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
					$k= 5x10^{-5}$ to $1x10^{-2}$ 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		
				$k= 2x10^{-2}$ to $6x10^{-3}$ 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 Stage: 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) : $1\times10^{-4}\times Q^{1.971}$ Date : 3/December/1998

Ground elevation : EL. m	Groundwater level (L_s): Nil	Gauge height (L_g): 0.73 m
Pipe length from gauge to hole mouth borehole mouth: (L_o)= 7.60 m	Depth of test section GL. - (L_s)= 2 m to (L_e)= 7 m	Length of section (L_t) 5 m

Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 1	Pu4	Pu5	Pu6	Pu7
Start time	13:16	13:29	13:41				
0(min)	34,313	35,562	41,340				
1	34,410	35,720	41,475				
2	34,493	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.	Qu1 863	Qu2 1,667	Qu3 918	Qu4	Qu5	Qu6	Qu7
Average lit./min	Qu1 86.3	Qu2 166.7	Qu3 91.8	Qu4	Qu5	Qu6	Qu7
Finish time	13:26	13:39	13:51				
(Pf)	0.63	2.31	0.71				
Friction Loss (Pf) = pf(Lo + Le) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)L_t+L_s)-Pf [kgf/cm2], q=Q_u/L_t [lit/min/m]

P1= 0.9 q1= 17.3

P2= 2.2 q2= 33.3

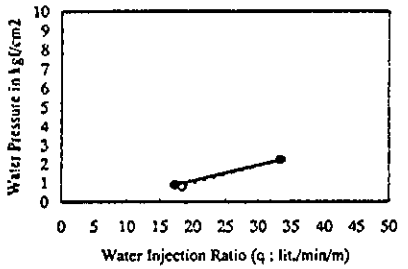
P3= 0.8 q3= 18.4

P4= q4=

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (128) Lu'

Critical Pressure: >2.2 kgf/cm2

Remarks : Presure could not built at 7 kgf/cm2 and 10 kgf/cm2 due to at 4 kgf/cm2 watertake more than 150 lit./min.

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 : Azhar Ms. & A. Gill Inspected by : M. Suga

GE2 - 4

Water Pressure Test

Hole No.: M98-1 Stage: 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) : $1\times10^{-4}\times Q^{1.971}$ Date : 4/December/1998

Ground elevation : EL. m	Groundwater level (L_s): Nil	Gauge height (L_g): 0.73 m
Pipe length from pressure gauge to borehole mouth: (L_o)= 7.76 m	Depth of test section GL. - (L_s)= 5 m to (L_e)= 10 m	Length of section (L_t) 5 m

Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 5.3	Pu4 4	Pu5 1	Pu6	Pu7
Start time	10:08	10:35	12:00	12:11	12:22		
0(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	57,939	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	59,925		
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.	Qu1 796	Qu2 1,479	Qu3 1,728	Qu4 1,516	Qu5 861	Qu6	Qu7
Average lit./min	Qu1 79.6	Qu2 147.9	Qu3 172.8	Qu4 151.6	Qu5 86.1	Qu6	Qu7
Finish time	10:18	10:45	12:10	12:23	12:32		
(Pf)	0.71	2.42	3.29	2.54	0.83		
Friction Loss (Pf) = pf(Lo + Le) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)L_t+L_s)-Pf [kgf/cm2], q=Q_u/L_t [lit/min/m]

P1= 1.1 q1= 15.9

P2= 2.4 q2= 29.6

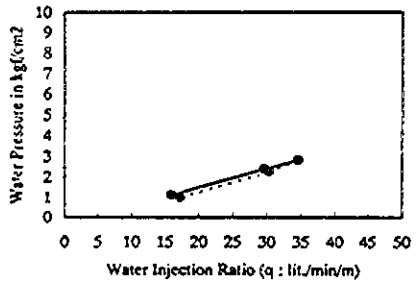
P3= 2.8 q3= 34.6

P4= 2.3 q4= 30.3

P5= 1.0 q5= 17.2

P6= q6=

P7= q7=



Lugeon value : (110) Lu'

Critical Pressure: >2.8 kgf/cm2

Remarks : At 7 and 10 kgf/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 just previous one minute

Prepared by : Azhor 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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 8/December/1998

Ground elevation : EL. m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L_e)= 7.20 m | Depth of test section: GL. - (L_o)= 10 m to (L_s)= 15 m | Length of section (L_s) 5 m

Reading of flow meter

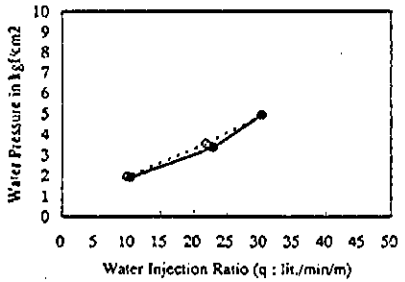
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 4	Po5 1	Po6	Po7
Start time	14:51	15:14	15:26	15:50	16:05		
0(min)	77,259	78,236	79,620	81,236	82,492		
1	77,315	78,351	79,770	81,359	82,544		
2	77,366	78,466	79,926	81,469	82,593		
3	77,425	78,579	80,075	81,586	82,639		
4	77,479	78,695	80,225	81,700	82,687		
5	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.	Qw1 522	Qw2 1,142	Qw3 1,511	Qw4 1,091	Qw5 497	Qw6	Qw7
Average lit./min	Qw1 52.2	Qw2 114.2	Qw3 151.1	Qw4 109.1	Qw5 49.7	Qw6	Qw7
Finish time	15:01	15:24	15:36	16:00	16:15		
(Pr)	0.42	1.96	3.41	1.79	0.38		

Friction Loss (Pr) = pr(L_e + L_s) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_e+L_s)-Pr [kgf/cm2], q=Q_w/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= q6=
P7= q7=



Lugeon value : (80) Lu'

Critical Pressure: >4.9 kgf/cm2

Remarks : Due to very high loss of water, pressure did not developed beyond 7 kgf/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 : A. Hamid & Azhar Inspected by : A. Gill

OE2 - 5

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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 17/December/1998

Ground elevation : EL. m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L_e)= 9.34 m | Depth of test section: GL. - (L_o)= 14.5 m to (L_s)= 20 m | Length of section (L_s) 5.5 m

Reading of flow meter

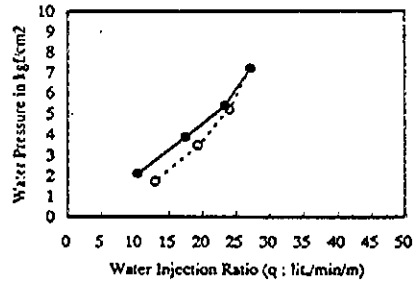
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	15:15	15:30	15:45	16:00	16:15	16:30	16:50
0(min)	98,290	99,000	200	2,000	3,660	5,100	6,250
1	98,359	99,092	327	2,141	3,792	5,206	6,321
2	98,416	99,192	454	2,298	3,923	5,312	6,393
3	98,473	99,287	583	2,448	4,057	5,418	6,464
4	98,528	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.	Qw1 572	Qw2 959	Qw3 1,285	Qw4 1,493	Qw5 1,319	Qw6 1,059	Qw7 716
Average lit./min	Qw1 57.2	Qw2 95.9	Qw3 128.5	Qw4 149.3	Qw5 131.9	Qw6 105.9	Qw7 71.6
Finish time	15:25	15:40	15:55	16:10	16:25	16:40	17:00
(Pr)	0.70	1.93	3.43	4.61	3.61	2.34	1.08

Friction Loss (Pr) = pr(L_e + L_s) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_e+L_s)-Pr [kgf/cm2], q=Q_w/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) Lu'

Critical Pressure: >7.2 kgf/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 : 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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{4}\times0^{1.971}$ Date : 1/January/1998

Ground elevation : EL. m | Groundwater level (L1): Nil | Gauge height (L2): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L0)= 9.30 m | Depth of test section: GL. - (L1)= 20 m to (L1)= 25 m | Length of section (L2) 5 m

Reading of flow meter

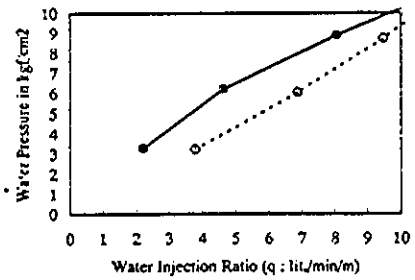
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	11:35	11:48	12:00	12:13	12:35	12:47	13:00
0(min)	37,970	38,120	38,410	38,910	39,610	40,130	40,500
1	37,981	38,149	38,450	38,970	39,657	40,164	40,518
2	37,994	38,167	38,490	39,028	39,705	40,198	40,536
3	38,006	38,191	38,530	39,087	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 lit.	Q1 110	Q2 231	Q3 402	Q4 590	Q5 474	Q6 343	Q7 189
Average lit./min	Q1 11	Q2 23.1	Q3 40.2	Q4 59	Q5 47.4	Q6 34.3	Q7 18.9
Passage time	11:45	11:58	12:10	12:23	12:45	12:57	13:10
(Pr)	0.03	0.14	0.43	0.91	0.59	0.31	0.10

Friction Loss (Pr) = pr(Lo + L1) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Q/L2 [lit/min/m]

P1=	3.3	q1=	2.2
P2=	6.2	q2=	4.6
P3=	8.9	q3=	8.0
P4=	11.4	q4=	11.8
P5=	8.7	q5=	9.5
P6=	6.0	q6=	6.9
P7=	3.2	q7=	3.8



Lugeon value : (7.8) Lu'

Critical Pressure: 7.1 kgf/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

GE2 - 6

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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{4}\times0^{1.971}$ Date : 2/January/1998

Ground elevation : EL. m | Groundwater level (L1): Nil | Gauge height (L2): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L0)= 8.90 m | Depth of test section: GL. - (L1)= 25 m to (L1)= 30 m | Length of section (L2) 5 m

Reading of flow meter

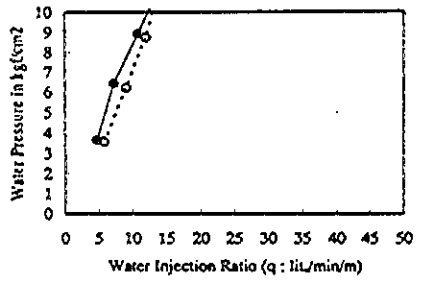
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	11:45	11:58	12:10	12:25	12:40	12:55	13:10
0(min)	45,385	45,710	46,190	46,870	47,700	48,410	48,910
1	45,419	45,746	46,246	46,938	47,750	48,456	48,938
2	45,433	45,783	46,302	47,006	47,820	48,501	48,967
3	45,456	45,819	46,357	47,076	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	48,773	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 lit.	Q1 237	Q2 362	Q3 544	Q4 710	Q5 602	Q6 454	Q7 290
Average lit./min	Q1 23.7	Q2 36.2	Q3 54.4	Q4 71.0	Q5 60.2	Q6 45.4	Q7 29.0
Passage time	11:55	12:08	12:20	12:35	12:50	13:05	13:20
(Pr)	0.17	0.40	0.90	1.51	1.09	0.63	0.26

Friction Loss (Pr) = pr(Lo + L1) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Q/L2 [lit/min/m]

P1=	3.6	q1=	4.7
P2=	6.4	q2=	7.2
P3=	8.9	q3=	10.9
P4=	11.3	q4=	14.2
P5=	8.7	q5=	12.0
P6=	6.2	q6=	9.1
P7=	3.6	q7=	5.8



Lugeon value : (11) Lu'

Critical Pressure: 6.4 kgf/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 (pr) : $1\times10^{-6}\times Q^{1.97}$ Date : 3/January/1998

Ground elevation : EL. m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 7.50 m | Depth of test section: GL. - (L_1)= 30 m to (L_3)= 35 m | Length of section (L_4) 5 m

Reading of flow meter

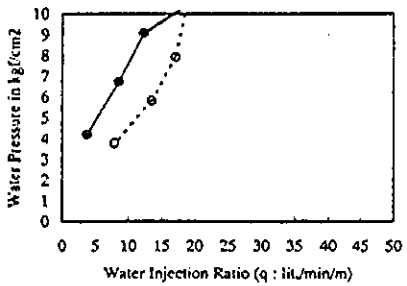
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	12:30	12:43	12:55	13:08	13:20	13:33	13:45
0(min)	54,440	54,660	55,220	55,950	56,960	57,900	58,610
1	54,454	54,703	55,281	56,031	57,034	57,966	58,644
2	54,477	54,746	55,342	56,117	57,120	58,032	58,688
3	54,496	54,784	55,404	56,207	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.	Qw1 185	Qw2 427	Qw3 613	Qw4 940	Qw5 854	Qw6 675	Qw7 395
Average lit./min	Qw1 18.5	Qw2 42.7	Qw3 61.3	Qw4 94	Qw5 85.4	Qw6 67.5	Qw7 39.5
Finish time	12:40	12:53	13:05	13:18	13:30	13:43	13:55
(Pr)	0.12	0.61	1.25	2.91	2.41	1.52	0.53

Friction Loss (Pr) = pr(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)L4+L2)-Pr [kgf/cm2], q=Qw/L4 [lit/min/m]

P1= 4.2 q1= 3.7
P2= 6.7 q2= 8.5
P3= 9.1 q3= 12.3
P4= 10.4 q4= 18.8
P5= 7.9 q5= 17.1
P6= 5.8 q6= 13.5
P7= 3.8 q7= 7.9



Lugeon value : (14) Lu'

Critical Pressure: 9.1 kgf/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 & Azhor Inspected by : A. Gill

GE2 - 7

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 (pr) : $1\times10^{-6}\times Q^{1.97}$ Date : 4/January/1999

Ground elevation : EL. m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 7.50 m | Depth of test section: GL. - (L_1)= 35 m to (L_3)= 40 m | Length of section (L_4) 5 m

Reading of flow meter

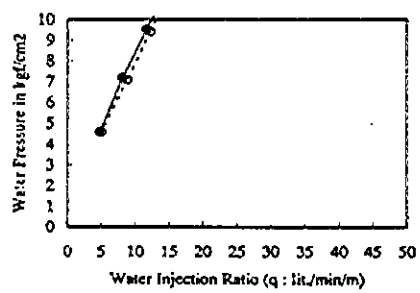
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	12:00	12:12	12:25	12:38	12:50	13:03	13:15
0(min)	66,300	66,600	67,100	67,800	68,630	69,330	69,830
1	66,325	66,641	67,158	67,875	68,691	69,374	69,854
2	66,350	66,682	67,217	67,951	68,752	69,418	69,880
3	66,375	66,723	67,275	68,027	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.	Qw1 245	Qw2 408	Qw3 583	Qw4 761	Qw5 612	Qw6 442	Qw7 252
Average lit./min	Qw1 24.5	Qw2 40.8	Qw3 58.3	Qw4 76.1	Qw5 61.2	Qw6 44.2	Qw7 25.2
Finish time	12:10	12:22	12:35	12:48	13:00	13:13	13:25
(Pr)	0.23	0.64	1.29	2.18	1.42	0.75	0.25

Friction Loss (Pr) = pr(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)L4+L2)-Pr [kgf/cm2], q=Qw/L4 [lit/min/m]

P1= 4.6 q1= 4.9
P2= 7.2 q2= 8.2
P3= 9.5 q3= 11.7
P4= 11.6 q4= 15.2
P5= 9.4 q5= 12.2
P6= 7.1 q6= 8.8
P7= 4.6 q7= 5.0



Lugeon value : 12 Lu

Critical Pressure: >12 kgf/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 : 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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : 1×10⁴×Q^1.971 Date : 5/January/1999

Ground elevation : EL. m | Groundwater level (Lw): Nil | Gauge height (Lg): 0.73 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 7.50 m | Depth of test section GL - (L1)= 40 m to (L2)= 45 m | Length of section (Ls) 5 m

Reading of flow meter

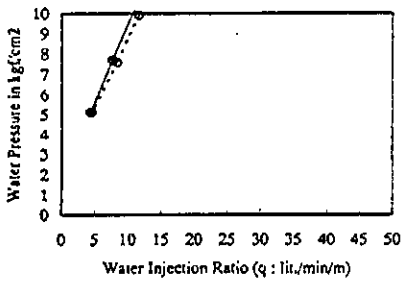
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	13:10	13:25	13:40	13:55	14:10	14:25	14:40
0(min)	85,430	85,655	86,050	86,620	87,430	88,021	88,455
1	85,452	85,693	86,104	86,691	87,487	88,062	88,477
2	85,474	85,732	86,157	86,764	87,544	88,105	88,498
3	85,497	85,769	86,212	86,838	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 lit.	Q1 217	Q2 382	Q3 540	Q4 729	Q5 581	Q6 419	Q7 227
Average lit./min	Q1 21.7	Q2 38.2	Q3 54	Q4 72.9	Q5 58.1	Q6 41.9	Q7 22.7
Finish time	13:20	13:35	13:50	14:05	14:20	14:35	14:50
(Pr)	0.21	0.63	1.24	2.24	1.43	0.75	0.22

Friction Loss (Pr) = pr(Lo + Ls) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qm/Ls [lit/min/m]

P1= 5.1 q1= 4.3
P2= 7.7 q2= 7.6
P3= 10.1 q3= 10.8
P4= 12.1 q4= 14.6
P5= 9.9 q5= 11.6
P6= 7.6 q6= 8.4
P7= 5.1 q7= 4.5



Lugeon value : 11 Lu

Critical Pressure: >12 kgf/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 : Azhor / Hamid Inspected by : Farhat M. Shah

GE2 - 8

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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : 1×10⁴×Q^1.971 Date : 10/January/1999

Ground elevation : EL. m | Groundwater level (Lw): Nil | Gauge height (Lg): 0.73 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 7.50 m | Depth of test section GL - (L1)= 45 m to (L2)= 50 m | Length of section (Ls) 5 m

Reading of flow meter

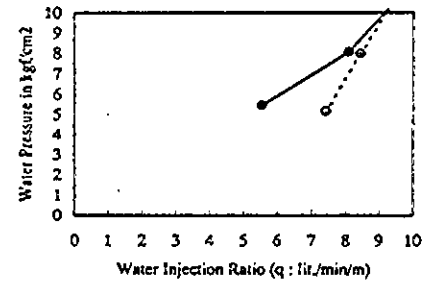
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	15:00	15:12	15:25	15:38	15:50	16:03	16:15
0(min)	13,590	13,965	14,450	15,018	15,630	16,190	16,685
1	13,618	14,005	14,499	15,071	15,678	16,233	16,723
2	13,646	14,045	14,547	15,122	15,726	16,276	16,760
3	13,674	14,085	14,594	15,174	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 lit.	Q1 277	Q2 404	Q3 479	Q4 527	Q5 476	Q6 422	Q7 371
Average lit./min	Q1 27.7	Q2 40.4	Q3 47.9	Q4 52.7	Q5 47.6	Q6 42.2	Q7 37.1
Finish time	15:10	15:22	15:35	15:48	16:00	16:13	16:25
(Pr)	0.37	0.77	1.08	1.30	1.07	0.84	0.65

Friction Loss (Pr) = pr(Lo + Ls) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qm/Ls [lit/min/m]

P1= 5.5 q1= 5.5
P2= 8.1 q2= 8.1
P3= 10.7 q3= 9.6
P4= 13.5 q4= 10.5
P5= 10.8 q5= 9.5
P6= 8.0 q6= 8.4
P7= 5.2 q7= 7.4



Lugeon value : 9.2 Lu

Critical Pressure: >14 kgf/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 : 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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{-6}\times Q^{1.771}$ Date : 13/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 50.30 m | Gauge height (L3): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L2)= 7.00 m | Depth of test section GL. - (L4)= 50 m to (L5)= 55 m | Length of section (L6) 5 m

Reading of flow meter

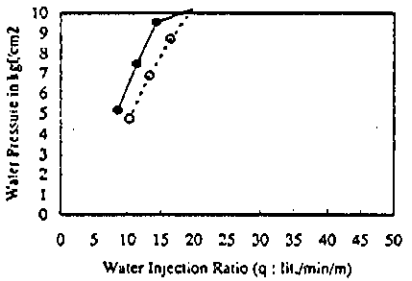
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:00	11:12	11:25	11:38	11:53	12:06	12:18
0(min)	31,000	31,520	32,170	33,030	34,280	35,190	34,860
1	31,046	31,577	32,240	33,120	34,362	35,257	34,912
2	31,093	31,634	32,312	33,210	34,444	35,323	34,963
3	31,137	31,691	32,383	33,304	34,527	35,390	35,016
4	31,180	31,747	32,454	33,398	34,608	35,456	35,066
5	31,222	31,804	32,525	33,494	34,690	35,523	35,118
6	31,264	31,862	32,596	33,591	34,774	35,590	35,170
7	31,305	31,918	32,666	33,692	34,855	35,656	35,221
8	31,346	31,975	32,737	33,797	34,937	35,723	35,271
9	31,387	32,032	32,810	33,907	35,019	35,789	35,324
10	31,428	32,088	32,884	34,020	35,102	35,856	35,375
11							
12							
13							
14							
15							
Total lit.	Qu1 428	Qu2 568	Qu3 714	Qu4 990	Qu5 822	Qu6 666	Qu7 515
Average lit./min	Qu1 42.8	Qu2 56.8	Qu3 71.4	Qu4 99	Qu5 82.2	Qu6 66.6	Qu7 51.5
Finish time	11:10	11:22	11:35	11:48	12:03	12:16	12:28
(Pr)	0.94	1.64	2.58	4.91	3.40	2.25	1.35

Friction Loss (Pr) = pr(L2 + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L2+L4)-Pr [kgf/cm2], q=Qu/L6 [lit/min/m]

P1= 5.2 q1= 8.6
P2= 7.5 q2= 11.4
P3= 9.5 q3= 14.3
P4= 10.2 q4= 19.8
P5= 8.7 q5= 16.4
P6= 6.9 q6= 13.3
P7= 4.8 q7= 10.3



Lugeon value : (15) Lu'

Critical Pressure: 9.5 kgf/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 : Azhor / Hamid Inspected by : Farhat M. Shah

GE2 - 9

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 (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{-6}\times Q^{1.771}$ Date : 28/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 50.30 m | Gauge height (L3): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L2)= 7.00 m | Depth of test section GL. - (L4)= 55 m to (L5)= 60 m | Length of section (L6) 5 m

Reading of flow meter

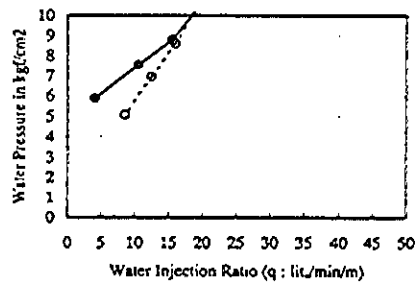
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:00	15:13	15:25	15:40	15:54	16:06	16:20
0(min)	73,030	73,300	73,930	74,910	76,010	76,820	77,453
1	73,051	73,384	74,009	75,005	76,092	76,884	77,497
2	73,075	73,395	74,086	75,100	76,171	76,948	77,539
3	73,092	73,444	74,164	75,195	76,250	77,010	77,581
4	73,112	73,495	74,240	75,289	76,330	77,074	77,627
5	73,132	73,550	74,317	75,385	76,411	77,137	77,670
6	73,151	73,605	74,396	75,480	76,491	77,197	77,712
7	73,170	73,662	74,474	75,574	76,570	77,259	77,756
8	73,190	73,715	74,552	75,667	76,652	77,323	77,797
9	73,211	73,773	74,630	75,760	76,733	77,385	77,840
10	73,234	73,830	74,708	75,855	76,811	77,446	77,882
11							
12							
13							
14							
15							
Total lit.	Qu1 204	Qu2 530	Qu3 778	Qu4 945	Qu5 801	Qu6 626	Qu7 429
Average lit./min	Qu1 20.4	Qu2 53	Qu3 77.8	Qu4 94.5	Qu5 80.1	Qu6 62.6	Qu7 42.9
Finish time	15:10	15:23	15:35	15:50	16:04	16:16	16:30
(Pr)	0.24	1.56	3.32	4.87	3.51	2.16	1.03

Friction Loss (Pr) = pr(L2 + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L2+L4)-Pr [kgf/cm2], q=Qu/L6 [lit/min/m]

P1= 5.9 q1= 4.1
P2= 7.5 q2= 10.6
P3= 8.8 q3= 15.6
P4= 10.2 q4= 18.9
P5= 8.6 q5= 16.0
P6= 6.9 q6= 12.5
P7= 5.1 q7= 8.6



Lugeon value : 13 Lu

Critical Pressure: >10 kgf/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 : 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 (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 30/January/1999

Ground elevation : EL. m | Groundwater level (La): GL.- 50.30 m | Gauge height (Lg): 0.73 m

Pipe length from pressure gauge to borehole mouth: (La)= 7.00 m | Depth of test section GL.-(La)= 60 m to (Lb)= 65 m | Length of section (Lb) 5 m

Reading of flow meter

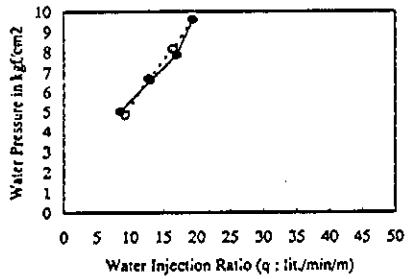
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:15	15:27	15:40	15:52	16:05	16:17	16:29
0(min)	11,270	11,828	12,670	13,738	14,890	14,846	15,602
1	11,313	11,894	12,764	13,838	14,972	14,910	15,648
2	11,356	11,958	12,846	13,933	15,054	14,974	15,695
3	11,398	12,022	12,930	14,030	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.	Qu1 428	Qu2 651	Qu3 848	Qu4 968	Qu5 820	Qu6 640	Qu7 461
Average lit./min	Qu1 42.8	Qu2 65.1	Qu3 84.8	Qu4 96.8	Qu5 82	Qu6 64	Qu7 46.1
Finish time	15:25	15:37	15:50	16:02	16:15	16:27	16:39
(Pr)	1.10	2.52	4.25	5.52	3.98	2.44	1.28

Friction Loss (Pr) = pr(La + Lb) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qu/Lb [lit/min/m]

P1=	5.0	q1=	8.6
P2=	6.6	q2=	13.0
P3=	7.9	q3=	17.0
P4=	9.6	q4=	19.4
P5=	8.1	q5=	16.4
P6=	6.7	q6=	12.8
P7=	4.8	q7=	9.2



Lugeon value : (20) **Lu**

Critical Pressure: >9.6 kgf/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 : Azhor / Hamid Inspected by : Farhat M. Shah

GE2 - 10

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 (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 02/February/1999

Ground elevation : EL. m | Groundwater level (La): GL.- 50.3 m | Gauge height (Lg): 0.73 m

Pipe length from pressure gauge to borehole mouth: (La)= 7.00 m | Depth of test section GL.-(La)= 65 m to (Lb)= 70 m | Length of section (Lb) 5 m

Reading of flow meter

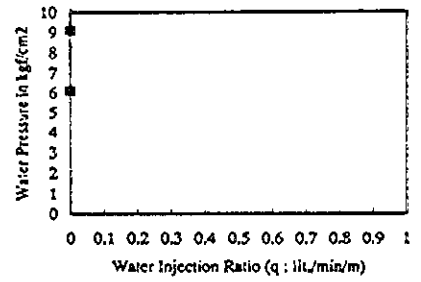
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:45	11:57	12:10	12:22	12:34	12:46	12:58
0(min)	7,974.5	7,980.8	7,981.0	7,981.3	7,988.1	7,988.6	7,988.7
1	7,974.5	7,980.8	7,981.0	7,981.7	7,988.1	7,988.6	7,988.7
2	7,974.5	7,980.8	7,981.0	7,982.5	7,988.1	7,988.6	7,988.7
3	7,974.5	7,980.8	7,981.0	7,983.7	7,988.1	7,988.6	7,988.7
4	7,974.5	7,980.8	7,981.1	7,984.5	7,988.1	7,988.6	7,988.7
5	7,974.5	7,980.9	7,981.1	7,985.4	7,988.2	7,988.6	7,988.7
6	7,974.5	7,980.9	7,981.1	7,985.9	7,988.2	7,988.7	7,988.7
7	7,974.5	7,980.9	7,981.1	7,986.2	7,988.2	7,988.7	7,988.7
8	7,974.5	7,980.9	7,981.1	7,986.6	7,988.2	7,988.7	7,988.7
9	7,974.5	7,980.9	7,981.1	7,987.0	7,988.2	7,988.7	7,988.7
10	7,974.5	7,980.9	7,981.2	7,987.4	7,988.3	7,988.7	7,988.7
11							
12							
13							
14							
15							
Total lit.	Qu1 0.0	Qu2 0.1	Qu3 0.2	Qu4 6.1	Qu5 0.2	Qu6 0.1	Qu7 0.0
Average lit./min	Qu1 0.00	Qu2 0.01	Qu3 0.02	Qu4 0.61	Qu5 0.02	Qu6 0.01	Qu7 0.00
Finish time	11:55	12:07	12:20	12:32	12:44	12:56	13:08
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(La + Lb) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qu/Lb [lit/min/m]

P1=	6.1	q1=	0.000
P2=	9.1	q2=	0.002
P3=	12.1	q3=	0.004
P4=	15.1	q4=	0.122
P5=	12.1	q5=	0.004
P6=	9.1	q6=	0.002
P7=	6.1	q7=	0.000



Lugeon value : 0.0 **Lu**

Critical Pressure: 15 kgf/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 : Azhor / Hamid 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 (pf) : $1\times10^{4}\times0^{3.771}$ Date : 17/December/1998

Ground elevation : EL. m	Groundwater level (L_1): Nil	Gauge height (L_3): 0.86 m
Pipe length from pressure gauge to borehole mouth: (L_2)= 7.50 m	Depth of test section: GL. - (L_4)= 2 m to (L_5)= 7 m	Length of section (L_6): 5 m

Reading of flow meter

Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3	Pu4	Pu5	Pu6	Pu7
Start time	13:37	13:40					
0(min)	11,320	12,040					
1	11,383	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.	Qw1 609	Qw2 590	Qw3	Qw4	Qw5	Qw6	Qw7
Average lit./min	Qw1 60.9	Qw2 147.5	Qw3	Qw4	Qw5	Qw6	Qw7
Finish time	13:47	13:45					
(Pr)	0.31	1.79					

Friction Loss (Pr) = pr(La + Le) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 1.2 q1= 12.2

P2= 2.7 q2= 29.5

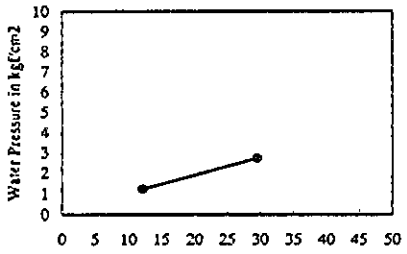
P3= q3=

P4= q4=

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (112) Lu'

Critical Pressure: >2.7 kgf/cm2

Remarks : Packer leaked at 1kgf/cm2 and 2 kgf/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 : Farhat M. Shah Inspected by : M. Suga

GE2 - 11

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 (pf) : $1\times10^{4}\times0^{3.771}$ Date : 18/December/1998

Ground elevation : EL. m	Groundwater level (L_1): Nil	Gauge height (L_3): 0.86 m
Pipe length from pressure gauge to borehole mouth: (L_2)= 6.89 m	Depth of test section: GL. - (L_4)= 5 m to (L_5)= 10 m	Length of section (L_6): 5 m

Reading of flow meter

Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 2.5	Pu4 1	Pu5	Pu6	Pu7
Start time	12:05	12:20	12:35	13:10			
0(min)	18,930	20,100	20,200	24,300			
1	19,002	20,228	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.	Qw1 684	Qw2 1,245	Qw3 294	Qw4 663	Qw5	Qw6	Qw7
Average lit./min	Qw1 68.4	Qw2 124.5	Qw3 98.0	Qw4 66.3	Qw5	Qw6	Qw7
Finish time	12:15	12:30	12:38	13:20			
(Pr)	0.49	1.61	1.00	0.46			

Friction Loss (Pr) = pr(La + Le) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 1.3 q1= 13.7

P2= 3.2 q2= 24.9

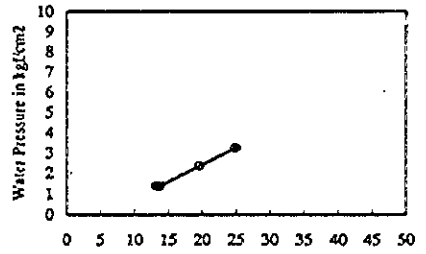
P3= 2.3 q3= 19.6

P4= 1.4 q4= 13.3

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (65) Lu'

Critical Pressure: >3.2 kgf/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 dilivery 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 just 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 (pr) : $1\times10^{6}\times Q^{1.971}$ Date : 20/December/1998

Ground elevation : EL. m | Groundwater level (L_o): Nil | Gauge height (L_g): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 6.81 m | Depth of test section: GL. - (L_o)= 10 m to (L_d)= 15 m | Length of section (L_d) 5 m

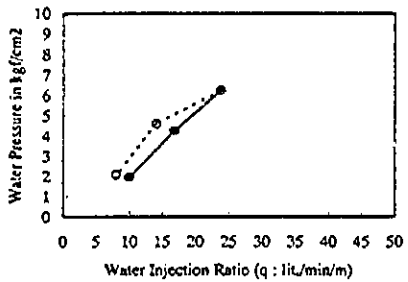
Reading of flow meter

Gauge P. (kg/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 4	Pu5 1	Pu6	Pu7
Start time	12:50	13:04	13:16	13:30	13:45		
0(min)	35,560	36,230	38,000	39,370	40,130		
1	35,608	36,311	38,125	39,436	40,167		
2	35,655	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	38,730	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.	Qu1 496	Qu2 842	Qu3 1,186	Qu4 703	Qu5 399	Qu6	Qu7
Average lit./min	Qu1 49.6	Qu2 84.2	Qu3 118.6	Qu4 70.3	Qu5 39.9	Qu6	Qu7
Finish time	13:00	13:14	13:26	13:40	13:55		
(Pr)	0.37	1.05	2.07	0.74	0.24		
Friction Loss (Pr) = pr(Lo + Ld) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)Lo+Ld)-Pr [kgf/cm2], q=Qu/Ld [lit/min/m]

P1= 2.0 q1= 9.9
P2= 4.3 q2= 16.8
P3= 6.3 q3= 23.7
P4= 4.6 q4= 14.1
P5= 2.1 q5= 8.0
P6= q6=
P7= q7=



Lugeon value : (36) Lu'

Critical Pressure: >6.3 kgf/cm2

Remarks : 10 kgf/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 just previous one minute

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

GE2 - 12

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 (pr) : $1\times10^{6}\times Q^{1.971}$ Date : 22/December/1998

Ground elevation : EL. m | Groundwater level (L_o): Nil | Gauge height (L_g): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 6.75 m | Depth of test section: GL. - (L_o)= 15 m to (L_d)= 20 m | Length of section (L_d) 5 m

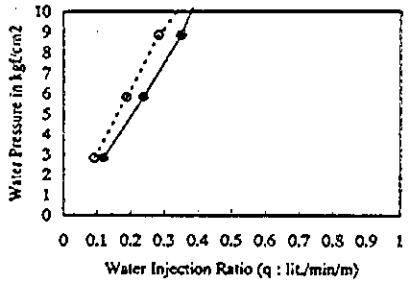
Reading of flow meter

Gauge P. (kg/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:30	12:45	12:57	13:10	13:22	13:35	13:50
0(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	5,892.1
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.	Qu1 5.9	Qu2 11.9	Qu3 17.5	Qu4 21.1	Qu5 14.2	Qu6 9.4	Qu7 4.6
Average lit./min	Qu1 0.59	Qu2 1.19	Qu3 1.75	Qu4 2.1	Qu5 1.42	Qu6 0.94	Qu7 0.46
Finish time	12:40	12:55	13:07	13:20	13:32	13:45	14:00
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(Lo + Ld) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)Lo+Ld)-Pr [kgf/cm2], q=Qu/Ld [lit/min/m]

P1= 2.8 q1= 0.12
P2= 5.8 q2= 0.24
P3= 8.8 q3= 0.35
P4= 11.8 q4= 0.42
P5= 8.8 q5= 0.28
P6= 5.8 q6= 0.19
P7= 2.8 q7= 0.09



Lugeon value : 0.4 Lu

Critical Pressure: >12 kgf/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 : Fathat M. Shah Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 5/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (p_r) : $1\times10^{6}\times Q^{1.971}$ Date : 24/December/1998

Ground elevation : EL. m | Groundwater level (L_o): Nil | Gauge height (L_g): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_e)= 7.50 m | Depth of test section GL. - (L_o)= 20 m to (L_s)= 25 m | Length of section (L_s) 5 m

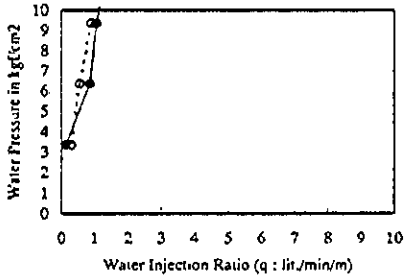
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:55	11:10	11:25	11:40	11:55	12:10	12:20
0(min)	49,350	49,373	49,440	49,501	49,583	49,636	49,667
1	49,351	49,378	49,446	49,508	49,588	49,638	49,668
2	49,351	49,383	49,451	49,515	49,592	49,641	49,670
3	49,352	49,387	49,457	49,522	49,597	49,644	49,671
4	49,353	49,392	49,462	49,529	49,601	49,647	49,673
5	49,353	49,396	49,468	49,536	49,606	49,649	49,674
6	49,354	49,400	49,473	49,544	49,610	49,652	49,676
7	49,355	49,404	49,478	49,549	49,615	49,655	49,677
8	49,355	49,408	49,483	49,556	49,619	49,658	49,678
9	49,356	49,412	49,488	49,563	49,623	49,661	49,680
10	49,356	49,416	49,493	49,570	49,628	49,664	49,682
11							
12							
13							
14							
15							
Total lit.	Qw1 6	Qw2 43	Qw3 53	Qw4 69	Qw5 45	Qw6 28	Qw7 15
Average lit./min	Qw1 0.6	Qw2 4.3	Qw3 5.3	Qw4 6.9	Qw5 4.5	Qw6 2.8	Qw7 1.5
Finish time	11:05	11:20	11:35	11:50	12:05	12:20	12:30
(Pe)	0.00	0.00	0.01	0.01	0.01	0.00	0.00

Calculation of Lugeon value

P=Pu+0.1(sin(a)Le+Ls)-Pr [kgf/cm2], q=Qw/Ls [lit/min/m]

P1=	3.3	q1=	0.1
P2=	6.3	q2=	0.9
P3=	9.3	q3=	1.1
P4=	12.3	q4=	1.4
P5=	9.3	q5=	0.9
P6=	6.3	q6=	0.6
P7=	3.3	q7=	0.3



Friction Loss (Pr) = pr(Le + Ls) [kgf/cm2]

Lugeon value : 1.1 Lu

Critical Pressure: >12 kgf/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 & Azhor Inspected by : M. Suga

GE2 - 13

Water Pressure Test

Hole No.: M98-2 Stage: 6/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a) 90 degrees Packer Type: Mechanical

Friction Loss per meter (p_r) : $1\times10^{6}\times Q^{1.971}$ Date : 24/December/1998

Ground elevation : EL. m | Groundwater level (L_o): GL.- 27.80 m | Gauge height (L_g): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_e)= 6.80 m | Depth of test section GL. - (L_o)= 25 m to (L_s)= 30 m | Length of section (L_s) 5 m

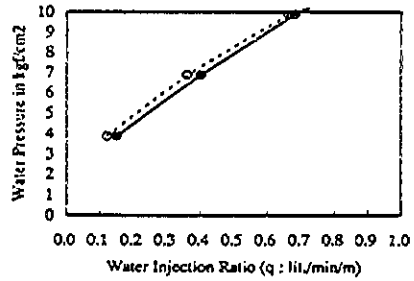
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:10	16:22	16:34	16:45	16:56	17:08	17:20
0(min)	51,403	51,454	51,479	51,528	51,584	51,619	51,638
1	51,404	51,456	51,482	51,533	51,587	51,621	51,638
2	51,405	51,458	51,486	51,538	51,590	51,623	51,639
3	51,406	51,460	51,489	51,543	51,594	51,625	51,639
4	51,406	51,462	51,493	51,549	51,597	51,626	51,640
5	51,407	51,464	51,496	51,554	51,600	51,628	51,641
6	51,408	51,466	51,500	51,559	51,602	51,630	51,641
7	51,409	51,468	51,503	51,565	51,606	51,632	51,642
8	51,409	51,470	51,506	51,570	51,609	51,633	51,642
9	51,410	51,472	51,509	51,576	51,613	51,635	51,643
10	51,411	51,474	51,513	51,581	51,617	51,637	51,644
11							
12							
13							
14							
15							
Total lit.	Qw1 8	Qw2 20	Qw3 34	Qw4 53	Qw5 33	Qw6 18	Qw7 6
Average lit./min	Qw1 0.8	Qw2 2.0	Qw3 3.4	Qw4 5.3	Qw5 3.3	Qw6 1.8	Qw7 0.6
Finish time	16:20	16:32	16:44	16:55	17:06	17:18	17:30
(Pe)	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Calculation of Lugeon value

P=Pu+0.1(sin(a)Le+Ls)-Pr [kgf/cm2], q=Qw/Ls [lit/min/m]

P1=	3.9	q1=	0.2
P2=	6.9	q2=	0.4
P3=	9.9	q3=	0.7
P4=	12.9	q4=	1.1
P5=	9.9	q5=	0.7
P6=	6.9	q6=	0.4
P7=	3.9	q7=	0.1



Friction Loss (Pr) = pr(Le + Ls) [kgf/cm2]

Lugeon value : 0.7 Lu

Critical Pressure: >13 kgf/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 & Azhor 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 (pv) : $1\times10^{4}\times Q^{0.971}$ Date : 25/December/1998

Ground elevation : EL. m	Groundwater level (Lo): GL.- 27.80 m	Gauge height (Lg): 0.86 m
Pipe length from pressure gauge to borehole mouth: (Le)= 6.70 m	Depth of test section GL.-(La)= 30 m to (Lb)= 35 m	Length of section (L) 5 m

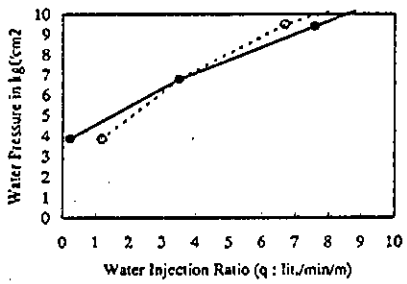
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	13:55	14:10	14:25	14:40	14:55	15:10	15:25
0(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.	Qu1 11	Qu2 175	Qu3 379	Qu4 567	Qu5 334	Qu6 175	Qu7 60
Average lit./min	Qu1 1.1	Qu2 17.5	Qu3 37.9	Qu4 56.7	Qu5 33.4	Qu6 17.5	Qu7 6.0
Finish time	14:05	14:20	14:35	14:50	15:05	15:20	15:35
(Pv)	0.00	0.10	0.48	1.05	0.37	0.10	0.01
Friction Loss (Pr) = pr(Le + La) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)Le+La)-Pr [kgf/cm2], q=Qu/Lb [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 Lu

Critical Pressure: >12 kgf/cm2

Remarks : Reverse flow for 50 seconds by decreasing from 4 to 1 kgf/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 : A. Hamid & Azhor Inspected by : M. Suga

GE2 - 14

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 (pv) : $1\times10^{4}\times Q^{0.971}$ Date : 27/December/1998

Ground elevation : EL. m	Groundwater level (Lo): GL.- 27.80 m	Gauge height (Lg): 0.86 m
Pipe length from pressure gauge to borehole mouth: (Le)= 6.73 m	Depth of test section GL.-(La)= 35 m to (Lb)= 40 m	Length of section (L) 5 m

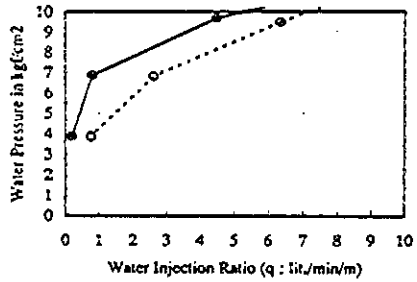
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:00	10:12	10:25	10:38	10:50	11:02	11:15
0(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.	Qu1 9.4	Qu2 40	Qu3 224	Qu4 512	Qu5 318	Qu6 131	Qu7 38
Average lit./min	Qu1 0.94	Qu2 4.0	Qu3 22.4	Qu4 51.2	Qu5 31.8	Qu6 13.1	Qu7 3.8
Finish time	10:10	10:22	10:35	10:48	11:00	11:12	11:25
(Pv)	0.00	0.01	0.19	0.98	0.38	0.07	0.01
Friction Loss (Pr) = pr(Le + La) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)Le+La)-Pr [kgf/cm2], q=Qu/Lb [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) Lu'

Critical Pressure: 8.4 kgf/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 & 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) : $1\times10^{-4}\times Q^{1.971}$ Date : 28/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 27.80 m | Gauge height (L_2): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 6.85 m | Depth of test section: GL.-(L_1)= 40 m to (L_2)= 45 m | Length of section (L_3) 5 m

Reading of flow meter

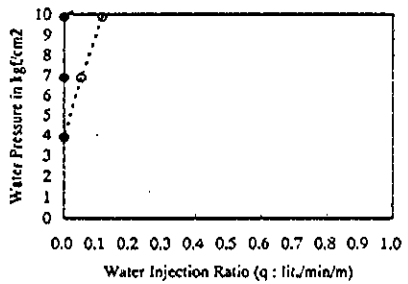
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:10	11:22	11:35	11:47	12:00	12:15	12:27
0(min)	9,700.7	9,702.8	9,703.5	9,704.4	9,717.0	9,722.6	9,724.9
1	9,700.7	9,702.8	9,703.5	9,705.5	9,717.5	9,722.8	9,724.9
2	9,700.7	9,702.8	9,703.5	9,706.6	9,718.0	9,723.0	9,724.9
3	9,700.7	9,702.8	9,703.5	9,707.7	9,718.7	9,723.3	9,724.9
4	9,700.7	9,702.8	9,703.5	9,708.8	9,719.2	9,723.6	9,724.9
5	9,700.7	9,702.8	9,703.5	9,709.9	9,719.8	9,723.9	9,724.9
6	9,700.7	9,702.8	9,703.5	9,711.1	9,720.4	9,724.2	9,724.9
7	9,700.7	9,702.8	9,703.5	9,712.2	9,721.0	9,724.4	9,724.9
8	9,700.7	9,702.8	9,703.5	9,713.3	9,721.6	9,724.7	9,724.9
9	9,700.7	9,702.8	9,703.5	9,714.4	9,722.2	9,725.0	9,724.9
10	9,700.7	9,702.8	9,703.5	9,715.5	9,722.8	9,725.2	9,724.9
11							
12							
13							
14							
15							
Total lit.	Qw1 0.0	Qw2 0.0	Qw3 0.0	Qw4 11.1	Qw5 5.8	Qw6 2.6	Qw7 0.0
Average lit./min	Qw1 0.00	Qw2 0.00	Qw3 0.00	Qw4 1.11	Qw5 0.58	Qw6 0.26	Qw7 0.00
Finish time	11:20	11:32	11:45	11:57	12:10	12:25	12:37
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (P_F) = $p_r(L_0 + L_3)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_W+0.1(\sin(a)L_1+L_2)-P_F$ [kgf/cm2], $q=Q_w/L_3$ [lit/min/m]

P1= 3.9 q1= 0.00
P2= 6.9 q2= 0.00
P3= 9.9 q3= 0.00
P4= 12.9 q4= 0.22
P5= 9.9 q5= 0.12
P6= 6.9 q6= 0.05
P7= 3.9 q7= 0.00



Lugeon value : (0.0) Lu'

Critical Pressure: 9.9 kgf/cm2

Remarks : Reverse flow for 7 seconds by decreasing from 7 to 4 kgf/cm2 and for 1 minutes to 1 kgf/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 Inspected by : Farhat M. Shah

GE2 - 15

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) : $1\times10^{-4}\times Q^{1.971}$ Date : 29/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 27.80 m | Gauge height (L_2): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 6.60 m | Depth of test section: GL.-(L_1)= 45 m to (L_2)= 50 m | Length of section (L_3) 5 m

Reading of flow meter

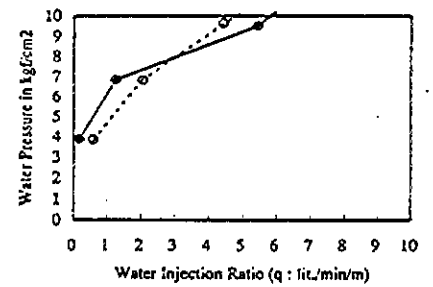
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:30	15:42	15:54	16:08	16:20	16:35	16:48
0(min)	7,477.0	77,488	77,555	77,892	78,293	78,732	78,829
1	7,477.9	77,492	77,582	77,924	78,316	78,742	78,832
2	7,478.7	77,499	77,610	77,965	78,338	78,752	78,835
3	7,479.6	77,507	77,638	78,005	78,361	78,762	78,837
4	7,480.4	77,513	77,667	78,044	78,384	78,773	78,840
5	7,481.3	77,520	77,693	78,082	78,407	78,783	78,843
6	7,482.1	77,526	77,719	78,120	78,429	78,793	78,846
7	7,483.0	77,533	77,746	78,158	78,450	78,804	78,849
8	7,483.8	77,539	77,772	78,193	78,473	78,814	78,852
9	7,484.6	77,546	77,799	78,231	78,493	78,825	78,855
10	7,485.4	77,551	77,827	78,268	78,514	78,835	78,858
11							
12							
13							
14							
15							
Total lit.	Qw1 8.4	Qw2 63	Qw3 272	Qw4 376	Qw5 221	Qw6 103	Qw7 29
Average lit./min	Qw1 0.8	Qw2 6.3	Qw3 27.2	Qw4 37.6	Qw5 22.1	Qw6 10.3	Qw7 2.9
Finish time	15:40	15:52	16:04	16:18	16:30	16:45	16:58
(Pr)	0.00	0.02	0.35	0.66	0.23	0.05	0.00

Friction Loss (P_F) = $p_r(L_0 + L_3)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_W+0.1(\sin(a)L_1+L_2)-P_F$ [kgf/cm2], $q=Q_w/L_3$ [lit/min/m]

P1= 3.9 q1= 0.2
P2= 6.8 q2= 1.3
P3= 9.5 q3= 5.4
P4= 12.2 q4= 7.5
P5= 9.6 q5= 4.4
P6= 6.8 q6= 2.1
P7= 3.9 q7= 0.6



Lugeon value : (2.4) Lu'

Critical Pressure: 6.8 kgf/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 & 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 (a) 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pr) : $1\times10^{6}\times Q^{1.971}$ Date : 30/December/1998

Ground elevation : EL. m | Groundwater level (L1): GL.- 27.80 m | Gauge height (L3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L2)= 7.70 m | Depth of test section GL. - (L)= 50 m to (L)= 55 m | Length of section (Ls) 5 m

Reading of flow meter

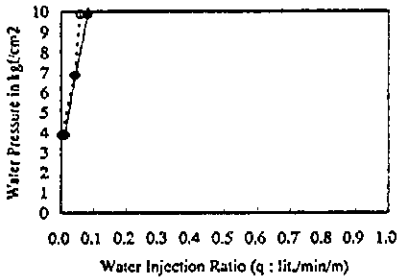
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:58	13:10	13:25	13:40	13:55	14:10	14:25
0(min)	2,224.3	2,226.5	2,231.5	2,235.6	2,240.9	2,244.2	2,246.5
1	2,224.4	2,226.7	2,232.4	2,236.1	2,241.2	2,244.4	2,246.5
2	2,224.5	2,226.9	2,232.9	2,236.5	2,241.5	2,244.6	2,246.5
3	2,224.5	2,227.1	2,233.4	2,236.9	2,241.9	2,244.8	2,246.5
4	2,224.6	2,227.3	2,233.7	2,237.3	2,242.2	2,245.0	2,246.5
5	2,224.6	2,227.5	2,234.0	2,237.8	2,242.5	2,245.2	2,246.6
6	2,224.6	2,227.7	2,234.3	2,238.2	2,242.8	2,245.4	2,246.6
7	2,224.7	2,227.9	2,234.6	2,238.7	2,243.1	2,245.6	2,246.6
8	2,224.7	2,228.1	2,234.9	2,239.1	2,243.3	2,245.8	2,246.6
9	2,224.7	2,228.3	2,235.2	2,239.7	2,243.6	2,246.0	2,246.6
10	2,224.8	2,228.6	2,235.5	2,240.2	2,243.8	2,246.2	2,246.6
11							
12							
13							
14							
15							
Total lit.	Qu1 0.5	Qu2 2.1	Qu3 4.0	Qu4 4.6	Qu5 2.9	Qu6 2.0	Qu7 0.1
Average lit./min	Qm1 0.05	Qm2 0.21	Qm3 0.40	Qm4 0.46	Qm5 0.29	Qm6 0.20	Qm7 0.01
Finish time	13:08	13:20	13:35	13:50	14:05	14:20	14:35
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + Ls) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qm/Ls [lit/min/m]

P1= 3.9 q1= 0.01
P2= 6.9 q2= 0.04
P3= 9.9 q3= 0.08
P4= 12.9 q4= 0.09
P5= 9.9 q5= 0.06
P6= 6.9 q6= 0.04
P7= 3.9 q7= 0.00



Lugeon value : 0.1 Lu

Critical Pressure: >13 kgf/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 & Azhor 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 (a) 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pr) : $1\times10^{6}\times Q^{1.971}$ Date : 31/December/1998

Ground elevation : EL. m | Groundwater level (L1): GL.- 27.80 m | Gauge height (L3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L2)= 7.60 m | Depth of test section GL. - (L)= 55 m to (L)= 60 m | Length of section (Ls) 5 m

Reading of flow meter

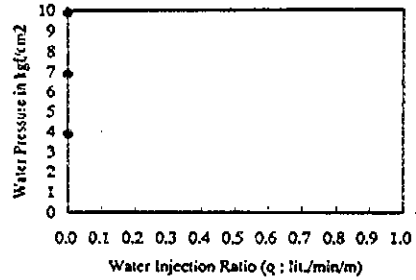
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	14:00	14:12	14:25	14:38	14:50	15:02	15:15
0(min)	7,953.6	7,955.3	7,955.9	7,956.0	7,956.8	7,956.8	7,956.8
1	7,953.6	7,955.3	7,955.9	7,956.0	7,956.8	7,956.8	7,956.8
2	7,953.6	7,955.3	7,955.9	7,956.0	7,956.8	7,956.8	7,956.8
3	7,953.6	7,955.3	7,955.9	7,956.0	7,956.8	7,956.8	7,956.8
4	7,953.6	7,955.3	7,955.9	7,956.0	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
6	7,953.6	7,955.3	7,955.9	7,956.0	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
8	7,953.6	7,955.3	7,955.9	7,956.0	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
10	7,953.6	7,955.3	7,955.9	7,956.0	7,956.8	7,956.8	7,956.8
11							
12							
13							
14							
15							
Total lit.	Qu1 0.0	Qu2 0.0	Qu3 0.0	Qu4 0.0	Qu5 0.0	Qu6 0.0	Qu7 0.0
Average lit./min	Qm1 0.0	Qm2 0.0	Qm3 0	Qm4 0.0	Qm5 0	Qm6 0	Qm7 0.0
Finish time	14:10	14:22	14:35	14:48	15:00	15:12	15:25
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + Ls) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qm/Ls [lit/min/m]

P1= 3.9 q1= 0.00
P2= 6.9 q2= 0.00
P3= 9.9 q3= 0.00
P4= 12.9 q4= 0.00
P5= 9.9 q5= 0.00
P6= 6.9 q6= 0.00
P7= 3.9 q7= 0.00



Lugeon value : 0.0 Lu

Critical Pressure: >13 kgf/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 & Azhor Inspected by : Farhat M. Shah

Water Pressure Test

Hole No.: M98-2 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_r) : $1\times10^{4}\times Q^{0.971}$ Date : 2/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 27.80 m | Gauge height (L_3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 6.60 m | Depth of test section GL. - (L_4)= 60 m to (L_4)= 65 m | Length of section (L_5) 5 m

Reading of flow meter

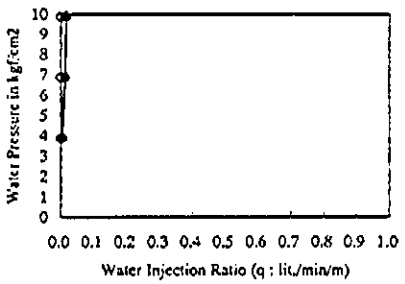
Gauge P. (kgf/cm2)	Pa1 1	Pa2 4	Pa3 7	Pa4 10	Pa5 7	Pa6 4	Pa7 1
Start time	09:40	09:55	10:08	10:20	10:32	10:45	11:00
0(min)	3,930.8	3,933.7	3,937.7	3,938.5	3,939.5	3,939.5	3,939.5
1	3,930.9	3,933.8	3,937.8	3,938.5	3,939.5	3,939.5	3,939.5
2	3,931.0	3,934.0	3,937.9	3,938.5	3,939.5	3,939.5	3,939.5
3	3,931.0	3,934.1	3,938.0	3,938.5	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	3,934.2	3,938.3	3,939.4	3,939.5	3,939.5	3,939.5
8	3,931.0	3,934.3	3,938.3	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.	Qw1 0.2	Qw2 0.6	Qw3 0.8	Qw4 1.2	Qw5 0.0	Qw6 0.0	Qw7 0.0
Average lit./min	Qw1 0.02	Qw2 0.06	Qw3 0.08	Qw4 0.12	Qw5 0.00	Qw6 0.00	Qw7 0.00
Finish time	09:50	10:05	10:18	10:30	10:42	10:55	11:10
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (P_f) = $p_r(L_2 + L_4)$ [kgf/cm2] = = =

Calculation of Lugeon value

$P=P_0+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_w/L_5$ [lit/min/m]

P1= 3.9 q1= 0.004
P2= 6.9 q2= 0.012
P3= 9.9 q3= 0.016
P4= 12.9 q4= 0.024
P5= 9.9 q5= 0.000
P6= 6.9 q6= 0.000
P7= 3.9 q7= 0.000



Lugeon value : 0.0 Lu

Critical Pressure: >13 kgf/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 & Azhor Inspected by : Farhat M. Shah

GE2 - 17

Water Pressure Test

Hole No.: M98-2 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_r) : $1\times10^{4}\times Q^{0.971}$ Date : 3/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 27.80 m | Gauge height (L_3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 6.70 m | Depth of test section GL. - (L_4)= 65 m to (L_4)= 70 m | Length of section (L_5) 5 m

Reading of flow meter

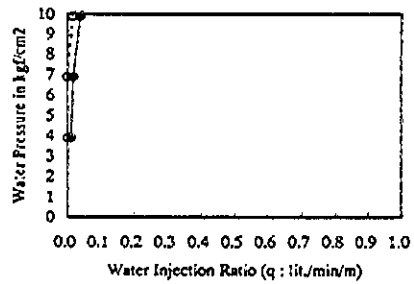
Gauge P. (kgf/cm2)	Pa1 1	Pa2 4	Pa3 7	Pa4 10	Pa5 7	Pa6 4	Pa7 1
Start time	09:45	09:58	10:10	10:23	10:35	10:50	11:05
0(min)	7,743.5	7,746.7	7,748.4	7,751.0	7,756.0	7,756.6	7,756.6
1	7,743.6	7,746.9	7,748.6	7,751.4	7,756.2	7,756.6	7,756.6
2	7,743.6	7,747.0	7,748.8	7,751.9	7,756.3	7,756.6	7,756.6
3	7,743.7	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	7,749.9	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.	Qw1 0.5	Qw2 0.9	Qw3 1.9	Qw4 4.8	Qw5 0.8	Qw6 0.0	Qw7 0.0
Average lit./min	Qw1 0.05	Qw2 0.09	Qw3 0.19	Qw4 0.48	Qw5 0.08	Qw6 0.00	Qw7 0.00
Finish time	09:55	10:08	10:20	10:33	10:45	11:00	11:15
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (P_f) = $p_r(L_2 + L_4)$ [kgf/cm2] = = =

Calculation of Lugeon value

$P=P_0+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_w/L_5$ [lit/min/m]

P1= 3.9 q1= 0.01
P2= 6.9 q2= 0.02
P3= 9.9 q3= 0.04
P4= 12.9 q4= 0.10
P5= 9.9 q5= 0.02
P6= 6.9 q6= 0.00
P7= 3.9 q7= 0.00



Lugeon value : 0.0 Lu

Critical Pressure: >13 kgf/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 & 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 (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 5/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 27.80 m | Gauge height (L3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L2)= 6.70 m | Depth of test section GL.-(L4)= 70 m to (L4)= 75 m | Length of section (L5) 5 m

Reading of flow meter

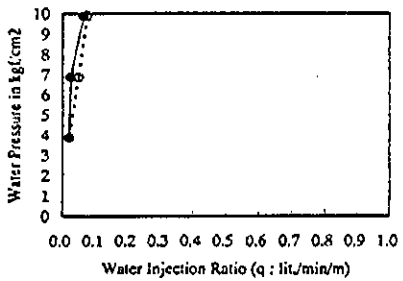
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:55	12:08	12:20	12:35	12:48	13:00	13:13
0(min)	7,662.4	7,667.2	7,670.5	7,675.0	7,683.5	7,688.1	7,691.0
1	7,662.5	7,667.3	7,670.8	7,675.6	7,683.8	7,688.5	7,691.1
2	7,662.6	7,667.4	7,671.1	7,676.3	7,684.2	7,688.8	7,691.2
3	7,662.7	7,667.5	7,671.4	7,677.1	7,684.6	7,689.0	7,691.3
4	7,662.8	7,667.6	7,671.7	7,677.9	7,685.0	7,689.2	7,691.4
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	7,685.8	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 lit.	Qu1 1.0	Qu2 1.2	Qu3 3.1	Qu4 7.6	Qu5 3.7	Qu6 2.4	Qu7 1.0
Average lit./min	Q1 0.10	Q2 0.12	Q3 0.31	Q4 0.76	Q5 0.37	Q6 0.24	Q7 0.10
Finish time	12:05	12:18	12:30	12:45	12:58	13:10	13:23
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(L2 + L4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qu/L5 [lit/min/m]

P1=	3.9	q1=	0.02
P2=	6.9	q2=	0.02
P3=	9.9	q3=	0.06
P4=	12.9	q4=	0.15
P5=	9.9	q5=	0.07
P6=	6.9	q6=	0.05
P7=	3.9	q7=	0.02



Lugeon value : (0.0) Lu'

Critical Pressure: 8.7 kgf/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 & Azhor Inspected by : Farhat M. Shah

GE2 - 18

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 (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 7/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 27.80 m | Gauge height (L3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L2)= 6.75 m | Depth of test section GL.-(L4)= 75 m to (L4)= 80 m | Length of section (L5) 5 m

Reading of flow meter

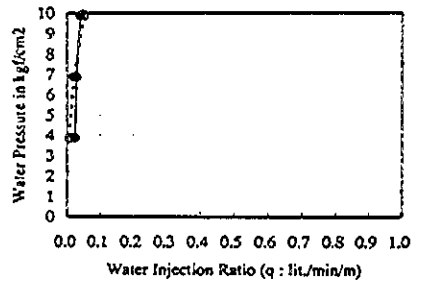
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:30	10:42	10:55	11:10	11:23	11:35	11:48
0(min)	8,135.9	8,138.0	8,139.9	8,142.2	8,147.0	8,149.6	8,149.7
1	8,136.0	8,138.2	8,140.1	8,142.6	8,147.2	8,149.7	8,149.7
2	8,136.1	8,138.3	8,140.3	8,143.0	8,147.5	8,149.8	8,149.7
3	8,136.2	8,138.4	8,140.5	8,143.4	8,147.7	8,149.9	8,149.8
4	8,136.3	8,138.6	8,140.7	8,143.8	8,148.0	8,150.0	8,149.8
5	8,136.5	8,138.7	8,140.9	8,144.3	8,148.3	8,150.1	8,149.8
6	8,136.6	8,138.8	8,141.0	8,144.7	8,148.5	8,150.2	8,149.9
7	8,136.7	8,139.0	8,141.2	8,145.3	8,148.8	8,150.3	8,149.9
8	8,136.8	8,139.2	8,141.5	8,145.7	8,149.1	8,150.4	8,149.9
9	8,136.9	8,139.3	8,141.7	8,146.2	8,149.4	8,150.5	8,149.9
10	8,137.0	8,139.4	8,141.9	8,146.7	8,149.6	8,150.6	8,150.0
11							
12							
13							
14							
15							
Total lit.	Qu1 1.1	Qu2 1.4	Qu3 2.0	Qu4 4.5	Qu5 2.6	Qu6 1.0	Qu7 0.3
Average lit./min	Q1 0.11	Q2 0.14	Q3 0.20	Q4 0.45	Q5 0.26	Q6 0.10	Q7 0.03
Finish time	10:40	10:52	11:05	11:20	11:33	11:45	11:58
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(L2 + L4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qu/L5 [lit/min/m]

P1=	3.9	q1=	0.02
P2=	6.9	q2=	0.03
P3=	9.9	q3=	0.04
P4=	12.9	q4=	0.09
P5=	9.9	q5=	0.05
P6=	6.9	q6=	0.02
P7=	3.9	q7=	0.01



Lugeon value : (0.0) Lu'

Critical Pressure: 9.5 kgf/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 & Azhor 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 (pr) : $1\times10^{4}\times0^{1.971}$ Date : 14/January/1999

Ground elevation : EL. m	Groundwater level (L_1): GL- 27.80 m	Gauge height (L_3): 0.86 m
Pipe length from pressure gauge to borehole mouth: (L_2)= 3.80 m	Depth of test section GL - (L_4)= 80 m to (L_5)= 85 m	Length of section (L_6) 5 m

Reading of flow meter

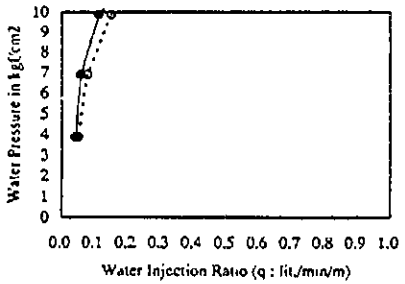
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	10:30	10:42	10:55	11:10	11:23	11:35	11:48
0(min)	1,160.1	1,163.6	1,167.5	1,175.3	1,188.0	1,195.8	1,199.3
1	1,160.2	1,163.9	1,168.1	1,176.5	1,188.7	1,196.2	1,199.5
2	1,160.2	1,164.2	1,168.6	1,177.8	1,189.3	1,196.6	1,199.8
3	1,160.3	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.	Qw1 2.1	Qw2 2.9	Qw3 5.6	Qw4 12.5	Qw5 7.5	Qw6 3.9	Qw7 2.5
Average lit./min	Qw1 0.21	Qw2 0.29	Qw3 0.56	Qw4 1.25	Qw5 0.75	Qw6 0.39	Qw7 0.25
Finish time	10:40	10:52	11:05	11:20	11:33	11:45	11:58
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (P_r) = pr(L_2 + L_4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_1+L_2)-Pr [kgf/cm2], q=Q_w/L_3 [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



Lugeon value : (0.1) Lu'

Critical Pressure: 8.9 kgf/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 & Azhor Inspected by : Farhat M. Shah

GE2 - 19

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 (pr) : $1\times10^{4}\times0^{1.971}$ Date : 27/January/1999

Ground elevation : EL. m	Groundwater level (L_1): GL- 32.40 m	Gauge height (L_3): 0.86 m
Pipe length from pressure gauge to borehole mouth: (L_2)= 4.10 m	Depth of test section GL - (L_4)= 85 m to (L_5)= 90 m	Length of section (L_6) 5 m

Reading of flow meter

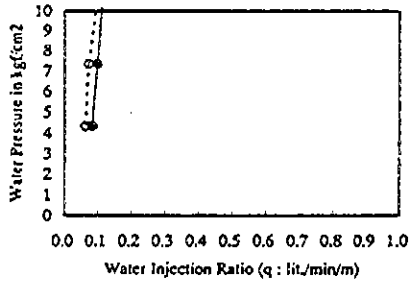
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	14:45	14:58	15:10	15:22	15:35	15:48	16:00
0(min)	8,316.0	8,324.0	8,332.0	8,339.0	8,348.0	8,352.0	8,356.0
1	8,316.3	8,324.3	8,333.1	8,339.9	8,348.5	8,352.3	8,356.2
2	8,316.8	8,325.0	8,333.5	8,340.6	8,348.9	8,352.7	8,356.5
3	8,317.5	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.	Qw1 4.1	Qw2 4.9	Qw3 5.6	Qw4 8.3	Qw5 4.8	Qw6 3.6	Qw7 3.1
Average lit./min	Qw1 0.41	Qw2 0.49	Qw3 0.56	Qw4 0.83	Qw5 0.48	Qw6 0.36	Qw7 0.31
Finish time	14:55	15:08	15:20	15:32	15:45	15:58	16:10
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (P_r) = pr(L_2 + L_4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_1+L_2)-Pr [kgf/cm2], q=Q_w/L_3 [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



Lugeon value : 0.1 Lu

Critical Pressure: >10 kgf/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 & Azhor Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-2 Stage: 19/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pr) : $1\times10^{4}\times Q^{1.971}$ Date : 29/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL- 27.80 m | Gauge height (L_3): 0.86 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.10 m | Depth of test section: GL - (L_1)= 90 m to (L_2)= 95 m | Length of section (L_0) 5 m

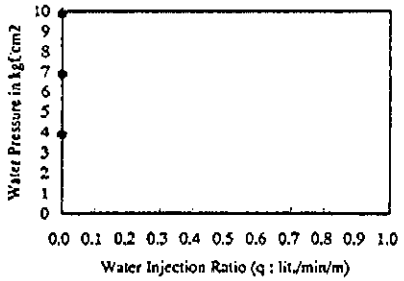
Reading of flow meter

	Pu1	Pu2	Pu3	Pu4	Pu5	Pu6	Pu7
(kgf/cm²)	1	4	7	10	7	4	1
Start time	10:30	10:42	10:55	11:08	11:20	11:32	11:45
0(min)	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
1	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
2	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
3	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
4	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
5	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
6	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
7	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
8	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
9	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
10	3,260.2	3,263.8	3,265.2	3,265.4	3,265.4	3,265.6	3,265.6
11							
12							
13							
14							
15							
Total lit.	Qw1 0.0	Qw2 0.0	Qw3 0.0	Qw4 0.0	Qw5 0.0	Qw6 0.0	Qw7 0.0
Average lit./min	Qw1 0.00	Qw2 0.00	Qw3 0.00	Qw4 0.00	Qw5 0.00	Qw6 0.00	Qw7 0.00
Finish time	10:40	10:52	11:05	11:18	11:30	11:42	11:55
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]						"	"
						"	"

Calculation of Lugeon value

P=Po+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/L0 [lit/min/m]

P1=	3.9	q1=	0.00
P2=	6.9	q2=	0.00
P3=	9.9	q3=	0.00
P4=	12.9	q4=	0.00
P5=	9.9	q5=	0.00
P6=	6.9	q6=	0.00
P7=	3.9	q7=	0.00



Lugeon value : 0.0 Lu

Critical Pressure: >13 kgf/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 & Azhor Inspected by : M. Suga

GE2 - 20

Water Pressure Test

Location: Dam Axis (Right Bank) Stage: 20/20

Hole No.: M98-2 Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pr) : $1\times10^{4}\times Q^{1.971}$ Date : 30/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL- 31.20 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.15 m | Depth of test section: GL - (L_1)= 95 m to (L_2)= 100 m | Length of section (L_0) 5 m

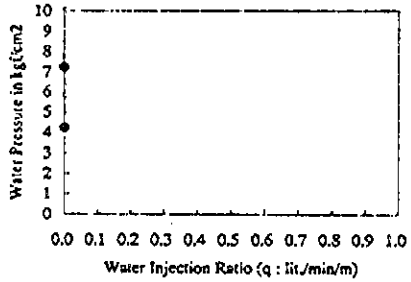
Reading of flow meter

Gauge P.	Pu1	Pu2	Pu3	Pu4	Pu5	Pu6	Pu7
(kgf/cm²)	1	4	7	10	7	4	1
Start time	16:45	16:57	17:10	17:22	17:34	17:46	17:58
0(min)	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
1	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
2	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
3	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
4	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
5	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
6	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
7	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
8	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
9	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
10	7,138.8	7,941.8	7,942.8	7,943.4	7,943.4	7,943.4	7,943.4
11							
12							
13							
14							
15							
Total lit.	Qw1 0.0	Qw2 0.0	Qw3 0.0	Qw4 0.0	Qw5 0.0	Qw6 0.0	Qw7 0.0
Average lit./min	Qw1 0.00	Qw2 0.00	Qw3 0.00	Qw4 0.00	Qw5 0.00	Qw6 0.00	Qw7 0.00
Finish time	16:55	17:07	17:20	17:32	17:44	17:56	18:08
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]						"	"
						"	"

Calculation of Lugeon value

P=Po+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/L0 [lit/min/m]

P1=	4.2	q1=	0.00
P2=	7.2	q2=	0.00
P3=	10.2	q3=	0.00
P4=	13.2	q4=	0.00
P5=	10.2	q5=	0.00
P6=	7.2	q6=	0.00
P7=	4.2	q7=	0.00



Lugeon value : 0.0 Lu

Critical Pressure: >13 kgf/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 & Azhor Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-3 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 (pv) : $1\times10^{6}\times0^{1.971}$ Date : '28/November/1998

Ground elevation : EL. m	Groundwater level (L_1): Nil	Gauge height (L_3): 0.96 m
Pipe length from pressure gauge to hole mouth: (L_0)= 3.97 m	Depth of test section: GL. - (L_1)= 2 m to (L_2)= 7 m	Length of section (L_0) 5 m

Reading of flow meter

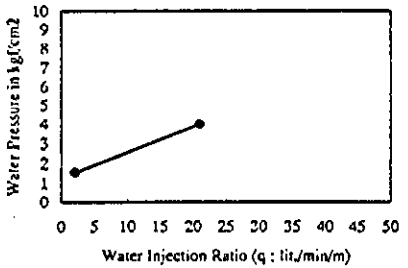
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3	Pu4	Pu5	Pu6	Pu7
Start time	10:57	11:10					
0(min)	58,470	58,600					
1	58,483	58,710					
2	58,494	58,805					
3	58,504	58,915					
4	58,516						
5	58,527						
6	58,537						
7	58,547						
8	58,556						
9	58,566						
10	58,576						
11							
12							
13							
14							
15							
Total lit.	Qu1 106	Qu2 315	Qu3	Qu4	Qu5	Qu6	Qu7
Average lit./min	Qu1 10.6	Qu2 105.0	Qu3	Qu4	Qu5	Qu6	Qu7
Finish time	11:07	11:14					
(Pv)	0.01	0.58					

Friction Loss (Pr) = pr(L2 + L1) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pv [kgf/cm2], q=Qu/L2 [lit/min/m]

P1= 1.5 q1= 2.1
P2= 4.0 q2= 21.0
P3= q3=
P4= q4=
P5= q5=
P6= q6=
P7= q7=



Lugeon value : (68) Lu'

Critical Pressure: >4.0 kgf/cm2

Remarks : Watertake at 2 kgf/cm2 was more than 100 lit./min. And due to surfacial leach 3.0m distance from borehole, pressure test was stopped. At 4kgf/cm2, pressure could not builted.

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

GE2 - 21

Water Pressure Test

Hole No.: M98-3 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 (pv) : $1\times10^{6}\times0^{1.971}$ Date : '30/November/1998

Ground elevation : EL. m	Groundwater level (L_1): Nil	Gauge height (L_3): 1.00 m
Pipe length from pressure gauge to hole mouth: (L_0)= 3.80 m	Depth of test section: GL. - (L_1)= 5 m to (L_2)= 10 m	Length of section (L_0) 5 m

Reading of flow meter

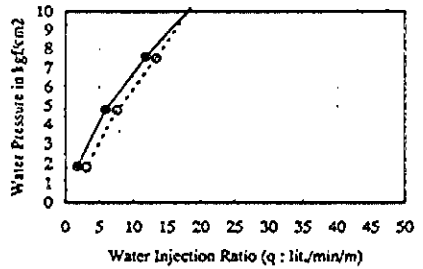
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:55	12:07	12:23	12:35	12:48	13:00	13:12
0(min)	65,406	65,558	66,189	66,950	68,085	68,833	69,225
1	65,416	65,589	66,256	67,038	68,154	68,873	69,241
2	65,425	65,619	66,310	67,130	68,222	68,912	69,256
3	65,434	65,649	66,370	67,229	68,290	68,950	69,272
4	65,443	65,677	66,430	67,310	68,360	68,988	69,287
5	65,452	65,706	66,487	67,405	68,428	69,027	69,303
6	65,460	65,736	66,545	67,500	68,496	69,065	69,318
7	65,469	65,765	66,600	67,588	68,563	69,099	69,334
8	65,477	65,795	66,663	67,684	68,626	69,141	69,349
9	65,486	65,823	66,722	67,780	68,689	69,177	69,365
10	65,494	65,852	66,779	67,874	68,753	69,212	69,379
11							
12							
13							
14							
15							
Total lit.	Qu1 88	Qu2 294	Qu3 590	Qu4 924	Qu5 668	Qu6 379	Qu7 154
Average lit./min	Qu1 8.8	Qu2 29.4	Qu3 59	Qu4 92.4	Qu5 66.8	Qu6 37.9	Qu7 15.4
Finish time	12:05	12:17	12:33	12:45	12:58	13:10	13:22
(Pv)	0.01	0.07	0.27	0.66	0.35	0.11	0.02

Friction Loss (Pr) = pr(L2 + L1) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pv [kgf/cm2], q=Qu/L2 [lit/min/m]

P1= 1.8 q1= 1.8
P2= 4.8 q2= 5.9
P3= 7.6 q3= 11.8
P4= 10.2 q4= 18.5
P5= 7.5 q5= 13.4
P6= 4.7 q6= 7.6
P7= 1.8 q7= 3.1



Lugeon value : (13) Lu'

Critical Pressure: 5.8 kgf/cm2

Remarks : Water table is Nill.

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 & Azumi Gill

Water Pressure Test

Hole No.: M98-3 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_f) : $1\times10^{4}\times Q^{1.97}$ Date : 2/December/1998

Ground elevation : EL. m | Groundwater level (L_1): Nill | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_2)= 3.80 m | Depth of test section: GL. - (L_1)= 10 m to (L_1)= 15 m | Length of section (L_0) = 5 m

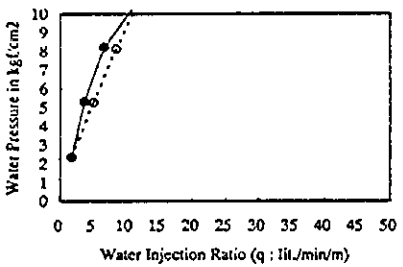
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	14:00	14:12	14:23	14:35	14:46	14:57	15:08
0(min)	50,886	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	53,061
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 lit.	Qw1 89	Qw2 182	Qw3 334	Qw4 611	Qw5 426	Qw6 253	Qw7 88
Average lit./min	Qw1 8.9	Qw2 18.2	Qw3 33.4	Qw4 61.1	Qw5 42.6	Qw6 25.3	Qw7 8.8
Finish time	14:10	14:22	14:33	14:45	14:56	15:07	15:18
(Pf)	0.01	0.04	0.14	0.46	0.23	0.08	0.01
Friction Loss (Pf) = pf(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

P=Pw+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L0 [lit/min/m]

P1=	2.3	q1=	1.8
P2=	5.3	q2=	3.6
P3=	8.2	q3=	6.7
P4=	10.9	q4=	12.2
P5=	8.1	q5=	8.5
P6=	5.3	q6=	5.1
P7=	2.3	q7=	1.8



Lugeon value : (6.6) **Lu'**

Critical Pressure: 7.4 kgf/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 : A. Gill

GE2 - 22

Water Pressure Test

Hole No.: M98-3 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_f) : $1\times10^{4}\times Q^{1.97}$ Date : 3/December/1998

Ground elevation : EL. m | Groundwater level (L_1): Nill | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_2)= 3.80 m | Depth of test section: GL. - (L_1)= 15 m to (L_1)= 20 m | Length of section (L_0) = 5 m

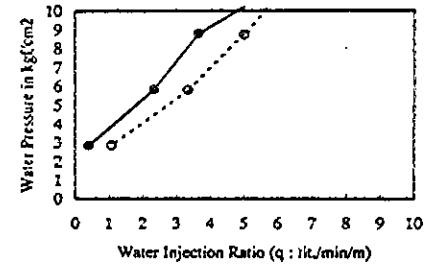
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:17	16:28	16:39	16:50	17:02	17:13	17:24
0(min)	59,521	59,566	59,701	59,908	60,280	60,545	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	60,726
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	60,406	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	59,680	59,884	60,228	60,531	60,712	60,768
11							
12							
13							
14							
15							
Total lit.	Qw1 20	Qw2 117	Qw3 183	Qw4 320	Qw5 251	Qw6 167	Qw7 54
Average lit./min	Qw1 2.0	Qw2 11.7	Qw3 18.3	Qw4 32.0	Qw5 25.1	Qw6 16.7	Qw7 5.4
Finish time	16:27	16:38	16:49	17:00	17:12	17:23	17:34
(Pf)	0.00	0.02	0.06	0.17	0.11	0.05	0.01
Friction Loss (Pf) = pf(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

P=Pw+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L0 [lit/min/m]

P1=	2.8	q1=	0.4
P2=	5.8	q2=	2.3
P3=	8.8	q3=	3.7
P4=	11.7	q4=	6.4
P5=	8.7	q5=	5.0
P6=	5.8	q6=	3.3
P7=	2.8	q7=	1.1



Lugeon value : (4.3) **Lu'**

Critical Pressure: 8.8 kgf/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 & A. Gill | Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-3 Stage: 5/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{6}\times Q^{1.971}$ Date : 5/December/1998

Ground elevation : EL. m | Groundwater level (Lw): Nill | Gauge height (La): 1.00 m

Pipe length from pressure gauge to hole mouth: (La)= 3.80 m | Depth of test section: GL. - (La)= 20 m to (Lb)= 25 m | Length of section (Lu): 5 m

Reading of flow meter

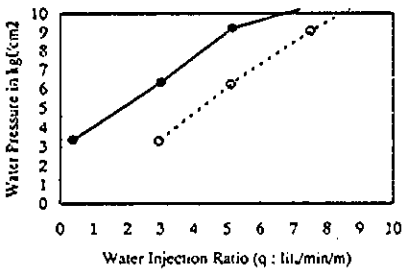
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:22	11:34	11:45	11:56	12:08	12:19	12:30
0(min)	65,411	65,456	65,630	65,930	66,516	66,911	67,162
1	65,414	65,469	65,656	65,977	66,554	66,933	67,164
2	65,417	65,484	65,680	65,028	66,590	66,956	67,166
3	65,418	65,500	65,706	66,080	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	67,033	67,206
6	65,423	65,546	65,783	66,237	66,741	67,069	67,220
7	65,424	65,561	65,809	66,288	66,778	67,097	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.	Qw1 19	Qw2 150	Qw3 257	Qw4 513	Qw5 375	Qw6 255	Qw7 117
Average lit./min	Qw1 1.9	Qw2 15	Qw3 25.7	Qw4 51.3	Qw5 37.5	Qw6 25.5	Qw7 14.7
Finish time	11:32	11:44	11:55	12:06	12:18	12:29	12:40
(Pr)	0.00	0.05	0.14	0.56	0.30	0.14	0.05

Friction Loss (Pr) = pr(La + Lu) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)Lu+Lu)-Pr [kgf/cm2], q=Qw/Lu [lit/min/m]

P1= 3.3 q1= 0.4
P2= 6.3 q2= 3.0
P3= 9.2 q3= 5.1
P4= 11.8 q4= 10.3
P5= 9.0 q5= 7.5
P6= 6.2 q6= 5.1
P7= 3.3 q7= 2.9



Lugeon value : (5.8) Lu'

Critical Pressure: 9.2 kgf/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 & A. Gill | Inspected by : M. Suga

GE2 - 23

Water Pressure Test

Hole No.: M98-3 Stage: 6/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{6}\times Q^{1.971}$ Date : 7/December/1998

Ground elevation : EL. m | Groundwater level (Lw): Nill | Gauge height (La): 1.00 m

Pipe length from pressure gauge to hole mouth: (La)= 3.80 m | Depth of test section: GL. - (La)= 25 m to (Lb)= 30 m | Length of section (Lu): 5 m

Reading of flow meter

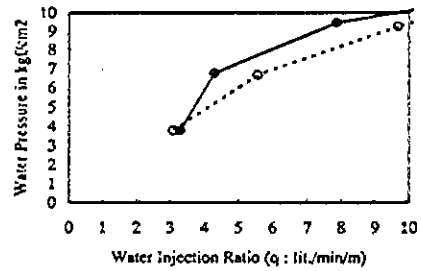
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:48	15:59	16:10	16:22	16:32	16:45	16:59
0(min)	80,088	80,279	80,531	81,006	81,776	82,271	52,508
1	80,107	80,302	80,570	81,071	81,818	82,293	52,516
2	80,125	80,324	80,611	81,141	81,862	82,318	52,527
3	80,141	80,346	80,650	81,215	81,907	82,345	52,539
4	80,159	80,368	80,689	81,288	81,956	82,373	52,552
5	80,176	80,389	80,728	81,361	82,004	82,399	52,566
6	80,192	80,410	80,767	81,435	82,053	82,427	52,581
7	80,208	80,431	80,807	81,510	82,101	82,454	52,596
8	80,223	80,452	80,845	81,579	82,150	82,482	52,611
9	80,238	80,473	80,885	81,654	82,199	82,510	52,626
10	80,252	80,493	80,924	81,727	82,246	82,538	52,643
11							
12							
13							
14							
15							
Total lit.	Qw1 164	Qw2 214	Qw3 393	Qw4 721	Qw5 470	Qw6 267	Qw7 135
Average lit./min	Qw1 16.4	Qw2 21.4	Qw3 39.3	Qw4 73	Qw5 48.4	Qw6 27.8	Qw7 15.4
Finish time	15:58	16:09	16:20	16:32	16:42	16:55	17:09
(Pr)	0.07	0.12	0.40	1.37	0.60	0.20	0.06

Friction Loss (Pr) = pr(La + Lu) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)Lu+Lu)-Pr [kgf/cm2], q=Qw/Lu [lit/min/m]

P1= 3.8 q1= 3.3
P2= 6.7 q2= 4.3
P3= 9.4 q3= 7.9
P4= 11.5 q4= 14.6
P5= 9.2 q5= 9.7
P6= 6.6 q6= 5.6
P7= 3.8 q7= 3.1



Lugeon value : (5.4) Lu'

Critical Pressure: 8.6 kgf/cm2

Remarks : For 3 minutes reverse running at franl 1 kgf/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 (pr) : $1\times10^{4}\times Q^{0.971}$ Date : 11/December/1998

Ground elevation : EL. m | Groundwater level (Lw): Nill | Gauge height (Lg): 1.00 m

Pipe length from pressure gauge to hole mouth: (Lo)= 3.80 m | Depth of test section GL. - (La)= 30 m to (Lb)= 35 m | Length of section (Ls) 5 m

Reading of flow meter

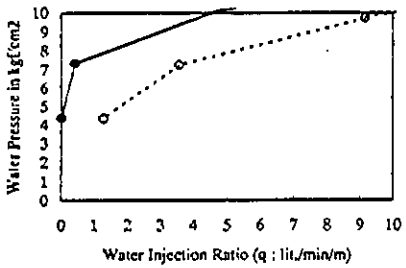
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:00	11:14	11:25	11:36	11:48	12:00	12:22
0(min)	92,745	92,751	92,795	93,088	93,932	94,386	94,556
1	92,745	92,753	92,818	93,168	93,987	94,400	94,561
2	92,745	92,754	92,841	93,226	94,025	94,417	94,567
3	92,745	92,756	92,862	93,298	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	93,035	93,837	94,400	94,555	94,616
11							
12							
13							
14							
15							
Total lit.	Qu1 0.2	Qu2 20.8	Qu3 240	Qu4 749	Qu5 468	Qu6 169	Qu7 60
Average lit./min	Qu1 0.02	Qu2 2.08	Qu3 24.0	Qu4 74.9	Qu5 46.8	Qu6 17.8	Qu7 6.4
Finish time	11:10	11:24	11:35	11:46	11:58	12:10	12:32
(Pr)	0.00	0.00	0.18	1.68	0.64	0.10	0.01

Friction Loss (Pr) = pr(Lo + La) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)Lo+La)-Pr [kgf/cm2], q=Qu/Ls [lit/min/m]

P1=	4.3	q1=	0.0
P2=	7.3	q2=	0.4
P3=	10.2	q3=	4.8
P4=	11.7	q4=	15.0
P5=	9.7	q5=	9.2
P6=	7.3	q6=	3.6
P7=	4.3	q7=	1.3



Lugeon value : (0.8) Lu'

Critical Pressure: 9.6 kgf/cm2

Remarks : At reversal pressure 1 kgf/cm2, the flow meter started reverse for 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 just previous one minute

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

GE2 - 24

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 (pr) : $1\times10^{4}\times Q^{0.971}$ Date : 12/December/1998

Ground elevation : EL. m | Groundwater level (Lw): Nill | Gauge height (Lg): 1.00 m

Pipe length from pressure gauge to hole mouth: (Lo)= 3.98 m | Depth of test section GL. - (La)= 35 m to (Lb)= 40 m | Length of section (Ls) 5 m

Reading of flow meter

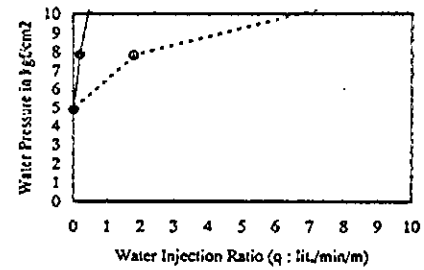
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:00	12:20	12:36	13:00	13:15	13:40	14:00
0(min)	9129.2	9137.6	9139.2	9,270	10,210	10,581	664.7
1	9129.2	9139.0	9139.7	9,326	10,255	10,588	664.7
2	9129.3	9140.0	9140.2	9,404	10,300	10,596	664.7
3	9129.4	9141.0	9141.2	9,498	10,343	10,605	664.7
4	9129.5	9142.5	9142.8	9,572	10,386	10,614	664.7
5	9129.6	9144.0	9144.9	9,657	10,428	10,623	664.7
6	9129.7	9145.3	9147.4	9,740	10,466	10,632	664.7
7	9129.8	9145.5	9150.0	9,824	10,504	10,641	664.7
8	9129.9	9146.5	9153.0	9,906	10,542	10,651	664.7
9	9130.1	9147.0	9156.4	10,097	10,580	10,660	664.7
10	9130.2	9147.6	9158.5	10,178	10,615	10,668	664.8
11							
12							
13							
14							
15							
Total lit.	Qu1 1.0	Qu2 10.0	Qu3 19.3	Qu4 908	Qu5 405	Qu6 87.0	Qu7 0.1
Average lit./min	Qu1 0.1	Qu2 1.0	Qu3 2.7	Qu4 90.8	Qu5 37.4	Qu6 9	Qu7 0.02
Finish time	12:10	12:30	12:46	13:10	13:25	13:50	14:10
(Pr)	0.00	0.00	0.00	2.83	0.49	0.03	0.00

Friction Loss (Pr) = pr(Lo + La) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)Lo+La)-Pr [kgf/cm2], q=Qu/Ls [lit/min/m]

P1=	4.8	q1=	0.0
P2=	7.8	q2=	0.2
P3=	10.8	q3=	0.5
P4=	11.0	q4=	18.2
P5=	10.4	q5=	7.5
P6=	7.8	q6=	1.8
P7=	4.8	q7=	0.0



Lugeon value : 0.5 Lu

Critical Pressure: 11 kgf/cm2

Remarks : By decreasing the pressure to 4 kgf/cm2, the flow started reverse for 3 minutes and to 1 kgf/cm2 for 7 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 just previous one minute

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

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 (pr) : $1\times10^{4}\times Q^{0.971}$ | Date : 15/December/1998

Ground elevation : EL. m	Groundwater level (L_1): Nill	Gauge height (L_2): 1.00 m
Pipe length from pressure gauge to hole mouth: (L_0)= 3.97 m	Depth of test section: GL. - (L_4)= 40 m to (L_5)= 45 m	Length of section (L_3) 5 m

Reading of flow meter

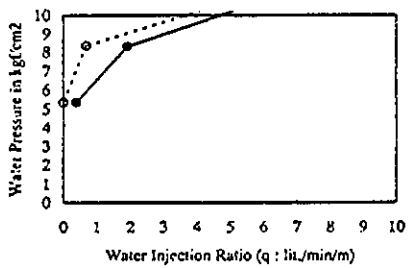
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:50	16:05	16:20	16:35	16:50	17:08	17:26
0(min)	16,180	16,220	16,350	16,720	17,302	17,550	17,580
1	16,182	16,233	16,380	16,770	17,325	17,554	17,580
2	16,183	16,248	16,413	16,820	17,348	17,558	17,580
3	16,185	16,262	16,444	16,860	17,371	17,562	17,580
4	16,187	16,272	16,475	16,917	17,397	17,566	17,580
5	16,189	16,282	16,507	16,960	17,438	17,570	17,580
6	16,191	16,292	16,538	17,018	17,464	17,573	17,580
7	16,193	16,302	16,568	17,070	17,487	17,577	17,580
8	16,195	16,311	16,601	17,120	17,527	17,580	17,580
9	16,197	16,320	16,633	17,175	17,553	17,584	17,580
10	16,199	16,329	16,664	17,232	17,576	17,587	17,580
11							
12							
13							
14							
15							
Total lit.	Qw1 19	Qw2 109	Qw3 314	Qw4 512	Qw5 274	Qw6 37	Qw7 0
Average lit./min	Qw1 1.9	Qw2 9.6	Qw3 31.4	Qw4 54	Qw5 27.6	Qw6 3.4	Qw7 0
Finish time	16:00	16:15	16:30	16:45	17:00	17:18	17:36
(Pr)	0.00	0.04	0.39	1.16	0.30	0.00	0.00

Friction Loss (Pr) = pr(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 5.3 q1= 0.4
P2= 8.3 q2= 1.9
P3= 11.0 q3= 6.3
P4= 13.2 q4= 10.9
P5= 11.0 q5= 5.5
P6= 8.3 q6= 0.7
P7= 5.4 q7= 0.0



Lugeon value : (2.8) Lu'
Critical Pressure: 9.0 kgf/cm2

Remarks : By decreasing pressure to 4 kgf/cm2, the flowmeter started reverse reading 4 minutes and to 1 kgf/cm2 for 5 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 just previous one minute.

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

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 (pr) : $1\times10^{4}\times Q^{0.971}$ | Date : 20/December/1998

Ground elevation : EL. m	Groundwater level (L_1): Nill	Gauge height (L_2): 1.00 m
Pipe length from pressure gauge to hole mouth: (L_0)= 4.40 m	Depth of test section: GL. - (L_4)= 45 m to (L_5)= 50 m	Length of section (L_3) 5 m

Reading of flow meter

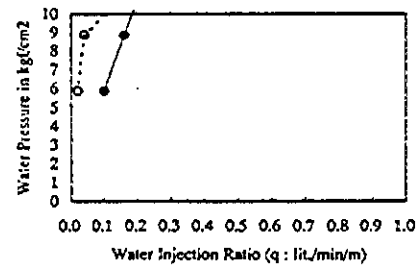
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:12	10:23	10:34	10:45	10:57	11:10	11:22
0(min)	32,737	32,750	32,759	32,772	32,793	32,802	32,804
1	32,737	32,750	32,760	32,774	32,794	32,802	32,804
2	32,738	32,751	32,761	32,776	32,795	32,802	32,804
3	32,738	32,752	32,762	32,779	32,796	32,802	32,804
4	32,739	32,753	32,763	32,781	32,797	32,802	32,804
5	32,739	32,753	32,764	32,783	32,798	32,803	32,804
6	32,740	32,754	32,766	32,784	32,799	32,803	32,804
7	32,740	32,755	32,767	32,786	32,800	32,803	32,804
8	32,741	32,756	32,768	32,789	32,801	32,803	32,805
9	32,742	32,757	32,769	32,791	32,802	32,803	32,805
10	32,742	32,758	32,770	32,793	32,803	32,804	32,805
11							
12							
13							
14							
15							
Total lit.	Qw1 5	Qw2 8	Qw3 11	Qw4 21	Qw5 10	Qw6 2	Qw7 1
Average lit./min	Qw1 0.5	Qw2 0.8	Qw3 1.1	Qw4 2.1	Qw5 1.0	Qw6 0.2	Qw7 0.1
Finish time	10:22	10:33	10:44	10:55	11:07	11:20	11:32
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 5.8 q1= 0.1
P2= 8.8 q2= 0.2
P3= 11.8 q3= 0.2
P4= 14.8 q4= 0.4
P5= 11.8 q5= 0.2
P6= 8.8 q6= 0.0
P7= 5.8 q7= 0.0



Lugeon value : 0.2 Lu
Critical Pressure: 12 kgf/cm2

Remarks : From 10 kgf/cm2 to 7 kgf/cm2, reverse flow for 2 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 just previous one minute.

Prepared by : A. Hamid | Inspected by : M. Suga

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 (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 24/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 53.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_0)= 2.80 m | Depth of test section GL.-(L_1)= 50 m to (L_2)= 55 m | Length of section (L_3) 5 m

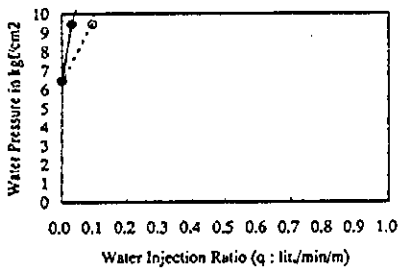
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	09:30	09:50	10:05	10:20	10:35	10:50	11:05
0(min)	8,521.0	8523.0	8,525.2	8,530.8	8,557.4	8,565.0	8,570.5
1	8,521.0	8523.0	8,525.5	8,533.2	8,557.5	8,565.5	8,570.5
2	8,521.0	8523.6	8,526.0	8,536.1	8,558.2	8,565.8	8,570.5
3	8,521.0	8523.8	8,526.4	8,538.3	8,558.5	8,566.5	8,570.5
4	8,521.0	8524.0	8,526.8	8,540.0	8,559.4	8,566.9	8,570.5
5	8,521.0	8524.1	8,527.2	8,543.0	8,560.8	8,567.4	8,570.5
6	8,521.0	8524.1	8,527.6	8,545.0	8,561.3	8,567.9	8,570.5
7	8,521.0	8524.2	8,528.0	8,547.0	8,561.9	8,568.5	8,570.5
8	8,521.0	8524.2	8,528.4	8,550.0	8,562.3	8,569.0	8,570.5
9	8,521.0	8524.4	8,528.8	8,553.0	8,562.8	8,569.5	8,570.5
10	8,521.0	8524.5	8,529.2	8,555.0	8,563.4	8,569.7	8,570.5
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	0.0	1.5	4.0	24.2	6.0	4.7	0.0
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.00	0.15	0.40	2.42	0.60	0.47	0.00
Finish time	09:40	10:00	10:15	10:30	10:45	11:00	11:15
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 6.5 q1= 0.00
P2= 9.4 q2= 0.03
P3= 12.4 q3= 0.08
P4= 15.4 q4= 0.48
P5= 12.4 q5= 0.12
P6= 9.4 q6= 0.09
P7= 6.5 q7= 0.00



Lugeon value : 0.0 Lu

Critical Pressure: 12 kgf/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 & Farhat Inspected by : M. Suga

GE2 - 26

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 (pr) : $1\times10^{4}\times Q^{1.971}$ Date : 25/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 53.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_0)= 3.80 m | Depth of test section GL.-(L_1)= 55 m to (L_2)= 60 m | Length of section (L_3) 5 m

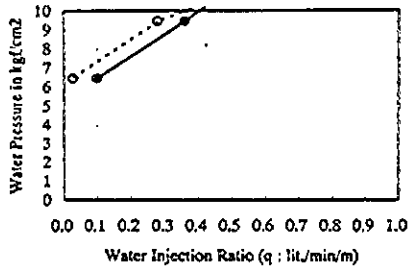
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:10	11:25	11:40	12:00	12:15	12:30	12:45
0(min)	3,890.4	43,901	43,923	43,960	44,020	44,057	4,006.6
1	3,890.6	43,903	43,926	43,965	44,023	44,058	4,006.6
2	3,890.8	43,905	43,929	43,969	44,026	44,059	4,006.6
3	3,891.0	43,907	43,932	43,977	44,030	44,060	4,006.6
4	3,891.1	43,909	43,935	43,983	44,034	44,062	4,006.6
5	3,891.8	43,911	43,938	43,989	44,038	44,063	4,007.0
6	3,892.5	43,912	43,942	43,995	44,042	44,064	4,007.0
7	3,893.3	43,914	43,944	43,999	44,046	44,066	4,007.0
8	3,894.0	43,916	43,948	44,007	44,050	44,067	4,007.5
9	3,894.7	43,917	43,951	44,012	44,054	44,069	4,007.5
10	3,895.4	43,919	43,953	44,018	44,057	44,071	4,008.0
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	5.0	18	30	58	37	14	1.4
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.5	1.8	3.0	5.8	3.7	1.4	0.1
Finish time	11:20	11:35	11:50	12:10	12:25	12:40	12:55
(Pr)	0.00	0.00	0.01	0.02	0.01	0.00	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 6.4 q1= 0.10
P2= 9.4 q2= 0.36
P3= 12.4 q3= 0.60
P4= 15.4 q4= 1.16
P5= 12.4 q5= 0.74
P6= 9.4 q6= 0.28
P7= 6.4 q7= 0.03



Lugeon value : 0.4 Lu

Critical Pressure: 13 kgf/cm2

Remarks : From 4 kgf/cm2 to 1 kgf/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 just previous one minute

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

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_f) : $1\times10^{4}\times Q^{1.971}$ Date : 27/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 53.50 m | Gauge height (L_2): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.30 m | Depth of test section GL.-(L_0)= 60 m to (L_4)= 65 m | Length of section (L_3) 5 m

Reading of flow meter

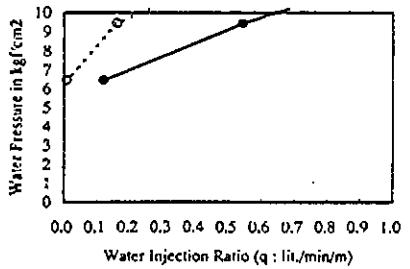
Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	13:00	13:11	13:22	13:34	13:48	14:00	14:15
0(min)	54,837	54,857	54,892	54,952	55,016	55,044	5,051.3
1	54,838	54,861	54,896	54,958	55,018	55,044	5,051.3
2	54,839	54,865	54,902	54,966	55,021	55,045	5,051.4
3	54,839	54,868	54,907	54,972	55,024	55,045	5,051.4
4	54,839	54,871	54,914	54,978	55,027	55,046	5,051.5
5	54,839	54,874	54,919	54,984	55,029	55,047	5,051.5
6	54,840	54,877	54,925	54,990	55,032	55,047	5,051.5
7	54,841	54,880	54,931	54,997	55,035	55,048	5,051.6
8	54,842	54,882	54,936	55,003	55,038	55,049	5,051.6
9	54,842	54,885	54,942	55,009	55,040	55,050	5,051.7
10	54,843	54,887	54,946	55,014	55,043	55,051	5,051.7
11							
12							
13							
14							
15							
Total lit.	Qw1 6	Qw2 30	Qw3 54	Qw4 62	Qw5 27	Qw6 7	Qw7 0.4
Average lit./min	Qw1 0.6	Qw2 2.7	Qw3 5.4	Qw4 6	Qw5 2.8	Qw6 0.8	Qw7 0.04
Finish time	13:10	13:21	13:32	13:44	13:58	14:10	14:25
(Pr)	0.00	0.00	0.02	0.02	0.00	0.00	0.00

Friction Loss (Pr) = $p_f(L_0 + L_4)$ [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L_1+L_2)-Pr [kgf/cm2], q=Q_w/L_3 [lit/min/m]

P1=	6.4	q1=	0.1
P2=	9.4	q2=	0.5
P3=	12.4	q3=	1.1
P4=	15.4	q4=	1.2
P5=	12.4	q5=	0.6
P6=	9.4	q6=	0.2
P7=	6.4	q7=	0.0



Lugeon value : 0.6 Lu

Critical Pressure: >15 kgf/cm2

Remarks : From 4 to 1 kgf/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 Inspected by : Farhat M. Shah

GE2 - 27

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_f) : $1\times10^{4}\times Q^{1.971}$ Date : 28/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 52.30 m | Gauge height (L_2): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_0)= 3.80 m | Depth of test section GL.-(L_0)= 65 m to (L_4)= 70 m | Length of section (L_3) 5 m

Reading of flow meter

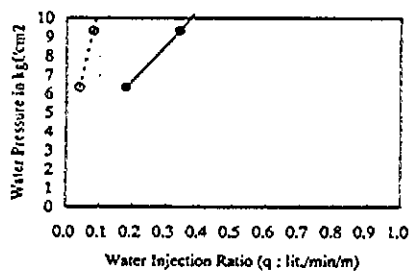
Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:30	15:42	15:54	16:10	16:25	16:40	17:00
0(min)	61,628	61,641	61,662	66,692	66,730	66,740	66,745
1	61,629	61,642	61,664	66,695	66,731	66,741	66,745
2	61,630	61,644	61,667	66,699	66,733	66,741	66,745
3	61,631	61,646	61,670	66,702	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	66,736	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.	Qw1 9	Qw2 17	Qw3 24	Qw4 34	Qw5 9	Qw6 4	Qw7 2
Average lit./min	Qw1 0.9	Qw2 1.7	Qw3 2.4	Qw4 3	Qw5 0.6	Qw6 0.4	Qw7 0.2
Finish time	15:40	15:52	16:04	16:20	16:35	16:50	17:10
(Pr)	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Friction Loss (Pr) = $p_f(L_0 + L_4)$ [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L_1+L_2)-Pr [kgf/cm2], q=Q_w/L_3 [lit/min/m]

P1=	6.3	q1=	0.2
P2=	9.3	q2=	0.3
P3=	12.3	q3=	0.5
P4=	15.3	q4=	0.7
P5=	12.3	q5=	0.1
P6=	9.3	q6=	0.1
P7=	6.3	q7=	0.0



Lugeon value : 0.4 Lu

Critical Pressure: >15 kgf/cm2

Remarks : From 4 to 1 kgf/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 just previous one minute

Prepared by : A. Hamid & Mahboob 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_f) : $1\times10^{-6}\times Q^{1.971}$ Date : 29/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 50.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_2)= 3.94 m | Depth of test section: GL.-(L_1)= 70 m to (L_e)= 75 m | Length of section (L_0) 5 m

Reading of flow meter

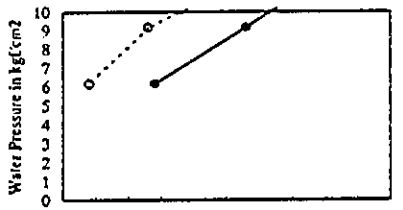
Gauge P.	Pu1	Pu2	Pu3	Pu4	Pu5	Pu6	Pu7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	15:10	15:25	15:40	16:00	16:15	16:30	16:45
0(min)	68,466	68,489	68,521	68,563	68,619	68,611	68,665
1	68,468	68,493	68,525	68,569	68,623	68,612	68,665
2	68,470	68,496	68,529	68,575	68,626	68,613	68,666
3	68,471	68,499	68,534	68,580	68,629	68,614	68,666
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 lit.	Qw1 14	Qw2 28	Qw3 41	Qw4 53	Qw5 31	Qw6 13	Qw7 4
Average lit./min	Qw1 1.4	Qw2 2.8	Qw3 4.1	Qw4 5.3	Qw5 3.1	Qw6 1.3	Qw7 0.4
Finish time	15:20	15:35	15:50	16:10	16:25	16:40	16:55
(Pe)	0.00	0.01	0.01	0.02	0.01	0.00	0.00

Friction Loss (P_f) = $p_f(L_e + L_s)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_w+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_w/L_3$ [lit/min/m]

P1= 6.1 q1= 0.3
P2= 9.1 q2= 0.6
P3= 12.1 q3= 0.8
P4= 15.1 q4= 1.1
P5= 12.1 q5= 0.6
P6= 9.1 q6= 0.3
P7= 6.1 q7= 0.1



Lugeon value : 0.6 Lu

Critical Pressure: >15 kgf/cm2

Remarks : From 7 to 4 kgf/cm2, for 3 minuites 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 & Gill Inspected by : Farhat M. Shah

GE2 - 28

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_f) : $1\times10^{-6}\times Q^{1.971}$ Date : 30/December/1998

Ground elevation : EL. m | Groundwater level (L_1): GL.- 45.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_2)= 3.93 m | Depth of test section: GL.-(L_1)= 75 m to (L_e)= 80 m | Length of section (L_0) 5 m

Reading of flow meter

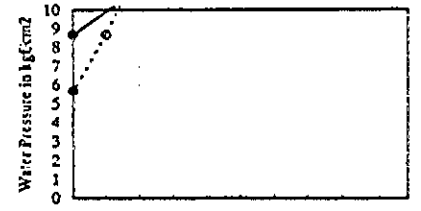
Gauge P.	Pu1	Pu2	Pu3	Pu4	Pu5	Pu6	Pu7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	15:00	15:15	15:30	15:45	16:00	16:15	16:30
0(min)	73,700	73,701	73,702	73,715	73,733	73,742	73,749
1	73,700	73,701	73,703	73,717	73,733	73,742	73,749
2	73,700	73,701	73,704	73,720	73,734	73,743	73,749
3	73,700	73,701	73,705	73,722	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 lit.	Qw1 0	Qw2 0	Qw3 12	Qw4 23	Qw5 9	Qw6 5	Qw7 0
Average lit./min	Qw1 0.0	Qw2 0.0	Qw3 1.2	Qw4 2.3	Qw5 0.9	Qw6 0.5	Qw7 0.0
Finish time	15:10	15:25	15:40	15:55	16:10	16:25	16:40
(Pe)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (P_f) = $p_f(L_e + L_s)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_w+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_w/L_3$ [lit/min/m]

P1= 5.7 q1= 0.0
P2= 8.7 q2= 0.0
P3= 11.6 q3= 0.2
P4= 14.6 q4= 0.5
P5= 11.6 q5= 0.2
P6= 8.6 q6= 0.1
P7= 5.7 q7= 0.0



Lugeon value : (0.0) Lu'

Critical Pressure: 8.7 kgf/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 & Mahboob Inspected by : Farhat M. Shah

Water Pressure Test

Hole No.: M98-3 | 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 (pr) : $1\times10^{4}\times Q^{1.97}$ | Date : 1/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 42.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_2)= 2.80 m | Depth of test section: GL.-(L_1)= 80 m to (L_0)= 85 m | Length of section (L_0) 5 m

Reading of flow meter

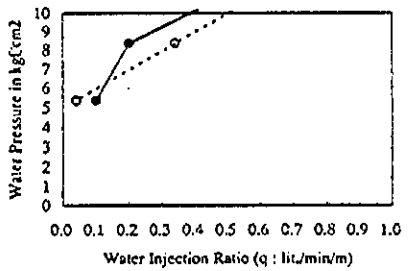
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	09:30	09:42	09:56	10:10	10:25	10:40	10:51
0(min)	79,912	79,920	79,931	79,965	80,018	80,052	80,057
1	79,912	79,921	79,934	79,970	80,021	80,054	80,057
2	79,913	79,922	79,937	79,974	80,024	80,055	80,057
3	79,913	79,923	79,940	79,979	80,026	80,057	80,058
4	79,914	79,924	79,942	79,984	80,029	80,059	80,058
5	79,914	79,925	79,945	79,988	80,033	80,061	80,058
6	79,915	79,926	79,948	79,993	80,036	80,062	80,058
7	79,915	79,927	79,950	79,998	80,039	80,064	80,059
8	79,916	79,928	79,953	80,002	80,043	80,066	80,059
9	79,916	79,929	79,956	80,007	80,047	80,067	80,059
10	79,917	79,930	79,958	80,012	80,050	80,069	80,059
11							
12							
13							
14							
15							
Total lit.	Qu1 5	Qu2 10	Qu3 27	Qu4 47	Qu5 32	Qu6 17	Qu7 2
Average lit./min	Qu1 0.5	Qu2 1	Qu3 2.7	Qu4 4.7	Qu5 3.2	Qu6 1.7	Qu7 0.2
Finish time	09:40	09:52	10:06	10:20	10:35	10:50	11:01
(Pr)	0.00	0.00	0.01	0.02	0.01	0.00	0.00

Friction Loss (Pr) = pr(La + Lo) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/Lo [lit/min/m]

P1=	5.3	q1=	0.1
P2=	8.3	q2=	0.2
P3=	11.3	q3=	0.5
P4=	14.3	q4=	0.9
P5=	11.3	q5=	0.6
P6=	8.3	q6=	0.3
P7=	5.3	q7=	0.0



Lugeon value : (0.3) Lu'

Critical Pressure: 9.0 kgf/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

GB2 - 29

Water Pressure Test

Hole No.: M98-3 | 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 (pr) : $1\times10^{4}\times Q^{1.97}$ | Date : 3/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 36.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to hole mouth: (L_2)= 3.95 m | Depth of test section: GL.-(L_1)= 85 m to (L_0)= 90 m | Length of section (L_0) 5 m

Reading of flow meter

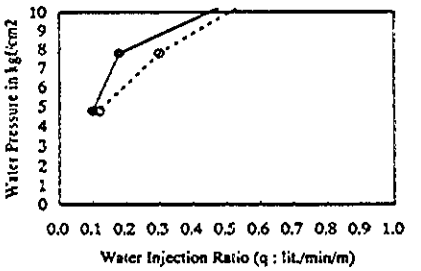
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:10	12:25	12:40	12:55	13:10	13:15	13:30
0(min)	86,000	86,007	86,020	86,051	86,102	86,131	86,138
1	86,001	86,008	86,023	86,056	86,105	86,133	86,138
2	86,001	86,009	86,026	86,061	86,108	86,134	86,139
3	86,002	86,010	86,029	86,067	86,111	86,136	86,140
4	86,002	86,011	86,032	86,072	86,114	86,137	86,141
5	86,002	86,011	86,034	86,077	86,118	86,139	86,142
6	86,003	86,012	86,037	86,081	86,121	86,140	86,142
7	86,004	86,013	86,040	86,084	86,124	86,142	86,142
8	86,004	86,014	86,042	86,088	86,126	86,143	86,143
9	86,004	86,015	86,045	86,092	86,129	86,145	86,144
10	86,005	86,016	86,047	86,097	86,131	86,146	86,144
11							
12							
13							
14							
15							
Total lit.	Qu1 5	Qu2 9	Qu3 27	Qu4 46	Qu5 29	Qu6 15	Qu7 6
Average lit./min	Qu1 0.5	Qu2 0.9	Qu3 2.7	Qu4 4.6	Qu5 2.9	Qu6 1.5	Qu7 0.6
Finish time	12:20	12:35	12:50	13:05	13:20	13:25	13:40
(Pr)	0.00	0.00	0.01	0.02	0.01	0.00	0.00

Friction Loss (Pr) = pr(La + Lo) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/Lo [lit/min/m]

P1=	4.7	q1=	0.1
P2=	7.7	q2=	0.2
P3=	10.7	q3=	0.5
P4=	13.7	q4=	0.9
P5=	10.7	q5=	0.6
P6=	7.7	q6=	0.3
P7=	4.7	q7=	0.1



Lugeon value : (0.2) Lu'

Critical Pressure: 7.7 kgf/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.: M98-3 Stage: 19/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pf) : $1\times10^{4}\times Q^{1.971}$ Date : 4/January/1999

Ground elevation : EL. m | Groundwater level (La): GL.- 35.50 m | Gauge height (Lg): 1.00 m

Pipe length from pressure gauge to hole mouth: (Le)= 3.95 m | Depth of test section GL.-(La)= 90 m to (Lb)= 95 m | Length of section (Ls) 5 m

Reading of flow meter

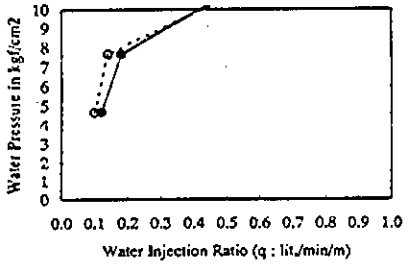
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	13:00	13:11	13:23	13:35	13:50	14:05	14:20
0(min)	91,240	91,248	91,260	91,290	91,340	91,366	91,373
1	91,240	91,249	91,262	91,294	91,342	91,367	91,373
2	91,241	91,250	91,265	91,299	91,345	91,367	91,374
3	91,241	91,250	91,267	91,304	91,347	91,368	91,374
4	91,242	91,251	91,269	91,309	91,349	91,369	91,375
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.	Qm1 6	Qm2 9	Qm3 24	Qm4 46	Qm5 25	Qm6 7	Qm7 5
Average lit./min	Qm1 0.6	Qm2 0.9	Qm3 2.4	Qm4 4.6	Qm5 2.5	Qm6 0.7	Qm7 0.5
Finish time	13:10	13:21	13:33	13:45	14:00	14:15	14:30
(Pf)	0.00	0.00	0.01	0.02	0.01	0.00	0.00

Friction Loss (Pf) = pf(Le + Ls) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)Le+Ls)-Pf [kgf/cm2], q=Qm/Ls [lit/min/m]

P1= 4.6 q1= 0.1
P2= 7.6 q2= 0.2
P3= 10.6 q3= 0.5
P4= 13.6 q4= 0.9
P5= 10.6 q5= 0.5
P6= 7.6 q6= 0.1
P7= 4.6 q7= 0.1



Lugeon value : (0.2) Lu'

Critical Pressure: 8.8 kgf/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 : A. Gill

Water Pressure Test

Hole No.: M98-3 Stage: 20/20

Location: Dam Axis (Right Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (pf) : $1\times10^{4}\times Q^{1.971}$ Date : 5/January/1999

Ground elevation : EL. m | Groundwater level (La): GL.- 33.40 m | Gauge height (Lg): 1.00 m

Pipe length from pressure gauge to hole mouth: (Le)= 3.95 m | Depth of test section GL.-(La)= 95 m to (Lb)= 100 m | Length of section (Ls) 5 m

Reading of flow meter

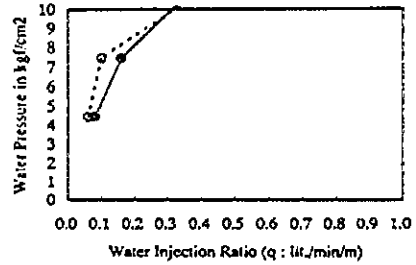
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	08:10	08:22	08:35	08:50	09:03	09:15	09:30
0(min)	10,587	10,592	10,600	10,620	10,650	10,670	10,675
1	10,587	10,593	10,602	10,623	10,652	10,671	10,675
2	10,588	10,594	10,604	10,626	10,653	10,671	10,675
3	10,588	10,594	10,605	10,628	10,654	10,672	10,675
4	10,589	10,595	10,607	10,631	10,656	10,672	10,676
5	10,589	10,596	10,609	10,634	10,658	10,672	10,676
6	10,590	10,597	10,611	10,638	10,659	10,673	10,676
7	10,590	10,597	10,612	10,640	10,662	10,674	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.	Qm1 4	Qm2 8	Qm3 17	Qm4 28	Qm5 18	Qm6 5	Qm7 3
Average lit./min	Qm1 0.4	Qm2 0.8	Qm3 1.7	Qm4 2.8	Qm5 1.8	Qm6 0.5	Qm7 0.3
Finish time	08:20	08:32	08:45	09:00	09:13	09:25	09:40
(Pf)	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Friction Loss (Pf) = pf(Le + Ls) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)Le+Ls)-Pf [kgf/cm2], q=Qm/Ls [lit/min/m]

P1= 4.4 q1= 0.1
P2= 7.4 q2= 0.2
P3= 10.4 q3= 0.3
P4= 13.4 q4= 0.6
P5= 10.4 q5= 0.4
P6= 7.4 q6= 0.1
P7= 4.4 q7= 0.1



Lugeon value : (0.2) Lu'

Critical Pressure: 8.3 kgf/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 & 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 (pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 11/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 4.50 m | Gauge height (L3): 0.70 m

Pipe length from pressure gauge to hole mouth: (L2)= 4.50 m | Depth of test section GL.-(L1)= 2 to (L4)= 7 | Length of section (L5) = 5 m

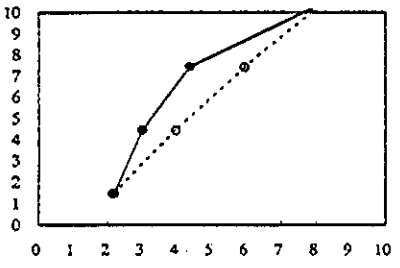
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:30	10:42	10:54	11:06	11:18	11:30	11:42
0(min)	57,346	57,480	57,660	58,020	58,450	58,763	58,968
1	57,358	57,496	57,682	58,059	58,481	58,783	58,979
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	58,922	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.	Qw1 109	Qw2 149	Qw3 218	Qw4 405	Qw5 297	Qw6 198	Qw7 107
Average lit/min	Qw1 10.9	Qw2 14.9	Qw3 21.8	Qw4 40.5	Qw5 29.7	Qw6 19.8	Qw7 10.7
Finish time	10:40	10:52	11:04	11:16	11:28	11:40	11:52
(Pr)	0.01	0.01	0.03	0.10	0.05	0.02	0.01
Friction Loss (Pr) = pr(L2 + L4) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L5 [lit/min/m]

P1=	1.5	q1=	2.2
P2=	4.4	q2=	3.0
P3=	7.4	q3=	4.4
P4=	10.4	q4=	8.1
P5=	7.4	q5=	5.9
P6=	4.4	q6=	4.0
P7=	1.5	q7=	2.1



Lugeon value : (4.5) Lu'

Critical Pressure: 6.9 kgf/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

GE2 - 31

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 (pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 11/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 7.50 m | Gauge height (L3): 0.70 m

Pipe length from pressure gauge to hole mouth: (L2)= 4.50 m | Depth of test section GL.-(L1)= 5 m to (L4)= 10 m | Length of section (L5) = 5 m

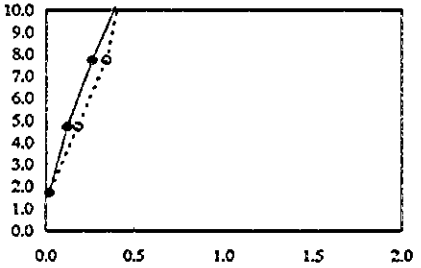
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:00	16:12	16:23	16:34	16:46	16:58	17:10
0(min)	63,021	63,022	63,029	63,043	63,066	63,084	63,092
1	63,021	63,023	63,030	63,045	63,067	63,085	63,092
2	63,021	63,024	63,031	63,047	63,069	63,086	63,092
3	63,022	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	63,690	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.	Qw1 1	Qw2 6	Qw3 13	Qw4 21	Qw5 17	Qw6 9	Qw7 1
Average lit/min	Qw1 0.1	Qw2 0.6	Qw3 1.3	Qw4 2.1	Qw5 1.7	Qw6 0.9	Qw7 0.1
Finish time	16:10	16:22	16:33	16:44	16:56	17:08	17:20
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(L2 + L4) [kgf/cm2]							

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L5 [lit/min/m]

P1=	1.7	q1=	0.0
P2=	4.7	q2=	0.1
P3=	7.7	q3=	0.3
P4=	10.7	q4=	0.4
P5=	7.7	q5=	0.3
P6=	4.7	q6=	0.2
P7=	1.7	q7=	0.0



Lugeon value : (0.3) Lu'

Critical Pressure: 5.7 kgf/cm2 6.0728E-05

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: 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 (Pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 12/January/1999

Ground elevation : EL. m | Groundwater level (L1): GL.- 12.50 m | Gauge height (L_H): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_o)= 4.50 m | Depth of test section: GL.-(L_4)= 10 to (L_e)= 15 | Length of section (L_e) 5 m

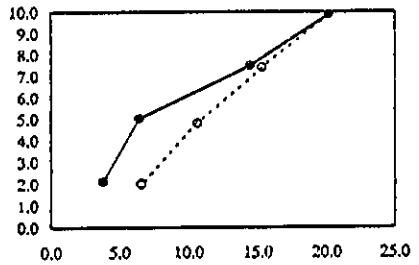
Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	08:00	08:12	08:24	08:35	08:47	08:58	09:10
0(min)	70,800	71,020	71,420	72,180	73,250	74,060	74,620
1	70,820	71,053	71,493	72,280	73,328	74,114	74,652
2	70,839	71,086	71,548	72,380	73,405	74,167	74,684
3	70,858	71,118	71,613	72,480	73,480	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 lit.	Qw1 190	Qw2 322	Qw3 722	Qw4 1,008	Qw5 766	Qw6 532	Qw7 329
Average lit./min	Qw1 19.0	Qw2 32.2	Qw3 72.2	Qw4 100.8	Qw5 76.6	Qw6 53.2	Qw7 32.9
Finish time	08:10	08:22	08:34	08:45	08:57	09:08	09:20
(Pr)	0.05	0.14	0.67	1.29	0.75	0.37	0.14
Friction Loss (Pr) = pr(Lo + Le) [kgf/cm2]							

Calculation of Lugeon value

P=Po+0.1(sin(a)Le+Le)-Pr [kgf/cm2], q=Qw/Le [lit/min/m]

P1=	2.1	q1=	3.8
P2=	5.0	q2=	6.4
P3=	7.5	q3=	14.4
P4=	9.9	q4=	20.2
P5=	7.4	q5=	15.3
P6=	4.8	q6=	10.6
P7=	2.0	q7=	6.6



Lugeon value : (11) Lu'

Critical Pressure: 5.0 kgf/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: 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 (Pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 12/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 14.50 m | Gauge height (L_H): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_o)= 4.50 m | Depth of test section: GL.-(L_e)= 15 m to (L_e)= 20 m | Length of section (L_e) 5 m

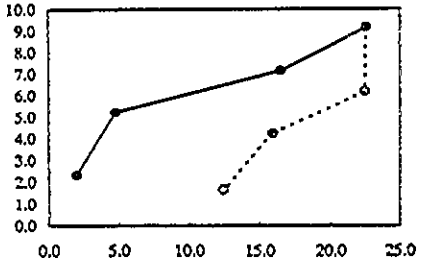
Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	16:30	16:42	16:54	17:10	17:21	17:32	17:44
0(min)	83,323	83,510	83,800	85,000	86,200	87,360	88,250
1	83,333	83,536	83,857	85,089	86,320	87,417	88,294
2	83,343	83,559	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	83,628	84,160	85,509	86,757	86,727	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	88,071	88,803
10	83,423	83,749	84,626	86,130	87,324	88,159	88,871
11							
12							
13							
14							
15							
Total lit.	Qw1 100	Qw2 239	Qw3 826	Qw4 1,130	Qw5 1,124	Qw6 799	Qw7 621
Average lit./min	Qw1 10.0	Qw2 23.9	Qw3 82.6	Qw4 113.0	Qw5 112.4	Qw6 79.9	Qw7 62.1
Finish time	16:40	16:52	17:04	17:20	17:31	17:42	17:54
(Pr)	0.02	0.10	1.17	2.18	2.16	1.10	0.67
Friction Loss (Pr) = pr(Lo + Le) [kgf/cm2]							

Calculation of Lugeon value

P=Po+0.1(sin(a)Le+Le)-Pr [kgf/cm2], q=Qw/Le [lit/min/m]

P1=	2.3	q1=	2.0
P2=	5.2	q2=	4.8
P3=	7.2	q3=	16.5
P4=	9.1	q4=	22.6
P5=	6.2	q5=	22.5
P6=	4.2	q6=	16.0
P7=	1.7	q7=	12.4



Lugeon value : (9.3) Lu'

Critical Pressure: 5.2 kgf/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: 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 (Pr) : $1\times10^{-6}\times Q^{1.9731}$ Date : 13/January/1999

Ground elevation : EL. m	Groundwater level (L_1): GL- 14.70 m	Gauge height (L_3): 0.70 m
Pipe length from pressure gauge to hole mouth: (L_2)= 4.50 m	Depth of test section: GL - (L_4)= 20 m to (L_5)= 25 m	Length of section (L_6): 5 m

Reading of flow meter

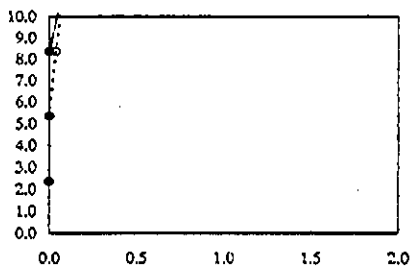
Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	07:30	07:42	07:54	08:05	08:17	08:29	08:42
0(min)	95,472	95,473	95,473	95,473	95,476	95,476	95,476
1	95,472	95,473	95,473	95,474	95,476	95,476	95,476
2	95,472	95,473	95,473	95,474	95,476	95,476	95,476
3	95,472	95,473	95,473	95,475	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.	Qw1 0	Qw2 0	Qw3 0	Qw4 4	Qw5 2	Qw6 0	Qw7 0
Average lit./min	Qw1 0.0	Qw2 0.0	Qw3 0.0	Qw4 0.4	Qw5 0.2	Qw6 0.0	Qw7 0.0
Finish time	07:40	07:52	08:04	08:15	08:27	08:39	08:52
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(La + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/L6 [lit/min/m]

P1=	2.3	q1=	0.0
P2=	5.3	q2=	0.0
P3=	8.3	q3=	0.0
P4=	11.3	q4=	0.1
P5=	8.3	q5=	0.0
P6=	5.3	q6=	0.0
P7=	2.3	q7=	0.0



Lugeon value : (0.0) Lu'

Critical Pressure: 8.3 kgf/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: 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 (Pr) : $1\times10^{-6}\times Q^{1.9731}$ Date : 13/January/1999

Ground elevation : EL. m	Groundwater level (L_1): GL- 14.20 m	Gauge height (L_3): 0.70 m
Pipe length from pressure gauge to hole mouth: (L_2)= 4.50 m	Depth of test section: GL - (L_4)= 25 m to (L_5)= 30 m	Length of section (L_6): 5 m

Reading of flow meter

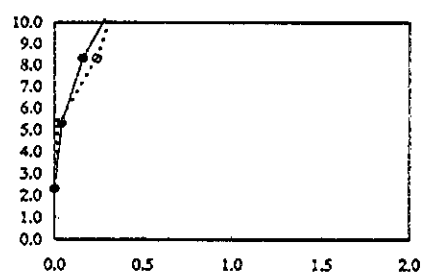
Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:45	16:57	17:09	17:20	17:32	17:44	17:55
0(min)	10,629	10,630	10,634	10,645	10,664	10,676	10,676
1	10,629	10,630	10,635	10,647	10,666	10,676	10,676
2	10,629	10,630	10,636	10,649	10,667	10,676	10,676
3	10,629	10,630	10,637	10,650	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.	Qw1 0	Qw2 2	Qw3 8	Qw4 18	Qw5 12	Qw6 1	Qw7 0
Average lit./min	Qw1 0.0	Qw2 0.2	Qw3 0.8	Qw4 1.8	Qw5 1.2	Qw6 0.1	Qw7 0.0
Finish time	16:55	17:07	17:19	17:30	17:42	17:54	18:05
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(La + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/L6 [lit/min/m]

P1=	2.3	q1=	0.0
P2=	5.3	q2=	0.0
P3=	8.3	q3=	0.2
P4=	11.3	q4=	0.4
P5=	8.3	q5=	0.2
P6=	5.3	q6=	0.0
P7=	2.3	q7=	0.0



Lugeon value : (0.1) Lu'

Critical Pressure: 6.8 kgf/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: 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 (Pr) : $1\times10^{-6}\times Q^{1.971}$ Date : 14/January/1999

Ground elevation : EL. m | Groundwater level (Lo): GL.- 14.10 m | Gauge height (Lu): 0.70 m

Pipe length from pressure gauge to hole mouth: (Le)= 4.50 m | Depth of test section: GL.-(Lo)= 30 m to (Lo)= 35 m | Length of section (Lu): 5 m

Reading of flow meter

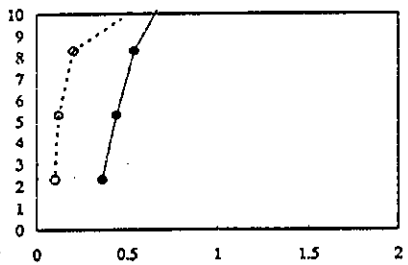
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	07:30	07:42	07:54	08:06	08:17	08:29	08:42
0(min)	19,631	19,660	19,688	19,722	19,761	19,770	19,771
1	19,633	19,662	19,691	19,726	19,762	19,770	19,771
2	19,635	19,664	19,693	19,730	19,763	19,771	19,771
3	19,637	19,666	19,695	19,733	19,764	19,771	19,772
4	19,639	19,669	19,698	19,737	19,765	19,772	19,772
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	10,646	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.	Qw1 18	Qw2 22	Qw3 27	Qw4 37	Qw5 10	Qw6 6	Qw7 5
Average lit./min	Qw1 1.8	Qw2 2.2	Qw3 2.7	Qw4 3.7	Qw5 1.0	Qw6 0.6	Qw7 0.5
Finish time	07:40	07:52	08:04	08:16	08:27	08:39	08:52
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Le + Lo) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)Lu+Lo)-Pr [kgf/cm2], q=Qw/Lu [lit/min/m]

P1=	2.3	q1=	0.4
P2=	5.3	q2=	0.4
P3=	8.3	q3=	0.5
P4=	11.3	q4=	0.7
P5=	8.3	q5=	0.2
P6=	5.3	q6=	0.1
P7=	2.3	q7=	0.1



Lugeon value : 0.7 Lu

Critical Pressure: >11 kgf/cm2

Remarks :

From 7kgf to 4kgf and from 4kgf to 1kgf for few sceeond 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

GE2 - 34

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 (Pr) : $1\times10^{-6}\times Q^{1.971}$ Date : 14/January/1999

Ground elevation : EL. m | Groundwater level (Lo): GL.- 13.70 m | Gauge height (Lu): 0.70 m

Pipe length from pressure gauge to hole mouth: (Le)= 4.50 m | Depth of test section: GL.-(Lo)= 35 m to (Lo)= 40 m | Length of section (Lu): 5 m

Reading of flow meter

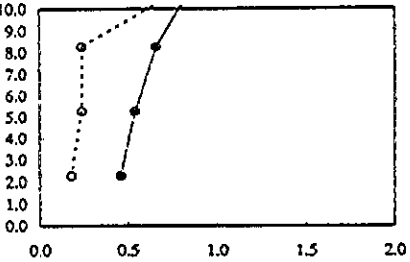
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	18:00	18:12	18:24	18:36	18:48	19:00	19:12
0(min)	31,298	31,331	31,367	31,410	31,455	31,460	31,467
1	31,300	31,334	31,371	31,415	31,456	31,461	31,468
2	31,302	31,337	31,374	31,420	31,457	31,462	31,469
3	31,305	31,339	31,377	31,425	31,459	31,463	31,470
4	31,307	31,342	31,381	31,427	31,460	31,465	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.	Qw1 23	Qw2 27	Qw3 33	Qw4 44	Qw5 12	Qw6 12	Qw7 9
Average lit./min	Qw1 2.3	Qw2 2.7	Qw3 3.3	Qw4 4.4	Qw5 1.2	Qw6 1.2	Qw7 0.9
Finish time	18:10	18:22	18:34	18:46	18:58	19:10	19:22
(Pr)	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Friction Loss (Pr) = pr(Le + Lo) [kgf/cm2]

Calculation of Lugeon value

P=Pw+0.1(sin(a)Lu+Lo)-Pr [kgf/cm2], q=Qw/Lu [lit/min/m]

P1=	2.3	q1=	0.5
P2=	5.3	q2=	0.5
P3=	8.3	q3=	0.7
P4=	11.2	q4=	0.9
P5=	8.3	q5=	0.2
P6=	5.3	q6=	0.2
P7=	2.3	q7=	0.2



Lugeon value : 0.8 Lu

Critical Pressure: >11 kgf/cm2

Remarks :

Revirse reading for few seconds by decredsing 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 just 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

Hole Inclination (a): 60 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 15/January/1999

Ground elevation : EL. m	Groundwater level (L_4): GL.- 13.50 m	Gauge height (L_3): 0.70 m
Pipe length from pressure gauge to hole mouth: (L_0)= 4.50 m	Depth of test section GL.-(L_1)= 40 m to (L_2)= 45 m	Length of section (L_3) 5 m

Reading of flow meter

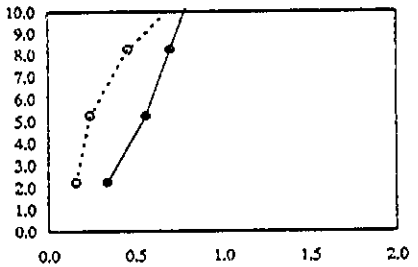
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	07:00	07:12	07:24	07:36	07:48	08:00	08:12
0(min)	41,489	41,512	41,547	41,590	41,624	41,640	41,647
1	41,491	41,515	41,551	41,595	41,636	41,641	41,648
2	41,493	41,518	41,555	41,599	41,638	41,642	41,649
3	41,495	41,520	41,559	41,603	41,639	41,643	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.	Qw1 17	Qw2 28	Qw3 35	Qw4 42	Qw5 23	Qw6 12	Qw7 8
Average lit./min	Qav1 1.7	Qav2 2.8	Qav3 3.5	Qav4 4.2	Qav5 2.3	Qav6 1.2	Qav7 0.8
Finish time	07:10	07:22	07:34	07:46	07:58	08:10	08:22
(Pr)	0.00	0.00	0.01	0.01	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1=	2.2	q1=	0.3
P2=	5.2	q2=	0.6
P3=	8.2	q3=	0.7
P4=	11.2	q4=	0.8
P5=	8.2	q5=	0.5
P6=	5.2	q6=	0.2
P7=	2.2	q7=	0.2



Lugeon value : 0.8 Lu

Critical Pressure: >11 kgf/cm2

Remarks :

From 7kgf to 4kgf and from 4kgf to 1kgf for few seceond 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

GE2 - 35

Water Pressure Test

Hole No.: M98-4 Stage: 10/14

Location: Dam Axis (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 60 degrees Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 15/January/1999

Ground elevation : EL. m	Groundwater level (L_4): GL.- 13.80 m	Gauge height (L_3): 0.70 m
Pipe length from pressure gauge to hole mouth: (L_0)= 4.50 m	Depth of test section GL.-(L_1)= 45 m to (L_2)= 50 m	Length of section (L_3) 5 m

Reading of flow meter

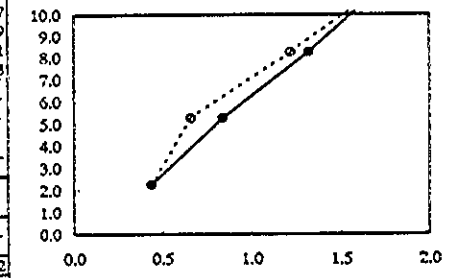
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	17:00	17:12	17:24	17:36	17:48	18:00	18:12
0(min)	49,618	49,642	49,691	49,760	49,850	49,915	49,951
1	49,628	49,647	49,698	49,769	49,855	49,918	49,953
2	49,622	49,652	49,705	49,778	49,861	49,921	49,955
3	49,624	49,656	49,711	49,787	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	49,744	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.	Qw1 22	Qw2 42	Qw3 66	Qw4 86	Qw5 61	Qw6 33	Qw7 22
Average lit./min	Qw1 2.2	Qw2 4.2	Qw3 6.6	Qw4 8.6	Qw5 6.1	Qw6 3.3	Qw7 2.2
Finish time	17:10	17:22	17:34	17:46	17:58	18:10	18:22
(Pr)	0.00	0.01	0.02	0.03	0.02	0.01	0.00

Friction Loss (Pr) = pr(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L3 [lit/min/m]

P1=	2.3	q1=	0.4
P2=	5.3	q2=	0.8
P3=	8.2	q3=	1.3
P4=	11.2	q4=	1.7
P5=	8.2	q5=	1.2
P6=	5.3	q6=	0.7
P7=	2.3	q7=	0.4



Lugeon value : 1.5 Lu

Critical Pressure: >11 kgf/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_f) : $1\times10^{-4}\times Q^{1.971}$ Date : 16/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 13.40 m | Gauge height (L2): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.50 m | Depth of test section: GL. - (L_1)= 50 m to (L_2)= 55 m | Length of section (L_3) 5 m

Reading of flow meter

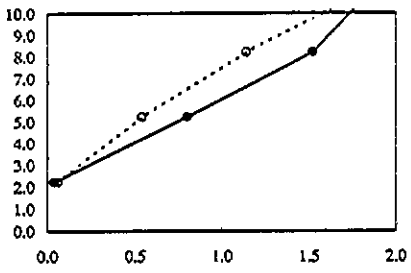
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	17:00	17:12	17:24	17:36	17:48	18:00	18:12
0(min)	54,282	54,300	54,354	54,452	54,550	54,601	54,625
1	54,282	54,306	54,362	54,462	54,555	54,603	54,625
2	54,282	54,310	54,370	54,472	54,561	54,606	54,625
3	54,282	54,314	54,377	54,481	54,567	54,609	54,626
4	54,282	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 lit.	Qw1 2	Qw2 40	Qw3 76	Qw4 94	Qw5 57	Qw6 27	Qw7 3
Average lit/min	Qw1 0.2	Qw2 4.0	Qw3 7.6	Qw4 9.4	Qw5 5.7	Qw6 2.7	Qw7 0.3
Finish time	17:10	17:22	17:34	17:46	17:58	18:10	18:22
(Pr)	0.00	0.01	0.03	0.05	0.02	0.00	0.00

Friction Loss (P_f) = $p_f(L_0 + L_3)$ [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L3 [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



Lugeon value : 2.0 Lu

Critical Pressure: >11 kgf/cm2

Remarks :

Revirse reading for few seconds by decredsing 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 just previous one minute

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

GE2 - 36

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_f) : $1\times10^{-4}\times Q^{1.971}$ Date : 16/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 13.40 m | Gauge height (L_2): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.50 m | Depth of test section: GL. - (L_1)= 55 m to (L_2)= 60 m | Length of section (L_3) 5 m

Reading of flow meter

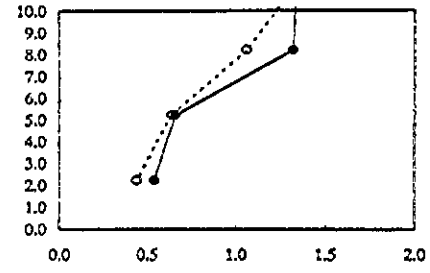
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:00	16:12	16:24	16:36	16:48	17:00	17:12
0(min)	60,028	60,068	60,118	60,202	60,273	60,329	60,362
1	60,031	60,071	60,125	60,209	60,278	60,333	60,369
2	60,034	60,074	60,132	60,216	60,283	60,337	60,366
3	60,037	60,078	60,139	60,222	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 lit.	Qto1 27	Qto2 33	Qto3 66	Qto4 67	Qto5 53	Qto6 32	Qto7 22
Average lit/min	Qav1 2.7	Qav2 3.3	Qav3 6.6	Qav4 6.7	Qav5 5.3	Qav6 3.2	Qav7 2.2
Finish time	16:10	16:22	16:34	16:46	16:58	17:10	17:22
(Pr)	0.00	0.01	0.02	0.03	0.02	0.01	0.00

Friction Loss (P_f) = $p_f(L_0 + L_3)$ [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L3 [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=	1.3
P5=	8.2	q5=	1.1
P6=	5.2	q6=	0.6
P7=	2.2	q7=	0.4



Lugeon value : 1.2 Lu

Critical Pressure: >11 kgf/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: 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_f) : $1\times10^{-4}\times Q^{1.971}$ Date : 17/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 13.50 m | Gauge height (L_3): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_2)= 4.50 m | Depth of test section: GL. - (L)= 60 m to (L_4)= 65 m | Length of section (L_0) 5 m

Reading of flow meter

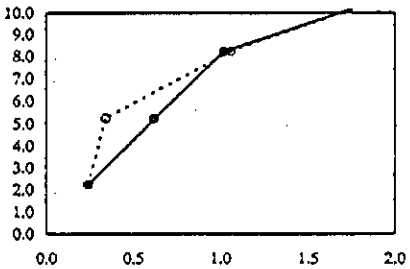
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	08:00	08:12	08:24	08:36	08:48	09:00	09:12
0(min)	65,869	65,902	65,953	66,018	66,135	66,187	66,200
1	65,870	65,905	65,959	66,029	66,140	66,188	66,201
2	65,872	65,908	65,964	66,040	66,145	66,190	66,203
3	65,873	65,911	65,968	66,050	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.	Qu1 12	Qu2 31	Qu3 51	Qu4 106	Qu5 53	Qu6 17	Qu7 12
Average lit./min	Q1 1.2	Q2 3.1	Q3 5.1	Q4 10.6	Q5 5.3	Q6 1.7	Q7 1.2
Finish time	08:10	08:22	08:34	08:46	08:58	09:10	09:22
(Pf)	0.00	0.01	0.02	0.07	0.02	0.00	0.00

Friction Loss (Pf) = $p_f(L_2+L_4)$ [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qu/L3 [lit/min/m]

P1=	2.2	q1=	0.2
P2=	5.2	q2=	0.6
P3=	8.2	q3=	1.0
P4=	11.2	q4=	2.1
P5=	8.2	q5=	1.1
P6=	5.2	q6=	0.3
P7=	2.2	q7=	0.2



Lugeon value : (1.7) Lu'

Critical Pressure: 8.2 kgf/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 : Azim Gill

GE2 - 37

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_f) : $1\times10^{-4}\times Q^{1.971}$ Date : 17/January/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 12.70 m | Gauge height (L_3): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_2)= 4.50 m | Depth of test section: GL. - (L)= 65 m to (L_4)= 70 m | Length of section (L_0) 5 m

Reading of flow meter

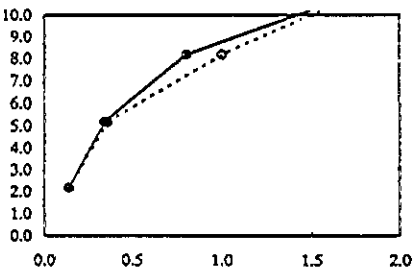
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:30	16:42	16:55	17:07	17:20	17:32	17:45
0(min)	74,107	74,116	74,135	74,178	74,270	74,323	74,343
1	74,108	74,118	74,139	74,186	74,275	74,325	74,344
2	74,108	74,120	74,144	74,195	74,280	74,327	74,344
3	74,109	74,121	74,148	74,205	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	74,155	74,222	74,295	74,332	74,396
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.	Qu1 7	Qu2 17	Qu3 40	Qu4 90	Qu5 50	Qu6 18	Qu7 7
Average lit./min	Q1 0.7	Q2 1.7	Q3 4.0	Q4 9.0	Q5 5.0	Q6 1.8	Q7 0.7
Finish time	16:40	16:52	17:05	17:17	17:30	17:42	17:55
(Pf)	0.00	0.00	0.01	0.05	0.02	0.00	0.00

Friction Loss (Pf) = $p_f(L_2+L_4)$ [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qu/L3 [lit/min/m]

P1=	2.2	q1=	0.1
P2=	5.2	q2=	0.3
P3=	8.2	q3=	0.8
P4=	11.1	q4=	1.8
P5=	8.2	q5=	1.0
P6=	5.2	q6=	0.4
P7=	2.2	q7=	0.1



Lugeon value : (0.7) Lu'

Critical Pressure: 7.2 kgf/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 : 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: Reading (liter)	Reading of Flow Meter: Volume of Flow (cm3)	Calculation
0	4,524.0	0	Calculation Formula
1	4,525.2	1,200	$k = \frac{q}{5.5rH}$
2	4,525.9	700	
3	4,525.9	0	k : Coefficient of Permeability (cm/sec)
4	4,526.0	100	r : Radius of Hole (cm)
5	4,526.5	500	H: Water Head (cm) ;
6	4,526.5	0	when groundwater is Nill H=h1+h3
7	4,526.9	400	when water found in the hole H=h2+h3
8	4,527.5	600	q : Constant Injection Rate into Hole
9	4,527.8	300	(cm3/sec)
10	4,528.0	200	
11	4,528.6	600	r = 21.5
12	4,528.9	300	H= 597
13	4,529.5	600	q= 7
14	4,529.9	400	k= 9.562E-05
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) =
Average		q = 405 cm3/min	9.56E-05 cm/sec
		= 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: Reading (liter)	Reading of Flow Meter: Volume of Flow (cm3)	Calculation
0	3,096.6	0	Calculation Formula
1	3,096.8	200	$k = \frac{q}{5.5rH}$
2	3,097.0	200	
3	3,097.3	300	k : Coefficient of Permeability (cm/sec)
4	3,097.5	200	r : Radius of Hole (cm)
5	3,097.8	300	H: Water Head (cm) ;
6	3,098.1	300	when groundwater is Nill H=h1+h3
7	3,098.3	200	when water found in the hole H=h2+h3
8	3,098.5	200	q : Constant Injection Rate into Hole
9	3,098.9	400	(cm3/sec)
10	3,099.1	200	
11	3,099.4	300	r = 21.5
12	3,099.7	300	H= 697
13	3,100.0	300	q= 4
14	3,100.3	300	k= 5.359E-05
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) =
Average		q = 265 cm3/min	5.36E-05 cm/sec
		= 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): 430 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

Start Time: (9:10) Date: 24 /February/1999

Time Elapsed (min.)	Reading of Flow Meter: Reading (liter)	Reading of Flow Meter: Volume of Flow (cm3)
0	3,970.0	0
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
Average		q = 2,965 cm3/min
		= 49 cm3/sec

Calculation

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 Nill H=h1+h3
when water found in the hole H=h2+h3
q : Constant Injection Rate into Hole (cm3/sec)

r = 21.5
H= 911
q= 49
k= 0.0004587

Permeability (k) = 4.59E-04 cm/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

Start Time: (11:00) Date: 24 /February/1999

Time Elapsed (min.)	Reading of Flow Meter: Reading (liter)	Reading of Flow Meter: Volume of Flow (cm3)
0	7,037.0	0
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
Average		q = 16,675 cm3/min
		= 278 cm3/sec

Calculation

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 Nill H=h1+h3
when water found in the hole H=h2+h3
q : Constant Injection Rate into Hole (cm3/sec)

r = 21.5
H= 903
q= 278
k= 0.0026027

Permeability (k) = 2.60E-03 cm/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.: M98-5 | Stage: 5/5

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

Start Time: (11:30) Date: 25 /February/1999

Time Elapsed (min.)	Reading of Flow Meter: Reading (liter)	Reading of Flow Meter: Volume of Flow (cm3)	Calculation
0	5,231.0	0	
1	5,233.0	2,000	Calculation Formula
2	5,235.0	2,000	$k = \frac{q}{5.5rH}$
3	5,238.0	3,000	
4	5,240.0	2,000	
5	5,242.0	2,000	k : Coefficient of Permeability (cm/sec)
6	5,245.0	3,000	r : Radius of Hole (cm)
7	5,247.0	2,000	H: Water Head (cm) ;
8	5,250.0	3,000	when groundwater is Nill H=h1+h3
9	5,252.0	2,000	when water found in the hole H=h2+h3
10	5,253.0	1,000	q : Constant Injection Rate into Hole (cm3/sec)
11	5,255.0	2,000	
12	5,257.0	2,000	r = 21.5
13	5,260.0	3,000	H= 1213
14	5,262.0	2,000	q= 38
15	5,265.0	3,000	k= 0.0002614
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 cm3	Permeability (k) =
Average		q = 2,250 cm3/min	2.61E-04 cm/sec
		= 38 cm3/sec	

Finish Time: (11:50)

Tested by: A. Hameed

Prepared by: A. Hameed

Inspected by: K.Yano

GE2 - 40

Water Pressure Test

Hole No.: M98-5 | Stage: 1/4

Location: Dam axis (River) | Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees | Packer Type: Mechanical

Friction Loss per meter (pr) : $1\times10^{-6}\times Q^{1.971}$ | Date : 25/February/1999

Ground elevation : EL. m | Groundwater level (L_w): GL.- 0.00 m | Gauge height (L_g): 0.82 m

Pipe length from pressure gauge to hole mouth: (L_e)= 4.60 m | Depth of test section: GL. - (L_e)= 10 m to (L_s)= 15 m | Length of section (L_s) 5 m

Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:00	10:12	10:25	10:36	10:48	11:00	11:12
0(min)	86,004	86,038	86,076	86,123	86,160	86,184	86,197
1	86,006	86,041	86,079	86,126	86,162	86,185	86,197
2	86,008	86,044	86,082	86,129	86,164	86,186	86,197
3	86,010	86,047	86,085	86,133	86,166	86,188	86,197
4	86,012	86,049	86,089	86,136	86,168	86,189	86,197
5	86,014	86,052	86,092	86,140	86,170	86,190	86,198
6	86,016	86,055	86,095	86,144	86,172	86,192	86,198
7	86,018	86,057	86,099	86,147	86,174	86,193	86,198
8	86,020	86,059	86,102	86,150	86,176	86,194	86,198
9	86,023	86,062	86,105	86,154	86,178	86,196	86,198
10	86,026	86,065	86,108	86,157	86,180	86,197	86,199
11							
12							
13							
14							
15							
Total lit.	Qw1 22	Qw2 27	Qw3 32	Qw4 34	Qw5 20	Qw6 13	Qw7 2
Average lit./min	Qw1 2.2	Qw2 2.7	Qw3 3.2	Qw4 3.4	Qw5 2	Qw6 1.3	Qw7 0.2
Finish time	10:10	10:22	10:35	10:46	10:58	11:10	11:22
(Pe)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(Le + Ls) [kgf/cm2]							

Calculation of Lugeon value

P=Pe+0.1(sin(a)Le+Ls)-Pr [kgf/cm2], q=Qw/Ls [lit/min/m]

P1= 1.1 q1= 0.4

P2= 4.1 q2= 0.5

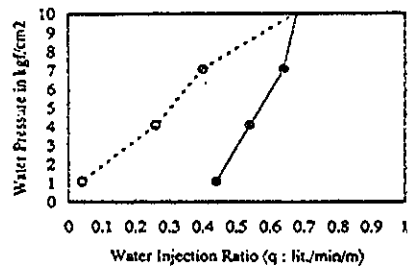
P3= 7.1 q3= 0.6

P4= 10.1 q4= 0.7

P5= 7.1 q5= 0.4

P6= 4.1 q6= 0.3

P7= 1.1 q7= 0.0



Lugeon value : 0.7 Lu

Critical Pressure: >10 kgf/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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-5 Stage: 2/4

Location: Dam axis (River) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 26/February/1999

Ground elevation : EL. m | Groundwater level (L_4): GL.- 0.00 m | Gauge height (L_1): 0.82 m

Pipe length from pressure gauge to hole mouth: (L_2)= 4.60 m | Depth of test section: GL. - (L_3)= 15 m to (L_4)= 20 m | Length of section (L_5) 5 m

Reading of flow meter

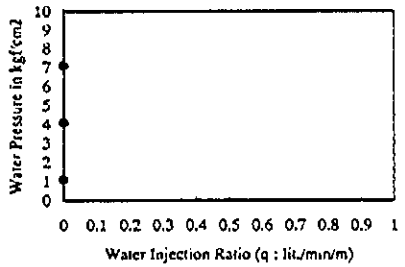
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	11:00	11:22	11:34	11:50	12:12	12:30	12:42
0(min)	297,002	297,002	297,002	297,002	297,002	297,002	297,002
1	297,002	297,002	297,002	297,002	297,002	297,002	297,002
2	297,002	297,002	297,002	297,002	297,002	297,002	297,002
3	297,002	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.	Qw1 0	Qw2 0	Qw3 0	Qw4 0	Qw5 0	Qw6 0	Qw7 0
Average lit./min	Qw1 0	Qw2 0	Qw3 0	Qw4 0	Qw5 0	Qw6 0	Qw7 0
Finish time	11:10	11:32	11:44	12:00	12:22	12:40	12:52
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(L_2 + L_4) [kgf/cm2]

Calculation of Lugeon value

P=Pe+0.1(sin(a)L_2+L_3)-Pr [kgf/cm2], q=Q_w/L_5 [lit/min/m]

P1=	1.1	q1=	0.0
P2=	4.1	q2=	0.0
P3=	7.1	q3=	0.0
P4=	10.1	q4=	0.0
P5=	7.1	q5=	0.0
P6=	4.1	q6=	0.0
P7=	1.1	q7=	0.0



Lugeon value : 0.0 Lu

Critical Pressure: >10 kgf/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 & Azhor | Inspected by : M. Suga

GE2 - 41

Water Pressure Test

Hole No.: M98-5 Stage: 3/4

Location: Dam axis (River) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pr) : $1\times10^{-4}\times Q^{1.971}$ Date : 26/February/1999

Ground elevation : EL. m | Groundwater level (L_4): GL.- 0.00 m | Gauge height (L_1): 0.82 m

Pipe length from pressure gauge to hole mouth: (L_2)= 4.60 m | Depth of test section: GL. - (L_3)= 20 m to (L_4)= 25 m | Length of section (L_5) 5 m

Reading of flow meter

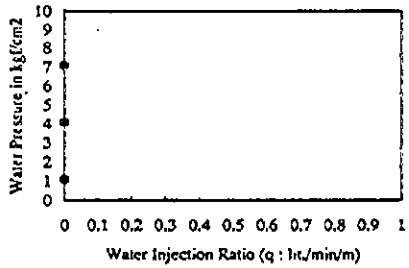
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	18:00	18:12	18:24	18:36	18:48	19:00	19:13
0(min)	301,123	301,124	301,124	301,125	301,125	301,126	301,127
1	301,123	301,124	301,124	301,125	301,125	301,126	301,127
2	301,123	301,124	301,124	301,125	301,125	301,126	301,127
3	301,123	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.	Qw1 0	Qw2 0	Qw3 0	Qw4 0	Qw5 0	Qw6 0	Qw7 0
Average lit./min	Qw1 0	Qw2 0	Qw3 0	Qw4 0	Qw5 0	Qw6 0	Qw7 0
Finish time	18:10	18:22	18:34	18:46	18:58	19:10	19:23
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(L_2 + L_4) [kgf/cm2]

Calculation of Lugeon value

P=Pe+0.1(sin(a)L_2+L_3)-Pr [kgf/cm2], q=Q_w/L_5 [lit/min/m]

P1=	1.1	q1=	0.0
P2=	4.1	q2=	0.0
P3=	7.1	q3=	0.0
P4=	10.1	q4=	0.0
P5=	7.1	q5=	0.0
P6=	4.1	q6=	0.0
P7=	1.1	q7=	0.0



Lugeon value : 0.0 Lu

Critical Pressure: >10 kgf/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 & 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_f) : $1\times10^{-4}\times Q^{1.971}$ Date : 27/February/1999

Ground elevation : EL. m | Groundwater level (L_w): GL- 0.00 m | Gauge height (L_g): 0.82 m

Pipe length from pressure gauge to hole mouth: (L_o)= 4.60 m | Depth of test section: GL - (L_o)= 25 m to (L_s)= 30 m | Length of section (L_s) 5 m

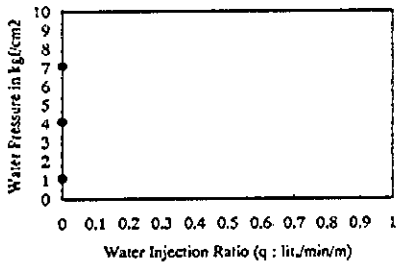
Reading of flow meter

Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	08:00	08:12	08:23	08:35	08:46	08:58	09:10
0(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.	Qw1 0	Qw2 0	Qw3 0	Qw4 0	Qw5 0	Qw6 0	Qw7 0
Average lit./min	Qw1 0	Qw2 0	Qw3 0	Qw4 0	Qw5 0	Qw6 0	Qw7 0
Finish time	08:10	08:22	08:33	08:45	08:56	09:08	09:20
(Pf)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pf) = $p_f(L_o + L_s)$ [kgf/cm²]							

Calculation of Lugeon value

P=Pw+0.1(sin(a)Lo+Ls)-Pf [kgf/cm2], q=Qw/Ls [lit/min/m]

P1= 1.1 q1= 0.0
P2= 4.1 q2= 0.0
P3= 7.1 q3= 0.0
P4= 10.1 q4= 0.0
P5= 7.1 q5= 0.0
P6= 4.1 q6= 0.0
P7= 1.1 q7= 0.0



Lugeon value : 0.0 Lu

Critical Pressure: >10 kgf/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 & Azhor Inspected by : M. Suga

GE2 - 42

Water Pressure Test

Hole No.: M98-6 Stage: 1/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (p_f) : $1\times10^{-4}\times Q^{1.971}$ Date : 30/January/1999

Ground elevation : EL. m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.73 m

Pipe length from pressure gauge to hole mouth: (L_o)= 4.36 m | Depth of test section: GL - (L_o)= 2 m to (L_s)= 7 m | Length of section (L_s) 5 m

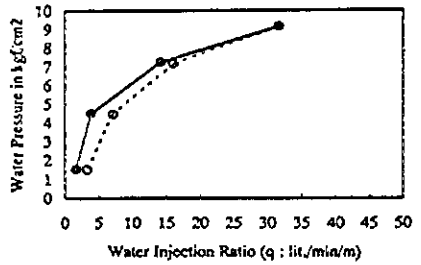
Reading of flow meter

Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:00	10:12	10:25	10:36	10:48	11:00	11:12
0(min)	68,992	69,098	69,333	70,060	71,650	72,465	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	69,532	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	69,667	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.	Qw1 83	Qw2 194	Qw3 710	Qw4 1,582	Qw5 802	Qw6 356	Qw7 166
Average lit./min	Qw1 8.4	Qw2 19.4	Qw3 71	Qw4 158.2	Qw5 80.2	Qw6 35.6	Qw7 16.6
Finish time	10:10	10:22	10:35	10:46	10:58	11:10	11:22
(Pf)	0.00	0.02	0.28	1.38	0.36	0.07	0.02
Friction Loss (Pf) = $p_f(L_o + L_s)$ [kgf/cm²]							

Calculation of Lugeon value

P=Pw+0.1(sin(a)Lo+Ls)-Pf [kgf/cm2], q=Qw/Ls [lit/min/m]

P1= 1.5 q1= 1.7
P2= 4.5 q2= 3.9
P3= 7.2 q3= 14.2
P4= 9.1 q4= 31.6
P5= 7.2 q5= 16.0
P6= 4.5 q6= 7.1
P7= 1.5 q7= 3.3



Lugeon value : (7.9) Lu'

Critical Pressure: 6.3 kgf/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 : Fathat M. Shah Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-6 Stage: 2/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pf) : $1\times10^{-4}\times Q^{1.971}$ Date : 31/January/1999

Ground elevation : EL. m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.70 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.40 m | Depth of test section GL - (L_0)= 5 m to (L_0)= 10 m | Length of section (L_0) 5 m

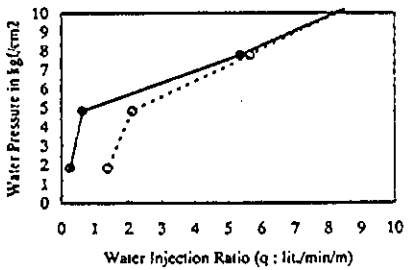
Reading of flow meter

Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	11:00	11:22	11:34	11:50	12:12	12:30	12:42
0(min)	74,494	74,516	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	75,768	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	76,148
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.	Qw1 13	Qw2 32	Qw3 268	Qw4 452	Qw5 283	Qw6 106	Qw7 69
Average lit./min	Qw1 1.3	Qw2 3.2	Qw3 26.8	Qw4 45.2	Qw5 28.3	Qw6 10.6	Qw7 6.9
Finish time	11:10	11:32	11:44	12:00	12:22	12:40	12:52
(Pr)	0.00	0.00	0.06	0.17	0.07	0.01	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L0 [lit/min/m]

P1= 1.8 q1= 0.3
P2= 4.8 q2= 0.6
P3= 7.8 q3= 5.4
P4= 10.6 q4= 9.0
P5= 7.8 q5= 5.7
P6= 4.8 q6= 2.1
P7= 1.8 q7= 1.4



Lugeon value : (1.3) Lu'

Critical Pressure: 4.8 kgf/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 & Azhor Inspected by : M. Suga

GE2 - 43

Water Pressure Test

Hole No.: M98-6 Stage: 3/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (Pf) : $1\times10^{-4}\times Q^{1.971}$ Date : 31/January/1999

Ground elevation : EL. m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.43 m | Depth of test section GL - (L_0)= 10 m to (L_0)= 15 m | Length of section (L_0) 5 m

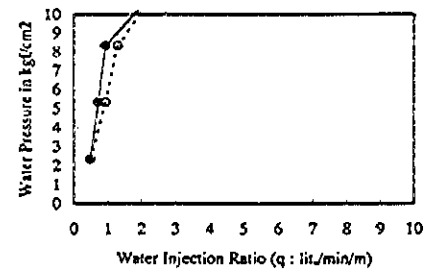
Reading of flow meter

Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	18:00	18:12	18:24	18:36	18:48	19:00	19:13
0(min)	81,136	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	81,522	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.	Qw1 24	Qw2 36	Qw3 47	Qw4 121	Qw5 65	Qw6 47	Qw7 24
Average lit./min	Qw1 2.4	Qw2 3.6	Qw3 4.7	Qw4 12.1	Qw5 6.5	Qw6 4.7	Qw7 2.4
Finish time	18:10	18:22	18:34	18:46	18:58	19:10	19:23
(Pr)	0.00	0.00	0.00	0.02	0.01	0.00	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

P=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/L0 [lit/min/m]

P1= 2.3 q1= 0.5
P2= 5.3 q2= 0.7
P3= 8.3 q3= 0.9
P4= 11.3 q4= 2.4
P5= 8.3 q5= 1.3
P6= 5.3 q6= 0.9
P7= 2.3 q7= 0.5



Lugeon value : (1.1) Lu'

Critical Pressure: 8.3 kgf/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 & Azhor Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-6 Stage: 4/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (P_f) : $1\times10^{-6}\times Q^{1.971}$ Date : 01/February/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 13.40 m | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to hole mouth: (L_0)= 5.48 m | Depth of test section: GL. - (L_1)= 15 m to (L_2)= 20 m | Length of section (L_3) 5 m

Reading of flow meter

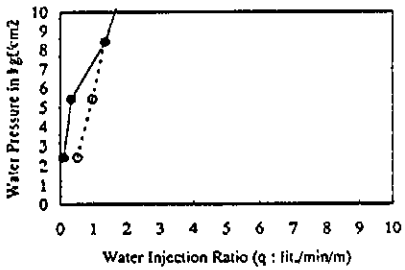
Gauge P. (kgf/cm²)	Ps1 1	Ps2 4	Ps3 7	Ps4 10	Ps5 7	Ps6 4	Ps7 1
Start time	09:00	09:12	09:24	09:36	09:50	10:02	10:10
0(min)	86,995	87,005	87,030	87,108	87,210	87,285	87,337
1	86,995	87,006	87,037	87,117	87,217	87,290	87,339
2	86,996	87,008	87,043	87,126	87,224	87,295	87,342
3	86,996	87,010	87,049	87,138	87,230	87,299	87,344
4	86,996	87,011	87,056	87,148	87,237	87,304	87,347
5	86,997	87,013	87,063	87,158	87,244	87,309	87,350
6	86,997	87,014	87,070	87,167	87,251	87,314	87,352
7	86,998	87,016	87,076	87,176	87,258	87,318	87,355
8	86,998	87,018	87,083	87,185	87,264	87,323	87,358
9	86,999	87,019	87,090	87,193	87,271	87,328	87,360
10	87,000	87,021	87,097	87,202	87,277	87,333	87,363
11							
12							
13							
14							
15							
Total lit.	Qm1 5	Qm2 16	Qm3 67	Qm4 94	Qm5 67	Qm6 48	Qm7 26
Average lit./min	Qm1 0.5	Qm2 1.6	Qm3 6.7	Qm4 9.4	Qm5 6.7	Qm6 4.8	Qm7 2.6
Finish time	09:10	09:22	09:34	09:46	10:00	10:12	10:20
(Pf)	0.00	0.00	0.01	0.02	0.01	0.00	0.00

Friction Loss (P_f) = $p_f(L_0 + L_3)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_m+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_m/L_3$ [lit/min/m]

P1=	2.4	q1=	0.1
P2=	5.4	q2=	0.3
P3=	8.4	q3=	1.3
P4=	11.4	q4=	1.9
P5=	8.4	q5=	1.3
P6=	5.4	q6=	1.0
P7=	2.4	q7=	0.5



Lugeon value : (0.7) **Lu'**

Critical Pressure: 5.4 kgf/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 & Azhor Inspected by : M. Suga

GE2 - 44

Water Pressure Test

Hole No.: M98-6 Stage: 5/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (P_f) : $1\times10^{-6}\times Q^{1.971}$ Date : 01/February/1999

Ground elevation : EL. m | Groundwater level (L_1): GL.- 13.40 m | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.44 m | Depth of test section: GL. - (L_1)= 20 m to (L_2)= 25 m | Length of section (L_3) 5 m

Reading of flow meter

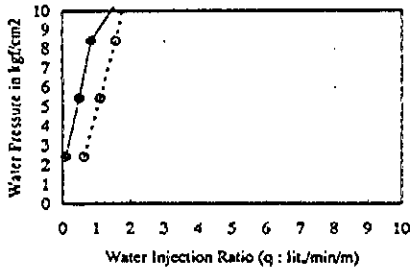
Gauge P. (kgf/cm²)	Ps1 1	Ps2 4	Ps3 7	Ps4 10	Ps5 7	Ps6 4	Ps7 1
Start time	15:00	15:12	15:25	15:37	15:50	16:02	16:14
0(min)	91,711	91,721	91,751	91,802	91,908	92,005	92,064
1	91,712	91,724	91,755	91,811	91,916	92,011	92,067
2	91,712	91,726	91,760	91,821	91,924	92,016	92,070
3	91,713	91,729	91,764	91,830	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	91,899	91,987	92,061	92,096
11							
12							
13							
14							
15							
Total lit.	Qm1 5	Qm2 25	Qm3 43	Qm4 97	Qm5 79	Qm6 56	Qm7 32
Average lit./min	Qm1 0.5	Qm2 2.5	Qm3 4.3	Qm4 9.7	Qm5 7.9	Qm6 5.6	Qm7 3.2
Finish time	15:10	15:22	15:35	15:47	16:00	16:12	16:24
(Pf)	0.00	0.00	0.00	0.02	0.01	0.01	0.00

Friction Loss (P_f) = $p_f(L_0 + L_3)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_m+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_m/L_3$ [lit/min/m]

P1=	2.4	q1=	0.1
P2=	5.4	q2=	0.5
P3=	8.4	q3=	0.9
P4=	11.4	q4=	1.9
P5=	8.4	q5=	1.6
P6=	5.4	q6=	1.1
P7=	2.4	q7=	0.6



Lugeon value : (1.1) **Lu'**

Critical Pressure: 8.4 kgf/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 & Azhor Inspected by : M. Suga

Water Pressure Test

Hole No.: M98-6 Stage: 6/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (P_f) : $1\times10^{-6}\times Q^{1.971}$ Date : 2/February/1999

Ground elevation : EL. m | Groundwater level (L_0): GL.- 13.40 m | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.70 m | Depth of test section GL. - (L_0)= 25 m to (L_1)= 30 m | Length of section (L_3) 5 m

Reading of flow meter

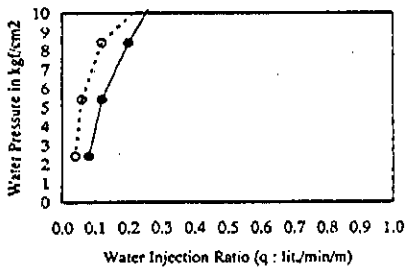
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	10:10	10:22	10:33	10:45	10:57	11:10	11:23
0(min)	98,460	98,470	98,477	98,487	98,502	98,508	98,511
1	98,460	98,470	98,477	98,488	98,502	98,508	98,511
2	98,461	98,472	98,478	98,491	98,503	98,508	98,511
3	98,461	98,473	98,480	98,493	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 lit.	Qu1 4	Qu2 6	Qu3 10	Qu4 15	Qu5 6	Qu6 3	Qu7 2
Average lit./min	Qu1 0.4	Qu2 0.6	Qu3 1	Qu4 1.5	Qu5 0.6	Qu6 0.3	Qu7 0.2
Finish time	10:20	10:32	10:43	10:55	11:07	11:20	11:33
(Pf)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pf) = pf(Lu + L2) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qu/L3 [lit/min/m]

P1=	2.4	q1=	0.1
P2=	5.4	q2=	0.1
P3=	8.4	q3=	0.2
P4=	11.4	q4=	0.3
P5=	8.4	q5=	0.1
P6=	5.4	q6=	0.1
P7=	2.4	q7=	0.0



Lugeon value : 0.3 Lu

Critical Pressure: >11 kgf/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 & Azhor Inspected by : M. Suga

GE2 - 45

Water Pressure Test

Hole No.: M98-6 Stage: 7/14

Location: Upstream Coffer Dam (Left Bank) Dia. of Hole: 76 m/m

Hole Inclination (a): 90 degrees Packer Type: Mechanical

Friction Loss per meter (P_f) : $1\times10^{-6}\times Q^{1.971}$ Date : 02/February/1999

Ground elevation : EL. m | Groundwater level (L_0): GL.- 13.40 m | Gauge height (L_2): 0.75 m

Pipe length from pressure gauge to hole mouth: (L_0)= 4.70 m | Depth of test section GL. - (L_0)= 30 m to (L_1)= 35 m | Length of section (L_3) 5 m

Reading of flow meter

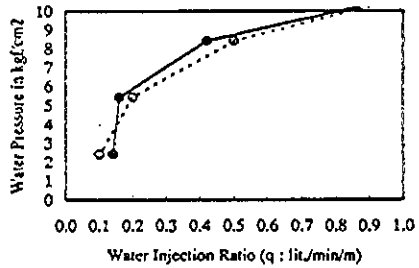
Gauge P. (kgf/cm)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:45	16:57	17:08	17:20	17:32	17:43	17:54
0(min)	11,850	11,871	11,883	11,912	11,972	11,998	12,008
1	11,850	11,872	11,885	11,917	11,975	11,999	12,008
2	11,851	11,873	11,886	11,923	11,978	12,000	12,009
3	11,852	11,874	11,888	11,929	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	12,011
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 lit.	Qu1 7	Qu2 8	Qu3 21	Qu4 58	Qu5 25	Qu6 10	Qu7 5
Average lit./min	Qu1 0.7	Qu2 0.8	Qu3 2.1	Qu4 5.8	Qu5 2.5	Qu6 1	Qu7 0.5
Finish time	16:55	17:07	17:18	17:30	17:42	17:53	18:04
(Pf)	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Friction Loss (Pf) = pf(Lu + L2) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qu/L3 [lit/min/m]

P1=	2.4	q1=	0.1
P2=	5.4	q2=	0.2
P3=	8.4	q3=	0.4
P4=	11.4	q4=	1.2
P5=	8.4	q5=	0.5
P6=	5.4	q6=	0.2
P7=	2.4	q7=	0.1



Lugeon value : 0.8 Lu

Critical Pressure: >11 kgf/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 & Azhor Inspected by : M. Suga