国際協力事業団

ブータン国

貿易産業省電力局

ブータン国
プナチャンチュ水力発電事業計画調査

最終報告書

Vol. Ⅲ
付　　録

2001年2月

電　源　開　発　株　式　会　社

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CHAPTER 6

METEOROLOGY AND HYDROLOGY

METEOROLOGY AND HYDROLOGY

Calculation Result of DAMBRK
– Simulation of 1994 GLOF
– Simulation of GLOF from Luggye Lake
– Simulation of GLOF from Raphstreng Lake
Calculation Result of Reservoir Sedimentation

Calculation Result of DAMBRK (1/3)

Simulation of 1994 GLOF

ANALYSIS OF THE DOWNSTREAM FLOOD HYDROGRAPH

PRODUCED BY THE DAM BREAK OF

RUN1 1 :

ON

1994 GLOF

BASED ON PROCEDURE DEVELOPED BY
DANNY L. FREAD, PH.D., SR. RESEARCH HYDROLOGIST

QUALITY CONTROL TESTING AND OTHER SUPPORT BY
JANICE M. LEWIS, RESEARCH HYDROLOGIST

HYDROLOGIC RESEARCH LABORATORY
W23, OFFICE OF HYDROLOGY
NOAA, NATIONAL WEATHER SERVICE
SILVER SPRING, MARYLAND 20910

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*** ***
*** SUMMARY OF INPUT DATA ***
*** ***
****
****

INPUT CONTROL PARAMETERS FOR RUN1 1 :

PARAMETER	VARIABLE	VALUE
NUMBER OF DYNAMIC ROUTING REACHES	KKN	1
TYPE OF RESERVOIR ROUTING	KUI	0
MULTIPLE DAM INDICATOR	MULDAM	0
PRINTING INSTRUCTIONS FOR INPUT SUMMARY	KDMP	5
NO. OF RESERVOIR INFLOW HYDROGRAPH POINTS	ITEH	2
INTERVAL OF CROSS-SECTION INFO PRINTED OUT WHEN JNK=9	NPRT	0
FLOOD-PLAIN MODEL PARAMETER	KFLP	0
METRIC INPUT/OUTPUT OPTION	METRIC	1

IOPUT= 1 0 0 0 0 0 1 1 0 0 0 0

RUN1 1 : RESERVOIR

TABLE OF ELEVATION VS SURFACE AREA

SURFACE AREA (SQ KM) SA(K)	ELEVATION (M) HSA(K)
1.1	4560.00
0.9	4535.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00

RUN1 1 : RESERVOIR AND BREACH PARAMETERS

PARAMETER	UNITS	VARIABLE	VALUE
LENGTH OF RESERVOIR	KM	RLM	2.10
ELEVATION OF WATER SURFACE	M	YO	4561.00
SIDE SLOPE OF BREACH		Z	0.00
ELEVATION OF BOTTOM OF BREACH	M	YBMIN	4535.00
WIDTH OF BASE OF BREACH	M	BB	35.00
TIME TO MAXIMUM BREACH SIZE	HOUR	TFH	3.50
ELEVATION (MSL) OF BOTTOM OF DAM	M	DATUM	4535.00
VOLUME-SURFACE AREA PARAMETER		VOL	0.00
ELEVATION OF WATER WHEN BREACHED	M	HF	4561.00
ELEVATION OF TOP OF DAM	M	HD	4561.00
ELEVATION OF UNCONTROLLED SPILLWAY CREST	M	HSP	0.00
ELEVATION OF CENTER OF GATE OPENINGS	M	HGT	0.00
DISCHARGE COEF. FOR UNCONTROLLED SPILLWAY		CS	0.00
DISCHARGE COEF. FOR GATE FLOW		CG	0.00
DISCHARGE COEF. FOR UNCONTROLLED WEIR FLOW		CDO	0.00
DISCHARGE THRU TURBINES	CMS	QT	50.00

CDO SHOULD NOT BE 0.0 IF OVERTOPPING MAY OCCUR

DHF(INTERVAL BETWEEN INPUT HYDROGRAPH ORDINATES) = 0.00 HRS.

TEH(TIME AT WHICH COMPUTATIONS TERMINATE)= 24.0000 HRS.

BREX(BREACH EXPONENT) = 0.000

MUD(MUD FLOW OPTION) = 0

IWF(TYPE OF WAVE FRONT TRACKING) = 0

KPRES(WETTED PERIMETER OPTION) = 0

KSL(LANDSLIDE PARAMETER) = 0

INFLOW HYDROGRAPH TO RUN1 1 :
****

50.00 50.00

TIME OF INFLOW HYDROGRAPH ORDINATES

0.0000 100.0000

CROSS-SECTIONAL PARAMETERS FOR 1994 GLOF
BELOW RUN1 1 :

PARAMETER	VARIABLE	VALUE
NUMBER OF CROSS-SECTIONS	NS	6
MAXIMUM NUMBER OF TOP WIDTHS	NCS	2
NUMBER OF CROSS-SECTIONAL HYDROGRAPHS TO PLOT	NTT	6
TYPE OF OUTPUT OTHER THAN HYDROGRAPH PLOTS	JNK	1
CROSS-SECTIONAL SMOOTHING PARAMETER	KSA	0
DOWNSTREAM SUPERCRITICAL OR NOT	KSUPC	1
NO. OF LATERAL INFLOW HYDROGRAPHS	LQ	5
NO. OF POINTS IN GATE CONTROL CURVE	KCG	0

NUMBER OF CROSS-SECTION WHERE HYDROGRAPH DESIRED
(MAX NUMBER OF HYDROGRAPHS = 6)
****

1 2 3 4 5 6

CROSS-SECTIONAL VARIABLES FOR 1994 GLOF
BELOW RUN1 1 :

PARAMETER	UNITS	VARIABLE
LOCATION OF CROSS-SECTION	KM	XS(I)
ELEVATION(MSL) OF FLOODING AT CROSS-SECTION	M	FSTG(I)
ELEV CORRESPONDING TO EACH TOP WIDTH	M	HS(K, I)
TOP WIDTH CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	M	BS(K, I)
TOP WIDTH CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	M	BSS(K, I)
NUMBER OF CROSS-SECTION		I
NUMBER OF ELEVATION LEVEL		K

CROSS-SECTION NUMBER 1
****

XS(I) = 0.000 FSTG(I) = 0.00

HS ...	4535.0	4560.0
BS ...	50.0	150.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 2
****

XS(I) = 36.500 FSTG(I) = 0.00

HS ...	3160.0	3180.0
BS ...	50.0	100.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 3
****

XS(I) = 76.100 FSTG(I) = 0.00

HS ...	1580.0	1600.0
BS ...	70.0	200.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 4
****

XS(I) = 110.800 FSTG(I) = 0.00

HS ...	1170.0	1190.0
BS ...	55.0	100.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 5
****

XS(I) = 171.500 FSTG(I) = 0.00

HS ...	570.0	590.0
BS ...	50.0	100.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 6
****

XS(I) = 219.200 FSTG(I) = 0.00

HS ...	130.0	150.0
BS ...	100.0	200.0
BSS ...	0.0	0.0

MANNING N ROUGHNESS COEFFICIENTS FOR THE GIVEN REACHES
(CM(K, I), K=1, NCS) WHERE I = REACH NUMBER

REACH 1 ... 0.050 0.050

REACH 2 ... 0.050 0.050

REACH 3 ... 0.050 0.050

REACH 4 ... 0.050 0.050

REACH 5 ... 0.050 0.050

CROSS-SECTIONAL VARIABLES FOR 1994 GLOF
BELOW RUN1 1 :

PARAMETER	UNITS	VARIABLE
MINIMUM COMPUTATIONAL DISTANCE USED BETWEEN CROSS-SECTIONS	KM	DXM(I)
CONTRACTION - EXPANSION COEFFICIENTS BETWEEN CROSS-SECTIONS		FKC(I)

REACH NUMBER	DXM(I)	FKC(I)
1	2.000	0.000
2	2.000	0.000
3	2.000	0.000
4	2.000	0.000
5	2.000	0.000

DOWNSTREAM FLOW PARAMETERS FOR 1994 GLOF
BELOW RUN1 1 :

PARAMETER	UNITS	VARIABLE	VALUE
MAX DISCHARGE AT DOWNSTREAM EXTREMITY	CMS	QMAXD	0.0
MAX LATERAL OUTFLOW PRODUCING LOSSES	CMS /M	QLL	0.000
INITIAL SIZE OF TIME STEP	HOUR	DTHM	0.0000
INITIAL WATER SURFACE ELEVATION DOWNSTREAM	M	YDN	135.00
SLOPE OF CHANNEL DOWNSTREAM OF DAM	%	SOM	0.00
THETA WEIGHTING FACTOR		THETA	0.00
CONVERGENCE CRITERION FOR STAGE	M	EPSY	0.000
TIME AT WHICH DAM STARTS TO FAIL	HOUR	TFI	0.00

AT REACH= 2 DXM SHOULD BE CHANGED TO 0.476 DUE TO CHANGE OF SLOPE CRITERIA

COMPUTATIONS WILL USE THE FOLLOWING DXM VALUES

2.000 2.000 2.000 2.000 2.000

LATERAL INFLOW REACH NUMBER

LQX(I)

1 2 3 4 5

(QL(L, 1), L=1, ITEH)
0. 0.

(QL(L, 2), L=1, ITEH)
70. 70.

(QL(L, 3), L=1, ITEH)
100. 100.

(QL(L, 4), L=1, ITEH)
0. 0.

(QL(L, 5), L=1, ITEH)
0. 0.

TOTAL NUMBER OF CROSS SECTIONS (ORIGINAL+INTERPOLATED) (N) = 108 (MAXIMUM ALLOWABLE = 200

****
****
*** ***
*** SUMMARY OF OUTPUT DATA ***
*** ***
****
****

1

CROSS-SECTION NO.	KM	BOTTOM ELEVATION M	REACH NO.	REACH LENGTH KM	SLOPE %	MESAGE
1	0.00	4535.00				
2	36.50	3160.00	1	36.50	3.77	
3	76.10	1580.00	2	39.60	3.99	
4	110.80	1170.00	3	34.70	1.18	
5	171.50	570.00	4	60.70	0.99	
6	219.20	130.00	5	47.70	0.92	SLOPE LESS THAN 1% MAY CAUSE SUBCRITICAL FLOW

TOTAL VOLUME IN RESERVOIR BEHIND
RUN1 1 : = 25.0 CU. M (MILLION)

DEFINITION OF VARIABLES IN RESERVOIR DEPLETION TABLE

PARAMETER	UNITS	VARIABLE
TIME STEP FROM START OF ANALYSIS		I
ITERATIONS NECESSARY TO SOLVE FLOW EQUATIONS		K
ELAPSED TIME FROM START OF ANALYSIS	HOUR	TTP(I)
TOTAL OUTFLOW FROM DAM	CMS	Q(I)
ELEVATION OF WATER SURFACE AT DAM	M	H2
ELEVATION OF BOTTOM OF BREACH	M	YB
EST DEPTH OF FLOW IMMEDIATELY DOWNSTREAM	M	D
SUBMERGENCE COEFFICIENT		SUB
VELOCITY CORRECTION		VCOR
TOTAL VOLUME DISCHARGED FROM TIME OF BREACH	MILLION CU M	OUTVOL
BREACH WIDTH	M	BB
RECTANGULAR BREACH DISCHARGE COEFFICIENT		COFR
INFLOW TO RESERVOIR	CMS	QI(I)
BREACH OUTFLOW	CMS	QBRECH
SPILLWAY OUTFLOW	CMS	QSPIL

RESERVOIR DEPLETION TABLE

	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
	0	0.000	50	4561.00	4561.00	4535.44	1.00	1.00	0.0	0.0	3.10	50.	0.	50.
2	2	0.070	50	4560.99	4560.48	4535.44	1.00	1.00	0.0	0.7	3.10	50.	0.	50.
3	2	0.140	52	4560.99	4559.96	4535.45	1.00	1.00	0.0	1.4	3.10	50.	3.	50.
1	1	0.210	56	4560.99	4559.44	4535.47	1.00	1.00	0.0	2.1	3.10	50.	7.	50.
5	1	0.280	64	4560.99	4558.92	4535.51	1.00	1.00	0.1	2.8	3.10	50.	14.	50.
3	1	0.350	74	4560.99	4558.40	4535.56	1.00	1.00	0.1	3.5	3.10	50.	25.	50.
7	1	0.420	89	4560.98	4557.88	4535.62	1.00	1.00	0.1	4.2	3.10	50.	39.	50.
3	2	0.490	107	4560.97	4557.36	4535.69	1.00	1.00	0.1	4.9	3.10	50.	57.	50.
9	2	0.560	129	4560.95	4556.84	4535.77	1.00	1.00	0.1	5.6	3.10	50.	80.	50.
0	2	0.630	156	4560.93	4556.32	4535.86	1.00	1.00	0.2	6.3	3.10	50.	107.	50.
1	2	0.700	188	4560.90	4555.80	4535.96	1.00	1.00	0.2	7.0	3.10	50.	138.	50.
2	2	0.770	223	4560.87	4555.28	4536.07	1.00	1.00	0.3	7.7	3.10	50.	174.	50.
3	2	0.840	264	4560.82	4554.76	4536.18	1.00	1.00	0.3	8.4	3.10	50.	214.	50.
4	2	0.910	307	4560.77	4554.24	4536.29	1.00	1.00	0.4	9.1	3.10	50.	260.	48.
5	2	0.980	353	4560.70	4553.72	4536.40	1.00	1.00	0.5	9.8	3.10	50.	309.	44.
6	2	1.050	403	4560.62	4553.20	4536.52	1.00	1.00	0.6	10.5	3.10	50.	364.	40.
7	2	1.120	458	4560.54	4552.68	4536.63	1.00	1.00	0.7	11.2	3.10	50.	422.	36.
8	2	1.190	516	4560.43	4552.16	4536.75	1.00	1.00	0.8	11.9	3.10	50.	485.	32.
9	2	1.260	579	4560.32	4551.64	4536.88	1.00	1.00	1.0	12.6	3.10	50.	551.	28.
0	2	1.330	645	4560.19	4551.12	4537.00	1.00	1.00	1.1	13.3	3.10	50.	622.	24.
1	2	1.400	715	4560.04	4550.60	4537.12	1.00	1.00	1.3	14.0	3.10	50.	695.	20.
2	2	1.470	787	4559.88	4550.08	4537.25	1.00	1.00	1.5	14.7	3.10	50.	772.	16.
3	2	1.540	862	4559.69	4549.56	4537.37	1.00	1.00	1.7	15.4	3.10	50.	851.	12.
4	2	1.610	940	4559.50	4549.04	4537.49	1.00	1.00	1.9	16.1	3.10	50.	932.	8.
5	2	1.680	1019	4559.28	4548.52	4537.61	1.00	1.00	2.2	16.8	3.10	50.	1016.	4.
6	2	1.750	1100	4559.04	4548.00	4537.73	1.00	1.00	2.4	17.5	3.10	50.	1100.	0.
7	2	1.820	1185	4558.78	4547.48	4537.86	1.00	1.00	2.7	18.2	3.10	50.	1186.	0.
8	2	1.890	1271	4558.51	4546.96	4537.97	1.00	1.00	3.0	18.9	3.10	50.	1271.	0.
9	2	1.960	1357	4558.21	4546.44	4538.09	1.00	1.00	3.4	19.6	3.10	50.	1357.	0.
0	2	2.030	1442	4557.89	4545.92	4538.20	1.00	1.00	3.7	20.3	3.10	50.	1442.	0.
1	2	2.100	1526	4557.55	4545.40	4538.31	1.00	1.00	4.1	21.0	3.10	50.	1526.	0.
2	2	2.170	1609	4557.19	4544.88	4538.41	1.00	1.00	4.5	21.7	3.10	50.	1609.	0.
3	2	2.240	1690	4556.81	4544.36	4538.51	1.00	1.00	4.9	22.4	3.10	50.	1690.	0.
4	2	2.310	1769	4556.41	4543.84	4538.60	1.00	1.00	5.3	23.1	3.10	50.	1769.	0.
5	2	2.380	1845	4555.99	4543.32	4538.69	1.00	1.01	5.8	23.8	3.10	50.	1846.	0.
6	2	2.450	1919	4555.55	4542.80	4538.78	1.00	1.01	6.3	24.5	3.10	50.	1920.	0.
7	2	2.520	1990	4555.10	4542.28	4538.86	1.00	1.01	6.8	25.2	3.10	50.	1991.	0.
8	2	2.590	2058	4554.62	4541.76	4538.93	1.00	1.01	7.3	25.9	3.10	50.	2059.	0.
9	2	2.660	2123	4554.13	4541.24	4539.00	1.00	1.01	7.8	26.6	3.10	50.	2123.	0.
0	2	2.730	2184	4553.62	4540.72	4539.07	1.00	1.01	8.3	27.3	3.10	50.	2184.	0.
1	2	2.800	2241	4553.09	4540.20	4539.13	1.00	1.01	8.9	28.0	3.10	50.	2242.	0.
2	2	2.870	2295	4552.55	4539.68	4539.19	1.00	1.01	9.5	28.7	3.10	50.	2296.	0.
3	2	2.940	2345	4552.00	4539.16	4539.24	1.00	1.02	10.0	29.4	3.10	50.	2346.	0.
4	2	3.010	2392	4551.43	4538.64	4539.29	1.00	1.02	10.6	30.1	3.10	50.	2393.	0.
5	2	3.080	2436	4550.84	4538.12	4539.33	1.00	1.02	11.2	30.8	3.10	50.	2436.	0.
6	2	3.150	2476	4550.25	4537.60	4539.37	1.00	1.02	11.9	31.5	3.10	50.	2476.	0.
7	2	3.220	2513	4549.64	4537.08	4539.41	1.00	1.03	12.5	32.2	3.10	50.	2513.	0.
8	2	3.290	2547	4549.02	4536.56	4539.45	1.00	1.03	13.1	32.9	3.10	50.	2548.	0.
9	2	3.360	2579	4548.40	4536.04	4539.48	1.00	1.04	13.8	33.6	3.10	50.	2580.	0.
0	2	3.430	2609	4547.76	4535.52	4539.51	1.00	1.05	14.4	34.3	3.10	50.	2609.	0.

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
***	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
51	2	3.500	2638	4547.11	4535.00	4539.54	1.00	1.05	15.1	35.0	3.10	50.	2638.	0.
52	2	3.570	2453	4546.48	4535.00	4539.35	1.00	1.06	15.7	35.0	3.10	50.	2454.	0.
53	2	3.640	2273	4545.89	4535.00	4539.17	1.00	1.06	16.3	35.0	3.10	50.	2274.	0.
54	2	3.710	2109	4545.34	4535.00	4538.99	1.00	1.06	16.9	35.0	3.10	50.	2109.	0.
55	2	3.780	1959	4544.83	4535.00	4538.82	1.00	1.06	17.4	35.0	3.10	50.	1959.	0.
56	2	3.850	1823	4544.36	4535.00	4538.67	1.00	1.06	17.9	35.0	3.10	50.	1823.	0.
57	2	3.920	1699	4543.92	4535.00	4538.52	1.00	1.07	18.3	35.0	3.10	50.	1699.	0.
58	2	3.990	1585	4543.51	4535.00	4538.38	1.00	1.07	18.7	35.0	3.10	50.	1586.	0.
59	2	4.060	1482	4543.13	4535.00	4538.25	1.00	1.07	19.1	35.0	3.10	50.	1482.	0.
60	2	4.130	1387	4542.77	4535.00	4538.13	1.00	1.07	19.5	35.0	3.10	50.	1387.	0
61	2	4.200	1300	4542.43	4535.00	4538.01	1.00	1.07	19.8	35.0	3.10	50.	1300.	0
62	2	4.270	1220	4542.11	4535.00	4537.90	1.00	1.08	20.1	35.0	3.10	50.	1220.	0
63	2	4.340	1146	4541.82	4535.00	4537.80	1.00	1.08	20.4	35.0	3.10	50.	1147.	0
64	2	4.410	1078	4541.54	4535.00	4537.70	1.00	1.08	20.7	35.0	3.10	50.	1079.	0
65	2	4.480	1016	4541.28	4535.00	4537.61	1.00	1.08	21.0	35.0	3.10	50.	1016.	0
66	2	4.550	958	4541.03	4535.00	4537.52	1.00	1.08	21.2	35.0	3.10	50.	959.	0
67	2	4.620	905	4540.80	4535.00	4537.44	1.00	1.08	21.5	35.0	3.10	50.	905.	0
68	2	4.690	855	4540.58	4535.00	4537.36	1.00	1.08	21.7	35.0	3.10	50.	855.	0
69	2	4.760	809	4540.37	4535.00	4537.28	1.00	1.09	21.9	35.0	3.10	50.	809.	0
70	2	4.830	766	4540.18	4535.00	4537.21	1.00	1.09	22.1	35.0	3.10	50.	767.	0
71	2	4.900	727	4539.99	4535.00	4537.14	1.00	1.09	22.3	35.0	3.10	50.	727.	0
72	2	4.970	690	4539.82	4535.00	4537.08	1.00	1.09	22.5	35.0	3.10	50.	690.	0
73	2	5.040	655	4539.65	4535.00	4537.02	1.00	1.09	22.6	35.0	3.10	50.	656.	0
74	2	5.110	623	4539.50	4535.00	4536.96	1.00	1.09	22.8	35.0	3.10	50.	624.	0
75	2	5.180	593	4539.35	4535.00	4536.90	1.00	1.09	22.9	35.0	3.10	50.	594.	0
76	2	5.250	565	4539.21	4535.00	4536.85	1.00	1.09	23.1	35.0	3.10	50.	566.	0
77	2	5.320	539	4539.07	4535.00	4536.80	1.00	1.10	23.2	35.0	3.10	50.	539.	0
78	2	5.390	514	4538.95	4535.00	4536.75	1.00	1.10	23.4	35.0	3.10	50.	515.	0
79	2	5.460	491	4538.83	4535.00	4536.70	1.00	1.10	23.5	35.0	3.10	50.	492.	0
80	2	5.530	470	4538.71	4535.00	4536.66	1.00	1.10	23.6	35.0	3.10	50.	470.	0
81	2	5.600	449	4538.60	4535.00	4536.62	1.00	1.10	23.7	35.0	3.10	50.	450.	0
82	2	5.670	430	4538.50	4535.00	4536.58	1.00	1.10	23.8	35.0	3.10	50.	431.	0
83	2	5.740	413	4538.40	4535.00	4536.54	1.00	1.10	23.9	35.0	3.10	50.	413.	0
84	2	5.810	396	4538.30	4535.00	4536.50	1.00	1.10	24.0	35.0	3.10	50.	396.	0
85	2	5.880	380	4538.21	4535.00	4536.46	1.00	1.10	24.1	35.0	3.10	50.	380.	0
86	2	5.950	365	4538.13	4535.00	4536.43	1.00	1.10	24.2	35.0	3.10	50.	365.	0
87	2	6.020	351	4538.04	4535.00	4536.40	1.00	1.10	24.3	35.0	3.10	50.	351.	0
88	2	6.090	337	4537.96	4535.00	4536.36	1.00	1.11	24.4	35.0	3.10	50.	338.	0
89	2	6.160	325	4537.89	4535.00	4536.33	1.00	1.11	24.5	35.0	3.10	50.	325.	0
90	2	6.230	313	4537.82	4535.00	4536.30	1.00	1.11	24.6	35.0	3.10	50.	313.	0
91	2	6.300	301	4537.75	4535.00	4536.28	1.00	1.11	24.7	35.0	3.10	50.	302.	0
92	1	6.370	291	4537.68	4535.00	4536.25	1.00	1.11	24.7	35.0	3.10	50.	291.	0
93	1	6.440	281	4537.62	4535.00	4536.22	1.00	1.11	24.8	35.0	3.10	50.	281.	0
94	1	6.510	271	4537.56	4535.00	4536.20	1.00	1.11	24.9	35.0	3.10	50.	272.	0
95	1	6.580	262	4537.50	4535.00	4536.17	1.00	1.11	24.9	35.0	3.10	50.	262.	
96	1	6.650	253	4537.44	4535.00	4536.15	1.00	1.11	25.0	35.0	3.10	50.	254.	
97	1	6.720	245	4537.39	4535.00	4536.13	1.00	1.11	25.1	35.0	3.10	50.	246.	
98	1	6.790	237	4537.34	4535.00	4536.11	1.00	1.11	25.1	35.0	3.10	50.	238.	
99	1	6.860	230	4537.29	4535.00	4536.09	1.00	1.11	25.2	35.0	3.10	50.	230.	
100	1	6.930	223	4537.24	4535.00	4536.07	1.00	1.11	25.2	35.0	3.10	50.	223.	

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
*	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
1	1	7.000	216	4537.19	4535.00	4536.05	1.00	1.11	25.3	35.0	3.10	50.	217.	0.
2	1	7.077	209	4537.15	4535.00	4536.03	1.00	1.11	25.4	35.0	3.10	50.	209.	0.
3	1	7.162	202	4537.09	4535.00	4536.01	1.00	1.11	25.4	35.0	3.10	50.	202.	0.
4	1	7.255	194	4537.04	4535.00	4535.98	1.00	1.11	25.5	35.0	3.10	50.	195.	0.
5	1	7.357	186	4536.98	4535.00	4535.96	1.00	1.12	25.6	35.0	3.10	50.	187.	0.
6	1	7.470	178	4536.93	4535.00	4535.94	1.00	1.12	25.6	35.0	3.10	50.	179.	0.
7	1	7.594	170	4536.87	4535.00	4535.91	1.00	1.12	25.7	35.0	3.10	50.	171.	0.
8	1	7.731	162	4536.81	4535.00	4535.88	1.00	1.12	25.8	35.0	3.10	50.	162.	0.
9	1	7.881	154	4536.74	4535.00	4535.86	1.00	1.12	25.9	35.0	3.10	50.	154.	0.
0	1	8.046	145	4536.68	4535.00	4535.83	1.00	1.12	26.0	35.0	3.10	50.	146.	0.
1	1	8.227	137	4536.62	4535.00	4535.80	1.00	1.12	26.1	35.0	3.10	50.	138.	0.
2	1	8.427	129	4536.55	4535.00	4535.77	1.00	1.12	26.2	35.0	3.10	50.	129.	0.
3	1	8.647	121	4536.49	4535.00	4535.74	1.00	1.12	26.3	35.0	3.10	50.	122.	0.
4	1	8.888	113	4536.42	4535.00	4535.71	1.00	1.12	26.4	35.0	3.10	50.	114.	0.
5	1	9.154	106	4536.36	4535.00	4535.69	1.00	1.12	26.5	35.0	3.10	50.	107.	0.
6	1	9.446	99	4536.30	4535.00	4535.66	1.00	1.12	26.6	35.0	3.10	50.	100.	0.
7	1	9.768	93	4536.24	4535.00	4535.63	1.00	1.12	26.7	35.0	3.10	50.	93.	0.
8	1	10.122	87	4536.19	4535.00	4535.61	1.00	1.12	26.8	35.0	3.10	50.	87.	0.
9	2	10.511	81	4536.14	4535.00	4535.59	1.00	1.13	26.9	35.0	3.10	50.	82.	0.
0	2	10.939	76	4536.09	4535.00	4535.56	1.00	1.13	27.0	35.0	3.10	50.	76.	0.
1	2	11.410	71	4536.04	4535.00	4535.54	1.00	1.13	27.2	35.0	3.10	50.	72.	0.
2	2	11.928	67	4536.00	4535.00	4535.52	1.00	1.13	27.3	35.0	3.10	50.	68.	0.
3	2	12.498	64	4535.97	4535.00	4535.51	1.00	1.13	27.4	35.0	3.10	50.	64.	0.
4	2	13.125	61	4535.94	4535.00	4535.49	1.00	1.13	27.6	35.0	3.10	50.	61.	0.
5	2	13.814	58	4535.91	4535.00	4535.48	1.00	1.13	27.7	35.0	3.10	50.	59.	0.
6	2	14.573	56	4535.89	4535.00	4535.47	1.00	1.13	27.9	35.0	3.10	50.	57.	0.
7	2	15.407	54	4535.87	4535.00	4535.46	1.00	1.13	28.0	35.0	3.10	50.	55.	0.
8	2	16.325	53	4535.85	4535.00	4535.46	1.00	1.13	28.2	35.0	3.10	50.	53.	0.
9	2	17.334	52	4535.84	4535.00	4535.45	1.00	1.13	28.4	35.0	3.10	50.	52.	0.
0	1	18.445	51	4535.83	4535.00	4535.44	1.00	1.13	28.6	35.0	3.10	50.	52.	0.
1	1	19.666	51	4535.83	4535.00	4535.44	1.00	1.13	28.8	35.0	3.10	50.	51.	0.
2	1	21.010	50	4535.82	4535.00	4535.44	1.00	1.13	29.1	35.0	3.10	50.	51.	0.
3	1	22.488	50	4535.82	4535.00	4535.44	1.00	1.13	29.4	35.0	3.10	50.	50.	0.

PARAMETER	UNITS	VARIABLE	VALUE
**********	*******	******	**********
INITIAL FLOW	CMS	Q(1)	50.
MAX FLOW	CMS	QM	2638.
FINAL FLOW	CMS	Q(NU)	50.
TIME TO MAX FLOW	HRS	TP	3.50
NUMBER OF TIME STEPS		NNU	133
TOTAL VOLUME DISCHARGED FROM RESERVOIR	MILLION CU M	DISVOL	29.

INITIAL CONDITIONS

(QDI(I), I=1, N)

50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	120.	120.	120.	120.	120.
120.	120.	120.	120.	120.	120.	120.	120.
120.	120.	120.	120.	120.	120.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.

(YI(I), I=1, N)

4535.44	4459.05	4382.67	4306.27	4229.89	4153.50	4077.11	4000.72
3924.33	3847.94	3771.56	3695.16	3618.78	3542.38	3466.00	3389.61
3313.22	3236.83	3160.45	3077.59	2994.38	2911.25	2828.05	2744.92
2661.72	2578.59	2495.39	2412.25	2329.06	2245.92	2162.74	2079.58
1996.41	1913.26	1830.09	1746.93	1663.76	1580.60	1556.87	1532.77
1508.66	1484.55	1460.44	1436.33	1412.23	1388.12	1364.01	1339.90
1315.80	1291.69	1267.58	1243.48	1219.37	1195.27	1171.17	1151.17
1131.17	1111.17	1091.17	1071.18	1051.18	1031.18	1011.18	991.19
971.19	951.19	931.19	911.20	891.20	871.20	851.20	831.21
811.21	791.21	771.21	751.22	731.22	711.22	691.22	671.23
651.23	631.23	611.24	591.24	571.24	552.08	532.91	513.75
494.59	475.44	456.28	437.13	417.97	398.82	379.67	360.52
341.37	322.23	303.08	283.93	264.79	245.64	226.50	207.35
188.21	169.07	149.93	130.78				

TIME PARAMETERS OF OUTFLOW HYDROGRAPH IMMEDIATELY DOWNSTREAM OF DAM

PARAMETER	UNITS	VARIABLE	VALUE
TIME TO FAILURE	HR	TFH	3.500
TIME TO START OF RISING LIMB OF HYDROGRAPH	HR	TFO	0.000
TIME TO PEAK	HR	TP	3.500
TIME STEP SIZE	HR	DTHI	0.175

ROUTING COMPLETED.

KTIME= 79 ALLOWABLE KTIME= 699 TT= 24.5

PROFILE OF CRESTS AND TIMES FOR 1994 GLOF
BELOW RUN1 1 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
********	********	********	********	********	**********	**********
0.000	4539.52	2580	3.522	9.67	0.00	0.00
2.027	4463.15	2585	3.522	9.67	0.00	0.00
4.055	4386.75	2583	3.522	9.71	0.00	0.00
6.082	4310.37	2577	3.522	9.69	0.00	0.00
8.110	4233.97	2567	3.522	9.72	0.00	0.00
10.137	4157.58	2554	3.522	9.70	0.00	0.00
12.165	4081.17	2539	3.522	9.72	0.00	0.00
14.192	4004.80	2542	3.697	9.72	0.00	0.00
16.220	3928.40	2544	3.697	9.77	0.00	0.00
18.247	3852.02	2540	3.697	9.76	0.00	0.00
20.274	3775.63	2539	3.784	9.80	0.00	0.00
22.302	3699.25	2537	3.784	9.81	0.00	0.00
24.329	3622.85	2533	3.872	9.84	0.00	0.00
26.357	3546.48	2534	3.872	9.85	0.00	0.00
28.384	3470.08	2531	3.872	9.88	0.00	0.00
30.412	3393.70	2523	3.872	9.89	0.00	0.00
32.439	3317.30	2511	3.872	9.91	0.00	0.00
34.466	3240.92	2513	4.047	9.93	0.00	0.00
36.494	3164.53	2515	4.047	9.97	0.00	0.00
38.578	3081.25	2582	4.047	10.27	0.00	0.00
40.662	2998.13	2576	4.047	9.90	0.00	0.00
42.745	2914.81	2566	4.047	10.00	0.00	0.00
44.829	2831.68	2567	4.222	9.70	0.00	0.00
46.913	2748.40	2569	4.222	9.77	0.00	0.00
48.997	2665.25	2566	4.222	9.52	0.00	0.00
51.081	2581.98	2559	4.222	9.56	0.00	0.00
53.165	2498.82	2548	4.222	9.34	0.00	0.00
55.249	2415.58	2554	4.397	9.36	0.00	0.00
57.333	2332.41	2555	4.397	9.19	0.00	0.00
59.416	2249.17	2552	4.397	9.19	0.00	0.00
61.500	2165.99	2542	4.397	9.03	0.00	0.00
63.584	2082.77	2542	4.572	9.03	0.00	0.00
65.668	1999.60	2545	4.572	8.90	0.00	0.00
67.752	1916.38	2540	4.572	8.88	0.00	0.00
69.836	1833.19	2528	4.572	8.75	0.00	0.00
71.920	1749.98	2530	4.747	8.73	0.00	0.00
74.003	1666.80	2529	4.747	8.63	0.00	0.00
76.087	1583.59	2524	4.747	8.60	0.00	0.00
78.128	1562.56	2615	4.747	4.35	0.00	0.00
80.169	1535.43	2620	4.922	10.04	0.00	0.00
82.210	1514.50	2615	4.922	4.40	0.00	0.00
84.251	1487.24	2609	5.097	13.02	0.00	0.00
86.291	1466.41	2608	4.922	4.46	0.00	0.00
88.332	1439.06	2607	5.272	12.51	0.00	0.00
90.373	1418.33	2598	5.097	4.53	0.00	0.00
92.414	1390.90	2609	5.447	12.24	0.00	0.00
94.455	1370.22	2589	5.272	4.63	0.00	0.00
96.496	1342.74	2598	5.447	12.59	0.00	0.00

PROFILE OF CRESTS AND TIMES FOR 1994 GLOF
BELOW RUN1 1 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
98.536	1322.14	2581	5.097	4.73	0.00	0.00
100.577	1294.60	2580	5.622	13.83	0.00	0.00
102.618	1274.09	2568	5.272	4.82	0.00	0.00
104.659	1246.44	2553	5.797	13.14	0.00	0.00
106.700	1226.03	2552	5.447	4.94	0.00	0.00
108.741	1198.27	2551	5.972	13.03	0.00	0.00
110.781	1177.99	2564	5.622	5.06	0.00	0.00
112.804	1154.79	2567	5.972	10.31	0.00	0.00
114.827	1138.16	2568	5.797	4.93	0.00	0.00
116.850	1114.60	2577	5.972	11.51	0.00	0.00
118.873	1098.37	2563	5.797	4.82	0.00	0.00
120.896	1074.44	2579	5.972	12.31	0.00	0.00
122.919	1058.56	2579	5.972	4.72	0.00	0.00
124.942	1034.29	2574	6.147	12.86	0.00	0.00
126.965	1018.73	2584	6.147	4.64	0.00	0.00
128.988	994.13	2570	6.322	13.36	0.00	0.00
131.011	978.87	2579	6.322	4.57	0.00	0.00
133.034	954.00	2582	6.322	13.83	0.00	0.00
135.057	938.96	2566	6.497	4.51	0.00	0.00
137.080	913.92	2581	6.497	14.18	0.00	0.00
139.103	899.08	2567	6.497	4.46	0.00	0.00
141.126	873.85	2569	6.672	14.36	0.00	0.00
143.149	859.16	2574	6.672	4.45	0.00	0.00
145.172	833.80	2552	6.847	14.38	0.00	0.00
147.195	819.20	2568	6.847	4.43	0.00	0.00
149.218	793.77	2568	6.847	14.34	0.00	0.00
151.241	779.21	2552	7.022	4.41	0.00	0.00
153.264	753.77	2567	7.022	14.47	0.00	0.00
155.287	739.25	2545	7.022	4.40	0.00	0.00
157.310	713.77	2553	7.197	14.57	0.00	0.00
159.333	699.29	2554	7.197	4.41	0.00	0.00
161.356	673.75	2529	7.372	14.58	0.00	0.00
163.379	659.30	2547	7.372	4.41	0.00	0.00
165.402	633.74	2538	7.372	14.53	0.00	0.00
167.425	619.29	2529	7.547	4.40	0.00	0.00
169.448	593.77	2538	7.547	14.41	0.00	0.00
171.471	579.30	2507	7.547	4.38	0.00	0.00
173.545	554.75	2526	7.722	13.05	0.00	0.00
175.618	540.71	2515	7.722	4.21	0.00	0.00
177.692	516.20	2506	7.897	13.53	0.00	0.00
179.766	502.14	2511	7.897	4.06	0.00	0.00
181.839	477.61	2477	7.897	13.83	0.00	0.00
183.913	463.50	2457	8.247	3.90	0.00	0.00
185.986	439.25	2503	8.247	14.01	0.00	0.00
188.060	425.09	2513	8.247	3.81	0.00	0.00
190.133	400.71	2476	8.247	14.18	0.00	0.00
192.207	386.46	2445	8.597	3.68	0.00	0.00

194.281	362.39	2495	8.597	14.24	0.00	0.00

PROFILE OF CRESTS AND TIMES FOR 1994 GLOF
BELOW RUN1 1 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
********	********	********	********	********	**********	**********
196.354	348.09	2494	8.597	3.60	0.00	0.00
198.428	323.91	2434	8.947	13.99	0.00	0.00
200.501	309.50	2435	8.947	3.49	0.00	0.00
202.575	285.58	2473	8.947	14.19	0.00	0.00
204.648	271.12	2447	8.947	3.40	0.00	0.00
206.722	247.17	2375	9.297	14.26	0.00	0.00
208.795	232.57	2403	9.297	3.32	0.00	0.00
210.869	208.82	2427	9.297	13.86	0.00	0.00
212.943	194.18	2386	9.297	3.22	0.00	0.00
215.016	170.44	2328	9.647	14.17	0.00	0.00
217.090	155.70	2368	9.647	3.17	0.00	0.00
219.163	132.08	2378	9.647	13.72	0.00	0.00

DISCHARGE HYDROGRAPH FOR 1994 GLOF ... STATION NUMBER 1
BELOW RUN1 1 : AT KM 0.00

GAGE ZERO = 4535.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 4539.52 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.52 M AT TIME = 3.522 HOURS
MAX FLOW = 2580 CMS AT TIME = 3.522 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	-4535.0	0	* . . . . .
0.2	0.5	57	.* . . . . .
0.4	0.6	87	.* . . . . .
0.6	0.8	148	.* . . . . .
0.8	1.1	244	. * . . . . .
1.0	1.4	371	. * . . . . .
1.2	1.8	528	. * . . . . .
1.4	2.1	717	. * . . . . .
1.6	2.5	929	. *. . . . .
1.8	2.8	1161	. . * . . . .
2.0	3.2	1405	. . * . . . .
2.2	3.5	1643	. . * . . . .
2.4	3.7	1865	. . *. . . .
2.6	4.0	2066	. . * . . . .
2.8	4.2	2240	. . * . . . .
3.0	4.3	2386	. . * . . . .
3.2	4.4	2502	. . * . . . .
3.4	4.5	2576	. . * . . . .
3.6	4.3	2384	. . * . . . .
3.8	3.8	1921	. . *. . . .
4.0	3.4	1578	. . * . . . .
4.2	3.0	1304	. . * . . . .
4.4	2.7	1089	. . * . . . .
4.6	2.5	922	. *. . . . .
4.8	2.3	787	. * . . . . .
5.0	2.1	677	. * . . . . .
5.2	1.9	587	. * . . . . .
5.4	1.8	513	. * . . . . .
5.6	1.6	451	. * . . . . .
5.8	1.5	399	. * . . . . .
6.0	1.4	355	. * . . . . .
6.2	1.3	319	. * . . . . .
6.4	1.2	287	. * . . . . .
6.6	1.2	260	. * . . . . .
6.8	1.1	237	. * . . . . .
7.0	1.1	217	. * . . . . .
7.2	1.0	199	. * . . . . .
7.4	1.0	184	. * . . . . .
7.6	0.9	170	. * . . . . .
7.8	0.9	159	. * . . . . .
8.0	0.8	148	.* . . . . .
8.2	0.8	139	.* . . . . .
8.4	0.8	131	.* . . . . .
8.6	0.8	123	.* . . . . .
8.8	0.7	117	.* . . . . .
9.0	0.7	111	.* . . . . .
9.2	0.7	106	.* . . . . .
9.4	0.7	101	.* . . . . .
9.6	0.7	97	.* . . . . .
9.8	0.6	93	.* . . . . .
10.0	0.6	89	.* . . . . .

DISCHARGE HYDROGRAPH FOR 1994 GLOF ... STATION NUMBER 19
BELOW RUN1 1 : AT KM 36.49

GAGE ZERO = 3160.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 3164.53 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.53 M AT TIME = 4.047 HOURS
MAX FLOW = 2515 CMS AT TIME = 4.047 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	-3160.0	0	* . . . . .
0.5	0.4	51	.* . . . . .
1.0	0.4	51	.* . . . . .
1.5	0.4	51	.* . . . . .
2.0	0.5	55	.* . . . . .
2.5	2.3	789	. * . . . . .
3.0	3.6	1659	. . * . . . .
3.5	4.2	2225	. . . * . . .
4.0	4.5	2506	. . . * . . .
4.5	4.0	2034	. . . * . . .
5.0	3.1	1350	. . * . . . .
5.5	2.6	955	. * . . . . .
6.0	2.1	700	. * . . . . .
6.5	1.8	530	. * . . . . .
7.0	1.6	413	. * . . . . .
7.5	1.4	330	. * . . . . .
8.0	1.2	270	. * . . . . .
8.5	1.1	225	. * . . . . .
9.0	1.0	190	. * . . . . .
9.5	0.9	163	. * . . . . .
10.0	0.8	142	.* . . . . .
10.5	0.8	126	.* . . . . .
11.0	0.7	113	.* . . . . .
11.5	0.7	102	.* . . . . .
12.0	0.6	93	.* . . . . .
12.5	0.6	86	.* . . . . .
13.0	0.6	80	.* . . . . .
13.5	0.6	75	.* . . . . .
14.0	0.5	71	.* . . . . .
14.5	0.5	67	.* . . . . .
15.0	0.5	65	.* . . . . .
15.5	0.5	62	.* . . . . .
16.0	0.5	60	.* . . . . .
16.5	0.5	59	.* . . . . .
17.0	0.5	57	.* . . . . .
17.5	0.5	56	.* . . . . .
18.0	0.5	55	.* . . . . .
18.5	0.5	54	.* . . . . .
19.0	0.5	54	.* . . . . .
19.5	0.5	53	.* . . . . .
20.0	0.5	52	.* . . . . .
20.5	0.5	52	.* . . . . .
21.0	0.5	52	.* . . . . .
21.5	0.5	51	.* . . . . .
22.0	0.4	51	.* . . . . .
22.5	0.4	51	.* . . . . .
23.0	0.4	51	.* . . . . .

DISCHARGE HYDROGRAPH FOR 1994 GLOF ... STATION NUMBER 38
BELOW RUN1 1 : AT KM 76.09

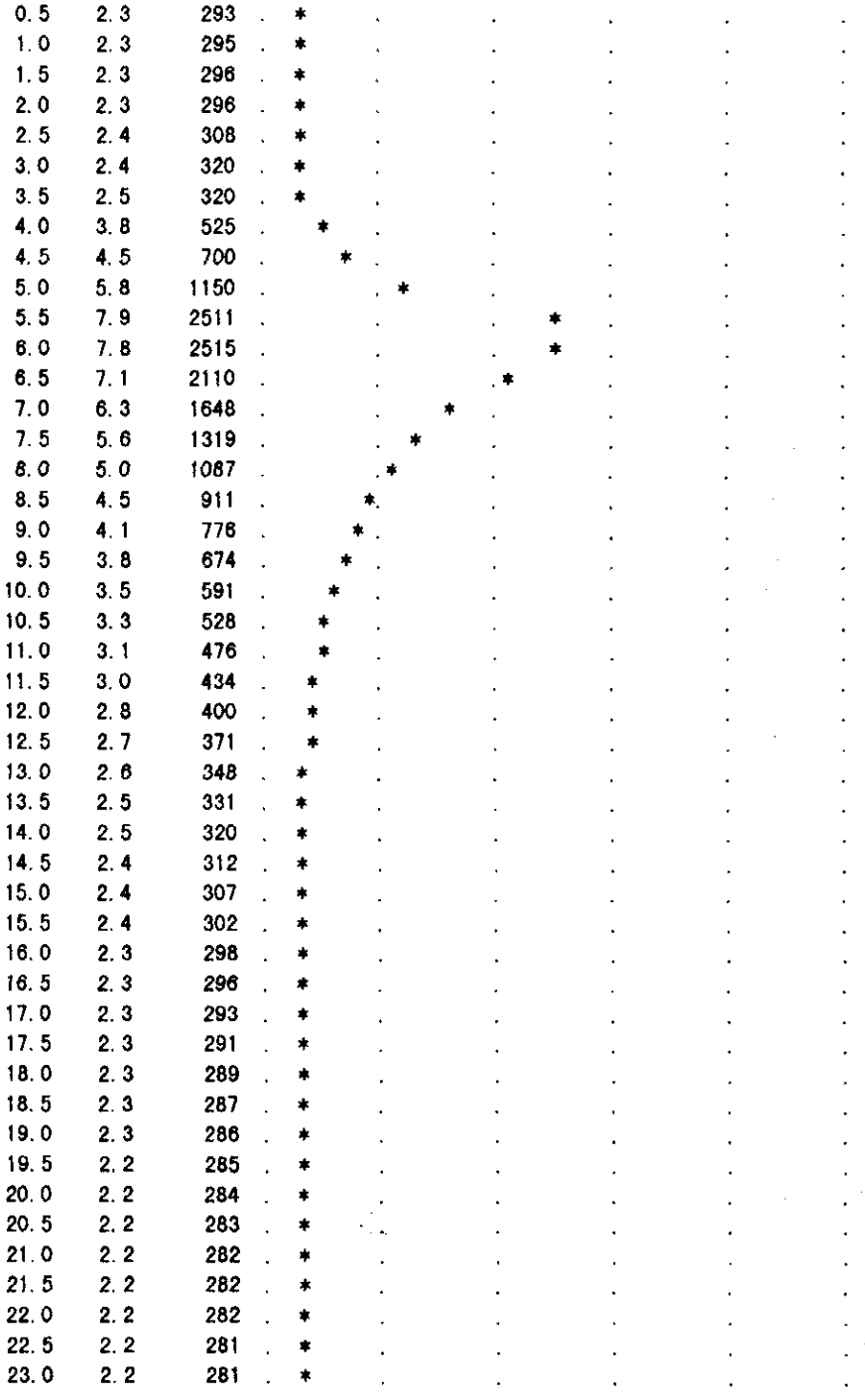
GAGE ZERO = 1580.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 1583.59 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 3.59 M AT TIME = 4.747 HOURS
MAX FLOW = 2525 CMS AT TIME = 4.747 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	-1580.0	0	* . . . . .
0.5	0.6	125	.* . . . . .
1.0	0.6	126	.* . . . . .
1.5	0.6	126	.* . . . . .
2.0	0.6	126	.* . . . . .
2.5	0.6	134	.* . . . . .
3.0	0.6	138	.* . . . . .
3.5	0.8	188	. * . . . . .
4.0	3.1	1962	. . . * . . .
4.5	3.5	2439	. . . . * . .
5.0	3.5	2441	. . . . * . .
5.5	3.0	1885	. . . *. . . .
6.0	2.5	1372	. . . * . . . .
6.5	2.2	1051	. . .* . . . .
7.0	1.9	826	. . * . . . . .
7.5	1.7	667	. . * . . . . .
8.0	1.5	551	. . * . . . . .
8.5	1.3	463	. . * . . . . .
9.0	1.2	396	. . * . . . . .
9.5	1.1	345	. . * . . . . .
10.0	1.0	304	. . * . . . . .
10.5	1.0	272	. . * . . . . .
11.0	0.9	246	. * . . . . .
11.5	0.9	225	. * . . . . .
12.0	0.8	208	. * . . . . .
12.5	0.8	194	. * . . . . .
13.0	0.8	182	. * . . . . .
13.5	0.8	172	. * . . . . .
14.0	0.7	164	. * . . . . .
14.5	0.7	157	. * . . . . .
15.0	0.7	151	. * . . . . .
15.5	0.7	146	.* . . . . .
16.0	0.7	142	.* . . . . .
16.5	0.7	139	.* . . . . .
17.0	0.7	136	.* . . . . .
17.5	0.6	133	.* . . . . .
18.0	0.6	131	.* . . . . .
18.5	0.6	129	.* . . . . .
19.0	0.6	128	.* . . . . .
19.5	0.6	127	.* . . . . .
20.0	0.6	126	.* . . . . .
20.5	0.6	125	.* . . . . .
21.0	0.6	125	.* . . . . .
21.5	0.6	124	.* . . . . .
22.0	0.6	125	.* . . . . .
22.5	0.6	125	.* . . . . .
23.0	0.6	124	.* . . . . .

DISCHARGE HYDROGRAPH FOR 1994 GLOF ... STATION NUMBER 55
BELOW RUN1 1 : AT KM 110.78

GAGE ZERO = 1170.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 1177.99 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 7.99 M AT TIME = 5.622 HOURS
MAX FLOW = 2564 CMS AT TIME = 5.622 HOURS

TIME HR	STAGE M	FLOW CMS
0.0	-1170.0	0
0.5	2.3	293
1.0	2.3	295
1.5	2.3	296
2.0	2.3	296
2.5	2.4	308
3.0	2.4	320
3.5	2.5	320
4.0	3.8	525
4.5	4.5	700
5.0	5.8	1150
5.5	7.9	2511
6.0	7.8	2515
6.5	7.1	2110
7.0	6.3	1648
7.5	5.6	1319
8.0	5.0	1087
8.5	4.5	911
9.0	4.1	776
9.5	3.8	674
10.0	3.5	591
10.5	3.3	528
11.0	3.1	476
11.5	3.0	434
12.0	2.8	400
12.5	2.7	371
13.0	2.6	348
13.5	2.5	331
14.0	2.5	320
14.5	2.4	312
15.0	2.4	307
15.5	2.4	302
16.0	2.3	298
16.5	2.3	296
17.0	2.3	293
17.5	2.3	291
18.0	2.3	289
18.5	2.3	287
19.0	2.3	286
19.5	2.2	285
20.0	2.2	284
20.5	2.2	283
21.0	2.2	282
21.5	2.2	282
22.0	2.2	282
22.5	2.2	281
23.0	2.2	281



DISCHARGE HYDROGRAPH FOR 1994 GLOF ... STATION NUMBER 85
BELOW RUN1 1 : AT KM 171.47

GAGE ZERO = 570.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 579.30 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 9.30 M AT TIME = 7.547 HOURS
MAX FLOW = 2508 CMS AT TIME = 7.547 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	-570.0	0	* . . . . .
0.5	3.9	465	. * . . . . .
1.0	4.1	529	. * . . . . .
1.5	4.2	535	. * . . . . .
2.0	4.2	535	. * . . . . .
2.5	4.2	542	. * . . . . .
3.0	4.3	562	. * . . . . .
3.5	4.3	570	. * . . . . .
4.0	4.6	624	. * . . . . .
4.5	4.8	660	. * . . . . .
5.0	4.9	685	. * . . . . .
5.5	5.0	702	. * . . . . .
6.0	5.0	721	. * . . . . .
6.5	5.3	775	. * . . . . .
7.0	6.6	1131	. * . . . . .
7.5	9.2	2426	. . * . . . .
8.0	8.9	2318	. . * . . . .
8.5	8.2	1980	. . * . . . .
9.0	7.5	1648	. . * . . . .
9.5	6.9	1386	. . * . . . .
10.0	6.4	1180	. . * . . . .
10.5	5.9	1024	. * . . . . .
11.0	5.5	895	. * . . . . .
11.5	5.2	790	. * . . . . .
12.0	4.9	704	. * . . . . .
12.5	4.6	636	. * . . . . .
13.0	4.5	601	. * . . . . .
13.5	4.4	580	. * . . . . .
14.0	4.3	561	. * . . . . .
14.5	4.2	547	. * . . . . .
15.0	4.2	534	. * . . . . .
15.5	4.1	524	. * . . . . .
16.0	4.1	516	. * . . . . .
16.5	4.1	510	. * . . . . .
17.0	4.0	504	. * . . . . .
17.5	4.0	499	. * . . . . .
18.0	4.0	495	. * . . . . .
18.5	4.0	491	. * . . . . .
19.0	3.9	488	. * . . . . .
19.5	3.9	485	. * . . . . .
20.0	3.9	483	. * . . . . .
20.5	3.9	481	. * . . . . .
21.0	3.9	479	. * . . . . .
21.5	3.9	477	. * . . . . .
22.0	3.9	475	. * . . . . .
22.5	3.9	474	. * . . . . .
23.0	3.9	473	. * . . . . .

DISCHARGE HYDROGRAPH FOR 1994 GLOF ... STATION NUMBER 108
BELOW RUN1 1 : AT KM 219.16

GAGE ZERO = 130.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 132.08 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 2.08 M AT TIME = 9.647 HOURS
MAX FLOW = 2379 CMS AT TIME = 9.647 HOURS

TIME HR	STAGE M	FLOW CMS	0 500 1000 1500 2000 2500
0.0	-130.0	0	*
0.5	0.8	480	*
1.0	0.8	619	*
1.5	0.8	665	*
2.0	0.8	671	*
2.5	0.8	672	*
3.0	0.8	676	*
3.5	0.8	681	*
4.0	0.8	693	*
4.5	0.8	698	*
5.0	0.8	706	*
5.5	0.8	713	*
6.0	0.8	718	*
6.5	0.8	723	*
7.0	0.8	732	*
7.5	0.8	752	*
8.0	0.8	805	*
8.5	0.8	962	*
9.0	1.1	1491	*
9.5	1.9	2230	*
10.0	2.0	2171	*
10.5	1.7	1794	*
11.0	1.5	1559	*
11.5	1.4	1363	*
12.0	1.2	1189	*
12.5	1.1	1053	*
13.0	1.0	940	*
13.5	1.0	844	*
14.0	0.9	764	*
14.5	0.8	701	*
15.0	0.8	678	*
15.5	0.8	674	*
16.0	0.8	668	*
16.5	0.8	661	*
17.0	0.8	657	*
17.5	0.8	653	*
18.0	0.8	649	*
18.5	0.8	646	*
19.0	0.8	643	*
19.5	0.8	640	*
20.0	0.8	638	*
20.5	0.8	635	*
21.0	0.8	633	*
21.5	0.8	632	*
22.0	0.8	630	*
22.5	0.8	628	*
23.0	0.8	627	*

Calculation Result of DAMBRK (2/3)

Simulation of GLOF from Luggye Lake

ANALYSIS OF THE DOWNSTREAM FLOOD HYDROGRAPH

PRODUCED BY THE DAM BREAK OF

RUN2 :

ON

Luggye Lake

ANALYSIS BY

BASED ON PROCEDURE DEVELOPED BY
DANNY L. FREAD, PH.D., SR. RESEARCH HYDROLOGIST

QUALITY CONTROL TESTING AND OTHER SUPPORT BY
JANICE M. LEWIS, RESEARCH HYDROLOGIST

HYDROLOGIC RESEARCH LABORATORY
W23, OFFICE OF HYDROLOGY
NOAA, NATIONAL WEATHER SERVICE
SILVER SPRING, MARYLAND 20910

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*** SUMMARY OF INPUT DATA ***
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INPUT CONTROL PARAMETERS FOR RUN2 :

PARAMETER	VARIABLE	VALUE
NUMBER OF DYNAMIC ROUTING REACHES	KKN	1
TYPE OF RESERVOIR ROUTING	KUI	0
MULTIPLE DAM INDICATOR	MULDAM	0
PRINTING INSTRUCTIONS FOR INPUT SUMMARY	KDMP	5
NO. OF RESERVOIR INFLOW HYDROGRAPH POINTS	ITEH	2
INTERVAL OF CROSS-SECTION INFO PRINTED OUT WHEN JNK=9	NPRT	0
FLOOD-PLAIN MODEL PARAMETER	KFLP	0
METRIC INPUT/OUTPUT OPTION	METRIC	1

IOPUT= 1 0 0 0 0 0 1 1 0 0 0 0

RUN2 : RESERVOIR

TABLE OF ELEVATION VS SURFACE AREA

SURFACE AREA (SQ KM) SA(K)	ELEVATION (M) HSA(K)
1.0	4560.00
1.0	4535.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00

RUN2 : RESERVOIR AND BREACH PARAMETERS

PARAMETER	UNITS	VARIABLE	VALUE
LENGTH OF RESERVOIR	KM	RLM	2.10
ELEVATION OF WATER SURFACE	M	YO	4561.00
SIDE SLOPE OF BREACH		Z	0.00
ELEVATION OF BOTTOM OF BREACH	M	YBMIN	4535.00

WIDTH OF BASE OF BREACH	M	BB	35.00
TIME TO MAXIMUM BREACH SIZE	HOUR	TFH	3.50
ELEVATION (MSL) OF BOTTOM OF DAM	M	DATUM	4535.00
VOLUME-SURFACE AREA PARAMETER		VOL	0.00
ELEVATION OF WATER WHEN BREACHED	M	HF	4561.00
ELEVATION OF TOP OF DAM	M	HD	4561.00
ELEVATION OF UNCONTROLLED SPILLWAY CREST	M	HSP	0.00
ELEVATION OF CENTER OF GATE OPENINGS	M	HGT	0.00
DISCHARGE COEF. FOR UNCONTROLLED SPILLWAY		CS	0.00
DISCHARGE COEF. FOR GATE FLOW		CG	0.00
DISCHARGE COEF. FOR UNCONTROLLED WEIR FLOW		CDO	0.00
DISCHARGE THRU TURBINES	CMS	QT	50.00

CDO SHOULD NOT BE 0.0 IF OVERTOPPING MAY OCCUR

DHF(INTERVAL BETWEEN INPUT HYDROGRAPH ORDINATES) = 0.00 HRS.

TEH(TIME AT WHICH COMPUTATIONS TERMINATE)= 24.0000 HRS.

BREX(BREACH EXPONENT) = 0.000

MUD(MUD FLOW OPTION) = 0

IWF(TYPE OF WAVE FRONT TRACKING) = 0

KPRES(WETTED PERIMETER OPTION) = 0

KSL(LANDSLIDE PARAMETER) = 0

INFLOW HYDROGRAPH TO RUN2 :

****

50.00 50.00

TIME OF INFLOW HYDROGRAPH ORDINATES

0.0000 100.0000

CROSS-SECTIONAL PARAMETERS FOR Luggye Lake
BELOW RUN2 :

PARAMETER	VARIABLE	VALUE
**********	******	*******
NUMBER OF CROSS-SECTIONS	NS	6
MAXIMUM NUMBER OF TOP WIDTHS	NCS	2

NUMBER OF CROSS-SECTIONAL HYDROGRAPHS TO PLOT	NTT	5
TYPE OF OUTPUT OTHER THAN HYDROGRAPH PLOTS	JNK	1
CROSS-SECTIONAL SMOOTHING PARAMETER	KSA	0
DOWNSTREAM SUPERCRITICAL OR NOT	KSUPC	1
NO. OF LATERAL INFLOW HYDROGRAPHS	LQ	5
NO. OF POINTS IN GATE CONTROL CURVE	KCG	0

NUMBER OF CROSS-SECTION WHERE HYDROGRAPH DESIRED
(MAX NUMBER OF HYDROGRAPHS = 6)

1 2 3 4 5

CROSS-SECTIONAL VARIABLES FOR Luggye Lake
BELOW RUN2 :

PARAMETER	UNITS	VARIABLE
LOCATION OF CROSS-SECTION	KM	XS(I)
ELEVATION(MSL) OF FLOODING AT CROSS-SECTION	M	FSTG(I)
ELEV CORRESPONDING TO EACH TOP WIDTH	M	HS(K,I)
TOP WIDTH CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	M	BS(K,I)
TOP WIDTH CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	M	BSS(K,I)
NUMBER OF CROSS-SECTION		I
NUMBER OF ELEVATION LEVEL		K

CROSS-SECTION NUMBER 1
XS(I) = 0.000 FSTG(I) = 0.00
HS ... 4535.0 4560.0
BS ... 50.0 150.0
BSS ... 0.0 0.0

CROSS-SECTION NUMBER 2
XS(I) = 4.500 FSTG(I) = 0.00
HS ... 4410.0 4430.0
BS ... 50.0 150.0
BSS ... 0.0 0.0

CROSS-SECTION NUMBER 3
XS(I) = 36.500 FSTG(I) = 0.00
HS ... 3160.0 3180.0
BS ... 50.0 100.0
BSS ... 0.0 0.0

CROSS-SECTION NUMBER 4
XS(I) = 76.100 FSTG(I) = 0.00
HS ... 1580.0 1600.0

```
BS  ...      70.0   200.0
BSS ...       0.0     0.0

CROSS-SECTION NUMBER  5
************************
XS(I) =   121.200   FSTG(I) =    0.00
HS  ...  1095.0  1115.0
BS  ...    30.0   100.0
BSS ...     0.0     0.0

CROSS-SECTION NUMBER  6
************************
XS(I) =   171.500   FSTG(I) =    0.00
HS  ...   570.0   590.0
BS  ...    50.0   100.0
BSS ...     0.0     0.0


MANNING N ROUGHNESS COEFFICIENTS FOR THE GIVEN REACHES
       (CM(K,I),K=1,NCS) WHERE I = REACH NUMBER
************************************************************

REACH  1 ... 0.050  0.050

REACH  2 ... 0.050  0.050

REACH  3 ... 0.050  0.050

REACH  4 ... 0.050  0.050

REACH  5 ... 0.050  0.050

     CROSS-SECTIONAL VARIABLES FOR      Luggye Lake
               BELOW   RUN2   :

PARAMETER                                    UNITS  VARIABLE
*******************************************  *******  ******

MINIMUM COMPUTATIONAL DISTANCE USED            KM      DXM(I)
     BETWEEN CROSS-SECTIONS

CONTRACTION - EXPANSION COEFFICIENTS                   FKC(I)
     BETWEEN CROSS-SECTIONS


          REACH NUMBER        DXM(I)    FKC(I)
          ************        ********  ********

               1              2.000     0.000

               2              2.000     0.000

               3              2.000     0.000

               4              2.000     0.000

               5              2.000     0.000

     DOWNSTREAM FLOW PARAMETERS FOR      Luggye Lake
```

BELOW RUN2 :

PARAMETER	UNITS	VARIABLE	VALUE
MAX DISCHARGE AT DOWNSTREAM EXTREMITY	CMS	QMAXD	0.0
MAX LATERAL OUTFLOW PRODUCING LOSSES	CMS /M	QLL	0.000
INITIAL SIZE OF TIME STEP	HOUR	DTHM	0.0000
INITIAL WATER SURFACE ELEVATION DOWNSTREAM	M	YDN	575.00
SLOPE OF CHANNEL DOWNSTREAM OF DAM	%	SOM	0.00
THETA WEIGHTING FACTOR		THETA	0.00
CONVERGENCE CRITERION FOR STAGE	M	EPSY	0.000
TIME AT WHICH DAM STARTS TO FAIL	HOUR	TFI	0.00

AT REACH= 3 DXM SHOULD BE CHANGED TO 0.434 DUE TO CHANGE OF SLOPE CRITERIA

COMPUTATIONS WILL USE THE FOLLOWING DXM VALUES

2.000 2.000 2.000 2.000 2.000

LATERAL INFLOW REACH NUMBER

LQX(I)

1 2 3 4 5

(QL(L, 1),L=1,ITEH)

0. 0.

(QL(L, 2),L=1,ITEH)

0. 0.

(QL(L, 3),L=1,ITEH)

70. 70.

(QL(L, 4),L=1,ITEH)

100. 100.

(QL(L, 5),L=1,ITEH)

0. 0.

TOTAL NUMBER OF CROSS SECTIONS (ORIGINAL+INTERPOLATED) (N) = 85 (MAXIMUM ALLOWABLE = 200

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*** ***
*** SUMMARY OF OUTPUT DATA ***
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1

CROSS-SECTION NO.	KM	BOTTOM ELEVATION M	REACH NO.	REACH LENGTH KM	SLOPE %	MESAGE
1	0.00	4535.00				
2	4.50	4410.00	1	4.50	2.78	
3	36.50	3160.00	2	32.00	3.91	
4	76.10	1580.00	3	39.60	3.99	
5	121.20	1095.00	4	45.10	1.08	
6	171.50	570.00	5	50.30	1.04	

TOTAL VOLUME IN RESERVOIR BEHIND
RUN2 : = 25.0 CU. M (MILLION)

DEFINITION OF VARIABLES IN RESERVOIR DEPLETION TABLE

PARAMETER	UNITS	VARIABLE
TIME STEP FROM START OF ANALYSIS		I
ITERATIONS NECESSARY TO SOLVE FLOW EQUATIONS		K
ELAPSED TIME FROM START OF ANALYSIS	HOUR	TTP(I)
TOTAL OUTFLOW FROM DAM	CMS	Q(I)
ELEVATION OF WATER SURFACE AT DAM	M	H2
ELEVATION OF BOTTOM OF BREACH	M	YB
EST DEPTH OF FLOW IMMEDIATELY DOWNSTREAM	M	D
SUBMERGENCE COEFFICIENT		SUB
VELOCITY CORRECTION		VCOR
TOTAL VOLUME DISCHARGED FROM TIME OF BREACH	MILLION CU M	OUTVOL
BREACH WIDTH	M	BB
RECTANGULAR BREACH DISCHARGE COEFFICIENT		COFR
INFLOW TO RESERVOIR	CMS	QI(I)
BREACH OUTFLOW	CMS	QBRECH
SPILLWAY OUTFLOW	CMS	QSPIL

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
***	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
1	0	0.000	50	4561.00	4561.00	4535.44	1.00	1.00	0.0	0.0	3.10	50.	0.	50.
2	2	0.070	50	4560.99	4560.48	4535.44	1.00	1.00	0.0	0.7	3.10	50.	0.	50.
3	2	0.140	52	4560.99	4559.96	4535.45	1.00	1.00	0.0	1.4	3.10	50.	3.	50.
4	1	0.210	56	4560.99	4559.44	4535.47	1.00	1.00	0.0	2.1	3.10	50.	7.	50.
5	1	0.280	64	4560.99	4558.92	4535.51	1.00	1.00	0.1	2.8	3.10	50.	14.	50.
6	1	0.350	74	4560.98	4558.40	4535.56	1.00	1.00	0.1	3.5	3.10	50.	25.	50.
7	2	0.420	89	4560.98	4557.88	4535.62	1.00	1.00	0.1	4.2	3.10	50.	39.	50.
8	2	0.490	107	4560.96	4557.36	4535.69	1.00	1.00	0.1	4.9	3.10	50.	57.	50.
9	2	0.560	129	4560.95	4556.84	4535.77	1.00	1.00	0.1	5.6	3.10	50.	80.	50.
10	2	0.630	156	4560.92	4556.32	4535.87	1.00	1.00	0.2	6.3	3.10	50.	107.	50.
11	2	0.700	187	4560.89	4555.80	4535.96	1.00	1.00	0.2	7.0	3.10	50.	138.	50.
12	2	0.770	223	4560.85	4555.28	4536.07	1.00	1.00	0.3	7.7	3.10	50.	173.	50.
13	2	0.840	263	4560.81	4554.76	4536.18	1.00	1.00	0.3	8.4	3.10	50.	214.	50.
14	2	0.910	306	4560.75	4554.24	4536.29	1.00	1.00	0.4	9.1	3.10	50.	258.	48.
15	2	0.980	351	4560.68	4553.72	4536.40	1.00	1.00	0.5	9.8	3.10	50.	308.	44.
16	2	1.050	401	4560.59	4553.20	4536.51	1.00	1.00	0.6	10.5	3.10	50.	361.	40.
17	2	1.120	455	4560.50	4552.68	4536.63	1.00	1.00	0.7	11.2	3.10	50.	419.	36.
18	2	1.190	512	4560.39	4552.16	4536.75	1.00	1.00	0.8	11.9	3.10	50.	481.	32.
19	2	1.260	574	4560.26	4551.64	4536.87	1.00	1.00	1.0	12.6	3.10	50.	546.	28.
20	2	1.330	639	4560.12	4551.12	4536.99	1.00	1.00	1.1	13.3	3.10	50.	615.	24.
21	2	1.400	707	4559.97	4550.60	4537.12	1.00	1.00	1.3	14.0	3.10	50.	687.	20.
22	2	1.470	777	4559.79	4550.08	4537.24	1.00	1.00	1.5	14.7	3.10	50.	762.	16.
23	2	1.540	851	4559.60	4549.56	4537.36	1.00	1.00	1.7	15.4	3.10	50.	839.	12.
24	2	1.610	926	4559.39	4549.04	4537.48	1.00	1.00	1.9	16.1	3.10	50.	918.	8.
25	2	1.680	1002	4559.16	4548.52	4537.60	1.00	1.00	2.1	16.8	3.10	50.	999.	4.
26	2	1.750	1080	4558.91	4548.00	4537.71	1.00	1.00	2.4	17.5	3.10	50.	1080.	0.
27	2	1.820	1162	4558.64	4547.48	4537.83	1.00	1.00	2.7	18.2	3.10	50.	1163.	0.
28	2	1.890	1245	4558.35	4546.96	4537.95	1.00	1.00	3.0	18.9	3.10	50.	1245.	0.
29	2	1.960	1327	4558.04	4546.44	4538.06	1.00	1.00	3.3	19.6	3.10	50.	1327.	0.
30	2	2.030	1408	4557.70	4545.92	4538.17	1.00	1.00	3.7	20.3	3.10	50.	1409.	0.
31	2	2.100	1488	4557.35	4545.40	4538.27	1.00	1.00	4.0	21.0	3.10	50.	1489.	0.
32	2	2.170	1567	4556.98	4544.88	4538.37	1.00	1.00	4.4	21.7	3.10	50.	1568.	0.
33	2	2.240	1644	4556.59	4544.36	4538.46	1.00	1.00	4.8	22.4	3.10	50.	1645.	0.
34	2	2.310	1719	4556.17	4543.84	4538.55	1.00	1.00	5.2	23.1	3.10	50.	1720.	0.
35	2	2.380	1792	4555.74	4543.32	4538.64	1.00	1.01	5.7	23.8	3.10	50.	1792.	0.
36	2	2.450	1862	4555.30	4542.80	4538.72	1.00	1.01	6.1	24.5	3.10	50.	1862.	0.
37	2	2.520	1929	4554.83	4542.28	4538.80	1.00	1.01	6.6	25.2	3.10	50.	1930.	0.
38	2	2.590	1994	4554.35	4541.76	4538.87	1.00	1.01	7.1	25.9	3.10	50.	1994.	0.
39	2	2.660	2055	4553.85	4541.24	4538.94	1.00	1.01	7.6	26.6	3.10	50.	2055.	0.
40	2	2.730	2113	4553.34	4540.72	4539.00	1.00	1.01	8.1	27.3	3.10	50.	2114.	0.
41	2	2.800	2168	4552.81	4540.20	4539.06	1.00	1.01	8.7	28.0	3.10	50.	2169.	0.
42	2	2.870	2221	4552.27	4539.68	4539.12	1.00	1.01	9.2	28.7	3.10	50.	2221.	0.
43	2	2.940	2270	4551.72	4539.16	4539.17	1.00	1.02	9.8	29.4	3.10	50.	2270.	0.
44	2	3.010	2316	4551.15	4538.64	4539.22	1.00	1.02	10.4	30.1	3.10	50.	2316.	0.
45	2	3.080	2359	4550.58	4538.12	4539.27	1.00	1.02	11.0	30.8	3.10	50.	2360.	0.
46	2	3.150	2400	4549.99	4537.60	4539.31	1.00	1.02	11.6	31.5	3.10	50.	2400.	0.
47	2	3.220	2438	4549.39	4537.08	4539.35	1.00	1.03	12.2	32.2	3.10	50.	2439.	0.
48	2	3.290	2474	4548.79	4536.56	4539.38	1.00	1.03	12.8	32.9	3.10	50.	2475.	0.
49	2	3.360	2509	4548.17	4536.04	4539.42	1.00	1.04	13.4	33.6	3.10	50.	2509.	0.
50	2	3.430	2542	4547.55	4535.52	4539.45	1.00	1.05	14.1	34.3	3.10	50.	2543.	0.

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPI
***	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	****

2	3.500	2575	4546.91	4535.00	4539.49	1.00	1.05	14.7	35.0	3.10	50.	2576.	0.
2	3.570	2398	4546.30	4535.00	4539.31	1.00	1.06	15.3	35.0	3.10	50.	2399.	0.
2	3.640	2225	4545.73	4535.00	4539.12	1.00	1.06	15.9	35.0	3.10	50.	2225.	0.
2	3.710	2067	4545.20	4535.00	4538.95	1.00	1.06	16.5	35.0	3.10	50.	2067.	0.
2	3.780	1923	4544.71	4535.00	4538.79	1.00	1.06	17.0	35.0	3.10	50.	1924.	0.
2	3.850	1793	4544.25	4535.00	4538.64	1.00	1.07	17.4	35.0	3.10	50.	1793.	0.
2	3.920	1674	4543.83	4535.00	4538.50	1.00	1.07	17.9	35.0	3.10	50.	1674.	0.
2	3.990	1565	4543.43	4535.00	4538.37	1.00	1.07	18.3	35.0	3.10	50.	1566.	0.
2	4.060	1466	4543.06	4535.00	4538.24	1.00	1.07	18.7	35.0	3.10	50.	1466.	0.
2	4.130	1375	4542.72	4535.00	4538.12	1.00	1.07	19.0	35.0	3.10	50.	1376.	0.
2	4.200	1292	4542.40	4535.00	4538.01	1.00	1.07	19.4	35.0	3.10	50.	1292.	0.
2	4.270	1215	4542.09	4535.00	4537.90	1.00	1.08	19.7	35.0	3.10	50.	1215.	0.
2	4.340	1144	4541.81	4535.00	4537.80	1.00	1.08	20.0	35.0	3.10	50.	1145.	0.
2	4.410	1079	4541.54	4535.00	4537.71	1.00	1.08	20.2	35.0	3.10	50.	1079.	0.
2	4.480	1019	4541.29	4535.00	4537.62	1.00	1.08	20.5	35.0	3.10	50.	1019.	0.
2	4.550	963	4541.05	4535.00	4537.54	1.00	1.08	20.8	35.0	3.10	50.	963.	0.
2	4.620	911	4540.83	4535.00	4537.46	1.00	1.08	21.0	35.0	3.10	50.	912.	0.
2	4.690	863	4540.62	4535.00	4537.38	1.00	1.08	21.2	35.0	3.10	50.	864.	0.
2	4.760	819	4540.42	4535.00	4537.31	1.00	1.09	21.4	35.0	3.10	50.	819.	0.
2	4.830	777	4540.23	4535.00	4537.24	1.00	1.09	21.6	35.0	3.10	50.	778.	0.
2	4.900	739	4540.05	4535.00	4537.17	1.00	1.09	21.8	35.0	3.10	50.	739.	0.
2	4.970	703	4539.88	4535.00	4537.11	1.00	1.09	22.0	35.0	3.10	50.	703.	0.
2	5.040	669	4539.72	4535.00	4537.05	1.00	1.09	22.2	35.0	3.10	50.	669.	0.
2	5.110	638	4539.57	4535.00	4536.99	1.00	1.09	22.3	35.0	3.10	50.	638.	0.
2	5.180	608	4539.42	4535.00	4536.94	1.00	1.09	22.5	35.0	3.10	50.	609.	0.
2	5.250	581	4539.29	4535.00	4536.88	1.00	1.09	22.7	35.0	3.10	50.	581.	0.
2	5.320	555	4539.16	4535.00	4536.83	1.00	1.10	22.8	35.0	3.10	50.	555.	0.
2	5.390	531	4539.03	4535.00	4536.79	1.00	1.10	22.9	35.0	3.10	50.	531.	0.
2	5.460	508	4538.91	4535.00	4536.74	1.00	1.10	23.1	35.0	3.10	50.	508.	0.
2	5.530	486	4538.80	4535.00	4536.70	1.00	1.10	23.2	35.0	3.10	50.	487.	0.
2	5.600	466	4538.69	4535.00	4536.66	1.00	1.10	23.3	35.0	3.10	50.	467.	0.
2	5.670	447	4538.59	4535.00	4536.62	1.00	1.10	23.4	35.0	3.10	50.	448.	0.
2	5.740	429	4538.49	4535.00	4536.58	1.00	1.10	23.5	35.0	3.10	50.	430.	0.
2	5.810	413	4538.40	4535.00	4536.54	1.00	1.10	23.6	35.0	3.10	50.	413.	0.
2	5.880	397	4538.31	4535.00	4536.50	1.00	1.10	23.7	35.0	3.10	50.	397.	0.
2	5.950	382	4538.22	4535.00	4536.47	1.00	1.10	23.8	35.0	3.10	50.	382.	0.
2	6.020	367	4538.14	4535.00	4536.44	1.00	1.10	23.9	35.0	3.10	50.	368.	0.
2	6.090	354	4538.06	4535.00	4536.41	1.00	1.10	24.0	35.0	3.10	50.	354.	0.
2	6.160	341	4537.99	4535.00	4536.38	1.00	1.11	24.1	35.0	3.10	50.	342.	0.
2	6.230	329	4537.92	4535.00	4536.35	1.00	1.11	24.2	35.0	3.10	50.	330.	0.
1	6.300	318	4537.85	4535.00	4536.32	1.00	1.11	24.3	35.0	3.10	50.	318.	0.
1	6.370	307	4537.78	4535.00	4536.29	1.00	1.11	24.4	35.0	3.10	50.	307.	0.
1	6.440	297	4537.72	4535.00	4536.27	1.00	1.11	24.4	35.0	3.10	50.	297.	0.
1	6.510	287	4537.66	4535.00	4536.24	1.00	1.11	24.5	35.0	3.10	50.	287.	0.
1	6.580	277	4537.60	4535.00	4536.22	1.00	1.11	24.6	35.0	3.10	50.	278.	0.
1	6.650	269	4537.54	4535.00	4536.19	1.00	1.11	24.6	35.0	3.10	50.	269.	0.
1	6.720	260	4537.49	4535.00	4536.17	1.00	1.11	24.7	35.0	3.10	50.	261.	0.
1	6.790	252	4537.43	4535.00	4536.15	1.00	1.11	24.8	35.0	3.10	50.	253.	0.
1	6.860	244	4537.38	4535.00	4536.13	1.00	1.11	24.8	35.0	3.10	50.	245.	0.
1	6.930	237	4537.34	4535.00	4536.11	1.00	1.11	24.9	35.0	3.10	50.	238.	0.

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
101	1	7.000	230	4537.29	4535.00	4536.09	1.00	1.11	25.0	35.0	3.10	50.	231.	0.
102	1	7.077	223	4537.24	4535.00	4536.07	1.00	1.11	25.0	35.0	3.10	50.	223.	0.
103	1	7.162	215	4537.19	4535.00	4536.05	1.00	1.11	25.1	35.0	3.10	50.	216.	0.
104	1	7.255	207	4537.13	4535.00	4536.03	1.00	1.11	25.2	35.0	3.10	50.	208.	0.
105	1	7.357	199	4537.08	4535.00	4536.00	1.00	1.11	25.2	35.0	3.10	50.	200.	0.
106	1	7.470	191	4537.02	4535.00	4535.98	1.00	1.12	25.3	35.0	3.10	50.	191.	0.
107	1	7.594	182	4536.96	4535.00	4535.95	1.00	1.12	25.4	35.0	3.10	50.	183.	0.
108	1	7.731	174	4536.89	4535.00	4535.92	1.00	1.12	25.5	35.0	3.10	50.	174.	0.
109	1	7.881	165	4536.83	4535.00	4535.90	1.00	1.12	25.6	35.0	3.10	50.	165.	0.
110	1	8.046	156	4536.76	4535.00	4535.87	1.00	1.12	25.7	35.0	3.10	50.	157.	0.
111	1	8.227	147	4536.70	4535.00	4535.84	1.00	1.12	25.8	35.0	3.10	50.	148.	0.
112	1	8.427	139	4536.63	4535.00	4535.81	1.00	1.12	25.9	35.0	3.10	50.	139.	0.
113	1	8.647	130	4536.56	4535.00	4535.78	1.00	1.12	26.0	35.0	3.10	50.	131.	0.
114	1	8.888	122	4536.50	4535.00	4535.75	1.00	1.12	26.1	35.0	3.10	50.	123.	0.
115	1	9.154	114	4536.43	4535.00	4535.72	1.00	1.12	26.2	35.0	3.10	50.	115.	0.
116	1	9.446	107	4536.37	4535.00	4535.69	1.00	1.12	26.3	35.0	3.10	50.	107.	0.
117	1	9.768	100	4536.30	4535.00	4535.66	1.00	1.12	26.4	35.0	3.10	50.	100.	0.
118	1	10.122	93	4536.24	4535.00	4535.63	1.00	1.12	26.6	35.0	3.10	50.	93.	0.
119	2	10.511	87	4536.19	4535.00	4535.61	1.00	1.12	26.7	35.0	3.10	50.	87.	0.
120	2	10.939	81	4536.13	4535.00	4535.59	1.00	1.13	26.8	35.0	3.10	50.	81.	0.
121	2	11.410	76	4536.09	4535.00	4535.56	1.00	1.13	27.0	35.0	3.10	50.	76.	0.
122	2	11.928	71	4536.04	4535.00	4535.54	1.00	1.13	27.1	35.0	3.10	50.	72.	0.
123	2	12.498	67	4536.00	4535.00	4535.52	1.00	1.13	27.2	35.0	3.10	50.	68.	0.
124	2	13.125	64	4535.97	4535.00	4535.51	1.00	1.13	27.4	35.0	3.10	50.	64.	0.
125	2	13.814	60	4535.93	4535.00	4535.49	1.00	1.13	27.5	35.0	3.10	50.	61.	0.
126	2	14.573	58	4535.91	4535.00	4535.48	1.00	1.13	27.7	35.0	3.10	50.	58.	0.
127	2	15.407	56	4535.89	4535.00	4535.47	1.00	1.13	27.9	35.0	3.10	50.	56.	0.
128	2	16.325	54	4535.87	4535.00	4535.46	1.00	1.13	28.1	35.0	3.10	50.	55.	0.
129	2	17.334	53	4535.85	4535.00	4535.46	1.00	1.13	28.3	35.0	3.10	50.	53.	0.
130	2	18.445	52	4535.84	4535.00	4535.45	1.00	1.13	28.5	35.0	3.10	50.	52.	0.
131	1	19.666	51	4535.83	4535.00	4535.44	1.00	1.13	28.7	35.0	3.10	50.	51.	0.
132	1	21.010	50	4535.83	4535.00	4535.44	1.00	1.13	28.9	35.0	3.10	50.	51.	0.
133	1	22.488	50	4535.82	4535.00	4535.44	1.00	1.13	29.2	35.0	3.10	50.	51.	0.

PARAMETER	UNITS	VARIABLE	VALUE
INITIAL FLOW	CMS	Q(1)	50.
MAX FLOW	CMS	QM	2576.
FINAL FLOW	CMS	Q(NU)	51.
TIME TO MAX FLOW	HRS	TP	3.50
NUMBER OF TIME STEPS		NNU	133
TOTAL VOLUME DISCHARGED FROM RESERVOIR	MILLION CU M	DISVOL	29.

INITIAL CONDITIONS

(QDI(I), I=1, N)

50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	120.	120.	120.	120.	120.
120.	120.	120.	120.	120.	120.	120.	120.
120.	120.	120.	120.	120.	120.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.	220.	220.	220.
220.	220.	220.	220.	220.			

(YI(I), I=1, N)

4535.49	4472.96	4410.46	4332.28	4254.21	4176.03	4097.96	4019.78
3941.71	3863.53	3785.46	3707.28	3629.21	3551.03	3472.96	3394.78
3316.71	3238.53	3160.46	3077.57	2994.40	2911.23	2828.07	2744.90
2661.73	2578.57	2495.41	2412.24	2329.08	2245.90	2162.75	2079.57
1996.42	1913.25	1830.09	1746.92	1663.76	1580.60	1558.96	1536.93
1514.90	1492.88	1470.85	1448.83	1426.81	1404.78	1382.76	1360.74
1338.73	1316.71	1294.70	1272.69	1250.68	1228.67	1206.66	1184.66
1162.66	1140.67	1118.69	1096.70	1075.68	1054.65	1033.63	1012.60
991.58	970.55	949.53	928.51	907.49	886.47	865.45	844.44
823.42	802.40	781.38	760.37	739.35	718.34	697.32	676.31
655.29	634.28	613.26	592.25	571.24			

TIME PARAMETERS OF OUTFLOW HYDROGRAPH IMMEDIATELY DOWNSTREAM OF DAM

PARAMETER	UNITS	VARIABLE	VALUE
TIME TO FAILURE	HR	TFH	3.500
TIME TO START OF RISING LIMB OF HYDROGRAPH	HR	TFO	0.000
TIME TO PEAK	HR	TP	3.500
TIME STEP SIZE	HR	DTHI	0.175

ROUTING COMPLETED.

KTIME= 81 ALLOWABLE KTIME= 699 TT= 24.1

PROFILE OF CRESTS AND TIMES FOR Luggye Lake
BELOW RUN2 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
0.000	4539.92	2575	3.500	8.74	0.00	0.00
2.250	4477.38	2563	3.500	8.59	0.00	0.00
4.499	4414.81	2529	3.500	8.47	0.00	0.00
6.499	4335.84	2510	3.500	10.64	0.00	0.00
8.499	4258.47	2491	3.500	8.67	0.00	0.00
10.498	4179.67	2493	3.675	10.43	0.00	0.00
12.498	4102.16	2494	3.675	8.89	0.00	0.00
14.498	4023.49	2489	3.762	10.32	0.00	0.00
16.497	3945.86	2488	3.762	9.09	0.00	0.00
18.497	3867.31	2486	3.762	10.23	0.00	0.00
20.497	3789.58	2480	3.762	9.27	0.00	0.00
22.496	3711.11	2482	3.850	10.17	0.00	0.00
24.496	3633.30	2478	3.850	9.42	0.00	0.00
26.496	3554.89	2469	3.850	10.15	0.00	0.00
28.495	3477.01	2457	3.850	9.54	0.00	0.00
30.495	3398.67	2456	4.025	10.14	0.00	0.00
32.495	3320.76	2459	4.025	9.68	0.00	0.00
34.494	3242.46	2457	4.025	10.18	0.00	0.00
36.494	3164.50	2450	4.025	9.80	0.00	0.00
38.578	3081.15	2510	4.025	10.25	0.00	0.00
40.662	2998.08	2507	4.200	9.74	0.00	0.00
42.745	2914.74	2511	4.200	9.98	0.00	0.00
44.829	2831.64	2509	4.200	9.57	0.00	0.00
46.913	2748.32	2503	4.200	9.73	0.00	0.00
48.997	2665.20	2492	4.200	9.38	0.00	0.00
51.081	2581.90	2494	4.375	9.52	0.00	0.00
53.165	2498.78	2495	4.375	9.22	0.00	0.00
55.249	2415.50	2492	4.375	9.33	0.00	0.00
57.333	2332.36	2486	4.375	9.07	0.00	0.00
59.416	2249.09	2478	4.550	9.14	0.00	0.00
61.500	2165.96	2484	4.550	8.92	0.00	0.00
63.584	2082.71	2483	4.550	8.99	0.00	0.00
65.668	1999.55	2476	4.550	8.79	0.00	0.00
67.752	1916.30	2467	4.725	8.83	0.00	0.00
69.836	1833.15	2472	4.725	8.65	0.00	0.00
71.920	1749.92	2469	4.725	8.69	0.00	0.00
74.003	1666.76	2462	4.725	8.53	0.00	0.00
76.087	1583.53	2455	4.900	8.55	0.00	0.00
78.137	1564.89	2557	4.900	4.09	0.00	0.00
80.187	1539.48	2551	5.075	9.30	0.00	0.00
82.236	1521.09	2544	4.900	4.08	0.00	0.00
84.286	1495.42	2544	5.250	11.62	0.00	0.00
86.336	1477.30	2545	5.075	4.10	0.00	0.00
88.385	1451.38	2540	5.425	13.73	0.00	0.00
90.435	1433.48	2540	5.250	4.15	0.00	0.00
92.484	1407.38	2531	5.425	15.70	0.00	0.00
94.534	1389.64	2526	5.425	4.21	0.00	0.00
96.584	1363.41	2511	5.600	15.74	0.00	0.00

PROFILE OF CRESTS AND TIMES FOR Luggye Lake
BELOW RUN2 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
98.633	1345.85	2512	5.425	4.27	0.00	0.00
100.683	1319.45	2508	5.775	15.21	0.00	0.00
102.733	1302.07	2496	5.600	4.35	0.00	0.00
104.782	1275.50	2499	5.950	15.39	0.00	0.00
106.832	1258.33	2486	5.600	4.43	0.00	0.00
108.882	1231.59	2482	5.950	15.35	0.00	0.00
110.931	1214.63	2479	5.775	4.52	0.00	0.00
112.981	1187.73	2481	6.125	15.13	0.00	0.00
115.031	1170.96	2481	5.950	4.64	0.00	0.00
117.080	1143.91	2482	6.125	15.28	0.00	0.00
119.130	1127.34	2479	5.950	4.77	0.00	0.00
121.180	1100.16	2485	6.300	15.10	0.00	0.00
123.191	1084.48	2479	6.125	4.84	0.00	0.00
125.203	1058.15	2480	6.300	13.83	0.00	0.00
127.215	1042.26	2483	6.300	4.86	0.00	0.00
129.226	1016.09	2473	6.475	13.51	0.00	0.00
131.238	1000.06	2478	6.475	4.87	0.00	0.00
133.250	974.00	2479	6.475	13.26	0.00	0.00
135.261	957.87	2467	6.475	4.86	0.00	0.00
137.273	931.91	2476	6.650	13.03	0.00	0.00
139.285	915.72	2471	6.650	4.85	0.00	0.00
141.296	889.81	2465	6.825	13.02	0.00	0.00
143.308	873.57	2471	6.825	4.83	0.00	0.00
145.320	847.69	2463	7.000	12.94	0.00	0.00
147.331	831.41	2461	7.000	4.81	0.00	0.00
149.343	805.59	2465	7.000	12.80	0.00	0.00
151.355	789.27	2451	7.000	4.77	0.00	0.00
153.366	763.46	2428	7.298	12.84	0.00	0.00
155.378	747.13	2451	7.298	4.76	0.00	0.00
157.390	721.40	2465	7.298	12.85	0.00	0.00
159.401	705.04	2459	7.298	4.73	0.00	0.00
161.413	679.24	2431	7.595	12.78	0.00	0.00
163.425	662.86	2436	7.595	4.69	0.00	0.00
165.436	637.20	2458	7.595	12.79	0.00	0.00
167.448	620.81	2460	7.595	4.68	0.00	0.00
169.460	595.05	2439	7.595	12.84	0.00	0.00
171.471	578.61	2416	7.893	4.62	0.00	0.00

DISCHARGE HYDROGRAPH FOR Luggye Lake ... STATION NUMBER 1
BELOW RUN2 : AT KM 0.00
GAGE ZERO = 4535.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 4539.92 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.92 M AT TIME = 3.500 HOURS
MAX FLOW = 2576 CMS AT TIME = 3.500 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	0.5	50	.* . . . . .
0.2	0.5	58	.* . . . . .
0.4	0.7	87	.* . . . . .
0.6	0.9	148	.* . . . . .
0.8	1.2	243	. * . . . . .
1.0	1.6	368	. * . . . . .
1.2	1.9	523	. * . . . . .
1.4	2.3	707	. * . . . . .
1.6	2.7	916	. *. . . . .
1.8	3.1	1139	. .* . . . . .
2.0	3.4	1373	. . * . . . . .
2.2	3.7	1599	. . * . . . . .
2.4	4.0	1811	. . * . . . . .
2.6	4.3	2002	. . * . . . . .
2.8	4.5	2169	. . * . . . . .
3.0	4.6	2309	. . * . . . . .
3.2	4.8	2427	. . * . . . . .
3.4	4.9	2528	. . * . . . . .
3.6	4.6	2330	. . * . . . . .
3.8	4.1	1888	. . *. . . . .
4.0	3.7	1556	. . * . . . . .
4.2	3.3	1292	. . * . . . . .
4.4	3.0	1091	. .* . . . . .
4.6	2.7	928	. *. . . . .
4.8	2.5	798	. * . . . . .
5.0	2.3	690	. * . . . . .
5.2	2.1	602	. * . . . . .
5.4	2.0	528	. * . . . . .
5.6	1.8	467	. * . . . . .
5.8	1.7	416	. * . . . . .
6.0	1.6	372	. * . . . . .
6.2	1.5	335	. * . . . . .
6.4	1.4	303	. * . . . . .
6.6	1.3	276	. * . . . . .
6.8	1.3	252	. * . . . . .
7.0	1.2	231	. * . . . . .
7.2	1.1	213	. * . . . . .
7.4	1.1	197	. * . . . . .
7.6	1.0	183	. * . . . . .
7.8	1.0	170	. * . . . . .
8.0	1.0	159	. * . . . . .
8.2	0.9	149	.* . . . . .
8.4	0.9	141	.* . . . . .
8.6	0.9	133	.* . . . . .
8.8	0.8	126	.* . . . . .
9.0	0.8	120	.* . . . . .
9.2	0.8	114	.* . . . . .
9.4	0.8	109	.* . . . . .
9.6	0.7	104	.* . . . . .
9.8	0.7	100	.* . . . . .
10.0	0.7	96	.* . . . . .

DISCHARGE HYDROGRAPH FOR Luggye Lake ... STATION NUMBER 3
BELOW RUN2 : AT KM 4.50
GAGE ZERO = 4410.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 4414.81 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.81 M AT TIME = 3.500 HOURS
MAX FLOW = 2530 CMS AT TIME = 3.500 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	0.5	50	.* . . . . .
0.5	0.5	57	.* . . . . .
1.0	1.2	237	. * . . . . .
1.5	2.2	662	. * . . . . .
2.0	3.2	1230	. . * . . . . .
2.5	4.0	1801	. . * . . . . .
3.0	4.5	2239	. . * . . . . .
3.5	4.8	2530	. . * . . . . .
4.0	3.9	1732	. . * . . . . .
4.5	3.0	1117	. .* . . . . .
5.0	2.4	765	. * . . . . .
5.5	2.0	549	. * . . . . .
6.0	1.7	410	. * . . . . .
6.5	1.4	317	. * . . . . .
7.0	1.3	253	. * . . . . .
7.5	1.1	207	. * . . . . .
8.0	1.0	173	. * . . . . .
8.5	0.9	147	.* . . . . .
9.0	0.8	128	.* . . . . .
9.5	0.8	113	.* . . . . .
10.0	0.7	101	.* . . . . .
10.5	0.7	92	.* . . . . .
11.0	0.7	85	.* . . . . .
11.5	0.6	79	.* . . . . .
12.0	0.6	74	.* . . . . .
12.5	0.6	70	.* . . . . .
13.0	0.6	67	.* . . . . .
13.5	0.6	64	.* . . . . .
14.0	0.5	62	.* . . . . .
14.5	0.5	60	.* . . . . .
15.0	0.5	58	.* . . . . .
15.5	0.5	57	.* . . . . .
16.0	0.5	56	.* . . . . .
16.5	0.5	55	.* . . . . .
17.0	0.5	54	.* . . . . .
17.5	0.5	54	.* . . . . .
18.0	0.5	53	.* . . . . .
18.5	0.5	53	.* . . . . .
19.0	0.5	52	.* . . . . .
19.5	0.5	52	.* . . . . .
20.0	0.5	52	.* . . . . .
20.5	0.5	51	.* . . . . .
21.0	0.5	51	.* . . . . .
21.5	0.5	51	.* . . . . .
22.0	0.5	51	.* . . . . .
22.5	0.5	51	.* . . . . .
23.0	0.5	51	.* . . . . .

DISCHARGE HYDROGRAPH FOR Luggye Lake ... STATION NUMBER 19
BELOW RUN2 : AT KM 36.49

GAGE ZERO = 3160.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 3164.50 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.50 M AT TIME = 4.025 HOURS
MAX FLOW = 2451 CMS AT TIME = 4.025 HOURS

TIME HR	STAGE M	FLOW CMS	0 500 1000 1500 2000 2500
0.0	0.5	55	.* . . . . .
0.5	0.5	53	.* . . . . .
1.0	0.6	60	.* . . . . .
1.5	0.8	79	. * . . . . .
2.0	0.9	96	. * . . . . .
2.5	2.3	717	. . * . . . .
3.0	3.5	1574	. . . . * . .
3.5	4.2	2134	. . . . . * .
4.0	4.5	2442	. . . . . *
4.5	4.1	2035	. . . . . * .
5.0	3.2	1358	. . . * . . .
5.5	2.7	970	. . * . . . .
6.0	2.2	718	. . * . . . .
6.5	1.9	548	. * . . . . .
7.0	1.7	430	. * . . . . .
7.5	1.5	347	. * . . . . .
8.0	1.3	284	. * . . . . .
8.5	1.2	237	. * . . . . .
9.0	1.1	202	. * . . . . .
9.5	1.0	174	. * . . . . .
10.0	0.9	152	. * . . . . .
10.5	0.9	134	. * . . . . .
11.0	0.8	120	. * . . . . .
11.5	0.8	108	. * . . . . .
12.0	0.7	99	. * . . . . .
12.5	0.7	91	. * . . . . .
13.0	0.6	85	. * . . . . .
13.5	0.6	79	. * . . . . .
14.0	0.6	75	.* . . . . .
14.5	0.6	71	.* . . . . .
15.0	0.6	68	.* . . . . .
15.5	0.6	65	.* . . . . .
16.0	0.5	63	.* . . . . .
16.5	0.5	61	.* . . . . .
17.0	0.5	59	.* . . . . .
17.5	0.5	58	.* . . . . .
18.0	0.5	57	.* . . . . .
18.5	0.5	56	.* . . . . .
19.0	0.5	55	.* . . . . .
19.5	0.5	54	.* . . . . .
20.0	0.5	54	.* . . . . .
20.5	0.5	54	.* . . . . .
21.0	0.5	54	.* . . . . .
21.5	0.5	54	.* . . . . .
22.0	0.5	54	.* . . . . .
22.5	0.5	54	.* . . . . .
23.0	0.5	53	.* . . . . .

DISCHARGE HYDROGRAPH FOR Luggye Lake ... STATION NUMBER 38
BELOW RUN2 : AT KM 76.09

GAGE ZERO = 1580.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 1583.53 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 3.52 M AT TIME = 4.900 HOURS
MAX FLOW = 2455 CMS AT TIME = 4.900 HOURS

TIME HR	STAGE M	FLOW CMS	0 500 1000 1500 2000 2500
0.0	0.6	125	. * . . . . .
0.5	0.6	123	. * . . . . .
1.0	0.6	130	. * . . . . .
1.5	0.6	151	. * . . . . .
2.0	0.6	164	. * . . . . .
2.5	0.6	167	. * . . . . .
3.0	0.7	171	. * . . . . .
3.5	0.9	234	. * . . . . .
4.0	3.0	1864	. . . . * . .
4.5	3.4	2346	. . . . . * .
5.0	3.5	2405	. . . . . * .
5.5	3.0	1890	. . . . * . .
6.0	2.5	1380	. . . * . . .
6.5	2.1	1064	. . . * . . .
7.0	1.9	840	. . * . . . .
7.5	1.6	683	. . * . . . .
8.0	1.5	566	. * . . . . .
8.5	1.3	477	. * . . . . .
9.0	1.2	410	. * . . . . .
9.5	1.1	357	. * . . . . .
10.0	1.0	316	. * . . . . .
10.5	1.0	283	. * . . . . .
11.0	0.9	256	. * . . . . .
11.5	0.9	233	. * . . . . .
12.0	0.8	216	. * . . . . .
12.5	0.8	201	. * . . . . .
13.0	0.8	188	. * . . . . .
13.5	0.7	178	. * . . . . .
14.0	0.7	169	. * . . . . .
14.5	0.7	162	. * . . . . .
15.0	0.7	156	. * . . . . .
15.5	0.7	150	. * . . . . .
16.0	0.7	146	. * . . . . .
16.5	0.6	142	. * . . . . .
17.0	0.6	139	. * . . . . .
17.5	0.6	136	. * . . . . .
18.0	0.6	134	. * . . . . .
18.5	0.6	132	. * . . . . .
19.0	0.6	130	. * . . . . .
19.5	0.6	128	. * . . . . .
20.0	0.6	127	. * . . . . .
20.5	0.6	127	. * . . . . .
21.0	0.6	126	. * . . . . .
21.5	0.6	126	. * . . . . .
22.0	0.6	126	. * . . . . .
22.5	0.6	126	. * . . . . .
23.0	0.6	125	. * . . . . .

DISCHARGE HYDROGRAPH FOR Luggye Lake ... STATION NUMBER 60
BELOW RUN2 : AT KM 121.18

GAGE ZERO = 1095.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 1100.16 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 5.16 M AT TIME = 6.300 HOURS
MAX FLOW = 2485 CMS AT TIME = 6.125 HOURS

TIME HR	STAGE M	FLOW CMS	0 500 1000 1500 2000 2500
0.0	1.7	306	
0.5	1.7	395	
1.0	1.7	427	
1.5	1.7	460	
2.0	1.7	489	
2.5	1.7	497	
3.0	1.7	484	
3.5	1.7	469	
4.0	1.7	582	
4.5	1.7	669	
5.0	1.7	797	
5.5	2.8	1407	
6.0	5.0	2445	
6.5	5.1	2391	
7.0	4.5	1995	
7.5	3.8	1589	
8.0	3.2	1290	
8.5	2.8	1073	
9.0	2.5	911	
9.5	2.2	783	
10.0	2.0	683	
10.5	1.8	605	
11.0	1.7	541	
11.5	1.7	506	
12.0	1.7	483	
12.5	1.7	464	
13.0	1.7	449	
13.5	1.7	437	
14.0	1.7	428	
14.5	1.7	419	
15.0	1.7	412	
15.5	1.7	407	
16.0	1.7	402	
16.5	1.7	397	
17.0	1.7	393	
17.5	1.7	390	
18.0	1.7	387	
18.5	1.7	385	
19.0	1.7	383	
19.5	1.7	381	
20.0	1.7	379	
20.5	1.7	378	
21.0	1.7	377	
21.5	1.7	376	
22.0	1.7	375	
22.5	1.7	374	
23.0	1.7	373	

1

Calculation Result of DAMBRK (3/3)

Simulation of GLOF from Raphstreng Lake

ANALYSIS OF THE DOWNSTREAM FLOOD HYDROGRAPH

PRODUCED BY THE DAM BREAK OF

RUN3 :

ON

Raphstreng

ANALYSIS BY

BASED ON PROCEDURE DEVELOPED BY
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SILVER SPRING, MARYLAND 20910

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*** SUMMARY OF INPUT DATA ***
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INPUT CONTROL PARAMETERS FOR RUN3 :

PARAMETER	VARIABLE	VALUE
NUMBER OF DYNAMIC ROUTING REACHES	KKN	1
TYPE OF RESERVOIR ROUTING	KUI	0
MULTIPLE DAM INDICATOR	MULDAM	0
PRINTING INSTRUCTIONS FOR INPUT SUMMARY	KDMP	5
NO. OF RESERVOIR INFLOW HYDROGRAPH POINTS	ITEH	2
INTERVAL OF CROSS-SECTION INFO PRINTED OUT WHEN JNK=9	NPRT	0
FLOOD-PLAIN MODEL PARAMETER	KFLP	0
METRIC INPUT/OUTPUT OPTION	METRIC	1

IOPUT= 1 0 0 0 0 0 1 1 0 0 0 0

RUN3 : RESERVOIR

TABLE OF ELEVATION VS SURFACE AREA

SURFACE AREA (SQ KM) SA(K)	ELEVATION (M) HSA(K)
1.1	4440.00
0.9	4410.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00
0.0	0.00

RUN3 : RESERVOIR AND BREACH PARAMETERS

PARAMETER	UNITS	VARIABLE	VALUE
LENGTH OF RESERVOIR	KM	RLM	1.90
ELEVATION OF WATER SURFACE	M	YO	4441.00
SIDE SLOPE OF BREACH		Z	0.00
ELEVATION OF BOTTOM OF BREACH	M	YBMIN	4410.00
WIDTH OF BASE OF BREACH	M	BB	34.00
TIME TO MAXIMUM BREACH SIZE	HOUR	TFH	3.50
ELEVATION (MSL) OF BOTTOM OF DAM	M	DATUM	4410.00
VOLUME-SURFACE AREA PARAMETER		VOL	0.00
ELEVATION OF WATER WHEN BREACHED	M	HF	4441.00
ELEVATION OF TOP OF DAM	M	HD	4441.00
ELEVATION OF UNCONTROLLED SPILLWAY CREST	M	HSP	0.00
ELEVATION OF CENTER OF GATE OPENINGS	M	HGT	0.00
DISCHARGE COEF. FOR UNCONTROLLED SPILLWAY		CS	0.00
DISCHARGE COEF. FOR GATE FLOW		CG	0.00
DISCHARGE COEF. FOR UNCONTROLLED WEIR FLOW		CDO	0.00
DISCHARGE THRU TURBINES	CMS	QT	50.00

CDO SHOULD NOT BE 0.0 IF OVERTOPPING MAY OCCUR

DHF(INTERVAL BETWEEN INPUT HYDROGRAPH ORDINATES) = 0.00 HRS.

TEH(TIME AT WHICH COMPUTATIONS TERMINATE)= 24.0000 HRS.

BREX(BREACH EXPONENT) = 0.000

MUD(MUD FLOW OPTION) = 0

IWF(TYPE OF WAVE FRONT TRACKING) = 0

KPRES(WETTED PERIMETER OPTION) = 0

KSL(LANDSLIDE PARAMETER) = 0

INFLOW HYDROGRAPH TO RUN3 :

0.00 0.00

TIME OF INFLOW HYDROGRAPH ORDINATES

0.0000 100.0000

CROSS-SECTIONAL PARAMETERS FOR Raphstreng
BELOW RUN3 :

PARAMETER	VARIABLE	VALUE
NUMBER OF CROSS-SECTIONS	NS	5
MAXIMUM NUMBER OF TOP WIDTHS	NCS	2
NUMBER OF CROSS-SECTIONAL HYDROGRAPHS TO PLOT	NTT	4
TYPE OF OUTPUT OTHER THAN HYDROGRAPH PLOTS	JNK	1
CROSS-SECTIONAL SMOOTHING PARAMETER	KSA	0
DOWNSTREAM SUPERCRITICAL OR NOT	KSUPC	1
NO. OF LATERAL INFLOW HYDROGRAPHS	LQ	4
NO. OF POINTS IN GATE CONTROL CURVE	KCG	0

NUMBER OF CROSS-SECTION WHERE HYDROGRAPH DESIRED
(MAX NUMBER OF HYDROGRAPHS = 6)

1 2 3 4

CROSS-SECTIONAL VARIABLES FOR Raphstreng
BELOW RUN3 :

PARAMETER	UNITS	VARIABLE
LOCATION OF CROSS-SECTION	KM	XS(I)
ELEVATION(MSL) OF FLOODING AT CROSS-SECTION	M	FSTG(I)
ELEV CORRESPONDING TO EACH TOP WIDTH	M	HS(K, I)
TOP WIDTH CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	M	BS(K, I)
TOP WIDTH CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	M	BSS(K, I)
NUMBER OF CROSS-SECTION		I
NUMBER OF ELEVATION LEVEL		K

CROSS-SECTION NUMBER 1

XS(I) = 0.000 FSTG(I) = 0.00

HS ...	4410.0	4430.0
BS ...	50.0	150.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 2

XS(I) = 32.000 FSTG(I) = 0.00

HS ...	3160.0	3180.0
BS ...	50.0	100.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 3

XS(I) = 71.600 FSTG(I) = 0.00

HS ...	1580.0	1600.0
BS ...	70.0	200.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 4

XS(I) = 116.700 FSTG(I) = 0.00

HS ...	1095.0	1115.0
BS ...	30.0	100.0
BSS ...	0.0	0.0

CROSS-SECTION NUMBER 5

XS(I) = 167.000 FSTG(I) = 0.00

HS ...	570.0	590.0
BS ...	50.0	100.0
BSS ...	0.0	0.0

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MANNING N ROUGHNESS COEFFICIENTS FOR THE GIVEN REACHES
(CM(K,I),K=1,NCS) WHERE I = REACH NUMBER

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REACH 1 ... 0.050 0.050

REACH 2 ... 0.050 0.050

REACH 3 ... 0.050 0.050

REACH 4 ... 0.050 0.050

CROSS-SECTIONAL VARIABLES FOR Raphstreng
BELOW RUN3 :

PARAMETER	UNITS	VARIABLE
MINIMUM COMPUTATIONAL DISTANCE USED BETWEEN CROSS-SECTIONS	KM	DXM(I)
CONTRACTION - EXPANSION COEFFICIENTS BETWEEN CROSS-SECTIONS		FKC(I)

REACH NUMBER	DXM(I)	FKC(I)
1	1.000	0.000
2	1.000	0.000
3	1.000	0.000
4	1.000	0.000

DOWNSTREAM FLOW PARAMETERS FOR Raphstreng
BELOW RUN3 :

PARAMETER	UNITS	VARIABLE	VALUE
MAX DISCHARGE AT DOWNSTREAM EXTREMITY	CMS	QMAXD	0.0
MAX LATERAL OUTFLOW PRODUCING LOSSES	CMS /M	QLL	0.000
INITIAL SIZE OF TIME STEP	HOUR	DTHM	0.0000
INITIAL WATER SURFACE ELEVATION DOWNSTREAM	M	YDN	575.00
SLOPE OF CHANNEL DOWNSTREAM OF DAM	%	SOM	0.00
THETA WEIGHTING FACTOR		THETA	0.00
CONVERGENCE CRITERION FOR STAGE	M	EPSY	0.000
TIME AT WHICH DAM STARTS TO FAIL	HOUR	TFI	0.00

AT REACH= 2 DXM SHOULD BE CHANGED TO 0.624 DUE TO CHANGE OF SLOPE CRITERIA

COMPUTATIONS WILL USE THE FOLLOWING DXM VALUES

1.000 1.000 1.000 1.000

LATERAL INFLOW REACH NUMBER

LQX(I)

1 2 3 4

(QL(L, 1),L=1,ITEM)
0. 0.

(QL(L, 2),L=1,ITEM)
0. 0.

(QL(L, 3),L=1,ITEM)
0. 0.

(QL(L, 4),L=1,ITEM)
0. 0.

TOTAL NUMBER OF CROSS SECTIONS (ORIGINAL+INTERPOLATED) (N) = 167 . (MAXIMUM ALLOWABLE = 200

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*** SUMMARY OF OUTPUT DATA ***
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CROSS-SECTION NO.	BOTTOM ELEVATION KM	BOTTOM ELEVATION M	REACH NO.	REACH LENGTH KM	SLOPE %	MESAGE
1	0.00	4410.00				
2	32.00	3160.00	1	32.00	3.91	
3	71.60	1580.00	2	39.60	3.99	
4	116.70	1095.00	3	45.10	1.08	
5	167.00	570.00	4	50.30	1.04	

TOTAL VOLUME IN RESERVOIR BEHIND

RUN3 : = 31.0 CU M (MILLION)

DEFINITION OF VARIABLES IN RESERVOIR DEPLETION TABLE

PARAMETER	UNITS	VARIABLE
TIME STEP FROM START OF ANALYSIS		I
ITERATIONS NECESSARY TO SOLVE FLOW EQUATIONS		K
ELAPSED TIME FROM START OF ANALYSIS	HOUR	TTP(I)
TOTAL OUTFLOW FROM DAM	CMS	Q(I)
ELEVATION OF WATER SURFACE AT DAM	M	H2
ELEVATION OF BOTTOM OF BREACH	M	YB
EST DEPTH OF FLOW IMMEDIATELY DOWNSTREAM	M	D
SUBMERGENCE COEFFICIENT		SUB
VELOCITY CORRECTION		VCOR
TOTAL VOLUME DISCHARGED FROM TIME OF BREACH	MILLION CU M	OUTVOL
BREACH WIDTH	M	BB
RECTANGULAR BREACH DISCHARGE COEFFICIENT		COFR
INFLOW TO RESERVOIR	CMS	QI(I)
BREACH OUTFLOW	CMS	QBRECH
SPILLWAY OUTFLOW	CMS	QSPIL

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QRECH	QSPIL
***	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
1	0	0.000	50	4441.00	4441.00	4410.44	1.00	1.00	0.0	0.0	3.10	0.	0.	50.
2	2	0.070	50	4440.99	4440.38	4410.44	1.00	1.00	0.0	0.7	3.10	0.	1.	50.
3	1	0.140	53	4440.98	4439.76	4410.45	1.00	1.00	0.0	1.4	3.10	0.	3.	50.
4	1	0.210	58	4440.97	4439.14	4410.48	1.00	1.00	0.0	2.0	3.10	0.	9.	50.
5	1	0.280	67	4440.95	4438.52	4410.52	1.00	1.00	0.1	2.7	3.10	0.	18.	50.
6	1	0.350	80	4440.94	4437.90	4410.58	1.00	1.00	0.1	3.4	3.10	0.	31.	50.
7	2	0.420	98	4440.92	4437.28	4410.65	1.00	1.00	0.1	4.1	3.10	0.	48.	50.
8	2	0.490	120	4440.89	4436.66	4410.74	1.00	1.00	0.1	4.8	3.10	0.	71.	50.
9	2	0.560	148	4440.86	4436.04	4410.83	1.00	1.00	0.2	5.4	3.10	0.	99.	50.
10	2	0.630	181	4440.83	4435.42	4410.94	1.00	1.00	0.2	6.1	3.10	0.	132.	50.
11	2	0.700	220	4440.78	4434.80	4411.05	1.00	1.00	0.3	6.8	3.10	0.	170.	50.
12	2	0.770	264	4440.73	4434.18	4411.17	1.00	1.00	0.3	7.5	3.10	0.	214.	50.
13	2	0.840	314	4440.66	4433.56	4411.30	1.00	1.00	0.4	8.2	3.10	0.	264.	50.
14	2	0.910	368	4440.59	4432.94	4411.42	1.00	1.00	0.5	8.8	3.10	0.	320.	48.
15	2	0.980	425	4440.50	4432.32	4411.55	1.00	1.00	0.6	9.5	3.10	0.	381.	44.
16	2	1.050	488	4440.40	4431.70	4411.68	1.00	1.00	0.7	10.2	3.10	0.	448.	40.
17	2	1.120	556	4440.29	4431.08	4411.81	1.00	1.00	0.8	10.9	3.10	0.	520.	36.
18	2	1.190	629	4440.15	4430.46	4411.95	1.00	1.00	1.0	11.6	3.10	0.	597.	32.
19	2	1.260	707	4440.01	4429.84	4412.09	1.00	1.00	1.1	12.2	3.10	0.	679.	28.
20	2	1.330	789	4439.84	4429.22	4412.23	1.00	1.00	1.3	12.9	3.10	0.	766.	24.
21	2	1.400	876	4439.66	4428.60	4412.37	1.00	1.00	1.5	13.6	3.10	0.	856.	20.
22	2	1.470	966	4439.45	4427.98	4412.51	1.00	1.00	1.8	14.3	3.10	0.	950.	16.
23	2	1.540	1059	4439.23	4427.36	4412.64	1.00	1.00	2.0	15.0	3.10	0.	1047.	12.
24	2	1.610	1155	4438.98	4426.74	4412.78	1.00	1.00	2.3	15.6	3.10	0.	1147.	8.
25	2	1.680	1253	4438.71	4426.12	4412.91	1.00	1.00	2.6	16.3	3.10	0.	1249.	4.
26	2	1.750	1352	4438.42	4425.50	4413.05	1.00	1.00	2.9	17.0	3.10	0.	1353.	0.
27	2	1.820	1457	4438.11	4424.88	4413.18	1.00	1.00	3.3	17.7	3.10	0.	1457.	0.
28	2	1.890	1562	4437.77	4424.26	4413.31	1.00	1.00	3.7	18.4	3.10	0.	1562.	0.
29	2	1.960	1666	4437.41	4423.64	4413.44	1.00	1.00	4.1	19.0	3.10	0.	1667.	0.
30	2	2.030	1770	4437.02	4423.02	4413.56	1.00	1.00	4.5	19.7	3.10	0.	1771.	0.
31	2	2.100	1873	4436.61	4422.40	4413.67	1.00	1.00	5.0	20.4	3.10	0.	1874.	0.
32	2	2.170	1974	4436.18	4421.78	4413.79	1.00	1.00	5.5	21.1	3.10	0.	1974.	0.
33	2	2.240	2073	4435.72	4421.16	4413.89	1.00	1.00	6.0	21.8	3.10	0.	2073.	0.
34	2	2.310	2169	4435.24	4420.54	4413.99	1.00	1.00	6.5	22.4	3.10	0.	2169.	0.
35	2	2.380	2261	4434.73	4419.92	4414.09	1.00	1.00	7.1	23.1	3.10	0.	2262.	0.
36	2	2.450	2351	4434.20	4419.30	4414.18	1.00	1.00	7.6	23.8	3.10	0.	2351.	0.
37	2	2.520	2436	4433.65	4418.68	4414.27	1.00	1.00	8.2	24.5	3.10	0.	2437.	0.
38	2	2.590	2518	4433.08	4418.06	4414.35	1.00	1.01	8.9	25.2	3.10	0.	2518.	0.
39	2	2.660	2595	4432.49	4417.44	4414.42	1.00	1.01	9.5	25.8	3.10	0.	2595.	0.
40	2	2.730	2667	4431.88	4416.82	4414.49	1.00	1.01	10.2	26.5	3.10	0.	2668.	0.
41	2	2.800	2736	4431.25	4416.20	4414.56	1.00	1.01	10.9	27.2	3.10	0.	2736.	0.
42	2	2.870	2799	4430.60	4415.58	4414.62	1.00	1.01	11.5	27.9	3.10	0.	2799.	0.
43	2	2.940	2858	4429.94	4414.96	4414.67	1.00	1.01	12.3	28.6	3.10	0.	2858.	0.
44	2	3.010	2912	4429.25	4414.34	4414.72	1.00	1.01	13.0	29.2	3.10	0.	2912.	0.
45	2	3.080	2961	4428.56	4413.72	4414.77	1.00	1.01	13.7	29.9	3.10	0.	2962.	0.
46	2	3.150	3006	4427.85	4413.10	4414.81	1.00	1.02	14.5	30.6	3.10	0.	3007.	0.
47	2	3.220	3047	4427.12	4412.48	4414.84	1.00	1.02	15.2	31.3	3.10	0.	3048.	0.
48	2	3.290	3084	4426.38	4411.86	4414.88	1.00	1.02	16.0	32.0	3.10	0.	3085.	0.
49	2	3.360	3118	4425.63	4411.24	4414.91	1.00	1.03	16.8	32.6	3.10	0.	3118.	0.
50	2	3.430	3148	4424.87	4410.62	4414.93	1.00	1.03	17.6	33.3	3.10	0.	3149.	0.

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRANCH	QSPILL
***	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
51	2	3.500	3176	4424.10	4410.00	4414.96	1.00	1.04	18.4	34.0	3.10	0.	3177.	0.
52	2	3.570	2943	4423.35	4410.00	4414.75	1.00	1.04	19.2	34.0	3.10	0.	2943.	0.
53	2	3.640	2720	4422.65	4410.00	4414.54	1.00	1.04	19.9	34.0	3.10	0.	2721.	0.
54	2	3.710	2518	4422.00	4410.00	4414.35	1.00	1.04	20.5	34.0	3.10	0.	2519.	0.
55	2	3.780	2334	4421.39	4410.00	4414.17	1.00	1.05	21.1	34.0	3.10	0.	2335.	0.
56	2	3.850	2167	4420.83	4410.00	4413.99	1.00	1.05	21.7	34.0	3.10	0.	2168.	0.
57	2	3.920	2015	4420.31	4410.00	4413.83	1.00	1.05	22.2	34.0	3.10	0.	2016.	0.
58	2	3.990	1876	4419.82	4410.00	4413.68	1.00	1.05	22.7	34.0	3.10	0.	1877.	0.
59	2	4.060	1749	4419.36	4410.00	4413.53	1.00	1.05	23.2	34.0	3.10	0.	1750.	0.
60	2	4.130	1633	4418.93	4410.00	4413.40	1.00	1.05	23.6	34.0	3.10	0.	1634.	0.
61	2	4.200	1527	4418.53	4410.00	4413.27	1.00	1.06	24.0	34.0	3.10	0.	1527.	0.
62	2	4.270	1429	4418.15	4410.00	4413.14	1.00	1.06	24.4	34.0	3.10	0.	1429.	0.
63	2	4.340	1339	4417.80	4410.00	4413.03	1.00	1.06	24.7	34.0	3.10	0.	1339.	0.
64	2	4.410	1256	4417.46	4410.00	4412.92	1.00	1.06	25.1	34.0	3.10	0.	1256.	0.
65	2	4.480	1180	4417.15	4410.00	4412.82	1.00	1.06	25.4	34.0	3.10	0.	1180.	0.
66	2	4.550	1109	4416.86	4410.00	4412.72	1.00	1.06	25.7	34.0	3.10	0.	1110.	0.
67	2	4.620	1044	4416.58	4410.00	4412.62	1.00	1.07	25.9	34.0	3.10	0.	1044.	0.
68	2	4.690	983	4416.32	4410.00	4412.53	1.00	1.07	26.2	34.0	3.10	0.	984.	0.
69	2	4.760	927	4416.07	4410.00	4412.45	1.00	1.07	26.4	34.0	3.10	0.	928.	0.
70	2	4.830	876	4415.83	4410.00	4412.37	1.00	1.07	26.6	34.0	3.10	0.	876.	0.
71	2	4.900	827	4415.61	4410.00	4412.29	1.00	1.07	26.9	34.0	3.10	0.	828.	0.
72	2	4.970	782	4415.40	4410.00	4412.22	1.00	1.07	27.1	34.0	3.10	0.	783.	0.
73	2	5.040	741	4415.20	4410.00	4412.15	1.00	1.07	27.3	34.0	3.10	0.	741.	0.
74	2	5.110	702	4415.02	4410.00	4412.08	1.00	1.08	27.4	34.0	3.10	0.	702.	0.
75	2	5.180	665	4414.84	4410.00	4412.02	1.00	1.08	27.6	34.0	3.10	0.	666.	0.
76	2	5.250	631	4414.67	4410.00	4411.96	1.00	1.08	27.8	34.0	3.10	0.	632.	0.
77	2	5.320	599	4414.51	4410.00	4411.90	1.00	1.08	27.9	34.0	3.10	0.	600.	0.
78	2	5.390	570	4414.35	4410.00	4411.84	1.00	1.08	28.1	34.0	3.10	0.	570.	0.
79	2	5.460	542	4414.21	4410.00	4411.79	1.00	1.08	28.2	34.0	3.10	0.	542.	0.
80	2	5.530	516	4414.07	4410.00	4411.74	1.00	1.08	28.3	34.0	3.10	0.	516.	0.
81	2	5.600	491	4413.94	4410.00	4411.69	1.00	1.08	28.5	34.0	3.10	0.	492.	0.
82	2	5.670	468	4413.81	4410.00	4411.64	1.00	1.08	28.6	34.0	3.10	0.	469.	0.
83	2	5.740	446	4413.69	4410.00	4411.60	1.00	1.09	28.7	34.0	3.10	0.	447.	0.
84	2	5.810	426	4413.57	4410.00	4411.55	1.00	1.09	28.8	34.0	3.10	0.	427.	0.
85	2	5.880	407	4413.46	4410.00	4411.51	1.00	1.09	28.9	34.0	3.10	0.	407.	0.
86	2	5.950	389	4413.36	4410.00	4411.47	1.00	1.09	29.0	34.0	3.10	0.	389.	0.
87	2	6.020	372	4413.26	4410.00	4411.43	1.00	1.09	29.1	34.0	3.10	0.	372.	0.
88	2	6.090	356	4413.16	4410.00	4411.40	1.00	1.09	29.2	34.0	3.10	0.	356.	0.
89	2	6.160	340	4413.07	4410.00	4411.36	1.00	1.09	29.3	34.0	3.10	0.	341.	0.
90	2	6.230	326	4412.98	4410.00	4411.33	1.00	1.09	29.4	34.0	3.10	0.	327.	0.
91	2	6.300	313	4412.89	4410.00	4411.29	1.00	1.09	29.5	34.0	3.10	0.	313.	0.
92	2	6.370	300	4412.81	4410.00	4411.26	1.00	1.09	29.5	34.0	3.10	0.	300.	0.
93	2	6.440	287	4412.74	4410.00	4411.23	1.00	1.09	29.6	34.0	3.10	0.	288.	0.
94	2	6.510	276	4412.66	4410.00	4411.20	1.00	1.10	29.7	34.0	3.10	0.	276.	0.
95	1	6.580	265	4412.59	4410.00	4411.17	1.00	1.10	29.8	34.0	3.10	0.	265.	0.
96	1	6.650	255	4412.52	4410.00	4411.15	1.00	1.10	29.8	34.0	3.10	0.	255.	0.
97	1	6.720	245	4412.45	4410.00	4411.12	1.00	1.10	29.9	34.0	3.10	0.	245.	0.
98	1	6.790	235	4412.39	4410.00	4411.09	1.00	1.10	29.9	34.0	3.10	0.	236.	0.
99	1	6.860	226	4412.33	4410.00	4411.07	1.00	1.10	30.0	34.0	3.10	0.	227.	0.
100	1	6.930	218	4412.27	4410.00	4411.04	1.00	1.10	30.1	34.0	3.10	0.	218.	0.

RESERVOIR DEPLETION TABLE

I	K	TIP(I)	Q(I)	HE	YB	D	SUB	VOOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
***	**	******	********	*******	*******	*******	****	****	*********	****	****	*****	******	*****
101	1	7.000	210	4412.21	4410.00	4411.02	1.00	1.10	30.1	34.0	3.10	0.	210.	0.
102	2	7.077	201	4412.15	4410.00	4411.00	1.00	1.10	30.2	34.0	3.10	0.	202.	0.
103	2	7.162	193	4412.09	4410.00	4410.97	1.00	1.10	30.2	34.0	3.10	0.	193.	0.
104	2	7.255	183	4412.02	4410.00	4410.94	1.00	1.10	30.3	34.0	3.10	0.	184.	0.
105	2	7.357	174	4411.95	4410.00	4410.92	1.00	1.10	30.4	34.0	3.10	0.	175.	0.
106	1	7.470	164	4411.88	4410.00	4410.89	1.00	1.10	30.4	34.0	3.10	0.	165.	0.
107	1	7.594	155	4411.80	4410.00	4410.85	1.00	1.10	30.5	34.0	3.10	0.	155.	0.
108	1	7.731	145	4411.72	4410.00	4410.82	1.00	1.11	30.6	34.0	3.10	0.	145.	0.
109	1	7.881	135	4411.64	4410.00	4410.79	1.00	1.11	30.7	34.0	3.10	0.	135.	0.
110	1	8.046	125	4411.56	4410.00	4410.75	1.00	1.11	30.7	34.0	3.10	0.	125.	0.
111	1	8.227	115	4411.48	4410.00	4410.72	1.00	1.11	30.8	34.0	3.10	0.	116.	0.
112	1	8.427	105	4411.39	4410.00	4410.68	1.00	1.11	30.9	34.0	3.10	0.	106.	0.
113	1	8.647	96	4411.31	4410.00	4410.64	1.00	1.11	31.0	34.0	3.10	0.	96.	0.
114	1	8.888	87	4411.22	4410.00	4410.61	1.00	1.11	31.0	34.0	3.10	0.	87.	0.
115	1	9.154	78	4411.14	4410.00	4410.57	1.00	1.11	31.1	34.0	3.10	0.	78.	0.
116	1	9.446	69	4411.05	4410.00	4410.53	1.00	1.11	31.2	34.0	3.10	0.	70.	0.
117	1	9.768	62	4410.97	4410.00	4410.49	1.00	1.12	31.3	34.0	3.10	0.	62.	0.
118	1	10.122	54	4410.89	4410.00	4410.46	1.00	1.12	31.4	34.0	3.10	0.	55.	0.
119	1	10.511	47	4410.82	4410.00	4410.42	1.00	1.12	31.4	34.0	3.10	0.	48.	0.
120	2	10.939	41	4410.74	4410.00	4410.39	1.00	1.12	31.5	34.0	3.10	0.	42.	0.
121	0	11.37	1766											
122	0	11.84	1766											
123	0	12.36	1766											
124	0	12.93	1766											
125	0	13.55	1766											
126	0	14.24	1766											
127	0	15.00	1766											
128	0	15.84	1766											
129	0	16.75	1766											
130	0	17.76	1766											
131	0	18.87	1766											
132	0	20.09	1766											
133	0	21.44	1766											
134	0	22.92	1766											
135	0	24.54	1766											

PARAMETER	UNITS	VARIABLE	VALUE
**********	*******	******	**********
INITIAL FLOW	CMS	Q(1)	50.
MAX FLOW	CMS	QM	3177.
FINAL FLOW	CMS	Q(NU)	50.
TIME TO MAX FLOW	HRS	TP	3.50
NUMBER OF TIME STEPS		NNU	135
TOTAL VOLUME DISCHARGED FROM RESERVOIR	MILLION CU M	DISVOL	31.

INITIAL CONDITIONS

(QDI(I), I=1, N)

50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	

(YI(I), I=1, N)

4410.44	4371.37	4332.31	4293.25	4254.19	4215.12	4176.06	4137.00
4097.94	4058.87	4019.81	3980.75	3941.69	3902.62	3863.56	3824.50
3785.44	3746.37	3707.31	3668.25	3629.19	3590.12	3551.06	3512.00
3472.94	3433.87	3394.81	3355.75	3316.69	3277.62	3238.56	3199.50
3160.44	3119.91	3079.41	3038.88	2998.38	2957.85	2917.35	2876.82
2836.32	2795.79	2755.29	2714.76	2674.26	2633.73	2593.23	2552.70
2512.19	2471.68	2431.16	2390.64	2350.14	2309.61	2269.10	2228.58
2188.07	2147.56	2107.05	2066.53	2026.02	1985.50	1944.99	1904.47
1863.96	1823.44	1782.93	1742.41	1701.90	1661.38	1620.87	1580.35
1569.59	1558.82	1548.04	1537.27	1526.50	1515.73	1504.95	1494.17
1483.40	1472.63	1461.85	1451.08	1440.31	1429.53	1418.76	1407.99
1397.21	1386.44	1375.67	1364.89	1354.12	1343.35	1332.58	1321.80
1311.03	1300.26	1289.49	1278.72	1267.94	1257.18	1246.40	1235.63
1224.86	1214.09	1203.32	1192.55	1181.78	1171.02	1160.25	1149.48
1138.71	1127.94	1117.18	1106.41	1095.64	1085.14	1074.63	1064.13
1053.63	1043.12	1032.62	1022.11	1011.61	1001.10	990.60	980.09
969.59	959.08	948.58	938.08	927.57	917.07	906.56	896.06
885.55	875.05	864.55	854.04	843.54	833.04	822.53	812.03
801.53	791.02	780.52	770.02	759.51	749.01	738.51	728.00
717.50	707.00	696.49	685.99	675.49	664.99	654.48	643.98
633.48	622.97	612.47	601.97	591.47	580.96	570.46	

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TIME PARAMETERS OF OUTFLOW HYDROGRAPH IMMEDIATELY DOWNSTREAM OF DAM

PARAMETER	UNITS	VARIABLE	VALUE
TIME TO FAILURE	HR	TFH	3.500
TIME TO START OF RISING LIMB OF HYDROGRAPH	HR	TFO	0.000
TIME TO PEAK	HR	TP	3.500
TIME STEP SIZE	HR	DTHI	0.175

ROUTING COMPLETED.

KTIME= 249 ALLOWABLE KTIME= 699 TT= 24.4

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PROFILE OF CRESTS AND TIMES FOR Raphstreng

BELOW RUN3 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
********	********	********	********	********	*********	*********
0.000	4414.96	3164	3.470	10.22	0.00	0.00
1.000	4375.91	3157	3.470	10.20	0.00	0.00
2.000	4336.84	3149	3.470	10.23	0.00	0.00
2.999	4297.78	3143	3.536	10.23	0.00	0.00
3.999	4258.72	3145	3.543	10.27	0.00	0.00
4.999	4219.67	3146	3.548	10.28	0.00	0.00
5.999	4180.61	3145	3.568	10.30	0.00	0.00
6.999	4141.55	3144	3.587	10.32	0.00	0.00
7.999	4102.49	3144	3.597	10.34	0.00	0.00
8.998	4063.44	3144	3.607	10.36	0.00	0.00
9.998	4024.38	3143	3.627	10.38	0.00	0.00
10.998	3985.32	3143	3.656	10.40	0.00	0.00
11.998	3946.26	3143	3.666	10.43	0.00	0.00
12.998	3907.20	3143	3.686	10.45	0.00	0.00
13.998	3868.14	3142	3.695	10.47	0.00	0.00
14.997	3829.09	3141	3.705	10.49	0.00	0.00
15.997	3790.03	3141	3.725	10.51	0.00	0.00
16.997	3750.97	3140	3.745	10.53	0.00	0.00
17.997	3711.91	3140	3.764	10.56	0.00	0.00
18.997	3672.85	3139	3.784	10.58	0.00	0.00
19.997	3633.80	3139	3.803	10.60	0.00	0.00
20.996	3594.74	3138	3.823	10.63	0.00	0.00
21.996	3555.68	3137	3.823	10.65	0.00	0.00
22.996	3516.62	3137	3.843	10.67	0.00	0.00
23.996	3477.56	3137	3.862	10.70	0.00	0.00
24.996	3438.51	3136	3.882	10.72	0.00	0.00
25.996	3399.45	3136	3.902	10.75	0.00	0.00
26.995	3360.39	3135	3.921	10.77	0.00	0.00
27.995	3321.33	3135	3.921	10.80	0.00	0.00
28.995	3282.27	3134	3.941	10.82	0.00	0.00
29.995	3243.22	3134	3.961	10.85	0.00	0.00
30.995	3204.16	3133	3.980	10.87	0.00	0.00
31.995	3165.10	3133	4.000	10.90	0.00	0.00
33.010	3124.49	3132	4.000	10.99	0.00	0.00
34.025	3083.99	3132	4.019	10.81	0.00	0.00
35.040	3043.41	3132	4.039	10.83	0.00	0.00
36.056	3002.89	3131	4.059	10.70	0.00	0.00
37.071	2962.32	3131	4.078	10.70	0.00	0.00
38.086	2921.79	3130	4.098	10.60	0.00	0.00
39.101	2881.24	3130	4.098	10.57	0.00	0.00
40.116	2840.70	3129	4.118	10.49	0.00	0.00
41.132	2800.15	3129	4.137	10.46	0.00	0.00
42.147	2759.62	3129	4.157	10.39	0.00	0.00
43.162	2719.07	3128	4.177	10.35	0.00	0.00
44.177	2678.53	3128	4.196	10.29	0.00	0.00
45.192	2637.99	3127	4.216	10.24	0.00	0.00
46.208	2597.45	3127	4.235	10.19	0.00	0.00
47.223	2556.91	3126	4.235	10.15	0.00	0.00

PROFILE OF CRESTS AND TIMES FOR Raphstreng

BELOW RUN3 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
********	********	********	********	********	**********	**********
48.238	2516.37	3126	4.255	10.10	0.00	0.00
49.253	2475.83	3125	4.275	10.05	0.00	0.00
50.269	2435.29	3125	4.294	10.01	0.00	0.00
51.284	2394.75	3125	4.314	9.96	0.00	0.00
52.299	2354.22	3124	4.334	9.92	0.00	0.00
53.314	2313.68	3124	4.353	9.88	0.00	0.00
54.329	2273.14	3123	4.373	9.84	0.00	0.00
55.345	2232.60	3123	4.393	9.80	0.00	0.00
56.360	2192.07	3123	4.412	9.75	0.00	0.00
57.375	2151.53	3122	4.412	9.72	0.00	0.00
58.390	2111.00	3122	4.432	9.68	0.00	0.00
59.405	2070.46	3121	4.471	9.64	0.00	0.00
60.421	2029.93	3121	4.491	9.60	0.00	0.00
61.436	1989.39	3120	4.510	9.56	0.00	0.00
62.451	1948.86	3120	4.530	9.53	0.00	0.00
63.466	1908.32	3119	4.530	9.49	0.00	0.00
64.482	1867.79	3119	4.550	9.46	0.00	0.00
65.497	1827.26	3119	4.569	9.42	0.00	0.00
66.512	1786.72	3118	4.589	9.39	0.00	0.00
67.527	1746.19	3118	4.609	9.35	0.00	0.00
68.542	1705.66	3117	4.628	9.32	0.00	0.00
69.558	1665.13	3117	4.648	9.29	0.00	0.00
70.573	1624.59	3117	4.667	9.26	0.00	0.00
71.588	1584.06	3116	4.687	9.22	0.00	0.00
72.590	1576.94	3115	4.726	4.30	0.00	0.00
73.592	1562.31	3113	4.785	13.02	0.00	0.00
74.594	1555.64	3111	4.766	4.22	0.00	0.00
75.596	1540.65	3110	4.864	20.45	0.00	0.00
76.598	1534.27	3107	4.824	4.20	0.00	0.00
77.600	1519.06	3106	4.903	21.20	0.00	0.00
78.602	1512.86	3103	4.883	4.21	0.00	0.00
79.604	1497.52	3102	4.962	21.08	0.00	0.00
80.606	1491.42	3099	4.962	4.24	0.00	0.00
81.609	1476.02	3099	5.021	20.41	0.00	0.00
82.611	1469.98	3096	5.021	4.27	0.00	0.00
83.613	1454.54	3095	5.060	19.36	0.00	0.00
84.615	1448.54	3092	5.080	4.32	0.00	0.00
85.617	1433.06	3092	5.119	20.35	0.00	0.00
86.619	1427.11	3089	5.139	4.36	0.00	0.00
87.621	1411.60	3088	5.178	18.48	0.00	0.00
88.623	1405.67	3086	5.198	4.41	0.00	0.00
89.625	1390.14	3085	5.237	22.14	0.00	0.00
90.627	1384.24	3083	5.256	4.46	0.00	0.00
91.629	1368.68	3082	5.296	21.51	0.00	0.00
92.631	1362.82	3080	5.315	4.51	0.00	0.00
93.633	1347.24	3079	5.355	20.57	0.00	0.00
94.635	1341.40	3077	5.355	4.56	0.00	0.00
95.637	1325.79	3077	5.414	19.71	0.00	0.00

PROFILE OF CRESTS AND TIMES FOR Raphstreng
BELOW RUN3 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
********	********	********	********	********	**********	**********
96.639	1319.99	3075	5.414	4.62	0.00	0.00
97.641	1304.36	3074	5.472	18.92	0.00	0.00
98.643	1298.59	3072	5.472	4.68	0.00	0.00
99.646	1282.93	3071	5.512	20.73	0.00	0.00
100.648	1277.19	3069	5.531	4.74	0.00	0.00
101.650	1261.52	3068	5.571	20.50	0.00	0.00
102.652	1255.80	3067	5.590	4.80	0.00	0.00
103.654	1240.11	3066	5.630	19.62	0.00	0.00
104.656	1234.43	3064	5.649	4.87	0.00	0.00
105.658	1218.71	3063	5.688	18.15	0.00	0.00
106.660	1213.06	3061	5.708	4.94	0.00	0.00
107.662	1197.32	3061	5.728	20.21	0.00	0.00
108.664	1191.70	3059	5.767	5.01	0.00	0.00
109.666	1175.94	3058	5.787	18.86	0.00	0.00
110.668	1170.36	3057	5.806	5.09	0.00	0.00
111.670	1154.58	3056	5.845	20.32	0.00	0.00
112.672	1149.03	3054	5.865	5.17	0.00	0.00
113.674	1133.23	3053	5.885	18.65	0.00	0.00
114.676	1127.71	3052	5.924	5.26	0.00	0.00
115.678	1111.90	3051	5.944	19.47	0.00	0.00
116.680	1106.42	3050	5.983	5.35	0.00	0.00
117.686	1090.78	3049	6.003	19.33	0.00	0.00
118.692	1085.33	3047	6.022	5.34	0.00	0.00
119.698	1069.70	3046	6.042	19.18	0.00	0.00
120.704	1064.25	3045	6.081	5.33	0.00	0.00
121.710	1048.62	3044	6.101	17.75	0.00	0.00
122.715	1043.16	3043	6.140	5.32	0.00	0.00
123.721	1027.54	3042	6.160	19.42	0.00	0.00
124.727	1022.08	3041	6.179	5.31	0.00	0.00
125.733	1006.46	3040	6.199	18.71	0.00	0.00
126.739	1001.01	3039	6.238	5.30	0.00	0.00
127.745	985.38	3038	6.258	20.00	0.00	0.00
128.750	979.93	3036	6.297	5.28	0.00	0.00
129.756	964.31	3036	6.317	21.77	0.00	0.00
130.762	958.85	3034	6.356	5.27	0.00	0.00
131.768	943.23	3034	6.356	19.35	0.00	0.00
132.774	937.78	3032	6.395	5.26	0.00	0.00
133.780	922.16	3032	6.415	21.22	0.00	0.00
134.785	916.70	3030	6.454	5.24	0.00	0.00
135.791	901.09	3030	6.474	19.02	0.00	0.00
136.797	895.63	3028	6.513	5.23	0.00	0.00
137.803	880.01	3028	6.533	21.74	0.00	0.00
138.809	874.56	3027	6.552	5.22	0.00	0.00
139.815	858.94	3026	6.572	17.27	0.00	0.00
140.820	853.49	3024	6.611	5.20	0.00	0.00
141.826	837.88	3024	6.631	18.64	0.00	0.00
142.832	832.42	3023	6.670	5.19	0.00	0.00
143.838	816.81	3022	6.690	20.85	0.00	0.00

PROFILE OF CRESTS AND TIMES FOR Kaphstreng

BELOW RUN3 :

DISTANCE FROM DAM KM	MAX ELEV M	MAX FLOW CMS	TIME MAX ELEV-HRS	MAX VEL M/S	FLOOD ELEV M	TIME FLOOD ELEV-HRS
********	********	********	********	********	**********	**********
144.844	811.35	3021	6.709	5.17	0.00	0.00
145.850	795.74	3020	6.729	19.11	0.00	0.00
146.855	790.29	3019	6.768	5.16	0.00	0.00
147.861	774.68	3018	6.788	18.09	0.00	0.00
148.867	769.22	3017	6.827	5.14	0.00	0.00
149.873	753.61	3016	6.847	17.72	0.00	0.00
150.879	748.16	3015	6.866	5.13	0.00	0.00
151.884	732.55	3014	6.886	20.12	0.00	0.00
152.890	727.09	3013	6.925	5.11	0.00	0.00
153.896	711.49	3013	6.945	16.61	0.00	0.00
154.902	706.03	3011	6.984	5.10	0.00	0.00
155.908	690.43	3011	7.004	18.86	0.00	0.00
156.914	684.96	3009	7.004	5.08	0.00	0.00
157.919	669.36	3003	7.004	21.07	0.00	0.00
158.925	663.88	2994	7.004	5.06	0.00	0.00
159.931	648.28	2982	7.004	17.58	0.00	0.00
160.937	642.78	2965	7.004	5.02	0.00	0.00
161.943	627.19	2959	7.293	19.98	0.00	0.00
162.949	621.75	2972	7.293	5.00	0.00	0.00
163.954	606.17	2983	7.293	22.71	0.00	0.00
164.960	600.73	2996	7.293	5.00	0.00	0.00
165.966	585.16	3012	7.293	16.97	0.00	0.00
166.972	579.75	3038	7.293	5.01	0.00	0.00

DISCHARGE HYDROGRAPH FOR Raphstreng ... STATION NUMBER 1
BELOW RUN3 : AT KM 0.00
GAGE ZERO = 4410.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 4414.96 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.96 M AT TIME = 3.470 HOURS
MAX FLOW = 3165 CMS AT TIME = 3.470 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	-4410.0	0	*
0.2	0.5	60	.*
0.4	0.6	96	.*
0.6	0.9	168	. *
0.8	1.2	287	. *
1.0	1.6	446	. *
1.2	2.0	644	. *
1.4	2.4	879	. *.
1.6	2.8	1143	. .*
1.8	3.1	1429	. . *
2.0	3.5	1726	. . *
2.2	3.8	2016	. . *
2.4	4.1	2285	. . . *
2.6	4.4	2526	. . . *
2.8	4.6	2732	. . . *
3.0	4.7	2901	. . . *.
3.2	4.8	3034	. . . *
3.4	4.9	3135	. . . .*
3.6	4.7	2848	. . . *.
3.8	4.1	2287	. . . *
4.0	3.7	1859	. . *.
4.2	3.3	1527	. . *
4.4	2.9	1268	. . *
4.6	2.7	1063	. .*
4.8	2.4	898	. *.
5.0	2.2	765	. *.
5.2	2.0	656	. * .
5.4	1.8	566	. * .
5.6	1.7	492	. * .
5.8	1.6	430	. * .
6.0	1.4	377	. * .
6.2	1.3	333	. * .
6.4	1.3	295	. * .
6.6	1.2	262	. * .
6.8	1.1	235	. * .
7.0	1.0	210	. * .
7.2	1.0	190	. * .
7.4	0.9	171	. * .
7.6	0.9	155	. * .
7.8	0.8	141	.* .
8.0	0.8	129	.* .
8.2	0.7	117	.* .
8.4	0.7	108	.* .
8.6	0.7	99	.* .
8.8	0.6	91	.* .
9.0	0.6	84	.* .
9.2	0.6	77	.* .
9.4	0.5	72	.* .
9.6	0.5	66	.* .
9.8	0.5	62	.* .
10.0	0.5	57	.* .

DISCHARGE HYDROGRAPH FOR Raphstreng ... STATION NUMBER 33
BELOW RUN3 : AT KM 31.99

GAGE ZERO = 3160.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 3165.10 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 5.10 M AT TIME = 4.000 HOURS
MAX FLOW = 3133 CMS AT TIME = 4.000 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.00	3160.0	0	*
0.25	0.4	50	.*
0.50	0.4	50	.*
0.75	0.4	50	.*
1.00	0.4	51	.*
1.25	0.4	51	.*
1.50	0.4	51	.*
1.75	0.5	58	.*
2.00	0.9	178	. *
2.25	2.3	831	. *
2.50	3.2	1392	. *
2.75	3.7	1840	. *
3.00	4.2	2245	. *
3.25	4.6	2578	. *
3.50	4.8	2834	. *
3.75	5.0	3023	. *
4.00	5.1	3133	. *
4.25	4.6	2663	. *
4.50	4.1	2129	. *
4.75	3.6	1726	. *
5.00	3.2	1416	. *
5.25	2.9	1175	. *
5.50	2.6	985	. *
5.75	2.3	833	. *
6.00	2.1	711	. *
6.25	1.9	611	. *
6.50	1.8	528	. *
6.75	1.6	460	. *
7.00	1.5	403	. *
7.25	1.4	356	. *
7.50	1.3	316	. *
7.75	1.2	281	. *
8.00	1.1	252	. *
8.25	1.1	225	. *
8.50	1.0	203	. *
8.75	1.0	184	. *
9.00	0.9	166	. *
9.25	0.8	151	. *
9.50	0.8	138	.*
9.75	0.8	126	.*
10.00	0.7	115	.*
10.25	0.7	106	.*
10.50	0.7	98	.*
10.75	0.6	90	.*
11.00	0.6	83	.*
11.25	0.6	77	.*
11.50	0.5	72	.*
11.75	0.5	67	.*
12.00	0.5	63	.*
12.25	0.5	59	.*

DISCHARGE HYDROGRAPH FOR Raphstreng ... STATION NUMBER 72
BELOW RUN3 : AT KM 71.59

GAGE ZERO = 1580.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 1584.06 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 4.06 M AT TIME = 4.687 HOURS
MAX FLOW = 3117 CMS AT TIME = 4.687 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	1580.0	0	* . . . . .
0.5	0.4	51	.* . . . . .
1.0	0.4	51	.* . . . . .
1.5	0.4	51	.* . . . . .
2.0	0.4	51	.* . . . . .
2.5	0.4	52	.* . . . . .
3.0	0.4	52	.* . . . . .
3.5	1.7	690	. * . . . . .
4.0	3.6	2547	. . . * . . .
4.5	4.0	3032	. . . * . .
5.0	3.7	2688	. . . * . . .
5.5	3.0	1878	. . *. . . .
6.0	2.5	1360	. . * . . . .
6.5	2.1	1016	. * . . . . .
7.0	1.8	778	. * . . . . .
7.5	1.6	612	. * . . . . .
8.0	1.4	490	. * . . . . .
8.5	1.2	397	. * . . . . .
9.0	1.1	327	. * . . . . .
9.5	1.0	273	. * . . . . .
10.0	0.9	229	. * . . . . .
10.5	0.8	195	. * . . . . .
11.0	0.7	167	. * . . . . .
11.5	0.7	144	.* . . . . .
12.0	0.6	126	.* . . . . .
12.5	0.6	110	.* . . . . .
13.0	0.5	97	.* . . . . .
13.5	0.5	86	.* . . . . .
14.0	0.5	76	.* . . . . .
14.5	0.4	68	.* . . . . .
15.0	0.4	62	.* . . . . .
15.5	0.4	57	.* . . . . .
16.0	0.4	54	.* . . . . .
16.5	0.4	52	.* . . . . .
17.0	0.4	52	.* . . . . .
17.5	0.4	53	.* . . . . .
18.0	0.4	53	.* . . . . .
18.5	0.4	53	.* . . . . .
19.0	0.4	52	.* . . . . .
19.5	0.4	52	.* . . . . .
20.0	0.4	52	.* . . . . .
20.5	0.4	52	.* . . . . .
21.0	0.4	52	.* . . . . .
21.5	0.4	52	.* . . . . .
22.0	0.4	52	.* . . . . .
22.5	0.4	52	.* . . . . .
23.0	0.4	52	.* . . . . .

DISCHARGE HYDROGRAPH FOR Raphstreng ... STATION NUMBER 117
BELOW RUN3 : AT KM 116.68

GAGE ZERO = 1095.00 M MAX ELEVATION REACHED BY FLOOD WAVE = 1106.42 M
FLOOD STAGE NOT AVAILABLE
MAX STAGE = 11.42 M AT TIME = 5.983 HOURS
MAX FLOW = 3050 CMS AT TIME = 5.963 HOURS

TIME HR	STAGE M	FLOW CMS	0 1000 2000 3000 4000 5000
0.0	-1095.0	0	* . . . . .
0.5	2.3	112	.* . . . . .
1.0	2.7	157	. * . . . . .
1.5	2.8	169	. * . . . . .
2.0	2.8	169	. * . . . . .
2.5	2.8	169	. * . . . . .
3.0	2.8	171	. * . . . . .
3.5	3.0	188	. * . . . . .
4.0	3.2	207	. * . . . . .
4.5	3.3	218	. * . . . . .
5.0	4.1	322	. * . . . . .
5.5	10.7	2664	. . . * . . .
6.0	11.4	3047	. . . * . .
6.5	10.5	2506	. . . * . . .
7.0	9.3	1904	. . *. . . .
7.5	8.3	1486	. . * . . . .
8.0	7.4	1180	. . * . . . .
8.5	6.7	951	. . * . . . .
9.0	6.1	780	. * . . . . .
9.5	5.6	647	. * . . . . .
10.0	5.1	542	. * . . . . .
10.5	4.7	460	. * . . . . .
11.0	4.4	393	. * . . . . .
11.5	4.1	340	. * . . . . .
12.0	3.8	295	. * . . . . .
12.5	3.5	258	. * . . . . .
13.0	3.3	227	. * . . . . .
13.5	3.1	203	. * . . . . .
14.0	3.0	188	. * . . . . .
14.5	3.0	182	. * . . . . .
15.0	2.9	175	. * . . . . .
15.5	2.8	169	. * . . . . .
16.0	2.8	163	. * . . . . .
16.5	2.7	158	. * . . . . .
17.0	2.7	153	. * . . . . .
17.5	2.7	150	. * . . . . .
18.0	2.6	148	.* . . . . .
18.5	2.6	147	.* . . . . .
19.0	2.6	146	.* . . . . .
19.5	2.6	146	.* . . . . .
20.0	2.6	146	.* . . . . .
20.5	2.6	145	.* . . . . .
21.0	2.6	145	.* . . . . .
21.5	2.6	144	.* . . . . .
22.0	2.6	144	.* . . . . .
22.5	2.6	143	.* . . . . .
23.0	2.6	143	.* . . . . .

Calculation Result of Reservoir Sedimentation

Calculation of Deposit Shape

(1) Calculation Process (EPDC/KCC FLOW500 MODEL)

i) Non-uniform flow calculation for the initial river sections

ii) Calculation of friction velocities (u*) at respective sections

iii) Calculation of sediment load based on the Lane-Kalinske formula

iv) Estimate of riverbed movement by equation of continuity and then surface elevation of deposit

(Numerical Analysis based on $\partial z/\partial t=1/(1-\lambda)\cdot 1/B\cdot \partial(q_B\cdot B)/\partial x$)

v) Related calculation of the above on daily basis

(2) Prerequisite for Calculation

vi) Diameter of Particle

Uniform diameter was adopted in this calculation. d=0.65 mm was adopted to make annual sediment load approximately $610\times 10^3 m^3$/year in the Lane-Kalinske formula, and then the porosity of 0.4 was used.

vii) River Discharge

The river discharge at Wangdi Rapids GS was used.

viii) Reservoir Elevation

The reservoir surface used for the calculation is set at 1,154 m.

(3) Lane-Kalinske Formula

$$q_B=q\cdot C_0\cdot P$$

$$C_0=5.55\cdot \triangle F(w_0)\cdot\{1/2\cdot(u_*/w_0)\cdot\exp(-(w_0/u_*)^2\}^{1.61}$$

Where

q_s : Suspended load (per unit width)

q : Inflow

C_0:Density of Suspended

w_0:Sedimentation Rate

u_*:Friction Velocity

Caluculation Result of Reservoir Sedimentation

No.	Distance (m)	Accumulative Distance (m)	Elevation of Riverbed(m)			
			Initial Condition	1Year	2Year	3Year
1	0	0	1,095.00	1,095.00	1,095.00	1,095.00
2	176	176	1,100.00	1,100.00	1,100.00	1,100.00
3	143	319	1,105.00	1,105.00	1,105.00	1,105.00
4	271	590	1,110.00	1,110.00	1,110.00	1,110.00
5	308	898	1,115.00	1,115.00	1,115.00	1,115.00
6	244	1,142	1,120.00	1,120.00	1,120.00	1,120.00
7	308	1,450	1,122.50	1,122.50	1,122.50	1,122.50
8	308	1,758	1,125.00	1,125.00	1,125.00	1,125.27
9	298	2,056	1,130.00	1,130.00	1,134.36	1,150.40
10	96	2,152	1,135.00	1,135.21	1,152.78	1,150.03
11	199	2,351	1,140.00	1,152.22	1,153.57	1,153.83
12	192	2,543	1,145.00	1,153.55	1,154.45	1,154.99
13	148	2,691	1,150.00	1,154.32	1,155.30	1,155.91
14	216	2,907	1,152.50	1,155.80	1,156.64	1,157.15
15	216	3,122	1,155.00	1,157.51	1,158.07	1,158.49
16	140	3,262	1,160.00	1,158.69	1,159.04	1,159.43
17	223	3,485	1,162.50	1,160.59	1,160.62	1,160.94
18	223	3,709	1,165.00	1,162.47	1,162.22	1,162.45
19	269	3,978	1,167.50	1,164.66	1,164.17	1,164.29
20	269	4,246	1,170.00	1,166.72	1,166.11	1,166.15
21	352	4,598	1,171.00	1,169.19	1,168.63	1,168.63
22	352	4,950	1,172.00	1,171.44	1,171.11	1,171.12
23	352	5,302	1,173.00	1,173.53	1,173.57	1,173.63
24	352	5,654	1,174.00	1,175.58	1,176.04	1,176.17
25	352	6,006	1,175.00	1,177.75	1,178.53	1,178.72
26	332	6,338	1,177.50	1,180.01	1,180.93	1,181.14
27	332	6,670	1,180.00	1,182.52	1,183.39	1,183.59
28	481	7,151	1,185.00	1,186.58	1,187.07	1,187.18
29	375	7,526	1,190.00	1,190.00	1,190.00	1,190.00

Caluculation Result of Reservoir Sedimentation

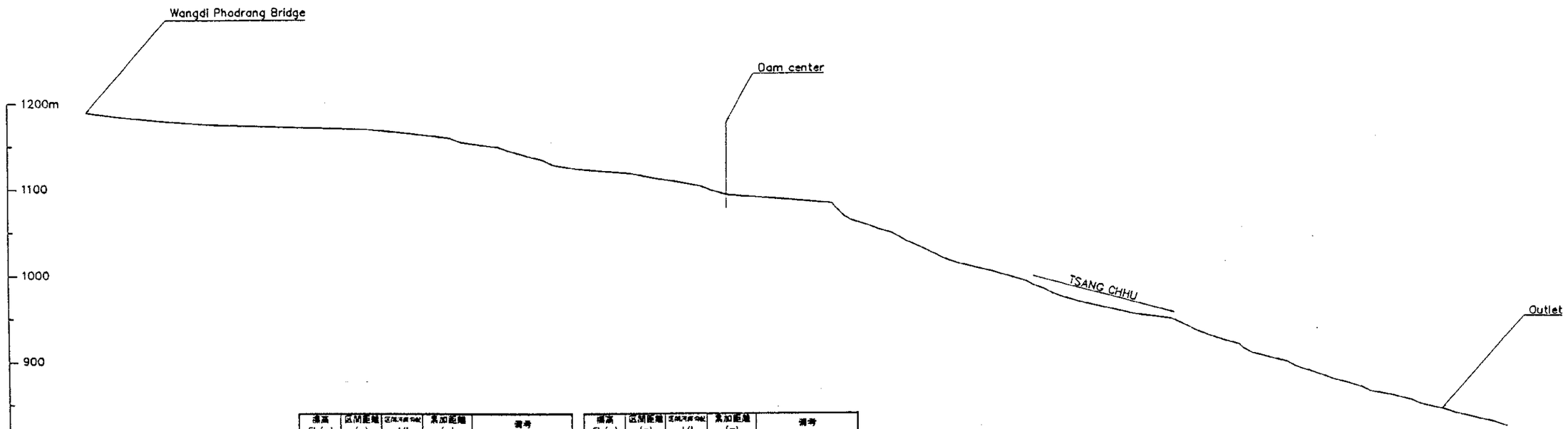
No.	Distance (m)	Accumulative Distance (m)	Elevation of Riverbed (m)			
			Initial Condition	4Year	5Yeaqr	6Year
1	0	0	1,095.00	1,095.00	1,095.00	1,095.00
2	176	176	1,100.00	1,100.00	1,100.00	1,100.00
3	143	319	1,105.00	1,105.00	1,105.00	1,105.00
4	271	590	1,110.00	1,110.00	1,110.00	1,110.00
5	308	898	1,115.00	1,115.00	1,115.00	1,115.00
6	244	1,142	1,120.00	1,120.00	1,120.00	1,120.00
7	308	1,450	1,122.50	1,122.50	1,122.67	1,130.66
8	308	1,758	1,125.00	1,135.22	1,151.29	1,152.75
9	298	2,056	1,130.00	1,153.04	1,153.17	1,153.95
10	96	2,152	1,135.00	1,153.54	1,153.65	1,154.41
11	199	2,351	1,140.00	1,154.41	1,154.56	1,155.44
12	192	2,543	1,145.00	1,155.45	1,155.63	1,156.49
13	148	2,691	1,150.00	1,156.31	1,156.52	1,157.32
14	216	2,907	1,152.50	1,157.61	1,157.87	1,158.57
15	216	3,122	1,155.00	1,158.96	1,159.26	1,159.84
16	140	3,262	1,160.00	1,159.85	1,160.17	1,160.69
17	223	3,485	1,162.50	1,161.30	1,161.64	1,162.07
18	223	3,709	1,165.00	1,162.77	1,163.11	1,163.47
19	269	3,978	1,167.50	1,164.57	1,164.91	1,165.20
20	269	4,246	1,170.00	1,166.39	1,166.71	1,166.96
21	352	4,598	1,171.00	1,168.82	1,169.11	1,169.31
22	352	4,950	1,172.00	1,171.29	1,171.53	1,171.71
23	352	5,302	1,173.00	1,173.78	1,173.99	1,174.14
24	352	5,654	1,174.00	1,176.31	1,176.48	1,176.61
25	352	6,006	1,175.00	1,178.85	1,178.99	1,179.10
26	332	6,338	1,177.50	1,181.26	1,181.37	1,181.46
27	332	6,670	1,180.00	1,183.69	1,183.77	1,183.83
28	481	7,151	1,185.00	1,187.23	1,187.27	1,187.30
29	375	7,526	1,190.00	1,190.00	1,190.00	1,190.00

Caluculation Result of Reservoir Sedimentation

No.	Distance (m)	Accumulative Distance (m)	Elevation of Riverbed (m)			
			Initial Condition	7Year	8Year	9Year
1	0	0	1,095.00	1,095.00	1,095.00	1,095.00
2	176	176	1,100.00	1,100.00	1,100.00	1,100.00
3	143	319	1,105.00	1,105.00	1,105.00	1,105.00
4	271	590	1,110.00	1,110.00	1,110.00	1,110.00
5	308	898	1,115.00	1,115.00	1,115.00	1,115.00
6	244	1,142	1,120.00	1,120.97	1,133.34	1,141.32
7	308	1,450	1,122.50	1,151.39	1,152.63	1,152.83
8	308	1,758	1,125.00	1,153.01	1,153.76	1,154.00
9	298	2,056	1,130.00	1,154.11	1,155.05	1,155.42
10	96	2,152	1,135.00	1,154.57	1,155.55	1,155.94
11	199	2,351	1,140.00	1,155.62	1,156.60	1,157.02
12	192	2,543	1,145.00	1,156.70	1,157.65	1,158.07
13	148	2,691	1,150.00	1,157.58	1,158.47	1,158.89
14	216	2,907	1,152.50	1,158.90	1,159.70	1,160.09
15	216	3,122	1,155.00	1,160.25	1,160.94	1,161.31
16	140	3,262	1,160.00	1,161.13	1,161.77	1,162.12
17	223	3,485	1,162.50	1,162.55	1,163.10	1,163.42
18	223	3,709	1,165.00	1,163.98	1,164.45	1,164.75
19	269	3,978	1,167.50	1,165.72	1,166.11	1,166.38
20	269	4,246	1,170.00	1,167.47	1,167.80	1,168.04
21	352	4,598	1,171.00	1,169.79	1,170.06	1,170.27
22	352	4,950	1,172.00	1,172.13	1,172.37	1,172.54
23	352	5,302	1,173.00	1,174.49	1,174.71	1,174.85
24	352	5,654	1,174.00	1,176.89	1,177.08	1,177.20
25	352	6,006	1,175.00	1,179.32	1,179.48	1,179.57
26	332	6,338	1,177.50	1,181.63	1,181.76	1,181.83
27	332	6,670	1,180.00	1,183.95	1,184.04	1,184.10
28	481	7,151	1,185.00	1,187.35	1,187.39	1,187.41
29	375	7,526	1,190.00	1,190.00	1,190.00	1,190.00

Caluculation Result of Reservoir Sedimentation

No.	Distance (m)	Accumulative Distance (m)	Elevation of Riverbed (m)			
			Initial Condition	10Year	20Year	30Year
1	0	0	1,095.00	1,095.00	1,095.00	1,152.34
2	176	176	1,100.00	1,100.00	1,100.00	1,153.00
3	143	319	1,105.00	1,105.00	1,138.17	1,153.54
4	271	590	1,110.00	1,110.00	1,152.64	1,154.59
5	308	898	1,115.00	1,115.09	1,153.74	1,156.00
6	244	1,142	1,120.00	1,151.05	1,154.74	1,157.15
7	308	1,450	1,122.50	1,153.04	1,156.18	1,158.59
8	308	1,758	1,125.00	1,154.20	1,157.67	1,160.05
9	298	2,056	1,130.00	1,155.67	1,159.15	1,161.48
10	96	2,152	1,135.00	1,156.18	1,159.63	1,161.94
11	199	2,351	1,140.00	1,157.27	1,160.63	1,162.90
12	192	2,543	1,145.00	1,158.33	1,161.61	1,163.83
13	148	2,691	1,150.00	1,159.17	1,162.37	1,164.55
14	216	2,907	1,152.50	1,160.39	1,163.48	1,165.61
15	216	3,122	1,155.00	1,161.62	1,164.61	1,166.68
16	140	3,262	1,160.00	1,162.43	1,165.35	1,167.38
17	223	3,485	1,162.50	1,163.74	1,166.54	1,168.50
18	223	3,709	1,165.00	1,165.06	1,167.75	1,169.63
19	269	3,978	1,167.50	1,166.68	1,169.22	1,171.00
20	269	4,246	1,170.00	1,168.32	1,170.71	1,172.39
21	352	4,598	1,171.00	1,170.51	1,172.69	1,174.22
22	352	4,950	1,172.00	1,172.75	1,174.70	1,176.07
23	352	5,302	1,173.00	1,175.03	1,176.74	1,177.93
24	352	5,654	1,174.00	1,177.34	1,178.80	1,179.81
25	352	6,006	1,175.00	1,179.69	1,180.88	1,181.71
26	332	6,338	1,177.50	1,181.91	1,182.86	1,183.51
27	332	6,670	1,180.00	1,184.16	1,184.84	1,185.31
28	481	7,151	1,185.00	1,187.44	1,187.74	1,187.95
29	375	7,526	1,190.00	1,190.00	1,190.00	1,190.00



標高 EL.(m)	区間距離 (m)	区間勾配 1/1	累加距離 (m)	備考
1,190	0.000	0	0.000	Wangdi Phodrang Bridge
1,185	374.721	75	374.721	
1,180	480.950	96	855.671	
1,175	663.520	133	1,519.191	
1,170	1,760.031	352	3,279.222	
1,165	537.571	108	3,816.793	
1,160	446.873	89	4,263.666	
1,155	139.817	28	4,403.483	
1,150	431.105	86	4,834.588	
1,145	147.854	30	4,982.442	
1,140	191.655	38	5,174.097	
1,135	199.413	40	5,373.510	
1,130	95.783	19	5,469.293	
1,125	298.382	60	5,767.675	
1,120	615.751	123	6,383.426	
1,115	244.448	49	6,627.872	
1,110	307.953	62	6,935.825	
1,105	270.565	54	7,206.390	
1,100	143.403	29	7,349.793	
1,095	175.790	35	7,525.583	Dam Center
1,090	612.927	123	8,138.510	
1,085	607.716	122	8,746.226	
1,080	49.919	10	8,796.145	
1,075	45.950	9	8,842.095	
1,070	47.822	10	8,889.917	
1,065	89.258	18	8,979.175	
1,060	161.715	32	9,140.890	
1,055	123.179	25	9,264.068	
1,050	172.387	34	9,436.456	
1,045	102.876	21	9,539.432	
1,040	89.686	18	9,629.118	
1,035	128.672	26	9,757.790	
1,030	88.442	20	9,846.432	
1,025	106.242	21	9,952.674	
1,020	105.516	21	10,058.190	
1,015	159.215	32	10,217.405	
1,010	208.678	42	10,426.083	

標高 EL.(m)	区間距離 (m)	区間勾配 1/1	累加距離 (m)	備考
1,005	198.112	40	10,624.195	
1,000	178.332	36	10,812.527	
995	187.555	38	11,000.082	
990	94.565	19	11,094.647	
985	126.030	27	11,220.677	
980	89.388	18	11,320.065	
975	140.075	28	11,460.140	
970	177.448	35	11,637.588	
965	213.761	43	11,851.349	
960	233.613	47	12,084.962	
955	232.592	47	12,317.554	
950	389.447	78	12,707.001	
945	121.516	24	12,828.517	
940	109.641	22	12,938.158	
935	103.842	21	13,041.800	
930	127.317	25	13,169.117	
925	152.208	30	13,321.325	
920	178.021	36	13,499.346	
915	58.883	12	13,558.229	
910	97.672	20	13,655.901	
905	215.278	43	13,871.177	
900	202.348	40	14,073.525	
895	85.846	17	14,159.371	
890	155.068	31	14,314.439	
885	157.783	32	14,472.222	
880	140.151	28	14,612.373	
875	188.812	37	14,799.185	
870	150.919	30	14,950.104	
865	107.887	22	15,057.991	
860	295.331	59	15,353.322	
855	196.962	39	15,550.284	
850	120.708	24	15,670.992	
845	242.856	48	15,913.848	
840	167.150	33	16,081.088	
835	221.258	44	16,302.346	
830	211.186	42	16,513.532	
825	165.732	0	16,679.274	

1:5,000

1:50,000

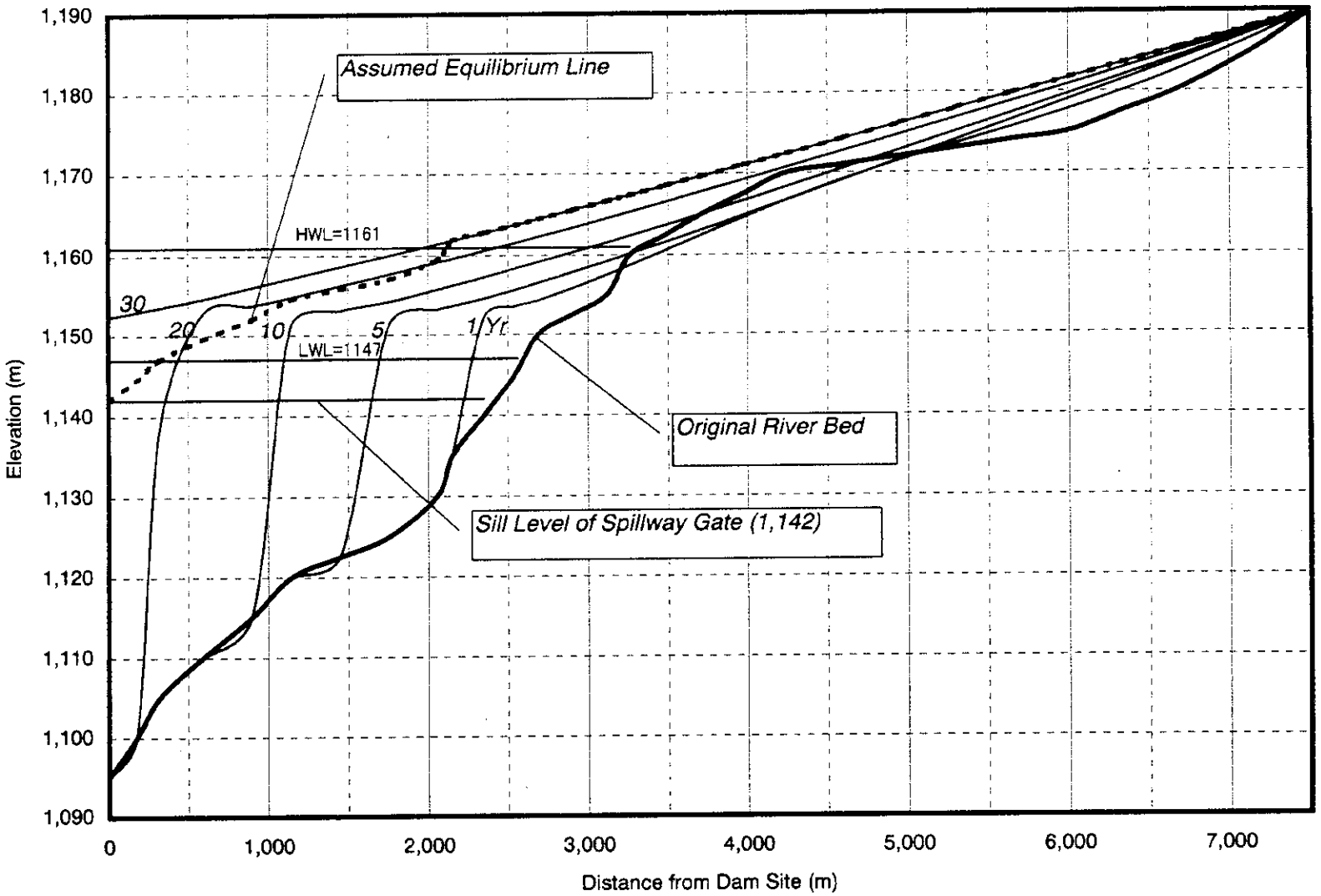
0 5000m

ELECTRIC POWER DEVELOPMENT CO., LTD.

PUNATSANGCHHU HYDROPOWER PROJECT

TSANGCHHU

PROFILE


Assumed Equilibrium Line
HWL=1161
LWL=1147
30
20
10
5
1/Yr
Original River Bed
Sill Level of Spillway Gate (1,142)
Elevation (m)
1,190
1,180
1,170
1,160
1,150
1,140
1,130
1,120
1,110
1,100
1,090
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Distance from Dam Site (m)

CHAPTER 7

GEOLOGY

GEOLOGY

Geologic Logs of Drill Holes
Photographs of Cores
Result of Permeability Test
Geologic Logs of Pits
Result of Seismic Prospecting
Result of Water Level Measurement in Drill Holes
Result of Laboratory Tests
Photographs of Rock Core Samples
Photographs of Soil Samples
Results of Petrographic Examination

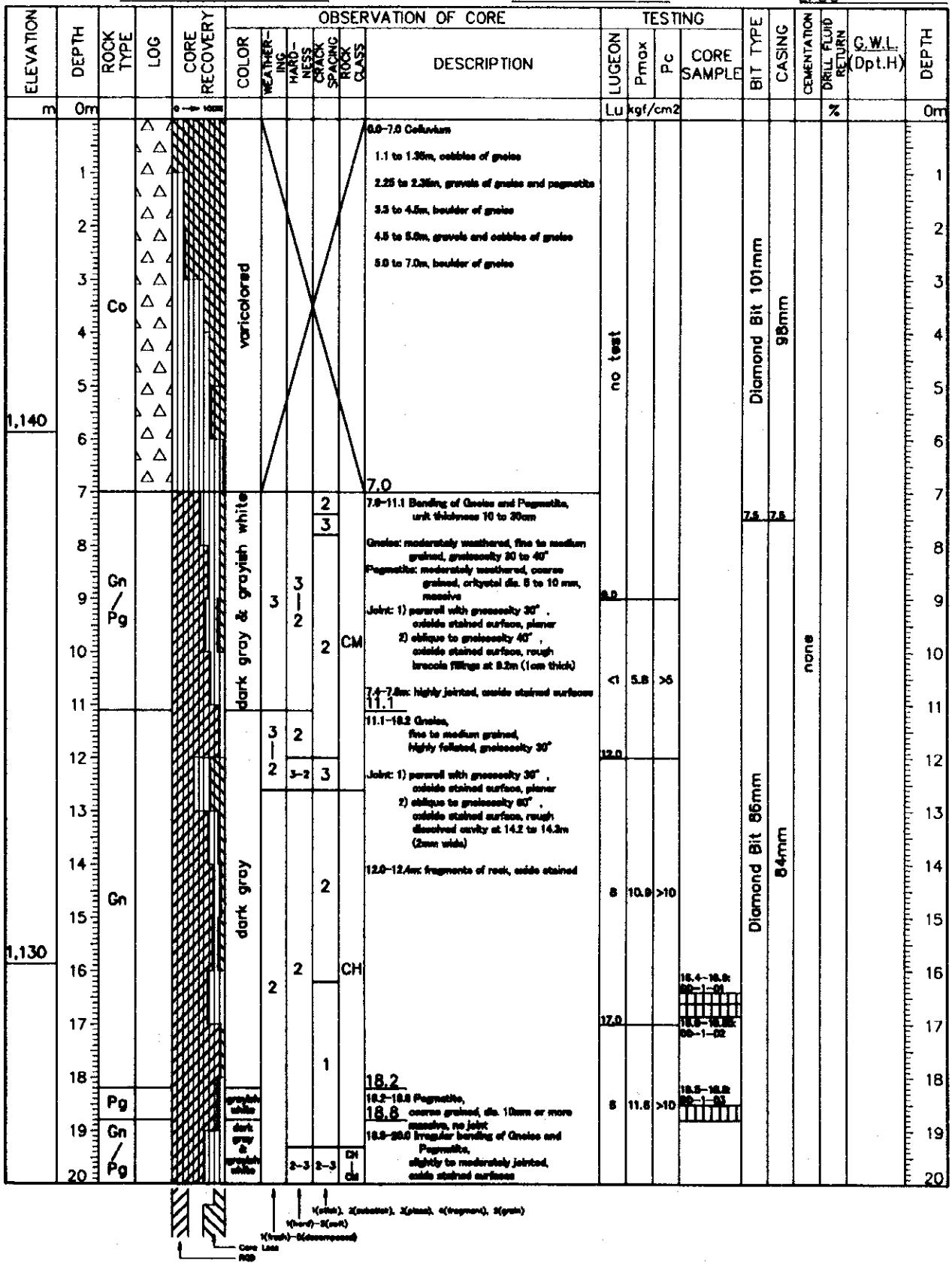
Geologic Logs of Drill Holes

GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-1 (SHEET 1 OF 3)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	60.0 m	COMMENCED	1999/11/16
ELEVATION	1,145.873 m	DIRECTION OF HOLE	vertical	COMPLETED	1999/12/19
COORDINATE	N1,073,183.854	CORE RECOVERY	88 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,299.387	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Selji Hongo, EPDC

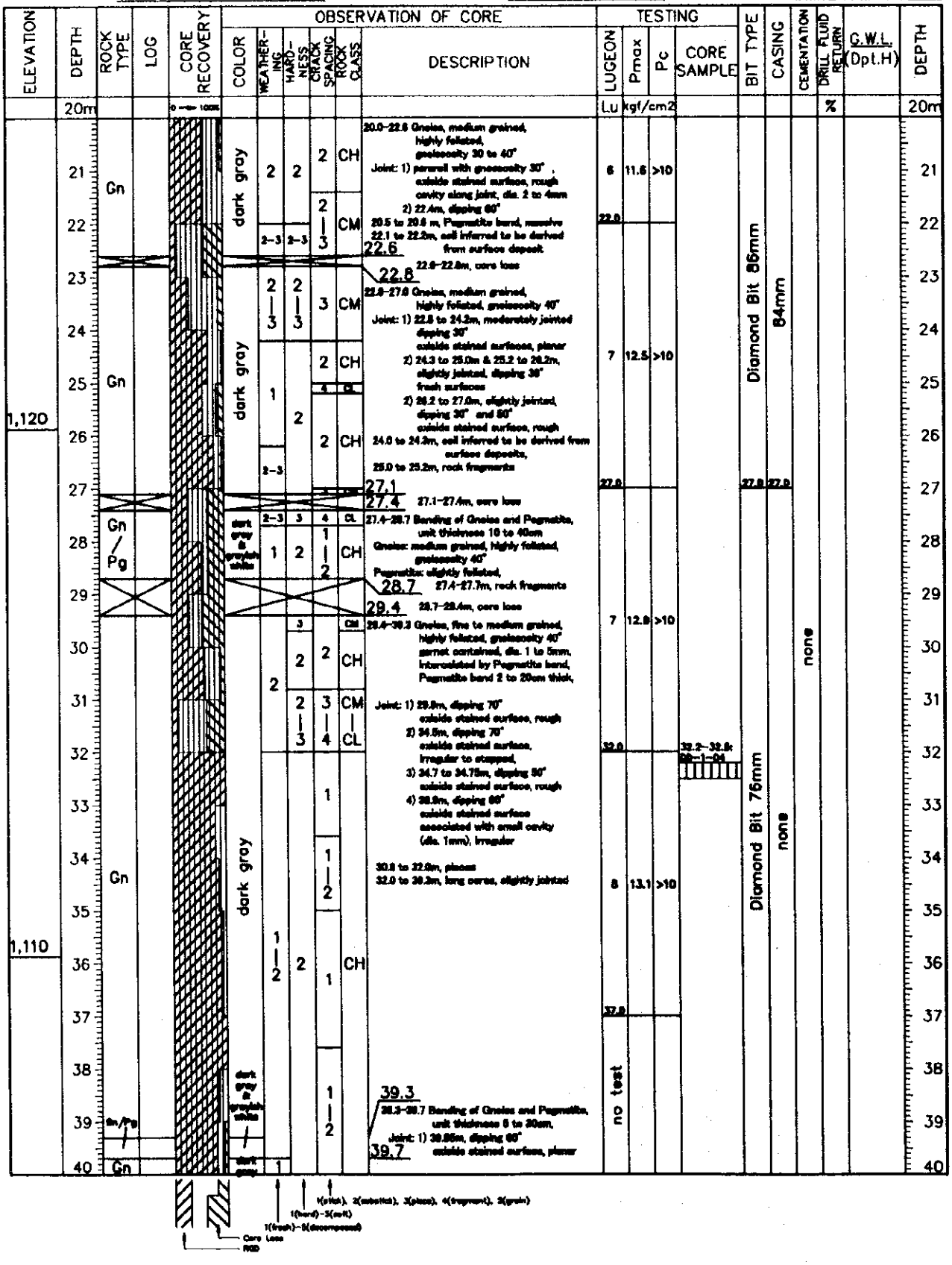


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-1 (SHEET 2 OF 3)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	60.0 m	COMMENCED	1999/11/16
ELEVATION	1,145.873 m	DIRECTION OF HOLE	vertical	COMPLETED	1999/12/19
COORDINATE	N1,073,183.854	CORE RECOVERY	88 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,299.387	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC



GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-1 (SHEET 3 OF 3)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	60.0 m	COMMENCED	1999/11/16
ELEVATION	1,145.873 m	DIRECTION OF HOLE	vertical	COMPLETED	1999/12/19
COORDINATE	N1,073,183.854	CORE RECOVERY	88 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,299.387	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

ELEVATION	DEPTH	ROCK TYPE	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK CLASS	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	CORE SAMPLE	BIT TYPE	CASING	CEMENTATION	DRILL FLUID RETURN	G.W.L. (Dpt.H)	DEPTH
	40m			0 — 100%							Lu	kgf/cm2						%		40m
1,100	41	Gn			dark gray	1	2	1/2	CH	38.7–44.3 Gneiss, medium grained, highly foliated, gneissosity 40° garnet contained, dia. less than 1mm, Joint: 1) 43.6 to 43.7m, dipping 70°, oxidate stained surface, rough thight, 41.4 to 41.5 m, Pegmatite band, massive									41
	42									44.3										42
	43									44.3–46.1 Banding of Gneiss and Pegmatite, unit thickness 2 to 10cm, Joint: 1) 44.8m, 45.1m, 45.8m, 46.7m, dipping 40 to 50°, oxidate stained surface, rough to planar 2) 46.6m, dipping 30° oxidate stained surface, planar 3) 46.2m, dipping 70° oxidate stained surface, planar									43
	44																			44
	45	Gn/Pg			dark gray white	2	2–3	3	CM	45.1										45
	46	Gn			dark gray	1/2	2	1/2	CH	46.1–47.0 Gneiss, medium grained, highly foliated, gneissosity 40° garnet contained, dia. less than 1mm, 46.75 to 46.7 m, Garnet Gneiss, massive to slightly foliated garnet dia. 2 to 5mm										46
	47									47.0 47.25 47.0–47.25m, core loss	47.0									47
	48	Gn/Pg			dark gray white	2	3	3–4	CM	47.25–48.6 Banding of Gneiss and Pegmatite, unit thickness 1 to 6cm, 47.25 to 47.8m, pieces, rock surfaces are stained by iron oxide										48
	49	Gn			dark gray	1	2	1/2	CH	48.6 48.6–51.5 Gneiss, fine to medium grained, highly foliated, gneissosity 20 to 50° garnet contained, dia. less than 1mm, Joint 1) 48.5m, dipping 90° oxidate stained surface, rough, 49.5 to 50.5 m, Garnet Gneiss, massive to slightly foliated garnet dia. 2 to 6mm	5	13.1	>10	50.1–50.9: 80–1–08	Diamond Bit 76mm	none	none			49
	50																			50
	51									51.5									51.0 99/12/16	51
	52	Gn/Pg			dark gray white	2	3	3–4	CM	51.5–52.2 Banding of Gneiss and Pegmatite, unit thickness 2 to 6cm, 52.2 51.8 to 52.1m, pieces	52.0									52
	53	Gn			dark gray	1				52.2–55.2 Gneiss, fine to medium grained, highly foliated, gneissosity 30° garnet contained, dia. less than 2mm, Joint 1) 52.4m, along gneissosity, dipping 40° oxidate stained surface, planar, 2) 54.1m, along gneissosity, dipping 90° oxidate stained surface, planar, 3) 57.7m, oblique to gneissosity, dipping 40° fresh surface, planar,										53
	54																			54
	55	Gn/Pg			dark gray white	1	2	1/2	CH	55.2 53.3 to 53.5 m, Pegmatite, massive 55.2–55.6 Banding of Gneiss and Pegmatite, unit thickness 5 to 10cm	5	15.1	10.1							55
1,090	56									55.6										56
	57	Gn			dark gray					55.6–57.9 Gneiss, fine to medium grained, highly foliated, gneissosity 30° garnet contained, dia. less than 2mm	57.0									57
	58									57.9										58
	59	Gn/Pg			dark gray white	1	2	2	CH	57.9–60.0 Banding of Gneiss and Pegmatite, unit thickness 2 to 20cm, Gneiss, high foliated, gneissosity 50° Pegmatite, slightly foliated 57.9 to 58.6m, pieces, rock surfaces are stained by iron oxide	8	15.1	10.1							59
	60										60.0									60

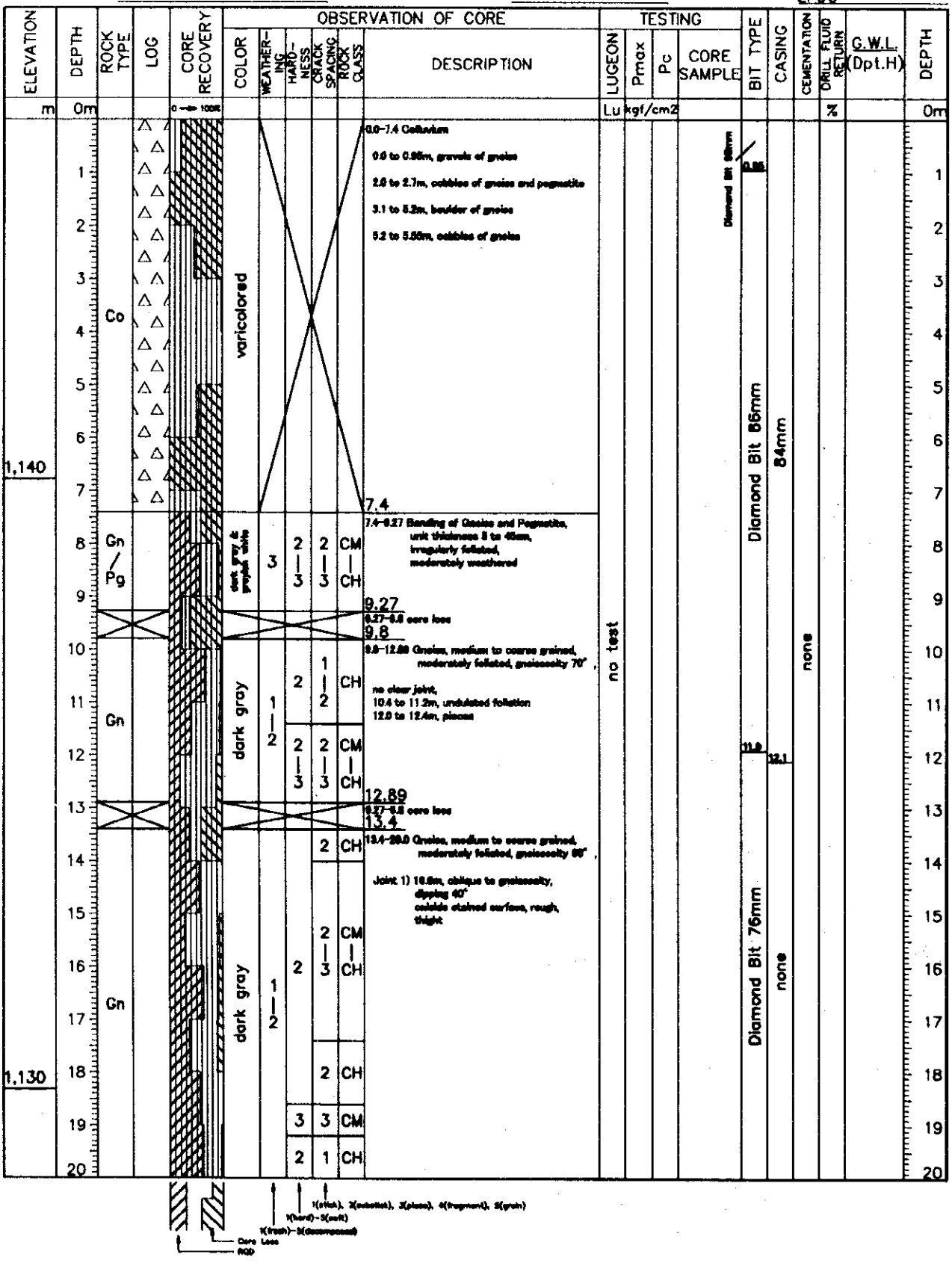
Core Loss

GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-2 (SHEET 1 OF 2)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	30.15 m	COMMENCED	1999/11/3
ELEVATION	1,145.873 m	DIRECTION OF HOLE	Inclined 60 N60E	COMPLETED	1999/11/15
COORDINATE	N1,073,183.854	CORE RECOVERY	81 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,299.387	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC



GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-2 (SHEET 2 OF 2)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	30.15 m	COMMENCED	1999/11/3
ELEVATION	1,145.873 m	DIRECTION OF HOLE	Inclined 60 N60E	COMPLETED	1999/11/15
COORDINATE	N1,073,183.854	CORE RECOVERY	81 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,299.387	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

ELEVATION	DEPTH	ROCK TYPE	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK CLASS	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	CORE SAMPLE	BIT TYPE	CASING	CEMENTATION	DRILL FLUID RETURN	G.W.L. (Dpt.H)	DEPTH
	20m			0 — 100%							Lu	kgf/cm2						%		20m
	21	Gn			dark gray	1—2	2	1	CH	20.0-24.9 Gneiss, medium to coarse grained, moderately foliated, gneissosity 60° Joint: 1) 23.85m, dipping 30°, oxide stained surface, planar, tight 2) 24.05m, along gneissosity, dipping 60°, oxide stained surface, planar	no test				Diamond Bit 76mm	none	none			21
	22																			22
	23																			23
	24									24.9 24.9-25.7 Pegmatite, massive, coarse grained, crystal dia. 10 to 20mm Joint: 1) 24.95m, 2 sets, dipping 40°, oxide stained surface, planar, tight 2) 25.1m, irregular, oxide stained surface, rough.										24
	25	Pg			greyish white	1		1—2		25.7 25.7-27.0 Banding of Gneiss and Pegmatite, unit thickness 1 to 10cm, Gneiss, coarse grained, slightly to moderately foliated,										25
	26	Gn / Pg			dark gray & greyish white	1—2														26
	27									27.0 27.0-31.15 Gneiss, medium grained, highly foliated, gneissosity 50° Joint: 1) along gneissosity 50°, oxide stained surface, planar, tight 2) 29.3 to 29.7m, dipping 60°, oxide stained surface, rough. 29.1 to 29.7 m, slightly weathered										27
	28	Gn			dark gray	2	2—3	2—3	CM—CH											28
	29																			29
	30					1	1	2	CH	30.15m, bottom of hole										30

1(fresh)–5(decomposed) 1(hard)–5(soft) 1(plate), 2(columnar), 3(platy), 4(fragment), 5(grain)

Core Loss

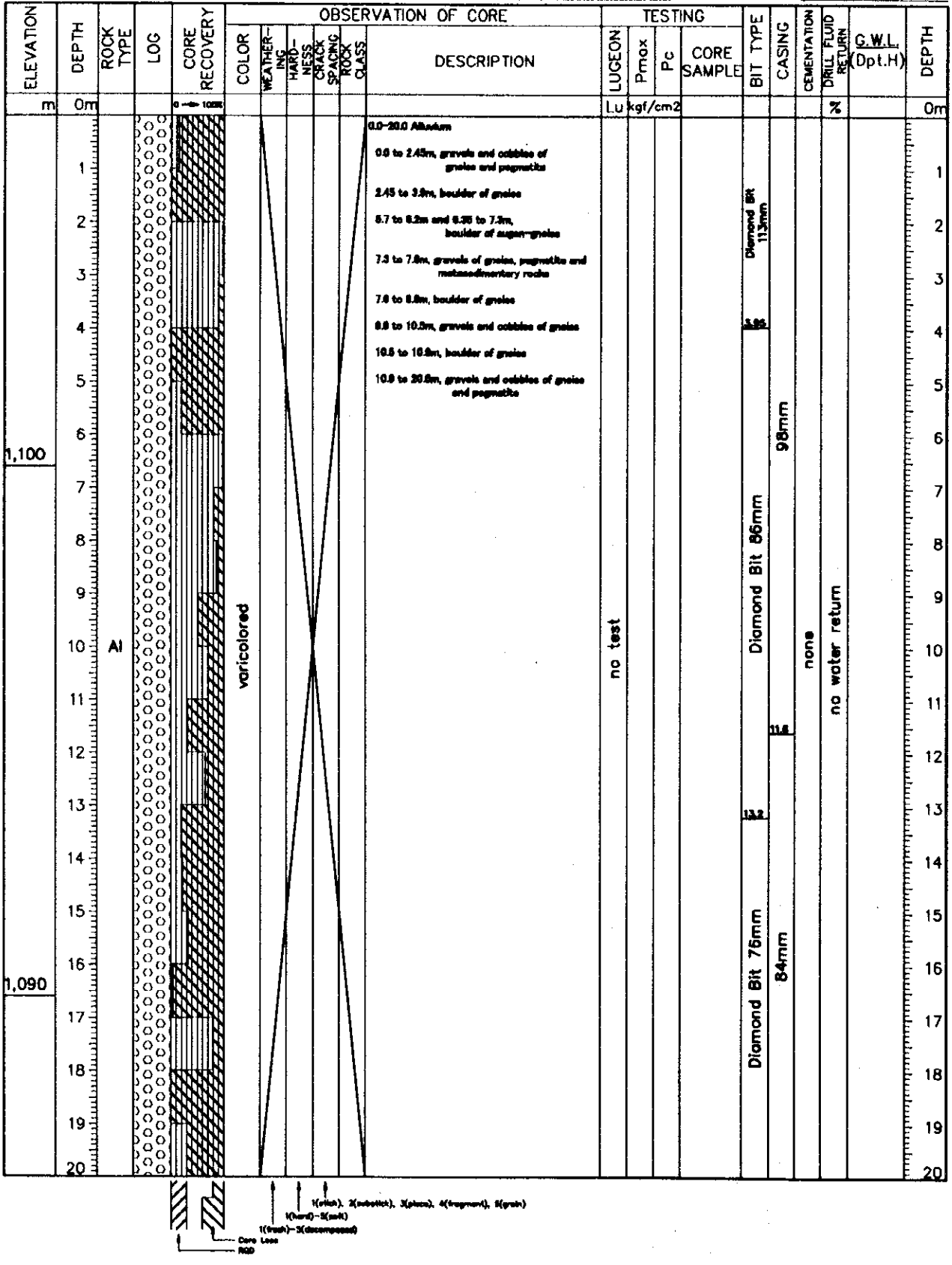
RQD

GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-3 (SHEET 1 OF 3)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	60.0 m	COMMENCED	2000/1/14
ELEVATION	1,106.602 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/2/12
COORDINATE	N1,073,158.971	CORE RECOVERY	33 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,256.509	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

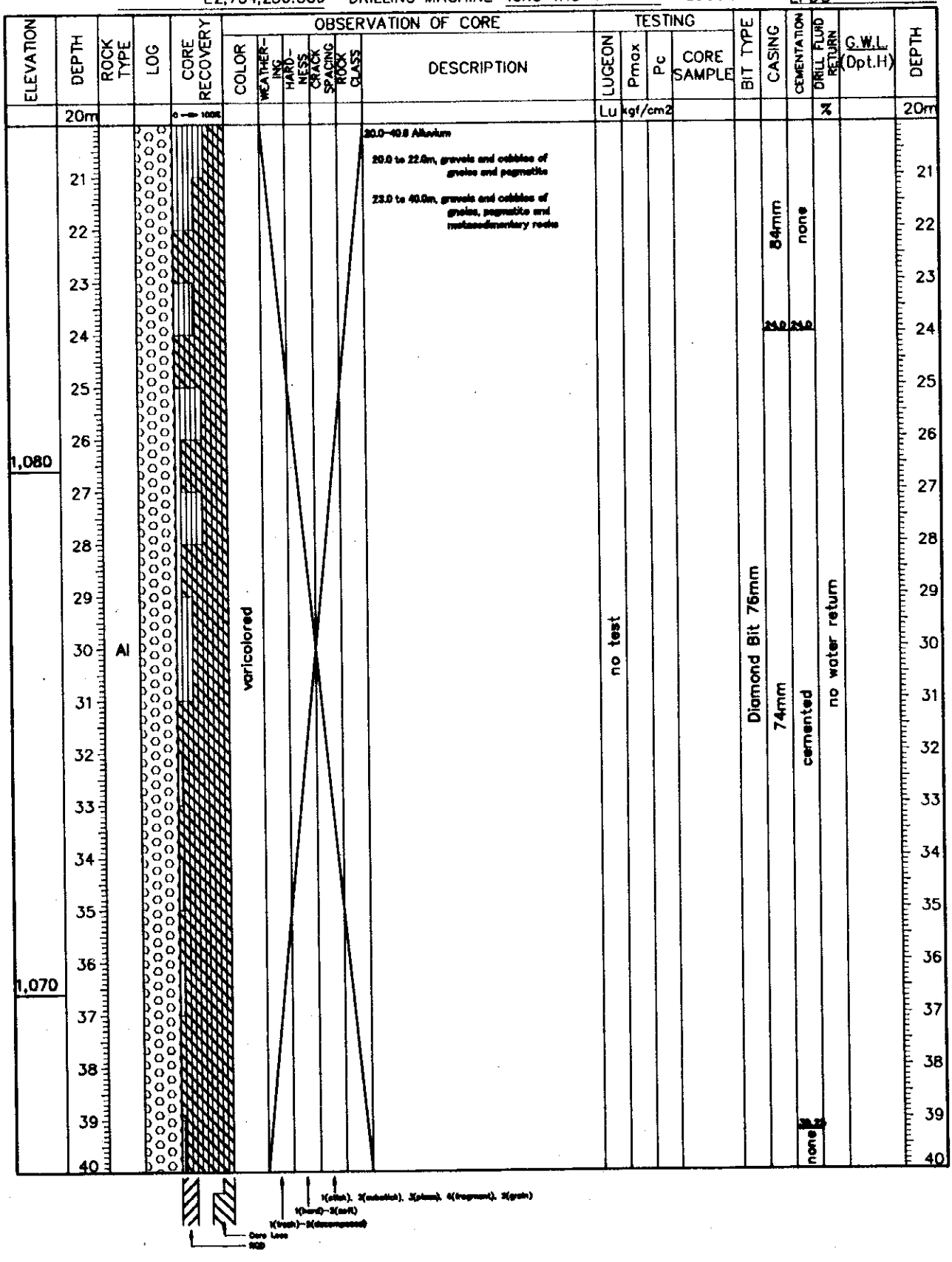


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-3 (SHEET 2 OF 3)

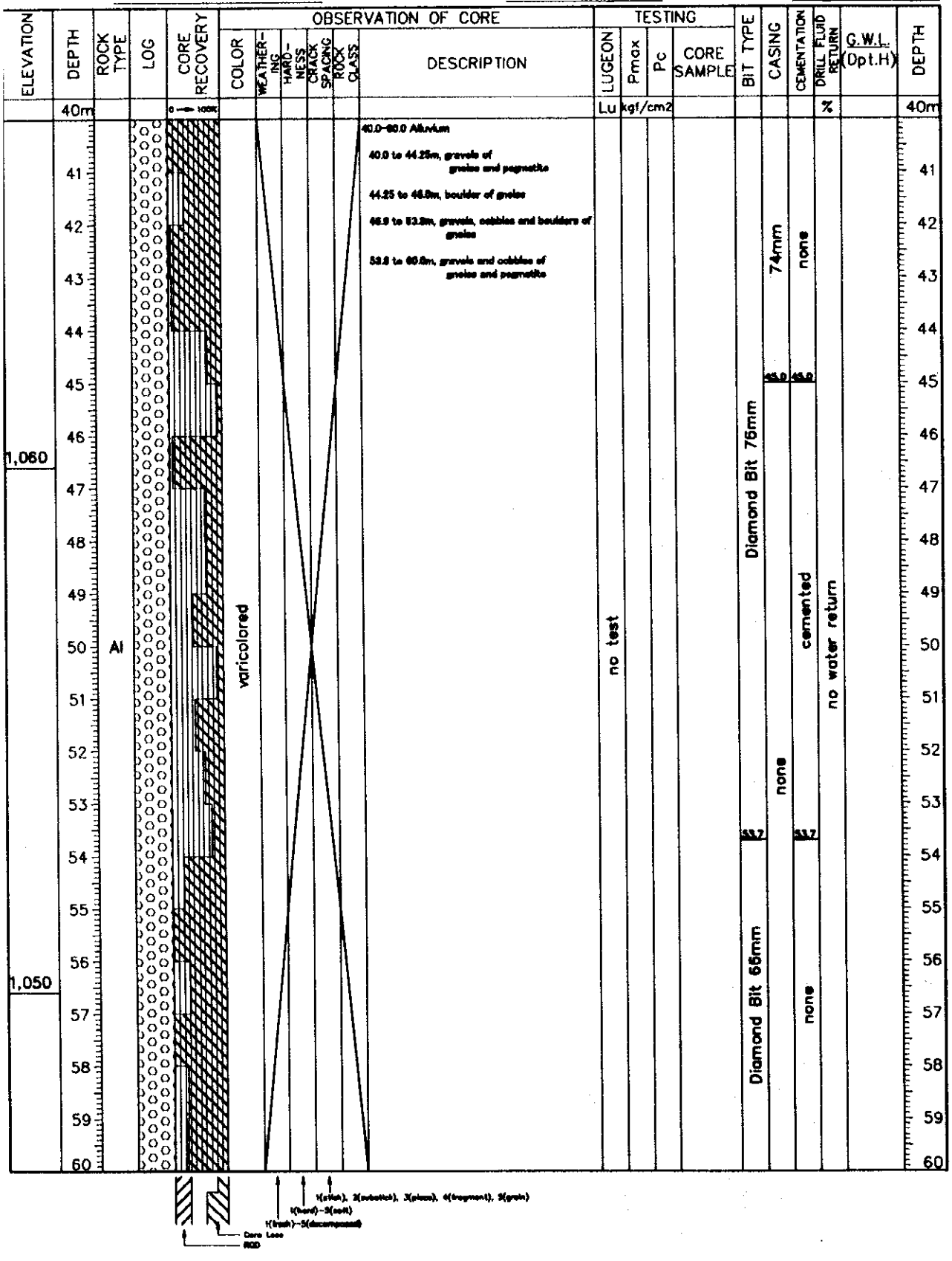
LOCATION	Dam, Left Bank	DEPTH OF HOLE	60.0 m	COMMENCED	2000/1/14
ELEVATION	1,106.602 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/2/12
COORDINATE	N1,073,158.971	CORE RECOVERY	33 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,256.509	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC



GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S HOLE No. DD-3 (SHEET 3 OF 3)

LOCATION	Dam, Left Bank	DEPTH OF HOLE	60.0 m	COMMENCED	2000/1/14
ELEVATION	1,106.602 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/2/12
COORDINATE	N1,073,158.971	CORE RECOVERY	33 %	DRILLED BY	Mr.Dorji, GSB
	E2,734,256.509	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

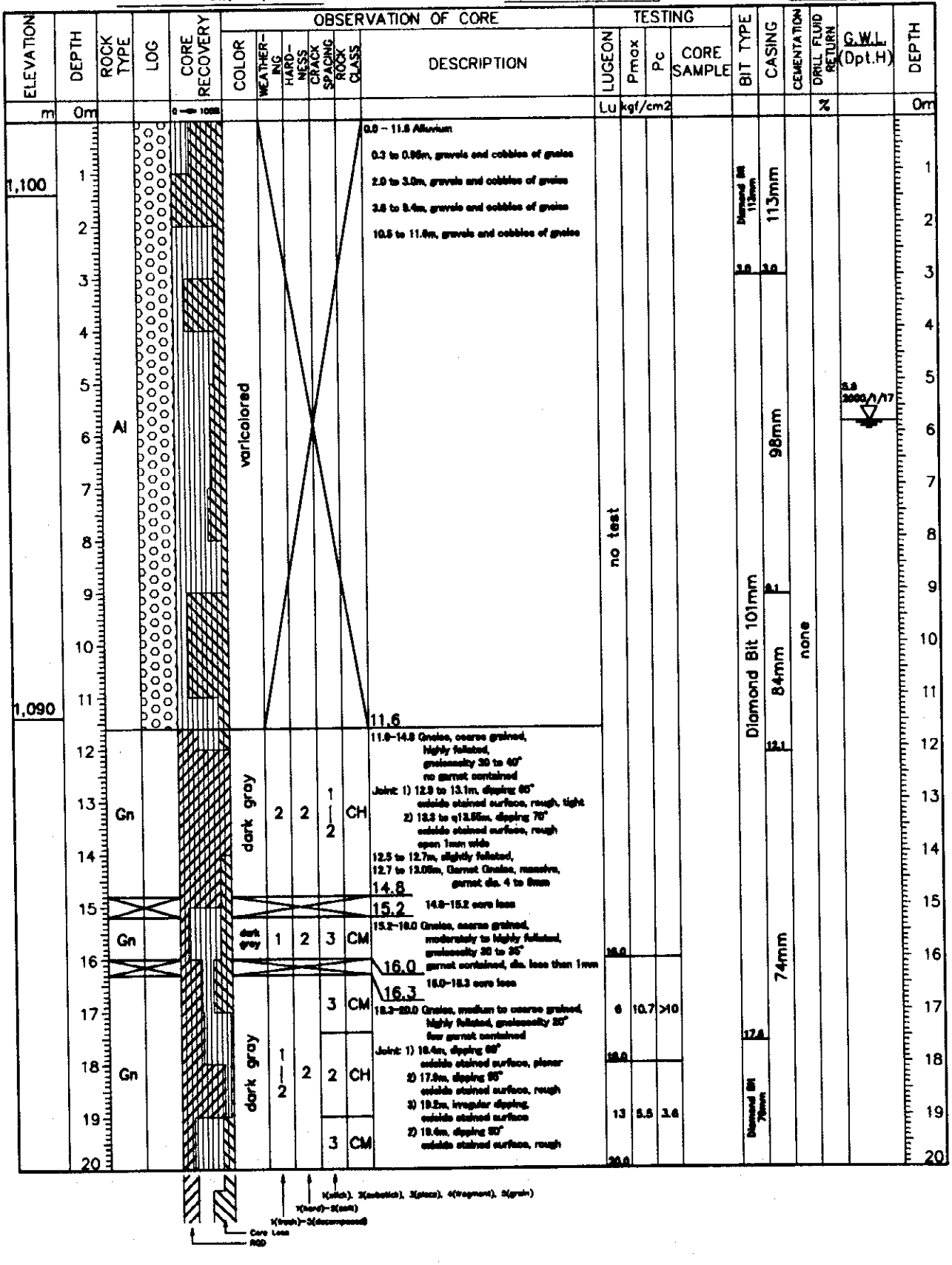


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-4 (SHEET 1 OF 3)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	50.0 m	COMMENCED	1999/12/27
ELEVATION	1,101.393 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/1/17
COORDINATE	N1,073,118.698	CORE RECOVERY	80 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,187.112	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

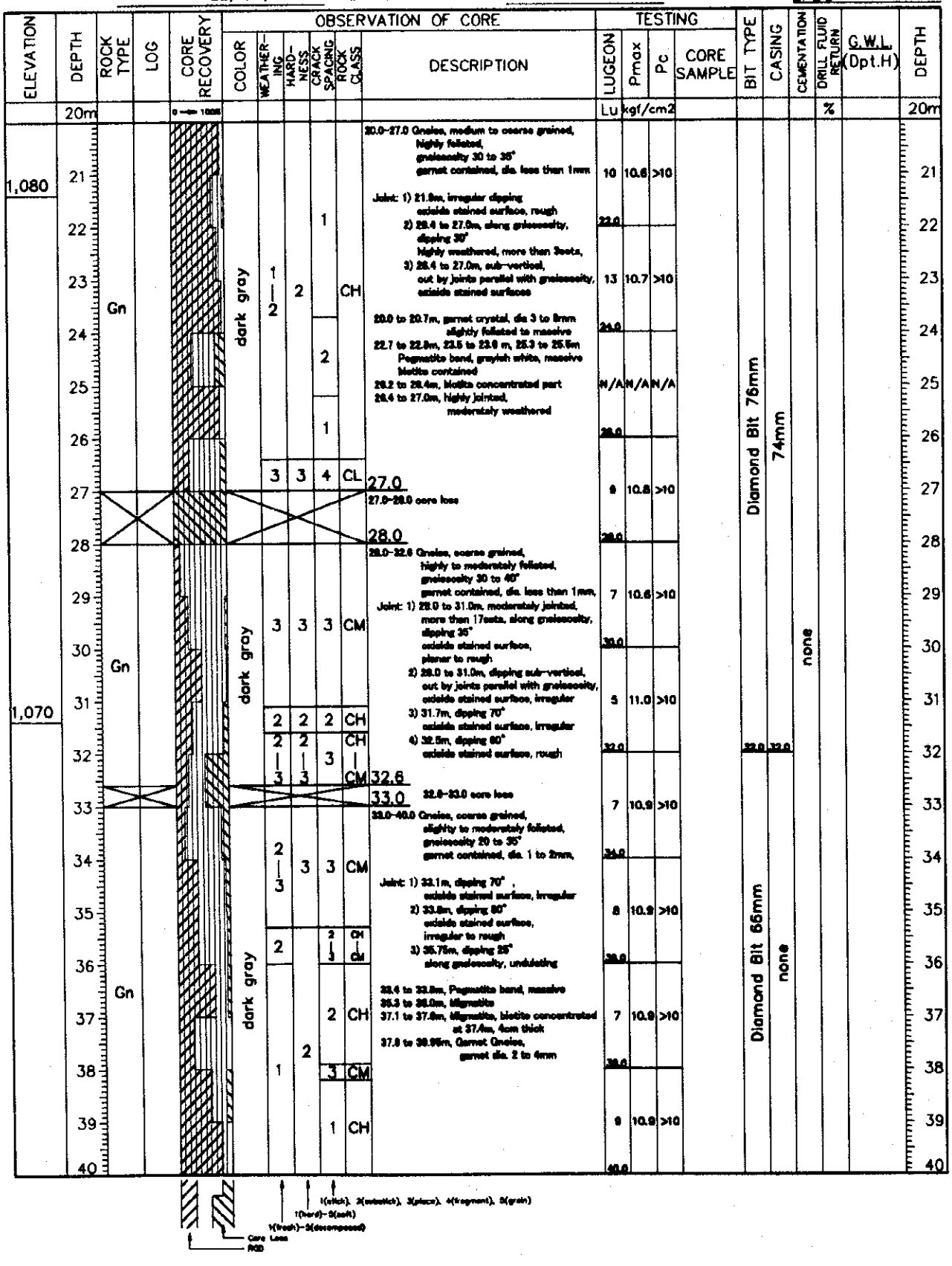


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-4 (SHEET 2 OF 3)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	50.0 m	COMMENCED	1999/12/27
ELEVATION	1,101.393 m	DIRECTION OF HOLE	verticol	COMPLETED	2000/1/17
COORDINATE	N1,073,118.698	CORE RECOVERY	80 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,187.112	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC



GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S HOLE No. DD-4 (SHEET 3 OF 3)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	50.0 m	COMMENCED	1999/12/27
ELEVATION	1,101.393 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/1/17
COORDINATE	N1,073,118.698	CORE RECOVERY	80 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,187.112	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

ELEVATION	DEPTH	ROCK TYPE	LOG	CORE RECOVERY	OBSERVATION OF CORE: COLOR	WEATHERING	HARDNESS	CRACK SPACING	ROCK CLASS	DESCRIPTION	TESTING: LUGEON	Pmax	Pc	CORE SAMPLE	BIT TYPE	CASING	CEMENTATION	DRILL FLUID RETURN	G.W.L. (Dpt.H)	DEPTH
	40m			0 ← → loss							Lu	kgf/cm2						%		40m
1,060	41	Gn			dark gray	1	2	1	CH	40.0–49.0 Gneiss, medium grained, moderately foliated, gneissosity 40 to 50° garnet contained, dia. 1 to 6mm	7	10.9	>10		Diamond Bit 66mm	none	none			41
	42					2	2–3	3	CH–CM	Joint: 1) 40.8m and 40.9m, dipping 55° oxide stained surface, planer 2) 41.2m, dipping 65° slightly weathered, planer 3) 42.65m and 44.8m, dipping 50° oxide stained surface, planer 4) 44.7m, along gneissosity, dipping 40° oxide stained surface, planer to rough 5) 44.7 to 44.9m, sub-vertical oxide stained surface, rough 6) 46.5 to 46.8m, along gneissosity, 3sets, dipping 40° oxide stained surface, rough	42.0									42
	43										8	11.0	>10							43
	44										44.0									44
	45					1–2	2	1–2	CH	Crack 1) 41.5 to 41.8m, sub-vertical, oxide stained, irregular	8	10.9	>10							45
	46										46.0									46
	47									42.5 to 42.6 m, pieces 42.6 to 43.1m, Pegmatite, biotite concentrated part is observed	3	10.9	>10							47
	48					3	4	CH–CM		46.4 to 46.3m, Pegmatite band biotite concentrated part is observed, 5 to 10cm thick	48.0									48
	49					2	2	1–2	CH	47.4 to 48.0m, pieces 48.7 to 48.8m, pieces to short cores	5	10.9	>10							49
							3	3	CM	49.0										
										49.0–49.5 core loss										
	50	Gn			dark gray	2	2–3	2–3	CH–CM	49.5 46.5–50.0 Gneiss, coarse grained, moderately foliated, gneissosity 30°	50.0									50
										50.0m, bottom of hole										

1(clay), 2(sebestos), 3(piece), 4(fragment), 5(grain)

1(fresh)–5(decomposed)

1(hard)–5(soft)

Core Loss

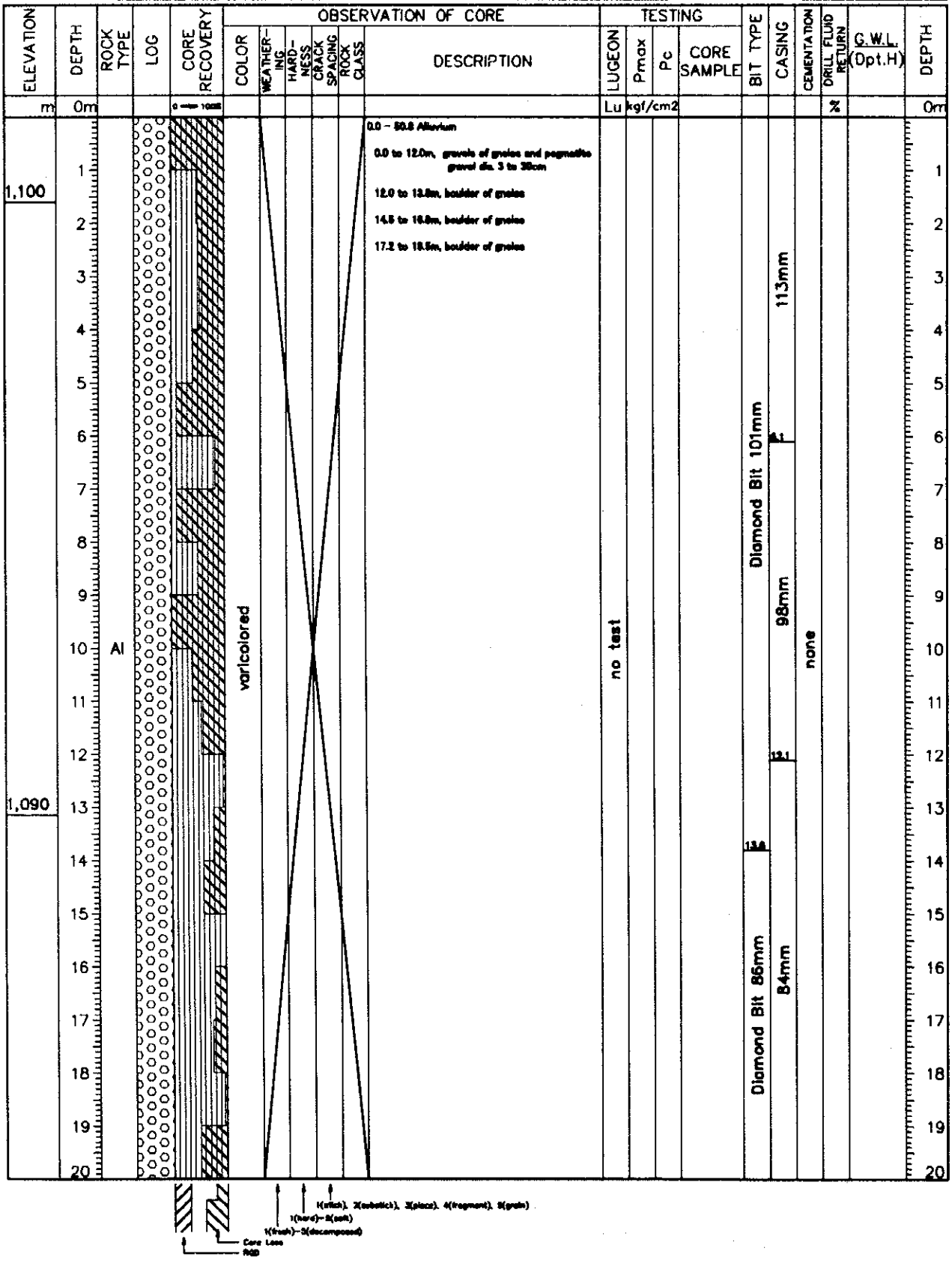
RQD

GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-5 (SHEET 1 OF 3)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	60.0 m	COMMENCED	1999/12/6
ELEVATION	1,101.393 m	DIRECTION OF HOLE	inclined 60 N60E	COMPLETED	1999/12/24
COORDINATE	N1,073,118.698	CORE RECOVERY	55 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,187.112	DRILLING MACHINE	Tone THC--1	LOGGED BY	Mr.Seiji Hongo, EPDC

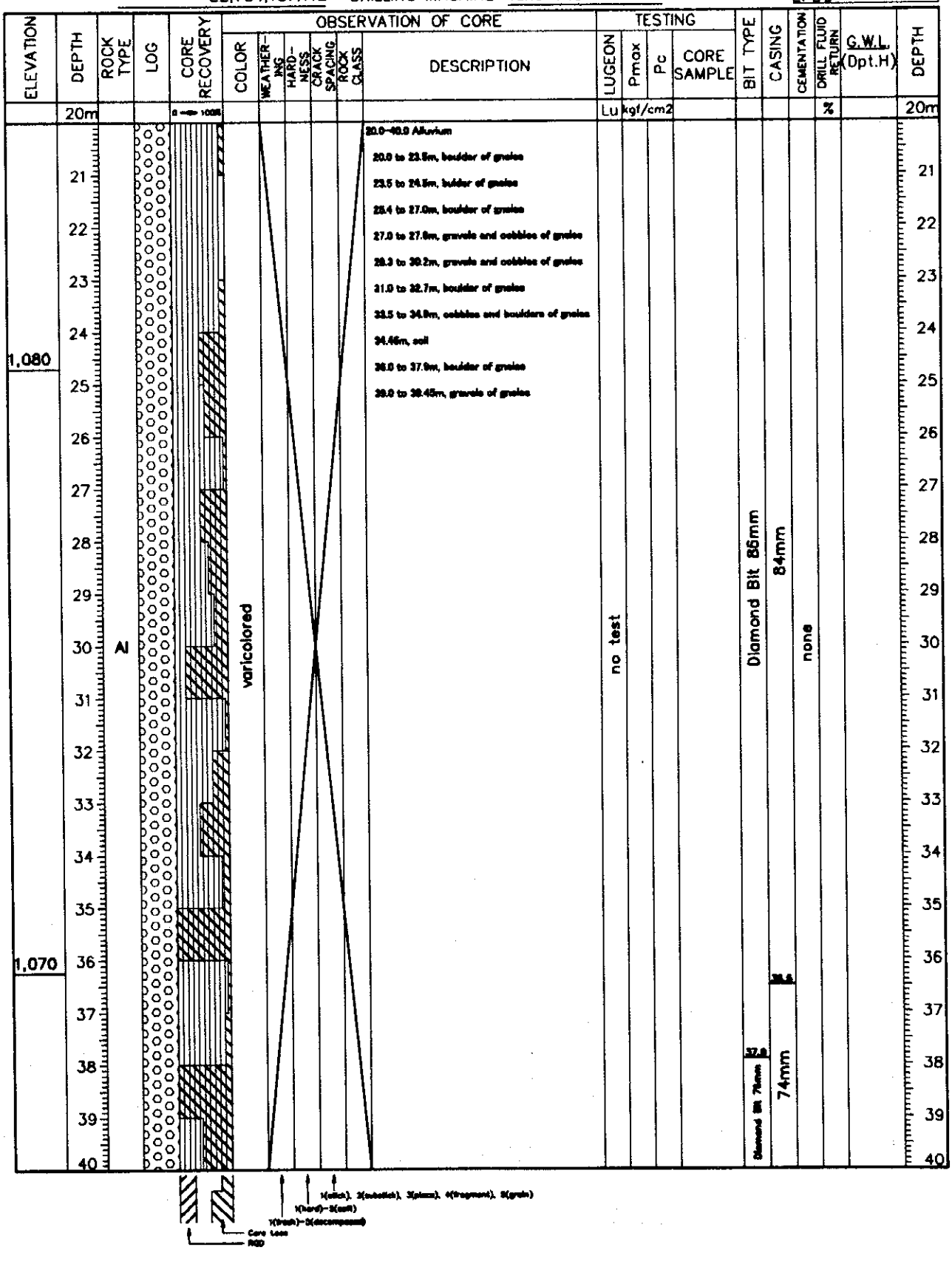


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-5 (SHEET 2 OF 3)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	60.0 m	COMMENCED	1999/12/6
ELEVATION	1,101.393 m	DIRECTION OF HOLE	inclined 60 N60E	COMPLETED	1999/12/24
COORDINATE	N1,073,118.698	CORE RECOVERY	55 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,187.112	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

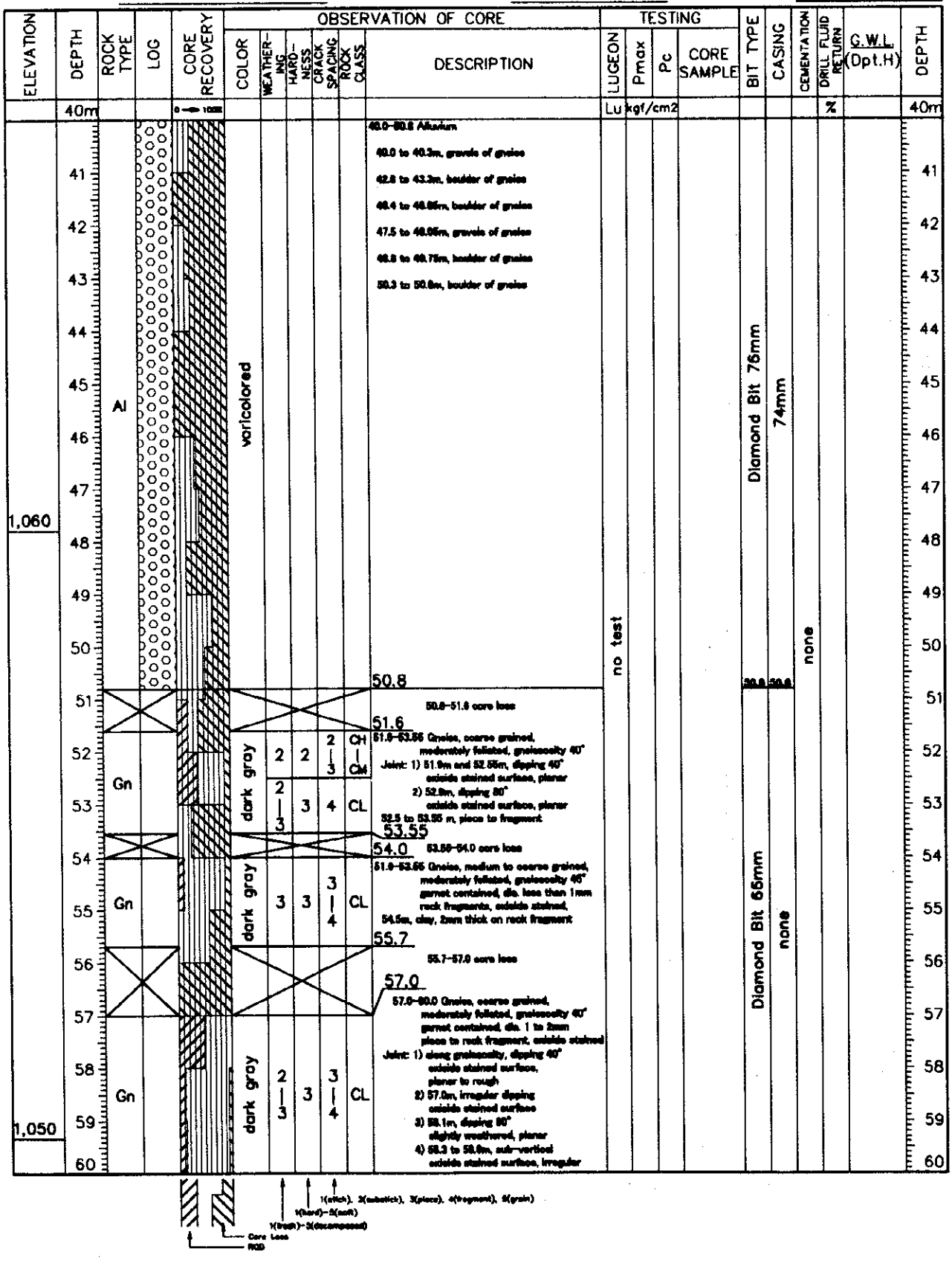


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-5 (SHEET 3 OF 3)

LOCATION	Dom, Right Bank	DEPTH OF HOLE	60.0 m	COMMENCED	1999/12/6
ELEVATION	1,101.393 m	DIRECTION OF HOLE	inclined 60 N60E	COMPLETED	1999/12/24
COORDINATE	N1,073,118.698	CORE RECOVERY	55 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,187.112	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

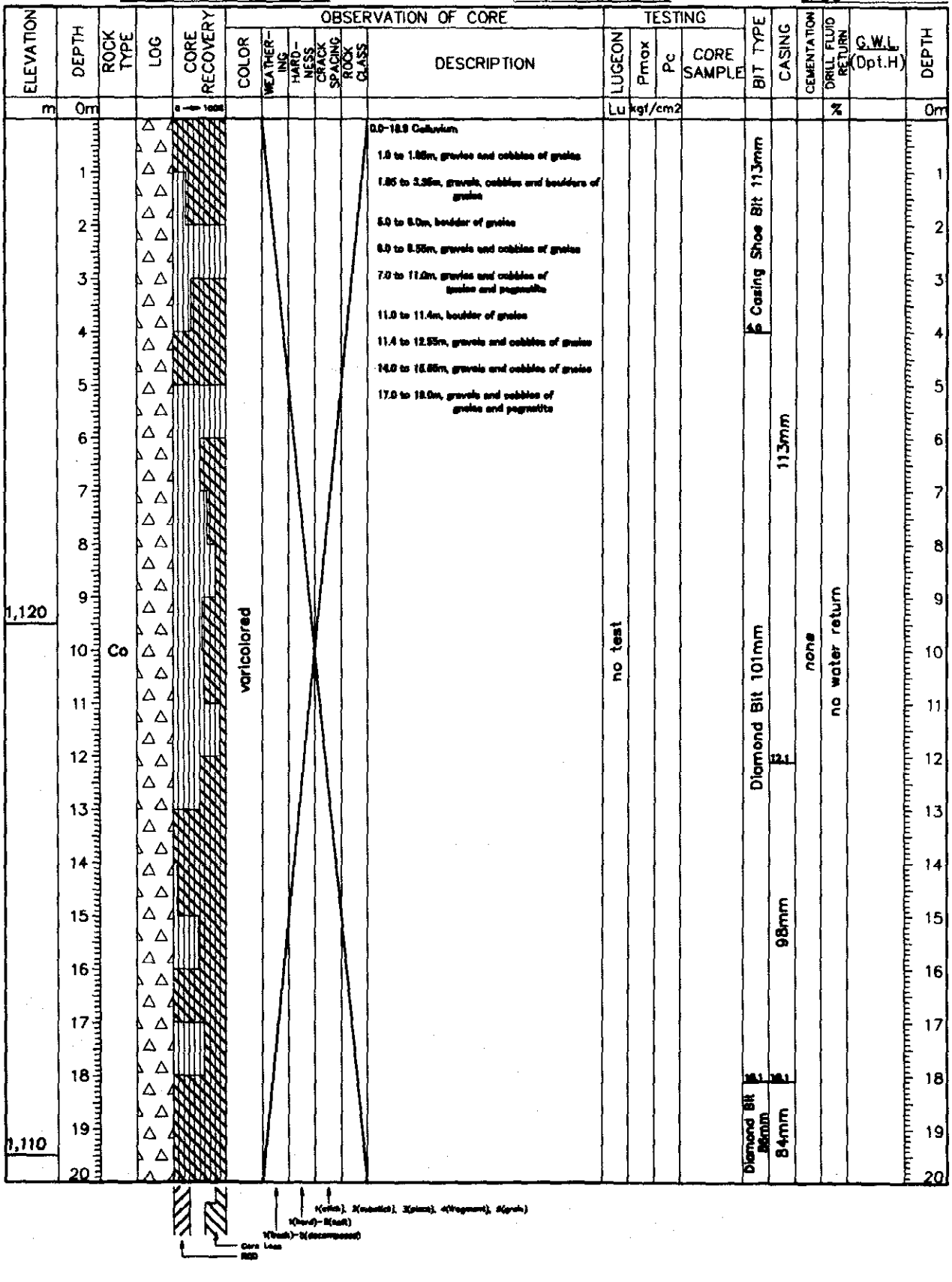


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-6 (SHEET 1 OF 4)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	80.0 m	COMMENCED	2000/1/24
ELEVATION	1,129.499 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/2/25
COORDINATE	N1,073,037.539	CORE RECOVERY	65 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,204.415	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC

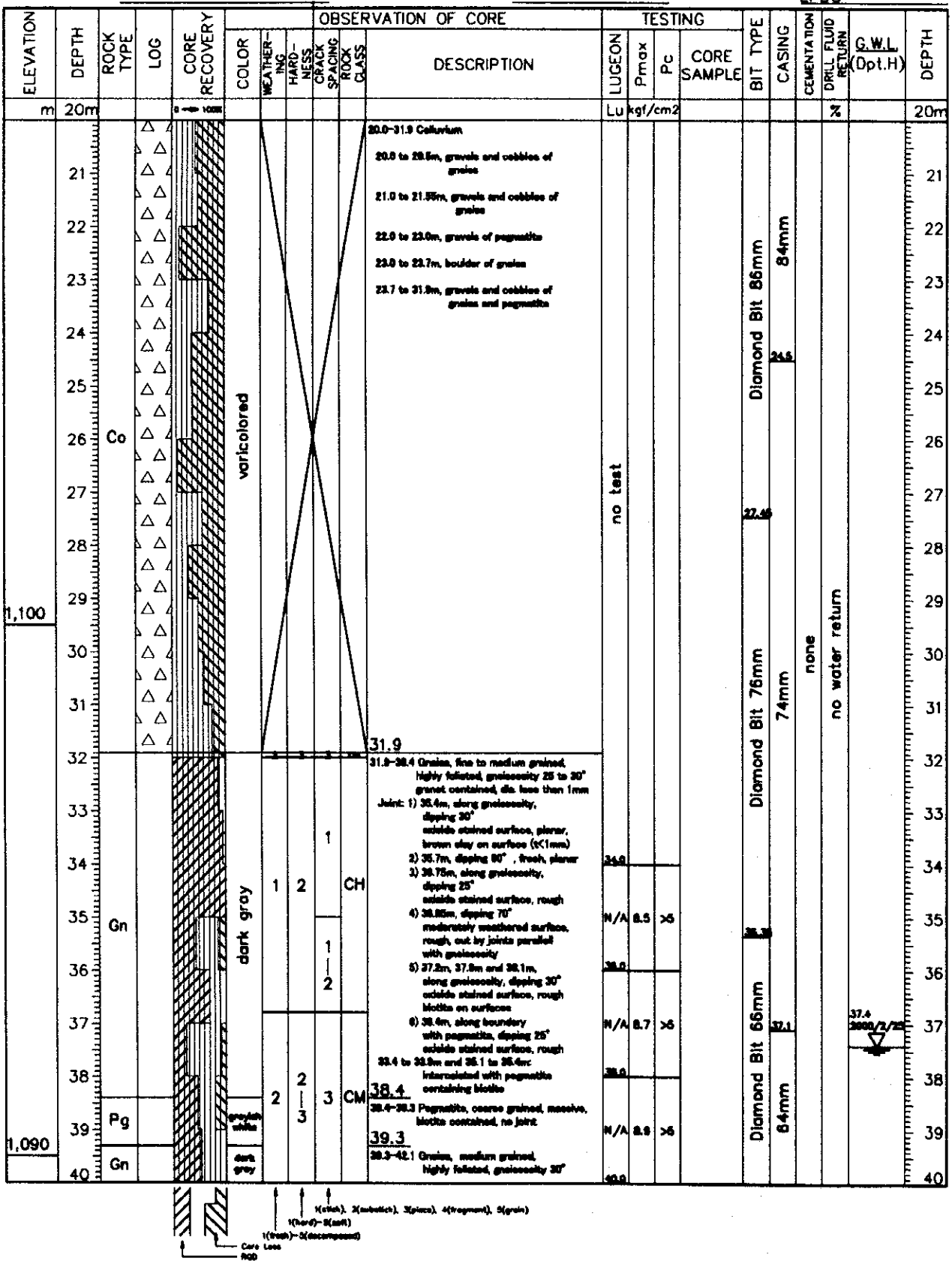


GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S

HOLE No. DD-6 (SHEET 2 OF 4)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	80.0 m	COMMENCED	2000/1/24
ELEVATION	1,129.499 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/2/25
COORDINATE	N1,073,037.539	CORE RECOVERY	65 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,204.415	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC



GEOLOGIC LOG OF DRILL HOLE

Puna Tsang Chhu Hydropower Project F/S HOLE No. DD-6 (SHEET 3 OF 4)

LOCATION	Dam, Right Bank	DEPTH OF HOLE	80.0 m	COMMENCED	2000/1/24
ELEVATION	1,129.499 m	DIRECTION OF HOLE	vertical	COMPLETED	2000/2/25
COORDINATE	N1,073,037.539	CORE RECOVERY	65 %	DRILLED BY	Mr.Singye Dorji, GSB
	E2,734,204.415	DRILLING MACHINE	Tone THC-1	LOGGED BY	Mr.Seiji Hongo, EPDC