200		
11									
12									
13									
14									
15									
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7		
Ill.	237	362	344	710	602	454	290		
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7		
Ill./min	23.7	36.2	34.4	71.0	60.2	45.4	29.0		
Remarks	11:45	11:58	12:10	12:25	12:45	13:05	13:20		
Friction Loss (P _f) = p(L _g + L)	0.17	0.40	0.90	1.51	1.09	0.63	0.26		
Calculation of Lugeon value									
P = P ₀ + 0.1(sin α) L _g + L _g P _r [kg/cm ²], q = Q _g / L _g [lit/min/m]									
P ₁	3.6	q ₁	4.7						
P ₂	6.4	q ₂	7.2						
P ₃	8.9	q ₃	10.9						
P ₄	11.3	q ₄	14.2						
P ₅	8.7	q ₅	12.0						
P ₆	6.2	q ₆	9.1						
P ₇	3.6	q ₇	5.8						



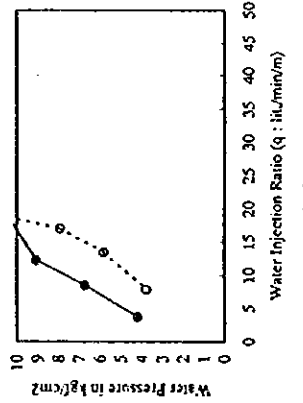
Lugeon value: 6.4 kg/cm²
 Critical Pressure: 6.4 kg/cm²

Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the just previous one minute.
 Prepared by: A. Hamid Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-1 Stage: 7/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ x Q^{1.75} Date: 3/January/1998

Ground elevation: EL. m		Groundwater level (L _g):		NIL		Gauge height (L _g): 0.73 m		
Pipe length from pressure gauge to borehole mouth: (L _p)= 7.50 m		Depth of test section to (L _s)= 30 m		to (L _g)= 35 m		Length of section (L _s)= 5 m		
Reading of flow meter								
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	
Start time	12:30	12:43	12:55	13:08	13:20	13:33	13:45	
Q (m ³ /min)	54.440	54.660	55.220	55.950	56.960	57.900	58.610	
1	54.454	54.703	55.281	56.031	57.034	57.966	58.644	
2	54.477	54.746	55.342	56.117	57.120	58.032	58.688	
3	54.496	54.784	55.404	56.207	57.205	58.100	58.727	
4	54.514	54.832	55.465	56.298	57.293	58.167	58.767	
5	54.533	54.875	55.526	56.390	57.380	58.235	58.807	
6	54.552	54.917	55.587	56.487	57.468	58.303	58.847	
7	54.570	54.954	55.648	56.585	57.556	58.370	58.886	
8	54.588	55.003	55.710	56.685	57.644	58.439	58.926	
9	54.607	55.045	55.771	56.787	57.731	58.507	58.966	
10	54.625	55.087	55.833	56.890	57.814	58.575	59.005	
11								
12								
13								
14								
15								
Total lit.	185	427	613	940	1254	1675	2095	
Average lit./min	18.5	42.7	61.3	94.0	125.4	167.5	209.5	
Flow time	12:40	12:53	13:05	13:18	13:30	13:43	13:55	
(P ₁)	0.12	0.61	1.25	2.91	2.41	1.52	0.53	
Friction Loss (P _f) = p(L _p + L _s) (kg/cm ²)								9.1
Remarks:								



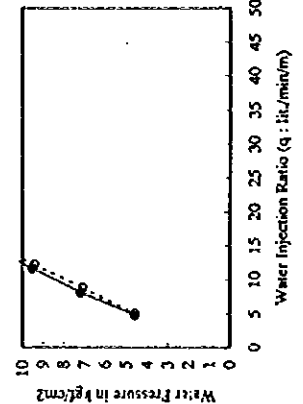
Water Injection Rate (q) : lit/min/m
 Lugeon value : (14) Lu'
 Critical Pressure: 9.1 kg/cm²

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: A. Gill

Water Pressure Test

Hole No.: M98-1 Stage: 8/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ x Q^{1.75} Date: 4/January/1999

Ground elevation: EL. m		Groundwater level (L _g):		NIL		Gauge height (L _g): 0.73 m		
Pipe length from pressure gauge to borehole mouth: (L _p)= 7.50 m		Depth of test section to (L _s)= 35 m		to (L _g)= 40 m		Length of section (L _s)= 5 m		
Reading of flow meter								
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	
Start time	12:00	12:12	12:25	12:38	12:50	13:03	13:15	
Q (m ³ /min)	66.300	66.600	67.100	67.800	68.600	69.300	69.800	
1	66.323	66.641	67.158	67.875	68.691	69.374	69.854	
2	66.350	66.682	67.217	67.951	68.752	69.418	69.890	
3	66.375	66.723	67.275	68.027	68.813	69.463	69.905	
4	66.398	66.763	67.334	68.103	68.874	69.507	69.930	
5	66.423	66.804	67.392	68.179	68.936	69.551	69.956	
6	66.448	66.845	67.450	68.255	68.997	69.595	69.981	
7	66.472	66.886	67.508	68.331	69.058	69.639	70.006	
8	66.497	66.926	67.567	68.409	69.120	69.683	70.032	
9	66.520	66.967	67.625	68.485	69.181	69.727	70.057	
10	66.545	67.008	67.683	68.561	69.242	69.772	70.082	
11								
12								
13								
14								
15								
Total lit.	245	408	583	761	945	1127	1307	
Average lit./min	24.5	40.8	58.3	76.1	94.5	112.7	130.7	
Flow time	12:10	12:22	12:35	12:48	13:00	13:13	13:25	
(P ₁)	0.23	0.64	1.29	2.18	1.82	0.75	0.25	
Friction Loss (P _f) = p(L _p + L _s) (kg/cm ²)								12
Remarks:								



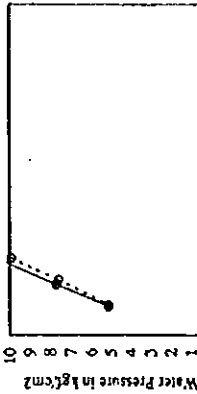
Water Injection Rate (q) : lit/min/m
 Lugeon value : 12 Lu
 Critical Pressure: >12 kg/cm²

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: Azhor Inspected by: A. Gill

Water Pressure Test

Hole No.: M98-1 Stage: 9/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁶ kg/cm² Date: 5/January/1999

Ground elevation: EL		Groundwater level (L): Nil		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _b) = 7.50 m		Depth of test section to (L _t) = 45 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P _{a1}	P _{a2}	P _{a3}	P _{a4}	P _{a5}	P _{a6}	P _{a7}
Start time	13:10	13:25	13:40	13:55	14:10	14:25	14:40
U (min)	85.430	85.655	86.050	86.620	87.430	88.021	88.655
1	85.432	85.693	86.104	86.691	87.487	88.062	88.477
2	85.474	85.732	86.157	86.764	87.544	88.105	88.498
3	85.497	85.769	86.212	86.838	87.602	88.145	88.521
4	85.518	85.807	86.265	86.910	87.662	88.188	88.543
5	85.539	85.846	86.319	86.983	87.721	88.230	88.567
6	85.562	85.886	86.374	87.057	87.778	88.271	88.592
7	85.584	85.923	86.428	87.128	87.834	88.313	88.613
8	85.602	85.961	86.481	87.201	87.893	88.355	88.636
9	85.626	86.000	86.534	87.276	87.951	88.398	88.658
10	85.647	86.037	86.590	87.349	88.011	88.440	88.682
11							
12							
13							
14							
15							
Total	Q _{a1}	Q _{a2}	Q _{a3}	Q _{a4}	Q _{a5}	Q _{a6}	Q _{a7}
lit.	217	362	540	779	581	419	227
Average	Q _{a1}	Q _{a2}	Q _{a3}	Q _{a4}	Q _{a5}	Q _{a6}	Q _{a7}
lit./min.	21.7	36.2	54.0	77.9	58.1	41.9	22.7
Flow time	13:20	13:35	13:50	14:05	14:20	14:35	14:50
(P)	0.21	0.63	1.24	2.24	1.33	0.75	0.22
Friction Loss (P _f) = p(L _b + L _t) (kg/cm ²)		Lugeon value: 11 Lu		Critical Pressure: >12 kg/cm ²		Remarks:	



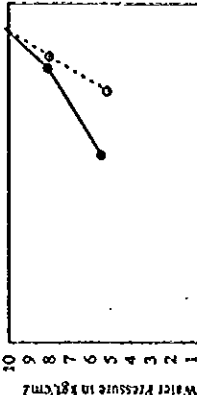
Water Injection Ratio (q : lit./min/m)
 Lugeon value: 11 Lu
 Critical Pressure: >12 kg/cm²

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the just previous one minute.
 Prepared by: Azhor / Hamid Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-1 Stage: 10/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁶ kg/cm² Date: 10/January/1999

Ground elevation: EL		Groundwater level (L): Nil		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _b) = 7.50 m		Depth of test section to (L _t) = 45 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P _{a1}	P _{a2}	P _{a3}	P _{a4}	P _{a5}	P _{a6}	P _{a7}
Start time	13:00	13:12	13:25	13:38	13:50	14:03	14:15
U (min)	13.590	13.965	14.459	15.018	15.630	16.190	16.685
1	13.618	14.005	14.499	15.071	15.678	16.233	16.723
2	13.646	14.045	14.547	15.121	15.726	16.276	16.760
3	13.674	14.085	14.594	15.174	15.773	16.319	16.798
4	13.701	14.126	14.642	15.225	15.820	16.362	16.835
5	13.728	14.166	14.690	15.280	15.868	16.403	16.872
6	13.756	14.207	14.737	15.332	15.916	16.445	16.910
7	13.784	14.248	14.786	15.386	15.963	16.487	16.946
8	13.811	14.288	14.833	15.437	16.010	16.527	16.981
9	13.839	14.328	14.881	15.492	16.058	16.570	17.019
10	13.867	14.369	14.929	15.545	16.106	16.612	17.056
11							
12							
13							
14							
15							
Total	Q _{a1}	Q _{a2}	Q _{a3}	Q _{a4}	Q _{a5}	Q _{a6}	Q _{a7}
lit.	377	404	479	527	476	422	371
Average	Q _{a1}	Q _{a2}	Q _{a3}	Q _{a4}	Q _{a5}	Q _{a6}	Q _{a7}
lit./min.	27.7	40.4	47.9	52.7	47.6	42.2	37.1
Flow time	13:10	13:22	13:35	13:48	14:00	14:13	14:25
(P)	0.37	0.77	1.08	1.30	1.07	0.94	0.65
Friction Loss (P _f) = p(L _b + L _t) (kg/cm ²)		Lugeon value: 9.2 Lu		Critical Pressure: >14 kg/cm ²		Remarks:	



Water Injection Ratio (q : lit./min/m)
 Lugeon value: 9.2 Lu
 Critical Pressure: >14 kg/cm²

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the just previous one minute.
 Prepared by: Azhor / Hamid Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-1 Stage: 11/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 101 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ x Q^{1.75} Date: 13/January/1999

Ground elevation: EL		Groundwater level (L _g): GL = 50.30 m		Gauge height (L _g): 0.73 m		
Pipe length from pressure gauge to borehole mouth: (L _b) = 7.00 m		Depth of test section: GL - (L _b) = 55 m to (L _g) = 5 m		Length of section (L _s) = 5 m		
Reading of flow meter						
Gauge P. (kg/cm ²)	P _{a1}	P _{a2}	P _{a3}	P _{a4}	P _{a5}	P _{a7}
Start time	11:00	11:12	11:25	11:38	11:53	12:18
Q (m ³ /min)	31.000	31.520	32.170	33.030	34.280	34.860
1	31.046	31.577	32.240	33.120	34.362	35.257
2	31.093	31.634	32.312	33.210	34.444	35.323
3	31.137	31.691	32.383	33.304	34.527	35.390
4	31.180	31.747	32.454	33.398	34.608	35.456
5	31.222	31.804	32.525	33.494	34.690	35.523
6	31.264	31.862	32.596	33.591	34.774	35.590
7	31.305	31.918	32.666	33.692	34.855	35.656
8	31.346	31.975	32.737	33.797	34.937	35.723
9	31.387	32.032	32.810	33.907	35.019	35.789
10	31.428	32.088	32.884	34.020	35.102	35.855
11						
12						
13						
14						
15						
Total lit.	428	568	714	990	822	666
Average lit./min	42.8	56.8	71.4	99.0	82.2	66.6
Final time	11:10	11:22	11:35	11:48	12:03	12:16
(P _f)	0.94	1.64	2.38	4.91	3.40	2.25
Friction Loss (P _f) = p(L _b + L _s) [kg/cm ²]						
Remarks:						

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: Azhor / Hamid Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-1 Stage: 12/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ x Q^{1.75} Date: 28/January/1999

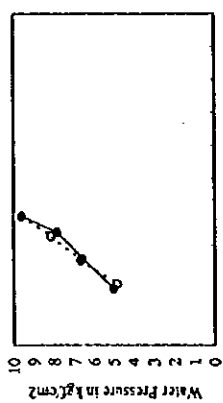
Ground elevation: EL		Groundwater level (L _g): GL = 50.30 m		Gauge height (L _g): 0.73 m		
Pipe length from pressure gauge to borehole mouth: (L _b) = 7.00 m		Depth of test section: GL - (L _b) = 55 m to (L _g) = 60 m		Length of section (L _s) = 5 m		
Reading of flow meter						
Gauge P. (kg/cm ²)	P _{a1}	P _{a2}	P _{a3}	P _{a4}	P _{a5}	P _{a7}
Start time	15:00	15:13	15:25	15:40	15:54	16:20
Q (m ³ /min)	73.030	73.100	73.930	74.910	76.010	76.820
1	73.051	73.284	74.009	75.005	76.092	76.884
2	73.075	73.295	74.086	75.100	76.171	76.948
3	73.092	73.444	74.164	75.195	76.250	77.010
4	73.112	73.495	74.240	75.289	76.330	77.074
5	73.132	73.550	74.317	75.385	76.411	77.137
6	73.151	73.605	74.396	75.480	76.491	77.197
7	73.170	73.662	74.474	75.574	76.570	77.256
8	73.190	73.715	74.552	75.667	76.652	77.297
9	73.211	73.773	74.630	75.760	76.733	77.345
10	73.234	73.830	74.708	75.853	76.813	77.446
11						
12						
13						
14						
15						
Total lit.	204	530	778	945	801	626
Average lit./min	20.4	53.0	77.8	94.5	80.1	62.6
Final time	15:10	15:23	15:35	15:50	16:04	16:30
(P _f)	0.24	1.56	3.32	4.87	3.51	2.16
Friction Loss (P _f) = p(L _b + L _s) [kg/cm ²]						
Remarks:						

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: Azhor / Hamid Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-1 Stage: 13/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ x Q^{1.75} Date: 30/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. m		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 7.00 m		Depth of test section: GL. - (L _g) = 65 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	15:15	15:27	15:40	15:52	16:05	16:17	16:29
Q (m ³ /min)	11.270	11.828	12.670	13.738	14.890	14.846	15.602
1	11.313	11.894	12.764	13.838	14.972	14.910	15.648
2	11.356	11.938	12.846	13.933	15.054	14.974	15.695
3	11.398	12.022	12.930	14.030	15.136	15.038	15.742
4	11.441	12.087	13.013	14.126	15.219	15.101	15.788
5	11.484	12.153	13.098	14.221	15.300	15.166	15.833
6	11.526	12.219	13.184	14.318	15.382	15.230	15.880
7	11.568	12.283	13.268	14.414	15.465	15.294	15.926
8	11.612	12.348	13.351	14.512	15.545	15.359	15.972
9	11.655	12.413	13.434	14.609	15.628	15.422	16.017
10	11.698	12.479	13.518	14.706	15.710	15.486	16.063
11							
12							
13							
14							
15							
Total lit.	428	651	848	968	870	640	461
Average lit./min	42.8	65.1	84.8	96.8	87.0	64.0	46.1
Breakdown time	15:25	15:37	15:50	16:02	16:15	16:27	16:39
(P _g)	3.10	2.52	4.25	5.52	3.98	2.44	1.28
Friction Loss (P _f) = p(L _p + L _s) [kg/cm ²]						P _g	
Remarks:							



Water Injection Ratio (q) : lit/min/m
 Luqeon value : (20) Lu
 Critical Pressure: >9.6 kg/cm²

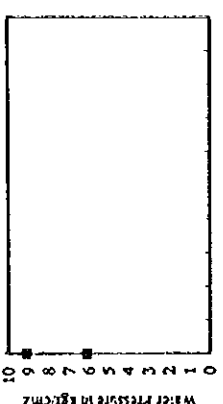
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute

Prepared by: Azhor / Humid Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-1 Stage: 14/14
 Location: Dam Axis (Right Bank, Dam Crest) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ x Q^{1.75} Date: 02/February/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. m		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 7.00 m		Depth of test section: GL. - (L _g) = 65 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	11:45	11:57	12:10	12:22	12:34	12:46	12:58
Q (m ³ /min)	7.9745	7.98038	7.9810	7.9813	7.9831	7.9886	7.9887
1	7.9745	7.98038	7.9810	7.9813	7.9831	7.9886	7.9887
2	7.9745	7.98038	7.9810	7.9825	7.9881	7.9886	7.9887
3	7.9745	7.98038	7.9810	7.9837	7.9881	7.9886	7.9887
4	7.9745	7.98038	7.9811	7.9845	7.9881	7.9886	7.9887
5	7.9745	7.98038	7.9811	7.9854	7.9881	7.9886	7.9887
6	7.9745	7.98038	7.9811	7.9859	7.9882	7.9887	7.9887
7	7.9745	7.98038	7.9811	7.9862	7.9882	7.9887	7.9887
8	7.9745	7.98038	7.9811	7.9866	7.9882	7.9887	7.9887
9	7.9745	7.98038	7.9811	7.9870	7.9883	7.9887	7.9887
10	7.9745	7.98038	7.9812	7.9874	7.9883	7.9887	7.9887
11							
12							
13							
14							
15							
Total lit.	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Average lit./min	0.00	0.01	0.02	0.51	0.02	0.01	0.00
Breakdown time	11:55	12:07	12:20	12:32	12:44	12:56	13:08
(P _g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P _f) = p(L _p + L _s) [kg/cm ²]						P _g	
Remarks:							



Water Injection Ratio (q) : lit/min/m
 Luqeon value: 0.0 Lu
 Critical Pressure: 1.5 kg/cm²

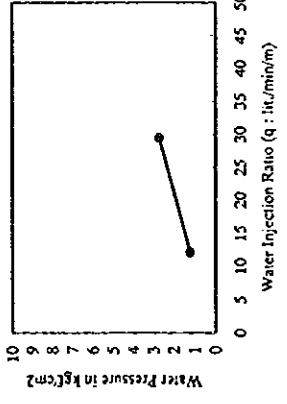
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute

Prepared by: Azhor / Humid Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 1/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ m/m Date: 17/December/1998

Ground elevation : EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _b)= 7.50 m		Depth of test section m to (L _b)= 7 m		Length of section (L _s)= 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	13:37	13:40					
Q (l/min)	11,320	12,040					
1	11,380	12,197					
2	11,445	12,332					
3	11,506	12,480					
4	11,568	12,630					
5	11,629						
6	11,690						
7	11,751						
8	11,810						
9	11,870						
10	11,929						
11							
12							
13							
14							
15							
Total lit.	609	590					
Average lit./min	60.9	147.5					
Friction loss (Pa)	0.31	1.79					
Friction Loss (Pr) = p(L _b + L _s) [kg/cm ²]							



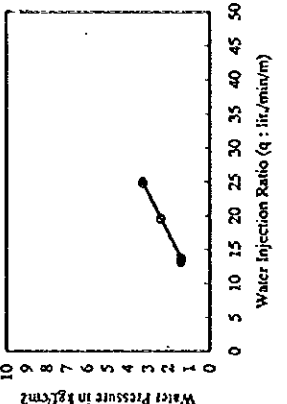
Lu_g value : (112) Lu' kg/cm²
 Critical Pressure: >2.7 kg/cm²

Remarks : Packer leaked at 1kg/cm² and 2 kg/cm².
 Note : Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by : Farhat M. Shah Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 2/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ m/m Date: 18/December/1998

Ground elevation : EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _b)= 6.89 m		Depth of test section m to (L _b)= 5 m		Length of section (L _s)= 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	12:05	12:30	12:35	13:10			
Q (l/min)	18,930	20,100	20,200	24,300			
1	19,002	20,238	20,300	24,367			
2	19,073	20,357	20,398	24,436			
3	19,143	20,477	20,494	24,502			
4	19,212	20,601		24,568			
5	19,279	20,727		24,633			
6	19,346	20,855		24,699			
7	19,413	20,982		24,766			
8	19,480	21,106		24,831			
9	19,547	21,223		24,898			
10	19,614	21,345		24,963			
11							
12							
13							
14							
15							
Total lit.	684	1,245	294	663			
Average lit./min	68.4	124.5	98.0	66.3			
Friction loss (Pa)	0.49	1.01	1.80	0.46			
Friction Loss (Pr) = p(L _b + L _s) [kg/cm ²]							



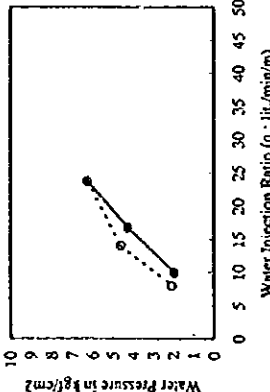
Lu_g value : (65) Lu' kg/cm²
 Critical Pressure: >3.2 kg/cm²

Remarks : Due to high water loss all stages could not be completed. Equipment condition unsatisfactory. Test had to be stopped three times due to puncture of delivery hose.
 Note : Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by : Farhat M. Shah Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 3/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1 x 10⁻⁵ kg/cm²/m Date: 20/December/1998

Ground elevation: EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _g) = 6.81 m		Depth of test section m to (L _g) = 15 m		Length of section (L _g) = 5 m			
Group P _i (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	12:30	13:04	13:16	13:30	13:45		
Q (m ³ /min)	35.568	36.220	34.000	39.370	40.130		
1	35.608	36.311	38.125	39.436	40.167		
2	35.651	36.391	38.258	39.504	40.207		
3	35.702	36.473	38.374	39.575	40.250		
4	35.752	36.558	38.497	39.647	40.294		
5	35.802	36.642	38.516	39.720	40.338		
6	35.852	36.726	38.790	39.792	40.382		
7	35.902	36.811	38.858	39.867	40.425		
8	35.952	36.899	38.980	39.937	40.465		
9	36.003	36.983	39.085	40.004	40.498		
10	36.056	37.072	39.186	40.073	40.529		
11							
12							
13							
14							
15							
Total lit.	496	842	1,186	703	399		
Average lit./min	49.6	84.2	118.6	70.3	39.9		
Friction Loss (Pr) = p(L _g + L _g) [kg/cm ²]	0.37	1.05	2.07	0.74	0.24		

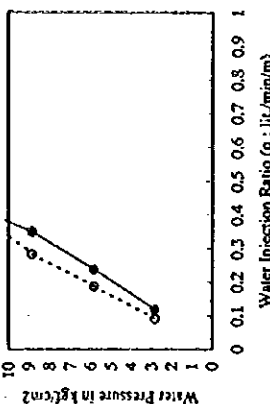


Remarks: 10 kg/cm² pressure could not built, due to more than maximum discharge of pump.
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the four previous one minute
 Prepared by: A. Humid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 4/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1 x 10⁻⁵ kg/cm²/m Date: 22/December/1998

Ground elevation: EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _g) = 6.75 m		Depth of test section m to (L _g) = 20 m		Length of section (L _g) = 5 m			
Group P _i (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	12:30	12:45	12:57	13:10	13:22	13:35	13:50
Q (m ³ /min)	5.784.9	5.798.0	5.813.5	5.838.0	5.862.0	5.879.0	5.888.9
1	5.785.5	5.799.2	5.815.3	5.840.2	5.863.4	5.880.0	5.889.3
2	5.786.1	5.800.5	5.817.1	5.842.5	5.864.9	5.880.9	5.889.8
3	5.786.7	5.801.7	5.818.9	5.844.6	5.866.3	5.881.8	5.890.3
4	5.787.3	5.802.9	5.820.7	5.846.8	5.867.7	5.882.8	5.890.8
5	5.787.9	5.804.1	5.822.4	5.848.8	5.869.5	5.883.7	5.891.2
6	5.788.5	5.805.3	5.824.2	5.850.9	5.870.6	5.884.7	5.891.7
7	5.789.1	5.806.4	5.825.9	5.853.0	5.872.0	5.885.6	5.892.6
8	5.789.7	5.807.6	5.827.6	5.855.1	5.873.4	5.886.5	5.892.6
9	5.790.2	5.808.7	5.829.3	5.857.1	5.874.8	5.887.5	5.893.1
10	5.790.8	5.809.9	5.831.0	5.859.1	5.876.2	5.888.4	5.893.5
11							
12							
13							
14							
15							
Total lit.	5.9	11.9	17.5	21.1	14.2	9.4	4.6
Average lit./min	0.59	1.19	1.75	2.1	1.42	0.94	0.46
Friction Loss (Pr) = p(L _g + L _g) [kg/cm ²]	0.09	0.09	0.09	0.09	0.09	0.09	0.09

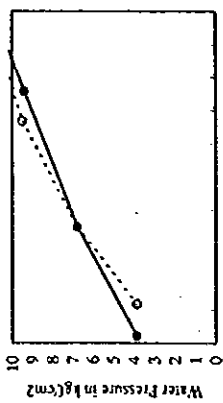


Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the four previous one minute
 Prepared by: Falhat M. Shah Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 7/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (pr): 1x10⁻³ kg/cm²/m Date: 25/December/1998

Ground elevation: EL		Groundwater level (L _g): GL		27.80 m		Gauge height (L _g): 0.86 m	
Pipe length from pressure gauge to borehole mouth: (L _g) = 6.70 m		Depth of test section to (L _g) = 35 m		to (L _g) = 35 m		Length of section (L _g) = 5 m	
Reading of flow meter							
Gauge P.	P-1	P-2	P-3	P-4	P-5	P-6	P-7
Start time	13:55	14:10	14:25	14:40	14:55	15:10	15:25
Q (lit/min)	54.004	54.051	54.262	54.747	55.343	55.693	55.861
1	54.005	54.068	54.302	54.807	55.378	55.709	55.866
2	54.006	54.088	54.343	54.865	55.412	55.727	55.871
3	54.007	54.108	54.383	54.923	55.447	55.745	55.877
4	54.008	54.128	54.421	54.980	55.481	55.762	55.882
5	54.009	54.148	54.460	55.039	55.516	55.780	55.888
6	54.010	54.166	54.496	55.095	55.549	55.797	55.895
7	54.012	54.182	54.533	55.149	55.581	55.815	55.901
8	54.013	54.196	54.569	55.204	55.613	55.833	55.908
9	54.014	54.212	54.605	55.260	55.645	55.850	55.915
10	54.015	54.226	54.641	55.314	55.677	55.868	55.921
11							
12							
13							
14							
15							
Total lit.	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
	11	175	379	567	354	175	60
Average lit./min	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
	1.1	17.5	37.9	56.7	35.4	17.5	6.0
Friction loss (Pr)	14:03	14:20	14:35	14:50	15:05	15:20	15:35
(Pr)	0.00	0.10	0.48	1.05	0.37	0.10	0.01
Calculation of Lugeon value							
$P = P_0 + 0.1(\sin \theta)(L_g - L_b)Pr$ [kg/cm ²], $q = Q/L_g$ [lit/min/m]							
P1 =	3.9	q1 =	0.2				
P2 =	6.8	q2 =	3.5				
P3 =	9.4	q3 =	7.6				
P4 =	11.8	q4 =	11.3				
P5 =	9.5	q5 =	6.7				
P6 =	6.8	q6 =	3.5				
P7 =	3.9	q7 =	1.2				



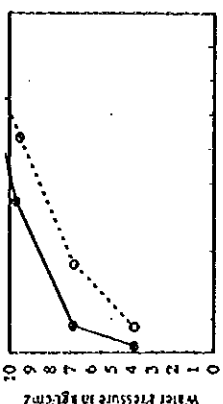
Lugeon value: 8.5
 Critical Pressure: >12 kg/cm²

Remarks: Reverse flow for 50 seconds by decreasing from 4 to 1 kg/cm².
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 8/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (pr): 1x10⁻³ kg/cm²/m Date: 27/December/1998

Ground elevation: EL		Groundwater level (L _g): GL		27.80 m		Gauge height (L _g): 0.86 m	
Pipe length from pressure gauge to borehole mouth: (L _g) = 6.73 m		Depth of test section to (L _g) = 35 m		to (L _g) = 40 m		Length of section (L _g) = 5 m	
Reading of flow meter							
Gauge P.	P-1	P-2	P-3	P-4	P-5	P-6	P-7
Start time	10:18	10:12	10:25	10:38	10:50	11:02	11:15
Q (lit/min)	2.842.0	62.856	62.902	63.163	63.700	64.026	64.161
1	2.842.8	62.860	62.923	63.214	63.732	64.037	64.163
2	2.843.9	62.864	62.946	63.266	63.765	64.050	64.166
3	2.844.9	62.868	62.968	63.318	63.798	64.063	64.170
4	2.845.7	62.872	62.990	63.370	63.831	64.076	64.173
5	2.846.7	62.875	63.013	63.421	63.863	64.090	64.177
6	2.847.7	62.879	63.035	63.471	63.895	64.103	64.181
7	2.848.7	62.882	63.058	63.520	63.927	64.116	64.186
8	2.849.6	62.886	63.081	63.571	63.958	64.130	64.190
9	2.850.5	62.890	63.103	63.623	63.990	64.143	64.195
10	2.851.4	62.896	63.126	63.675	64.018	64.157	64.199
11							
12							
13							
14							
15							
Total lit.	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
	9.4	40	274	512	318	331	38
Average lit./min	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
	0.84	4.0	27.4	51.2	31.8	33.1	3.8
Friction loss (Pr)	10:10	10:22	10:35	10:48	11:00	11:12	11:25
(Pr)	0.00	0.01	0.19	0.98	0.38	0.07	0.01
Calculation of Lugeon value							
$P = P_0 + 0.1(\sin \theta)(L_g - L_b)Pr$ [kg/cm ²], $q = Q/L_g$ [lit/min/m]							
P1 =	3.9	q1 =	0.19				
P2 =	6.9	q2 =	0.8				
P3 =	9.7	q3 =	4.5				
P4 =	11.9	q4 =	10.2				
P5 =	9.5	q5 =	6.4				
P6 =	6.8	q6 =	2.6				
P7 =	3.9	q7 =	0.8				



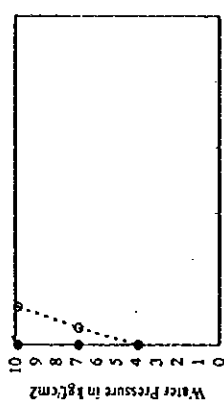
Lugeon value: (1.4)
 Critical Pressure: 8.4 kg/cm²

Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 9/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ x Q^{1.75} Date: 28/December/1998

Ground elevation: EL. m		Groundwater level (L _g): GL. = 27.80 m		Gauge height (L _g): 0.86 m		
Pipe length from pressure gauge to borehole mouth: (L _p) = 6.85 m		Depth of test section: GL. - (L _p) = 45 m		Length of section (L _s) = 5 m		
Reading of flow meter						
Gauge Pt. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}
Start time	11:22	11:35	11:47	12:00	12:15	12:27
Q (mm ³)	9,700.7	9,702.8	9,703.5	9,704.4	9,712.0	9,722.6
1	9,700.7	9,702.8	9,703.5	9,704.4	9,712.0	9,722.6
2	9,700.7	9,702.8	9,703.5	9,704.4	9,712.0	9,722.6
3	9,700.7	9,702.8	9,703.5	9,704.4	9,712.0	9,722.6
4	9,700.7	9,702.8	9,703.5	9,704.4	9,712.0	9,722.6
5	9,700.7	9,702.8	9,703.5	9,704.4	9,712.0	9,722.6
6	9,700.7	9,702.8	9,703.5	9,711.1	9,720.4	9,724.9
7	9,700.7	9,702.8	9,703.5	9,712.2	9,721.0	9,724.9
8	9,700.7	9,702.8	9,703.5	9,713.3	9,721.6	9,724.9
9	9,700.7	9,702.8	9,703.5	9,714.4	9,722.2	9,724.9
10	9,700.7	9,702.8	9,703.5	9,715.5	9,722.8	9,724.9
11						
12						
13						
14						
15						
Total	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}
lit.	0.0	0.0	0.0	11.1	5.8	2.6
Average	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}
lit./min	0.00	0.00	0.00	1.11	0.58	0.26
Friction loss	11.20	11.32	11.45	11.57	12.10	12.37
(P _f)	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P _f) = p _f (L _p + L _s) [kg/cm ²]						



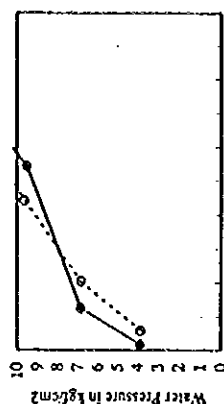
Water Injection Ratio (q): 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
 Lu_g value: (0.0) Lu_s
 Critical Pressure: 9.9 kg/cm²

Remarks: Reverse flow for 7 seconds by decreasing from 7 to 4 kg/cm² and for 1 minutes to 1 kg/cm².
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 10/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ x Q^{1.75} Date: 29/December/1998

Ground elevation: EL. m		Groundwater level (L _g): GL. = 27.80 m		Gauge height (L _g): 0.86 m		
Pipe length from pressure gauge to borehole mouth: (L _p) = 6.60 m		Depth of test section: GL. - (L _p) = 45 m		Length of section (L _s) = 5 m		
Reading of flow meter						
Gauge Pt. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}
Start time	15:30	15:42	15:54	16:08	16:20	16:45
Q (mm ³)	7,477.0	77,488	77,555	77,592	78,293	78,733
1	7,477.0	77,488	77,555	77,592	78,293	78,733
2	7,477.0	77,488	77,555	77,592	78,293	78,733
3	7,477.0	77,488	77,555	77,592	78,293	78,733
4	7,477.0	77,488	77,555	77,592	78,293	78,733
5	7,477.0	77,488	77,555	77,592	78,293	78,733
6	7,477.0	77,488	77,555	77,592	78,293	78,733
7	7,477.0	77,488	77,555	77,592	78,293	78,733
8	7,477.0	77,488	77,555	77,592	78,293	78,733
9	7,477.0	77,488	77,555	77,592	78,293	78,733
10	7,477.0	77,488	77,555	77,592	78,293	78,733
11						
12						
13						
14						
15						
Total	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}
lit.	8.4	63	272	376	221	103
Average	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}
lit./min	0.8	6.3	27.2	37.6	22.1	10.3
Friction loss	15.40	15.52	16.04	16.18	16.30	16.58
(P _f)	0.00	0.02	0.33	0.66	0.23	0.03
Friction Loss (P _f) = p _f (L _p + L _s) [kg/cm ²]						



Water Injection Ratio (q): 0 1 2 3 4 5 6 7 8 9 10
 Lu_g value: (2.4) Lu_s
 Critical Pressure: 6.8 kg/cm²

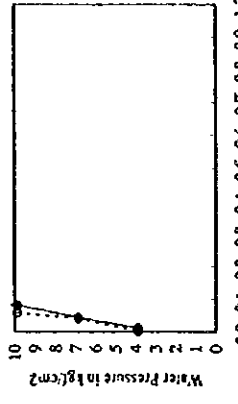
Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 11/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (θ): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ kg/cm²/m Date: 30/December/1998

Ground elevation: EL. m Groundwater level (L_g): GL - 27.80 m Gauge height (L_g): 0.86 m
 Pipe length from pressure gauge to borehole mouth: (L_p) = 7.70 m Depth of test section: 55 m Length of section (L_s): 5 m
 GL - (L_g) = 55 m to (L_s) = 5 m

Reading of flow meter										Calculation of Lugeon value												
Gauge P. (kg/cm ²)	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	q ₁	q ₂	q ₃	q ₄	q ₅	q ₆	q ₇
Start time	12:58	13:10	13:25	13:40	13:55	14:10	14:25	14:40	14:55	15:10	15:25	15:40	15:55	16:10	16:25	16:40	16:55	17:10	17:25	17:40	17:55	18:10
U (mm)	2.224.4	2.226.5	2.231.5	2.235.6	2.240.9	2.244.2	2.246.5	2.248.8	2.251.1	2.253.4	2.255.7	2.258.0	2.260.3	2.262.6	2.264.9	2.267.2	2.269.5	2.271.8	2.274.1	2.276.4	2.278.7	2.281.0
1	2.224.4	2.226.5	2.231.5	2.235.6	2.240.9	2.244.2	2.246.5	2.248.8	2.251.1	2.253.4	2.255.7	2.258.0	2.260.3	2.262.6	2.264.9	2.267.2	2.269.5	2.271.8	2.274.1	2.276.4	2.278.7	2.281.0
2	2.224.5	2.226.6	2.231.6	2.235.7	2.241.0	2.244.3	2.246.6	2.248.9	2.251.2	2.253.5	2.255.8	2.258.1	2.260.4	2.262.7	2.265.0	2.267.3	2.269.6	2.271.9	2.274.2	2.276.5	2.278.8	2.281.1
3	2.224.5	2.227.1	2.233.4	2.236.9	2.241.9	2.244.8	2.246.5	2.248.2	2.250.9	2.253.6	2.256.3	2.259.0	2.261.7	2.264.4	2.267.1	2.269.8	2.272.5	2.275.2	2.277.9	2.280.6	2.283.3	2.286.0
4	2.224.6	2.227.3	2.233.7	2.237.3	2.242.5	2.245.2	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
5	2.224.6	2.227.5	2.234.0	2.237.8	2.243.2	2.245.7	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
6	2.224.6	2.227.7	2.234.3	2.238.2	2.243.8	2.245.4	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
7	2.224.7	2.227.9	2.234.6	2.238.7	2.243.1	2.245.6	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
8	2.224.7	2.228.1	2.234.9	2.239.1	2.243.3	2.245.8	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
9	2.224.7	2.228.3	2.235.2	2.239.7	2.243.6	2.246.0	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
10	2.224.8	2.228.6	2.235.5	2.240.2	2.243.8	2.246.2	2.246.6	2.248.1	2.250.6	2.253.1	2.255.6	2.258.1	2.260.6	2.263.1	2.265.6	2.268.1	2.270.6	2.273.1	2.275.6	2.278.1	2.280.6	2.283.1
11																						
12																						
13																						
14																						
15																						
Total lit.	0.5	2.1	4.0	4.6	4.6	2.9	2.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Average lit./min	0.05	0.21	0.40	0.46	0.46	0.29	0.20	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Friction loss (P ₉)	13:08	13:20	13:35	13:50	14:05	14:20	14:35	14:50	15:05	15:20	15:35	15:50	16:05	16:20	16:35	16:50	17:05	17:20	17:35	17:50	18:05	18:20
Friction Loss (P ₉) = p(L _g + L _s) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Water Injection Ratio (q; lit./min/m)
 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

Lugeon value: 0.1 Lu
 Critical Pressure: >13 kg/cm²

Remarks: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 50% to 110% of the injection rate in the last previous one minute.

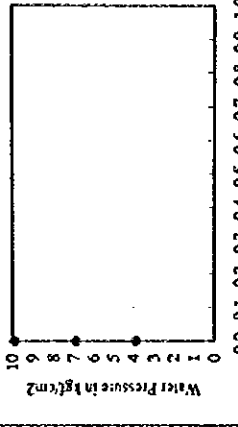
Prepared by: A. Hamid & Azhar Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 12/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (θ): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ kg/cm²/m Date: 21/December/1998

Ground elevation: EL. m Groundwater level (L_g): GL - 27.80 m Gauge height (L_g): 0.86 m
 Pipe length from pressure gauge to borehole mouth: (L_p) = 7.60 m Depth of test section: 55 m Length of section (L_s): 5 m
 GL - (L_g) = 55 m to (L_s) = 5 m

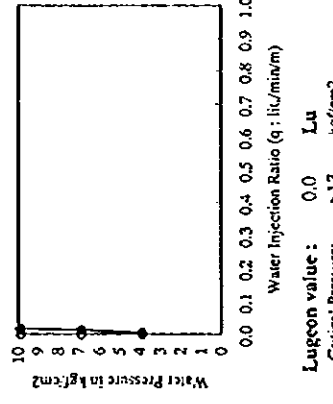
Reading of flow meter										Calculation of Lugeon value												
Gauge P. (kg/cm ²)	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	q ₁	q ₂	q ₃	q ₄	q ₅	q ₆	q ₇
Start time	14:00	14:12	14:25	14:38	14:50	15:02	15:15	15:28	15:40	15:52	16:05	16:18	16:30	16:42	16:55	17:08	17:20	17:32	17:45	17:58	18:10	18:22
U (mm)	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
1	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
2	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
3	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
4	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
5	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
6	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
7	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
8	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
9	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
10	7.953.6	7.955.3	7.955.9	7.956.0	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8	7.956.8
11																						
12																						
13																						
14																						
15																						
Total lit.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average lit./min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Friction loss (P ₉)	14:10	14:22	14:35	14:48	15:00	15:12	15:25	15:38	15:50	16:02	16:15	16:28	16:40	16:52	17:05	17:18	17:30	17:42	17:55	18:08	18:20	18:32
Friction Loss (P ₉) = p(L _g + L _s) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Water Pressure Test

Hole No.: M98-2 Stage: 13/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1 x 10⁻⁶ x Q^{1.75} Date: 2/January/1999

Ground elevation: EL		m		Groundwater level (L _g): GL = 27.80 m		Gauge height (L _g): 0.86 m	
Pipe length from pressure gauge to borehole mouth: (L _p) = 6.60 m		GL - (L _p) = 65 m to (L _g) = 65 m		Depth of test section		Length of section (L _s) = 5 m	
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	09:40	09:55	10:10	10:25	10:40	10:55	11:10
Q (m ³ /min)	3.930.8	3.933.7	3.937.7	3.938.5	3.939.5	3.939.5	3.939.5
1	3.930.9	3.933.8	3.937.8	3.938.5	3.939.5	3.939.5	3.939.5
2	3.931.0	3.934.0	3.937.9	3.938.5	3.939.5	3.939.5	3.939.5
3	3.931.0	3.934.1	3.938.0	3.938.6	3.939.5	3.939.5	3.939.5
4	3.931.0	3.934.1	3.938.1	3.938.6	3.939.5	3.939.5	3.939.5
5	3.931.0	3.934.1	3.938.2	3.938.9	3.939.5	3.939.5	3.939.5
6	3.931.0	3.934.2	3.938.2	3.939.2	3.939.5	3.939.5	3.939.5
7	3.931.0	3.934.3	3.938.3	3.939.4	3.939.5	3.939.5	3.939.5
8	3.931.0	3.934.3	3.938.4	3.939.5	3.939.5	3.939.5	3.939.5
9	3.931.0	3.934.3	3.938.4	3.939.6	3.939.5	3.939.5	3.939.5
10	3.931.0	3.934.3	3.938.5	3.939.7	3.939.5	3.939.5	3.939.5
11							
12							
13							
14							
15							
Total lit.	0.2	0.6	0.8	1.2	0.0	0.0	0.0
Average lit./min	0.02	0.06	0.08	0.12	0.00	0.00	0.00
Remarks	09:50	10:05	10:13	10:30	10:42	10:55	11:10
Friction Loss (P ₇) = p(L _s + L _p) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lugeon value: 0.0 Lu							
Critical Pressure: >13 kg/cm ²							

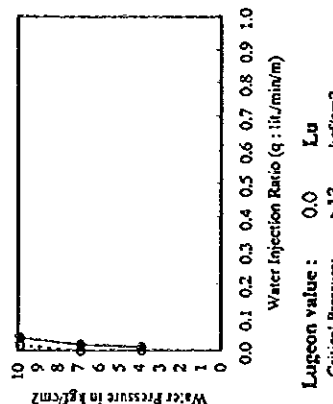


Remarks: -
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 14/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1 x 10⁻⁶ x Q^{1.75} Date: 3/January/1999

Ground elevation: EL		m		Groundwater level (L _g): GL = 27.80 m		Gauge height (L _g): 0.86 m	
Pipe length from pressure gauge to borehole mouth: (L _p) = 6.70 m		GL - (L _p) = 65 m to (L _g) = 70 m		Depth of test section		Length of section (L _s) = 5 m	
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	09:55	09:58	10:10	10:23	10:35	10:50	11:05
Q (m ³ /min)	7.743.5	7.746.7	7.748.4	7.751.0	7.756.0	7.756.6	7.756.6
1	7.743.6	7.746.9	7.748.6	7.751.4	7.756.2	7.756.6	7.756.6
2	7.743.6	7.747.0	7.748.8	7.751.9	7.756.3	7.756.6	7.756.6
3	7.743.7	7.747.1	7.748.9	7.752.3	7.756.4	7.756.6	7.756.6
4	7.743.7	7.747.2	7.749.1	7.752.8	7.756.4	7.756.6	7.756.6
5	7.743.8	7.747.2	7.749.3	7.753.2	7.756.5	7.756.6	7.756.6
6	7.743.8	7.747.3	7.749.5	7.753.7	7.756.6	7.756.6	7.756.6
7	7.743.8	7.747.3	7.749.7	7.754.2	7.756.6	7.756.6	7.756.6
8	7.743.9	7.747.4	7.749.8	7.754.7	7.756.7	7.756.6	7.756.6
9	7.743.9	7.747.5	7.750.1	7.755.2	7.756.7	7.756.6	7.756.6
10	7.744.0	7.747.6	7.750.3	7.755.8	7.756.8	7.756.6	7.756.6
11							
12							
13							
14							
15							
Total lit.	0.5	0.9	1.9	4.8	0.8	0.0	0.0
Average lit./min	0.05	0.09	0.19	0.48	0.08	0.00	0.00
Remarks	09:55	10:08	10:20	10:33	10:45	11:00	11:15
Friction Loss (P ₇) = p(L _s + L _p) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lugeon value: 0.0 Lu							
Critical Pressure: >13 kg/cm ²							

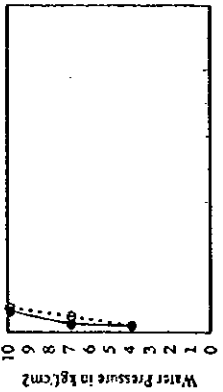


Remarks: -
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 15/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ x Q² Date: 5/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. m		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 6.70 m		Depth of test section: GL. - (L _g) = 75 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Q (mm)	P1	P2	P3	P4	P5	P6	P7
1	11:55	12:08	12:20	12:35	12:48	13:00	13:13
2	7:662.4	7:667.2	7:670.5	7:675.0	7:683.5	7:688.1	7:691.0
3	7:662.6	7:667.4	7:671.1	7:676.3	7:684.2	7:688.8	7:691.2
4	7:662.8	7:667.6	7:671.4	7:677.1	7:684.6	7:689.0	7:691.5
5	7:662.9	7:667.8	7:672.0	7:678.7	7:685.4	7:689.4	7:691.5
6	7:663.0	7:667.9	7:672.3	7:679.5	7:686.8	7:689.6	7:691.6
7	7:663.1	7:668.0	7:672.6	7:680.3	7:686.1	7:689.8	7:691.7
8	7:663.2	7:668.1	7:672.9	7:681.1	7:686.5	7:690.1	7:691.8
9	7:663.3	7:668.3	7:673.3	7:681.8	7:686.9	7:690.3	7:691.9
10	7:663.4	7:668.4	7:673.6	7:682.6	7:687.2	7:690.5	7:692.0
11							
12							
13							
14							
15							
Total	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
lit.	1.0	1.2	3.1	7.6	3.7	2.4	1.0
Average	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
lit./min	0.10	0.12	0.31	0.76	0.37	0.24	0.10
Friction loss	12:05	12:18	12:30	12:45	12:58	13:10	13:23
(P)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P) = p(L _s + L _p) [kg/cm ²]						Lu' [kg/cm ²]	
						Lu' = 8.7	



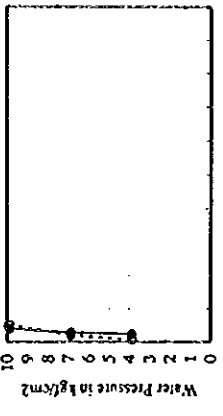
Water Injection Ratio (q : lit/min/m)
 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
 Lu' value: (0.0) Lu' kg/cm²
 Critical Pressure: 8.7

Remarks: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhar Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 16/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ x Q² Date: 7/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. m		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 6.75 m		Depth of test section: GL. - (L _g) = 80 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Q (mm)	P1	P2	P3	P4	P5	P6	P7
1	10:30	10:42	10:55	11:10	11:23	11:35	11:48
2	8:135.9	8:138.0	8:139.9	8:142.2	8:147.0	8:149.6	8:149.7
3	8:136.0	8:138.2	8:140.1	8:142.6	8:147.2	8:149.7	8:149.7
4	8:136.1	8:138.3	8:140.3	8:143.0	8:147.5	8:149.8	8:149.7
5	8:136.2	8:138.4	8:140.5	8:143.4	8:147.7	8:149.9	8:149.8
6	8:136.3	8:138.6	8:140.7	8:143.8	8:148.0	8:150.0	8:149.8
7	8:136.3	8:138.7	8:140.9	8:144.3	8:148.3	8:150.1	8:149.8
8	8:136.6	8:138.8	8:141.0	8:144.7	8:148.5	8:150.2	8:149.9
9	8:136.7	8:139.0	8:141.2	8:145.3	8:148.8	8:150.3	8:149.9
10	8:136.8	8:139.2	8:141.5	8:145.7	8:149.1	8:150.4	8:149.9
11	8:136.9	8:139.3	8:141.7	8:146.2	8:149.4	8:150.5	8:149.9
12	8:137.0	8:139.4	8:141.9	8:146.7	8:149.6	8:150.6	8:150.0
13							
14							
15							
Total	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
lit.	1.1	1.4	2.0	4.5	2.6	1.0	0.3
Average	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7
lit./min	0.11	0.14	0.20	0.45	0.26	0.10	0.03
Friction loss	10:40	10:52	11:05	11:20	11:33	11:45	11:58
(P)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P) = p(L _s + L _p) [kg/cm ²]						Lu' [kg/cm ²]	
						Lu' = 9.5	



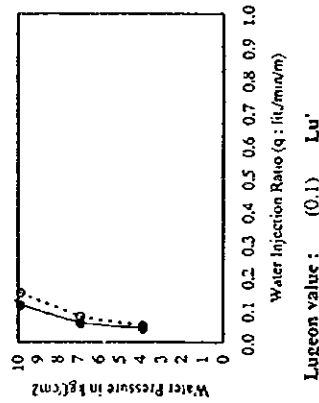
Water Injection Ratio (q : lit/min/m)
 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
 Lu' value: (0.0) Lu' kg/cm²
 Critical Pressure: 9.5

Remarks: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhar Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 17/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ x Q² m Date: 14/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL = 27.80 m		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 3.90 m		Depth of test section: GL - (L _p) = 85 m to (L _g) = 80 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	10:20	10:42	10:55	11:10	11:23	11:35	11:48
Q (min)	1.160.1	1.163.6	1.167.5	1.175.3	1.188.0	1.195.8	1.199.3
1	1.160.2	1.163.9	1.168.1	1.176.5	1.188.7	1.196.2	1.199.5
2	1.160.2	1.164.2	1.168.6	1.177.8	1.189.3	1.196.6	1.199.8
3	1.160.3	1.164.6	1.169.1	1.179.0	1.190.1	1.197.0	1.200.0
4	1.160.3	1.164.9	1.169.7	1.180.2	1.190.8	1.197.3	1.200.3
5	1.160.5	1.165.2	1.170.3	1.181.5	1.191.6	1.197.8	1.200.5
6	1.160.8	1.165.5	1.170.8	1.182.7	1.192.3	1.198.1	1.200.8
7	1.161.1	1.165.7	1.171.3	1.184.0	1.193.1	1.198.5	1.201.0
8	1.161.5	1.166.0	1.171.9	1.185.2	1.193.9	1.198.9	1.201.2
9	1.161.9	1.166.3	1.172.5	1.186.5	1.194.6	1.199.3	1.201.5
10	1.162.2	1.166.5	1.173.1	1.187.8	1.195.5	1.199.7	1.201.8
11							
12							
13							
14							
15							
Total lit.	2.1	2.9	5.6	12.5	7.5	3.9	2.5
Average lit./min	0.21	0.29	0.56	1.25	0.75	0.39	0.25
Friction Loss (P _f) = p(L _p + L _s) [kg/cm ²]	10:40	10:52	11:05	11:20	11:33	11:45	11:58
(P _f)	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Calculation of Lugeon value
 $P = P_0 + 0.1(\sin(a)(L_p + L_s) + P_f)$ [kg/cm²], $q = Q_p / L_s$ [lit/min/m]
 P₁ = 3.9 q₁ = 0.04
 P₂ = 6.9 q₂ = 0.06
 P₃ = 9.9 q₃ = 0.11
 P₄ = 12.9 q₄ = 0.25
 P₅ = 9.9 q₅ = 0.15
 P₆ = 6.9 q₆ = 0.08
 P₇ = 3.9 q₇ = 0.05

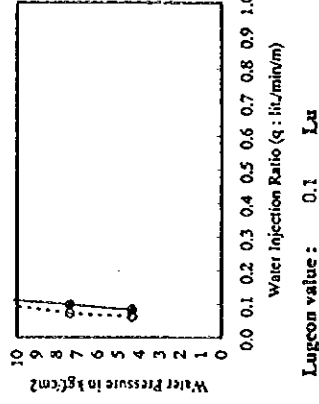
Water Injection Ratio (q): lit/min/m
 Lugeon value: (0.1) Lu' kg/cm²
 Critical Pressure: 8.9

Remarks: -
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 Stage: 18/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ x Q² m Date: 27/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL = 32.40 m		Gauge height (L _g): 0.86 m			
Pipe length from pressure gauge to borehole mouth: (L _p) = 4.10 m		Depth of test section: GL - (L _p) = 85 m to (L _g) = 90 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	14:45	14:58	15:10	15:23	15:35	15:48	16:00
Q (min)	8.316.0	8.324.0	8.332.0	8.339.0	8.348.0	8.352.0	8.356.0
1	8.316.3	8.324.3	8.333.1	8.339.9	8.348.5	8.352.9	8.356.2
2	8.316.8	8.325.0	8.333.5	8.340.6	8.348.9	8.352.7	8.356.5
3	8.317.5	8.325.5	8.334.0	8.341.5	8.349.5	8.353.0	8.356.7
4	8.317.9	8.326.1	8.334.6	8.342.3	8.349.9	8.353.5	8.357.1
5	8.318.3	8.326.5	8.335.0	8.343.0	8.350.4	8.353.8	8.357.4
6	8.318.7	8.327.0	8.335.7	8.343.9	8.350.8	8.354.1	8.357.8
7	8.319.0	8.327.6	8.336.1	8.344.9	8.351.3	8.354.5	8.358.1
8	8.319.4	8.328.0	8.336.6	8.345.8	8.351.8	8.354.8	8.358.4
9	8.319.8	8.328.4	8.337.2	8.346.6	8.352.4	8.355.3	8.358.8
10	8.320.1	8.328.9	8.337.6	8.347.3	8.352.8	8.355.6	8.359.1
11							
12							
13							
14							
15							
Total lit.	4.1	4.9	5.6	8.3	4.8	3.6	3.1
Average lit./min	0.41	0.49	0.56	0.83	0.48	0.36	0.31
Friction Loss (P _f) = p(L _p + L _s) [kg/cm ²]	14:55	15:08	15:20	15:32	15:45	15:58	16:10
(P _f)	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Calculation of Lugeon value
 $P = P_0 + 0.1(\sin(a)(L_p + L_s) + P_f)$ [kg/cm²], $q = Q_p / L_s$ [lit/min/m]
 P₁ = 4.3 q₁ = 0.08
 P₂ = 7.3 q₂ = 0.10
 P₃ = 10.3 q₃ = 0.11
 P₄ = 13.3 q₄ = 0.17
 P₅ = 10.3 q₅ = 0.10
 P₆ = 7.3 q₆ = 0.07
 P₇ = 4.3 q₇ = 0.06

Water Injection Ratio (q): lit/min/m
 Lugeon value: 0.1 Lu' kg/cm²
 Critical Pressure: >10

Remarks: -
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: M. Suza

Water Pressure Test

Hole No.: M98-3 Stage: 1/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ kg/cm²/m Date: 28/November/1998

Ground elevation: EL. m		Groundwater level (L _g): NIL		Gauge height (L _g): 0.96 m			
Pipe length from pressure gauge to hole mouth: (L _p)= 3.97 m		Depth of test section to (L _s)= 2 m		Length of section (L _s)= 5 m			
Reading of flow meter							
Gauge #	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	10.57	11.10					
2	58.470	58.600					
3	58.483	58.710					
4	58.494	58.805					
5	58.504	58.915					
6	58.516						
7	58.527						
8	58.537						
9	58.547						
10	58.556						
11	58.566						
12	58.576						
13							
14							
15							
Total lit.	106	315					
Average lit./min	10.6	105.0					
Friction loss (P _f)	11.07	11.14					
(P _f)	0.01	0.58					
Calculation of Lu_g value							
$P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \rho g$							
P ₁	1.5						
P ₂	4.0						
P ₃							
P ₄							
P ₅							
P ₆							
P ₇							
$q = Q_0 / L_s$ (lit/min/m)							
q ₁	2.1						
q ₂	21.0						
q ₃							
q ₄							
q ₅							
q ₆							
q ₇							
Calculation of Lu_g value							
$P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \rho g$							
P ₁	1.8						
P ₂	4.8						
P ₃	7.6						
P ₄	10.2						
P ₅	13.4						
P ₆	4.7						
P ₇	1.8						
$q = Q_0 / L_s$ (lit/min/m)							
q ₁	1.8						
q ₂	5.9						
q ₃	11.8						
q ₄	18.5						
q ₅	13.4						
q ₆	7.6						
q ₇	3.1						
Reading of flow meter							
Gauge #	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	11.53	12.07	12.53	12.98	13.48	13.90	13.12
2	65.406	65.558	66.189	66.930	68.085	68.833	69.225
3	65.416	65.589	66.236	67.038	68.154	68.873	69.241
4	65.425	65.619	66.310	67.130	68.222	68.912	69.256
5	65.434	65.649	66.370	67.239	68.290	68.950	69.272
6	65.443	65.677	66.430	67.310	68.360	68.988	69.287
7	65.452	65.704	66.487	67.405	68.428	69.027	69.303
8	65.460	65.736	66.545	67.500	68.496	69.065	69.318
9	65.469	65.765	66.600	67.588	68.563	69.099	69.334
10	65.477	65.795	66.663	67.684	68.628	69.141	69.349
11	65.486	65.823	66.722	67.780	68.680	69.177	69.365
12	65.494	65.852	66.779	67.874	68.733	69.212	69.379
13							
14							
15							
Total lit.	88	294	590	924	668	379	154
Average lit./min	8.8	29.4	59	92.4	66.8	37.9	15.4
Friction loss (P _f)	12.05	12.17	12.33	12.45	12.58	13.10	13.22
(P _f)	0.01	0.107	0.27	0.66	0.35	0.11	0.02
Calculation of Lu_g value							
$P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \rho g$							
P ₁	1.8						
P ₂	4.8						
P ₃	7.6						
P ₄	10.2						
P ₅	13.4						
P ₆	4.7						
P ₇	1.8						
$q = Q_0 / L_s$ (lit/min/m)							
q ₁	1.8						
q ₂	5.9						
q ₃	11.8						
q ₄	18.5						
q ₅	13.4						
q ₆	7.6						
q ₇	3.1						
Reading of flow meter							
Gauge #	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	10.57	11.10					
2	58.470	58.600					
3	58.483	58.710					
4	58.494	58.805					
5	58.504	58.915					
6	58.516						
7	58.527						
8	58.537						
9	58.547						
10	58.556						
11	58.566						
12	58.576						
13							
14							
15							
Total lit.	106	315					
Average lit./min	10.6	105.0					
Friction loss (P _f)	11.07	11.14					
(P _f)	0.01	0.58					
Calculation of Lu_g value							
$P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \rho g$							
P ₁	1.5						
P ₂	4.0						
P ₃							
P ₄							
P ₅							
P ₆							
P ₇							
$q = Q_0 / L_s$ (lit/min/m)							
q ₁	2.1						
q ₂	21.0						
q ₃							
q ₄							
q ₅							
q ₆							
q ₇							
Reading of flow meter							
Gauge #	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	10.57	11.10					
2	58.470	58.600					
3	58.483	58.710					
4	58.494	58.805					
5	58.504	58.915					
6	58.516						
7	58.527						
8	58.537						
9	58.547						
10	58.556						
11	58.566						
12	58.576						
13							
14							
15							
Total lit.	106	315					
Average lit./min	10.6	105.0					
Friction loss (P _f)	11.07	11.14					
(P _f)	0.01	0.58					
Calculation of Lu_g value							
$P = P_0 + 0.1(\sin(\alpha)L_p + L_s) \rho g$							
P ₁	1.5						
P ₂	4.0						
P ₃							
P ₄							
P ₅							
P ₆							
P ₇							
$q = Q_0 / L_s$ (lit/min/m)							
q ₁	2.1						
q ₂	21.0						
q ₃							
q ₄							
q ₅							
q ₆							
q ₇							

Remarks: Water table is Nil.
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the just previous one minute.
 Prepared by: A. Hamid Inspected by: Raja Bashir

Water Pressure Test

Hole No.: M98-3 Stage: 2/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ kg/cm²/m Date: 30/November/1998

Ground elevation: EL. m		Groundwater level (L _g): NIL		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _p)= 3.80 m		Depth of test section to (L _s)= 5 m		Length of section (L _s)= 5 m			
Reading of flow meter							
Gauge #	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	11.53	12.07	12.53	12.98	13.48	13.90	13.12
2	65.406	65.558	66.189	66.930	68.085	68.833	69.225
3	65.416	65.589	66.236	67.038	68.154	68.873	69.241
4	65.425	65.619	66.310	67.130	68.222	68.912	69.256
5	65.434	65.649	66.370	67.239	68.290	68.950	69.272
6	65.443	65.677	66.430	67.310	68.360	68.988	69.287
7	65.452	65.704	66.487	67.405	68.428	69.027	69.303
8	65.460	65.736	66.545	67.500	68.496	69.065	69.318
9	65.469	65.765	66.600	67.588	68.563	69.099	69.334
10	65.477	65.795	66.663	67.684	68.628	69.141	69.349
11	65.486	65.823	66.722	67.780	68.680	69.177	69.365
12	65.494	65.852	66.779	67.874	68.733	69.212	69.379
13							
14							
15							
Total lit.	88	294	590	924	668	379	154
Average lit./min	8.8	29.4	59	92			

Water Pressure Test

Hole No.: M98-3 Stages: 3/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ kg/cm²/m Date: 2/December/1998

Ground elevation: EL. _____ m		Groundwater level (L _g): Nil		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 3.80 m		Depth of test section to (L _g) = 10 m		Length of section (L _g) = 5 m			
Reading of flow meter							
Gauge P.	P1	P2	P3	P4	P5	P6	P7
Start time	14:00	14:12	14:23	14:35	14:46	14:57	15:08
Q (m ³ /min)	50.896	51.013	51.227	51.678	52.334	52.786	53.044
1	50.895	51.031	51.261	51.738	52.378	52.811	53.053
2	50.905	51.059	51.295	51.799	52.420	52.837	53.081
3	50.914	51.068	51.330	51.860	52.463	52.862	53.069
4	50.923	51.086	51.364	51.921	52.505	52.888	53.078
5	50.932	51.104	51.397	51.982	52.548	52.913	53.087
6	50.941	51.123	51.429	52.043	52.591	52.940	53.097
7	50.950	51.141	51.463	52.105	52.634	52.965	53.106
8	50.958	51.160	51.496	52.165	52.675	52.990	53.115
9	50.967	51.177	51.529	52.227	52.716	53.014	53.123
10	50.975	51.195	51.561	52.289	52.760	53.039	53.132
11	.....	.....	.....	.....	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	.....
14	.....	.....	.....	.....	.....	.....	.....
15	.....	.....	.....	.....	.....	.....	.....
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	89	182	334	611	426	253	88
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit/min	8.9	18.2	33.4	61.1	42.6	25.3	8.8
Final time	14:10	14:22	14:33	14:45	14:56	15:07	15:18
(P _f)	0.01	0.04	0.14	0.46	0.23	0.08	0.01
Friction Loss (P _f) = p(L _g + L)	kg/cm ²						.....
Friction Loss (P _f) = p(L _g + L)	kg/cm ²						.....
Calculation of Lugeon value	Lugeon value: (6.6)						L _{u'}
Critical Pressure:						7.4	kg/cm ²

Water Pressure in kg/cm² vs Water Injection Ratio (q : lit/min/m)

Remarks: _____
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid Inspected by: A. Gil

Water Pressure Test

Hole No.: M98-3 Stages: 4/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ kg/cm²/m Date: 3/December/1998

Ground elevation: EL. _____ m		Groundwater level (L _g): Nil		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 3.80 m		Depth of test section to (L _g) = 15 m		Length of section (L _g) = 5 m			
Reading of flow meter							
Gauge P.	P1	P2	P3	P4	P5	P6	P7
Start time	16:17	16:28	16:39	16:50	17:02	17:13	17:24
Q (m ³ /min)	59.521	59.566	59.701	59.908	60.280	60.543	60.714
1	59.525	59.580	59.719	59.937	60.306	60.561	60.719
2	59.529	59.592	59.736	59.967	60.331	60.578	60.736
3	59.531	59.601	59.754	59.997	60.356	60.594	60.732
4	59.533	59.614	59.771	60.028	60.380	60.610	60.739
5	59.535	59.626	59.788	60.062	60.405	60.626	60.745
6	59.537	59.637	59.806	60.100	60.430	60.645	60.750
7	59.538	59.649	59.823	60.129	60.456	60.661	60.754
8	59.539	59.660	59.840	60.164	60.481	60.679	60.759
9	59.540	59.671	59.860	60.197	60.506	60.695	60.764
10	59.541	59.683	59.884	60.228	60.531	60.712	60.768
11	.....	.....	.....	.....	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	.....
14	.....	.....	.....	.....	.....	.....	.....
15	.....	.....	.....	.....	.....	.....	.....
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	20	117	183	320	251	167	54
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit/min	2.0	11.7	18.3	32.0	25.1	16.7	5.4
Final time	16:27	16:38	16:49	17:00	17:12	17:23	17:34
(P _f)	0.00	0.02	0.06	0.17	0.11	0.05	0.01
Friction Loss (P _f) = p(L _g + L)	kg/cm ²						.....
Friction Loss (P _f) = p(L _g + L)	kg/cm ²						.....
Calculation of Lugeon value	Lugeon value: (4.3)						L _{u'}
Critical Pressure:						8.8	kg/cm ²

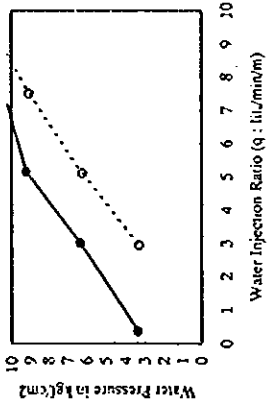
Water Pressure in kg/cm² vs Water Injection Ratio (q : lit/min/m)

Remarks: _____
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & A. Gil Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-3 Stage: 5/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 mm/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ x Q^{1.75} Date: 5/December/1998

Ground elevation: EL. m		Groundwater level (L _g):		Nill		Gauge height (L _g): 1.00 m	
Pipe length from pressure gauge to hole mouth: (L _p)= 3.80 m		Depth of test section GL - (L _g)= 20 m to (L _g)= 25 m		Length of section (L _s)		5 m	
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	11:22	11:34	11:45	11:56	12:08	12:19	12:30
Q (lit/min)	65.411	65.456	65.630	65.930	66.516	66.911	67.162
1	65.414	65.469	65.656	65.977	66.554	66.931	67.164
2	65.417	65.484	65.680	65.028	66.590	66.956	67.166
3	65.418	65.500	65.706	66.080	66.628	66.981	67.176
4	65.419	65.515	65.731	66.132	66.665	67.007	67.190
5	65.421	65.531	65.757	66.184	66.703	67.031	67.206
6	65.423	65.546	65.783	66.237	66.741	67.059	67.220
7	65.424	65.561	65.809	66.288	66.778	67.091	67.234
8	65.426	65.576	65.835	66.340	66.816	67.113	67.240
9	65.428	65.591	65.860	66.392	66.853	67.140	67.263
10	65.430	65.606	65.887	66.443	66.891	67.166	67.279
11							
12							
13							
14							
15							
Total lit.	19	150	257	513	375	255	117
Average lit./min	1.9	15	25.7	51.3	37.5	25.5	11.7
Pressure loss (P ₇)	0.00	0.05	0.14	0.36	0.30	0.18	0.05
Friction Loss (P ₇) = p(L _p + L _s) [kg/cm ²]							



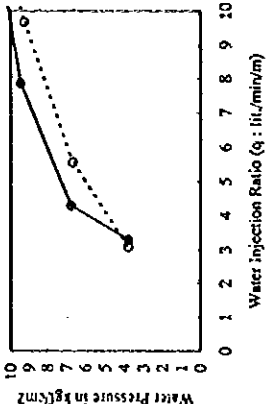
Lugeon value : (5.8) Lu'
 Critical Pressure: 9.2 kg/cm²

Remarks: For 3 minutes reverse running at final 1 kg/cm² pressure.
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the just previous one minute.
 Prepared by: A. Hamid & A. Gill Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-3 Stage: 6/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 mm/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ x Q^{1.75} Date: 7/December/1998

Ground elevation: EL. m		Groundwater level (L _g):		Nill		Gauge height (L _g): 1.00 m	
Pipe length from pressure gauge to hole mouth: (L _p)= 3.80 m		Depth of test section GL - (L _g)= 25 m to (L _g)= 30 m		Length of section (L _s)		5 m	
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	15:44	15:59	16:10	16:22	16:32	16:45	16:53
Q (lit/min)	80.088	80.279	80.531	81.008	81.776	82.271	82.508
1	80.107	80.302	80.570	81.071	81.818	82.293	82.516
2	80.125	80.324	80.611	81.141	81.862	82.318	82.527
3	80.141	80.346	80.650	81.215	81.907	82.345	82.539
4	80.159	80.368	80.689	81.288	81.956	82.373	82.552
5	80.176	80.389	80.728	81.361	82.004	82.399	82.566
6	80.192	80.410	80.767	81.435	82.053	82.427	82.581
7	80.208	80.431	80.807	81.510	82.101	82.454	82.596
8	80.223	80.452	80.845	81.579	82.150	82.482	82.611
9	80.238	80.473	80.885	81.654	82.199	82.510	82.626
10	80.252	80.493	80.924	81.727	82.246	82.538	82.643
11							
12							
13							
14							
15							
Total lit.	164	214	303	721	470	267	135
Average lit./min	16.4	21.4	30.3	72.1	47.0	26.7	13.5
Pressure loss (P ₇)	0.07	0.12	0.40	1.37	0.80	0.20	0.08
Friction Loss (P ₇) = p(L _p + L _s) [kg/cm ²]							



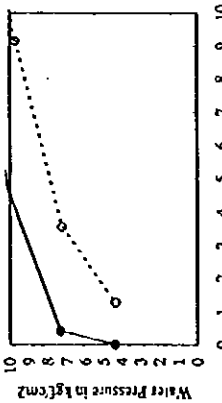
Lugeon value : (5.4) Lu'
 Critical Pressure: 8.6 kg/cm²

Remarks: For 3 minutes reverse running at final 1 kg/cm² pressure.
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the just previous one minute.
 Prepared by: A. Hamid Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-3 Stage: 7/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ kg/cm²/m Date: 11/December/1998

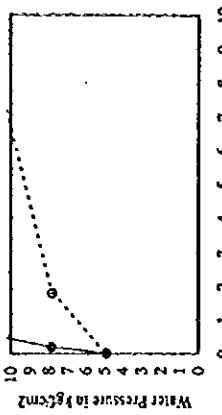
Ground elevation: EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 1.80 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 3.80 m		Depth of test section to (L _p) = 30 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	11:00	11:14	11:25	11:36	11:48	12:00	12:22
Q (m ³ /min)	92.745	92.751	92.795	93.088	93.932	94.386	94.556
1	92.745	92.753	92.818	93.168	93.987	94.400	94.561
2	92.745	92.754	92.841	93.226	94.025	94.417	94.567
3	92.745	92.756	92.862	93.298	94.074	94.431	94.572
4	92.745	92.760	92.885	93.379	94.123	94.448	94.574
5	92.745	92.761	92.907	93.445	94.171	94.466	94.584
6	92.745	92.763	92.930	93.523	94.220	94.483	94.590
7	92.745	92.765	92.952	93.602	94.267	94.501	94.596
8	92.745	92.767	92.980	93.680	94.315	94.519	94.602
9	92.745	92.770	93.018	93.769	94.360	94.536	94.609
10	92.745	92.771	93.055	93.857	94.400	94.553	94.616
11							
12							
13							
14							
15							
Total lit.	0.2	20.8	240	749	468	169	60
Average lit./min	0.02	2.08	24.0	74.9	46.8	17.8	6.4
Friction loss (P _f)	0.02	0.00	0.18	1.68	0.64	0.10	0.01
Friction Loss (P _f) = p(L _p + L _s) [kg/cm ²]						Lugeon value: (0.8) Lu' kg/cm ²	
Remarks: At reversal pressure 1 kg/cm ² , the flow meter started reverse for 4 minutes.						Critical Pressure: 9.6 kg/cm ²	



Water Pressure Test

Hole No.: M98-3 Stage: 8/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ kg/cm²/m Date: 12/December/1998

Ground elevation: EL. m		Groundwater level (L _g): Nil		Gauge height (L _g): 1.90 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 3.98 m		Depth of test section to (L _p) = 35 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	12:00	12:20	12:36	13:00	13:15	13:40	14:00
Q (m ³ /min)	91.292	91.376	91.952	9.270	10.210	10.581	664.7
1	91.292	91.390	91.977	9.326	10.255	10.588	664.7
2	91.293	91.400	91.402	9.404	10.300	10.596	664.7
3	91.294	91.410	91.412	9.498	10.343	10.605	664.7
4	91.295	91.425	91.428	9.572	10.386	10.614	664.7
5	91.296	91.440	91.449	9.657	10.428	10.623	664.7
6	91.297	91.453	91.474	9.740	10.466	10.632	664.7
7	91.298	91.465	91.500	9.824	10.504	10.641	664.7
8	91.299	91.465	91.530	9.906	10.542	10.651	664.7
9	91.301	91.470	91.564	10.087	10.580	10.660	664.7
10	91.302	91.476	91.585	10.178	10.615	10.668	664.8
11							
12							
13							
14							
15							
Total lit.	0.1	10.0	19.3	908	405	87.0	0.1
Average lit./min	0.1	1.0	2.7	90.8	37.4	9	0.02
Friction loss (P _f)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P _f) = p(L _p + L _s) [kg/cm ²]						Lugeon value: 0.5 Lu kg/cm ²	
Remarks: By decreasing the pressure to 4 kg/cm ² , the flow started reverse for 3 minutes and to 1 kg/cm ² for 7 minutes.						Critical Pressure: 11 kg/cm ²	



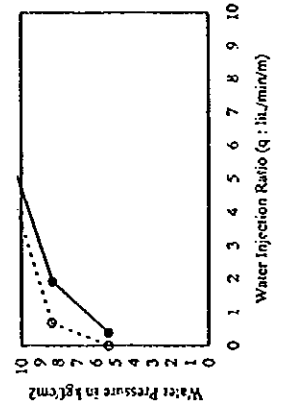
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid Inspected by: M. Syed

Water Pressure Test

Hole No.: M98-3 Stage: 9/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ kg/cm²/m Date: 15/December/1998

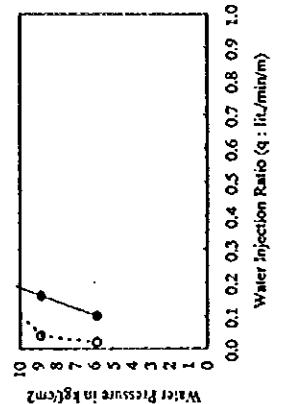
Ground elevation : EL		m		Groundwater level (L _g):		Nil		Gauge height (L _g):		1.00 m	
Pipe length from pressure gauge to hole mouth: (L _g)=		3.97 m		Depth of test section to (L _g)=		45 m		Length of section (L _g)=		5 m	
Reading of flow meter											
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀	P ₁₁
Start time	15:50	16:05	16:20	16:35	16:50	17:05	17:20	17:35	17:50	18:05	18:20
Q (mm)	16,180	16,220	16,250	16,280	16,310	16,340	16,370	16,400	16,430	16,460	16,490
1	16,182	16,233	16,240	16,270	16,325	16,354	16,380	16,413	16,448	16,480	16,510
2	16,183	16,248	16,413	16,420	16,448	16,475	16,502	16,529	16,556	16,583	16,610
3	16,185	16,262	16,444	16,460	16,475	16,490	16,505	16,520	16,535	16,550	16,565
4	16,187	16,272	16,475	16,490	16,505	16,520	16,535	16,550	16,565	16,580	16,595
5	16,189	16,282	16,507	16,520	16,535	16,550	16,565	16,580	16,595	16,610	16,625
6	16,191	16,292	16,538	16,550	16,565	16,580	16,595	16,610	16,625	16,640	16,655
7	16,193	16,302	16,568	16,580	16,595	16,610	16,625	16,640	16,655	16,670	16,685
8	16,195	16,311	16,601	16,610	16,625	16,640	16,655	16,670	16,685	16,700	16,715
9	16,197	16,320	16,633	16,640	16,655	16,670	16,685	16,700	16,715	16,730	16,745
10	16,199	16,329	16,664	16,670	16,685	16,700	16,715	16,730	16,745	16,760	16,775
11											
12											
13											
14											
15											
Total lit.	19	109	314	512	274	37	0	0	0	0	0
Average lit./min	1.9	9.6	31.4	51.2	27.4	3.7	0	0	0	0	0
Remarks	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30
(P ₁)	0.00	0.04	0.39	1.16	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = p(L _g + L) [kg/cm ²]											
Friction Loss (Pr) = 0.2 Lu' [kg/cm ²]											
Lu' = 9.0 [kg/cm ²]											
Critical Pressure: 9.0											
Remarks: By decreasing pressure to 4 kg/cm ² , the flowmeter started reverse reading a minutes and to 1 kg/cm ² for 5 minutes.											



Water Pressure Test

Hole No.: M98-3 Stage: 10/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ kg/cm²/m Date: 20/December/1998

Ground elevation : EL		m		Groundwater level (L _g):		Nil		Gauge height (L _g):		1.00 m	
Pipe length from pressure gauge to hole mouth: (L _g)=		4.40 m		Depth of test section to (L _g)=		45 m		Length of section (L _g)=		5 m	
Reading of flow meter											
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀	P ₁₁
Start time	10:12	10:23	10:34	10:45	10:57	11:10	11:22	11:34	11:46	11:58	12:10
Q (mm)	32,737	32,750	32,759	32,772	32,793	32,802	32,804	32,797	32,786	32,781	32,777
1	32,738	32,751	32,761	32,776	32,795	32,802	32,804	32,796	32,786	32,781	32,777
2	32,738	32,751	32,761	32,776	32,795	32,802	32,804	32,796	32,786	32,781	32,777
3	32,738	32,751	32,761	32,776	32,795	32,802	32,804	32,796	32,786	32,781	32,777
4	32,739	32,753	32,763	32,781	32,797	32,802	32,804	32,796	32,786	32,781	32,777
5	32,740	32,754	32,764	32,783	32,798	32,803	32,804	32,796	32,786	32,781	32,777
6	32,740	32,754	32,764	32,783	32,798	32,803	32,804	32,796	32,786	32,781	32,777
7	32,740	32,754	32,764	32,783	32,798	32,803	32,804	32,796	32,786	32,781	32,777
8	32,741	32,756	32,766	32,785	32,799	32,804	32,805	32,797	32,787	32,782	32,778
9	32,742	32,757	32,767	32,786	32,800	32,805	32,806	32,798	32,788	32,783	32,779
10	32,742	32,758	32,770	32,793	32,803	32,804	32,805	32,797	32,787	32,782	32,778
11											
12											
13											
14											
15											
Total lit.	5	8	11	21	10	2	1	0	0	0	0
Average lit./min	0.5	0.8	1.1	2.1	1.0	0.2	0.1	0	0	0	0
Remarks	10:22	10:33	10:44	10:55	11:07	11:20	11:32	11:44	11:55	12:07	12:19
(P ₁)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = p(L _g + L) [kg/cm ²]											
Friction Loss (Pr) = 0.2 Lu' [kg/cm ²]											
Lu' = 12 [kg/cm ²]											
Critical Pressure: 12											
Remarks: From 10 kg/cm ² to 7 kg/cm ² , reverse flow for 2 minutes.											



Water Pressure Test

Hole No.: M98-3 Stage: 11/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-6} \times 0^{0.711}$ Date: 24/December/1998

Ground elevation: EL		Groundwater level (L _g): GL = 53.50 m		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _h) = 2.80 m		Depth of test section: GL - (L _h) = 55 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Start time (h:min)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
09:30	8523.0	8523.0	8523.0	8523.0	8523.0	8523.0	8523.0
1	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
2	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
3	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
4	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
5	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
6	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
7	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
8	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
9	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
10	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0	8521.0
11							
12							
13							
14							
15							
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final time	09:40	10:00	10:15	10:30	10:45	11:00	11:15
Friction Loss (P _f) = p(L _h + L _s) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Water Injection Ratio (q; lit/min/m)

Lugeon value: 0.0 Lu
Critical Pressure: 12 kg/cm²

Remarks: From 4 kg/cm² to 1 kg/cm² reverse flow 4 minutes.

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.

Prepared by: A. Hamid & Farhat Inspected by: M. Suja

Water Pressure Test

Hole No.: M98-3 Stage: 12/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-6} \times 0^{0.711}$ Date: 25/December/1998

Ground elevation: EL		Groundwater level (L _g): GL = 53.50 m		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _h) = 3.80 m		Depth of test section: GL - (L _h) = 60 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Start time (h:min)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
11:10	43901	43923	43945	43967	43989	44011	44033
1	3890.4	43901	43923	43945	43967	43989	44011
2	3890.8	43905	43926	43946	43967	43989	44011
3	3891.0	43907	43928	43948	43969	43990	44012
4	3891.8	43909	43931	43951	43972	43993	44014
5	3892.5	43912	43914	43936	43957	43978	44000
6	3893.3	43914	43916	43938	43959	43980	44002
7	3894.0	43916	43918	43940	43961	43982	44004
8	3894.7	43917	43919	43941	43962	43983	44005
9	3895.4	43919	43921	43943	43964	43985	44007
10							
11							
12							
13							
14							
15							
Total	5.0	18	30	42	54	66	78
Average	0.5	1.8	3.0	4.2	5.4	6.6	7.8
Final time	11:20	11:35	11:50	12:10	12:25	12:40	12:55
Friction Loss (P _f) = p(L _h + L _s) [kg/cm ²]	0.00	0.00	0.01	0.02	0.01	0.00	0.00

Water Injection Ratio (q; lit/min/m)

Lugeon value: 0.4 Lu
Critical Pressure: 13 kg/cm²

Remarks: From 4 kg/cm² to 1 kg/cm² reverse flow 4 minutes.

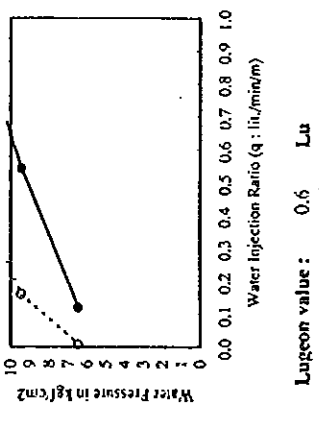
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.

Prepared by: A. Hamid & Farhat Inspected by: M. Suja

Water Pressure Test

Hole No.: M98-3 Stage: 13/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ kg/cm²/m Date: 27/December/1998

Ground elevation: EL		Groundwater level (L _g): G.L. = 53.50 m		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 4.30 m		Depth of test section: G.L. - (L _g) = 65 m to (L _h) = 65 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
(kg/cm ²)	1	4	7	10	7	4	1
Start time	13:00	13:11	13:22	13:34	13:46	14:00	14:15
Q (min)	54.837	54.857	54.892	54.952	55.016	55.044	55.051.3
1	54.838	54.861	54.896	54.958	55.018	55.044	55.051.3
2	54.839	54.865	54.902	54.966	55.021	55.045	55.051.4
3	54.839	54.868	54.907	54.972	55.024	55.045	55.051.4
4	54.839	54.871	54.914	54.978	55.027	55.046	55.051.5
5	54.839	54.874	54.919	54.984	55.029	55.047	55.051.5
6	54.840	54.877	54.925	54.990	55.032	55.047	55.051.5
7	54.841	54.880	54.931	54.997	55.035	55.048	55.051.6
8	54.842	54.882	54.936	55.003	55.038	55.049	55.051.6
9	54.842	54.885	54.942	55.009	55.040	55.050	55.051.7
10	54.843	54.887	54.946	55.014	55.043	55.051	55.051.7
11							
12							
13							
14							
15							
Total lit.	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Average lit./min	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Friction loss	13:10	13:21	13:32	13:44	13:54	14:10	14:25
(Pa)	0.00	0.00	0.02	0.02	0.00	0.00	0.00
Friction Loss (P _r) = p(L _w + L _s) [kg/cm ²]							
Lugeon value: 0.6 Lu							
Critical Pressure: >15 kg/cm ²							

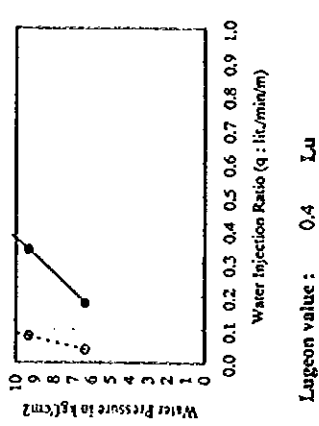


Remarks: From 4 to 1 kg/cm², for 3 minutes in reverse flowing.
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Humid
 Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-3 Stage: 14/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ kg/cm²/m Date: 28/December/1998

Ground elevation: EL		Groundwater level (L _g): G.L. = 53.30 m		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 3.80 m		Depth of test section: G.L. - (L _g) = 65 m to (L _h) = 70 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
(kg/cm ²)	1	4	7	10	7	4	1
Start time	15:30	15:42	15:54	16:10	16:26	16:40	17:00
Q (min)	61.628	61.641	61.662	66.692	66.730	66.740	66.745
1	61.629	61.642	61.664	66.695	66.731	66.741	66.745
2	61.630	61.644	61.667	66.699	66.733	66.741	66.745
3	61.631	61.646	61.670	66.702	66.734	66.742	66.745
4	61.632	61.648	61.672	66.706	66.736	66.742	66.746
5	61.632	61.649	61.674	66.709	66.738	66.742	66.746
6	61.633	61.651	61.676	66.712	66.737	66.743	66.746
7	61.634	61.652	61.679	66.716	66.737	66.743	66.747
8	61.635	61.654	61.681	66.719	66.738	66.743	66.747
9	61.636	61.656	61.683	66.722	66.738	66.744	66.747
10	61.637	61.658	61.686	66.726	66.739	66.744	66.747
11							
12							
13							
14							
15							
Total lit.	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Average lit./min	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Friction loss	15:40	15:52	16:04	16:20	16:35	16:50	17:10
(Pa)	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Friction Loss (P _r) = p(L _w + L _s) [kg/cm ²]							
Lugeon value: 0.4 Lu							
Critical Pressure: >15 kg/cm ²							

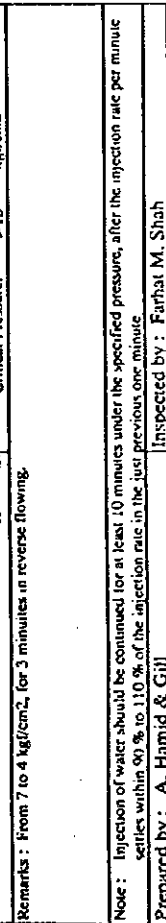


Remarks: From 4 to 1 kg/cm², for 4 minutes in reverse flowing.
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Humid & Mathboob
 Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-3 Stage: 15/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ kg/cm²/m Date: 29/December/1998

Ground elevation: EL		Groundwater level (L _g): GL- 50.50 m		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 3.94 m		Depth of test section: 75 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	15:10	15:25	15:40	16:00	16:15	16:30	16:45
Q (mm)	68.466	68.489	68.521	68.503	68.619	68.611	68.665
1	68.468	68.492	68.525	68.509	68.623	68.612	68.665
2	68.470	68.496	68.529	68.575	68.626	68.613	68.666
3	68.471	68.499	68.534	68.580	68.629	68.614	68.668
4	68.473	68.503	68.538	68.585	68.632	68.616	68.667
5	68.474	68.506	68.542	68.591	68.635	68.617	68.667
6	68.475	68.508	68.546	68.596	68.638	68.618	68.667
7	68.477	68.510	68.550	68.601	68.641	68.620	68.668
8	68.478	68.513	68.554	68.606	68.644	68.621	68.668
9	68.479	68.515	68.558	68.611	68.647	68.622	68.668
10	68.480	68.517	68.562	68.616	68.650	68.624	68.669
11							
12							
13							
14							
15							
Total	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Lit.	1.4	2.8	4.1	5.3	3.1	1.3	4
Average	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
lit./min	1.4	2.8	4.1	5.3	3.1	1.3	0.4
Final time	15:20	15:35	15:50	16:10	16:25	16:40	16:55
(P)	0.00	0.01	0.01	0.02	0.01	0.00	0.00
Friction Loss (P) = p(L _g + L _s) [kg/cm ²]							



Remarks: From 7 to 4 kg/cm², for 3 minutes in reverse flowing.

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the just previous one minute.

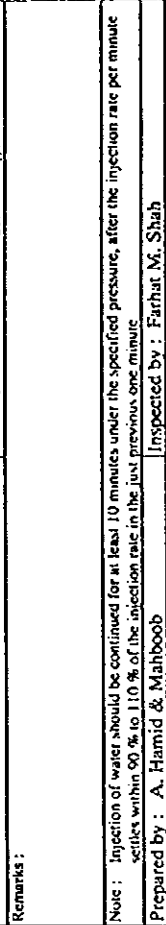
Prepared by: A. Hamid & Gil

Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-3 Stage: 16/20
 Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁶ kg/cm²/m Date: 30/December/1998

Ground elevation: EL		Groundwater level (L _g): GL- 45.50 m		Gauge height (L _g): 1.00 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 3.93 m		Depth of test section: 80 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	15:00	15:15	15:30	15:45	16:00	16:15	16:30
Q (mm)	73.700	73.701	73.702	73.715	73.733	73.742	73.749
1	73.700	73.701	73.704	73.717	73.733	73.742	73.749
2	73.700	73.701	73.704	73.720	73.734	73.743	73.749
3	73.700	73.701	73.705	73.722	73.735	73.743	73.749
4	73.700	73.701	73.706	73.724	73.736	73.744	73.749
5	73.700	73.701	73.708	73.727	73.737	73.744	73.749
6	73.700	73.701	73.709	73.729	73.738	73.745	73.749
7	73.700	73.701	73.710	73.732	73.739	73.746	73.749
8	73.700	73.701	73.712	73.734	73.740	73.746	73.749
9	73.700	73.701	73.713	73.736	73.741	73.747	73.749
10	73.700	73.701	73.714	73.738	73.742	73.747	73.749
11							
12							
13							
14							
15							
Total	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
Lit.	0	0	12	23	9	5	0
Average	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇
lit./min	0.0	0.0	1.2	2.3	0.9	0.5	0.0
Final time	15:10	15:25	15:40	15:55	16:10	16:25	16:40
(P)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P) = p(L _g + L _s) [kg/cm ²]							



Remarks:

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the just previous one minute.

Prepared by: A. Hamid & Mahboob

Inspected by: Farhat M. Shah

Water Pressure Test

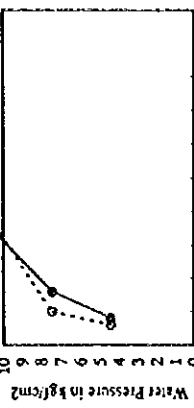
Hole No.: M98-3
 Location: Dam Axis (Right Bank)
 Hole Inclination (α): 90 degrees
 Stage: 19/20
 Dia. of Hole: 76 m/m
 Packer Type: Mechanical
 Date: 4/January/1999

Ground elevation: EL		m		Groundwater level (L _g): GL- 35.50 m		Gauge height (L _g): 1.00 m	
Pipe length from pressure gauge to hole mouth: (L _g)= 3.95 m		m		Depth of test section: 95 m		Length of section (L _s): 5 m	
Friction Loss per meter (P _f): 1x10 ⁻³ kg/cm ² /m							
Calculation of Lugeon value							
Start time	Q (l/min)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆
1	13:00	13:11	13:23	13:35	13:50	14:05	14:20
2	91,240	91,248	91,260	91,290	91,340	91,366	91,373
3	91,241	91,250	91,265	91,299	91,345	91,367	91,374
4	91,242	91,251	91,269	91,304	91,347	91,368	91,374
5	91,242	91,253	91,272	91,313	91,352	91,369	91,375
6	91,243	91,254	91,275	91,317	91,355	91,370	91,376
7	91,244	91,254	91,277	91,322	91,358	91,371	91,376
8	91,244	91,255	91,279	91,326	91,360	91,371	91,377
9	91,245	91,256	91,282	91,331	91,363	91,372	91,377
10	91,246	91,257	91,284	91,336	91,365	91,373	91,378
11							
12							
13							
14							
15							
Total lit.	6	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6
Average lit./min	0.6	0.2	0.3	0.4	0.5	0.6	0.7
Friction loss (P _f)	0.00	0.00	0.01	0.02	0.01	0.00	0.00
Friction Loss (P _f) = p _f (L _g + L _s) [kg/cm ²]							
Lugeon value: (0.2) Lu' kg/cm ²							
Critical Pressure: 8.8 kg/cm ²							
Remarks:							
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute							
Prepared by: A. Hamid							
Inspected by: A. Gill							

Water Pressure Test

Hole No.: M98-3
 Location: Dam Axis (Right Bank)
 Hole Inclination (α): 90 degrees
 Stage: 20/20
 Dia. of Hole: 76 m/m
 Packer Type: Mechanical
 Date: 5/January/1999

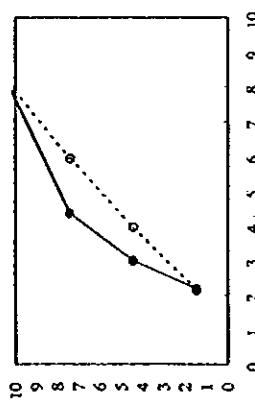
Ground elevation: EL		m		Groundwater level (L _g): GL- 33.40 m		Gauge height (L _g): 1.00 m	
Pipe length from pressure gauge to hole mouth: (L _g)= 3.95 m		m		Depth of test section: 95 m		Length of section (L _s): 5 m	
Friction Loss per meter (P _f): 1x10 ⁻³ kg/cm ² /m							
Calculation of Lugeon value							
Start time	Q (l/min)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆
1	08:10	08:22	08:35	08:50	09:03	09:15	09:30
2	10,587	10,592	10,602	10,620	10,650	10,670	10,675
3	10,588	10,594	10,604	10,626	10,653	10,671	10,675
4	10,588	10,594	10,605	10,628	10,654	10,672	10,675
5	10,589	10,595	10,607	10,631	10,658	10,672	10,676
6	10,590	10,596	10,609	10,634	10,658	10,673	10,676
7	10,590	10,597	10,611	10,638	10,659	10,673	10,677
8	10,590	10,598	10,614	10,643	10,664	10,674	10,677
9	10,591	10,599	10,615	10,646	10,666	10,675	10,678
10	10,591	10,600	10,617	10,648	10,668	10,675	10,678
11							
12							
13							
14							
15							
Total lit.	4	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6
Average lit./min	0.4	0.2	0.3	0.4	0.5	0.6	0.7
Friction loss (P _f)	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Friction Loss (P _f) = p _f (L _g + L _s) [kg/cm ²]							
Lugeon value: (0.2) Lu' kg/cm ²							
Critical Pressure: 8.3 kg/cm ²							
Remarks:							
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute							
Prepared by: A. Hamid & Azhor							
Inspected by: Farhat M. Shah							



Water Pressure Test

Hole No.: M98-4 Stage: 1/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ x Q² m/m Date: 11/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 4.50 m		Depth of test section to (L _g) = 2 m		Length of section (L _g) = 5 m			
Reading of flow meter							
Gauge P _i (kg/cm ²)	P _{i1}	P _{i2}	P _{i3}	P _{i4}	P _{i5}	P _{i6}	P _{i7}
Start time	10:30	10:42	10:54	11:06	11:18	11:30	11:42
U (min)	57.346	57.480	57.604	57.720	57.830	57.946	58.066
1	57.358	57.496	57.620	57.736	57.846	57.962	58.082
2	57.370	57.513	57.704	58.100	58.511	58.803	58.990
3	57.382	57.528	57.726	58.141	58.542	58.823	59.001
4	57.393	57.544	57.749	58.182	58.572	58.843	59.011
5	57.404	57.558	57.771	58.223	58.601	58.863	59.022
6	57.414	57.573	57.792	58.263	58.631	58.883	59.033
7	57.424	57.583	57.814	58.304	58.661	58.903	59.043
8	57.435	57.601	57.836	58.344	58.690	58.921	59.054
9	57.445	57.615	57.857	58.385	58.719	58.942	59.064
10	57.455	57.629	57.878	58.425	58.747	58.961	59.075
11							
12							
13							
14							
15							
Total lit.	109	149	218	405	297	198	107
Average lit./min	10.9	14.9	21.8	40.5	29.7	19.8	10.7
Remarks (P _i)	0.01	0.01	0.03	0.10	0.05	0.02	0.01

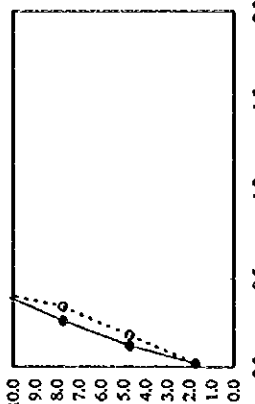


Lugeon value: (4-5) L_g'
 Critical Pressure: 6.9 kg/cm²
 Remarks: COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 2/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): 1x10⁻⁴ x Q² m/m Date: 11/January/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 4.50 m		Depth of test section to (L _g) = 5 m		Length of section (L _g) = 5 m			
Reading of flow meter							
Gauge P _i (kg/cm ²)	P _{i1}	P _{i2}	P _{i3}	P _{i4}	P _{i5}	P _{i6}	P _{i7}
Start time	16:00	16:12	16:23	16:34	16:46	16:56	17:10
U (min)	63.021	63.022	63.023	63.043	63.066	63.084	63.092
1	63.021	63.023	63.030	63.043	63.067	63.086	63.092
2	63.021	63.024	63.031	63.047	63.069	63.086	63.092
3	63.021	63.025	63.033	63.049	63.071	63.086	63.092
4	63.022	63.026	63.034	63.051	63.073	63.087	63.092
5	63.022	63.026	63.035	63.053	63.075	63.088	63.092
6	63.022	63.026	63.036	63.056	63.076	63.089	63.092
7	63.022	63.027	63.038	63.058	63.078	63.090	63.093
8	63.022	63.027	63.039	63.060	63.080	63.091	63.093
9	63.022	63.027	63.040	63.062	63.082	63.092	63.093
10	63.022	63.028	63.042	63.064	63.083	63.093	63.093
11							
12							
13							
14							
15							
Total lit.	101	136	193	211	171	91	1
Average lit./min	10.1	13.6	19.3	21.1	17.1	9.1	0.1
Remarks (P _i)	16.10	16.22	16.33	16.44	16.56	17.08	17.20



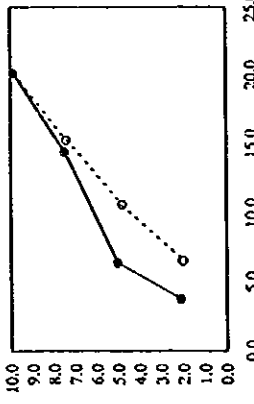
Lugeon value: (0-3) L_g'
 Critical Pressure: 5.7 kg/cm²
 Remarks: COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 3/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): $1 \times 10^{-4} \times Q^{1.8549}$ Date: 12/January/1999

Ground elevation: EL. m Groundwater level (L_g): CL. 12.50 m Gauge height (L_g): 0.70 m
 Pipe length from pressure gauge to hole mouth: (L_p) = 4.50 m CL. (L_p) = 15 m to (L_g) = 15 m
 Depth of test section (L_s) = 5 m

Reading of flow meter														
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇							
(kg/cm ²)	1	4	7	10	7	4	1							
Start time	08:00	08:12	08:24	08:35	08:47	08:58	09:10							
Q (min)	70.800	71.020	71.420	72.180	73.250	74.060	74.620							
1	70.800	71.053	71.483	72.280	73.328	74.114	74.652							
2	70.339	71.086	71.548	72.380	73.405	74.167	74.684							
3	70.858	71.118	71.613	72.480	73.488	74.220	74.717							
4	70.877	71.150	71.679	72.581	73.558	74.273	74.751							
5	70.896	71.182	71.748	72.681	73.635	74.325	74.784							
6	70.915	71.213	71.819	72.782	73.712	74.379	74.817							
7	70.934	71.246	71.891	72.884	73.792	74.483	74.850							
8	70.953	71.278	71.979	72.986	73.865	74.486	74.883							
9	70.971	71.310	72.060	73.087	73.940	74.539	74.916							
10	70.990	71.342	72.142	73.188	74.016	74.592	74.949							
11														
12														
13														
14														
15														
Total	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇							
Hr.	190	322	722	1,008	766	532	329							
Average	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇							
lit/min	19.0	32.2	72.2	100.8	76.6	53.2	32.9							
Remarks	08:10	08:22	08:34	08:45	08:57	09:08	09:20							
Friction Loss (P _f) = p(L _p × L _g) (kg/cm ²)	P _f	0.05	0.14	0.67	1.29	0.75	0.37							
Calculation of Lu _g value	$P = P_0 + 0.1(\sin(\theta) \times L_p) + P_f$ (kg/cm ²); $q = Q/L_p$ (lit/min/m) P ₁ = 2.1 q ₁ = 3.8 P ₂ = 5.0 q ₂ = 6.4 P ₃ = 7.5 q ₃ = 14.4 P ₄ = 9.9 q ₄ = 20.2 P ₅ = 7.4 q ₅ = 15.3 P ₆ = 4.8 q ₆ = 10.6 P ₇ = 2.0 q ₇ = 6.6													



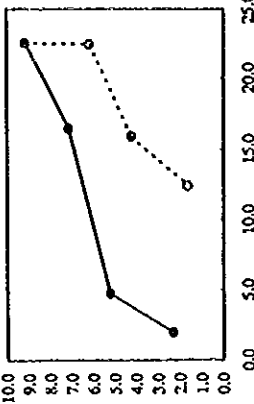
Lu_g value: (11) Lu_g Critical Pressure: 5.0 kg/cm²
 Remarks: COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhar Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 4/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): $1 \times 10^{-4} \times Q^{1.8549}$ Date: 12/January/1999

Ground elevation: EL. m Groundwater level (L_g): CL. 14.50 m Gauge height (L_g): 0.70 m
 Pipe length from pressure gauge to hole mouth: (L_p) = 4.50 m CL. (L_p) = 20 m to (L_g) = 5 m
 Depth of test section (L_s) = 5 m

Reading of flow meter														
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇							
(kg/cm ²)	1	4	7	10	7	4	1							
Start time	16:30	16:42	16:54	17:10	17:21	17:32	17:44							
Q (min)	83.323	83.510	83.800	85.000	86.200	87.360	88.250							
1	83.323	83.536	83.857	85.089	86.320	87.417	88.294							
2	83.343	83.555	83.920	85.184	86.432	87.487	88.348							
3	83.352	83.583	83.986	85.289	86.542	87.563	88.410							
4	83.362	83.606	84.057	85.395	86.647	87.644	88.474							
5	83.372	83.650	84.160	85.509	86.757	86.721	88.537							
6	83.382	83.650	84.248	85.625	86.869	86.811	88.602							
7	83.392	83.674	84.333	85.745	86.976	86.897	88.668							
8	83.403	83.697	84.428	85.867	87.092	86.984	88.736							
9	83.413	83.720	84.536	85.999	87.212	86.071	88.803							
10	83.423	83.749	84.626	86.130	87.324	88.159	88.871							
11														
12														
13														
14														
15														
Total	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇							
Hr.	100	239	826	1,170	1,126	799	621							
Average	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇							
lit/min	10.0	23.9	82.6	117.0	112.6	79.9	62.1							
Remarks	16:40	16:52	17:04	17:10	17:31	17:42	17:54							
Friction Loss (P _f) = p(L _p × L _g) (kg/cm ²)	P _f	0.02	0.10	1.17	2.18	2.16	1.10							
Calculation of Lu _g value	$P = P_0 + 0.1(\sin(\theta) \times L_p) + P_f$ (kg/cm ²); $q = Q/L_p$ (lit/min/m) P ₁ = 2.3 q ₁ = 2.0 P ₂ = 5.2 q ₂ = 4.8 P ₃ = 7.2 q ₃ = 16.5 P ₄ = 9.1 q ₄ = 22.6 P ₅ = 6.2 q ₅ = 22.5 P ₆ = 4.2 q ₆ = 16.0 P ₇ = 1.7 q ₇ = 12.4													



Lu_g value: (9.3) Lu_g Critical Pressure: 5.2 kg/cm²
 Remarks: COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhar Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 5/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.711}$ Date: 13/January/1999

Ground elevation: EL		Groundwater level (L _g): GL = 14.70 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _h) = 4.50 m		Depth of test section GL - (L _h) = 2.5 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P _{h1}	P _{h2}	P _{h3}	P _{h4}	P _{h5}	P _{h6}	P _{h7}
Start time	07:30	07:42	07:54	08:05	08:17	08:29	08:42
Q (lit/min)	95.472	95.473	95.473	95.473	95.476	95.476	95.476
1	95.472	95.473	95.473	95.474	95.476	95.476	95.476
2	95.472	95.473	95.473	95.474	95.476	95.476	95.476
3	95.472	95.473	95.473	95.475	95.476	95.476	95.476
4	95.472	95.473	95.473	95.475	95.476	95.476	95.476
5	95.472	95.473	95.473	95.475	95.477	95.476	95.476
6	95.472	95.473	95.473	95.476	95.477	95.476	95.476
7	95.472	95.473	95.473	95.476	95.477	95.476	95.476
8	95.472	95.473	95.473	95.476	95.477	95.476	95.476
9	95.472	95.473	95.473	95.477	95.478	95.476	95.476
10	95.472	95.473	95.473	95.477	95.478	95.476	95.476
11							
12							
13							
14							
15							
Total lit.	0	0	0	0	0	0	0
Average lit./min	0.0	0.0	0.0	0.4	0.2	0.0	0.0
Friction loss (P) (kg/cm ²)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculation of Lu _g value							
$P = P_0 + 0.1(\sin \alpha)(L_h + L_s) \cdot Pr$						$q = Q_0 \cdot L_s$ [lit/min/m]	
$P_1 = 2.3$						$q_1 = 0.0$	
$P_2 = 5.3$						$q_2 = 0.0$	
$P_3 = 8.3$						$q_3 = 0.0$	
$P_4 = 11.3$						$q_4 = 0.1$	
$P_5 = 8.3$						$q_5 = 0.0$	
$P_6 = 5.3$						$q_6 = 0.0$	
$P_7 = 2.3$						$q_7 = 0.0$	

Remarks: COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 1.10 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 6/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.711}$ Date: 13/January/1999

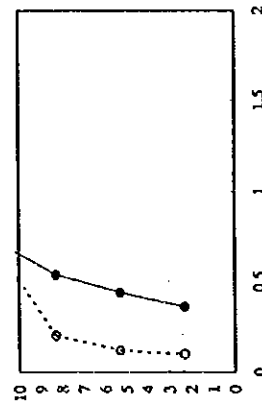
Ground elevation: EL		Groundwater level (L _g): GL = 14.20 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _h) = 4.50 m		Depth of test section GL - (L _h) = 2.5 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P _{h1}	P _{h2}	P _{h3}	P _{h4}	P _{h5}	P _{h6}	P _{h7}
Start time	16:45	16:57	17:09	17:20	17:32	17:44	17:55
Q (lit/min)	10.629	10.630	10.635	10.647	10.666	10.676	10.676
1	10.629	10.630	10.635	10.647	10.666	10.676	10.676
2	10.629	10.630	10.635	10.649	10.667	10.676	10.676
3	10.629	10.630	10.637	10.650	10.668	10.676	10.676
4	10.629	10.630	10.638	10.652	10.669	10.676	10.676
5	10.629	10.630	10.638	10.654	10.670	10.676	10.676
6	10.629	10.631	10.639	10.655	10.671	10.676	10.676
7	10.629	10.631	10.640	10.657	10.673	10.676	10.676
8	10.629	10.631	10.640	10.659	10.674	10.676	10.676
9	10.629	10.631	10.641	10.661	10.675	10.676	10.676
10	10.629	10.632	10.642	10.663	10.676	10.677	10.676
11							
12							
13							
14							
15							
Total lit.	0	2	8	18	12	1	0
Average lit./min	0.0	0.2	0.8	1.8	1.2	0.1	0.0
Friction loss (P) (kg/cm ²)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculation of Lu _g value							
$P = P_0 + 0.1(\sin \alpha)(L_h + L_s) \cdot Pr$						$q = Q_0 \cdot L_s$ [lit/min/m]	
$P_1 = 2.3$						$q_1 = 0.0$	
$P_2 = 5.3$						$q_2 = 0.0$	
$P_3 = 8.3$						$q_3 = 0.2$	
$P_4 = 11.3$						$q_4 = 0.4$	
$P_5 = 8.3$						$q_5 = 0.2$	
$P_6 = 5.3$						$q_6 = 0.0$	
$P_7 = 2.3$						$q_7 = 0.0$	

Remarks: COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 1.10 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 7/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.71}$ Date: 14/January/1999

Ground elevation: EL		Groundwater level (L _g): GL = 14.10 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 4.50 m		Depth of test section: GL - (L _p) = 35 m to (L _g) = 5 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	07:30	07:42	07:54	08:06	08:17	08:29	08:42
Q (m ³ /min)	19.631	19.660	19.688	19.722	19.761	19.770	19.771
1	19.633	19.662	19.691	19.726	19.762	19.770	19.771
2	19.635	19.664	19.693	19.730	19.763	19.771	19.771
3	19.637	19.666	19.695	19.733	19.764	19.771	19.772
4	19.639	19.669	19.698	19.737	19.765	19.772	19.773
5	19.641	19.672	19.701	19.741	19.766	19.772	19.773
6	19.642	19.674	19.704	19.744	19.767	19.773	19.773
7	19.644	19.676	19.707	19.748	19.768	19.774	19.774
8	19.646	19.678	19.709	19.752	19.769	19.774	19.774
9	19.647	19.680	19.712	19.756	19.770	19.775	19.775
10	19.649	19.682	19.715	19.759	19.771	19.776	19.776
11							
12							
13							
14							
15							
Total lit.	18	22	27	37	10	6	5
Average lit./min	1.8	2.2	2.7	3.7	1.0	0.6	0.5
Friction loss (Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = p(L _p + L _s) [kgf/cm ²]							



Calculation of Lugeon value
 $P_1 = 2.3$ $q_1 = 0.4$
 $P_2 = 5.3$ $q_2 = 0.4$
 $P_3 = 8.3$ $q_3 = 0.5$
 $P_4 = 11.3$ $q_4 = 0.7$
 $P_5 = 8.3$ $q_5 = 0.2$
 $P_6 = 5.3$ $q_6 = 0.1$
 $P_7 = 2.3$ $q_7 = 0.1$

Lugeon value: 0.7 Lu
 Critical Pressure: >11 kgf/cm²

Remarks: From 7kgf to 4kgf and from 4kgf to 1kgf for few second reversed run
 COS60=0.868

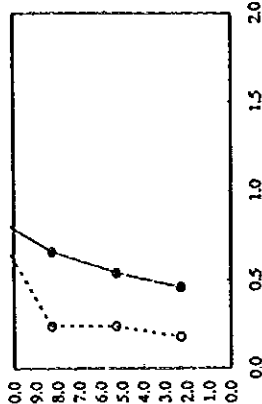
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute

Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 8/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.71}$ Date: 14/January/1999

Ground elevation: EL		Groundwater level (L _g): GL = 13.70 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 4.50 m		Depth of test section: GL - (L _p) = 35 m to (L _g) = 5 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	18:10	18:12	18:24	18:36	18:48	19:00	19:12
Q (m ³ /min)	31.298	31.331	31.367	31.410	31.455	31.460	31.467
1	31.300	31.334	31.371	31.415	31.456	31.461	31.468
2	31.302	31.337	31.374	31.420	31.457	31.463	31.469
3	31.305	31.339	31.377	31.425	31.459	31.465	31.470
4	31.307	31.342	31.381	31.427	31.461	31.466	31.471
5	31.309	31.345	31.384	31.432	31.461	31.466	31.472
6	31.312	31.348	31.388	31.436	31.462	31.467	31.472
7	31.314	31.350	31.391	31.441	31.463	31.468	31.473
8	31.316	31.353	31.394	31.446	31.465	31.470	31.474
9	31.319	31.356	31.397	31.449	31.466	31.471	31.475
10	31.321	31.358	31.400	31.454	31.467	31.472	31.476
11							
12							
13							
14							
15							
Total lit.	23	27	33	44	12	12	9
Average lit./min	2.3	2.7	3.3	4.4	1.2	1.2	0.9
Friction loss (Pr)	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Friction Loss (Pr) = p(L _p + L _s) [kgf/cm ²]							



Calculation of Lugeon value
 $P_1 = 2.3$ $q_1 = 0.5$
 $P_2 = 5.3$ $q_2 = 0.5$
 $P_3 = 8.3$ $q_3 = 0.7$
 $P_4 = 11.2$ $q_4 = 0.9$
 $P_5 = 8.3$ $q_5 = 0.2$
 $P_6 = 5.3$ $q_6 = 0.2$
 $P_7 = 2.3$ $q_7 = 0.2$

Lugeon value: 0.8 Lu
 Critical Pressure: >11 kgf/cm²

Remarks: Reverse reading for few seconds by decreasing to 4 & 1 kgf/cm²
 COS60=0.868

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute

Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 9/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Packer Type: Mechanical
 Hole Inclination (a): 60 degrees
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.75}$ Date: 15/January/1999

Ground elevation: EL		Groundwater level (L _g): GL = 13.50 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 4.50 m		Depth of test section: GL - (L _g) = 45 m to (L _g) = 40 m		Length of section (L _g): 5 m			
Calculation of Lugeon value							
Gauge P. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	07:00	07:12	07:24	07:36	07:48	08:00	08:12
U (mm)	41.489	41.512	41.547	41.590	41.634	41.640	41.647
1	41.491	41.515	41.551	41.595	41.636	41.641	41.648
2	41.493	41.518	41.555	41.599	41.638	41.642	41.649
3	41.495	41.520	41.559	41.603	41.643	41.645	41.650
4	41.496	41.522	41.562	41.608	41.640	41.645	41.651
5	41.498	41.525	41.565	41.612	41.641	41.646	41.652
6	41.499	41.528	41.568	41.615	41.642	41.648	41.653
7	41.500	41.531	41.571	41.619	41.643	41.649	41.653
8	41.502	41.534	41.575	41.623	41.645	41.650	41.654
9	41.504	41.537	41.578	41.627	41.646	41.651	41.654
10	41.506	41.540	41.582	41.632	41.647	41.652	41.655
11							
12							
13							
14							
15							
Total lit.	17	28	35	42	49	52	57
Average lit./min	1.7	2.8	3.5	4.2	4.9	5.2	5.8
March time	07:10	07:22	07:34	07:46	07:58	08:10	08:22
Friction Loss (Pr) = p(L _g + L _g) (kg/cm ²)	0.00	0.00	0.01	0.01	0.00	0.00	0.00

$P = P_o + 0.1(\sin \theta)(L_g + L_g) \cdot Pr$ (kg/cm²), $q = Q/L_g$ (lit/min/m)

$P_1 = 2.2$ $q_1 = 0.3$
 $P_2 = 5.2$ $q_2 = 0.6$
 $P_3 = 8.2$ $q_3 = 0.7$
 $P_4 = 11.2$ $q_4 = 0.8$
 $P_5 = 8.2$ $q_5 = 0.5$
 $P_6 = 5.2$ $q_6 = 0.2$
 $P_7 = 2.2$ $q_7 = 0.2$

Lugeon value: 0.8 Lu
 Critical Pressure: >11 kg/cm²

Remarks: From 7kgf to 4kgf and from 4kgf to 1kgf for few second reversed run

COS60=0.868

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the just previous one minute

Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 10/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Packer Type: Mechanical
 Hole Inclination (a): 60 degrees
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.75}$ Date: 15/January/1999

Ground elevation: EL		Groundwater level (L _g): GL = 13.80 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 4.50 m		Depth of test section: GL - (L _g) = 50 m to (L _g) = 45 m		Length of section (L _g): 5 m			
Calculation of Lugeon value							
Gauge P. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	17:00	17:12	17:24	17:36	17:48	18:00	18:12
U (mm)	49.618	49.642	49.691	49.760	49.850	49.915	49.951
1	49.628	49.647	49.698	49.769	49.855	49.918	49.953
2	49.622	49.652	49.705	49.778	49.861	49.921	49.955
3	49.624	49.656	49.711	49.787	49.867	49.924	49.958
4	49.627	49.660	49.718	49.795	49.873	49.928	49.960
5	49.629	49.663	49.725	49.804	49.880	49.931	49.962
6	49.631	49.667	49.731	49.812	49.886	49.934	49.964
7	49.633	49.671	49.737	49.821	49.893	49.937	49.967
8	49.635	49.676	49.746	49.829	49.900	49.941	49.969
9	49.638	49.680	49.750	49.838	49.906	49.944	49.971
10	49.640	49.684	49.757	49.846	49.911	49.948	49.973
11							
12							
13							
14							
15							
Total lit.	22	42	66	86	61	33	22
Average lit./min	2.2	4.2	6.6	8.6	6.1	3.3	2.2
March time	17:10	17:22	17:34	17:46	17:58	18:10	18:22
Friction Loss (Pr) = p(L _g + L _g) (kg/cm ²)	0.00	0.01	0.02	0.03	0.02	0.01	0.00

$P = P_o + 0.1(\sin \theta)(L_g + L_g) \cdot Pr$ (kg/cm²), $q = Q/L_g$ (lit/min/m)

$P_1 = 2.3$ $q_1 = 0.4$
 $P_2 = 5.3$ $q_2 = 0.8$
 $P_3 = 8.2$ $q_3 = 1.3$
 $P_4 = 11.2$ $q_4 = 1.7$
 $P_5 = 8.2$ $q_5 = 1.2$
 $P_6 = 5.3$ $q_6 = 0.7$
 $P_7 = 2.3$ $q_7 = 0.4$

Lugeon value: 1.5 Lu
 Critical Pressure: >11 kg/cm²

Remarks: COS60=0.868

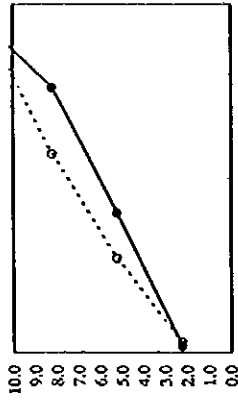
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the just previous one minute

Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 11/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p) : $1 \times 10^{-4} \times Q^{1.75}$ Date: 16/January/1999

Ground elevation: EL		Groundwater level (L _g): G.L. = 13.40 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _h) = 4.50 m		Depth of test section: 55 m to (L _h) = 55 m		Length of section (L _s): 5 m			
Calculation of Luqson value							
$P = P_0 + 0.1(\sin \theta) L_s \rho + P_r$ [kg/cm ²], $q = Q/L_s$ [lit/min/m]							
	P1 = 2.2	q1 = 0.0					
	P2 = 5.2	q2 = 0.8					
	P3 = 8.2	q3 = 1.5					
	P4 = 11.2	q4 = 1.9					
	P5 = 8.2	q5 = 1.1					
	P6 = 5.2	q6 = 0.5					
	P7 = 2.2	q7 = 0.1					
Reading of flow meter							
Gauge P. (kg/cm ²)	P1	P2	P3	P4	P5	P6	P7
Start time	17:00	17:12	17:24	17:36	17:48	18:00	18:12
Q (mm)	54.282	54.306	54.354	54.452	54.550	54.601	54.625
1	54.282	54.306	54.362	54.462	54.555	54.603	54.625
2	54.282	54.310	54.370	54.472	54.561	54.606	54.625
3	54.282	54.314	54.377	54.481	54.567	54.609	54.626
4	54.283	54.317	54.384	54.490	54.573	54.613	54.626
5	54.283	54.321	54.392	54.499	54.579	54.615	54.626
6	54.283	54.325	54.400	54.508	54.584	54.618	54.627
7	54.283	54.328	54.408	54.518	54.589	54.620	54.627
8	54.283	54.332	54.415	54.528	54.595	54.622	54.627
9	54.283	54.336	54.422	54.537	54.601	54.625	54.628
10	54.284	54.340	54.430	54.546	54.607	54.628	54.628
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	2	40	76	94	57	27	3
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit/min	0.2	4.0	7.6	9.4	5.7	2.7	0.1
lit/min	17:10	17:22	17:34	17:46	17:58	18:10	18:22
Friction Loss (Pr) = p(L _s + L _h) [kg/cm ²]	(Pr)	0.00	0.01	0.03	0.05	0.02	0.00
Luqson value:	2.0		Lu		kg/cm ²		
Critical Pressure:	>11						

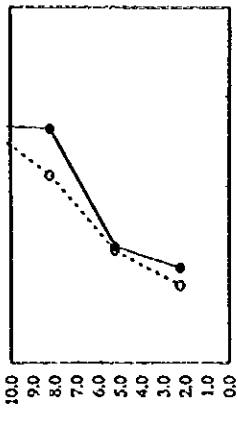


Remarks: Revise reading for few seconds by decreasing to 4 & 1 kg/cm²
 COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 12/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p) : $1 \times 10^{-4} \times Q^{1.75}$ Date: 16/January/1999

Ground elevation: EL		Groundwater level (L _g): G.L. = 13.40 m		Gauge height (L _g): 0.70 m			
Pipe length from pressure gauge to hole mouth: (L _h) = 4.50 m		Depth of test section: 55 m to (L _h) = 60 m		Length of section (L _s): 5 m			
Calculation of Luqson value							
$P = P_0 + 0.1(\sin \theta) L_s \rho + P_r$ [kg/cm ²], $q = Q/L_s$ [lit/min/m]							
	P1 = 2.2	q1 = 0.5					
	P2 = 5.2	q2 = 0.7					
	P3 = 8.2	q3 = 1.3					
	P4 = 11.2	q4 = 1.5					
	P5 = 8.2	q5 = 1.1					
	P6 = 5.2	q6 = 0.6					
	P7 = 2.2	q7 = 0.4					
Reading of flow meter							
Gauge P. (kg/cm ²)	P1	P2	P3	P4	P5	P6	P7
Start time	16:00	16:12	16:24	16:36	16:48	17:00	17:12
Q (mm)	60.028	60.068	60.118	60.202	60.273	60.329	60.362
1	60.031	60.071	60.125	60.209	60.278	60.333	60.369
2	60.034	60.074	60.127	60.216	60.283	60.337	60.366
3	60.037	60.078	60.139	60.222	60.289	60.340	60.368
4	60.040	60.081	60.146	60.224	60.294	60.343	60.370
5	60.043	60.084	60.153	60.235	60.299	60.346	60.372
6	60.045	60.088	60.159	60.242	60.304	60.349	60.375
7	60.048	60.091	60.166	60.249	60.310	60.352	60.377
8	60.050	60.094	60.172	60.255	60.315	60.355	60.379
9	60.053	60.097	60.178	60.262	60.320	60.358	60.382
10	60.055	60.101	60.184	60.269	60.326	60.361	60.384
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	27	33	66	67	53	32	22
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit/min	2.7	3.3	6.6	6.7	5.3	3.2	2.2
lit/min	16:10	16:22	16:34	16:46	16:58	17:10	17:22
Friction Loss (Pr) = p(L _s + L _h) [kg/cm ²]	(Pr)	0.00	0.01	0.02	0.03	0.02	0.00
Luqson value:	1.2		Lu		kg/cm ²		
Critical Pressure:	>11						

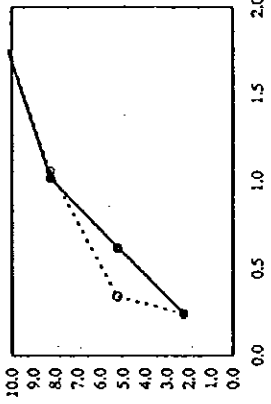


Remarks: Revise reading for few seconds by decreasing to 4 & 1 kg/cm²
 COS60=0.868
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: Farhat M. Shah

Water Pressure Test

Hole No.: M98-4 Stage: 13/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.711}$ Date: 17/January/1999

Ground elevation: EL		m		Groundwater level (L _g): GL = 13.50 m		Gauge height (L _g): 0.70 m	
Pipe length from pressure gauge to hole mouth: (L _g) = 4.50 m		GL - (L _g) = 60 m to (L _g) = 65 m		Depth of test section		Length of section (L _g) = 5 m	
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	16.307	16.42	16.55	17.07	17.20	17.32	17.45
Start time	08:00	08:12	08:24	08:36	08:48	09:00	09:12
Q (m ³ /min)	65.869	65.942	65.953	66.018	66.135	66.187	66.200
1	65.870	65.905	65.959	66.029	66.140	66.188	66.201
2	65.872	65.908	65.964	66.040	66.145	66.190	66.203
3	65.873	65.911	65.968	66.050	66.151	66.192	66.204
4	65.875	65.914	65.973	66.060	66.156	66.194	66.205
5	65.876	65.916	65.978	66.071	66.161	66.196	66.206
6	65.877	65.919	65.984	66.082	66.167	66.197	66.207
7	65.878	65.922	65.988	66.093	66.172	66.199	66.209
8	65.879	65.924	65.993	66.103	66.178	66.201	66.210
9	65.880	65.927	65.998	66.114	66.183	66.202	66.211
10	65.881	65.933	66.004	66.124	66.188	66.204	66.212
11							
12							
13							
14							
15							
Total lit.	12	31	51	106	53	17	12
Average lit./min	0.7	1.7	4.0	9.0	5.0	1.8	0.7
Final time	08:10	08:22	08:34	08:46	08:58	09:10	09:22
(P)	0.00	0.01	0.02	0.07	0.02	0.00	0.00
Friction Loss (P _f) = p(L _g + L _g) [kg/cm ²]							
Lugeon value: (1.7) Lu' kg/cm ²							
Critical Pressure: 8.2							



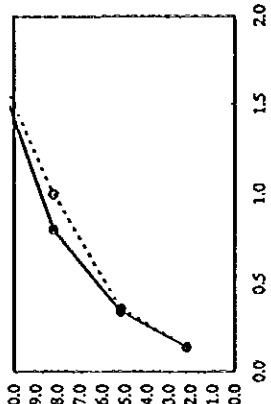
COS60=0.868

Remarks: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhar Inspected by: Azim Gill

Water Pressure Test

Hole No.: M98-4 Stage: 14/14
 Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 60 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.711}$ Date: 17/January/1999

Ground elevation: EL		m		Groundwater level (L _g): GL = 12.70 m		Gauge height (L _g): 0.70 m	
Pipe length from pressure gauge to hole mouth: (L _g) = 4.50 m		GL - (L _g) = 65 m to (L _g) = 70 m		Depth of test section		Length of section (L _g) = 5 m	
Reading of flow meter							
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1	16.307	16.42	16.55	17.07	17.20	17.32	17.45
Start time	08:00	08:12	08:24	08:36	08:48	09:00	09:12
Q (m ³ /min)	74.107	74.116	74.135	74.178	74.270	74.323	74.343
1	74.108	74.118	74.139	74.186	74.275	74.325	74.344
2	74.108	74.120	74.144	74.195	74.280	74.327	74.344
3	74.109	74.121	74.148	74.205	74.284	74.329	74.345
4	74.110	74.123	74.151	74.214	74.289	74.330	74.346
5	74.111	74.125	74.153	74.222	74.295	74.332	74.356
6	74.111	74.126	74.160	74.231	74.300	74.334	74.347
7	74.112	74.128	74.164	74.241	74.304	74.336	74.348
8	74.113	74.129	74.168	74.250	74.310	74.337	74.349
9	74.113	74.131	74.171	74.260	74.315	74.339	74.349
10	74.114	74.133	74.175	74.268	74.320	74.341	74.350
11							
12							
13							
14							
15							
Total lit.	7	17	40	90	50	18	7
Average lit./min	0.7	1.7	4.0	9.0	5.0	1.8	0.7
Final time	08:40	08:52	09:05	09:17	09:30	09:42	09:55
(P)	0.00	0.00	0.01	0.05	0.02	0.00	0.00
Friction Loss (P _f) = p(L _g + L _g) [kg/cm ²]							
Lugeon value: (0.7) Lu' kg/cm ²							
Critical Pressure: 7.2							



COS60=0.868

Remarks: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90% to 110% of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhar Inspected by: Azim Gill

Permeability Test (Open End Constant Head Method)

Hole No.: M98-5 Stage: 1/5
 Location: Dam axis (river) Dia. of Hole (2r): 430 mm
 Bottom of Hole (GL- h1): 1.50 m Bottom of Casing: 1.50 m
 Groundwater Level (GL- h2): 0.00 m Constant Head Level (GL + h3): 4.47 m

Test Record

Start Time: (16:30) Date: 23 /February/1999

Time Elapsed (min.)	Reading of Flow Meter		Calculation
	Reading (liter)	Volume of Flow (cm ³)	
0	4,524.0	0	Calculation Formula $k = \frac{q}{5.5rH}$ k : Coefficient of Permeability (cm/sec) r : Radius of Hole (cm) H: Water Head (cm); when groundwater is Nil H=h1+h3 when water found in the hole H=h2+h3 q : Constant Injection Rate into Hole (cm ³ /sec)
1	4,525.2	1,200	
2	4,525.9	700	
3	4,525.9	0	
4	4,526.0	100	
5	4,526.5	500	
6	4,526.5	0	
7	4,526.9	400	
8	4,527.5	600	
9	4,527.8	300	
10	4,528.0	200	
11	4,528.6	600	
12	4,528.9	300	
13	4,529.5	600	
14	4,529.9	400	
15	4,530.3	400	
16	4,530.8	500	
17	4,531.1	300	
18	4,531.5	400	
19	4,531.8	300	
20	4,532.1	300	
Total		Q= 8,100 cm³	Permeability (k) = 9.56E-05 cm/sec
Average		q = 405 cm³/min = 7 cm³/sec	

Finish Time: (16:50)

Tested by: A. Hameed
 Prepared by: A. Hameed
 Inspected by: K. Yano

Permeability Test (Open End Constant Head Method)

Hole No.: M98-5 Stage: 2/5
 Location: Dam axis (river) Dia. of Hole (2r): 430 mm
 Bottom of Hole (GL- h1): 2.50 m Bottom of Casing: 2.50 m
 Groundwater Level (GL- h2): 0.00 m Constant Head Level (GL + h3): 4.47 m

Test Record

Start Time: (18:10) Date: 23 /February/1999

Time Elapsed (min.)	Reading of Flow Meter		Calculation
	Reading (liter)	Volume of Flow (cm ³)	
0	3,096.6	0	Calculation Formula $k = \frac{q}{5.5rH}$ k : Coefficient of Permeability (cm/sec) r : Radius of Hole (cm) H: Water Head (cm); when groundwater is Nil H=h1+h3 when water found in the hole H=h2+h3 q : Constant Injection Rate into Hole (cm ³ /sec)
1	3,096.8	200	
2	3,097.0	200	
3	3,097.3	300	
4	3,097.5	200	
5	3,097.8	300	
6	3,098.1	300	
7	3,098.3	200	
8	3,098.5	200	
9	3,098.9	400	
10	3,099.1	200	
11	3,099.4	300	
12	3,099.7	300	
13	3,100.0	300	
14	3,100.3	300	
15	3,100.7	400	
16	3,101.0	300	
17	3,101.2	200	
18	3,101.4	200	
19	3,101.7	300	
20	3,101.9	200	
Total		Q= 5,300 cm³	Permeability (k) = 5.36E-05 cm/sec
Average		q = 265 cm³/min = 4 cm³/sec	

Finish Time: (18:30)

Tested by: A. Hameed
 Prepared by: A. Hameed
 Inspected by: K. Yano

Permeability Test (Open End Constant Head Method)

Hole No.: M98-5 Stage: 3/5
 Location: Dam axis (river) Dia. of Hole (2r): 490 mm
 Bottom of Hole (GL- h1): 3.50 m Bottom of Casing: 3.50 m
 Groundwater Level (GL- h2): 0.00 m Constant Head Level (GL + h3): 5.61 m

Test Record

Time Elapsed (min.)	Reading of Flow Meter Reading (liter)	Volume of Flow (cm ³)	Calculation
0	3,970.0	0	Calculation Formula $k = \frac{q}{5.5rH}$ k : Coefficient of Permeability (cm/sec) r : Radius of Hole (cm) H: Water Head (cm) : when groundwater is Nil H=h1+h3 when water found in the hole H=h2+h3 q : Constant Injection Rate into Hole (cm ³ /sec)
1	3,975.4	5,400	
2	3,980.0	4,600	
3	3,984.2	4,200	
4	3,988.3	4,100	
5	3,990.5	2,200	
6	3,992.7	2,200	
7	3,995.4	2,700	
8	3,995.7	300	
9	3,998.2	2,500	
10	4,000.7	2,500	
11	4,004.9	4,200	
12	4,007.2	2,300	
13	4,010.9	3,700	
14	4,013.2	2,300	
15	4,014.4	1,200	
16	4,017.2	2,800	
17	4,020.7	3,500	
18	4,024.2	3,500	
19	4,026.9	2,700	
20	4,029.3	2,400	
Total		Q= 59,300 cm³	Permeability (k) = 4.59E-04 cm/sec
Average		q = 2,965 cm³/min	
		= 49 cm³/sec	

Finish Time: (9:30)

Tested by: A. Hameed
 Prepared by: A. Hameed
 Inspected by: K. Yano

Permeability Test (Open End Constant Head Method)

Hole No.: M98-5 Stage: 4/5
 Location: Dam axis (river) Dia. of Hole (2r): 430 mm
 Bottom of Hole (GL- h1): 4.50 m Bottom of Casing: 4.50 m
 Groundwater Level (GL- h2): 0.00 m Constant Head Level (GL + h3): 4.53 m

Test Record

Time Elapsed (min.)	Reading of Flow Meter Reading (liter)	Volume of Flow (cm ³)	Calculation
0	7,037.0	0	Calculation Formula $k = \frac{q}{5.5rH}$ k : Coefficient of Permeability (cm/sec) r : Radius of Hole (cm) H: Water Head (cm) : when groundwater is Nil H=h1+h3 when water found in the hole H=h2+h3 q : Constant Injection Rate into Hole (cm ³ /sec)
1	7,054.6	17,600	
2	7,072.7	18,100	
3	7,090.6	17,900	
4	7,108.7	18,100	
5	7,126.2	17,500	
6	7,144.0	17,800	
7	7,162.0	18,000	
8	7,180.0	18,000	
9	7,197.7	17,700	
10	7,215.4	17,700	
11	7,233.5	18,100	
12	7,250.9	17,400	
13	7,256.3	5,400	
14	7,271.5	15,200	
15	7,294.2	22,700	
16	7,309.3	15,100	
17	7,324.5	15,200	
18	7,340.0	15,500	
19	7,354.7	14,700	
20	7,370.5	15,800	
Total		Q= 333,500 cm³	Permeability (k) = 2.60E-03 cm/sec
Average		q = 16,675 cm³/min	
		= 278 cm³/sec	

Finish Time: (11:20)

Tested by: A. Hameed
 Prepared by: A. Hameed
 Inspected by: K. Yano

Permeability Test (Open End Constant Head Method)

Hole No.: M98-S Stage: S/S
 Location: Dam axis (river) Dia. of Hole (2r): 430 mm
 Bottom of Hole (GL- h1): 7.50 m Bottom of Casing: 7.50 m
 Groundwater Level (GL- h2): 0.00 m Constant Head Level (GL + h3): 4.63 m

Test Record

Date: 25/February/1999

Time Elapsed (min.)	Reading (liter)	Volume of Flow (cm ³)	Calculation
0	5,231.0	0	
1	5,233.0	2,000	Calculation Formula $k = \frac{q}{5.5rH}$ k : Coefficient of Permeability (cm/sec) r : Radius of Hole (cm) H : Water Head (cm) when groundwater is Nil H=h1-h3 when water found in the hole H=h2-h3 q : Constant Injection Rate into Hole (cm ³ /sec)
2	5,235.0	2,000	
3	5,238.0	3,000	
4	5,240.0	2,000	
5	5,242.0	2,000	
6	5,245.0	3,000	
7	5,247.0	2,000	
8	5,250.0	3,000	
9	5,252.0	2,000	
10	5,253.0	1,000	
11	5,255.0	2,000	
12	5,257.0	2,000	
13	5,260.0	3,000	
14	5,262.0	2,000	
15	5,265.0	3,000	
16	5,267.0	2,000	
17	5,269.0	2,000	
18	5,272.0	3,000	
19	5,274.0	2,000	
20	5,276.0	2,000	
Total		Q = 45,000 cm ³	Permeability (k) =
Average		q = 2,250 cm ³ /min = 38 cm ³ /sec	2.61E-04 cm/sec

Finish Time: (11:50)

Tested by: A. Hameed
 Prepared by: A. Hameed
 Inspected by: K. Yano

Water Pressure Test

Hole No.: M98-S Stage: 1/4
 Location: Dam axis (River) Dia. of Hole: 76 mm
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (P_f): 1x10⁻⁴ x Q^{1.75} Date: 25/February/1999

Ground elevation : EL. m	Groundwater level (L _g) : GL. 0.00 m	Gauge height (L _g) : 0.82 m
Pipe length from pressure gauge to hole mouth : (L _g) = 4.60 m	Depth of test section : 10 m to (L _g) = 15 m	Length of section (L _g) : 5 m
Reading of flow meter		
Q (min)	P ₁ P ₂ P ₃ P ₄ P ₅ P ₆ P ₇ P ₈	P _g
1	86,004 86,038 86,078 86,123 86,168 86,184 86,197	86,197
2	86,008 86,044 86,082 86,129 86,164 86,186 86,197	86,197
3	86,010 86,047 86,085 86,133 86,166 86,188 86,197	86,197
4	86,012 86,049 86,089 86,136 86,168 86,189 86,197	86,197
5	86,014 86,052 86,092 86,140 86,170 86,190 86,198	86,198
6	86,016 86,055 86,095 86,144 86,172 86,192 86,198	86,198
7	86,018 86,057 86,099 86,147 86,174 86,194 86,198	86,198
8	86,020 86,059 86,102 86,150 86,176 86,194 86,198	86,198
9	86,023 86,062 86,105 86,154 86,178 86,196 86,198	86,198
10	86,026 86,065 86,108 86,157 86,180 86,197 86,199	86,199
11		
12		
13		
14		
15		
Total lit	Q ₁ Q ₂ Q ₃ Q ₄ Q ₅ Q ₆ Q ₇	Q _g
Average lit/min	2.2 2.7 3.2 3.4 2 1.3 0.2	11.22
Friction loss (P _f)	0.00 0.01 0.00 0.00 0.00 0.00 0.00	0.00
Friction Loss (P _f) = P _f (L _g + L _g) (kg/cm ²)		
Remarks :		

Water Pressure in kg/cm² vs Water Injection Ratio (q : lit/min/m)

Water Injection Ratio (q : lit/min/m) : 0.7 Lu
 Critical Pressure: >10 kg/cm²

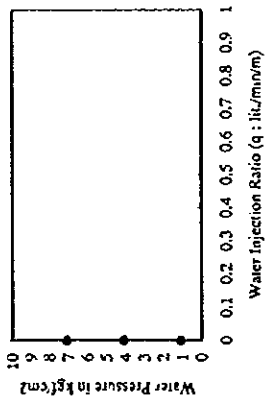
Note : Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute

Prepared by: Fahad M. Shah Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-5 Stage: 2/4
 Location: Dam axis (River) Dia. of Hole: 76 mm
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ x Q^{1.75} Date: 26/February/1999

Ground elevation: EL		Groundwater level (L _g): GL = 0.00 m		Gauge height (L _g): 0.82 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 4.60 m		Depth of test section GL - (L _g) = 20 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	11:50	11:22	11:34	11:50	12:12	12:30	12:42
Q (min)	297.002	297.002	297.002	297.002	297.002	297.002	297.002
1	297.002	297.002	297.002	297.002	297.002	297.002	297.002
2	297.002	297.002	297.002	297.002	297.002	297.002	297.002
3	297.002	297.002	297.002	297.002	297.002	297.002	297.002
4	297.002	297.002	297.002	297.002	297.002	297.002	297.002
5	297.002	297.002	297.002	297.002	297.002	297.002	297.002
6	297.002	297.002	297.002	297.002	297.002	297.002	297.002
7	297.002	297.002	297.002	297.002	297.002	297.002	297.002
8	297.002	297.002	297.002	297.002	297.002	297.002	297.002
9	297.002	297.002	297.002	297.002	297.002	297.002	297.002
10	297.002	297.002	297.002	297.002	297.002	297.002	297.002
11							
12							
13							
14							
15							
Total lit.	0	0	0	0	0	0	0
Average lit./min	0	0	0	0	0	0	0
Friction loss (P _f)	11:10	11:32	11:44	12:00	12:22	12:40	12:52
Friction Loss (P _f) = p(L _w + L _s) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00



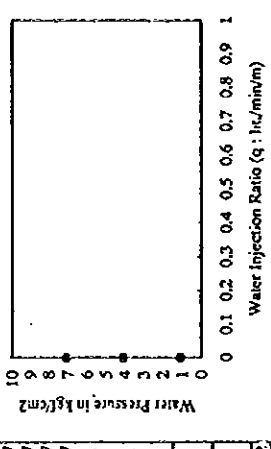
Water Injection Ratio (q : lit/min/m)
 Lugeon value : 0.0 Lu
 Critical Pressure: >10 kg/cm²

Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-5 Stage: 3/4
 Location: Dam axis (River) Dia. of Hole: 76 mm
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁻⁴ x Q^{1.75} Date: 26/February/1999

Ground elevation: EL		Groundwater level (L _g): GL = 0.00 m		Gauge height (L _g): 0.82 m			
Pipe length from pressure gauge to hole mouth: (L _p) = 4.60 m		Depth of test section GL - (L _g) = 20 m		Length of section (L _s) = 5 m			
Reading of flow meter							
Gauge P. (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	18:00	18:12	18:24	18:36	18:48	19:00	19:13
Q (min)	301.123	301.124	301.124	301.125	301.125	301.126	301.127
1	301.123	301.124	301.124	301.125	301.125	301.126	301.127
2	301.123	301.124	301.124	301.125	301.125	301.126	301.127
3	301.123	301.124	301.124	301.125	301.125	301.126	301.127
4	301.123	301.124	301.124	301.125	301.125	301.126	301.127
5	301.123	301.124	301.124	301.125	301.125	301.126	301.127
6	301.123	301.124	301.124	301.125	301.125	301.126	301.127
7	301.123	301.124	301.124	301.125	301.125	301.126	301.127
8	301.123	301.124	301.124	301.125	301.125	301.126	301.127
9	301.123	301.124	301.124	301.125	301.125	301.126	301.127
10	301.123	301.124	301.124	301.125	301.125	301.126	301.127
11							
12							
13							
14							
15							
Total lit.	0	0	0	0	0	0	0
Average lit./min	0	0	0	0	0	0	0
Friction loss (P _f)	18:10	18:22	18:34	18:46	18:58	19:10	19:22
Friction Loss (P _f) = p(L _w + L _s) [kg/cm ²]	0.00	0.00	0.00	0.00	0.00	0.00	0.00



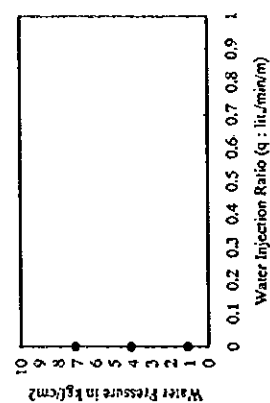
Water Injection Ratio (q : lit/min/m)
 Lugeon value : 0.0 Lu
 Critical Pressure: >10 kg/cm²

Remarks:
 Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.
 Prepared by: A. Hamid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-5 Stage: 4/4
 Location: Dam axis (River) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.911}$ Date: 27/February/1999

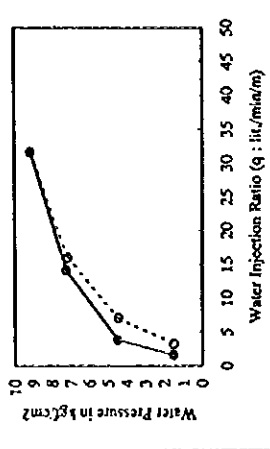
Ground elevation: EL		m		Groundwater level (L _g): GL = 0.00 m		Gauge height (L _g): 0.82 m	
Pipe length from pressure gauge to hole mouth: (L _h) = 4.60 m		m		GL = (L _g) = 30 m		Length of section (L _s) = 5 m	
Reading of flow meter							
Gauge P.	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	08:00	08:12	08:23	08:35	08:46	08:58	09:10
Q (m ³ /min)	64.072	64.077	64.080	64.083	64.082	64.081	64.079
1	64.072	64.077	64.080	64.083	64.082	64.081	64.079
2	64.072	64.077	64.080	64.083	64.082	64.081	64.079
3	64.072	64.077	64.080	64.083	64.082	64.081	64.079
4	64.072	64.077	64.080	64.083	64.082	64.081	64.079
5	64.072	64.077	64.080	64.083	64.082	64.081	64.079
6	64.072	64.077	64.080	64.083	64.082	64.081	64.079
7	64.072	64.077	64.080	64.083	64.082	64.081	64.079
8	64.072	64.077	64.080	64.083	64.082	64.081	64.079
9	64.072	64.077	64.080	64.083	64.082	64.081	64.079
10	64.072	64.077	64.080	64.083	64.082	64.081	64.079
11							
12							
13							
14							
15							
Total lit.	0	0	0	0	0	0	0
Average lit./min	0	0	0	0	0	0	0
Friction loss (P _f)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (P _f) = p(L _h + L _s) [kg/cm ²]							
Lugeon value: 0.0 Lu							
Critical Pressure: >10 kg/cm ²							
Remarks:							
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 40 % to 110 % of the injection rate in the last previous one minute							
Prepared by: A. Hamid & Azhor							
Inspected by: M. Suga							



Water Pressure Test

Hole No.: M98-6 Stage: 1/14
 Location: Upstream Cofferdam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.911}$ Date: 30/January/1999

Ground elevation: EL		m		Groundwater level (L _g): Nil		Gauge height (L _g): 0.73 m	
Pipe length from pressure gauge to hole mouth: (L _h) = 4.36 m		m		GL = (L _g) = 2 m		Length of section (L _s) = 5 m	
Reading of flow meter							
Gauge P.	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	10:40	10:12	10:25	10:36	10:48	11:00	11:12
Q (m ³ /min)	68.992	69.098	69.333	70.660	71.660	72.463	72.832
1	69.003	69.117	69.410	70.210	71.732	72.500	72.849
2	69.016	69.131	69.472	70.383	71.812	72.537	72.865
3	69.026	69.152	69.523	70.546	71.891	72.575	72.882
4	69.034	69.173	69.598	70.700	71.972	72.611	72.900
5	69.043	69.193	69.657	70.856	72.050	72.645	72.917
6	69.050	69.212	69.741	71.008	72.129	72.681	72.933
7	69.057	69.232	69.814	71.164	72.210	72.716	72.948
8	69.064	69.252	69.889	71.322	72.292	72.750	72.965
9	69.071	69.272	69.966	71.483	72.371	72.785	72.982
10	69.076	69.292	70.043	71.642	72.452	72.821	72.998
11							
12							
13							
14							
15							
Total lit.	84	144	710	1,592	802	356	166
Average lit./min	8.4	19.4	71	158.2	80.2	35.6	16.6
Friction loss (P _f)	0.00	0.02	0.28	1.38	0.36	0.07	0.02
Friction Loss (P _f) = p(L _h + L _s) [kg/cm ²]							
Lugeon value: (7.9) Lu							
Critical Pressure: 6.3 kg/cm ²							
Remarks:							
Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute							
Prepared by: Fatmat M. Shah							
Inspected by: M. Suga							



Water Pressure Test

Hole No.: M98-6 Stages: 2/14
 Location: Upstream Cofferdam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.71}$ Date: 31/January/1999

Ground elevation: EL		Groundwater level (L _g):		Depth of test section		Gauge height (L _g):		
Pipe length from pressure gauge to hole mouth: (L _g)= 4.40 m		GL - (L _g)= 5 m to (L _g)= 10 m		Length of section (L _s)		0.70 m		
Reading of flow meter								
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	
Start time	11:00	11:22	11:34	11:50	12:12	12:30	12:42	
Q (m ³ /min)	74.494	74.510	74.570	75.146	75.710	76.007	76.120	
1	74.496	74.520	74.597	75.187	75.739	76.023	76.127	
2	74.497	74.524	74.624	75.228	75.764	76.032	76.134	
3	74.499	74.527	74.652	75.270	75.796	76.045	76.141	
4	74.500	74.530	74.678	75.314	75.826	76.055	76.146	
5	74.501	74.533	74.706	75.357	75.854	76.064	76.155	
6	74.502	74.536	74.734	75.402	75.882	76.074	76.162	
7	74.504	74.539	74.760	75.448	75.910	76.083	76.169	
8	74.505	74.542	74.786	75.497	75.937	76.092	76.175	
9	74.506	74.545	74.811	75.548	75.965	76.103	76.182	
10	74.507	74.548	74.838	75.598	75.993	76.113	76.189	
11								
12								
13								
14								
15								
Total	lit.	13	32	268	452	283	106	69
Average	lit./min	1.3	3.2	26.8	45.2	28.3	10.6	6.9
Remarks	lit./min	11:10	11:32	11:54	12:09	12:22	12:40	12:52
(P ₁)	0.00	0.00	0.06	0.17	0.07	0.01	0.00	0.00
Friction Loss (P _f) = p(L _s + L _g) (kg/cm ²)								
Remarks:								



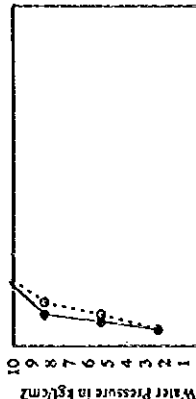
Water Pressure in kg/cm²
 Water Injection Ratio (q: lit/min/m)
 Lu_g value: (1.3) Lu'_g
 Critical Pressure: 4.8 kg/cm²

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-6 Stages: 3/14
 Location: Upstream Cofferdam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (α): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^{-4} \times Q^{1.71}$ Date: 31/January/1999

Ground elevation: EL		Groundwater level (L _g):		Depth of test section		Gauge height (L _g):		
Pipe length from pressure gauge to hole mouth: (L _g)= 4.43 m		GL - (L _g)= 10 m to (L _g)= 15 m		Length of section (L _s)		0.73 m		
Reading of flow meter								
Gauge P.	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	
Start time	18:00	18:12	18:24	18:36	18:48	19:00	19:13	
Q (m ³ /min)	81.139	81.172	81.222	81.294	81.430	81.507	81.560	
1	81.138	81.176	81.227	81.305	81.437	81.512	81.562	
2	81.141	81.179	81.232	81.323	81.443	81.517	81.565	
3	81.143	81.184	81.237	81.334	81.449	81.523	81.567	
4	81.145	81.187	81.241	81.345	81.456	81.527	81.569	
5	81.147	81.190	81.246	81.357	81.462	81.532	81.571	
6	81.150	81.193	81.251	81.368	81.469	81.536	81.574	
7	81.152	81.197	81.255	81.381	81.476	81.541	81.577	
8	81.155	81.201	81.260	81.392	81.482	81.545	81.579	
9	81.158	81.204	81.264	81.404	81.488	81.549	81.581	
10	81.160	81.208	81.269	81.415	81.495	81.554	81.584	
11								
12								
13								
14								
15								
Total	lit.	24	36	47	121	65	47	24
Average	lit./min	2.4	3.6	4.7	12.1	6.5	4.7	2.4
Remarks	lit./min	18:10	18:22	18:34	18:46	18:58	19:10	19:23
(P ₁)	0.00	0.00	0.00	0.02	0.01	0.00	0.00	
Friction Loss (P _f) = p(L _s + L _g) (kg/cm ²)								
Remarks:								



Water Pressure in kg/cm²
 Water Injection Ratio (q: lit/min/m)
 Lu_g value: (1.1) Lu'_g
 Critical Pressure: 8.3 kg/cm²

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute
 Prepared by: A. Hamid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-6 Stages: 4/14
 Location: Upstream Colfer Dam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (θ): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁴ x Q^{1.75} Date: 01/February/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. 13.40 m		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 5.48 m		Depth of test section: 15 m to (L _g) = 20 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P _i (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	09:00	09:12	09:24	09:36	09:50	10:02	10:10
Q (m ³ /min)	86.995	87.005	87.030	87.108	87.210	87.283	87.337
1	86.995	87.006	87.037	87.117	87.217	87.293	87.339
2	86.996	87.010	87.049	87.138	87.230	87.299	87.342
3	86.996	87.011	87.056	87.148	87.237	87.304	87.347
4	86.997	87.013	87.063	87.158	87.244	87.309	87.350
5	86.997	87.014	87.070	87.167	87.251	87.314	87.352
6	86.998	87.016	87.076	87.176	87.258	87.318	87.355
7	86.998	87.018	87.083	87.185	87.264	87.323	87.358
8	86.999	87.019	87.090	87.193	87.271	87.328	87.360
9	87.000	87.021	87.097	87.202	87.277	87.333	87.363
10							
11							
12							
13							
14							
15							
Total lit.	5	16	67	94	67	48	26
Average lit./min	0.5	1.6	6.7	9.4	6.7	4.8	2.6
Franch limit (Pa)	0.01	0.02	0.04	0.06	0.08	0.10	0.12
Friction Loss (P _f) = p _f (L _g + L _s) [kg/cm ²]	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Lugeon value: (0.7)	Lu'		5.4		kg/cm ²		
Critical Pressure:							

Calculation of Lugeon value

$P = P_0 + 0.1(\sin \theta)(L_1 + L_2) \cdot P_i$ [kg/cm²], $q = Q/L_s$ [lit/min/m]

$P_1 = 2.4$, $q_1 = 0.1$
 $P_2 = 5.4$, $q_2 = 0.3$
 $P_3 = 8.4$, $q_3 = 1.3$
 $P_4 = 11.4$, $q_4 = 1.9$
 $P_5 = 8.4$, $q_5 = 1.3$
 $P_6 = 5.4$, $q_6 = 1.0$
 $P_7 = 2.4$, $q_7 = 0.5$

Water Pressure in kg/cm²

Water Injection Ratio (q) in lit/min/m

Water Pressure Test

Hole No.: M98-6 Stages: 5/14
 Location: Upstream Colfer Dam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (θ): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p_f): 1x10⁴ x Q^{1.75} Date: 01/February/1999

Ground elevation: EL. m		Groundwater level (L _g): GL. 13.40 m		Gauge height (L _g): 0.73 m			
Pipe length from pressure gauge to hole mouth: (L _g) = 4.44 m		Depth of test section: 20 m to (L _g) = 25 m		Length of section (L _s): 5 m			
Reading of flow meter							
Gauge P _i (kg/cm ²)	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Start time	15:00	15:12	15:25	15:37	15:50	16:02	16:14
Q (m ³ /min)	91.711	91.724	91.751	91.802	91.908	92.045	92.064
1	91.712	91.724	91.755	91.811	91.916	92.011	92.067
2	91.712	91.726	91.760	91.821	91.924	92.016	92.070
3	91.713	91.729	91.764	91.830	91.932	92.022	92.073
4	91.713	91.731	91.768	91.840	91.940	92.027	92.077
5	91.714	91.734	91.773	91.849	91.947	92.033	92.080
6	91.714	91.736	91.777	91.859	91.956	92.039	92.083
7	91.715	91.739	91.781	91.869	91.964	92.044	92.087
8	91.715	91.741	91.785	91.878	91.972	92.050	92.090
9	91.716	91.744	91.789	91.889	91.980	92.055	92.093
10	91.716	91.746	91.794	91.894	91.987	92.061	92.096
11							
12							
13							
14							
15							
Total lit.	5	25	43	97	79	56	32
Average lit./min	0.5	2.5	4.3	9.7	7.9	5.6	3.2
Franch limit (Pa)	15:10	15:22	15:35	15:47	16:00	16:12	16:24
Friction Loss (P _f) = p _f (L _g + L _s) [kg/cm ²]	0.01	0.01	0.00	0.02	0.01	0.01	0.00
Lugeon value: (1.1)	Lu'		8.4		kg/cm ²		
Critical Pressure:							

Calculation of Lugeon value

$P = P_0 + 0.1(\sin \theta)(L_1 + L_2) \cdot P_i$ [kg/cm²], $q = Q/L_s$ [lit/min/m]

$P_1 = 2.4$, $q_1 = 0.1$
 $P_2 = 5.4$, $q_2 = 0.5$
 $P_3 = 8.4$, $q_3 = 0.9$
 $P_4 = 11.4$, $q_4 = 1.9$
 $P_5 = 8.4$, $q_5 = 1.6$
 $P_6 = 5.4$, $q_6 = 1.1$
 $P_7 = 2.4$, $q_7 = 0.6$

Water Pressure in kg/cm²

Water Injection Ratio (q) in lit/min/m

Water Pressure Test

Hole No.: M98-6 Stage: 6/14
 Location: Upstream Coffier Dam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^4 \times Q^{1.71}$ Date: 2/February/1999

Ground elevation: EL		m		Groundwater level (L _g): GL- 13.40 m		Gauge height (L _g): 0.73 m	
Pipe length from pressure gauge to hole mouth: (L _p)= 4.70 m		m		Depth of test section GL - (L _g)= 30 m to (L _g)= 30 m		Length of section (L _s)= 5 m	
Calculation of Lugeon value							
Gauge P. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	10:10	10:22	10:33	10:45	10:57	11:10	11:23
Q (min)	98.460	98.470	98.477	98.487	98.502	98.508	98.511
1	98.460	98.470	98.477	98.488	98.502	98.508	98.511
2	98.461	98.472	98.478	98.491	98.503	98.508	98.511
3	98.461	98.473	98.480	98.493	98.504	98.509	98.511
4	98.461	98.473	98.481	98.494	98.504	98.509	98.511
5	98.462	98.474	98.482	98.496	98.505	98.509	98.511
6	98.462	98.474	98.483	98.497	98.505	98.510	98.512
7	98.462	98.475	98.484	98.498	98.506	98.510	98.512
8	98.463	98.475	98.485	98.499	98.506	98.510	98.512
9	98.463	98.476	98.486	98.501	98.507	98.511	98.512
10	98.464	98.476	98.487	98.502	98.508	98.511	98.513
11							
12							
13							
14							
15							
Total	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}	Q _{o7}
lit.	4	6	10	15	6	3	2
Average	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}	Q _{o7}
lit./min	0.4	0.6	1	1.5	0.6	0.3	0.2
Friction loss (Pr)	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Friction Loss (Pr) = p(L _w + L _s) [kg/cm ²]							
Water Injection Ratio (q: lit./min/m) Lugeon value: 0.3 Lu Critical Pressure: >11 kg/cm ²							

Remarks:

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.

Prepared by: A. Hamid & Azhor Inspected by: M. Suga

Water Pressure Test

Hole No.: M98-6 Stage: 7/14
 Location: Upstream Coffier Dam (Left Bank) Dia. of Hole: 76 m/m
 Hole Inclination (a): 90 degrees Packer Type: Mechanical
 Friction Loss per meter (p): $1 \times 10^4 \times Q^{1.71}$ Date: 02/February/1999

Ground elevation: EL		m		Groundwater level (L _g): GL- 13.40 m		Gauge height (L _g): 0.75 m	
Pipe length from pressure gauge to hole mouth: (L _p)= 4.70 m		m		Depth of test section GL - (L _g)= 30 m to (L _g)= 35 m		Length of section (L _s)= 5 m	
Calculation of Lugeon value							
Gauge P. (kg/cm ²)	P _{o1}	P _{o2}	P _{o3}	P _{o4}	P _{o5}	P _{o6}	P _{o7}
Start time	16:45	16:57	17:08	17:20	17:32	17:43	17:54
Q (min)	11.850	11.871	11.883	11.912	11.972	11.998	12.008
1	11.850	11.872	11.885	11.917	11.975	11.999	12.008
2	11.851	11.873	11.886	11.923	11.978	12.000	12.009
3	11.852	11.874	11.888	11.929	11.980	12.001	12.009
4	11.853	11.874	11.892	11.935	11.982	12.003	12.010
5	11.853	11.875	11.894	11.940	11.985	12.004	12.010
6	11.854	11.876	11.896	11.946	11.987	12.005	12.011
7	11.855	11.877	11.898	11.951	11.989	12.006	12.012
8	11.855	11.878	11.899	11.958	11.992	12.006	12.012
9	11.856	11.879	11.902	11.964	11.995	12.007	12.012
10	11.857	11.879	11.904	11.970	11.997	12.008	12.013
11							
12							
13							
14							
15							
Total	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}	Q _{o7}
lit.	7	8	21	38	25	10	5
Average	Q _{o1}	Q _{o2}	Q _{o3}	Q _{o4}	Q _{o5}	Q _{o6}	Q _{o7}
lit./min	0.7	0.8	2.1	5.8	2.5	1	0.5
Friction loss (Pr)	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Friction Loss (Pr) = p(L _w + L _s) [kg/cm ²]							
Water Injection Ratio (q: lit./min/m) Lugeon value: 0.8 Lu Critical Pressure: >11 kg/cm ²							

Remarks:

Note: Injection of water should be continued for at least 10 minutes under the specified pressure, after the injection rate per minute settles within 90 % to 110 % of the injection rate in the last previous one minute.

Prepared by: A. Hamid & Azhor Inspected by: M. Suga