ANNEXURE – IX

PRELIMINARY DESIGN OF SPILLWAY

Ogee Shaped Spillway

The discharge over an ogee crest is given by the formula

$$Q = CLH_d^{3/2}$$

Where Q = discharge in cumec or cusec

C = discharge coefficient which is influenced by a number of facts such as

(1) The depth of approach

(2) relation of actual crest shape to ideal nappe shape

(3) upstream face slope

(4) downstream apron interference

(5) Downstream submergence

H_d = Total head on the crest, including velocity of approach head

ha = Reservoir level – crest level + $Va^2/2g$

L = Effective length of crest

Pier and abutment Effects

The effect of end contractions may be taken into account by reduction the net crest length as follows:-

$$L = L - 2(NKp + Ka)Hd$$

Where L = Net length of crest; N = Number of piers

Kp = Pier contraction coefficient, 0.2 for square abutment and 0.01 for round abutment.

Ka = abutment contraction coefficient, 0.2 for square abutment and 0.01 for round abutment.

HIGH OVER FLOW SPILLWAY WATER SURFACE PROFILES

	WITHOUT PIPES			CENTER LINE OF GATE BAY			ALONG PIERS		
H/Hd	0.50	1.00	1.33	0.50	1.00	1.33	0.50	1.00	1.33
H/Hd	**Y/Hd**			**Y/Hd**			**Y/Hd**		
-1	-0.490	-0.933	-1.21	-0.482	-0.941	-1.230	-0.495	-0.950	-1.235
-0.8	-0.484	-0.915	-1.185	-0.480	-0.932	-1.215	-0.492	-0.910	-1.225
-0.6	-0.475	-0.893	-1.151	-0.472	-0.913	-1.194	-0.490	-0.932	-1.209
-0.4	-0.460	-0.865	-1.110	-0.457	-0.890	-1.165	-0.482	-0.930	-1.218
-0.2	-0.425	-0.821	-1.060	-0.431	-0.855	-1.122	-0.440	-0.925	-1.244
0.0	-0.371	-0.755	-1.000	-0.384	-0.805	-1.071	-0.383	-0.779	-1.103
0.2	-0.300	-0.681	-0.919	-0.313	-0.735	-1.015	-0.265	-0.651	-0.950
0.4	-0.200	-0.586	-0.821	-0.220	-0.647	-0.944	-0.185	-0.545	-0.821
0.6	-0.075	-0.465	-0.705	-0.088	-0.539	-0.847	-0.076	-0.425	-0.689
0.8	0.075	-0.320	-0.569	-0.075	-0.389	-0.725	0.060	-0.285	-0.549
1.0	0.258	-0.145	-0.411	-0.257	-0.202	-0.564	0.240	-0.121	-0.389
1.2	0.470	0.055	-0.220	0.462	0.015	-0.356	0.445	0.067	-0.215
1.4	0.705	0.294	-0.002	0.705	0.266	-0.102	0.675	0.286	0.011
1.6	0.972	0.563	0.243	0.977	0.521	0.172	0.925	0.521	0.208
1.8	1.269	0.857	0.531	1.278	0.860	0.465	1.177	0.779	0.438

DOWN STREAM QUADRANT DATA

X	$X^{1.85}$	X	$X^{1.85}$	Hd	$2Hd^{0.85}$	Hd	$2Hd^{0.85}$
0.1	0.014	3	7.633	0.5	1.11	10.5	14.758
0.15	0.03	3.5	10.151	1	2	11	15.354
0.2	0.151	4	12.996	1.5	2.83	11.5	15.945
0.25	0.077	4.5	16.16	2	3.605	12	16.535
0.3	0.108	5	19.638	2.5	4.358	12.5	17.112
0.35	0.143	6	27.515	3	5.088	13	17.696
0.4	0.184	7	36.596	3.5	5.801	13.5	18.273
0.45	0.228	8	46.851	4	6.498	14	18.847
0.5	0.277	9	58.257	4.5	7.182	14.5	19.417
0.6	0.389	10	70.795	5	7.855	15	19.985
0.7	0.52	12	99.194	5.5	8.518	15.5	20.58
0.8	0.662	14	131.928	6	9.172	16	21.112
0.9	0.823	16	168.897	6.5	9.818	16.5	21.671
1	1	18	210.017	7	10.46	17	22.229
1.2	1.401	20	255.215	7.5	11.087	17.5	22.783
1.4	1.864	25	385.646	8	11.713	18	23.335
1.6	2.386	30	540.349	8.5	12.332	18.5	23.885
1.8	2.967	35	718.664	9	12.946	19	24.433
2	3.605	40	920.049	9.5	13.555	19.5	24.978
2.5	5.447			10	14.159	20	25.521

CO-ORDINATES FOR UPSTREAM QUADRANT

X/Hd	**Y/Hd**	**X/Hd**	**Y/Hd**
0.0000	0.0000	-0.2000	0.0494

-0.0200	0.0004	-0.2100	0.0556
-0.0400	0.0016	-0.2200	0.0624
-0.0600	0.0038	-0.2300	0.0701
-0.0800	0.0068	-0.2400	0.0787
-0.1000	0.0108	-0.2450	0.0836
-0.1200	1.0158	-0.2500	0.0889
-0.1400	0.0221	-0.2550	0.0948
-0.1600	0.0296	-0.2600	0.1016
-0.1700	0.0339	-0.2650	0.1099
-0.1800	0.0386	-0.2680	0.1165
-0.1900	0.0437	-0.2700	0.1260

According to the latest analytical study of U.S. Army the upstream curve of the ogee shape has an equation as below

$$Y = \frac{0.724(X+0.270H_d)^{1.85}}{H_d^{0.85}} + 0.126H_d - 0.4315H_d^{0.375}(X+0.270H_d)^{0.625}$$