Water Pressure Test

Hole No.: M98-14 Stage: 35/36

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 14/August/1999

Ground elevation : EL. 382.001 m	Groundwater level (L_1): GL.- 12.40 m	Gauge height (L_3): 1.00 m
Pipe length from pressure gauge to borehole mouth: (L_0)= 5.16 m	Depth of test section GL.-(L_1)= 170 m to (L_2)= 175 m	Length of section (L_3) 5.00 m

Reading of flow meter

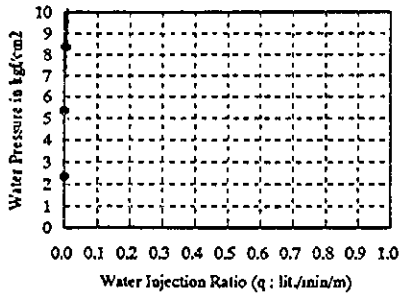
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	18:40	18:50	19:00	19:10	19:20	19:30	19:40
0(min)	234.1	234.1	234.1	234.1	234.4	234.5	234.5
1	234.1	234.1	234.1	234.1	234.5	234.5	234.5
2	234.1	234.1	234.1	234.2	234.5	234.5	234.5
3	234.1	234.1	234.1	234.2	234.5	234.5	234.5
4	234.1	234.1	234.1	234.2	234.5	234.5	234.5
5	234.1	234.1	234.1	234.3	234.5	234.5	234.5
6	234.1	234.1	234.1	234.3	234.5	234.5	234.5
7	234.1	234.1	234.1	234.3	234.5	234.5	234.5
8	234.1	234.1	234.1	234.4	234.5	234.5	234.5
9	234.1	234.1	234.1	234.4	234.5	234.5	234.5
10	234.1	234.1	234.1	234.4	234.5	234.5	234.5
11							
12							
13							
14							
15							
Total lit.	Qw1 0.0	Qw2 0.0	Qw3 0.0	Qw4 0.3	Qw5 0.1	Qw6 0.0	Qw7 0.0
Average lit./min	Qw1 0.00	Qw2 0.00	Qw3 0.00	Qw4 0.03	Qw5 0.01	Qw6 0.00	Qw7 0.00
Finish time	18:50	19:00	19:10	19:20	19:30	19:40	19:50
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = $p_f(L_0 + L_3)$ [kgf/cm2] 0.0 2.3 0.0 11.3

Calculation of Lugeon value

$P=P_0+0.1(\sin(a)L_1+L_2)-P_F$ [kgf/cm2], $q=Q_w/L_3$ [lit/min/m]

P1=	2.3	q1=	0.00
P2=	5.3	q2=	0.00
P3=	8.3	q3=	0.00
P4=	11.3	q4=	0.01
P5=	8.3	q5=	0.00
P6=	5.3	q6=	0.00
P7=	2.3	q7=	0.00



Lugeon value : 0.0 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 : Iqbal / A. Hameed Inspected by : A. Fayaz

GE2 - 99

Water Pressure Test

Hole No.: M98-14 Stage: 36/36

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 15/August/1999

Ground elevation : EL. 382.001 m	Groundwater level (L_1): GL.- 12.50 m	Gauge height (L_3): 1.00 m
Pipe length from pressure gauge to borehole mouth: (L_0)= 5.16 m	Depth of test section GL.-(L_1)= 175 m to (L_2)= 180 m	Length of section (L_3) 5.00 m

Reading of flow meter

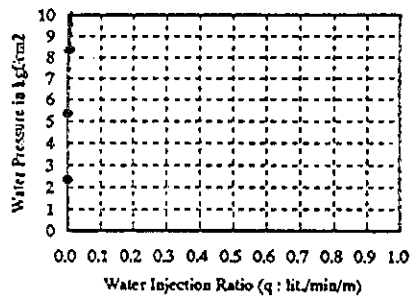
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	8:30	8:40	8:50	9:00	9:10	9:20	9:30
0(min)	572.4	572.4	572.4	572.4	572.6	572.7	572.7
1	572.4	572.4	572.4	572.4	572.6	572.7	572.7
2	572.4	572.4	572.4	572.4	572.6	572.7	572.7
3	572.4	572.4	572.4	572.4	572.6	572.7	572.7
4	572.4	572.4	572.4	572.5	572.7	572.7	572.7
5	572.4	572.4	572.4	572.5	572.7	572.7	572.7
6	572.4	572.4	572.4	572.5	572.7	572.7	572.7
7	572.4	572.4	572.4	572.5	572.7	572.7	572.7
8	572.4	572.4	572.4	572.6	572.7	572.7	572.7
9	572.4	572.4	572.4	572.6	572.7	572.7	572.7
10	572.4	572.4	572.4	572.6	572.7	572.7	572.7
11							
12							
13							
14							
15							
Total lit.	Qw1 0.0	Qw2 0.0	Qw3 0.0	Qw4 0.2	Qw5 0.1	Qw6 0.0	Qw7 0.0
Average lit./min	Qw1 0.00	Qw2 0.00	Qw3 0.00	Qw4 0.02	Qw5 0.01	Qw6 0.00	Qw7 0.00
Finish time	8:40	8:50	9:00	9:10	9:20	9:30	9:40
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = $p_f(L_0 + L_3)$ [kgf/cm2] 0.0 2.4 0.0 11.3

Calculation of Lugeon value

$P=P_0+0.1(\sin(a)L_1+L_2)-P_F$ [kgf/cm2], $q=Q_w/L_3$ [lit/min/m]

P1=	2.4	q1=	0.00
P2=	5.4	q2=	0.00
P3=	8.4	q3=	0.00
P4=	11.3	q4=	0.00
P5=	8.3	q5=	0.00
P6=	5.4	q6=	0.00
P7=	2.4	q7=	0.00



Lugeon value : 0.0 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 : Iqbal / A. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-15 Stage: 1 / 20

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 4-Jul-99

Ground elevation : EL. 451.253 m	Groundwater level (L_0): 4.5 m	Gauge height (L_3): 1.10 m
Pipe length from gauge to hole mouth borehole mouth: (L_2)= 3.90 m	Depth of test section GL. - (L_0)= 2 m to (L_4)= 7 m	Length of section (L_5) 5.00 m

Reading of flow meter

Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4					
Start time	8:10	9:10					
0(min)	218	240					
1	315	385					
2	413	537					
3	510	694					
4	607	858					
5	705	1,027					
6	801						
7	899						
8	994						
9	1,092						
10	1,188						
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	970	787	0				
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	97.0	157.4	0.0				
Finish time	8:20	9:20	0:10				
(Pe)	0.49	1.27	0.00				

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

Calculation of Lugeon value

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

P1= 1.1 q1= 19.40

P2= 3.3 q2= 31.48

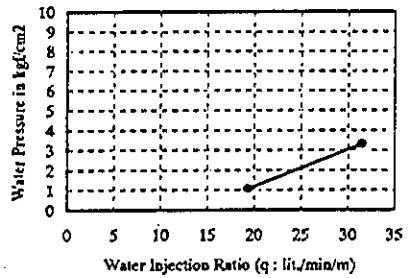
P3= q3=

P4= q4=

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (68) Lu'

Critical Pressure: >3.3 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. Hameed Inspected by :

GE2 - 100

Water Pressure Test

Hole No.: M98-15 Stage: 2 / 20

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 29-Aug-99

Ground elevation : EL. 451.253 m	Groundwater level (L_0): 7.5 m	Gauge height (L_3): 1.10 m
Pipe length from pressure gauge to borehole mouth: (L_2)= 3.90 m	Depth of test section GL. - (L_0)= 5 m to (L_4)= 10 m	Length of section (L_5) 5.00 m

Reading of flow meter

Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4					
Start time	18:10	18:24					
0(min)	356	154					
1	435	286					
2	506	431					
3	582	579					
4	657						
5	734						
6	809						
7	884						
8	959						
9	1,033						
10	1,109						
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	753	425	0	0	0	0	0
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	75.3	141.7	0.0	0.0	0.0	0.0	0.0
Finish time	18:20	18:34					
(Pe)	0.45	1.55	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1= 1.4 q1= 15.06

P2= 3.3 q2= 28.33

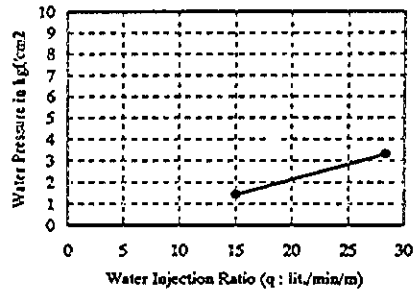
P3= q3=

P4= q4=

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (75) Lu'

Critical Pressure: >3.3 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. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-15 | Stage: 3 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ | Date : 30-Aug-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 12.5 | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.10 m | Depth of test section: GL. - (L_2)= 10 m to (L_2)= 15 m | Length of section (L_0) 5.00 m

Reading of flow meter

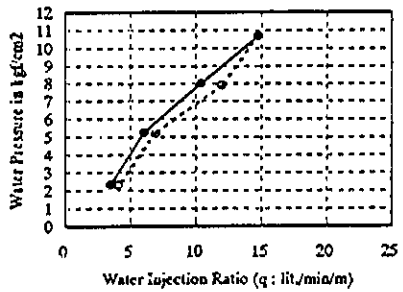
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	17:10	17:22	17:35	17:48	18:00	18:11	18:22
0(min)	431	618	935	492	245	615	985
1	449	648	987	569	304	652	1,007
2	466	679	1,037	643	364	687	1,027
3	485	708	1,088	719	422	723	1,048
4	503	739	1,142	792	482	760	1,066
5	522	771	1,195	863	544	792	1,087
6	539	801	1,246	938	605	822	1,106
7	555	830	1,301	1,013	667	859	1,126
8	572	861	1,351	1,086	726	891	1,147
9	590	889	1,404	1,157	787	927	1,165
10	606	920	1,455	1,229	844	960	1,188
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	175	302	520	737	599	345	203
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	17.5	30.2	52.0	73.7	59.9	34.5	20.3
Finish time	17:20	17:32	17:45	17:58	18:10	18:21	18:32
(Pr)	0.04	0.12	0.34	0.68	0.45	0.15	0.05

Friction Loss (Pr) = pr(L_0 + L_2) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_1+L_2)-Pr [kgf/cm2], q=Q_m/L_0 [lit/min/m]

P1=	2.3	q1=	3.50
P2=	5.2	q2=	6.04
P3=	8.0	q3=	10.40
P4=	10.7	q4=	14.74
P5=	7.9	q5=	11.98
P6=	5.2	q6=	6.90
P7=	2.3	q7=	4.06



Lugeon value : 14 Lu

Critical Pressure: >11 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. Hameed / Iqbal | Inspected by :

GE2 - 101

Water Pressure Test

Hole No.: M98-15 | Stage: 4 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ | Date : 8/July/1999

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 17.5 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.10 m | Depth of test section: GL. - (L_2)= 15 m to (L_2)= 20 m | Length of section (L_0) 5.00 m

Reading of flow meter

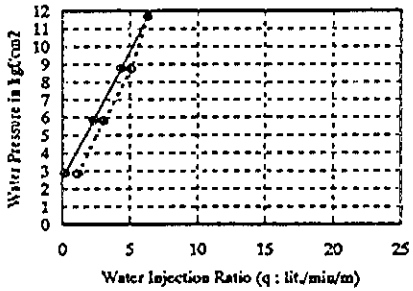
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	17:10	17:20	17:30	17:41	17:51	18:04	18:15
0(min)	917.0	938	70	370	710	0	160
1	917.0	951	86	403	736	15	166
2	920.0	961	100	433	762	31	172
3	921.0	972	131	464	788	46	177
4	922.0	986	153	500	813	61	183
5	923.0	998	176	527	839	77	189
6	924.0	1,015	198	558	865	92	195
7	925.0	1,021	222	590	890	108	200
8	927.0	1,033	243	622	916	123	206
9	928.0	1,045	266	655	941	139	212
10	928.0	1,055	290	687	966	154	218
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	11	117	220	317	256	154	58
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	1.1	11.7	22.0	31.7	25.6	15.4	5.8
Finish time	17:20	17:30	17:40	17:51	18:01	18:14	18:25
(Pr)	0.00	0.02	0.08	0.17	0.11	0.04	0.01

Friction Loss (Pr) = pr(L_0 + L_2) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_1+L_2)-Pr [kgf/cm2], q=Q_m/L_0 [lit/min/m]

P1=	2.8	q1=	0.22
P2=	5.8	q2=	2.34
P3=	8.8	q3=	4.40
P4=	11.7	q4=	6.34
P5=	8.7	q5=	5.12
P6=	5.8	q6=	3.08
P7=	2.8	q7=	1.16



Lugeon value : 5.2 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. Hameed | Inspected by :

Water Pressure Test

Hole No.: M98-15 Stage: 5 / 20

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

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

Friction Loss per meter (Pf) : $1\times10^{5}\times Q^{1.971}$ Date : 2-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 22.5 m | Gauge height (L_0): 1.06 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.10 m | Depth of test section: GL. - (L_1)= 20 m to (L_2)= 25 m | Length of section (L_3): 5.00 m

Reading of flow meter

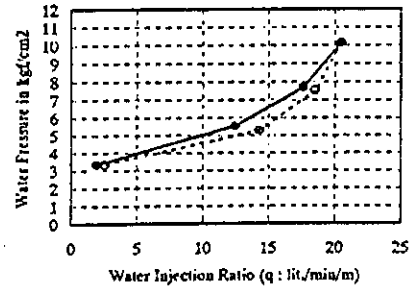
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	11:30	11:41	11:52	12:05	12:16	12:27	12:37
0(min)	830.0	970	940	0	41	980	720
1	840.0	1,019	1,027	103	133	1,050	734
2	850.0	1,070	1,115	205	226	1,121	747
3	859.0	1,120	1,202	309	318	1,193	752
4	868.0	1,276	1,290	411	411	1,265	765
5	879.0	1,330	1,375	514	505	1,338	779
6	888.0	1,382	1,465	617	597	1,410	793
7	898.0	1,436	1,555	719	688	1,481	806
8	907.0	1,489	1,644	820	780	1,553	820
9	917.0	1,541	1,733	922	873	1,624	833
10	926.0	1,594	1,822	1,025	967	1,696	847
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	96	624	882	1,025	926	716	127
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	9.6	62.4	88.2	102.5	92.6	71.6	12.7
Finish time	11:40	11:51	12:02	12:15	12:26	12:37	12:47
(Pe)	0.02	0.83	1.65	2.22	1.82	1.09	0.04

Friction Loss (Pf) = pf(Lo + L1) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.3	q1=	1.92
P2=	5.5	q2=	12.48
P3=	7.7	q3=	17.64
P4=	10.1	q4=	20.50
P5=	7.5	q5=	18.52
P6=	5.3	q6=	14.32
P7=	3.3	q7=	2.54



Lugeon value : 20 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. Hameed / Shakil Inspected by :

GE2 - 102

Water Pressure Test

Hole No.: M98-15 Stage: 6 / 20

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

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

Friction Loss per meter (Pf) : $1\times10^{5}\times Q^{1.971}$ Date : 3-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 25.50 m | Gauge height (L_0): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.10 m | Depth of test section: GL. - (L_1)= 25 m to (L_2)= 30 m | Length of section (L_3): 5.00 m

Reading of flow meter

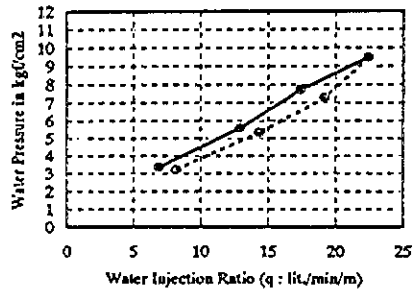
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	16:05	16:17	16:30	16:42	16:54	17:05	17:15
0(min)	532	912	691	589	753	737	478
1	565	977	776	699	831	807	517
2	600	1,040	862	810	928	878	557
3	635	1,104	949	922	1,026	950	598
4	672	1,169	1,037	1,035	1,125	1,023	640
5	707	1,234	1,126	1,149	1,225	1,097	683
6	740	1,300	1,211	1,259	1,321	1,169	722
7	774	1,367	1,297	1,370	1,418	1,240	762
8	808	1,430	1,382	1,482	1,516	1,313	804
9	843	1,469	1,472	1,595	1,615	1,383	847
10	877	1,559	1,561	1,709	1,713	1,455	888
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	345	647	870	1,120	960	718	410
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	34.5	64.7	87.0	112.0	96.0	71.8	41.0
Finish time	16:15	16:27	16:40	16:52	17:04	17:15	17:25
(Pe)	0.31	1.08	1.94	3.19	2.36	1.33	0.44

Friction Loss (Pf) = pf(Lo + L1) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.3	q1=	6.90
P2=	5.6	q2=	12.94
P3=	7.7	q3=	17.40
P4=	9.5	q4=	22.40
P5=	7.3	q5=	19.20
P6=	5.3	q6=	14.36
P7=	3.2	q7=	8.20



Lugeon value : (24) 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. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-15 Stage: 7 / 20

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 5-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_w): 25.50 m | Gauge height (L_g): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 3.80 m | Depth of test section: GL. - (L_o)= 30 m to (L_e)= 35 m | Length of section (L_s) 5.00 m

Reading of flow meter

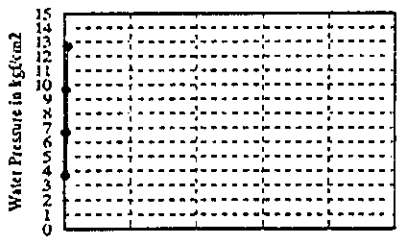
Gauge P.	Pe1	Pe2	Pe3	Pe4	Pe5	Pe6	Pe7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	13:00	13:11	13:22	13:34	13:45	13:56	14:07
0(min)	215	220	228	237	251	260	265
1	216	221	229	239	253	261	265
2	216	222	230	240	252	261	265
3	217	223	231	241	253	262	265
4	217	223	232	242	255	262	266
5	218	224	232	244	256	263	266
6	218	225	233	245	257	263	267
7	218	225	234	246	257	264	267
8	219	226	235	248	258	264	268
9	219	227	235	249	259	265	268
10	220	227	236	250	259	265	269
11							
12							
13							
14							
15							
Total	Qe1	Qe2	Qe3	Qe4	Qe5	Qe6	Qe7
lit.	5	7	8	13	8	5	4
Average	Qe1	Qe2	Qe3	Qe4	Qe5	Qe6	Qe7
lit./min	0.5	0.7	0.8	1.3	0.8	0.5	0.4
Finish time	13:10	13:21	13:32	13:44	13:55	14:06	14:17
(Pe)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1=	3.6	q1=	0.10
P2=	6.6	q2=	0.14
P3=	9.6	q3=	0.16
P4=	12.6	q4=	0.26
P5=	9.6	q5=	0.16
P6=	6.6	q6=	0.10
P7=	3.6	q7=	0.08



Lugeon value : 0.2 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. Hameed Inspected by :

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Water Pressure Test

Hole No.: M98-15 Stage: 8 / 20

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 6-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_w): 25.5 m | Gauge height (L_g): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 3.80 m | Depth of test section: GL. - (L_o)= 35 m to (L_e)= 40 m | Length of section (L_s) 5.00 m

Reading of flow meter

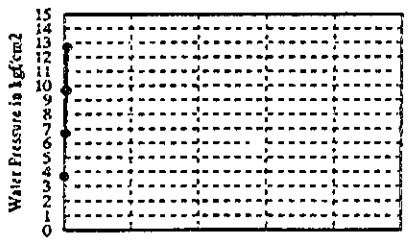
Gauge P.	Pe1	Pe2	Pe3	Pe4	Pe5	Pe6	Pe7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	16:00	16:10	16:20	16:30	16:40	16:50	17:00
0(min)	4	7	13	22	32	37	40
1	4	8	14	23	32	37	40
2	4	9	15	24	33	37	40
3	4	9	16	25	33	38	40
4	4	10	17	26	34	38	40
5	4	10	18	27	34	38	40
6	4	11	19	28	35	39	40
7	4	11	19	29	35	39	40
8	4	12	20	30	36	39	40
9	4	12	21	31	37	40	40
10	4	13	22	32	37	40	40
11							
12							
13							
14							
15							
Total	Qe1	Qe2	Qe3	Qe4	Qe5	Qe6	Qe7
lit.	0	6	9	10	5	3	0
Average	Qe1	Qe2	Qe3	Qe4	Qe5	Qe6	Qe7
lit./min	0	0.6	0.9	1	0.5	0.3	0
Finish time	16:10	16:20	16:30	16:40	16:50	17:00	17:10
(Pe)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1=	3.7	q1=	0.00
P2=	6.6	q2=	0.12
P3=	9.6	q3=	0.18
P4=	12.6	q4=	0.20
P5=	9.6	q5=	0.10
P6=	6.6	q6=	0.06
P7=	3.7	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. Hameed Inspected by :

Water Pressure Test

Hole No.: M98-15 Stage: 9 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.97}$ Date : 15/July/1999

Ground elevation : EL. 451.253 m | Groundwater level (Lo): 25.50 m | Gauge height (Lg): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 4.00 m | Depth of test section: GL. - (Lo)= 40 m to (Lo)= 45 m | Length of section (Ls): 5.00 m

Reading of flow meter

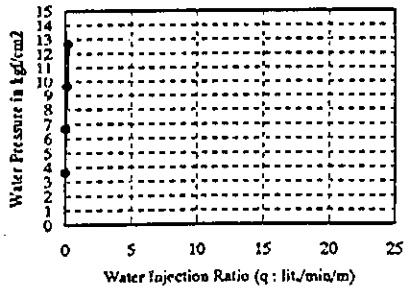
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	16:00	16:10	16:20	16:30	16:40	16:50	17:00
0(min)	312	312	315	322	332	340	343
1	312	312	316	323	333	340	343
2	312	313	316	324	333	341	343
3	312	313	317	325	334	341	343
4	312	313	317	326	335	342	343
5	312	313	318	327	335	342	343
6	312	313	318	328	336	342	343
7	312	313	319	329	337	343	343
8	312	313	320	330	337	343	343
9	312	313	320	331	338	343	343
10	312	313	321	332	339	343	343
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	0	1	6	10	7	3	0
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	0	0.1	0.6	1	0.7	0.3	0
Finish time	16:10	16:20	16:30	16:40	16:50	17:00	17:10
(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)Ls+Ls)-Pr [kgf/cm2], q=Qo/Ls [lit/min/m]

P1=	3.6	q1=	0.00
P2=	6.6	q2=	0.02
P3=	9.6	q3=	0.12
P4=	12.6	q4=	0.20
P5=	9.6	q5=	0.14
P6=	6.6	q6=	0.06
P7=	3.6	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. Hameed Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-15 Stage: 10 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.97}$ Date : 8-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (Lo): 25.50 m | Gauge height (Lg): 1.00 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 4.00 m | Depth of test section: GL. - (Lo)= 45 m to (Lo)= 50 m | Length of section (Ls): 5.00 m

Reading of flow meter

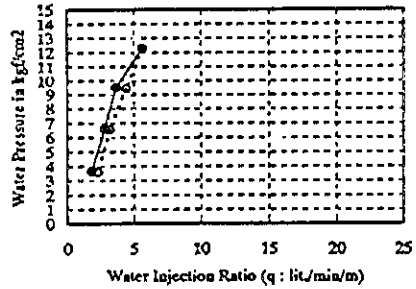
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	14:45	14:56	15:06	15:17	15:28	15:38	15:48
0(min)	179	285	446	692	1	225	387
1	189	298	464	720	32	241	399
2	198	312	483	748	53	257	410
3	207	326	501	777	74	273	421
4	216	340	520	805	95	289	433
5	225	354	538	833	116	306	444
6	234	368	557	861	138	322	455
7	243	383	575	890	159	338	467
8	252	397	594	919	180	354	478
9	261	411	613	947	201	370	489
10	270	425	630	975	222	386	501
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	91	140	184	283	221	161	114
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	9.1	14	18.4	28.3	22.1	16.1	11.4
Finish time	14:55	15:06	15:16	15:27	15:38	15:48	15:58
(Pr)	0.04	0.09	0.15	0.36	0.22	0.12	0.06

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

Calculation of Lugeon value

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

P1=	3.6	q1=	1.82
P2=	6.6	q2=	2.90
P3=	9.5	q3=	3.68
P4=	12.3	q4=	5.66
P5=	9.4	q5=	4.42
P6=	6.5	q6=	3.22
P7=	3.6	q7=	2.28



Lugeon value : 4.6 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. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-14 Stage: 11 / 20

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

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

Friction Loss per meter (pr) : $1\times10^{-6}\times Q^{1.971}$ Date : 14-Sep-99

Ground elevation : EL. 451.253 m	Groundwater level (L1) GL.- 25.50 m	Gauge height (L2): 1.02 m
Pipe length from pressure gauge to borehole mouth: (L0)= 4.00 m	Depth of test section: GL. - (L1)= 50 m to (L2)= 55 m	Length of section (L3): 5.00 m

Reading of flow meter

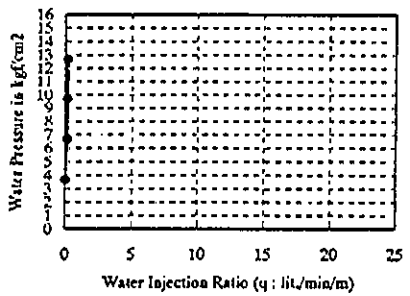
Gauge P.	Pe1	Pe2	Pe3	Pe4	Pe5	Pe6	Pe7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	15:20	15:30	15:40	15:50	16:00	16:10	16:20
0(min)	158	162	168	177	187	196	204
1	158	162	169	178	188	197	204
2	158	163	170	179	188	197	204
3	158	163	171	180	189	198	205
4	158	164	172	180	190	199	205
5	158	165	172	181	191	200	205
6	159	165	173	182	192	201	205
7	159	166	174	183	192	201	205
8	159	166	175	184	193	202	206
9	159	167	176	185	194	203	206
10	159	168	176	186	195	203	206
11							
12							
13							
14							
15							
Total lit.	Qe1 1	Qe2 6	Qe3 8	Qe4 9	Qe5 8	Qe6 7	Qe7 2
Average lit/min	Qe1 0.1	Qe2 0.6	Qe3 0.8	Qe4 0.9	Qe5 0.8	Qe6 0.7	Qe7 0.2
Finish time	15:30	15:40	15:50	16:00	16:10	16:20	16:30
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.7	q1=	0.02
P2=	6.7	q2=	0.12
P3=	9.7	q3=	0.16
P4=	12.7	q4=	0.18
P5=	9.7	q5=	0.16
P6=	6.7	q6=	0.14
P7=	3.7	q7=	0.04



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. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-15 Stage: 12 / 20

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 16-Sep-99

Ground elevation : EL. 451.253 m	Groundwater level (L1) GL.- 25.50 m	Gauge height (L2): 1.00 m
Pipe length from pressure gauge to borehole mouth: (L0)= 4.00 m	Depth of test section: GL. - (L1)= 55 m to (L2)= 60 m	Length of section (L3): 5.00 m

Reading of flow meter

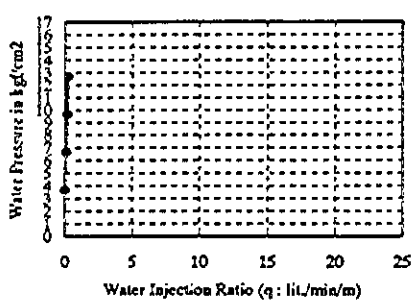
Gauge P.	Pe1	Pe2	Pe3	Pe4	Pe5	Pe6	Pe7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	8:10	8:21	8:33	8:44	8:54	9:04	9:16
0(min)	118	120	127	135	147	156	165
1	118	120	128	136	148	157	165
2	118	121	128	137	149	158	165
3	118	121	129	138	149	158	166
4	118	122	130	140	150	159	166
5	118	122	130	141	151	159	166
6	118	123	131	142	152	160	166
7	118	123	132	143	153	160	166
8	118	124	132	144	154	161	167
9	118	124	133	146	155	161	167
10	118	124	134	147	156	162	167
11							
12							
13							
14							
15							
Total lit.	Qe1 0	Qe2 4	Qe3 7	Qe4 12	Qe5 9	Qe6 6	Qe7 2
Average lit/min	Qe1 0.0	Qe2 0.4	Qe3 0.7	Qe4 1.2	Qe5 0.9	Qe6 0.6	Qe7 0.2
Finish time	8:20	8:31	8:43	8:54	9:04	9:14	9:26
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.7	q1=	0.00
P2=	6.6	q2=	0.08
P3=	9.6	q3=	0.14
P4=	12.6	q4=	0.24
P5=	9.6	q5=	0.18
P6=	6.6	q6=	0.12
P7=	3.6	q7=	0.04



Lugeon value : 0.2 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. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-15 Stage: 13 / 20

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

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

Friction Loss per meter (P_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 19/July/1999

Ground elevation : EL. 451.253 m	Groundwater level (L_w) GL.- 25.50 m	Gauge height (L_s): 1.10 m
Pipe length from pressure gauge to borehole mouth: (L_o)= 4.00 m	Depth of test section: GL. - (L_o)= 60 m to (L_e)= 65 m	Length of section (L_s): 5.00 m

Reading of flow meter

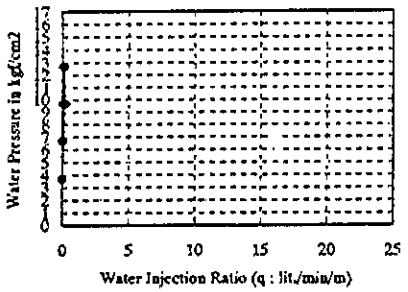
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	9:15	9:26	9:36	9:46	9:56	10:06	10:17
Q(min)	357	362	365	370	376	378	380
1	357	362	365	371	376	378	380
2	357	362	366	372	376	378	380
3	357	362	367	372	376	378	380
4	357	362	367	373	377	378	380
5	357	363	368	373	377	378	380
6	357	363	368	374	377	379	380
7	357	363	369	374	377	379	380
8	357	363	369	375	388	379	380
9	357	364	370	375	388	379	380
10	357	364	370	376	388	379	380
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	0	2	5	6	12	1	0
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	0	0.2	0.5	0.6	1.2	0.1	0
Finish time	9:25	9:36	9:46	9:56	10:06	10:16	10:27
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = $p_f(L_o + L_e)$ [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_w+L_o)-Pr [kgf/cm2], q=Q_m/L_s [lit/min/m]

P1=	3.7	q1=	0.00
P2=	6.7	q2=	0.04
P3=	9.7	q3=	0.10
P4=	12.7	q4=	0.12
P5=	9.7	q5=	0.24
P6=	6.7	q6=	0.02
P7=	3.7	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. Hameed Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-15 Stage: 14 / 20

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

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

Friction Loss per meter (P_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 18-Sep-99

Ground elevation : EL. 382.001 m	Groundwater level (L_w) GL.- 25.50 m	Gauge height (L_s): 1.05 m
Pipe length from pressure gauge to borehole mouth: (L_o)= 4.00 m	Depth of test section: GL. - (L_o)= 65 m to (L_e)= 70 m	Length of section (L_s): 5.00 m

Reading of flow meter

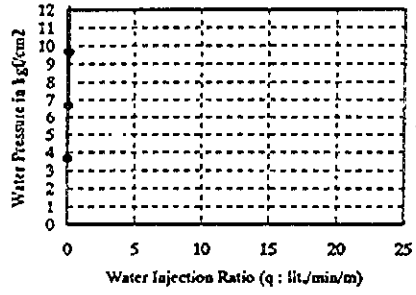
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	8:15	8:26	8:37	8:47	8:57	9:07	9:17
Q(min)	112	116	122	139	139	139	144
1	112	116	123	139	139	139	144
2	112	117	124	140	140	140	144
3	112	117	124	141	140	140	144
4	112	118	125	141	141	141	144
5	112	118	126	142	141	141	144
6	112	119	126	143	142	142	145
7	113	119	127	144	142	142	145
8	113	120	128	145	143	143	145
9	113	120	128	145	143	143	145
10	113	120	129	146	144	144	145
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	1.0	4.0	7.0	7.0	5.0	5.0	1.0
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	0.10	0.40	0.70	0.70	0.50	0.50	0.10
Finish time	8:25	8:36	8:47	8:57	9:07	9:17	9:27
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = $p_f(L_o + L_e)$ [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L_w+L_o)-Pr [kgf/cm2], q=Q_m/L_s [lit/min/m]

P1=	3.7	q1=	0.02
P2=	6.7	q2=	0.08
P3=	9.7	q3=	0.14
P4=	12.7	q4=	0.14
P5=	9.7	q5=	0.10
P6=	6.7	q6=	0.10
P7=	3.7	q7=	0.02



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 : Mashtaque Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-15 Stage: 15 / 20

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

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

Friction Loss per meter (pv) : $1\times10^{-5}\times Q^{1.971}$ Date : 19-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 25.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.00 m | Depth of test section: GL. - (L_3)= 70 m to (L_4)= 75 m | Length of section (L_5) 5.00 m

Reading of flow meter

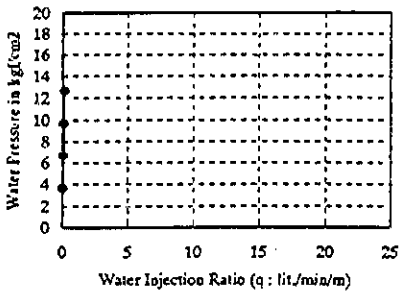
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	9:15	9:25	9:35	9:46	9:56	10:06	10:16
0(min)	979	980	983	988	996	2	6
1	979	980	983	989	997	2	6
2	979	980	984	990	997	2	6
3	979	981	984	990	998	3	6
4	979	981	984	991	998	3	6
5	979	981	985	992	999	3	6
6	980	981	985	993	999	4	6
7	980	982	986	994	1,000	4	7
8	980	982	986	994	1,000	4	7
9	980	982	987	995	1,001	5	7
10	980	982	987	996	1,001	5	7
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	1	1	1	3	2	1	0
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.1	0.3	0.3	0.8	0.5	0.3	0.0
Finish time	9:25	13:45	14:45	15:45	16:45	17:45	18:45
(Pv)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pf) = pv(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.6	q1=	0.02
P2=	6.6	q2=	0.05
P3=	9.6	q3=	0.05
P4=	12.6	q4=	0.15
P5=	9.6	q5=	0.10
P6=	6.6	q6=	0.05
P7=	3.7	q7=	0.00



Lugeon value : 0.1 Lu

Critical Pressure: >13 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 : Mashtaque Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-15 Stage: 16 /20

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

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

Friction Loss per meter (pv) : $1\times10^{-5}\times Q^{1.971}$ Date : 20-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 25.50 m | Gauge height (L_3): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.00 m | Depth of test section: GL. - (L_3)= 75 m to (L_4)= 80 m | Length of section (L_5) 5.00 m

Reading of flow meter

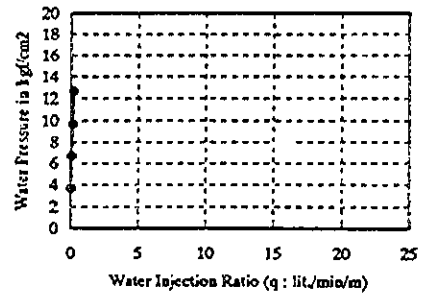
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm3)	1	4	7	10	7	4	1
Start time	15:00	15:11	15:22	15:33	15:43	15:53	16:03
0(min)	712	714	719	726	736	743	747
1	712	714	719	727	737	743	747
2	712	715	720	728	737	744	747
3	712	715	720	729	738	744	747
4	712	715	721	730	739	744	747
5	712	716	722	731	739	745	747
6	712	716	722	732	740	745	748
7	712	716	723	733	741	746	748
8	713	717	723	734	741	746	748
9	713	717	724	735	742	747	748
10	713	717	725	736	743	747	748
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	1	3	6	10	7	4	1
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.1	0.3	0.6	1.0	0.7	0.4	0.1
Finish time	15:10	15:21	12:38	15:43	15:53	16:03	16:13
(Pv)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pf) = pv(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.6	q1=	0.02
P2=	6.6	q2=	0.06
P3=	9.6	q3=	0.12
P4=	12.6	q4=	0.20
P5=	9.6	q5=	0.14
P6=	6.6	q6=	0.08
P7=	3.6	q7=	0.02



Lugeon value : 0.1 Lu

Critical Pressure: >13 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 : Mashtaque Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-15 | Stage: 17 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ | Date : 19-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 25.50 m | Gauge height (L_2): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.00 m | Depth of test section: GL. - (L_1)= 80 m to (L_3)= 85 m | Length of section (L_3): 5.00 m

Reading of flow meter

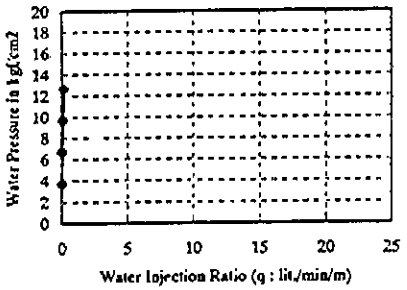
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	9:15	9:25	9:35	9:46	9:56	10:06	10:16
0(min)	979	980	983	988	996	2	6
1	979	980	983	989	997	2	6
2	979	980	984	990	997	2	6
3	979	981	984	990	998	3	6
4	979	981	984	991	998	3	6
5	979	981	985	992	999	3	6
6	980	981	985	993	999	4	6
7	980	982	986	994	1,000	4	7
8	980	982	986	994	1,000	4	7
9	980	982	987	995	1,001	5	7
10	980	982	987	996	1,001	5	7
11							
12							
13							
14							
15							
Total lit.	Qo1 1	Qo2 2	Qo3 4	Qo4 8	Qo5 5	Qo6 3	Qo7 1
Average lit/min	Qo1 0.1	Qo2 0.2	Qo3 0.4	Qo4 0.8	Qo5 0.5	Qo6 0.3	Qo7 0.1
Finish time	9:25	9:35	9:45	9:56	10:06	10:16	10:26
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.6	q1=	0.02
P2=	6.6	q2=	0.04
P3=	9.6	q3=	0.08
P4=	12.6	q4=	0.16
P5=	9.6	q5=	0.10
P6=	6.6	q6=	0.06
P7=	3.6	q7=	0.02



Lugeon value : 0.1 Lu

Critical Pressure: >13 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 : Mashtaque | Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-15 | Stage: 18 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ | Date : 22-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_1): 25.50 m | Gauge height (L_2): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.00 m | Depth of test section: GL. - (L_1)= 85 m to (L_3)= 90 m | Length of section (L_3): 5.00 m

Reading of flow meter

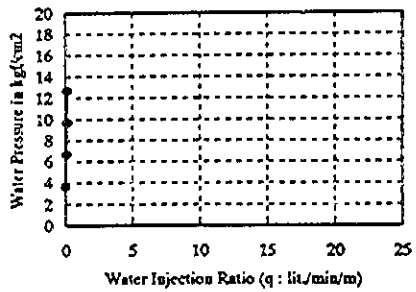
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	10:15	10:25	10:36	10:47	10:58	11:09	11:19
0(min)	287	288	293	301	309	316	322
1	287	289	293	302	309	316	322
2	287	289	294	303	310	317	322
3	287	289	295	304	311	317	322
4	287	290	295	305	312	318	322
5	287	290	296	306	313	318	322
6	287	291	297	306	313	319	322
7	287	291	297	307	314	319	322
8	287	292	298	308	315	320	322
9	287	292	299	309	316	320	322
10	287	292	299	309	316	321	322
11							
12							
13							
14							
15							
Total lit.	Qo1 0.0	Qo2 4.0	Qo3 6.0	Qo4 8.0	Qo5 7.0	Qo6 5.0	Qo7 0.0
Average lit/min	Qo1 0.0	Qo2 0.4	Qo3 0.6	Qo4 0.8	Qo5 0.7	Qo6 0.5	Qo7 0.0
Finish time	10:25	10:35	10:46	10:57	11:08	11:19	11:29
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	3.7	q1=	0.00
P2=	6.6	q2=	0.08
P3=	9.6	q3=	0.12
P4=	12.6	q4=	0.16
P5=	9.6	q5=	0.14
P6=	6.6	q6=	0.10
P7=	3.7	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. Hameed | Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-15 Stage: 19 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{5}\times Q^{1.971}$ Date : 22-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_3): 25.50 m | Gauge height (L_1): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.00 m | Depth of test section: GL. - (L_4)= 90 m to (L_5)= 95 m | Length of section (L_0) 5.00 m

Reading of flow meter

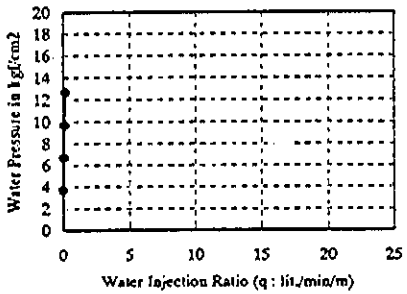
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	18:00	18:11	18:22	18:32	18:42	18:52	19:02
Q(min)	747	749	755	762	771	776	779
1	747	749	756	763	772	776	779
2	747	750	757	764	772	777	779
3	747	750	758	765	773	777	779
4	747	751	758	766	773	777	779
5	747	751	759	767	774	778	779
6	747	752	759	767	774	778	779
7	747	752	760	768	775	778	779
8	747	753	761	769	775	779	779
9	747	753	762	770	776	779	779
10	747	754	762	771	776	779	779
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	0	5	7	9	5	3	0
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.00	0.50	0.70	0.90	0.50	0.30	0.00
Finish time	18:10	18:21	18:32	18:42	18:52	19:02	19:12
(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=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/Lo [lit/min/m]

P1=	3.7	q1=	0.00
P2=	6.6	q2=	0.10
P3=	9.6	q3=	0.14
P4=	12.6	q4=	0.18
P5=	9.6	q5=	0.10
P6=	6.6	q6=	0.06
P7=	3.7	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. Hameed Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-15 Stage: 20 / 20

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

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

Friction Loss per meter (Pr) : $1\times10^{5}\times Q^{1.971}$ Date : 24-Sep-99

Ground elevation : EL. 451.253 m | Groundwater level (L_3) GL.- 25.50 m | Gauge height (L_1): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.00 m | Depth of test section: GL. - (L_4)= 95 m to (L_5)= 100 m | Length of section (L_0) 5.00 m

Reading of flow meter

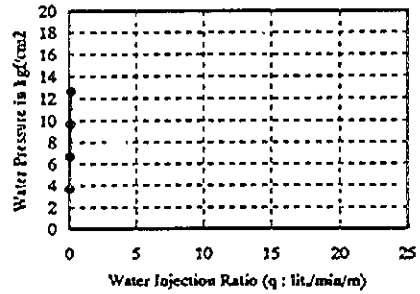
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	9:30	9:41	9:52	10:03	10:14	10:25	10:36
Q(min)	689	703	708	717	726	730	733
1	689	703	709	718	726	730	733
2	690	703	710	719	727	731	733
3	690	704	711	719	727	731	733
4	690	704	711	720	728	731	733
5	690	704	712	721	728	731	733
6	690	705	712	722	729	732	734
7	690	705	713	723	729	732	734
8	691	705	713	724	729	732	734
9	691	706	714	725	729	733	734
10	691	707	715	725	730	733	734
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	2	4	7	8	4	3	1
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.2	0.4	0.7	0.8	0.4	0.3	0.1
Finish time	9:40	9:51	10:02	10:13	10:24	10:35	10:46
(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=Po+0.1(sin(a)L1+L2)-Pr [kgf/cm2], q=Qw/Lo [lit/min/m]

P1=	3.6	q1=	0.04
P2=	6.6	q2=	0.08
P3=	9.6	q3=	0.14
P4=	12.6	q4=	0.16
P5=	9.6	q5=	0.08
P6=	6.6	q6=	0.06
P7=	3.6	q7=	0.02



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. Hameed / Iqubal Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 | Stage: 1/14

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ | Date : 23/July/1999

Ground elevation : EL. 546.267 m	Groundwater level (L_w): Nil	Gauge height (L_g): 0.75 m
Pipe length from gauge to hole mouth borehole mouth: (L_o)= 6.90 m	Depth of test section: GL. - (L_1)= 2 m to (L_2)= 7 m	Length of section (L_s): 5.00 m

Reading of flow meter

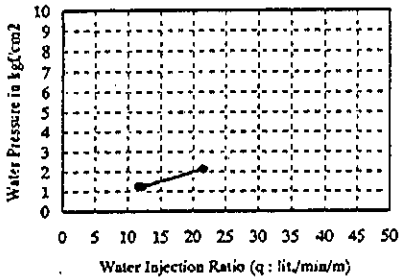
Gauge P. (kgf/cm2)	Po1 1	Po2 2.5	Po3 1	Po4	Po5	Po6	Po7
Start time	17:45	18:00	18:15				
0(min)	9,077	9,857	11,807				
1	9,139	9,961	11,870				
2	9,217	10,070	11,926				
3	9,270	10,177	11,984				
4	9,338	10,285	12,043				
5	9,387	10,392	12,102				
6	9,446	10,505	12,160				
7	9,507	10,612	12,219				
8	9,567	10,720	12,277				
9	9,629	10,828	12,335				
10	9,687	10,935	12,395				
11							
12							
13							
14							
15							
Total lit.	Q_{w1} 610	Q_{w2} 1,078	Q_{w3} 588	Q_{w4}	Q_{w5}	Q_{w6}	Q_{w7}
Average lit./min	Q_{w1} 61.0	Q_{w2} 107.8	Q_{w3} 58.8	Q_{w4}	Q_{w5}	Q_{w6}	Q_{w7}
Finish time	17:55	18:10	18:25				
(Pr)	0.29	0.91	0.27				

Friction Loss (Pr) = $p_f(L_o + L_s)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_o+0.1(\sin(a)L_o+L_s)-P_f$ [kgf/cm2], $q=Q_w/L_s$ [lit/min/m]

P1=	1.2	q1=	12.20
P2=	2.1	q2=	21.56
P3=	1.3	q3=	11.76
P4=		q4=	
P5=		q5=	
P6=		q6=	
P7=		q7=	



Lugeon value : (105) Lu'

Critical Pressure: >2.1 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 : Shakil / Mushtaq | Inspected by : A. Fayaz

GE2 - 110

Water Pressure Test

Hole No.: M98-16 | Stage: 2/14

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ | Date : 24/July/1999

Ground elevation : EL. 546.267 m	Groundwater level (L_w): Nil	Gauge height (L_g): 0.75 m
Pipe length from pressure gauge to borehole mouth: (L_o)= 6.00 m	Depth of test section: GL. - (L_1)= 5 m to 10 m	Length of section (L_s): 5.00 m

Reading of flow meter

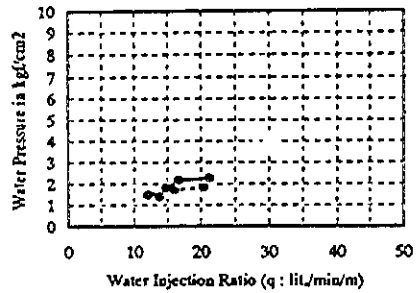
Gauge P. (kgf/cm2)	Po1 1	Po2 1.5	Po3 2	Po4 2.5	Po5 2	Po6 1.5	Po7 1
Start time	14:12	14:24	14:36	14:48	15:00	15:12	15:24
0(min)	16,800	17,620	18,500	19,480	20,723	21,820	22,790
1	16,871	17,693	18,582	19,587	20,814	21,901	22,852
2	16,940	17,767	18,665	19,693	20,905	21,982	22,910
3	17,008	17,840	18,747	19,799	21,098	22,063	22,971
4	17,078	17,915	18,830	19,904	21,189	22,143	23,032
5	17,146	17,990	18,915	20,010	21,282	22,223	23,093
6	17,213	18,062	19,001	20,116	21,376	22,304	23,153
7	17,284	18,137	19,083	20,223	21,467	22,384	23,213
8	17,353	18,211	19,166	20,329	21,560	22,464	23,274
9	17,421	18,286	19,250	20,435	21,650	22,544	23,334
10	17,490	18,362	19,333	20,540	21,742	22,624	23,395
11							
12							
13							
14							
15							
Total lit.	Q_{w1} 690	Q_{w2} 742	Q_{w3} 833	Q_{w4} 1,060	Q_{w5} 1,019	Q_{w6} 804	Q_{w7} 605
Average lit./min	Q_{w1} 69.0	Q_{w2} 74.2	Q_{w3} 83.3	Q_{w4} 106.0	Q_{w5} 101.9	Q_{w6} 80.4	Q_{w7} 60.5
Finish time	14:22	14:34	14:46	14:58	15:10	15:22	15:34
(Pr)	0.46	0.54	0.67	1.08	1.00	0.63	0.36

Friction Loss (Pr) = $p_f(L_o + L_s)$ [kgf/cm2]

Calculation of Lugeon value

$P=P_o+0.1(\sin(a)L_o+L_s)-P_f$ [kgf/cm2], $q=Q_w/L_s$ [lit/min/m]

P1=	1.4	q1=	13.80
P2=	1.8	q2=	11.84
P3=	2.2	q3=	16.66
P4=	2.2	q4=	21.20
P5=	1.8	q5=	20.38
P6=	1.7	q6=	16.08
P7=	1.5	q7=	12.10



Lugeon value : (35) Lu'

Critical Pressure: 2.1 kgf/cm2 -1.002E-10

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 : Mushtaq / Shakil | Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 Stage: 3/14

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

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

Friction Loss per meter (Pr) : $1\times10^{5}\times Q^{1.971}$ Date : 25/July/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.75 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 5.80 m | Depth of test section: GL. - (L_1)= 10 m to (L_0)= 15 m | Length of section (L_3): 5.00 m

Reading of flow meter

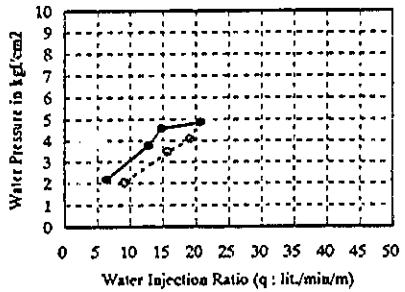
Gauge P. (kgf/cm2)	Pe1 1	Pe2 3	Pe3 4	Pe4 5	Pe5 4	Pe6 3	Pe7 1
Start time	15:30	15:40	15:50	16:00	16:10	16:20	16:30
0(min)	28,300	28,680	29,380	30,340	31,430	32,410	33,260
1	28,330	28,744	29,452	30,443	31,522	32,497	33,304
2	28,360	28,808	29,536	30,548	31,613	32,573	33,349
3	28,391	28,873	29,608	30,652	31,705	32,653	33,395
4	28,422	28,938	29,672	30,755	31,797	32,730	33,445
5	28,454	29,001	29,745	30,858	31,893	32,808	33,490
6	28,487	29,065	29,828	30,962	31,992	32,885	33,540
7	28,519	29,138	29,892	31,066	32,090	32,964	33,583
8	28,552	29,192	29,996	31,171	32,190	33,041	33,628
9	28,587	29,256	30,042	31,274	32,286	33,118	33,672
10	28,622	29,319	30,117	31,377	32,383	33,195	33,718
11							
12							
13							
14							
15							
Total lit.	Qw1 322	Qw2 639	Qw3 737	Qw4 1,037	Qw5 953	Qw6 785	Qw7 458
Average lit/min	Qw1 32.2	Qw2 63.9	Qw3 73.7	Qw4 103.7	Qw5 95.3	Qw6 78.5	Qw7 45.8
Finish time	15:40	15:50	16:00	16:10	16:20	16:30	16:40
(Pr)	0.15	0.57	0.76	1.49	1.26	0.86	0.30

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/L3 [lit/min/m]

P1=	2.2	q1=	6.44
P2=	2.8	q2=	12.78
P3=	4.6	q3=	14.74
P4=	4.8	q4=	20.74
P5=	4.1	q5=	19.06
P6=	3.5	q6=	15.70
P7=	2.0	q7=	9.16



Lugeon value : (34) Lu'

Critical Pressure: 4.6 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 : Shakil / Mushtaq Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-16 Stage: 4/14

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

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

Friction Loss per meter (Pr) : $1\times10^{5}\times Q^{1.971}$ Date : 26/July/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.73 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 6.50 m | Depth of test section: GL. - (L_1)= 15 m to (L_0)= 20 m | Length of section (L_3): 5.00 m

Reading of flow meter

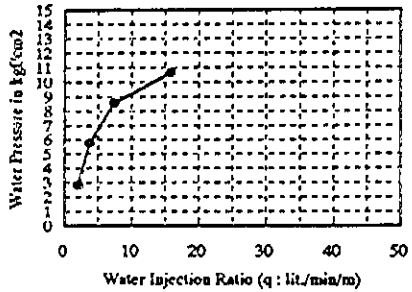
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	15:30	15:40	15:51	16:02	16:12	16:22	16:32
0(min)	39,941	40,070	40,260	40,690	41,481	41,854	42,046
1	39,954	2,308	40,295	40,740	41,516	41,875	42,056
2	39,965	2,311	40,330	40,815	41,552	41,895	42,067
3	39,975	2,313	40,368	40,895	41,590	41,913	42,078
4	39,984	2,316	40,404	40,975	41,628	41,932	42,088
5	39,993	2,318	40,440	41,055	41,664	41,951	42,097
6	40,003	2,321	40,478	41,138	41,701	41,969	42,107
7	40,012	2,324	40,516	41,220	41,739	41,988	42,118
8	40,021	2,326	40,555	41,309	41,779	42,006	42,128
9	40,030	2,329	40,593	41,396	41,818	42,026	42,138
10	40,040	40,254	40,630	41,481	41,854	42,044	42,146
11							
12							
13							
14							
15							
Total lit.	Qw1 99	Qw2 184	Qw3 370	Qw4 791	Qw5 373	Qw6 190	Qw7 102
Average lit/min	Qw1 9.9	Qw2 18.4	Qw3 37.0	Qw4 79.1	Qw5 37.3	Qw6 19.0	Qw7 10.2
Finish time	15:40	15:50	16:01	16:12	16:22	16:32	16:42
(Pr)	0.02	0.07	0.27	1.19	0.27	0.07	0.02

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/L3 [lit/min/m]

P1=	2.8	q1=	1.98
P2=	5.8	q2=	3.68
P3=	8.6	q3=	7.40
P4=	10.6	q4=	15.82
P5=	8.6	q5=	7.46
P6=	5.8	q6=	3.80
P7=	2.8	q7=	2.04



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 : Mushtaq Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 Stage: 5/14

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 26/July/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_w): Nil | Gauge height (L_G): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_G)= 6.85 m | Depth of test section: GL. - (L_s)= 20 m to (L_e)= 25 m | Length of section (L_s): 5.00 m

Reading of flow meter

Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	13:15	13:26	13:36	13:37	13:48	13:59	14:10
0(min)	6,415	6,456	6,553	6,590	6,831	6,953	7,001
1	6,419	6,459	6,566	6,704	6,841	6,958	7,003
2	6,422	6,469	6,579	6,717	6,855	6,962	7,004
3	6,425	6,478	6,591	6,731	6,868	6,967	7,006
4	6,428	6,486	6,604	6,744	6,881	6,972	7,007
5	6,430	6,494	6,616	6,757	6,893	6,977	7,009
6	6,433	6,503	6,628	6,770	6,904	6,981	7,011
7	6,436	6,511	6,640	6,784	6,915	6,986	7,012
8	6,438	6,518	6,654	6,797	6,927	6,990	7,014
9	6,441	6,526	6,667	6,811	6,938	6,995	7,016
10	6,444	6,533	6,680	6,825	6,949	6,999	7,017
11							
12							
13							
14							
15							
Total lit.	Q=1 29	Q=2 83	Q=3 127	Q=4 135	Q=5 118	Q=6 46	Q=7 16
Average lit/min	Q=1 2.9	Q=2 8.3	Q=3 12.7	Q=4 13.5	Q=5 11.8	Q=6 4.6	Q=7 1.6
Finish time	13:25	13:36	13:46	13:47	13:58	14:09	14:20
(Pr)	0.00	0.02	0.04	0.05	0.03	0.01	0.00

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

Calculation of Lugeon value

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

P1= 3.3 q1= 0.58

P2= 6.3 q2= 1.56

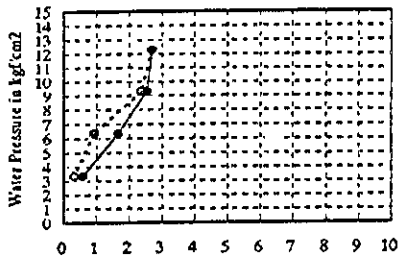
P3= 9.3 q3= 2.54

P4= 12.3 q4= 2.70

P5= 9.3 q5= 2.36

P6= 6.3 q6= 0.92

P7= 3.3 q7= 0.32



Lugeon value : 2.8 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 : Mushtaq Inspected by : A. Fayaz

GE2 - 112

Water Pressure Test

Hole No.: M98-16 Stage: 6/14

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 28/July/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_w): Nil | Gauge height (L_G): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_G)= 6.85 m | Depth of test section: GL. - (L_s)= 25 m to (L_e)= 30 m | Length of section (L_s): 5.00 m

Reading of flow meter

Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	17:30	17:41	17:52	18:10	18:22	18:33	18:44
0(min)	58,678	58,837	59,216	59,960	61,070	62,020	62,700
1	547	58,872	59,280	60,063	61,164	62,090	62,735
2	547	58,909	59,343	60,167	61,250	62,157	62,770
3	548	58,946	59,407	60,270	61,336	62,225	62,806
4	548	58,983	59,473	60,373	61,421	62,293	62,842
5	548	59,021	59,544	60,478	61,506	62,361	62,877
6	548	59,060	59,617	60,586	61,592	62,428	62,913
7	549	59,096	59,688	60,694	61,677	62,496	62,949
8	549	59,135	59,761	60,804	61,763	62,562	62,985
9	549	59,169	59,846	60,912	61,848	62,626	63,020
10	58,830	59,206	59,913	61,020	61,933	62,691	63,056
11							
12							
13							
14							
15							
Total lit.	Q=1 152	Q=2 369	Q=3 697	Q=4 1,060	Q=5 863	Q=6 671	Q=7 356
Average lit/min	Q=1 15.2	Q=2 36.9	Q=3 69.7	Q=4 106.0	Q=5 86.3	Q=6 67.1	Q=7 35.6
Finish time	17:40	17:51	18:02	18:20	18:32	18:43	18:54
(Pr)	0.07	0.39	1.37	3.14	2.09	1.27	0.36

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

Calculation of Lugeon value

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

P1= 3.8 q1= 3.04

P2= 6.4 q2= 7.38

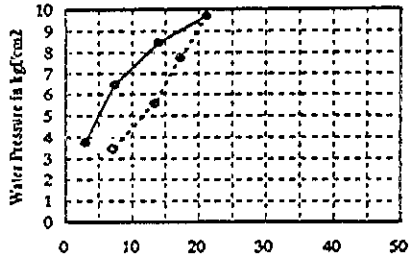
P3= 8.5 q3= 13.94

P4= 9.7 q4= 21.20

P5= 7.7 q5= 17.26

P6= 5.6 q6= 13.42

P7= 3.5 q7= 7.12



Lugeon value : (13) Ln'

Critical Pressure: 7.7 kgf/cm2 -1.9984E-15

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 : Mushtaq / Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 Stage: 7/14

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 31/July/1999

Ground elevation : EL. 546.267 m | Groundwater level (L1): Nil | Gauge height (L3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L0)= 5.98 m | Depth of test section GL. - (L2)= 30 m to (L2)= 35 m | Length of section (L): 5.00 m

Reading of flow meter

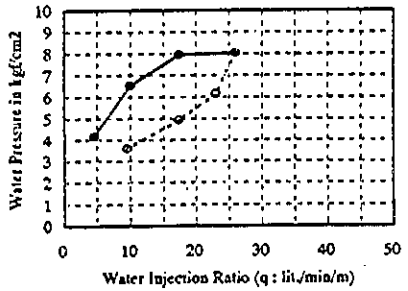
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	14:30	14:45	14:57	15:10	15:25	15:37	15:50
(t)(min)	849	1,103	1,680	3,713	5,110	6,330	7,260
1	871	1,150	1,752	3,843	5,220	6,423	7,308
2	894	1,197	1,843	3,965	5,332	6,510	7,356
3	917	1,245	1,926	4,096	5,442	6,598	7,405
4	940	1,294	2,013	4,227	5,556	6,585	7,452
5	962	1,345	2,107	4,355	5,664	6,775	7,500
6	985	1,396	2,184	4,487	5,780	6,850	7,549
7	1,007	1,448	2,274	4,629	5,908	6,948	7,596
8	1,030	1,502	2,365	4,750	6,026	7,036	7,644
9	1,053	1,555	2,455	4,880	6,144	7,124	7,692
10	1,076	1,603	2,550	5,013	6,262	7,200	7,740
11							
12							
13							
14							
15							
Total lit.	Qo1 227	Qo2 500	Qo3 870	Qo4 1,300	Qo5 1,152	Qo6 870	Qo7 480
Average lit/min	Qo1 22.7	Qo2 50.0	Qo3 87.0	Qo4 130.0	Qo5 115.2	Qo6 87.0	Qo7 48.0
Finish time	14:40	14:55	15:07	15:20	15:35	15:47	16:00
(Pe)	0.17	0.81	2.40	5.30	4.17	2.40	0.74

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

Calculation of Lugeon value

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

P1=	4.2	q1=	4.54
P2=	6.5	q2=	10.00
P3=	7.9	q3=	17.40
P4=	8.0	q4=	26.00
P5=	6.2	q5=	23.04
P6=	4.9	q6=	17.40
P7=	3.6	q7=	9.60



Lugeon value : (28) Lu

Critical Pressure: 7.9 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 : Mushtaq / Iqbal Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-16 Stage: 8/14

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 1/August/1999

Ground elevation : EL. 546.267 m | Groundwater level (L1): Nil | Gauge height (L3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L0)= 5.80 m | Depth of test section GL. - (L2)= 35 m to (L2)= 40 m | Length of section (L): 5.00 m

Reading of flow meter

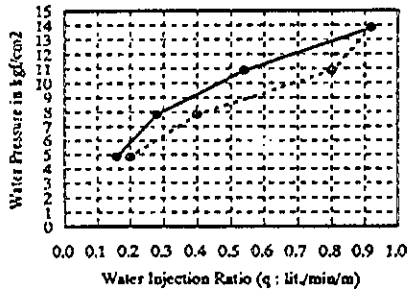
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	16:35	16:47	17:00	17:11	17:22	17:33	17:45
(t)(min)	57	69	85	114	164	208	228
1	58	70	88	119	167	210	229
2	59	71	91	123	171	212	230
3	60	73	93	128	175	214	231
4	61	74	96	132	180	216	232
5	61	76	99	137	184	218	233
6	62	77	101	141	188	220	234
7	63	78	104	146	192	222	235
8	63	80	107	151	196	224	236
9	64	81	109	155	200	226	237
10	65	83	112	160	204	228	238
11							
12							
13							
14							
15							
Total lit.	Qo1 8	Qo2 14	Qo3 27	Qo4 46	Qo5 40	Qo6 20	Qo7 10
Average lit/min	Qo1 0.8	Qo2 1.4	Qo3 2.7	Qo4 4.6	Qo5 4	Qo6 2	Qo7 1
Finish time	16:45	16:57	17:10	17:21	17:32	17:43	17:55
(Pe)	0.00	0.00	0.00	0.01	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=Qo/L2 [lit/min/m]

P1=	4.8	q1=	0.16
P2=	7.8	q2=	0.28
P3=	10.8	q3=	0.54
P4=	13.8	q4=	0.92
P5=	10.8	q5=	0.80
P6=	7.8	q6=	0.40
P7=	4.8	q7=	0.20



Lugeon value : (0.5) 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 : Mushtaq / Iqbal Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 Stage: 9/14

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

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

Friction Loss per meter (pf) : $1\times10^{-5}\times Q^{1.97}$ Date : 2/August/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_0): Nil | Gauge height (L_0): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 5.85 m | Depth of test section: GL. - (L_1)= 40 m to (L_2)= 45 m | Length of section (L_3): 5.00 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	15:20	15:32	15:45	16:00	16:12	16:22	16:32
0(min)	880	897	924	960	1,021	1,063	1,085
1	882	899	928	966	1,025	1,065	1,086
2	884	902	932	972	1,029	1,069	1,087
3	885	904	935	978	1,033	1,071	1,088
4	886	906	939	983	1,037	1,073	1,089
5	888	909	943	989	1,041	1,075	1,090
6	890	911	944	995	1,045	1,076	1,092
7	890	913	950	999	1,049	1,078	1,093
8	891	915	953	1,004	1,054	1,080	1,094
9	893	918	956	1,009	1,058	1,082	1,095
10	894	920	960	1,014	1,062	1,085	1,097
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	14	23	36	54	41	22	12
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	1.4	2.3	3.6	5.4	4.1	2.2	1.2
Finish time	15:30	15:42	15:55	16:10	16:22	16:32	16:42
(Pf)	0.00	0.00	0.01	0.01	0.01	0.00	0.00

Friction Loss (Pf) = pf(Lo + L1) [kgf/cm2]

Calculation of Lugeon value

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

P1= 5.3 q1= 0.28

P2= 8.3 q2= 0.46

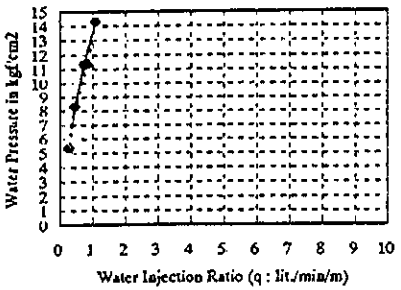
P3= 11.3 q3= 0.72

P4= 14.3 q4= 1.08

P5= 11.3 q5= 0.82

P6= 8.3 q6= 0.44

P7= 5.3 q7= 0.24



Lugeon value : 0.6 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 : Mushtaq Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-16 Stage: 10/14

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

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

Friction Loss per meter (pf) : $1\times10^{-5}\times Q^{1.97}$ Date : 3/August/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_0): Nil | Gauge height (L_0): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 5.95 m | Depth of test section: GL. - (L_1)= 45 m to (L_2)= 50 m | Length of section (L_3): 5.00 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	15:30	15:42	15:55	16:07	16:20	16:31	16:42
0(min)	656	686	798	935	1,119	1,255	1,350
1	658	695	811	952	1,133	1,265	1,352
2	660	704	824	970	1,146	1,274	1,354
3	663	713	837	988	1,154	1,283	1,357
4	666	722	850	1,000	1,172	1,293	1,359
5	668	732	863	1,024	1,185	1,302	1,361
6	671	741	877	1,042	1,199	1,311	1,364
7	674	750	894	1,060	1,212	1,321	1,366
8	677	759	903	1,079	1,225	1,330	1,368
9	679	768	906	1,095	1,238	1,339	1,370
10	682	778	929	1,115	1,252	1,349	1,373
11							
12							
13							
14							
15							
Total	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit.	26	92	131	180	133	94	23
Average	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
lit./min	2.6	9.2	13.1	18	13.3	9.4	2.3
Finish time	15:40	15:52	16:05	16:17	16:30	16:41	16:52
(Pf)	0.00	0.04	0.08	0.15	0.08	0.04	0.00

Friction Loss (Pf) = pf(L2 + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1= 5.8 q1= 0.52

P2= 8.8 q2= 1.84

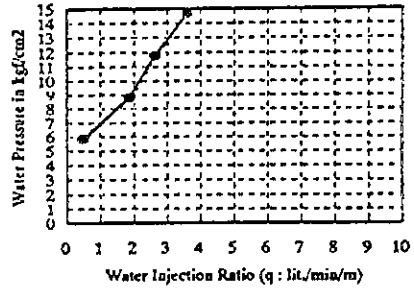
P3= 11.7 q3= 2.62

P4= 14.7 q4= 3.60

P5= 11.7 q5= 2.66

P6= 8.8 q6= 1.88

P7= 5.8 q7= 0.46



Lugeon value : 2.2 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 : Mushtaq Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 Stage: 11/14

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

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

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

Ground elevation : EL. 546.267 m | Groundwater level (Lw): Nil | Gauge height (Lo): 0.85 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 6.10 m | Depth of test section: Gl. - (Lo)= 50 m to (Lo)= 55 m | Length of section (Lo): 5.00 m

Reading of flow meter

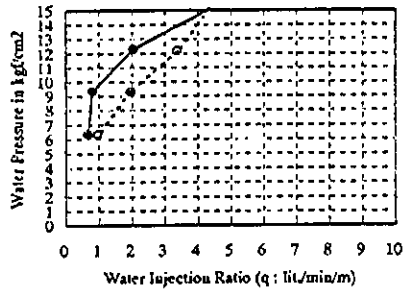
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	14:45	14:55	15:06	15:17	15:28	15:40	15:50
Q(min)	1,971	2,015	2,082	2,204	2,450	2,624	2,725
1	1,975	2,020	2,092	2,224	2,458	2,633	2,725
2	1,978	2,025	2,102	2,244	2,485	2,643	2,734
3	1,982	2,030	2,113	2,266	2,502	2,653	2,739
4	1,985	2,035	2,123	2,284	2,519	2,663	2,744
5	1,988	2,039	2,133	2,304	2,535	2,673	2,749
6	1,991	2,044	2,144	2,326	2,552	2,683	2,751
7	1,994	2,048	2,154	2,351	2,569	2,692	2,754
8	1,997	2,052	2,166	2,375	2,586	2,702	2,764
9	2,000	2,054	2,174	2,398	2,602	2,712	2,768
10	2,004	2,055	2,184	2,422	2,619	2,722	2,773
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	33	40	102	218	169	98	48
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	3.3	4.0	10.2	21.8	16.9	9.8	4.8
Finish time	14:55	15:05	15:16	15:27	15:38	15:50	16:00
(Pr)	0.01	0.01	0.05	0.24	0.15	0.05	0.01

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

Calculation of Lugeon value

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

P1=	6.3	q1=	0.66
P2=	9.3	q2=	0.80
P3=	12.3	q3=	2.04
P4=	15.1	q4=	4.36
P5=	12.2	q5=	3.38
P6=	9.3	q6=	1.96
P7=	6.3	q7=	0.96



Lugeon value : 1.1 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 : Mushtaq / Iqbal Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-16 Stage: 12/14

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 5/August/1999

Ground elevation : EL. 546.267 m | Groundwater level (Lw): Nil | Gauge bright (Lo): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 5.75 m | Depth of test section: Gl. - (Lo)= 55 m to (Lo)= 60 m | Length of section (Lo): 5.00 m

Reading of flow meter

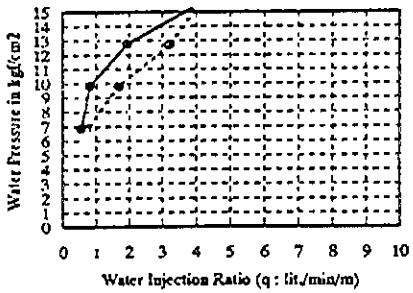
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	15:00	15:12	15:25	15:37	15:48	16:00	16:12
Q(min)	101	140	190	311	520	690	780
1	104	144	199	332	536	697	784
2	107	148	209	353	556	708	788
3	110	152	219	373	567	717	791
4	112	156	229	394	584	725	795
5	115	161	239	415	600	734	799
6	118	166	248	435	617	740	802
7	121	169	258	456	632	751	806
8	123	175	268	476	648	759	810
9	126	177	277	497	665	768	813
10	129	181	288	517	680	775	816
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	28	41	98	206	160	85	36
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	2.8	4.1	9.8	20.6	16.0	8.5	3.6
Finish time	15:10	15:22	15:35	15:47	15:58	16:10	16:22
(Pr)	0.00	0.01	0.05	0.24	0.14	0.04	0.01

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

Calculation of Lugeon value

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

P1=	6.8	q1=	0.56
P2=	9.8	q2=	0.82
P3=	12.8	q3=	1.96
P4=	15.6	q4=	4.12
P5=	12.7	q5=	3.20
P6=	9.8	q6=	1.70
P7=	6.8	q7=	0.72



Lugeon value : 0.9 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 : Mushtaq / Iqbal Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-16 Stage: 13/14

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

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

Friction Loss per meter (P_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 6/August/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.82 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 6.57 m | Depth of test section: GL. - (L_1)= 60 m to (L_2)= 65 m | Length of section (L_s) 5.00 m

Reading of flow meter

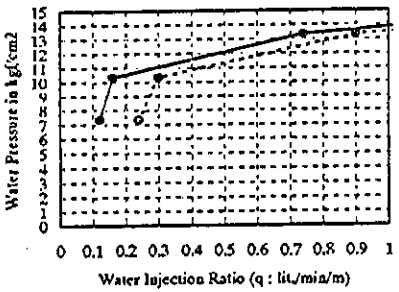
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	15:23	15:34	15:45	15:57	16:08	16:20	16:31
0(min)	342	350	360	400	520	568	585
1	343	351	363	411	524	569	586
2	343	352	367	423	529	571	587
3	344	353	371	435	533	572	588
4	345	353	374	447	538	574	589
5	345	354	378	458	542	575	591
6	346	355	382	470	547	577	592
7	347	356	386	482	551	578	593
8	347	356	389	494	556	580	594
9	348	357	393	505	560	581	596
10	348	358	397	517	565	583	597
11							
12							
13							
14							
15							
Total lit.	Qw1 6	Qw2 8	Qw3 37	Qw4 117	Qw5 45	Qw6 15	Qw7 12
Average lit./min	Qw1 0.6	Qw2 0.8	Qw3 3.7	Qw4 11.7	Qw5 4.5	Qw6 1.5	Qw7 1.2
Finish time	15:33	15:44	15:55	16:07	16:18	16:30	16:41
(Pf)	0.00	0.00	0.01	0.09	0.01	0.00	0.00

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

Calculation of Lugeon value

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

P1=	7.3	q1=	0.12
P2=	10.3	q2=	0.16
P3=	13.3	q3=	0.74
P4=	16.2	q4=	2.34
P5=	13.3	q5=	0.90
P6=	10.3	q6=	0.30
P7=	7.3	q7=	0.24



Lugeon value : 0.2 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 : Iqbal / Hameed Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-16 Stage: 14/14

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

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

Friction Loss per meter (P_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 7/August/1999

Ground elevation : EL. 546.267 m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 5.85 m | Depth of test section: GL. - (L_1)= 65 m to (L_2)= 70 m | Length of section (L_s) 5.00 m

Reading of flow meter

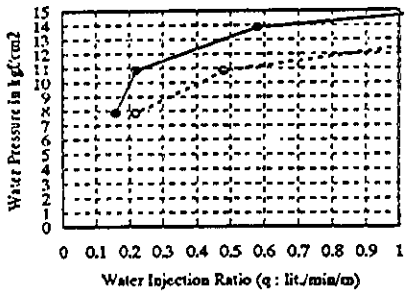
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	15:30	15:41	15:52	16:03	16:13	16:24	16:25
0(min)	272	283	295	328	433	505	529
1	272	285	298	338	441	507	530
2	273	286	301	348	448	510	531
3	274	287	304	359	456	513	532
4	275	288	307	370	463	515	533
5	276	289	309	380	470	517	534
6	277	290	312	391	477	520	535
7	277	291	315	401	483	522	537
8	278	292	318	411	490	524	538
9	279	293	321	421	498	527	539
10	280	294	324	432	505	529	540
11							
12							
13							
14							
15							
Total lit.	Qw1 8	Qw2 11	Qw3 29	Qw4 104	Qw5 72	Qw6 24	Qw7 11
Average lit./min	Qw1 0.8	Qw2 1.1	Qw3 2.9	Qw4 10.4	Qw5 7.2	Qw6 2.4	Qw7 1.1
Finish time	15:40	15:51	16:02	16:13	16:23	16:34	16:35
(Pf)	0.00	0.00	0.01	0.07	0.03	0.00	0.00

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

Calculation of Lugeon value

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

P1=	7.8	q1=	0.16
P2=	10.8	q2=	0.22
P3=	13.8	q3=	0.58
P4=	16.8	q4=	2.08
P5=	13.8	q5=	1.44
P6=	10.8	q6=	0.48
P7=	7.8	q7=	0.22



Lugeon value : 0.2 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 : Mashtaque Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-17 Stage: 1/12

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

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

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

Ground elevation : EL. 571.860 m | Groundwater level (L_1): Nil | Gauge height (L_3): 0.82 m

Pipe length from gauge to hole mouth borehole mouth: (L_0)= 5.65 m | Depth of test section GL. - (L_2)= 2 m to (L_4)= 7 m | Length of section (L_5) 5.00 m

Reading of flow meter

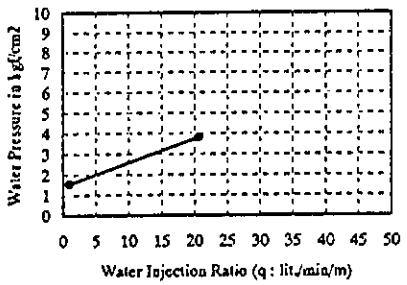
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3	Po4	Po5	Po6	Po7
Start time	17:30	17:45					
0(min)	6,396	6,490					
1	6,402	6,555					
2	6,408	6,665					
3	6,413	6,770					
4	6,418	6,885					
5	6,422	6,990					
6	6,427	7,104					
7	6,432	7,214					
8	6,436						
9	6,441						
10	6,446						
11							
12							
13							
14							
15							
Total lit.	Qw1 50	Qw2 724	Qw3	Qw4	Qw5	Qw6	Qw7
Average lit./min	Qw1 5.0	Qw2 103.4	Qw3	Qw4	Qw5	Qw6	Qw7
Finish time	17:40	17:55					
(Pr)	0.00	0.72					

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/L5 [lit/min/m]

P1= 1.5 q1= 1.00
P2= 3.8 q2= 20.69
P3= q3=
P4= q4=
P5= q5=
P6= q6=
P7= q7=



Lugeon value : (74) Lu'

Critical Pressure: >3.8 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 : Mushtaque / Iqbal Inspected by :

GE2 - 117

Water Pressure Test

Hole No.: M98-17 Stage: 2/12

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 5/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_1): Nil | Gauge height (L_3): 0.78 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 5.63 m | Depth of test section GL. - (L_2)= 5 m to (L_4)= 10 m | Length of section (L_5) 5.00 m

Reading of flow meter

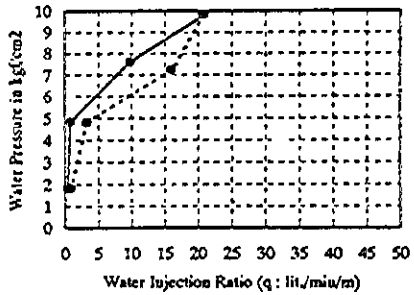
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	14:00	14:10	14:22	14:35	14:17	15:00	15:12
0(min)	1,541	1,566	1,610	2,110	3,170	4,000	4,170
1	1,543	1,570	1,648	2,215	3,255	4,015	4,174
2	1,545	1,573	1,690	2,320	3,334	4,030	4,178
3	1,547	1,576	1,735	2,425	3,412	4,060	4,185
4	1,549	1,579	1,780	2,529	3,492	4,080	4,189
5	1,551	1,581	1,830	2,631	3,573	4,095	4,193
6	1,554	1,584	1,883	2,742	3,652	4,111	4,197
7	1,556	1,587	1,937	2,850	3,737	4,125	4,202
8	1,558	1,600	1,990	2,960	3,811	4,140	4,206
9	1,560	1,603	2,045	3,047	3,892	4,153	4,210
10	1,562	1,609	2,100	3,157	3,972	4,167	4,215
11							
12							
13							
14							
15							
Total lit.	Qw1 21	Qw2 43	Qw3 490	Qw4 1,047	Qw5 802	Qw6 167	Qw7 45
Average lit./min	Qw1 2.1	Qw2 4.3	Qw3 49.0	Qw4 104.7	Qw5 80.2	Qw6 16.7	Qw7 4.5
Finish time	14:10	14:20	14:32	14:45	14:27	15:10	15:22
(Pr)	0.00	0.00	0.23	1.02	0.60	0.03	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/L5 [lit/min/m]

P1= 1.8 q1= 0.42
P2= 4.8 q2= 0.96
P3= 7.6 q3= 9.80
P4= 9.8 q4= 20.94
P5= 7.2 q5= 16.04
P6= 4.8 q6= 3.34
P7= 1.8 q7= 0.90



Lugeon value : (22) Lu'

Critical Pressure: >9.8 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 : Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-17 Stage: 3/12

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 6/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_w): Nil | Gauge height (L_g): 1.00 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.55 m | Depth of test section: GL. - (L_u)= 10 m to (L_d)= 15 m | Length of section (L_s): 5.00 m

Reading of flow meter

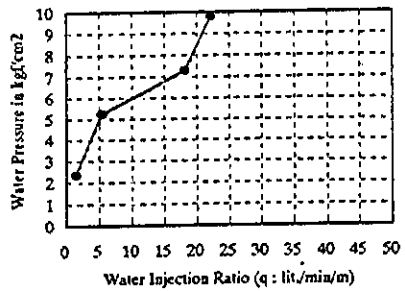
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	18:15	18:27	18:38	18:50	19:01	19:12	19:30
0(min)	6,141	6,224	6,520	7,530	8,670	9,590	9,880
1	6,149	6,249	6,604	7,638	8,762	9,619	9,887
2	6,156	6,275	6,690	7,748	8,854	9,647	9,895
3	6,163	6,302	6,780	7,860	8,945	9,674	9,902
4	6,170	6,329	6,867	7,973	9,036	9,702	9,908
5	6,177	6,356	6,951	8,084	9,128	9,731	9,914
6	6,184	6,383	7,056	8,195	9,218	9,758	9,922
7	6,191	6,411	7,150	8,307	9,309	9,787	9,929
8	6,197	6,437	7,239	8,417	9,399	9,815	9,938
9	6,204	6,465	7,332	8,529	9,490	9,843	9,946
10	6,211	6,493	7,428	8,640	9,583	9,871	9,953
11							
12							
13							
14							
15							
Total lit.	Qw1 70	Qw2 269	Qw3 908	Qw4 1,110	Qw5 913	Qw6 281	Qw7 73
Average lit./min	Qw1 7.0	Qw2 26.9	Qw3 90.8	Qw4 111.0	Qw5 91.3	Qw6 28.1	Qw7 7.3
Finish time	18:25	18:37	18:48	19:00	19:11	19:22	19:40
(Pf)	0.01	0.10	1.06	1.57	1.07	0.10	0.01

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

Calculation of Lugeon value

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

P1=	2.3	q1=	1.40
P2=	5.3	q2=	5.38
P3=	7.3	q3=	18.16
P4=	9.8	q4=	22.20
P5=	7.3	q5=	18.26
P6=	5.2	q6=	5.62
P7=	2.3	q7=	1.46



Lugeon value : (23) Lu'

Critical Pressure: >9.8 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. Hameed Inspected by :

GE2 - 118

Water Pressure Test

Hole No.: M98-17 Stage: 4/12

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 7/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.81 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 5.40 m | Depth of test section: GL. - (L_u)= 15 m to (L_d)= 20 m | Length of section (L_s): 5.00 m

Reading of flow meter

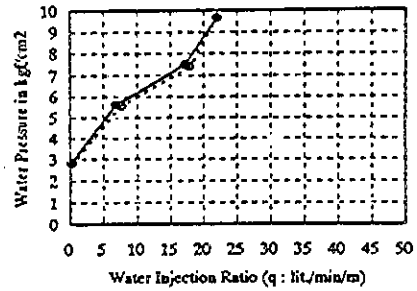
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	18:30	18:42	18:53	19:05	19:16	19:27	19:37
0(min)	2941	2960	3460	4640	6024	6944	7329
1	2943	2994	3546	4750	6114	6983	7330
2	2943	3027	3632	4860	6203	7021	7333
3	2944	3060	3718	4971	6292	7059	7334
4	2945	3094	3804	5081	6381	7097	7335
5	2946	3128	3890	5191	6470	7136	7336
6	2947	3162	3977	5302	6560	7174	7338
7	2948	3198	4063	5412	6649	7212	7339
8	2949	3233	4149	5522	6738	7250	7340
9	2950	3268	4235	5632	6827	7288	7341
10	2951	3303	4321	5742	6916	7327	7343
11							
12							
13							
14							
15							
Total lit.	Qw1 10	Qw2 343	Qw3 861	Qw4 1,102	Qw5 892	Qw6 383	Qw7 14
Average lit./min	Qw1 1.0	Qw2 34.3	Qw3 86.1	Qw4 110.2	Qw5 89.2	Qw6 38.3	Qw7 1.4
Finish time	18:40	18:52	19:03	19:15	19:26	19:37	19:47
(Pf)	0.00	0.22	1.33	2.17	1.43	0.27	0.00

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

Calculation of Lugeon value

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

P1=	2.8	q1=	0.20
P2=	5.6	q2=	6.86
P3=	7.5	q3=	17.22
P4=	9.7	q4=	22.04
P5=	7.4	q5=	17.84
P6=	5.6	q6=	7.66
P7=	2.8	q7=	0.28



Lugeon value : (23) Lu'

Critical Pressure: >9.7 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 : Mushtaque Inspected by :

Water Pressure Test

Hole No.: M98-17 Stage: 5/12

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 8/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_1): Nil | Gauge height (L_3): 0.82 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 5.33 m | Depth of test section: GL. - (L_4)= 20 m to (L_5)= 25 m | Length of section (L_0) = 5.00 m

Reading of flow meter

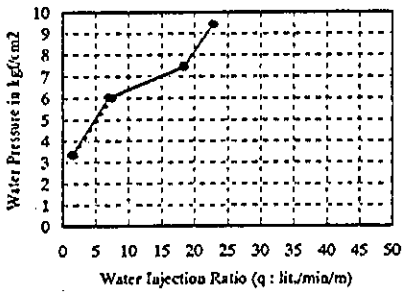
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	16:40	16:52	17:04	17:15	17:26	17:37	17:50
Q(min)	5374	5471	5850	6810	8110	9070	9500
1	5381	5506	5942	6924	8203	9107	9509
2	5389	5540	6035	7038	8095	9145	9517
3	5396	5577	6126	7153	8086	9182	9525
4	5404	5613	6218	7267	8478	9220	9533
5	5411	5648	6313	7381	8571	9258	9540
6	5419	5682	6403	7495	8661	9294	9548
7	5426	5717	6495	7610	8753	9331	9557
8	5434	5753	6587	7723	8845	9369	9565
9	5441	5790	6680	7838	8936	9406	9572
10	5449	5825	6773	7954	9026	9443	9580
11							
12							
13							
14							
15							
Total lit.	Qo1 75	Qo2 354	Qo3 923	Qo4 1,144	Qo5 916	Qo6 373	Qo7 80
Average lit./min	Qo1 7.5	Qo2 35.4	Qo3 92.3	Qo4 114.4	Qo5 91.6	Qo6 37.3	Qo7 8.0
Finish time	16:50	17:02	17:14	17:25	17:36	17:47	18:00
(Pr)	0.01	0.29	1.90	2.90	1.87	0.32	0.02

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

Calculation of Lugeon value

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

P1= 3.3 q1= 1.50
P2= 6.0 q2= 7.08
P3= 7.4 q3= 18.46
P4= 9.4 q4= 22.88
P5= 7.5 q5= 18.32
P6= 6.0 q6= 7.46
P7= 3.3 q7= 1.60



Lugeon value : (25) Lu

Critical Pressure: >9.4 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 : Iqbal Inspected by :

GE2 - 119

Water Pressure Test

Hole No.: M98-17 Stage: 6/12

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 9/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_1): Nil | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.74 m | Depth of test section: GL. - (L_4)= 25 m to (L_5)= 30 m | Length of section (L_0) = 5.00 m

Reading of flow meter

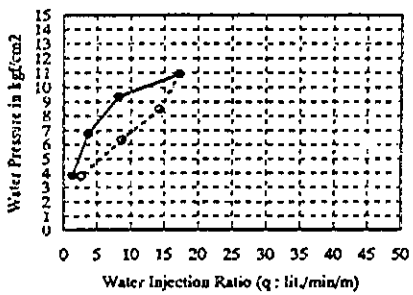
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	18:35	18:47	19:00	19:12	19:23	19:34	19:45
Q(min)	7,012	7,101	7,342	7,833	8,750	9,535	10,012
1	7,020	7,120	7,381	7,913	8,819	9,578	10,025
2	7,027	7,138	7,421	7,990	8,891	9,622	10,038
3	7,033	7,057	7,461	8,072	8,946	9,664	10,052
4	7,041	7,075	7,502	8,154	9,036	9,708	10,065
5	7,047	7,199	7,543	8,243	9,108	9,750	10,077
6	7,054	7,212	7,585	8,330	9,181	9,793	10,091
7	7,061	7,221	7,627	8,420	9,252	9,837	10,104
8	7,068	7,250	7,670	8,510	9,323	9,881	10,118
9	7,075	7,268	7,712	7,601	9,395	9,924	10,132
10	7,082	7,287	7,755	8,695	9,465	9,968	10,145
11							
12							
13							
14							
15							
Total lit.	Qo1 70	Qo2 186	Qo3 413	Qo4 862	Qo5 715	Qo6 433	Qo7 133
Average lit./min	Qo1 7.0	Qo2 18.6	Qo3 41.3	Qo4 86.2	Qo5 71.5	Qo6 43.3	Qo7 13.3
Finish time	18:45	18:57	19:10	19:22	19:33	19:44	19:55
(Pr)	0.01	0.09	0.46	1.95	1.35	0.50	0.05

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

Calculation of Lugeon value

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

P1= 3.8 q1= 1.40
P2= 6.7 q2= 3.72
P3= 9.4 q3= 8.26
P4= 10.9 q4= 17.24
P5= 8.5 q5= 14.30
P6= 6.3 q6= 8.66
P7= 3.8 q7= 2.66



Lugeon value : (6.3) 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. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-17 Stage: 7/12

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 15/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_s): Nil | Gauge height (L_s): 0.79 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.79 m | Depth of test section: GL. - (L_o)= 30 m to (L_o)= 35 m | Length of section (L_s): 5.00 m

Reading of flow meter

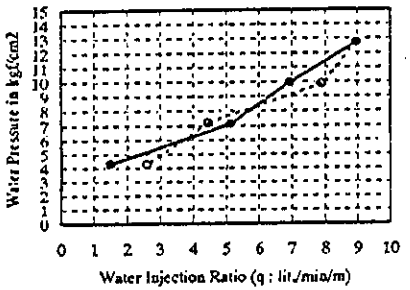
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	13:25	13:36	13:47	13:58	14:09	14:20	14:31
Q(min)	6,982	7,182	7,480	7,860	8,340	8,881	9,124
1	7,002	7,210	7,514	7,903	8,377	8,812	9,137
2	7,020	7,236	7,547	7,946	8,415	8,843	9,150
3	7,039	7,261	7,582	7,991	8,454	8,874	9,163
4	7,056	7,286	7,615	8,036	8,493	7,907	9,176
5	7,072	7,311	7,650	8,081	8,532	8,940	9,189
6	7,088	7,337	7,687	8,125	8,572	8,972	9,201
7	7,106	7,362	7,721	8,171	8,612	9,004	9,214
8	7,022	7,387	7,756	8,216	8,653	9,037	9,227
9	7,039	7,413	7,791	8,262	8,693	9,071	9,240
10	7,057	7,439	7,827	8,308	8,735	9,104	9,254
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	75	257	347	448	395	223	130
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	7.5	25.7	34.7	44.8	39.5	22.3	13
Finish time	13:35	13:46	13:57	14:08	14:19	14:30	14:41
(Pr)	0.02	0.21	0.38	0.63	0.49	0.16	0.05

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

Calculation of Lugeon value

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

P1=	4.3	q1=	1.50
P2=	7.1	q2=	5.14
P3=	10.0	q3=	6.94
P4=	12.7	q4=	8.96
P5=	9.8	q5=	7.90
P6=	7.2	q6=	4.46
P7=	4.3	q7=	2.60



Lugeon value : 6.6 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. Hameed / Iqbal Inspected by : A. Fayaz

GB2 - 120

Water Pressure Test

Hole No.: M98-17 Stage: 8/12

Location: Dam Axis (Left 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 : 16/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_s): Nil | Gauge height (L_s): 0.82 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.72 m | Depth of test section: GL. - (L_o)= 35 m to (L_o)= 40 m | Length of section (L_s): 5.00 m

Reading of flow meter

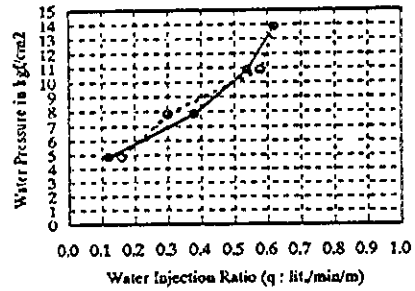
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	13:10	13:20	13:31	13:42	13:53	14:04	14:15
Q(min)	119	126	148	178	212	243	259
1	120	128	150	181	215	245	260
2	121	129	153	184	218	246	260
3	121	131	156	187	221	248	261
4	122	134	159	190	224	249	262
5	123	136	161	194	226	251	263
6	123	138	163	197	229	252	264
7	124	140	166	199	232	254	264
8	124	142	169	203	235	255	265
9	125	143	172	206	238	257	266
10	125	145	175	209	241	258	267
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	6	19	27	31	29	15	8
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.6	1.9	2.7	3.1	2.9	1.5	0.8
Finish time	13:20	13:30	13:41	13:52	14:03	14:14	14:25
(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)Ls+Lo)-Pr [kgf/cm2], q=Qw/Ls [lit/min/m]

P1=	4.8	q1=	0.12
P2=	7.8	q2=	0.38
P3=	10.8	q3=	0.54
P4=	13.8	q4=	0.62
P5=	10.8	q5=	0.58
P6=	7.8	q6=	0.30
P7=	4.8	q7=	0.16



Lugeon value : 0.5 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 : A. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-17 Stage: 9/12

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 19/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.83 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.79 m | Depth of test section: GL. - (L_1)= 40 m to (L_2)= 45 m | Length of section (L_s) 5.00 m

Reading of flow meter

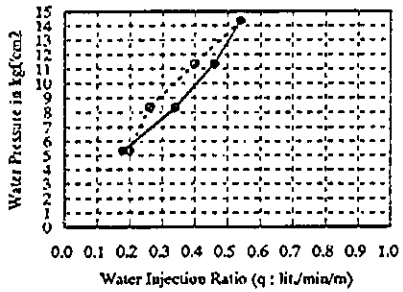
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	13:10	13:24	13:37	13:50	14:02	14:14	14:25
Q(min)	785	800	823	856	887	909	923
1	786	802	825	859	889	910	924
2	787	804	827	862	891	911	925
3	788	805	830	864	893	912	926
4	789	807	832	867	895	914	927
5	790	809	834	870	897	915	928
6	791	810	836	873	899	916	929
7	791	812	839	875	901	918	930
8	792	814	841	878	903	919	931
9	793	815	843	880	905	921	932
10	794	817	846	883	907	922	933
11							
12							
13							
14							
15							
Total lit.	Qw1 9	Qw2 17	Qw3 23	Qw4 27	Qw5 20	Qw6 13	Qw7 10
Average lit./min	Q1 0.9	Q2 1.7	Q3 2.3	Q4 2.7	Q5 2.0	Q6 1.3	Q7 1.0
Finish time	13:20	13:34	13:47	14:00	14:12	14:24	14:35
(Pf)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

P=Po+0.1(sin(a)Lo+L2)-Pf [kgf/cm2], q=Qw/Ls [lit/min/m]

P1=	5.3	q1=	0.18
P2=	8.3	q2=	0.34
P3=	11.3	q3=	0.46
P4=	14.3	q4=	0.54
P5=	11.3	q5=	0.40
P6=	8.3	q6=	0.26
P7=	5.3	q7=	0.20



Lugeon value : 0.4 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 : A. Hameed / Iqbal Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-17 Stage: 10/12

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 20/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_w): Nil | Gauge height (L_g): 0.85 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.78 m | Depth of test section: GL. - (L_1)= 45 m to (L_2)= 50 m | Length of section (L_s) 5.00 m

Reading of flow meter

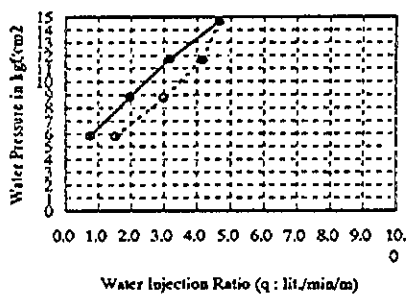
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	12:10	12:21	12:32	12:43	12:54	13:07	13:08
Q(min)	4,644	4,684	4,785	4,960	5,220	5,450	5,607
1	4,648	4,694	4,800	4,981	5,240	5,465	5,614
2	4,653	4,703	4,816	5,003	5,261	5,479	5,621
3	4,657	4,713	4,831	5,326	5,281	5,494	5,629
4	4,660	4,723	4,846	5,049	5,302	5,509	5,637
5	4,664	4,733	4,863	5,073	5,323	5,523	5,645
6	4,667	4,743	4,879	5,047	5,344	5,538	5,653
7	4,671	4,753	4,896	5,121	5,365	5,554	5,660
8	4,674	4,763	4,912	5,145	5,386	5,569	5,668
9	4,678	4,772	4,928	5,169	5,407	5,584	5,676
10	4,682	4,782	4,944	5,193	5,428	5,599	5,683
11							
12							
13							
14							
15							
Total lit.	Qw1 38	Qw2 98	Qw3 159	Qw4 233	Qw5 208	Qw6 149	Qw7 76
Average lit./min	Q1 3.8	Q2 9.8	Q3 15.9	Q4 23.3	Q5 20.8	Q6 14.9	Q7 7.6
Finish time	12:20	12:31	12:42	12:53	13:04	13:17	13:18
(Pf)	0.01	0.04	0.12	0.25	0.20	0.10	0.03

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

Calculation of Lugeon value

P=Po+0.1(sin(a)Lo+L2)-Pf [kgf/cm2], q=Qw/Ls [lit/min/m]

P1=	5.8	q1=	0.76
P2=	8.8	q2=	1.96
P3=	11.7	q3=	3.18
P4=	14.6	q4=	4.66
P5=	11.6	q5=	4.16
P6=	8.7	q6=	2.98
P7=	5.8	q7=	1.52



Lugeon value : 2.6 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 : Iqbal / Mushtaq Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-17 Stage: 11/12

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 21/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.88 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.60 m | Depth of test section: GL. - (L_1)= 50 m to (L_3)= 55 m | Length of section (L_3): 5.00 m

Reading of flow meter

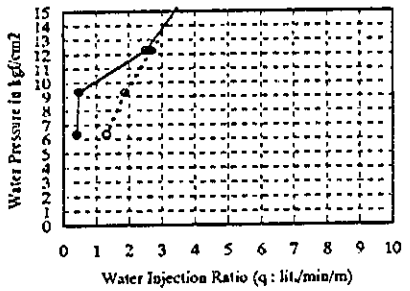
Gauge P.	Pe1	Pe2	Pe3	Pe4	Pe5	Pe6	Pe7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	15:16	15:27	15:38	15:49	15:50	16:09	16:20
Q(min)	295	318	350	488	670	810	909
1	598	320	365	507	683	819	915
2	300	322	378	525	697	829	922
3	302	324	391	544	710	838	929
4	304	326	404	562	724	848	936
5	306	328	416	579	737	857	942
6	308	331	428	595	751	866	949
7	310	334	440	612	764	876	955
8	312	337	452	629	777	885	962
9	314	339	464	645	790	894	969
10	316	342	476	661	804	904	975
11							
12							
13							
14							
15							
Total	Q_{w1}	Q_{w2}	Q_{w3}	Q_{w4}	Q_{w5}	Q_{w6}	Q_{w7}
lit.	21	24	126	173	134	94	66
Average	Q_{w1}	Q_{w2}	Q_{w3}	Q_{w4}	Q_{w5}	Q_{w6}	Q_{w7}
lit./min	2.1	2.4	12.6	17.3	13.4	9.4	6.6
Finish time	15:26	15:37	15:48	15:59	16:00	16:19	16:30
(Pr)	0.00	0.00	0.08	0.15	0.09	0.05	0.02

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	6.3	q1=	0.42
P2=	9.3	q2=	0.48
P3=	12.3	q3=	2.52
P4=	15.2	q4=	3.46
P5=	12.2	q5=	2.68
P6=	9.3	q6=	1.88
P7=	6.3	q7=	1.32



Lugeon value : 2.0 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 : A. Hameed Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-17 Stage: 12/12

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 23/August/1999

Ground elevation : EL. 571.860 m | Groundwater level (L_1): Nil | Gauge height (L_2): 0.30 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.61 m | Depth of test section: GL. - (L_1)= 55 m to (L_3)= 60 m | Length of section (L_3): 5.00 m

Reading of flow meter

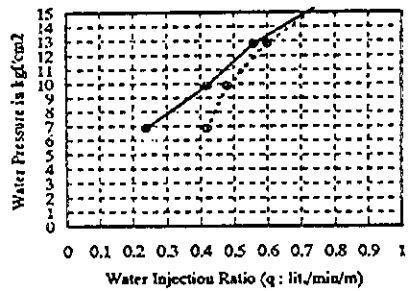
Gauge P.	Pe1	Pe2	Pe3	Pe4	Pe5	Pe6	Pe7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	10:30	10:41	10:51	11:02	11:12	11:24	11:34
Q(min)	144	160	182	213	253	287	312
1	145	162	185	217	256	289	314
2	146	164	188	221	260	292	316
3	147	166	191	225	262	294	318
4	148	168	193	228	265	297	320
5	150	171	196	233	268	299	322
6	151	173	199	237	271	301	324
7	152	175	202	240	274	304	326
8	154	177	205	244	277	306	329
9	155	179	208	248	280	309	331
10	156	181	210	252	283	311	333
11							
12							
13							
14							
15							
Total	Q_{w1}	Q_{w2}	Q_{w3}	Q_{w4}	Q_{w5}	Q_{w6}	Q_{w7}
lit.	12	21	28	39	30	24	21
Average	Q_{w1}	Q_{w2}	Q_{w3}	Q_{w4}	Q_{w5}	Q_{w6}	Q_{w7}
lit./min	1.2	2.1	2.8	3.9	3.0	2.4	2.1
Finish time	10:40	10:51	11:01	11:12	11:22	11:34	11:44
(Pr)	0.00	0.00	0.00	0.01	0.01	0.00	0.00

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	6.8	q1=	0.24
P2=	9.8	q2=	0.42
P3=	12.8	q3=	0.56
P4=	15.8	q4=	0.78
P5=	12.8	q5=	0.60
P6=	9.8	q6=	0.48
P7=	6.8	q7=	0.42



Lugeon value : 0.4 Lu

Critical Pressure: >16 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. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-18 | Stage: 1/36

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ | Date : 31/08/99

Ground elevation : EL. 560.337 m | Groundwater level (L_1): 4.5 m | Gauge height (L_3): 0.81 m

Pipe length from gauge to hole mouth borehole mouth: (L_2)= 3.70 m | Depth of test section GL - (L_4)= 2 m to (L_6)= 7 m | Length of section (L_5) 5.00 m

Reading of flow meter

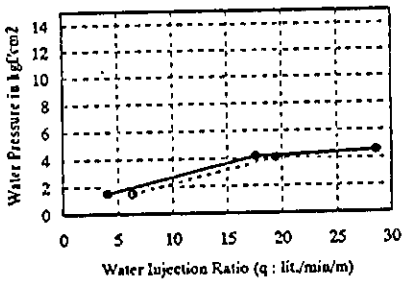
Gauge P.	Pa1	Pa2	Pa3	Pa4	Pa5	Pa6	Pa7
(kgf/cm2)	1	4	5	4	1		
Start time	15:22	15:33	15:44	15:56	16:07		
Q(min)	200	480	490	2	990		
1	221	567	628	99	1,021		
2	242	653	759	196	1,053		
3	263	736	890	292	1,085		
4	282	823	1,033	389	1,116		
5	302	910	1,177	487	1,148		
6	322	998	1,324	584	1,180		
7	342	1,086	1,472	680	1,211		
8	362	1,178	1,617	777	1,242		
9	382	1,268	1,767	873	1,272		
10	403	1,360	1,921	974	1,305		
11							
12							
13							
14							
15							
Total lit.	Qa1 203	Qa2 880	Qa3 1,431	Qa4 972	Qa5 315	Qa6	Qa7
Average lit./min	Qa1 20.3	Qa2 88.0	Qa3 143.1	Qa4 97.2	Qa5 31.5	Qa6	Qa7
Finish time	15:32	15:43	15:54	16:06	16:17		
(Pf)	0.02	0.39	1.01	0.47	0.05		

Friction Loss (Pf) = pf(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L4+L2)-Pf [kgf/cm2], q=Qa/L5 [lit/min/m]

P1=	1.5	q1=	4.06
P2=	4.1	q2=	17.60
P3=	4.5	q3=	28.62
P4=	4.1	q4=	19.44
P5=	1.5	q5=	6.30
P6=		q6=	
P7=		q7=	



Lugeon value : (73) Lu'

Critical Pressure: >4.5 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. Hameed | Inspected by :

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Water Pressure Test

Hole No.: M98-18 | Stage: 2/36

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

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

Friction Loss per meter (Pf) : $1\times10^{-5}\times Q^{1.971}$ | Date : 1/9/99

Ground elevation : EL. 560.337 m | Groundwater level (L_1): 8 m | Gauge height (L_3): 0.81 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 3.70 m | Depth of test section GL - (L_4)= 5 m to (L_6)= 10 m | Length of section (L_5) 5.00 m

Reading of flow meter

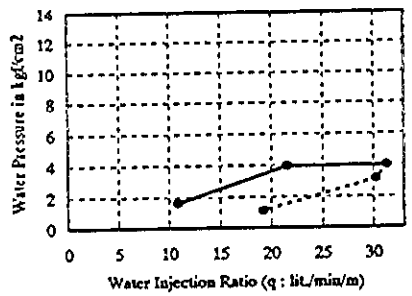
Gauge P.	Pa1	Pa2	Pa3	Pa4	Pa5	Pa6	Pa7
(kgf/cm2)	1	4	5	4	1		
Start time	12:14	12:25	12:36	12:46	12:57		
Q(min)	840	430	770	430	112		
1	891	527	919	567	209		
2	945	626	1,067	712	305		
3	999	727	1,223	860	403		
4	1,055	831	1,375	1,010	498		
5	1,112	938	1,534	1,162	595		
6	1,167	1,046	1,692	1,318	692		
7	1,222	1,157	1,852	1,472	787		
8	1,276	1,275	2,017	1,634	883		
9	1,330	1,393	2,178	1,797	979		
10	1,384	1,510	2,338	1,945	1,074		
11							
12							
13							
14							
15							
Total lit.	Qa1 544	Qa2 1,080	Qa3 1,568	Qa4 1,515	Qa5 962	Qa6	Qa7
Average lit./min	Qa1 54.4	Qa2 108.0	Qa3 156.8	Qa4 151.5	Qa5 96.2	Qa6	Qa7
Finish time	12:24	12:35	12:46	12:56	13:07		
(Pf)	0.23	0.89	1.85	1.73	0.71		

Friction Loss (Pf) = pf(Lo + L4) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)L4+L2)-Pf [kgf/cm2], q=Qa/L5 [lit/min/m]

P1=	1.6	q1=	10.88
P2=	3.9	q2=	21.60
P3=	4.0	q3=	31.36
P4=	3.1	q4=	30.30
P5=	1.1	q5=	19.24
P6=		q6=	
P7=		q7=	



Lugeon value : (49) Lu

Critical Pressure: 4.0 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. Hameed / Iqbal | Inspected by :

Water Pressure Test

Hole No.: M98-18 Stage: 3/36

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

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

Friction Loss per meter (pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 3/9/99

Ground elevation : EL. 560.337 m | Groundwater level (Lw): 12.5 m | Gauge height (Lg): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 3.66 m | Depth of test section: GL. - (La)= 10 m to (Lb)= 15 m | Length of section (L): 5.00 m

Reading of flow meter

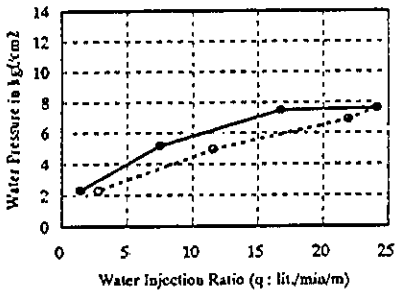
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	8	7	4	1
Start time	16:18	16:30	16:41	16:53	17:05	17:16	17:27
t(min)	36	130	560	980	260	360	221
1	42	162	633	1,097	360	416	233
2	50	198	710	1,215	464	474	247
3	56	236	799	1,335	572	530	262
4	63	295	870	1,455	682	589	277
5	70	313	953	1,580	794	646	293
6	79	352	1,040	1,695	900	705	305
7	85	390	1,125	1,820	1,015	764	320
8	93	428	1,216	1,940	1,127	823	334
9	101	468	1,306	2,065	1,240	882	347
10	109	506	1,398	2,185	1,355	940	361
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	73	376	838	1,205	1,095	580	140
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	7.3	37.6	83.8	120.5	109.5	58.0	14.0
Finish time	16:28	16:40	16:51	17:03	17:15	17:26	17:37
(Pe)	0.01	0.17	0.85	1.73	1.43	0.41	0.02

Friction Loss (Pf) = pf(Lo + L) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)Lo+La)-Pf [kgf/cm2], q=Qo/L [lit/min/m]

P1=	2.3	q1=	1.46
P2=	5.2	q2=	7.52
P3=	7.5	q3=	16.76
P4=	7.6	q4=	24.10
P5=	6.9	q5=	21.90
P6=	4.9	q6=	11.60
P7=	2.3	q7=	2.80



Lugeon value : (18) 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. Hameed / Iqbal Inspected by :

GE2 - 124

Water Pressure Test

Hole No.: M98-18 Stage: 4/36

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

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

Friction Loss per meter (pf) : $1\times10^{-5}\times Q^{1.971}$ Date : 4/9/99

Ground elevation : EL. 560.337 m | Groundwater level (Lw): 7.5 m | Gauge height (Lg): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 3.70 m | Depth of test section: GL. - (La)= 15 m to (Lb)= 20 m | Length of section (L): 5.00 m

Reading of flow meter

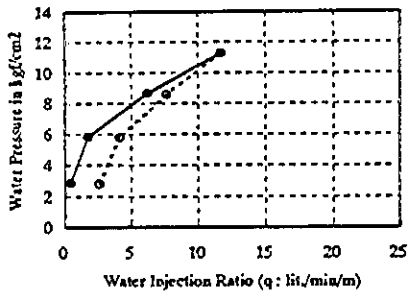
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	18:00	18:12	18:24	18:36	18:48	18:59	19:09
t(min)	533	557	656	30	640	43	255
1	536	565	686	88	678	64	268
2	538	574	716	145	717	85	281
3	541	583	745	204	755	105	294
4	544	592	777	261	793	126	309
5	546	600	808	318	837	147	320
6	548	609	839	378	870	168	332
7	550	618	870	436	909	189	345
8	551	627	902	494	947	210	358
9	552	636	935	555	985	230	371
10	554	645	967	615	1,023	251	384
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	21	88	311	585	383	208	129
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	2.1	8.8	31.1	58.5	38.3	20.8	12.9
Finish time	18:10	18:22	18:34	18:46	18:58	19:09	19:19
(Pe)	0.00	0.01	0.16	0.57	0.25	0.07	0.03

Friction Loss (Pf) = pf(Lo + L) [kgf/cm2]

Calculation of Lugeon value

P=Po+0.1(sin(a)Lo+La)-Pf [kgf/cm2], q=Qo/L [lit/min/m]

P1=	2.8	q1=	0.42
P2=	5.8	q2=	1.76
P3=	8.7	q3=	6.22
P4=	11.3	q4=	11.70
P5=	8.6	q5=	7.66
P6=	5.8	q6=	4.16
P7=	2.8	q7=	2.58



Lugeon value : (3.6) Lu'

Critical Pressure: 6.8 kgf/cm2 -1.245E-11

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. Hameed Inspected by :

Water Pressure Test

Hole No.: M98-18 Stage: 5/36

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 5/9/99

Ground elevation : EL. 560.337 m | Groundwater level (L_1): 22.5 m | Gauge height (L_2): 0.79 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 3.70 m | Depth of test section: GL. - (L_1)= 20 m to (L_3)= 25 m | Length of section (L_3) 5.00 m

Reading of flow meter

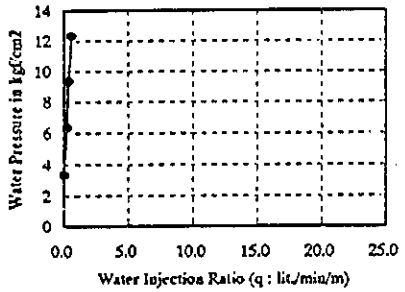
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	16:50	17:00	17:10	17:20	17:30	17:40	17:50
0(min)	393.0	395	406	423	454	473	484
1	393.0	396	407	426	456	474	484
2	393.0	397	409	429	457	475	484
3	393.0	398	411	432	459	476	484
4	393.0	400	413	435	461	477	485
5	393.0	401	414	438	463	478	485
6	393.0	402	416	441	465	480	485
7	393.0	403	418	444	467	481	485
8	393.0	404	419	447	469	482	485
9	393.0	405	421	450	471	483	485
10	393.0	406	423	453	473	484	485
11							
12							
13							
14							
15							
Total lit.	Qw1 0	Qw2 11	Qw3 17	Qw4 30	Qw5 19	Qw6 11	Qw7 1
Average lit/min	Qw1 0.0	Qw2 1.1	Qw3 1.7	Qw4 3.0	Qw5 1.9	Qw6 1.1	Qw7 0.1
Finish time	17:00	17:10	17:20	17:30	17:40	17:50	18:00
(Pe)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1=	3.3	q1=	0.00
P2=	6.3	q2=	0.22
P3=	9.3	q3=	0.34
P4=	12.3	q4=	0.60
P5=	9.3	q5=	0.38
P6=	6.3	q6=	0.22
P7=	3.3	q7=	0.02



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 : A. Hameed / Shakil Inspected by :

GB2 - 125

Water Pressure Test

Hole No.: M98-18 Stage: 6/36

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ Date : 7/9/99

Ground elevation : EL. 560.337 m | Groundwater level (L_1): 27.50 m | Gauge height (L_2): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 3.70 m | Depth of test section: GL. - (L_1)= 25 m to (L_3)= 30 m | Length of section (L_3) 5.00 m

Reading of flow meter

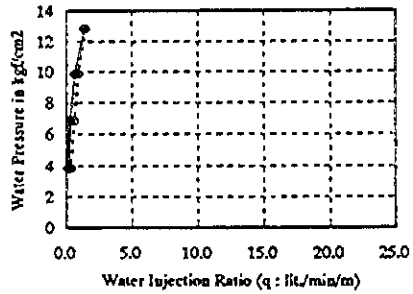
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	12:15	12:25	12:35	12:45	12:55	13:05	13:15
0(min)	20	29	44	82	154	202	232
1	20	30	47	89	158	205	233
2	21	32	51	96	163	208	235
3	22	33	54	103	168	211	236
4	23	35	57	111	173	214	238
5	23	36	60	118	178	217	240
6	24	38	64	124	182	220	241
7	25	39	67	131	187	223	243
8	25	40	70	138	191	226	244
9	26	42	74	145	196	229	246
10	27	43	77	152	200	232	248
11							
12							
13							
14							
15							
Total lit.	Qw1 7	Qw2 14	Qw3 33	Qw4 70	Qw5 46	Qw6 30	Qw7 16
Average lit/min	Qw1 0.7	Qw2 1.4	Qw3 3.3	Qw4 7.0	Qw5 4.6	Qw6 3.0	Qw7 1.6
Finish time	12:25	12:35	12:45	12:55	13:05	13:15	13:25
(Pe)	0.00	0.00	0.00	0.01	0.01	0.00	0.00

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

Calculation of Lugeon value

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

P1=	3.8	q1=	0.14
P2=	6.8	q2=	0.28
P3=	9.8	q3=	0.66
P4=	12.8	q4=	1.40
P5=	9.8	q5=	0.92
P6=	6.8	q6=	0.60
P7=	3.8	q7=	0.32



Lugeon value : 1.0 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. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-19 Stage: 1/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 19/08/99

Ground elevation : EL. 488.720 m	Groundwater level (L_w): 4.5 m	Gauge height (L_g): 0.80 m
Pipe length from gauge to hole mouth	Depth of test section	Length of section (L_s)
borehole mouth: (L_o)= 4.85 m	GL. - (L_s)= 2 m to (L_s)= 7 m	5.00 m

Reading of flow meter

Gauge P.	Pa1	Pa2	Pa3	Pa4	Pa5	Pa6	Pa7
(kgf/cm2)	1	4					
Start time	11:05	11:15					
Q(min)	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
1	951	308					
2	970	405					
3	999	520					
4	1,018	653					
5	1,027	806					
6	1,045	974					
7	1,064						
8	1,083						
9	1,101						
10	1,120						
11							
12							
13							
14							
15							
Total lit.	Q=1 188	Q=2 754	Q=3	Q=4	Q=5	Q=6	Q=7
Average lit./min	Q=1 18.8	Q=2 75.4	Q=3	Q=4	Q=5	Q=6	Q=7
Finish time	11:15	11:25					
(Pe)	0.02	0.34	0.00	0.00	0.00		

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

Calculation of Lugeon value

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

P1= 1.5 q1= 3.76

P2= 4.2 q2= 15.08

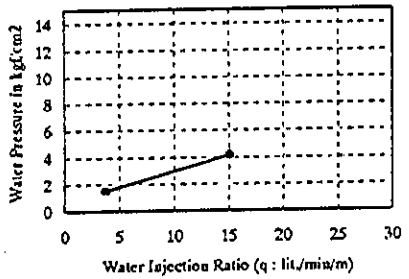
P3= q3=

P4= q4=

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (40) Lu'

Critical Pressure: >4.2 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 : A. Hameed Inspected by :

GE2 - 126

Water Pressure Test

Hole No.: M98-19 Stage: 2/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 20/08/99

Ground elevation : EL. 488.720 m	Groundwater level (L_w): 7.5 m	Gauge height (L_g): 0.78 m
Pipe length from pressure gauge to	Depth of test section	Length of section (L_s)
borehole mouth: (L_o)= 4.85 m	GL. - (L_s)= 5 m to (L_s)= 10 m	5.00 m

Reading of flow meter

Gauge P.	Pa1	Pa2	Pa3	Pa4	Pa5	Pa6	Pa7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	10:30	10:41	10:52	11:03	11:14	11:24	11:34
Q(min)	Q=1	Q=2	Q=3	Q=4	Q=5	Q=6	Q=7
1	602	790	90	500	12	415	710
2	620	815	123	545	50	441	724
3	635	840	158	592	88	467	740
4	651	864	194	638	125	495	755
5	666	889	228	684	163	523	772
6	681	913	263	731	201	551	788
7	696	937	299	778	240	582	805
8	711	961	334	825	279	612	821
9	825	985	369	872	317	643	838
10	739	1,008	404	920	356	673	855
11	753	1,033	439	967	395	704	872
12							
13							
14							
15							
Total lit.	Q=1 151	Q=2 243	Q=3 349	Q=4 467	Q=5 383	Q=6 289	Q=7 162
Average lit./min	Q=1 15.1	Q=2 24.3	Q=3 34.9	Q=4 46.7	Q=5 38.3	Q=6 28.9	Q=7 16.2
Finish time	10:40	10:51	11:02	11:13	11:24	11:34	11:44
(Pe)	0.02	0.05	0.11	0.19	0.13	0.07	0.02

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

Calculation of Lugeon value

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

P1= 1.8 q1= 3.02

P2= 4.8 q2= 4.86

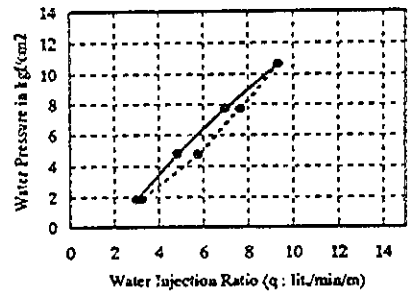
P3= 7.7 q3= 6.98

P4= 10.6 q4= 9.34

P5= 7.7 q5= 7.66

P6= 4.8 q6= 5.78

P7= 1.8 q7= 3.24



Lugeon value : 8.9 Lu

Critical Pressure: >11 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. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-19 Stage: 3/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 22/08/99

Ground elevation : EL. 488.720 m | Groundwater level (L_w): 12.5 m | Gauge height (L_s): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.85 m | Depth of test section: GL. - (L_o)= 10 m to (L_e)= 15 m | Length of section (L_e) 5.00 m

Reading of flow meter

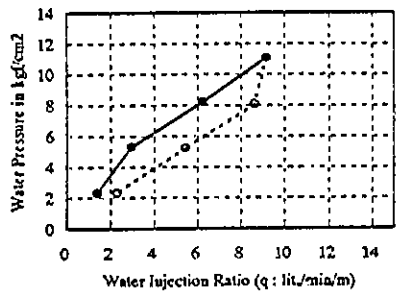
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	14:26	14:37	14:50	15:02	15:14	15:25	15:36
Q(min)	970	60	270	674	210	672	960
1	977	77	299	718	251	699	971
2	985	93	331	762	293	727	983
3	992	109	362	807	338	755	995
4	999	123	393	851	382	783	1,007
5	1,006	137	425	896	426	811	1,019
6	1,013	152	456	941	469	838	1,030
7	1,020	166	488	989	512	864	1,041
8	1,027	180	520	1,036	556	891	1,053
9	1,034	194	551	1,084	599	918	1,064
10	1,040	208	582	1,132	641	945	1,075
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	70	148	312	458	431	273	115
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	7.0	14.8	31.2	45.8	43.1	27.3	11.5
Finish time	14:36	14:47	15:00	15:12	15:24	15:35	15:46
(Pr)	0.01	0.03	0.13	0.28	0.25	0.10	0.02

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

Calculation of Lugeon value

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

P1=	2.3	q1=	1.40
P2=	5.3	q2=	2.96
P3=	8.2	q3=	6.24
P4=	11.1	q4=	9.16
P5=	8.1	q5=	8.62
P6=	5.2	q6=	5.46
P7=	2.3	q7=	2.30



Lugeon value : (5.4) Lu'

Critical Pressure: 5.3 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. Hameed / Iqbal Inspected by :

GE2 - 127

Water Pressure Test

Hole No.: M98-19 Stage: 4/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 25/08/99

Ground elevation : EL. 488.720 m | Groundwater level (L_w): 17.5m | Gauge height (L_s): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.85 m | Depth of test section: GL. - (L_o)= 15 m to (L_e)= 20 m | Length of section (L_e) 5.00 m

Reading of flow meter

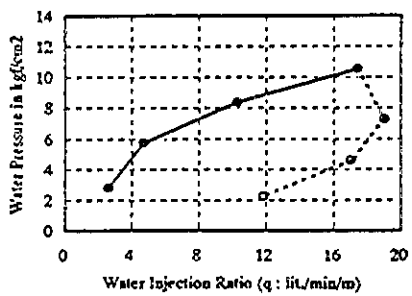
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	11:12	11:23	11:34	11:46	11:58	12:10	12:20
Q(min)	305	437	675	200	100	90	960
1	320	463	722	280	180	170	1,014
2	333	487	767	365	265	255	1,072
3	346	511	814	449	355	340	1,130
4	359	534	865	535	451	425	1,190
5	373	557	920	623	547	508	1,248
6	385	580	974	715	645	595	1,309
7	398	603	1,027	800	744	678	1,370
8	411	627	1,081	898	845	764	1,430
9	424	650	1,134	979	946	852	1,492
10	436	673	1,188	1,070	1,050	940	1,552
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	131	236	513	870	950	850	592
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	13.1	23.6	51.3	87.0	95.0	85.0	59.2
Finish time	11:22	11:33	11:44	11:56	12:08	12:20	12:30
(Pr)	0.03	0.10	0.47	1.32	1.57	1.26	0.62

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

Calculation of Lugeon value

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

P1=	2.8	q1=	2.62
P2=	5.7	q2=	4.72
P3=	8.4	q3=	10.26
P4=	10.5	q4=	17.40
P5=	7.3	q5=	19.00
P6=	4.6	q6=	17.00
P7=	2.2	q7=	11.84



Lugeon value : (7.8) Lu'

Critical Pressure: 7.0 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. Hameed Inspected by :

Water Pressure Test

Hole No.: M98-19 Stage: 5/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 26/08/99

Ground elevation : EL. 488.720 m | Groundwater level (L_1): 22.5 m | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.85 m | Depth of test section: GL. - (L_0)= 20 m to (L_0)= 25 m | Length of section (L_2): 5.00 m

Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 2	Po3 1	Po4	Po5	Po6	Po7
Start time	15:13	15:24	15:35				
0(min)	740	180	740				
1	825	310	843				
2	923	447	1,010				
3	1,023	590	1,125				
4	1,125	730	1,260				
5	1,230	875	1,400				
6	1,335	1,025	1,530				
7	1,442	1,185	1,650				
8	1,553	1,340	1,795				
9	1,665	1,500	1,955				
10	1,780	1,660	2,012				
11							
12							
13							
14							
15							
Total lit.	Qo1 1,040	Qo2 1,480	Qo3 1,272	Qo4	Qo5	Qo6	Qo7
Average lit./min	Qo1 104.0	Qo2 148.0	Qo3 127.2	Qo4	Qo5	Qo6	Qo7
Finish time	15:23	15:34	15:45				
(Pr)	2.36	4.73	3.51				

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

Calculation of Lugeon value

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

P1= 1.0 q1= 20.80

P2= q2=

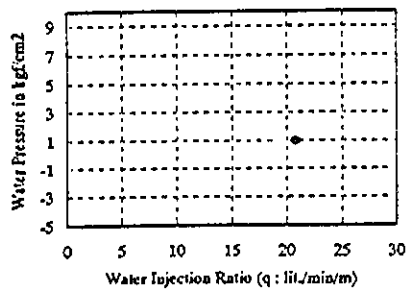
P3= q3=

P4= q4=

P5= q5=

P6= q6=

P7= q7=



Lugeon value : (214) Lu

Critical Pressure: >1.0 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. Hameed / Shakil Inspected by :

GE2 - 128

Water Pressure Test

Hole No.: M98-19 Stage: 6/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 28/08/99

Ground elevation : EL. 488.720 m | Groundwater level (L_1): 27.50 m | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.85 m | Depth of test section: GL. - (L_0)= 25 m to (L_0)= 30 m | Length of section (L_2): 5.00 m

Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 4	Po5 1	Po6	Po7
Start time	11:37	11:48	12:00	14:47	15:00		
0(min)	190	472	960	50	690		
1	216	513	1,037	110	723		
2	240	553	1,117	172	767		
3	255	593	1,205	232	812		
4	298	634	1,301	294	858		
5	315	676	1,429	355	902		
6	335	720	1,564	416	950		
7	359	764	1,704	474	996		
8	383	811	1,855	530	1,042		
9	405	854	2,011	588	1,098		
10	430	901	2,160	645	1,131		
11							
12							
13							
14							
15							
Total lit.	Qo1 240	Qo2 429	Qo3 1,200	Qo4 595	Qo5 451	Qo6	Qo7
Average lit./min	Qo1 24.0	Qo2 42.9	Qo3 120.0	Qo4 59.5	Qo5 45.1	Qo6	Qo7
Finish time	11:47	11:58	12:10	14:57	15:10		
(Pr)	0.16	0.49	3.75	0.94	0.55		

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

Calculation of Lugeon value

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

P1= 3.7 q1= 4.80

P2= 6.3 q2= 3.58

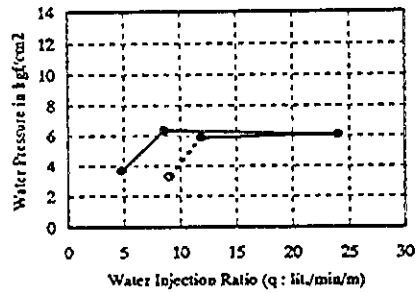
P3= 6.1 q3= 24.00

P4= 5.9 q4= 11.90

P5= 3.3 q5= 9.02

P6= q6=

P7= q7=



Lugeon value : (14) 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 : A. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-19 Stage: 7/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 29/08/99

Ground elevation : EL. 488.720 m | Groundwater level (L_w): 32.50 m | Gauge height (L_g): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.85 m | Depth of test section: GL. - (L_o)= 30 m to (L_e)= 35 m | Length of section (L_e) 5.00 m

Reading of flow meter

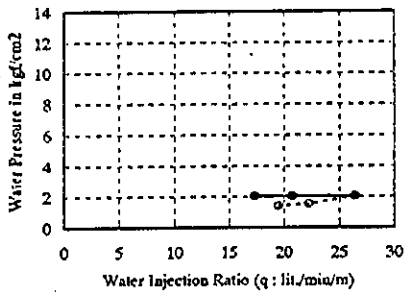
Gauge P. (kgf/cm2)	Po1 1	Po2 2	Po3 4	Po4 2	Po5 1	Po6	Po7
Start time	17:10	17:21	17:32	17:44	17:55		
0(min)	860	10	310	770	951		
1	945	108	440	881	1,049		
2	1,030	207	570	992	1,146		
3	1,128	309	700	1,103	1,244		
4	1,203	411	731	1,213	1,341		
5	1,287	513	965	1,324	1,439		
6	1,375	618	1,095	1,436	1,535		
7	1,462	725	1,236	1,547	1,633		
8	1,550	830	1,360	1,659	1,730		
9	1,638	939	1,494	1,770	1,828		
10	1,726	1,047	1,630	1,882	1,925		
11							
12							
13							
14							
15							
Total lit.	Qw1 866	Qw2 1,037	Qw3 1,320	Qw4 1,112	Qw5 974	Qw6 0	Qw7 0
Average lit/min	Qw1 86.6	Qw2 103.7	Qw3 132	Qw4 111.2	Qw5 97.4	Qw6 0	Qw7 0
Finish time	17:20	17:31	17:42	17:54	18:05	0:10	0:10
(Pr)	2.30	3.29	5.29	3.77	2.90	0.00	0.00

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

Calculation of Lugeon value

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

P1= 2.0 q1= 17.32
P2= 2.0 q2= 20.74
P3= 2.0 q3= 26.40
P4= 1.6 q4= 22.24
P5= 1.4 q5= 19.48
P6= q6=
P7= q7=



Lugeon value : (129) Lu

Critical Pressure: >2.0 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. Hameed Inspected by :

GE2 - 129

Water Pressure Test

Hole No.: M98-19 Stage: 8/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 1/9/99

Ground elevation : EL. 488.720 m | Groundwater level (L_w): 37.5 m | Gauge height (L_g): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_o)= 4.85 m | Depth of test section: GL. - (L_o)= 35 m to (L_e)= 40 m | Length of section (L_e) 5.00 m

Reading of flow meter

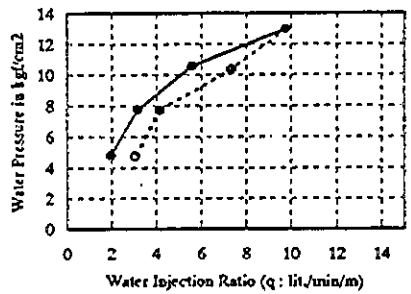
Gauge P. (kgf/cm)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	8:30	8:41	8:52	9:04	9:15	9:26	9:37
0(min)	864	970	150	470	2	380	595
1	874	986	178	519	37	399	609
2	885	1,002	206	568	73	418	623
3	895	1,018	234	617	110	438	638
4	904	1,034	262	665	146	459	654
5	914	1,050	290	713	183	481	669
6	923	1,065	317	762	221	503	685
7	933	1,081	345	811	258	524	701
8	943	1,097	373	860	295	544	716
9	953	1,113	401	909	333	565	732
10	962	1,129	429	958	369	587	747
11							
12							
13							
14							
15							
Total lit.	Qw1 98	Qw2 159	Qw3 279	Qw4 488	Qw5 367	Qw6 207	Qw7 152
Average lit/min	Qw1 9.8	Qw2 15.9	Qw3 27.9	Qw4 48.8	Qw5 36.7	Qw6 20.7	Qw7 15.2
Finish time	8:40	8:51	9:02	9:14	9:25	9:36	9:47
(Pr)	0.04	0.09	0.28	0.85	0.48	0.16	0.09

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

Calculation of Lugeon value

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

P1= 4.8 q1= 1.96
P2= 7.7 q2= 3.18
P3= 10.5 q3= 5.58
P4= 13.0 q4= 9.76
P5= 10.3 q5= 7.34
P6= 7.7 q6= 4.14
P7= 4.7 q7= 3.04



Lugeon value : 4.6 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. Hameed Inspected by :

Water Pressure Test

Hole No.: M98-19 Stage: 9/36

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 1/9/99

Ground elevation : EL. 488.720 m | Groundwater level (L_1): 42.50 m | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.85 m | Depth of test section: GL - (L_4)= 40 m to (L_5)= 45 m | Length of section (L_0) 5.00 m

Reading of flow meter

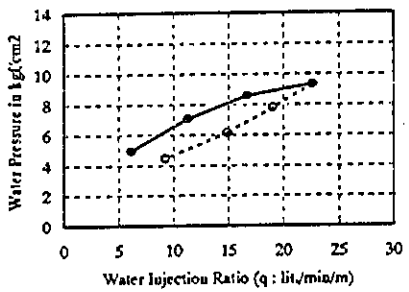
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	16:30	16:41	16:52	15:03	15:13	15:24	15:35
0(min)	320	670	273	130	311	341	117
1	351	726	356	247	406	416	163
2	381	782	439	355	502	490	208
3	412	839	522	467	595	566	254
4	442	895	606	580	689	639	301
5	473	951	689	693	784	713	347
6	504	1,008	773	807	879	789	394
7	534	1,064	856	920	975	863	439
8	565	1,121	940	1,032	1,069	936	486
9	595	1,177	1,023	1,146	1,164	1,010	532
10	627	1,234	1,107	1,259	1,260	1,085	579
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	307	564	834	1,129	949	744	462
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min.	30.7	56.4	83.4	112.9	94.9	74.4	46.2
Finish time	16:40	16:51	17:02	15:13	15:23	15:34	15:45
(Pr)	0.38	1.27	2.75	5.00	3.55	2.20	0.86

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

Calculation of Lugeon value

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

P1=	4.9	q1=	6.14
P2=	7.1	q2=	11.28
P3=	8.6	q3=	16.68
P4=	9.3	q4=	22.58
P5=	7.8	q5=	18.98
P6=	6.1	q6=	14.88
P7=	4.5	q7=	9.24



Lugeon value : (18) · 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. Hameed Inspected by : A. Fayaz

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Water Pressure Test

Hole No.: M98-19 Stage: 10/36

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 2/9/99

Ground elevation : EL. 488.720 m | Groundwater level (L_1): 47.50 m | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.85 m | Depth of test section: GL - (L_4)= 45 m to (L_5)= 50 m | Length of section (L_0) 5.00 m

Reading of flow meter

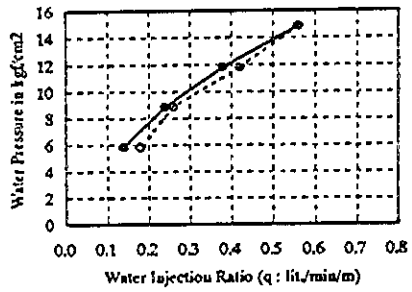
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	15:30	15:40	15:50	16:01	16:14	16:22	16:33
0(min)	730	737	750	771	800	822	836
1	731	738	752	774	802	823	837
2	732	739	754	777	804	824	838
3	732	740	756	780	806	826	839
4	733	741	758	783	808	827	840
5	734	742	760	785	811	828	840
6	734	744	762	787	813	830	841
7	735	745	763	791	815	831	842
8	736	746	765	794	817	832	843
9	736	747	767	797	819	833	844
10	737	749	769	799	821	835	845
11							
12							
13							
14							
15							
Total	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit.	7	12	19	28	21	13	9
Average	Qo1	Qo2	Qo3	Qo4	Qo5	Qo6	Qo7
lit./min	0.7	1.2	1.9	2.8	2.1	1.3	0.9
Finish time	15:40	15:50	16:00	16:11	16:24	16:32	16:43
(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)L1+L2)-Pr [kgf/cm2], q=Qo/L0 [lit/min/m]

P1=	5.8	q1=	0.14
P2=	8.8	q2=	0.24
P3=	11.8	q3=	0.38
P4=	14.8	q4=	0.56
P5=	11.8	q5=	0.42
P6=	8.8	q6=	0.26
P7=	5.8	q7=	0.18



Lugeon value : 0.3 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 : A. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-19 Stage: 11/36

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 3/9/99

Ground elevation : EL. 488.720 m | Groundwater level (Lw) GL.- 52.50 m | Gauge height (La): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 4.70 m | Depth of test section GL. - (La)= 50 m to (Lb)= 55 m | Length of section (L) 5.00 m

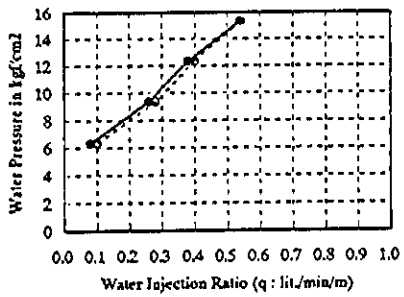
Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	12:30	12:40	12:51	13:10	13:21	13:31	13:41
Q(min)	710	715	730	751	780	801	816
1	710	715	732	754	782	803	816
2	710	717	734	756	784	804	816
3	711	718	736	759	786	805	817
4	711	719	738	762	788	807	817
5	711	721	740	764	790	809	818
6	712	722	742	767	792	810	818
7	712	723	744	770	794	811	819
8	713	725	746	772	796	813	819
9	713	726	747	775	798	814	820
10	714	728	749	778	800	815	821
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	4	13	19	27	20	14	5
Average lit./min	Qw1 0.4	Qw2 1.3	Qw3 1.9	Qw4 2.7	Qw5 2	Qw6 1.4	Qw7 0.5
Finish time	12:40	12:50	13:01	13:20	13:31	13:41	13:51
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Friction Loss (Pr) = pr(Lo + La) [kgf/cm2]							

Calculation of Lugeon value

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

P1=	6.3	q1=	0.08
P2=	9.3	q2=	0.26
P3=	12.3	q3=	0.38
P4=	15.3	q4=	0.54
P5=	12.3	q5=	0.40
P6=	9.3	q6=	0.28
P7=	6.3	q7=	0.10



Lugeon value : 0.3 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 : A. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-19 Stage: 12/36

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 4/9/99

Ground elevation : EL. 488.720 m | Groundwater level (Lw) GL.- 57.50 m | Gauge height (La): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lo)= 4.85 m | Depth of test section GL. - (La)= 55 m to (Lb)= 60 m | Length of section (L) 5.00 m

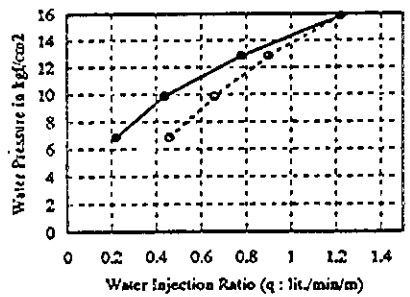
Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	8:20	8:30	8:40	8:50	9:00	9:10	9:20
Q(min)	680	715	760	820	883	929	963
1	681	717	763	826	888	932	965
2	682	719	767	832	892	936	967
3	683	722	771	838	897	939	970
4	684	724	775	844	901	942	972
5	685	726	779	850	906	946	974
6	686	729	783	857	910	949	977
7	687	731	787	863	915	952	979
8	689	733	791	869	919	956	981
9	690	735	795	875	924	959	984
10	691	737	799	881	928	962	986
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	11	22	39	61	45	33	23
Average lit./min	Qw1 1.1	Qw2 2.2	Qw3 3.9	Qw4 6.1	Qw5 4.5	Qw6 3.3	Qw7 2.3
Finish time	8:30	8:40	8:50	9:00	9:10	9:20	9:30
(Pr)	0.00	0.00	0.01	0.02	0.01	0.01	0.00
Friction Loss (Pr) = pr(Lo + La) [kgf/cm2]							

Calculation of Lugeon value

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

P1=	6.8	q1=	0.22
P2=	9.8	q2=	0.44
P3=	12.8	q3=	0.78
P4=	15.8	q4=	1.22
P5=	12.8	q5=	0.90
P6=	9.8	q6=	0.66
P7=	6.8	q7=	0.46



Lugeon value : 0.5 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. Hameed Inspected by : A. Fayaz

Water Pressure Test

Hole No.: M98-19 Stage: 13/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 5/9/99

Ground elevation : EL. 488.720 m | Groundwater level (Lo) GL.- 62.50 m | Gauge height (Lg): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lg)= 4.85 m | Depth of test section: GL.-(La)= 60 m to (Lb)= 65 m | Length of section (L): 5.00 m

Reading of flow meter

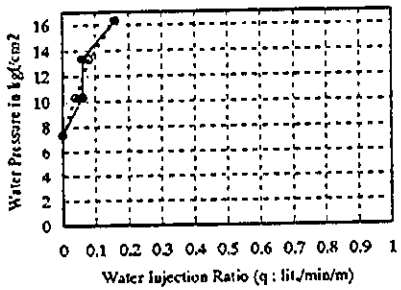
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	9:35	9:45	9:55	10:05	10:15	10:25	10:35
Q(min)	475	481	486	490	498	502	505
1	475	482	486	490	498	502	505
2	475	482	486	491	499	502	505
3	475	482	486	492	499	502	505
4	475	482	487	493	500	503	505
5	475	482	487	494	500	503	505
6	475	483	487	495	501	503	505
7	475	483	488	495	501	504	505
8	475	483	488	496	501	504	505
9	475	484	488	497	502	504	505
10	475	484	489	498	502	504	505
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	0	3	3	8	4	2	0
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0	0.3	0.3	0.8	0.4	0.2	0
Finish time	9:45	9:55	10:05	10:15	10:25	10:35	10:45
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1=	7.3	q1=	0.00
P2=	10.3	q2=	0.06
P3=	13.3	q3=	0.06
P4=	16.3	q4=	0.16
P5=	13.3	q5=	0.08
P6=	10.3	q6=	0.04
P7=	7.3	q7=	0.00



Lugeon value : 0.0 Lu

Critical Pressure: >16 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. Hameed Inspected by : A. Fayaz

GE2 - 132

Water Pressure Test

Hole No.: M98-19 Stage: 14/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 6/9/99

Ground elevation : EL. 488.720 m | Groundwater level (Lo) GL.- 67.50 m | Gauge height (Lg): 0.80 m

Pipe length from pressure gauge to borehole mouth: (Lg)= 4.85 m | Depth of test section: GL.-(La)= 65 m to (Lb)= 70 m | Length of section (L): 5.00 m

Reading of flow meter

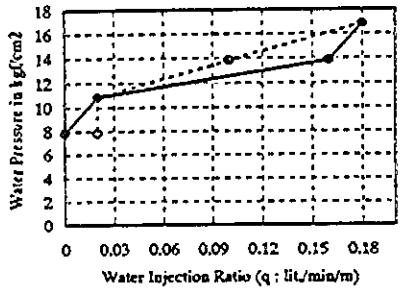
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	12:30	12:40	12:50	13:00	13:10	13:20	13:30
Q(min)	517	524	527	536	545	550	551
1	517	524	527	536	545	550	551
2	517	524	528	537	546	550	551
3	517	524	529	538	546	550	551
4	517	524	530	539	547	550	551
5	517	524	531	540	547	550	551
6	517	524	532	541	548	550	551
7	517	524	533	542	549	550	552
8	517	525	534	543	549	551	552
9	517	525	535	544	550	551	552
10	517	525	535	545	550	551	552
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	0.0	1.0	8.0	9.0	5.0	1.0	1.0
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.00	0.10	0.80	0.90	0.50	0.10	0.10
Finish time	12:40	12:50	13:00	13:10	13:20	13:30	13:40
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1=	7.8	q1=	0.00
P2=	10.8	q2=	0.02
P3=	13.8	q3=	0.16
P4=	16.8	q4=	0.18
P5=	13.8	q5=	0.10
P6=	10.8	q6=	0.02
P7=	7.8	q7=	0.02



Lugeon value : 0.0 Lu

Critical Pressure: >17 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 : Mashtaque Inspected by : A. Fayaz

Feasibility Test - 01
(Open End Constant Head Method)

Location: Munda Dam

Borehole No.: M98-20 Dia. of Borehole (2r): 90.0 m/m

Bottom of Borehole (GL.- h1): 2.0 m Bottom of Casing: 2.0 m

Groundwater Level (GL.- h2): Nill Constant Head Level (GL. + h3) 2.0 m

Test Record

Start Time: (10:45) Date: (15 /09/1999)

Time Elapsed (min.)	Reading of Flow Meter: Reading (m^3)	Reading of Flow Meter: Volume of Flow (cm^3)	Calculation
0	249.526	0	Calculation Formula $k = \frac{q}{5.5rH}$
1	249.532	6	k : Coefficient of Permeability (cm/sec)
2	249.538	6	r : Radius of Borehole (cm)
3	249.544	6	H: Water Head (cm) ;
4	249.550	6	when groundwater is Nill H=h1+h3
5	249.556	6	When there is groundwater H=h2-h3
6	249.562	6	q : Constant Injection Rate into Hole (cm3/sec)
7	249.569	7	
8	249.575	6	r = 4.5
9	249.581	6	H= 400
10	249.587	6	q= 98
11	249.594	7	k= 0.00993266
12	249.600	6	
13	249.605	5	
14	249.610	5	
15	249.616	6	
16	249.622	6	
17	249.627	5	
18	249.633	6	
19	249.638	5	
20	249.644	6	
Total	Q=	118 cm3	Permeability (k) =
Average	q =	5,900 cm3/min	9.93E-03 cm/sec
	=	98.33 cm3/sec	

Finish Time: (11:05)

Tested by: Mushtaq/Iqbal

Prepared by: A. Hamid

Inspected by: A. Fayaz

GE2 - 133

Feasibility Test - 02
(Open End Constant Head Method)

Location: Munda Dam

Borehole No.: M98-20 Dia. of Borehole (2r): 90.0 m/m

Bottom of Borehole (GL.- h1): 3.0 m Bottom of Casing: 3.10 m

Groundwater Level (GL.- h2): Nil Constant Head Level (GL. + h3 3.10 m

Test Record

Start Time: (12:05) Date: (15 /09/1999)

Time Elapsed (min.)	Reading of Flow Meter: Reading (m^3)	Reading of Flow Meter: Volume of Flow (cm^3)	Calculation
0	250.587	0	Calculation Formula $k = \frac{q}{5.5rH}$
1	250.590	3	k : Coefficient of Permeability (cm/sec)
2	250.592	2	r : Radius of Borehole (cm)
3	250.595	3	H: Water Head (cm) ;
4	250.598	3	when groundwater is Nill H=h1+h3
5	250.600	2	when there is groundwater H=h2-h3
6	250.603	3	q : Constant Injection Rate into Hole (cm3/sec)
7	250.606	3	
8	250.608	2	r = 4.5
9	250.611	3	H= 610
10	250.613	2	q= 44
11	250.616	3	k= 0.00292543
12	250.619	3	
13	250.621	2	
14	250.624	3	
15	250.627	3	
16	250.629	2	
17	250.632	3	
18	250.635	3	
19	250.637	2	
20	250.640	3	
Total	Q=	53 cm3	Permeability (k) =
Average	q =	2,650 cm3/min	2.93E-03 cm/sec
	=	44.167 cm3/sec	

Finish Time: (12:25)

Tested by: Mushtaq/Iqbal

Prepared by: A. Hamid

Inspected by: A. Fayaz

Water Pressure Test

Hole No.: M98-20 Stage: 2/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 16/09/99

Ground elevation : EL. 418.234 m | Groundwater level (L_1): 12.5 m | Gauge height (L_3): 0.77 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.85 m | Depth of test section: GL. - (L_2)= 5 m to (L_4)= 10 m | Length of section (L_5): 5.00 m

Reading of flow meter

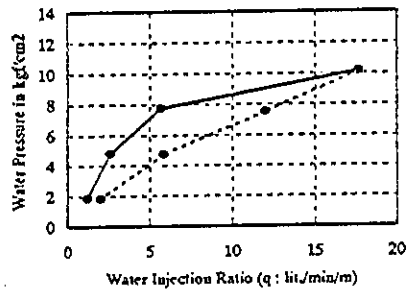
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	12:15	12:26	12:38	12:49	13:00	13:11	13:22
Q(min)	113	190	350	750	710	340	654
1	119	205	379	839	775	372	664
2	125	218	407	927	839	404	674
3	131	232	435	1,015	902	434	685
4	137	245	463	1,101	963	464	695
5	143	257	492	1,189	1,022	494	704
6	149	270	520	1,277	1,081	522	714
7	155	283	548	1,365	1,141	551	725
8	161	295	576	1,454	1,198	578	735
9	167	308	604	1,543	1,254	605	744
10	173	320	633	1,632	1,311	632	755
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	60	130	283	882	601	292	101
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	6.0	13.0	28.3	88.2	60.1	29.2	10.1
Finish time	12:25	12:36	12:48	12:59	13:10	13:21	13:32
(Pr)	0.00	0.02	0.07	0.68	0.32	0.08	0.01

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/L5 [lit/min/m]

P1=	1.8	q1=	1.20
P2=	4.8	q2=	2.60
P3=	7.8	q3=	5.66
P4=	10.2	q4=	17.64
P5=	7.5	q5=	12.02
P6=	4.8	q6=	5.84
P7=	1.8	q7=	2.02



Lugeon value : (5.0) Lu

Critical Pressure: 7.4 kgf/cm2 1.6613E-08

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. Hameed / Iqbal Inspected by :

GE2 - 134

Water Pressure Test

Hole No.: M98-20 Stage: 3/36

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

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

Friction Loss per meter (pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 18/09/99

Ground elevation : EL. 418.234 m | Groundwater level (L_1): 12.5 m | Gauge height (L_3): 0.81 m

Pipe length from pressure gauge to borehole mouth: (L_0)= 4.85 m | Depth of test section: GL. - (L_2)= 11 m to (L_4)= 15 m | Length of section (L_5): 4.00 m

Reading of flow meter

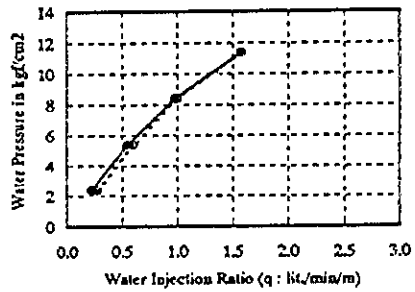
Gauge P.	Po1	Po2	Po3	Po4	Po5	Po6	Po7
(kgf/cm2)	1	4	7	10	7	4	1
Start time	15:15	15:26	15:37	15:48	15:59	16:10	16:20
Q(min)	61	71	95	140	204	246	270
1	62	73	99	147	208	248	271
2	63	75	103	153	212	251	272
3	64	78	107	160	216	253	273
4	65	80	111	166	220	256	275
5	65	82	115	172	224	258	276
6	66	84	118	179	228	261	277
7	67	87	122	185	232	263	278
8	68	89	126	191	236	266	279
9	69	91	130	197	240	268	280
10	70	93	134	203	244	270	281
11							
12							
13							
14							
15							
Total	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit.	9	22	39	63	40	24	11
Average	Qw1	Qw2	Qw3	Qw4	Qw5	Qw6	Qw7
lit./min	0.9	2.2	3.9	6.3	4.0	2.4	1.1
Finish time	15:25	15:36	15:47	15:58	16:09	16:20	16:30
(Pr)	0.00	0.00	0.00	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/L5 [lit/min/m]

P1=	2.4	q1=	0.23
P2=	5.4	q2=	0.55
P3=	8.4	q3=	0.98
P4=	11.4	q4=	1.58
P5=	8.4	q5=	1.00
P6=	5.4	q6=	0.60
P7=	2.4	q7=	0.28



Lugeon value : 1.4 Lu'

Critical Pressure: >11 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. Hameed / Iqbal Inspected by :

Water Pressure Test

Hole No.: M98-20 | Stage: 4/36

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ | Date : 21/09/99

Ground elevation : El. 418.234 m | Groundwater level (L_0): 17.5 m | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.85 m | Depth of test section: GL. - (L_1)= 15 m to (L_2)= 20 m | Length of section (L_3) 5.00 m

Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 8	Po5 7	Po6 4	Po7 1
Start time	10:00	10:11	10:22	10:33	10:44	10:55	11:06
Q(min)	315	440	780	275	18	570	940
1	326	472	832	350	73	608	957
2	337	504	882	425	127	644	972
3	348	536	929	497	181	680	989
4	358	569	975	569	235	716	1,000
5	368	599	1,021	641	289	753	1,023
6	378	631	1,068	712	344	789	1,039
7	388	662	1,114	783	398	825	1,055
8	399	693	1,160	855	452	861	1,072
9	409	725	1,206	926	506	898	1,088
10	419	756	1,253	998	561	934	1,105
11							
12							
13							
14							
15							
Total lit.	Qo1 104	Qo2 316	Qo3 473	Qo4 723	Qo5 543	Qo6 364	Qo7 165
Average lit./min	Qo1 10.4	Qo2 31.6	Qo3 47.3	Qo4 72.3	Qo5 54.3	Qo6 36.4	Qo7 16.5
Finish time	10:10	10:21	10:32	10:43	10:54	11:05	11:16
(Pf)	0.02	0.18	0.40	0.92	0.52	0.24	0.05

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

Calculation of Lugeon value

$P=P_0+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_m/L_3$ [lit/min/m]

P1= 2.8 q1= 2.08

P2= 5.7 q2= 6.32

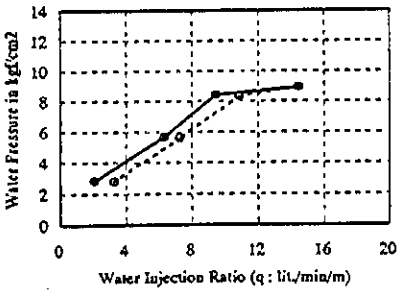
P3= 8.4 q3= 9.46

P4= 8.9 q4= 14.46

P5= 8.3 q5= 10.86

P6= 5.6 q6= 7.28

P7= 2.8 q7= 3.30



Lugeon value : (12) 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. Hameed | Inspected by :

GE2 - 135

Water Pressure Test

Hole No.: M98-20 | Stage: 5/36

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

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

Friction Loss per meter (p_f) : $1\times10^{-5}\times Q^{1.971}$ | Date : 22/09/99

Ground elevation : El. 418.234 m | Groundwater level (L_0): 22.5 m | Gauge height (L_3): 0.75 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.85 m | Depth of test section: GL. - (L_1)= 20 m to (L_2)= 25 m | Length of section (L_3) 5.00 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	14:56	15:07	15:19	15:30	15:42	15:53
Q(min)	700	858	200	777	473	27	384
1	714	890	251	844	522	60	400
2	728	921	301	911	571	94	417
3	743	950	351	977	622	128	435
4	757	980	400	1,043	672	163	453
5	770	1,010	449	1,107	720	197	472
6	784	1,039	499	1,172	769	230	490
7	797	1,068	547	1,236	817	264	508
8	811	1,096	594	1,302	867	298	527
9	824	1,124	643	1,365	914	331	545
10	837	1,152	690	1,429	964	364	563
11							
12							
13							
14							
15							
Total lit.	Qo1 137	Qo2 294	Qo3 490	Qo4 652	Qo5 491	Qo6 337	Qo7 179
Average lit./min	Qo1 13.7	Qo2 29.4	Qo3 49.0	Qo4 65.2	Qo5 49.1	Qo6 33.7	Qo7 17.9
Finish time	14:55	15:06	15:17	15:29	15:40	15:52	16:03
(Pf)	0.04	0.20	0.53	0.94	0.54	0.26	0.07

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

Calculation of Lugeon value

$P=P_0+0.1(\sin(a)L_1+L_2)-P_f$ [kgf/cm2], $q=Q_m/L_3$ [lit/min/m]

P1= 3.3 q1= 2.74

P2= 6.1 q2= 5.88

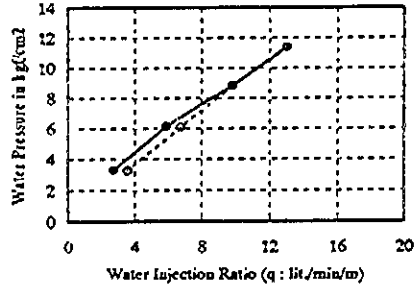
P3= 8.8 q3= 9.80

P4= 11.4 q4= 13.04

P5= 8.8 q5= 9.82

P6= 6.1 q6= 6.74

P7= 3.3 q7= 3.58



Lugeon value : 11 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. Hameed / Shakil | Inspected by :

Water Pressure Test

Hole No.: M98-20 Stage: 6/36

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

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

Friction Loss per meter (Pr) : $1\times10^{-5}\times Q^{1.971}$ Date : 31/09/99

Ground elevation : EL. 418.234 m | Groundwater level (L_1): 27.50 m | Gauge height (L_3): 0.80 m

Pipe length from pressure gauge to borehole mouth: (L_2)= 4.85 m | Depth of test section GL - (L_1)= 25 m to (L_2)= 30 m | Length of section (L_3) 5.00 m

Reading of flow meter

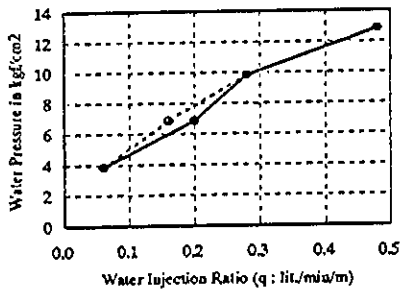
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	14:30	14:41	14:52	15:04	15:15	15:26	15:36
0(min)	262	270	281	298	323	337	345
1	262	271	282	300	324	338	345
2	262	272	284	303	326	339	345
3	262	273	285	305	327	339	346
4	263	274	286	308	328	340	346
5	263	275	288	310	330	341	346
6	263	276	289	313	331	342	347
7	264	277	291	315	332	343	347
8	264	278	292	317	334	343	347
9	265	279	293	320	335	344	347
10	265	280	295	322	337	345	348
11							
12							
13							
14							
15							
Total lit.	Qw1 3	Qw2 10	Qw3 14	Qw4 24	Qw5 14	Qw6 8	Qw7 3
Average lit./min	Qw1 0.3	Qw2 1.0	Qw3 1.4	Qw4 2.4	Qw5 1.4	Qw6 0.8	Qw7 0.3
Finish time	14:40	14:51	15:02	15:14	15:25	15:36	15:46
(Pr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Friction Loss (Pr) = pr(L_2 + L_3) [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=	3.8	q1=	0.06
P2=	6.8	q2=	0.20
P3=	9.8	q3=	0.28
P4=	12.8	q4=	0.48
P5=	9.8	q5=	0.28
P6=	6.8	q6=	0.16
P7=	3.8	q7=	0.06



Lugeon value : 0.3 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. Hameed / Iqbal Inspected by :

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Water Pressure Test

Hole No.: Qs-1 Stage: 1/10

Location: Sappare Quarry Site 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 : 13/January/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL- 0.30 m | Gauge height (L_3): 0.35 m

Pipe length from pressure gauge to hole mouth: (L_2)= 21.00 m | Depth of test section GL - (L_1)= 3 m to (L_2)= 8 m | Length of section (L_3) 5 m

Reading of flow meter

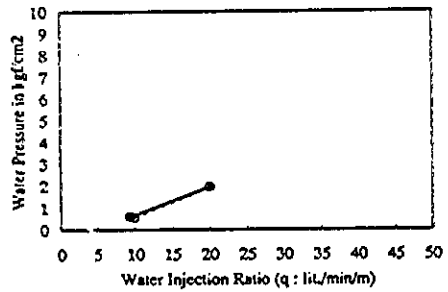
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 1	Po4	Po5	Po6	Po7
Start time	13:15	13:30	14:42				
0(min)	520	1,293	2,402				
1	570	1,390	2,450				
2	614	1,489	2,498				
3	660	1,591	2,545				
4	710	1,690	2,595				
5	754	1,791	2,644				
6	790	1,891	2,694				
7	846	1,992	2,746				
8	890	2,091	2,796				
9	937	2,193	2,845				
10	985	2,294	2,896				
11							
12							
13							
14							
15							
Total lit.	Qw1 465	Qw2 1,001	Qw3 494				
Average lit./min	Qw1 46.5	Qw2 100.1	Qw3 49.4				
Finish time	13:25	13:40	14:52				
(Pr)	0.47	2.11	0.52				

Friction Loss (Pr) = pr(L_2 + L_3) [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=	0.6	q1=	9.3
P2=	2.0	q2=	20.0
P3=	0.5	q3=	9.9
P4=		q4=	
P5=		q5=	
P6=		q6=	
P7=		q7=	



Lugeon value : (84) Lu'

Critical Pressure: >2.0 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 : Fafhat M. Shah Inspected by : M. Suga

Water Pressure Test

Hole No.: Qs-1 | Stage: 2/10

Location: Sappare Quarry Site | 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 : 14/January/1999

Ground elevation : EL. 528.24 m	Groundwater level (L1): GL.- 0.60 m	Gauge height (L3): 0.35 m
Pipe length from pressure gauge to hole mouth: (L0)= 20.65 m	Depth of test section GL.-(L1)= 5 m to (L2)= 10 m	Length of section (L3) 5 m

Reading of flow meter

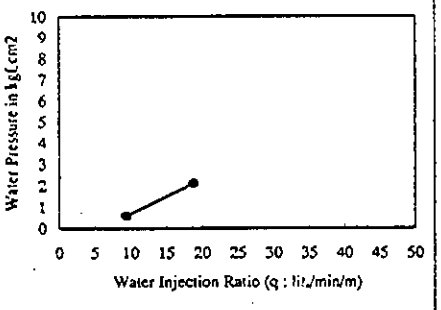
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 1	Pu4	Pu5	Pu6	Pu7
Start time	14:07	14:20	14:32				
Q(min)	3,835	4,415	5,522				
1	3,882	4,505	5,569				
2	3,927	4,595	5,616				
3	3,974	4,688	5,663				
4	4,020	4,781	5,710				
5	4,067	4,875	5,758				
6	4,114	4,970	5,806				
7	4,169	5,066	5,853				
8	4,206	5,162	5,900				
9	4,254	5,258	5,948				
10	4,303	5,354	5,996				
11							
12							
13							
14							
15							
Total lit.	Qw1 468	Qw2 939	Qw3 474				
Average lit./min	Qw1 46.8	Qw2 93.9	Qw3 47.4				
Finish time	14:17	14:30	14:42				
(Pf)	0.50	1.99	0.52				

Friction Loss (Pf) = pf(L0 + L1) [kgf/cm2]

Calculation of Lugeon value

P=P0+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 0.6 q1= 9.4
P2= 2.1 q2= 18.8
P3= 0.6 q3= 9.5
P4= q4=
P5= q5=
P6= q6=
P7= q7=



Lugeon value : (68) Lu'

Critical Pressure: >2.1 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 : Fafhat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Qs-1 | Stage: 3/10

Location: Sappare Quarry Site | 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 : 01/February/1999

Ground elevation : EL. 528.24 m	Groundwater level (L1): GL.- 0.30 m	Gauge height (L3): 0.30 m
Pipe length from pressure gauge to hole mouth: (L0)= 21.30 m	Depth of test section GL.-(L1)= 10 m to (L2)= 15 m	Length of section (L3) 5 m

Reading of flow meter

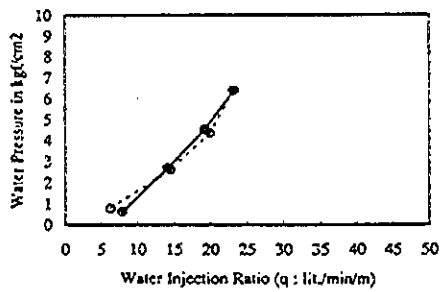
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	17:15	17:27	17:51	18:03	18:14	18:25	18:37
Q(min)	5,000	5,525	6,485	7,580	8,805	9,865	10,625
1	5,044	5,590	6,572	7,605	8,929	9,948	10,642
2	5,088	5,660	6,678	7,815	9,020	10,010	10,666
3	5,125	5,731	6,766	7,937	9,120	10,080	10,696
4	5,163	5,805	6,860	8,043	9,220	10,154	10,732
5	5,202	5,876	6,960	8,160	9,316	10,227	10,766
6	5,244	5,944	7,058	8,270	9,410	10,292	10,801
7	5,288	6,015	7,153	8,382	9,510	10,370	10,836
8	5,320	6,085	7,250	8,505	9,607	10,444	10,870
9	5,354	6,156	7,349	8,623	9,700	10,516	10,906
10	5,394	6,230	7,447	8,740	9,801	10,590	10,940
11							
12							
13							
14							
15							
Total lit.	Qw1 394	Qw2 705	Qw3 962	Qw4 1,160	Qw5 996	Qw6 725	Qw7 315
Average lit./min	Qw1 39.4	Qw2 70.5	Qw3 96.2	Qw4 116	Qw5 99.6	Qw6 72.5	Qw7 31.5
Finish time	17:25	17:37	18:01	18:13	18:24	18:35	18:47
(Pf)	0.44	1.38	2.55	3.68	2.73	1.46	0.28

Friction Loss (Pf) = pf(L0 + L1) [kgf/cm2]

Calculation of Lugeon value

P=P0+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 0.6 q1= 7.9
P2= 2.7 q2= 14.1
P3= 4.5 q3= 19.2
P4= 6.4 q4= 23.2
P5= 4.3 q5= 19.9
P6= 2.6 q6= 14.5
P7= 0.8 q7= 6.3



Lugeon value : (33) 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 : Fafhat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Qs-1 | Stage: 4/10

Location: Sappare Quarry Site | 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 : 03/February/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL- 0.30 m | Gauge height (L_3): 0.35 m

Pipe length from pressure gauge to hole mouth: (L_0)= 21.40 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

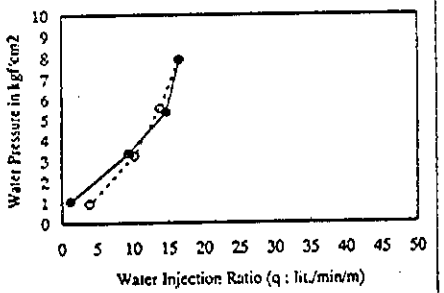
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	15:21	15:32	15:43	15:55	16:08	16:19	16:30
0(min)	10,967	11,043	11,540	12,353	13,218	13,933	14,450
1	10,976	11,089	11,600	12,443	13,284	13,983	14,460
2	10,982	11,133	11,678	12,527	13,353	14,034	14,472
3	10,987	11,180	11,754	12,615	13,420	14,085	14,486
4	10,993	11,226	11,827	12,690	13,490	14,135	14,500
5	10,999	11,275	11,900	12,780	13,560	14,182	14,515
6	11,005	11,320	11,976	12,857	13,630	14,238	14,535
7	11,010	11,368	12,048	12,930	13,700	14,292	14,560
8	11,016	11,416	12,124	13,015	13,768	14,342	14,590
9	11,022	11,453	12,197	13,094	13,838	14,392	14,618
10	11,027	11,512	12,270	13,178	13,907	14,442	14,645
11							
12							
13							
14							
15							
Total lit.	Qw1 60	Qw2 469	Qw3 730	Qw4 825	Qw5 689	Qw6 509	Qw7 195
Average lit/min	Qw1 6	Qw2 46.9	Qw3 73	Qw4 82.5	Qw5 68.9	Qw6 50.9	Qw7 19.5
Finish time	15:31	15:42	15:53	16:05	16:18	16:29	16:40
(Pr)	0.01	0.72	1.72	2.19	1.53	0.84	0.13

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	1.1	q1=	1.2
P2=	3.3	q2=	9.4
P3=	5.3	q3=	14.6
P4=	7.9	q4=	16.5
P5=	5.5	q5=	13.8
P6=	3.2	q6=	10.2
P7=	0.9	q7=	3.9



Lugeon value : (29) Lu'

Critical Pressure: >7.9 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 : Fathat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Qs-1 | Stage: 5/10

Location: Sappare Quarry Site | 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 : 05/February/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL- 0.30 m | Gauge height (L_3): 0.40 m

Pipe length from pressure gauge to hole mouth: (L_0)= 21.50 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

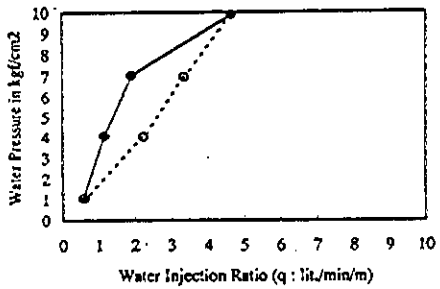
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:32	12:44	12:55	13:00	13:17	13:28	13:39
0(min)	14,674	14,715	14,780	14,880	15,128	15,310	15,425
1	14,678	14,722	14,793	14,901	15,146	15,333	15,427
2	14,682	14,728	14,803	14,920	15,164	15,344	15,430
3	14,685	14,734	14,812	14,943	15,181	15,354	15,433
4	14,688	14,740	14,822	14,967	15,198	15,364	15,436
5	14,691	14,745	14,830	14,992	15,215	15,374	15,439
6	14,693	14,751	14,839	15,017	15,232	15,384	15,443
7	14,695	14,756	14,848	15,040	15,248	15,394	15,446
8	14,697	14,761	14,857	15,065	15,264	15,403	15,448
9	14,700	14,767	14,867	15,089	15,280	15,413	15,452
10	14,702	14,773	14,876	15,113	15,296	15,422	15,455
11							
12							
13							
14							
15							
Total lit.	Qw1 28	Qw2 58	Qw3 96	Qw4 233	Qw5 168	Qw6 112	Qw7 30
Average lit/min	Qw1 2.8	Qw2 5.8	Qw3 9.6	Qw4 23.3	Qw5 16.8	Qw6 11.2	Qw7 3
Finish time	12:42	12:54	13:05	13:10	13:27	13:38	13:49
(Pr)	0.00	0.01	0.04	0.21	0.11	0.05	0.00

Friction Loss (Pr) = pr(Lo + L3) [kgf/cm2]

Calculation of Lugeon value

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

P1=	1.1	q1=	0.6
P2=	4.1	q2=	1.2
P3=	7.0	q3=	1.9
P4=	9.9	q4=	4.7
P5=	7.0	q5=	3.4
P6=	4.0	q6=	2.2
P7=	1.1	q7=	0.6



Lugeon value : (2.6) 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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Qs-1 | Stage: 6/10

Location: Sappare Quarry Site | 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 : 06/February/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL.- 0.20 m | Gauge height (L_3): 0.40 m

Pipe length from pressure gauge to hole mouth: (L_2)= 8.50 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

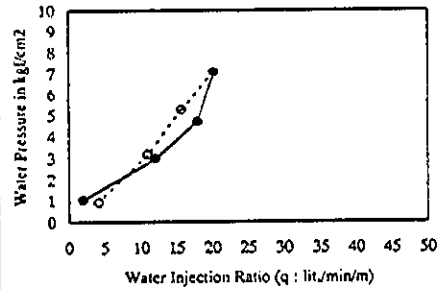
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:57	17:08	17:19	17:30	17:41	17:52	18:03
0(min)	15,512	15,658	16,305	17,270	18,305	19,123	19,690
1	15,522	15,710	16,295	17,280	18,384	19,180	19,709
2	15,533	15,769	16,485	17,488	18,463	19,236	19,728
3	15,543	15,826	16,575	17,589	18,542	19,294	19,748
4	15,552	15,888	16,665	17,688	18,622	19,350	19,768
5	15,562	15,950	16,755	17,785	18,700	19,406	19,788
6	15,572	16,012	16,845	17,885	18,776	19,466	19,810
7	15,580	16,074	16,935	17,990	18,856	19,519	19,832
8	15,590	16,135	17,024	18,083	18,934	19,570	19,854
9	15,600	16,197	17,113	18,183	19,014	19,620	19,875
10	15,610	16,260	17,203	18,282	19,090	19,670	19,897
11							
12							
13							
14							
15							
Total lit.	Qu1 98	Qu2 602	Qu3 898	Qu4 1,012	Qu5 785	Qu6 547	Qu7 207
Average lit./min	Qu1 9.8	Qu2 60.2	Qu3 89.8	Qu4 101.2	Qu5 78.5	Qu6 54.7	Qu7 20.7
Finish time	17:07	17:18	17:29	17:40	17:51	18:02	18:13
(Pv)	0.03	1.08	2.38	3.01	1.82	0.90	0.13

Friction Loss (Pf) = pf(L2 + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L2+L3)-Pf [kgf/cm2], q=Qu/L5 [lit/min/m]

P1= 1.0 q1= 2.0
P2= 3.0 q2= 12.0
P3= 4.7 q3= 18.0
P4= 7.0 q4= 20.2
P5= 5.2 q5= 15.7
P6= 3.2 q6= 10.9
P7= 0.9 q7= 4.1



Lugeon value : (36) Lu'

Critical Pressure: >7.0 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 : Fathat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Qs-1 | Stage: 7/10

Location: Sappare Quarry Site | 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 : 08/February/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL.- 0.20 m | Gauge height (L_3): 0.35 m

Pipe length from pressure gauge to hole mouth: (L_2)= 8.33 m | Depth of test section GL.-(L_4)= 30 m to (L_5)= 35 m | Length of section (L_6) 5 m

Reading of flow meter

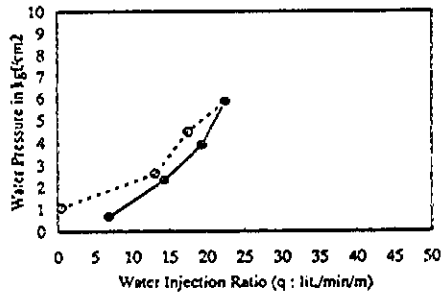
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:01	12:12	12:24	12:35	12:46	12:57	13:08
0(min)	19,923	20,292	21,150	22,280	23,448	24,365	25,026
1	19,959	20,367	21,250	22,372	23,538	24,428	25,027
2	19,993	20,438	21,345	22,516	23,625	24,492	25,028
3	20,024	20,510	21,442	22,620	23,715	24,558	25,030
4	20,063	20,578	21,538	22,738	23,814	24,624	25,032
5	20,096	20,650	21,634	22,848	23,892	24,689	25,034
6	20,129	20,722	21,732	22,959	23,980	24,755	25,037
7	20,163	20,793	21,828	23,073	24,066	24,821	25,042
8	20,197	20,864	21,923	23,182	24,155	24,886	25,045
9	20,231	20,934	22,020	23,292	24,240	24,952	25,048
10	20,267	21,007	22,118	23,401	24,325	25,018	25,052
11							
12							
13							
14							
15							
Total lit.	Qu1 344	Qu2 715	Qu3 968	Qu4 1,121	Qu5 877	Qu6 653	Qu7 26
Average lit./min	Qu1 34.4	Qu2 71.5	Qu3 96.8	Qu4 112.1	Qu5 87.7	Qu6 65.3	Qu7 2.6
Finish time	12:11	12:22	12:34	12:45	12:56	13:07	13:18
(Pv)	0.41	1.74	3.16	4.21	2.60	1.45	0.00

Friction Loss (Pf) = pf(L2 + L4) [kgf/cm2]

Calculation of Lugeon value

P=Pu+0.1(sin(a)L2+L3)-Pf [kgf/cm2], q=Qu/L5 [lit/min/m]

P1= 0.6 q1= 6.9
P2= 2.3 q2= 14.3
P3= 3.9 q3= 19.4
P4= 5.8 q4= 22.4
P5= 4.5 q5= 17.5
P6= 2.6 q6= 13.1
P7= 1.1 q7= 0.5



Lugeon value : (43) Lu'

Critical Pressure: >5.8 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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Qs-1 | Stage: 8/10

Location: Sappare Quarry Site | 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 : 09/February/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL.- 0.30 m | Gauge height (L_2): 0.33 m

Pipe length from pressure gauge to hole mouth: (L_0)= 7.77 m | Depth of test section: GL.-(L_1)= 35 m to (L_2)= 40 m | Length of section (L_3) 5 m

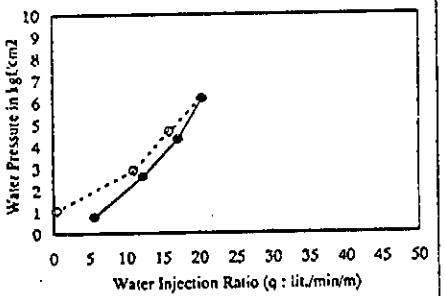
Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	13:00	13:11	13:22	13:33	13:44	13:55	14:06
0(min)	25,058	25,363	26,056	27,010	28,115	28,930	28,503
1	25,090	25,425	26,142	27,116	28,194	28,983	28,505
2	25,118	25,486	26,228	27,221	28,275	29,040	28,508
3	25,146	25,547	26,316	27,325	28,355	29,093	28,511
4	25,173	25,610	26,390	27,429	28,435	29,147	28,514
5	25,200	25,671	26,485	27,532	28,514	29,212	28,516
6	25,228	25,732	26,570	27,634	28,592	29,266	28,518
7	25,256	25,794	26,656	27,735	28,673	29,320	28,520
8	25,283	25,857	26,740	27,833	28,753	29,373	28,522
9	25,311	25,916	26,825	27,931	28,832	29,427	28,524
10	25,338	25,977	26,910	28,030	28,910	29,481	28,526
11							
12							
13							
14							
15							
Total lit.	Qw1 280	Qw2 614	Qw3 854	Qw4 1,020	Qw5 795	Qw6 551	Qw7 23
Average lit./min	Qw1 28	Qw2 61.4	Qw3 85.4	Qw4 102	Qw5 79.5	Qw6 55.1	Qw7 2.3
Finish time	13:10	13:21	13:32	13:43	13:54	14:05	14:16
(Pr)	0.31	1.44	2.75	3.90	2.39	1.16	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

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

P1= 0.8 q1= 5.6
P2= 2.6 q2= 12.3
P3= 4.3 q3= 17.1
P4= 6.2 q4= 20.4
P5= 4.7 q5= 15.9
P6= 2.9 q6= 11.0
P7= 1.1 q7= 0.5



Lugeon value : (35) Lu'

Critical Pressure: >6.2 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 : Fathat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Qs-1 | Stage: 9/10

Location: Sappare Quarry Site | 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 : 14/February/1999

Ground elevation : EL. 528.24 m | Groundwater level (L_1): GL.- 0.25 m | Gauge height (L_2): 0.35 m

Pipe length from pressure gauge to hole mouth: (L_0)= 14.00 m | Depth of test section: GL.-(L_1)= 40 m to (L_2)= 45 m | Length of section (L_3) 5 m

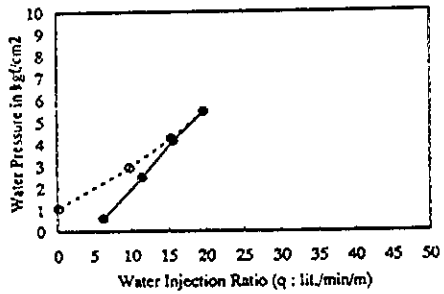
Reading of flow meter

Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	10:55	11:06	11:17	11:28	11:39	11:50	12:01
0(min)	29,560	29,921	30,567	31,446	32,473	33,283	33,787
1	29,591	29,981	30,645	31,547	32,552	33,335	33,787
2	29,623	30,040	30,721	31,648	32,630	33,385	33,788
3	29,655	30,098	30,798	31,747	32,705	33,433	33,789
4	29,686	30,156	30,877	31,843	32,782	33,483	33,790
5	29,718	30,213	30,956	31,942	32,860	33,531	33,790
6	29,749	30,273	31,035	32,040	32,937	33,580	33,791
7	29,780	30,330	31,114	32,140	33,012	33,628	33,792
8	29,810	30,385	31,191	32,236	33,090	33,676	33,793
9	29,840	30,440	31,271	32,334	33,165	33,724	33,793
10	29,870	30,494	31,350	32,432	33,242	33,772	33,794
11							
12							
13							
14							
15							
Total lit.	Qw1 310	Qw2 573	Qw3 783	Qw4 986	Qw5 770	Qw6 489	Qw7 7
Average lit./min	Qw1 31	Qw2 57.3	Qw3 78.3	Qw4 98.6	Qw5 77	Qw6 48.9	Qw7 0.7
Finish time	11:05	11:16	11:27	11:38	11:49	12:00	12:11
(Pr)	0.47	1.58	2.93	4.61	2.83	1.16	0.00
Friction Loss (Pr) = pr(Lo + L2) [kgf/cm2]							

Calculation of Lugeon value

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

P1= 0.6 q1= 6.2
P2= 2.5 q2= 11.5
P3= 4.1 q3= 15.7
P4= 5.4 q4= 19.7
P5= 4.2 q5= 15.4
P6= 2.9 q6= 9.8
P7= 1.1 q7= 0.1



Lugeon value : (32) 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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Os-1 | Stage: 10/10
Location: Sappare Quarry Site | 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 : 15/February/1999

Ground elevation : EL. 528.24 m	Groundwater level (L_1): GL- 0.30 m	Gauge height (L_2): 0.35 m
Pipe length from pressure gauge to hole mouth: (L_0)= 13.47 m	Depth of test section GL - (L_0)= 45 m to (L_0)= 50 m	Length of section (L_0) 5 m

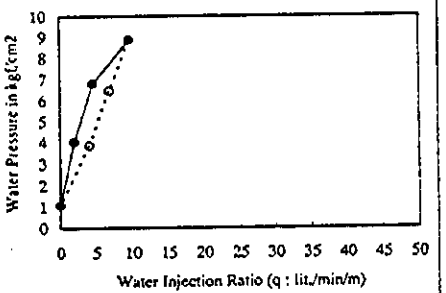
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	14:00	14:10	14:21	14:32	14:43	14:54	15:07
0(min)	33,799	33,799	33,905	34,186	34,708	35,062	35,284
1	33,799	33,811	33,926	34,232	34,743	35,080	35,284
2	33,799	33,821	33,948	34,279	34,778	35,100	35,284
3	33,799	33,830	33,971	34,327	34,813	35,121	35,284
4	33,799	33,840	33,994	34,375	34,848	35,142	35,284
5	33,799	33,850	34,017	34,424	34,883	35,163	35,284
6	33,799	33,859	34,040	34,472	34,918	35,183	35,284
7	33,799	33,868	34,063	34,521	34,953	35,204	35,284
8	33,799	33,876	34,085	34,570	34,987	35,225	35,284
9	33,799	33,887	34,109	34,618	35,020	35,246	35,284
10	33,799	33,897	34,133	34,667	35,052	35,267	35,284
11							
12							
13							
14							
15							
Total lit.	Qw1 0	Qw2 98	Qw3 228	Qw4 481	Qw5 344	Qw6 205	Qw7 0
Average lit./min	Qw1 0	Qw2 9.8	Qw3 22.8	Qw4 48.1	Qw5 34.4	Qw6 20.5	Qw7 0
Finish time	14:10	14:20	14:31	14:42	14:53	15:04	15:17
(Pr)	0.00	0.05	0.28	1.21	0.63	0.23	0.00
Friction Loss (Pr) = pr(Lo + L1) [kgf/cm2]							

Calculation of Lugeon value

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

P1= 1.1 q1= 0.0
P2= 4.0 q2= 2.0
P3= 6.8 q3= 4.6
P4= 8.9 q4= 9.6
P5= 6.4 q5= 6.9
P6= 3.8 q6= 4.1
P7= 1.1 q7= 0.0



Lugeon value : (7.1) 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 : Fathat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Os-2 | Stage: 1/19
Location: Sappare Quarry Site | 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 : 28/February/1999

Ground elevation : EL. 513.37 m	Groundwater level (L_1): Nil	Gauge height (L_2): 0.29 m
Pipe length from pressure gauge to hole mouth: (L_0)= 10.30 m	Depth of test section GL - (L_0)= 3.5 m to (L_0)= 10 m	Length of section (L_0) 6.5 m

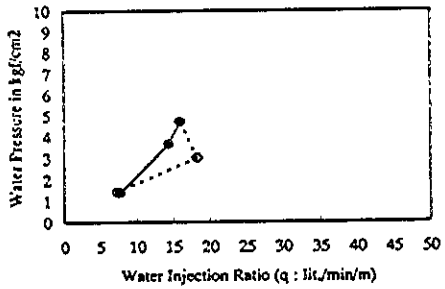
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 5.3	Pu4 4	Pu5 1	Pu6	Pu7
Start time	16:15	16:26	16:37	16:48	16:59		
0(min)	35,320	35,980	36,990	38,220	39,431		
1	35,372	36,080	37,100	38,333	39,479		
2	35,423	36,170	37,210	38,457	39,528		
3	35,474	36,270	37,320	38,577	39,575		
4	35,523	36,360	37,435	38,700	39,619		
5	35,575	36,455	37,450	38,822	39,661		
6	35,624	36,545	37,550	38,940	39,710		
7	35,674	36,638	37,670	39,055	39,756		
8	35,723	36,731	37,787	39,176	39,805		
9	35,772	36,825	37,910	39,293	39,856		
10	35,822	36,916	38,030	39,410	39,907		
11							
12							
13							
14							
15							
Total lit.	Qw1 502	Qw2 936	Qw3 1,040	Qw4 1,190	Qw5 476		
Average lit./min	Qw1 50.2	Qw2 93.6	Qw3 104	Qw4 119	Qw5 47.6		
Finish time	16:25	16:36	16:47	16:58	17:09		
(Pr)	0.31	1.06	1.31	1.71	0.28		
Friction Loss (Pr) = pr(Lo + L1) [kgf/cm2]							

Calculation of Lugeon value

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

P1= 1.4 q1= 7.7
P2= 3.6 q2= 14.4
P3= 4.7 q3= 16.0
P4= 3.0 q4= 18.3
P5= 1.4 q5= 7.3
P6= q6=
P7= q7=



Lugeon value : (33) Lu'
Critical Pressure: >4.7 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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Os-2 | Stage: 2/19
Location: Sappare Quarry Site | Dia. of Hole: 76 m/m
Hole Inclination (a): 90 degrees | Packer Type: Mechanical
Friction Loss per meter (Pf) : $1\times10^{-6}\times Q^{1.971}$ | Date : 01/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_w): Nil | Gauge height (L_3): 0.35 m
Pipe length from pressure gauge to hole mouth: (L_0)= 9.80 m | Depth of test section GL - (L_0)= 10 m to (L_2)= 15 m | Length of section (L_0) 5 m

Reading of flow meter

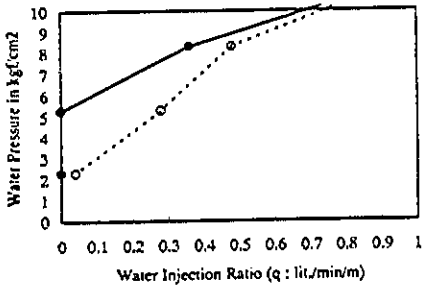
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	18:29	18:40	18:51	19:01	19:11	19:21	19:31
0(min)	39,922	39,922	39,923	39,949	39,998	40,023	40,038
1	39,922	39,922	39,924	39,953	40,000	40,024	40,038
2	39,922	39,922	39,925	39,958	40,003	40,026	40,038
3	39,922	39,922	39,926	39,963	40,005	40,027	40,039
4	39,922	39,922	39,927	39,968	40,008	40,029	40,039
5	39,922	39,922	39,929	39,972	40,010	40,031	40,039
6	39,922	39,922	39,931	39,977	40,013	40,032	40,039
7	39,922	39,922	39,933	39,982	40,015	40,033	40,039
8	39,922	39,922	39,936	39,987	40,017	40,035	40,039
9	39,922	39,922	39,938	39,992	40,019	40,036	40,040
10	39,922	39,922	39,941	39,996	40,022	40,037	40,040
11							
12							
13							
14							
15							
Total lit.	Qw1 0	Qw2 0	Qw3 18	Qw4 47	Qw5 24	Qw6 14	Qw7 2
Average lit./min	Qw1 0	Qw2 0	Qw3 1.8	Qw4 4.7	Qw5 2.4	Qw6 1.4	Qw7 0.2
Finish time	18:39	18:50	19:01	19:11	19:21	19:31	19:41
(Pf)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Calculation of Lugeon value

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

P1= 2.3 q1= 0.0
P2= 5.3 q2= 0.0
P3= 8.3 q3= 0.4
P4= 11.3 q4= 0.9
P5= 8.3 q5= 0.5
P6= 5.3 q6= 0.3
P7= 2.3 q7= 0.0



Lugeon value : (0.0) Lu'
Critical Pressure: 5.3 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 : Fafhat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Os-2 | Stage: 3/19
Location: Sappare Quarry Site | Dia. of Hole: 76 m/m
Hole Inclination (a): 90 degrees | Packer Type: Mechanical
Friction Loss per meter (Pf) : $1\times10^{-6}\times Q^{1.971}$ | Date : 03/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_w): Nil | Gauge height (L_3): 0.30 m
Pipe length from pressure gauge to hole mouth: (L_0)= 9.40 m | Depth of test section GL - (L_0)= 15 m to (L_2)= 20 m | Length of section (L_0) 5 m

Reading of flow meter

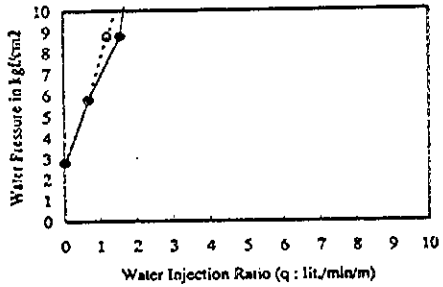
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:00	11:11	11:21	11:31	11:41	11:51	12:01
0(min)	40,056	40,066	40,105	40,192	40,286	40,349	40,387
1	40,057	40,069	40,113	40,200	40,293	40,353	40,387
2	40,058	40,074	40,120	40,210	40,299	40,356	40,387
3	40,058	40,075	40,128	40,220	40,306	40,360	40,387
4	40,058	40,079	40,136	40,230	40,312	40,363	40,387
5	40,058	40,082	40,143	40,239	40,317	40,367	40,387
6	40,058	40,086	40,152	40,248	40,323	40,371	40,387
7	40,058	40,089	40,160	40,257	40,329	40,375	40,387
8	40,058	40,093	40,168	40,266	40,335	40,378	40,387
9	40,058	40,097	40,176	40,275	40,341	40,381	40,387
10	40,058	40,100	40,184	40,283	40,347	40,384	40,387
11							
12							
13							
14							
15							
Total lit.	Qw1 2	Qw2 34	Qw3 79	Qw4 91	Qw5 61	Qw6 35	Qw7 0
Average lit./min	Qw1 0.2	Qw2 3.4	Qw3 7.9	Qw4 9.1	Qw5 6.1	Qw6 3.5	Qw7 0
Finish time	11:10	11:21	11:31	11:41	11:51	12:01	12:11
(Pf)	0.00	0.00	0.01	0.02	0.01	0.00	0.00

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

Calculation of Lugeon value

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

P1= 2.8 q1= 0.0
P2= 5.8 q2= 0.7
P3= 8.8 q3= 1.6
P4= 11.8 q4= 1.8
P5= 8.8 q5= 1.2
P6= 5.8 q6= 0.7
P7= 2.8 q7= 0.0



Lugeon value : 1.9 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 : Fafhat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Os-2 Stage: 4/19

Location: Sappare Quarry Site 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 : 04/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_4): Nil | Gauge height (L_5): 0.30 m

Pipe length from pressure gauge to hole mouth: (L_6)= 9.20 m | Depth of test section: GL. - (L_0)= 20 m to (L_2)= 25 m | Length of section (L_3) 5 m

Reading of flow meter

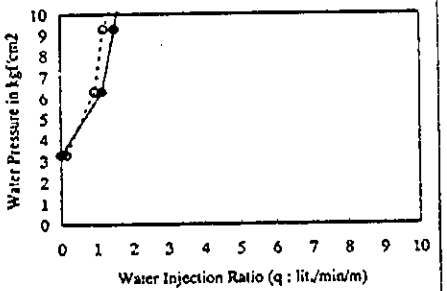
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	10:30	10:41	10:51	11:01	11:11	11:21	11:31
0(min)	40,421	40,424	40,491	40,571	40,669	40,733	40,783
1	40,421	40,430	40,498	40,579	40,671	40,738	40,784
2	40,421	40,436	40,506	40,587	40,678	40,743	40,785
3	40,421	40,442	40,514	40,596	40,684	40,748	40,786
4	40,421	40,447	40,522	40,604	40,691	40,752	40,786
5	40,421	40,452	40,529	40,614	40,698	40,756	40,787
6	40,421	40,458	40,536	40,623	40,704	40,761	40,787
7	40,421	40,464	40,544	40,632	40,710	40,765	40,788
8	40,421	40,469	40,551	40,641	40,716	40,770	40,788
9	40,421	40,475	40,558	40,651	40,723	40,775	40,789
10	40,421	40,481	40,566	40,661	40,729	40,780	40,790
11							
12							
13							
14							
15							
Total lit.	Qw1 0	Qw2 57	Qw3 75	Qw4 90	Qw5 60	Qw6 47	Qw7 7
Average lit./min	Qw1 0	Qw2 5.7	Qw3 7.5	Qw4 9	Qw5 6	Qw6 4.7	Qw7 0.7
Finish time	10:40	10:51	11:01	11:11	11:21	11:31	11:41
(Pf)	0.00	0.01	0.02	0.02	0.01	0.01	0.00

Friction Loss (Pf) = pf(L2 - L4) [kgf/cm2]

Calculation of Lugeon value

P=P0+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 3.3 q1= 0.0
P2= 6.3 q2= 1.1
P3= 9.3 q3= 1.5
P4= 12.3 q4= 1.8
P5= 9.3 q5= 1.2
P6= 6.3 q6= 0.9
P7= 3.3 q7= 0.1



Lugeon value : 1.6 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

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Water Pressure Test

Hole No.: Os-2 Stage: 5/19

Location: Sappare Quarry Site 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 : 04/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_4): Nil | Gauge height (L_5): 0.30 m

Pipe length from pressure gauge to hole mouth: (L_6)= 9.65 m | Depth of test section: GL. - (L_0)= 25 m to (L_2)= 30 m | Length of section (L_3) 5 m

Reading of flow meter

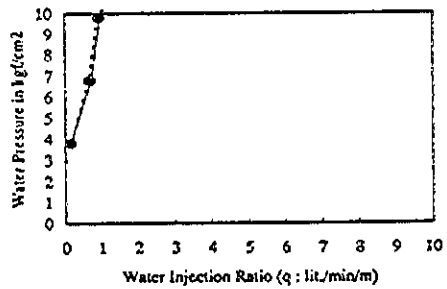
Gauge P. (kgf/cm2)	Po1 1	Po2 4	Po3 7	Po4 10	Po5 7	Po6 4	Po7 1
Start time	14:40	14:52	15:03	15:14	15:25	15:36	15:47
0(min)	40,805	40,814	40,854	40,916	41,004	41,051	41,090
1	40,805	40,817	40,857	40,924	41,010	41,054	41,091
2	40,806	40,820	40,862	40,932	41,015	41,057	41,092
3	40,806	40,823	40,868	40,940	41,020	41,060	41,093
4	40,807	40,827	40,874	40,949	41,024	41,064	41,094
5	40,808	40,830	40,879	40,958	41,028	41,068	41,095
6	40,808	40,833	40,885	40,966	41,033	41,071	41,095
7	40,809	40,837	40,890	40,974	40,037	41,074	41,096
8	40,810	40,841	40,896	40,983	41,041	41,077	41,096
9	40,811	40,845	40,901	40,991	41,045	41,080	41,097
10	40,812	40,849	40,902	40,999	41,049	41,083	41,098
11							
12							
13							
14							
15							
Total lit.	Qw1 7	Qw2 35	Qw3 48	Qw4 83	Qw5 45	Qw6 32	Qw7 8
Average lit./min	Qw1 0.7	Qw2 3.5	Qw3 4.8	Qw4 8.3	Qw5 4.5	Qw6 3.2	Qw7 0.8
Finish time	14:50	15:02	15:13	15:24	15:35	15:46	15:57
(Pf)	0.00	0.00	0.01	0.02	0.01	0.00	0.00

Friction Loss (Pf) = pf(L2 - L4) [kgf/cm2]

Calculation of Lugeon value

P=P0+0.1(sin(a)L1+L2)-Pf [kgf/cm2], q=Qw/L3 [lit/min/m]

P1= 3.8 q1= 0.1
P2= 6.8 q2= 0.7
P3= 9.8 q3= 1.0
P4= 12.8 q4= 1.7
P5= 9.8 q5= 0.9
P6= 6.8 q6= 0.6
P7= 3.8 q7= 0.2



Lugeon value : 1.0 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 : Fathat M. Shah Inspected by : M. Suga

Water Pressure Test

Hole No.: Qs-2 | Stage: 6/19

Location: Sappare Quarry Site | 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 : 06/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_0): Nil | Gauge height (L_3): 0.30 m

Pipe length from pressure gauge to hole mouth: (L_0)= 9.00 m | Depth of test section GL - (L_1)= 30 m to (L_2)= 35 m | Length of section (L_3) 5 m

Reading of flow meter

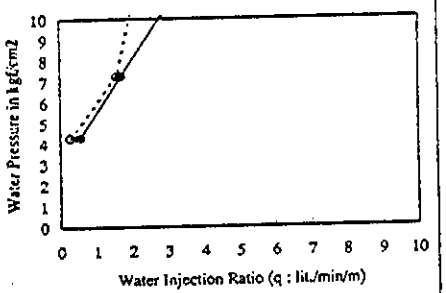
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:41	16:52	17:03	17:15	17:26	17:37	17:48
0(min)	41,100	41,135	41,222	41,394	41,560	41,663	41,748
1	41,103	41,143	41,236	41,413	41,570	41,671	41,749
2	41,105	41,152	41,252	41,431	41,580	41,678	41,750
3	41,108	41,161	41,266	41,448	41,590	41,686	41,752
4	41,111	41,170	41,281	41,466	41,600	41,693	41,755
5	41,114	41,178	41,295	41,483	41,610	41,702	41,757
6	41,116	41,186	41,309	41,499	41,620	41,710	41,759
7	41,119	41,194	41,323	41,512	41,630	41,718	41,761
8	41,121	41,203	41,336	41,527	41,640	41,726	41,767
9	41,124	41,211	41,350	41,541	41,649	41,734	41,765
10	41,127	41,219	41,364	41,555	41,659	41,742	41,762
11							
12							
13							
14							
15							
Total lit.	Qu1 27	Qu2 84	Qu3 142	Qu4 161	Qu5 99	Qu6 79	Qu7 14
Average lit./min	Qu1 2.7	Qu2 8.4	Qu3 14.2	Qu4 16.1	Qu5 9.9	Qu6 7.9	Qu7 1.4
Finish time	16:51	17:02	17:13	17:25	17:36	17:47	17:58
(Pr)	0.00	0.03	0.07	0.09	0.04	0.02	0.00

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

Calculation of Lugeon value

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

P1=	4.3	q1=	0.5
P2=	7.3	q2=	1.7
P3=	10.2	q3=	2.8
P4=	13.2	q4=	3.2
P5=	10.2	q5=	2.0
P6=	7.3	q6=	1.6
P7=	4.3	q7=	0.3



Lugeon value : 2.7 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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Qs-2 | Stage: 7/19

Location: Sappare Quarry Site | 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 : 10/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_0): Nil | Gauge height (L_3): 0.30 m

Pipe length from pressure gauge to hole mouth: (L_0)= 9.70 m | Depth of test section GL - (L_1)= 35 m to (L_2)= 40 m | Length of section (L_3) 5 m

Reading of flow meter

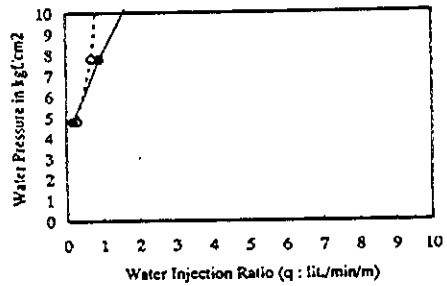
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	17:30	17:41	17:52	18:03	18:14	18:25	18:36
0(min)	41,797	41,809	41,864	41,960	42,055	42,100	42,137
1	41,798	41,812	41,870	41,971	42,059	42,104	42,139
2	41,798	41,816	41,879	41,980	42,064	42,108	42,141
3	41,799	41,820	41,889	41,988	42,068	42,112	42,142
4	41,800	41,825	41,899	41,998	42,073	42,115	42,144
5	41,801	41,830	41,908	42,002	42,077	42,118	42,145
6	41,802	41,835	41,918	42,012	42,081	42,121	42,146
7	41,803	41,840	41,928	42,022	42,085	42,125	42,148
8	41,804	41,845	41,936	42,032	42,090	42,128	42,149
9	41,805	41,850	41,945	42,042	42,094	42,131	42,150
10	41,806	41,854	41,954	42,052	42,098	42,135	42,151
11							
12							
13							
14							
15							
Total lit.	Qu1 9	Qu2 45	Qu3 90	Qu4 92	Qu5 43	Qu6 35	Qu7 14
Average lit./min	Qu1 0.9	Qu2 4.5	Qu3 9	Qu4 9.2	Qu5 4.3	Qu6 3.5	Qu7 1.4
Finish time	17:40	17:51	18:02	18:13	18:24	18:35	18:46
(Pr)	0.00	0.01	0.03	0.04	0.01	0.01	0.00

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

Calculation of Lugeon value

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

P1=	4.8	q1=	0.2
P2=	7.8	q2=	0.9
P3=	10.7	q3=	1.8
P4=	13.7	q4=	1.8
P5=	10.8	q5=	0.9
P6=	7.8	q6=	0.7
P7=	4.8	q7=	0.3



Lugeon value : 1.4 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 : Fathat M. Shah | Inspected by : M. Suga

Water Pressure Test

Hole No.: Os-2 | Stage: 8/19

Location: Sappare Quarry Site | 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 : 12/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): Nil | Gauge height (L_3): 0.30 m

Pipe length from pressure gauge to hole mouth: (L_2)= 9.00 m | Depth of test section: GL - (L_4)= 40 m to (L_5)= 45 m | Length of section (L_6) 5 m

Reading of flow meter

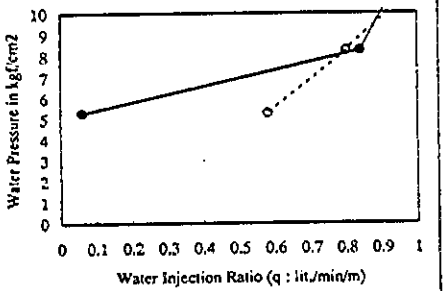
Gauge P. (kgf/cm2)	Ps1 1	Ps2 4	Ps3 7	Ps4 10	Ps5 7	Ps6 4	Ps7 1
Start time	14:07	14:18	14:29	14:40	14:51	15:02	15:13
0(min)	42,162	42,167	42,213	42,265	42,347	42,400	42,443
1	42,262	42,171	42,218	42,273	42,352	42,404	42,446
2	42,262	42,175	42,223	42,281	42,357	42,408	42,449
3	42,262	42,179	42,228	42,289	42,362	42,412	42,452
4	42,262	42,184	42,232	42,297	42,367	42,415	42,455
5	42,163	42,189	42,236	42,305	42,372	42,419	42,458
6	42,163	42,193	42,241	42,313	42,377	42,423	42,461
7	42,163	42,197	42,246	42,320	42,382	42,428	42,464
8	42,164	42,201	42,250	42,328	42,387	42,432	42,467
9	42,164	42,205	42,255	42,336	42,392	42,436	42,470
10	42,165	42,209	42,260	42,343	42,397	42,440	42,472
11							
12							
13							
14							
15							
Total lit.	Qw1 3	Qw2 42	Qw3 47	Qw4 78	Qw5 50	Qw6 40	Qw7 29
Average lit./min	Qw1 0.3	Qw2 4.2	Qw3 4.7	Qw4 7.8	Qw5 5	Qw6 4	Qw7 2.9
Finish time	14:17	14:28	14:39	14:50	15:01	15:12	15:23
(Pr)	0.00	0.01	0.01	0.03	0.01	0.01	0.00

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

Calculation of Lugeon value

P=Pw+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/L5 [lit/min/m]

P1= 5.3 q1= 0.1
P2= 8.3 q2= 0.8
P3= 11.3 q3= 0.9
P4= 14.3 q4= 1.6
P5= 11.3 q5= 1.0
P6= 8.3 q6= 0.8
P7= 5.3 q7= 0.6



Lugeon value : 0.8 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 : Fafhat M. Shah | Inspected by : M. Suga

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Water Pressure Test

Hole No.: Os-2 | Stage: 9/19

Location: Sappare Quarry Site | 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 : 14/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL- 10.25 m | Gauge height (L_3): 0.37 m

Pipe length from pressure gauge to hole mouth: (L_2)= 9.90 m | Depth of test section: GL - (L_4)= 45 m to (L_5)= 50 m | Length of section (L_6) 5 m

Reading of flow meter

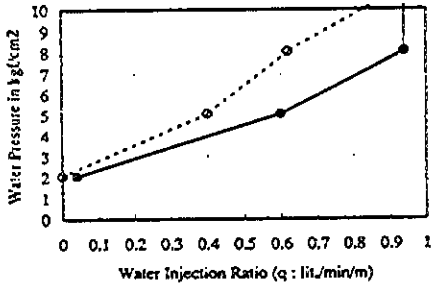
Gauge P. (kgf/cm2)	Ps1 1	Ps2 4	Ps3 7	Ps4 10	Ps5 7	Ps6 4	Ps7 1
Start time	14:15	14:26	14:37	14:48	14:59	15:01	15:23
0(min)	42,576	42,581	42,213	42,662	42,712	42,746	42,768
1	42,576	42,584	42,218	42,667	42,716	42,748	42,768
2	42,576	42,587	42,223	42,672	42,719	42,750	42,768
3	42,577	42,590	42,228	42,677	42,722	42,752	42,768
4	42,577	42,593	42,232	42,681	42,725	42,754	42,768
5	42,577	42,596	42,236	42,685	42,728	42,756	42,768
6	42,577	42,599	42,241	42,690	42,731	42,758	42,768
7	42,578	42,602	42,246	42,694	42,734	42,760	42,768
8	42,578	42,605	42,250	42,699	42,737	42,762	42,768
9	42,578	42,608	42,255	42,704	42,740	42,764	42,768
10	42,578	42,611	42,260	42,709	42,743	42,766	42,768
11							
12							
13							
14							
15							
Total lit.	Qw1 2	Qw2 30	Qw3 47	Qw4 47	Qw5 31	Qw6 20	Qw7 0
Average lit./min	Qw1 0.2	Qw2 3	Qw3 4.7	Qw4 4.7	Qw5 3.1	Qw6 2	Qw7 0
Finish time	14:25	14:36	14:47	14:58	15:09	15:11	15:31
(Pr)	0.00	0.00	0.01	0.01	0.01	0.00	0.00

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

Calculation of Lugeon value

P=Pw+0.1(sin(a)L2+L3)-Pr [kgf/cm2], q=Qw/L5 [lit/min/m]

P1= 2.1 q1= 0.0
P2= 5.1 q2= 0.6
P3= 8.1 q3= 0.9
P4= 11.1 q4= 0.9
P5= 8.1 q5= 0.6
P6= 5.1 q6= 0.4
P7= 2.1 q7= 0.0



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 : Fafhat M. Shah | Inspected by : Azim Gill

Water Pressure Test

Hole No.: Qs-2 | Stage: 10/19

Location: Sappare Quarry Site | 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 : 16/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (Lw): GL- 10.25 m | Gauge height (Lg): 0.37 m

Pipe length from pressure gauge to hole mouth: (Lo)= 9.20 m | Depth of test section GL - (La)= 50 m to (Lb)= 55 m | Length of section (L) 5 m

Reading of flow meter

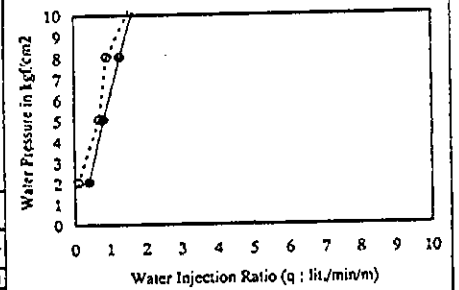
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	15:20	15:31	15:41	15:51	16:01	16:11	16:21
0(min)	42,804	42,829	42,876	42,948	43,047	43,098	43,138
1	42,806	42,834	42,883	42,957	43,052	43,102	43,138
2	42,808	42,839	42,890	42,967	43,057	43,106	43,139
3	42,810	42,843	42,896	42,977	43,062	43,110	43,139
4	42,812	42,847	42,902	42,986	43,067	43,113	43,140
5	42,814	42,851	42,908	42,995	43,071	43,116	43,140
6	42,816	42,855	42,915	43,004	43,075	43,119	43,141
7	42,818	42,860	42,921	43,013	43,080	43,123	43,141
8	42,820	42,864	42,927	43,022	43,084	43,126	43,142
9	42,822	42,867	42,933	43,030	43,088	43,129	43,143
10	42,824	42,870	42,940	43,038	43,093	43,133	43,143
11	———	———	———	———	———	———	———
12	———	———	———	———	———	———	———
13	———	———	———	———	———	———	———
14	———	———	———	———	———	———	———
15							
Total lit.	Qw1 20	Qw2 41	Qw3 64	Qw4 90	Qw5 46	Qw6 35	Qw7 5
Average lit./min	Qw1 2	Qw2 4.1	Qw3 6.4	Qw4 9	Qw5 4.6	Qw6 3.5	Qw7 0.5
Finish time	15:30	15:41	15:51	16:01	16:11	16:21	16:31
(Pr)	0.00	0.01	0.02	0.05	0.01	0.01	0.00

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

Calculation of Lugeon value

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

P1= 2.1 q1= 0.4
P2= 5.1 q2= 0.8
P3= 8.0 q3= 1.3
P4= 11.0 q4= 1.8
P5= 8.1 q5= 0.9
P6= 5.1 q6= 0.7
P7= 2.1 q7= 0.1



Lugeon value : 1.6 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 : Fafhat M. Shah | Inspected by : Azim Gill

GE2 - 146

Water Pressure Test

Hole No.: Qs-2 | Stage: 11/19

Location: Sappare Quarry Site | 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 : 19/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (Lw): GL- 10.25 m | Gauge height (Lg): 0.37 m

Pipe length from pressure gauge to hole mouth: (Lo)= 8.93 m | Depth of test section GL - (La)= 55 m to (Lb)= 60 m | Length of section (L) 5 m

Reading of flow meter

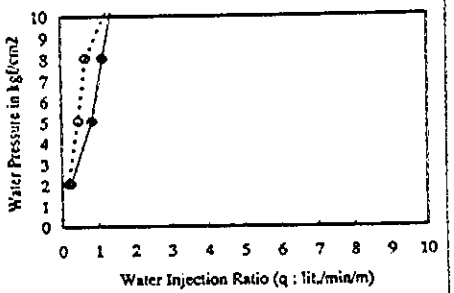
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	12:30	12:41	12:51	13:01	13:11	13:21	13:31
0(min)	43,340	43,354	43,400	43,463	43,545	43,584	43,611
1	43,342	43,359	43,406	43,470	43,549	43,587	43,612
2	43,344	43,364	43,411	43,477	43,553	43,590	43,613
3	43,345	43,368	43,417	43,485	43,556	43,592	43,614
4	43,346	43,372	43,423	43,493	43,560	43,594	43,615
5	43,347	43,376	43,428	43,500	43,563	43,596	43,616
6	43,348	43,380	43,433	43,507	43,566	43,599	43,617
7	43,349	43,384	43,439	43,515	43,570	43,601	43,618
8	43,350	43,388	43,445	43,522	43,573	43,603	43,619
9	43,351	43,392	43,451	43,530	43,576	43,605	43,620
10	43,352	43,396	43,457	43,537	43,579	43,607	43,620
11	———	———	———	———	———	———	———
12	———	———	———	———	———	———	———
13	———	———	———	———	———	———	———
14	———	———	———	———	———	———	———
15							
Total lit.	Qw1 12	Qw2 42	Qw3 57	Qw4 74	Qw5 34	Qw6 23	Qw7 9
Average lit./min	Qw1 1.2	Qw2 4.2	Qw3 5.7	Qw4 7.4	Qw5 3.4	Qw6 2.3	Qw7 0.9
Finish time	12:40	12:51	13:01	13:11	13:21	13:31	13:41
(Pr)	0.00	0.01	0.02	0.03	0.01	0.00	0.00

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

Calculation of Lugeon value

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

P1= 2.1 q1= 0.2
P2= 5.1 q2= 0.8
P3= 8.0 q3= 1.1
P4= 11.0 q4= 1.5
P5= 8.1 q5= 0.7
P6= 5.1 q6= 0.5
P7= 2.1 q7= 0.2



Lugeon value : 1.4 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 : Fafhat M. Shah | Inspected by : Azim Gill

Water Pressure Test

Hole No.: Qs-2 | Stage: 12/19

Location: Sappare Quarry Site | 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 : 20/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL.- 10.25 m | Gauge height (L_3): 0.37 m

Pipe length from pressure gauge to hole mouth: (L_2)= 9.25 m | Depth of test section: GL.-(L_4)= 60 m to (L_5)= 65 m | Length of section (L_6) 5 m

Reading of flow meter

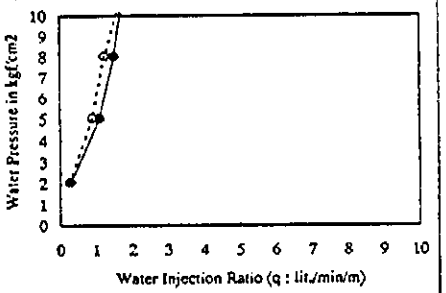
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	12:30	12:41	12:51	13:01	13:11	13:21	13:31
Q(min)	43,645	43,662	43,727	43,818	43,915	43,980	43,028
1	43,647	43,668	43,735	43,828	43,922	43,985	43,030
2	43,649	43,674	43,743	43,838	43,929	43,990	43,032
3	43,650	43,680	43,750	43,848	43,936	43,995	43,033
4	43,651	43,685	43,757	43,857	43,942	44,000	43,034
5	43,653	43,690	43,765	43,866	43,948	44,005	43,035
6	43,655	43,696	43,773	43,875	43,954	44,009	43,037
7	43,656	43,701	43,780	43,883	43,959	44,013	43,038
8	43,657	43,706	43,787	43,890	43,965	44,017	43,039
9	43,658	43,712	43,794	43,898	43,971	44,021	43,040
10	43,659	43,717	43,802	43,906	43,977	44,025	43,041
11							
12							
13							
14							
15							
Total lit.	Qw1 14	Qw2 55	Qw3 75	Qw4 88	Qw5 62	Qw6 45	Qw7 13
Average lit./min	Qw1 1.4	Qw2 5.5	Qw3 7.5	Qw4 8.8	Qw5 6.2	Qw6 4.5	Qw7 1.3
Finish time	12:40	12:51	13:01	13:11	13:21	13:31	13:41
(Pr)	0.00	0.02	0.04	0.05	0.03	0.01	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=	2.1	q1=	0.3
P2=	5.0	q2=	1.1
P3=	8.0	q3=	1.5
P4=	11.0	q4=	1.8
P5=	8.0	q5=	1.2
P6=	5.0	q6=	0.9
P7=	2.1	q7=	0.3



Lugeon value : 1.7 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 : Fafhat M. Shah | Inspected by : Azim Gill

GE2 - 147

Water Pressure Test

Hole No.: Qs-2 | Stage: 13/19

Location: Sappare Quarry Site | 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 : 22/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL.- 10.25 m | Gauge height (L_3): 0.37 m

Pipe length from pressure gauge to hole mouth: (L_2)= 9.10 m | Depth of test section: GL.-(L_4)= 65 m to (L_5)= 70 m | Length of section (L_6) 5 m

Reading of flow meter

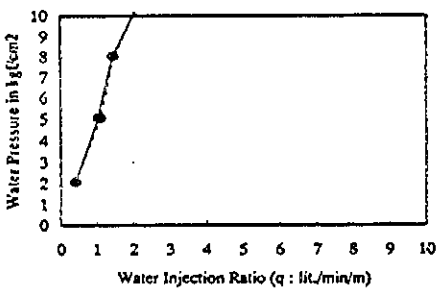
Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	17:05	17:16	17:27	17:38	17:49	18:00	18:11
Q(min)	44,057	44,102	44,158	44,237	44,353	44,428	44,485
1	44,060	44,107	44,165	44,249	44,360	44,434	44,487
2	44,062	44,112	44,173	44,260	44,368	44,439	44,489
3	44,064	44,118	44,180	44,271	44,375	44,445	44,491
4	44,066	44,123	44,187	44,283	44,382	44,451	44,493
5	44,068	44,128	44,194	44,294	44,390	44,456	44,495
6	44,070	44,134	44,202	44,305	44,397	44,462	44,497
7	44,072	44,139	44,209	44,316	44,404	44,467	44,499
8	44,074	44,144	44,216	44,327	44,411	44,472	44,501
9	44,076	44,149	44,223	44,339	44,418	44,478	44,503
10	44,078	44,154	44,230	44,350	44,426	44,483	44,505
11							
12							
13							
14							
15							
Total lit.	Qw1 21	Qw2 52	Qw3 72	Qw4 113	Qw5 73	Qw6 55	Qw7 20
Average lit./min	Qw1 2.1	Qw2 5.2	Qw3 7.2	Qw4 11.3	Qw5 7.3	Qw6 5.5	Qw7 2
Finish time	17:15	17:26	17:37	17:48	17:59	18:10	18:21
(Pr)	0.00	0.02	0.04	0.09	0.04	0.02	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=	2.1	q1=	0.4
P2=	5.0	q2=	1.0
P3=	8.0	q3=	1.4
P4=	11.0	q4=	2.3
P5=	8.0	q5=	1.5
P6=	5.0	q6=	1.1
P7=	2.1	q7=	0.4



Lugeon value : 2.0 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 : Fafhat M. Shah | Inspected by : Azim Gill

Water Pressure Test

Hole No.: Qs-2 | Stage: 14/19

Location: Sappare Quarry Site | 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/March/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL.- 10.25 m | Gauge height (L_3): 0.37 m

Pipe length from pressure gauge to hole mouth: (L_0)= 9.60 m | Depth of test section: GL.-(L_1)= 70 m to (L_2)= 75 m | Length of section (L_3) 5 m

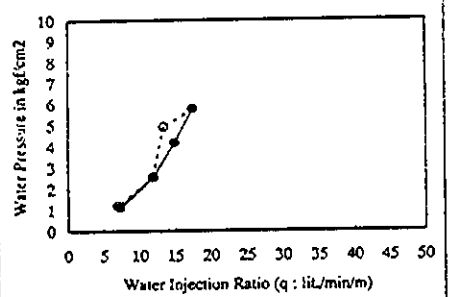
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	16:00	16:11	16:21	16:31	16:41	16:51	17:01
0(min)	44,561	44,965	45,582	46,463	47,373	48,131	48,822
1	44,596	45,025	45,655	46,559	47,443	48,197	48,859
2	44,630	45,083	45,738	46,646	47,526	48,263	48,894
3	44,666	45,140	45,803	46,735	47,590	48,270	48,928
4	44,701	45,201	45,887	46,812	47,654	48,335	48,961
5	44,746	45,268	45,958	46,909	47,719	48,400	48,996
6	44,773	45,316	46,023	46,997	47,783	48,466	49,031
7	44,818	45,375	46,075	47,072	47,847	48,533	49,065
8	44,844	45,433	46,178	47,168	47,912	48,597	49,098
9	44,888	45,490	46,241	47,256	47,976	48,661	49,132
10	44,924	45,558	46,325	47,333	48,041	48,726	49,167
11							
12							
13							
14							
15							
Total lit.	Qw1 363	Qw2 593	Qw3 743	Qw4 870	Qw5 668	Qw6 595	Qw7 345
Average lit/min	Qw1 36.3	Qw2 59.3	Qw3 74.3	Qw4 87	Qw5 66.8	Qw6 59.5	Qw7 34.5
Finish time	16:10	16:21	16:31	16:41	16:51	17:01	17:11
(Pr)	0.95	2.49	3.89	5.31	3.15	2.51	0.86
Friction Loss (Pr) = pr(Lo + L1) [kgf/cm2]							

Calculation of Lugeon value

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

P1=	1.1	q1=	7.3
P2=	2.6	q2=	11.9
P3=	4.2	q3=	14.9
P4=	5.8	q4=	17.4
P5=	4.9	q5=	13.4
P6=	2.6	q6=	11.9
P7=	1.2	q7=	6.9



Lugeon value : (24) Lu'

Critical Pressure: >5.8 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 : Fathat M. Shah | Inspected by : Azim Gill

GE2 - 148

Water Pressure Test

Hole No.: Qs-2 | Stage: 15/19

Location: Sappare Quarry Site | 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/May/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL.- 10.25 m | Gauge height (L_3): 0.40 m

Pipe length from pressure gauge to hole mouth: (L_0)= 8.45 m | Depth of test section: GL.-(L_1)= 75 m to (L_2)= 80 m | Length of section (L_3) 5 m

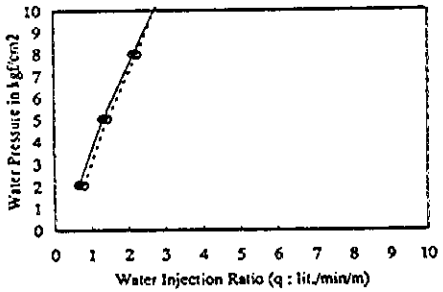
Reading of flow meter

Gauge P. (kgf/cm2)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	13:30	13:41	13:53	14:05	14:17	14:30	14:45
0(min)	49,230	49,273	49,348	49,470	49,630	49,748	49,827
1	49,234	49,281	49,359	49,485	49,641	49,755	49,831
2	49,237	49,288	49,370	49,499	49,652	49,763	49,835
3	49,241	49,294	49,380	49,515	49,664	49,770	49,839
4	49,244	49,301	49,391	49,529	49,675	49,777	49,843
5	49,247	49,308	49,402	49,544	49,686	49,785	49,847
6	49,250	49,314	49,412	49,559	49,697	49,792	49,851
7	49,254	49,320	49,423	49,574	49,709	49,799	49,855
8	49,257	49,327	49,433	49,588	49,720	49,806	49,859
9	49,260	49,333	49,444	49,603	49,731	49,813	49,863
10	49,263	49,339	49,455	49,618	49,742	49,820	49,867
11							
12							
13							
14							
15							
Total lit.	Qw1 33	Qw2 66	Qw3 107	Qw4 148	Qw5 112	Qw6 72	Qw7 40
Average lit/min	Qw1 3.3	Qw2 6.6	Qw3 10.7	Qw4 14.8	Qw5 11.2	Qw6 7.2	Qw7 4
Finish time	13:40	13:51	14:03	14:15	14:27	14:40	14:55
(Pr)	0.01	0.03	0.09	0.17	0.10	0.04	0.01
Friction Loss (Pr) = pr(Lo + L1) [kgf/cm2]							

Calculation of Lugeon value

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

P1=	2.1	q1=	0.7
P2=	5.0	q2=	1.3
P3=	8.0	q3=	2.1
P4=	10.9	q4=	3.0
P5=	8.0	q5=	2.2
P6=	5.0	q6=	1.4
P7=	2.1	q7=	0.8



Lugeon value : 2.7 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 : Azim Gill | Inspected by :

Water Pressure Test

Hole No.: Qs-2 Stage: 16/19

Location: Sappare Quarry Site 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 : 28/May/1999

Ground elevation : EL. 513.37 m | Groundwater level (Lw): GL- 10.25 m | Gauge height (Lu): 0.37 m

Pipe length from pressure gauge to hole mouth: (Lo)= 7.70 m | Depth of test section GL - (La)= 80 m to (Lb)= 85 m | Length of section (L) 5 m

Reading of flow meter

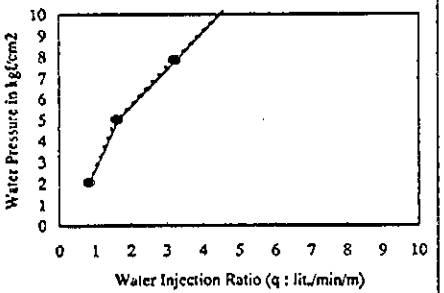
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	16:30	16:42	16:55	17:10	17:22	17:35	17:47
Q(min)	49,974	50,025	50,118	50,293	50,534	50,694	50,774
1	49,978	50,033	50,134	50,317	50,550	50,702	50,778
2	49,984	50,041	50,151	50,341	50,566	50,710	50,782
3	49,987	50,049	50,168	50,365	50,582	50,718	50,786
4	49,991	50,059	50,185	50,389	50,598	50,726	50,790
5	49,995	50,067	50,201	50,413	50,614	50,734	50,794
6	50,000	50,075	50,217	50,437	50,630	50,741	50,798
7	50,004	50,083	50,233	50,461	50,645	50,749	50,802
8	50,008	50,091	50,249	50,485	50,661	50,757	50,806
9	50,012	50,099	50,265	50,509	50,677	50,765	50,810
10	50,016	50,107	50,281	50,533	50,693	50,773	50,814
11							
12							
13							
14							
15							
Total lit.	Qw1 42	Qw2 82	Qw3 163	Qw4 240	Qw5 159	Qw6 79	Qw7 40
Average lit./min	Qw1 4.2	Qw2 8.2	Qw3 16.3	Qw4 24	Qw5 15.9	Qw6 7.9	Qw7 4
Finish time	16:40	16:52	17:05	17:20	17:32	17:45	17:57
(Pr)	0.01	0.06	0.22	0.46	0.21	0.05	0.01

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

Calculation of Lugeon value

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

P1=	2.0	q1=	0.8
P2=	5.0	q2=	1.6
P3=	7.8	q3=	3.3
P4=	10.6	q4=	4.8
P5=	7.9	q5=	3.2
P6=	5.0	q6=	1.6
P7=	2.0	q7=	0.8



Lugeon value : 4.5 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 : Azim Gill Inspected by :

GE2 - 149

Water Pressure Test

Hole No.: Qs-2 Stage: 17/19

Location: Sappare Quarry Site 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 : 28/May/1999

Ground elevation : EL. 513.37 m | Groundwater level (Lw): GL- 10.25 m | Gauge height (Lu): 0.37 m

Pipe length from pressure gauge to hole mouth: (Lo)= 7.60 m | Depth of test section GL - (La)= 85 m to (Lb)= 90 m | Length of section (L) 5 m

Reading of flow meter

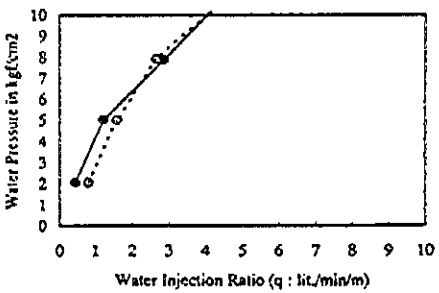
Gauge P. (kgf/cm2)	Pe1 1	Pe2 4	Pe3 7	Pe4 10	Pe5 7	Pe6 4	Pe7 1
Start time	12:15	12:27	12:40	12:52	13:03	13:15	13:30
Q(min)	50,905	50,935	51,004	51,156	51,377	50,694	50,774
1	50,908	50,942	51,018	51,178	51,390	50,702	50,778
2	50,911	50,948	51,034	51,200	51,404	50,710	50,782
3	50,913	50,954	51,049	51,222	51,418	50,718	50,786
4	50,915	50,960	51,063	51,244	51,432	50,726	50,790
5	50,917	50,966	51,077	51,266	51,444	50,734	50,794
6	50,919	50,972	51,091	51,288	51,456	50,741	50,798
7	50,921	50,978	51,105	51,310	51,470	50,749	50,802
8	50,923	50,984	51,119	51,332	51,484	50,757	50,806
9	50,925	50,990	51,133	51,354	51,496	50,765	50,810
10	50,927	50,996	51,147	51,376	51,510	50,773	50,814
11							
12							
13							
14							
15							
Total lit.	Qw1 22	Qw2 61	Qw3 143	Qw4 220	Qw5 133	Qw6 79	Qw7 40
Average lit./min	Qw1 2.2	Qw2 6.1	Qw3 14.3	Qw4 22	Qw5 13.3	Qw6 7.9	Qw7 4
Finish time	12:25	12:37	12:50	13:02	13:13	13:25	13:40
(Pr)	0.00	0.03	0.18	0.41	0.15	0.05	0.01

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

Calculation of Lugeon value

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

P1=	2.1	q1=	0.4
P2=	5.0	q2=	1.2
P3=	7.9	q3=	2.9
P4=	10.7	q4=	4.4
P5=	7.9	q5=	2.7
P6=	5.0	q6=	1.6
P7=	2.0	q7=	0.8



Lugeon value : 4.0 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 : Azim Gill Inspected by :

Water Pressure Test

Hole No.: Qs-2 | Stage: 18/19
Location: Sappare Quarry Site | 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 : 31/May/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL- 10.25 m | Gauge height (L_3): 0.37 m
Pipe length from pressure gauge to hole mouth: (L_0)= 8.00 m | Depth of test section GL - (L_1)= 90 m to (L_2)= 95 m | Length of section (L_3) 5 m

Reading of flow meter

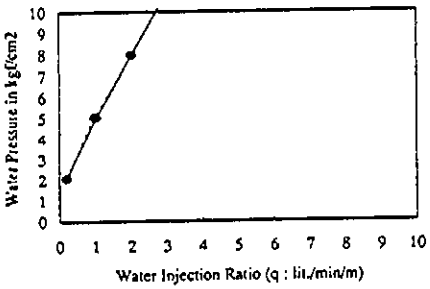
Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	17:15	17:27	17:40	17:51	18:05	18:16	18:27
0(min)	51,653	51,666	51,720	51,823	51,974	52,076	52,125
1	51,654	51,671	51,730	51,838	51,985	52,080	52,126
2	51,655	51,676	51,740	51,853	51,995	52,085	52,127
3	51,656	51,682	51,750	51,868	52,005	52,090	52,128
4	51,657	51,687	51,760	51,883	52,015	52,095	52,129
5	51,658	51,692	51,770	51,898	52,025	52,100	52,130
6	51,659	51,697	51,780	51,913	52,035	52,105	52,131
7	51,660	51,702	51,790	51,928	52,045	52,110	52,132
8	51,661	51,707	51,800	51,943	52,055	52,115	52,133
9	51,662	51,712	51,810	51,958	52,065	52,120	52,134
10	51,663	51,717	51,820	51,973	52,075	52,125	52,135
11							
12							
13							
14							
15							
Total lit.	Qw1 10	Qw2 51	Qw3 100	Qw4 150	Qw5 101	Qw6 49	Qw7 10
Average lit./min	Qw1 1	Qw2 5.1	Qw3 10	Qw4 15	Qw5 10.1	Qw6 4.9	Qw7 1
Finish time	17:25	17:37	17:50	18:01	18:15	18:26	18:37
(Pr)	0.00	0.02	0.09	0.20	0.09	0.02	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= 2.1 q1= 0.2
P2= 5.0 q2= 1.0
P3= 8.0 q3= 2.0
P4= 10.9 q4= 3.0
P5= 8.0 q5= 2.0
P6= 5.0 q6= 1.0
P7= 2.1 q7= 0.2



Lugeon value : 2.7 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 : Azim Gill | Inspected by :

GE2 - 150

Water Pressure Test

Hole No.: Qs-2 | Stage: 19/19
Location: Sappare Quarry Site | 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 : 06/June/1999

Ground elevation : EL. 513.37 m | Groundwater level (L_1): GL- 10.25 m | Gauge height (L_3): 0.37 m
Pipe length from pressure gauge to hole mouth: (L_0)= 8.90 m | Depth of test section GL - (L_1)= 95 m to (L_2)= 100 m | Length of section (L_3) 5 m

Reading of flow meter

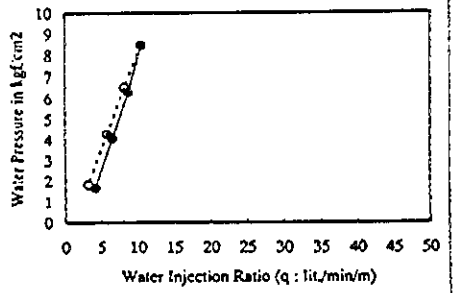
Gauge P. (kgf/cm²)	Pu1 1	Pu2 4	Pu3 7	Pu4 10	Pu5 7	Pu6 4	Pu7 1
Start time	11:55	12:07	12:20	12:32	12:45	13:00	13:15
0(min)	52,170	52,430	52,900	53,400	54,000	54,430	54,770
1	52,191	52,467	52,943	53,455	54,039	54,478	54,785
2	52,214	52,503	52,986	53,505	54,081	54,507	54,801
3	52,234	52,539	53,030	53,556	54,123	54,536	54,817
4	52,255	52,575	53,074	53,609	54,164	54,574	54,833
5	52,275	52,612	53,119	53,663	54,209	54,597	54,849
6	52,295	52,648	53,164	53,716	54,247	54,623	54,865
7	52,316	51,702	53,209	53,769	54,287	54,655	54,881
8	52,336	52,684	53,252	53,822	54,329	54,682	54,897
9	52,357	52,720	53,295	53,875	54,370	54,711	54,913
10	52,377	52,756	53,337	53,928	54,410	54,740	54,929
11							
12							
13							
14							
15							
Total lit.	Qw1 207	Qw2 326	Qw3 437	Qw4 528	Qw5 410	Qw6 290	Qw7 159
Average lit./min	Qw1 20.7	Qw2 32.6	Qw3 43.7	Qw4 52.8	Qw5 41	Qw6 29	Qw7 15.9
Finish time	12:05	12:17	12:30	12:42	12:55	13:10	13:25
(Pr)	0.41	1.00	1.78	2.59	1.57	0.79	0.24

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= 1.7 q1= 4.1
P2= 4.1 q2= 6.5
P3= 6.3 q3= 8.7
P4= 8.5 q4= 10.6
P5= 6.5 q5= 8.2
P6= 4.3 q6= 5.8
P7= 1.8 q7= 3.2



Lugeon value : (12) Lu'
Critical Pressure: >8.5 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 : Azim Gill | Inspected by :