COOKE L.C.I.D.

Hydrology Report

Wake County, NC

BRETHAUER CONSULTING ENGINEERING
1012 North Salem Street
Apex, North Carolina 27502
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NORTH CAROLINA PROFESSIONAL SEAL 17938 ENGINEER MELANIE J. BRETHAUER

11 FEB 99

11 February 1999
Job Number 9827

RIP RAP PAD SIZING

COOKE LCID
RALEIGH, NC
FILE: 9827.XLS
DATE: 10 FEB 1999
10 YEAR STORM

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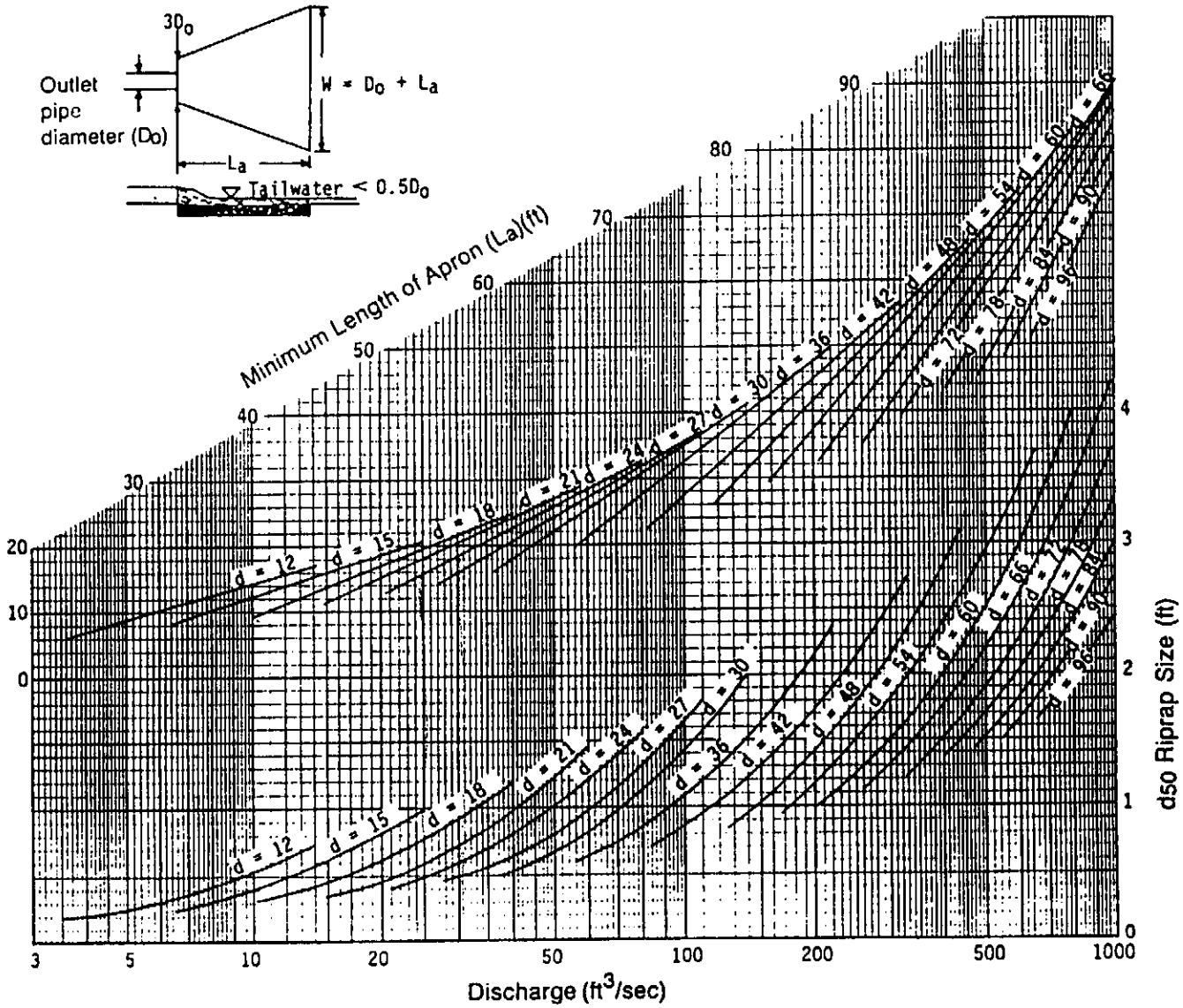
STRUCTURE	Q cfs	Do in	La ft	W ft	d50 ft	CLASS
FES1 - west	24.0	24	16	18	0.5	B
FES2 - east	30.2	24	18	20	0.5	B

NOTE:

Class A riprap d50 = 3"	Thickness = 12"
Class B riprap d50 = 8"	Thickness = 22"
Class I riprap d50 = 12"	Thickness = 27"
Class II riprap d50 = 15"	Thickness = 30"

Minimum La for 12" @ 3.6 cfs = 6'	, d50 (min) = .5
Minimum La for 15" @ 6.4 cfs = 8'	, d50 (min) = .5
Minimum La for 18" @ 10 cfs = 9'	, d50 (min) = .5
Minimum La for 24" @ 21 cfs = 13'	, d50 (min) = .5
Minimum La for 30" @ 38 cfs = 16'	, d50 (min) = .5
Minimum La for 36" @ 56 cfs = 20'	, d50 (min) = .6



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

BUOYANCY CALCULATIONS

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BASIN	INVERT ELEV ft	RISER TOP ELEV ft	HEIGHT RISER ft	WEIGHT RISER lbs	BOUY FORCE lbs	FACTOR SAFETY	MIN VOL CONC cf	ACTUAL VOL CONC cf	ACTUAL LENGTH CONC ft	ACTUAL WIDTH CONC ft	ACTUAL HEIGHT CONC ft
1	212.0	215	3.0	87	1764	5	59	75.0	5.0	5.0	3.0
2	212.0	215	3.0	87	1764	5	59	75.0	5.0	5.0	3.0

Risers are 36" diameter, 16 gauge = 29 pounds/linear foot
Bouyant Force = 62.4 lb/ft^3 (area of riser) (height of riser)
Approximate weight of Concrete = 150 lb/ft^3

SWALE CALCULATIONS

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n = 0.013
g = 195
h = 22

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	SWALE	AREA (in^2)	AREA (ac)	A TOTAL AREA (ac)	tc TIME CON (min)	I INT.	RUNOFF COEFF WD	Cc AVG RUN COF.	Q FLOW (cfs)	SLOPE (%)
BASIN 1 - from west	1	6.2	1.42	1.42	5.0	7.2	0.60	0.60	6.2	4.0
	2	3.0	0.69	2.11	5.0	7.2	0.60	0.60	9.2	8.3
	3	3.0	0.69	2.80	5.0	7.2	0.60	0.60	12.1	5.0
	4	3.7	0.85	3.65	5.0	7.2	0.60	0.60	15.8	3.0
	5	9.7	2.23	5.88	5.0	7.2	0.60	0.60	25.5	1.3
	6	1.2	0.28	6.15	5.0	7.2	0.60	0.60	26.7	8.3
	7	0.2	0.05	6.20	5.0	7.2	0.60	0.60	26.9	4.0
	8	1.8	0.41	6.61	5.0	7.2	0.60	0.60	28.7	5.0
	9	7.5	1.72	8.33	5.0	7.2	0.60	0.60	36.1	2.0
BASIN 1 - from east	10	3.0	0.69	0.69	5.0	7.2	0.60	0.60	3.0	2.5
BASIN 2 - from east	11	1.0	0.23	0.23	5.0	7.2	0.60	0.60	1.0	8.0
	12	1.7	0.39	0.62	5.0	7.2	0.60	0.60	2.7	8.0
	13	2.3	0.53	1.15	5.0	7.2	0.60	0.60	5.0	7.0
	14	3.0	0.69	1.84	5.0	7.2	0.60	0.60	8.0	4.0
	15	6.0	1.38	3.21	5.0	7.2	0.60	0.60	13.9	5.0
	16	9.5	2.18	5.39	5.0	7.2	0.60	0.60	23.4	1.0
	17	5.0	1.15	6.54	5.0	7.2	0.60	0.60	28.4	5.0
	18	3.8	0.87	7.42	5.0	7.2	0.60	0.60	32.1	2.0
	19	1.0	0.23	7.64	5.0	7.2	0.60	0.60	33.1	8.5
BASIN 2 - from west	20	2.0	0.46	0.46	5.0	7.2	0.60	0.60	2.0	3.5

Trapezoidal Report

Label	C Coefficient	Kutter's n Coefficient	Mannings Coefficient	Roughness Height (ft)	Slope (ft/ft)	Kinematic Viscosity (ft²/s)	Depth (ft)	Left Side Slope (H : V)	Right Side Slope (H : V)	Bottom Width (ft)	Discharge (cfs)	Friction Factor	Reynolds Number	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)
Swale 1			0.030		.040000		0.67	3.00	3.00	0.00	6.20			1.3	4.23	4.02	0.77	.019364	4.61
Swale 2			0.040		.083000		0.75	3.00	3.00	0.00	9.20			1.7	4.77	4.52	0.90	.032661	5.39
Swale 3			0.040		.050000		0.92	3.00	3.00	0.00	12.10			2.5	5.81	5.51	1.00	.031489	4.78
Swale 4			0.030		.030000		1.00	3.00	3.00	0.00	15.80			3.0	6.35	6.02	1.12	.017094	5.23
Swale 5			0.030		.013000		1.40	3.00	3.00	0.00	25.50			5.9	8.88	8.43	1.35	.016037	4.31
Swale 6			0.040		.083000		1.12	3.00	3.00	0.00	26.70			3.8	7.11	6.75	1.38	.028335	7.04
Swale 7			0.040		.040000		1.29	3.00	3.00	0.00	26.90			5.0	8.18	7.76	1.38	.028307	5.36
Swale 8			0.040		.050000		1.27	3.00	3.00	0.00	28.70			4.8	8.04	7.62	1.42	.028064	5.93
Swale 9			0.030		.020000		1.48	3.00	3.00	0.00	36.10			6.5	9.34	8.86	1.55	.015311	5.52
Swale 10			0.030		.025000		0.56	3.00	3.00	0.00	3.00			0.9	3.52	3.34	0.57	.021332	3.22
Swale 11			0.030		.080000		0.30	3.00	3.00	0.00	1.00			0.3	1.88	1.78	0.37	.024697	3.79
Swale 12			0.030		.080000		0.43	3.00	3.00	0.00	2.70			0.6	2.72	2.58	0.55	.021634	4.86
Swale 13			0.030		.070000		0.56	3.00	3.00	0.00	5.00			0.9	3.52	3.34	0.70	.019928	5.39
Swale 14			0.030		.040000		0.74	3.00	3.00	0.00	8.00			1.6	4.66	4.42	0.85	.018717	4.91
Swale 15			0.040		.050000		0.97	3.00	3.00	0.00	13.90			2.8	6.12	5.81	1.06	.030912	4.94
Swale 16			0.030		.010000		1.43	3.00	3.00	0.00	23.40			6.1	9.04	8.57	1.30	.016222	3.82
Swale 17			0.040		.050000		1.27	3.00	3.00	0.00	28.40			4.8	8.00	7.59	1.41	.028103	5.91
Swale 18			0.040		.020000		1.57	3.00	3.00	0.00	32.10			7.4	9.95	9.44	1.48	.027648	4.32
Swale 19			0.040		.085000		1.21	3.00	3.00	0.00	33.10			4.4	7.67	7.28	1.50	.027535	7.49
Swale 20			0.030		.025000		0.48	3.00	3.00	0.00	2.00			0.7	3.03	2.87	0.49	.022517	2.91

Trapezoidal Report

Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
0.33	1.00	1.41	Supercritical
0.45	1.21	1.55	Supercritical
0.35	1.27	1.24	Supercritical
0.43	1.43	1.30	Supercritical
0.29	1.69	0.91	Subcritical
0.77	1.89	1.65	Supercritical
0.45	1.74	1.18	Supercritical
0.55	1.82	1.31	Supercritical
0.47	1.95	1.13	Supercritical
0.16	0.72	1.08	Supercritical
0.22	0.52	1.73	Supercritical
0.37	0.80	1.85	Supercritical
0.45	1.01	1.80	Supercritical
0.38	1.11	1.43	Supercritical
0.38	1.35	1.25	Supercritical
0.23	1.66	0.80	Subcritical
0.54	1.81	1.31	Supercritical
0.29	1.86	0.86	Subcritical
0.87	2.09	1.70	Supercritical
0.13	0.61	1.05	Supercritical

EROSION CONTROL POND CALCULATIONS
RISER/BARREL STRUCTURE

COOKE LCID
RALEIGH, NC
FILE: 9827.XLS
DATE: 18 JAN 1999

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POND #1 - WEST SIDE

POST DEVELOPMENT HYDROLOGY

	9.50	acres	=	WATERSHED AREA "A"
	9.50	acres	=	DISTURBED AREA
	1,850	ft	=	HYDRAULIC LENGTH "L"
	289	ft	=	ELEVATION OF HIGHEST POINT IN WATERSHED
	215	ft	=	ELEVATION OF LOWEST POINT IN WATERSHED
	74	ft	=	CHANGE IN ELEVATION
Calculate	8.8	min	=	TIME OF CONCENTRATION = Tc = ((L^3/H)^0.385)/128
Check Min	8.8	min	=	TIME OF CONCENTRATION = Tc = minimum is 5 minutes
	195.0		=	g 25 year storm
	22.0		=	h 25 year storm
	6.32		=	INTENSITY = I = g/(h+Tc)
	0.6		=	SCS CURVE NUMBER
	0.40		=	RUNOFF COEFFICIENT

10 YEAR STORM - EC Design Storm

	24.0	cfs	=	FLOW = Q = CIA

100 YEAR STORM - Emergency Spillway Design

	290.0		=	g
	25.0		=	h
	8.57		=	INTENSITY = I = g/(h+Tc)
	32.6	cfs	=	FLOW = Q = CIA

ESTIMATE VOLUME OF RUNOFF

	24.0	cfs	=	DESIGN FLOW
	1656.7	in	=	ULTIMATE SOIL STORAGE = S = (1000/CN)-10
	3.9	in	=	PRECIPITATION DEPTH = P = from TP-40 (6 HOUR)
	80.66	in	=	RUNOFF DEPTH = Q* = (P-0.2S)^2/(P+0.8S)
	2,781,473	cf	=	RUNOFF VOLUME = V = Q*/A
10 year	**1388.3**	min	=	TIME TO PEAK = Tp = V/(1.39Qp)
100 year	**1024.3**	min	=	TIME TO PEAK = Tp = V/(1.39Qp)

ESTIMATED STORAGE

17,100	cf	=	Min Storage Volume (1,800 * Disturbed Acres)
3.0	ft		Storage Depth
131	ft	=	Storage Length
44	ft	=	Storage Width
3.0			Length to Width Ratio
3.0			Side Slopes (x:1)

PERMANENT STORAGE

ONTOUR (ft)	LENGTH (ft)	WIDTH (ft)	AREA (sf)	INCREM VOLUME (cf)	STORAGE ACCUM VOLUME (cf)			
212	110.0	36.7	4,033	2,017	2,017			
213	116.0	42.7	4,949	4,491	6,508			
214	122.0	48.7	5,937	5,443	11,951		CHECK	
215	128.0	54.7	6,997	6,467	18,419	>	17,100	ok

ONTOUR (ft)	LENGTH (ft)	WIDTH (ft)	AREA (sf)	INCREM VOLUME (cf)	S ACCUM VOLUME (cf)	Z STAGE (ft)	Y ln S	X ln Z	Z, est (ft)
215	128.0	54.7	6,997	3,499	3,499	0			
216	134.0	60.7	8,129	7,563	11,062	1	9.3113	0.0000	1.33
217	140.0	66.7	9,333	8,731	19,793	2	9.8931	0.6931	2.19
218	146.0	72.7	10,609	9,971	29,765	3	10.3011	1.0986	3.11
219	152.0	78.7	11,957	11,283	41,048	4	10.6225	1.3863	4.10
220	158.0	84.7	13,377	12,667	53,715	5	10.8915	1.6094	5.16

Regression Output

Ks=	7915.0	= exp(intercept)
b=	1.2	= x variable
Constant =	9.0	= intercept

OUTLET CHARACTERISTICS

RISER

Diameter	D (in) =	36
Diameter	D (ft) =	3
Area	A (ft) =	7.07
Circumference	C (ft) =	9.42
Weir Coeff.	Cw =	3
Orifice Cof.	Co =	0.59
Crest		215

BARREL

Diameter	D (in) =	24
Diameter	D (ft) =	2
Area	A (ft) =	3.14
Orifice Cof.	Co =	0.59
Invert Elev		212

CHECK
Ariser/Abarrel = 2.25 = 1.5 (min)
OK

WEIR FLOW Q = CwLH^1.5
RISER ORIFICE Q = CdrLD(2gh)^1/2
EMERGENCY WEIR Q = CwL(Hs)^3/2
CULVERT SUBMERGED ORIFICE Q = CdA(2g(H-D/2))^1/2

10 YEAR STORM ROUTING

24.0 cfs	=	PEAK RUNOFF = Qp
1388.3 min	=	TIME TO PEAK = Tp
10 min	=	TIME STEP
24.0 cfs	=	PEAK OUTFLOW
215.9 ft	=	MAXIMUM STAGE

TIME min	INFLOW cfs	STORAGE cf	STAGE ft	OUTFLOW cfs	RISER WEIR STAGE ft	RISER WEIR (cfs)	RISER ORIFICE (cfs)	BARREL ORIFICE (cfs)	EMER SPILL STAGE ft	EMER SPILL FLOW cfs	OUTFLOW TOTAL cfs
0	0	0	212.0	0.00	0.00	na	na	0.00	0	0	0.0
10	0	0	212.0	0.00	-3.00	na	na	0.00	0	0	0.0
20	0	2	212.0	0.00	-3.00	na	na	0.41	0	0	0.0
30	0	9	212.0	0.00	-3.00	na	na	0.82	0	0	0.0
40	0	26	212.0	1.28	-2.99	na	na	1.28	0	0	0.0
50	0	55	212.0	1.77	-2.99	na	na	1.77	0	0	0.0
60	0	101	212.0	2.30	-2.98	na	na	2.30	0	0	0.0
70	0	168	212.0	2.85	-2.96	na	na	2.85	0	0	0.0
80	0	258	212.1	3.43	-2.95	na	na	3.43	0	0	0.0
90	0	376	212.1	4.03	-2.93	na	na	4.03	0	0	0.0
100	0	525	212.1	4.65	-2.90	na	na	4.65	0	0	0.0
110	0	708	212.1	5.29	-2.87	na	na	5.29	0	0	0.0
120	0	931	212.2	5.95	-2.84	na	na	5.95	0	0	0.0
130	1	1195	212.2	6.62	-2.80	na	na	6.62	0	0	0.0

140	1	1504	212.2	7.30	-2.76	na	na	7.30	0	0	0.0
150	1	1863	212.3	8.00	-2.71	na	na	8.00	0	0	0.0
160	1	2274	212.3	8.72	-2.66	na	na	8.72	0	0	0.0
170	1	2741	212.4	9.45	-2.60	na	na	9.45	0	0	0.0
180	1	3268	212.5	10.18	-2.53	na	na	10.18	0	0	0.0
190	1	3858	212.5	10.93	-2.46	na	na	10.93	0	0	0.0
200	1	4514	212.6	11.69	-2.38	na	na	11.69	0	0	0.0
210	1	5239	212.7	12.47	-2.30	na	na	12.47	0	0	0.0
220	1	6038	212.8	13.25	-2.21	na	na	13.25	0	0	0.0
230	2	6913	212.9	14.04	-2.11	na	na	14.04	0	0	0.0
240	2	7867	213.0	14.84	-2.01	na	na	14.84	0	0	0.0
250	2	8904	213.1	15.64	-1.89	na	na	15.64	0	0	0.0
260	2	10027	213.2	16.46	-1.78	na	na	16.46	0	0	0.0
270	2	11239	213.4	17.28	-1.65	na	na	17.28	0	0	0.0
280	2	12542	213.5	18.12	-1.52	na	na	18.12	0	0	0.0
290	2	13941	213.6	18.96	-1.38	na	na	18.96	0	0	0.0
300	3	15438	213.8	19.80	-1.23	na	na	19.80	0	0	0.0
310	3	17036	213.9	20.66	-1.07	na	na	20.66	0	0	0.0
320	3	18738	214.1	21.52	-0.91	na	na	21.52	0	0	0.0
330	3	20546	214.3	22.38	-0.74	na	na	22.38	0	0	0.0
340	3	22464	214.4	23.25	-0.56	na	na	23.25	0	0	0.0
350	4	24494	214.6	24.13	-0.37	na	na	24.13	0	0	0.0
360	4	26639	214.8	25.02	-0.17	na	na	25.02	0	0	0.0
370	4	28901	215.0	25.90	0.03	na	na	25.90	0	0	0.0
380	4	31283	215.2	26.80	0.25	3.4	16.6	26.80	0	0	3.4
390	4	31722	215.3	26.96	0.28	4.3	17.9	26.96	0	0	4.3
400	5	31775	215.3	26.98	0.29	4.4	18.0	26.98	0	0	4.4
410	5	31891	215.3	27.02	0.30	4.6	18.3	27.02	0	0	4.6
420	5	31994	215.3	27.06	0.31	4.9	18.6	27.06	0	0	4.9
430	5	32101	215.3	27.10	0.32	5.1	18.9	27.10	0	0	5.1
440	5	32207	215.3	27.13	0.33	5.3	19.2	27.13	0	0	5.3
450	6	32313	215.3	27.17	0.34	5.5	19.4	27.17	0	0	5.5
460	6	32419	215.3	27.21	0.35	5.8	19.7	27.21	0	0	5.8
470	6	32525	215.4	27.25	0.36	6.0	20.0	27.25	0	0	6.0
480	6	32632	215.4	27.29	0.37	6.2	20.2	27.29	0	0	6.2
490	7	32738	215.4	27.32	0.37	6.5	20.5	27.32	0	0	6.5
500	7	32844	215.4	27.36	0.38	6.7	20.7	27.36	0	0	6.7
510	7	32950	215.4	27.40	0.39	7.0	21.0	27.40	0	0	7.0
520	7	33056	215.4	27.44	0.40	7.2	21.2	27.44	0	0	7.2
530	8	33162	215.4	27.48	0.41	7.5	21.5	27.48	0	0	7.5
540	8	33267	215.4	27.51	0.42	7.7	21.7	27.51	0	0	7.7
550	8	33373	215.4	27.55	0.43	8.0	22.0	27.55	0	0	8.0
560	8	33478	215.4	27.59	0.44	8.2	22.2	27.59	0	0	8.2
570	9	33583	215.4	27.62	0.45	8.5	22.4	27.62	0	0	8.5
580	9	33687	215.5	27.66	0.46	8.8	22.7	27.66	0	0	8.8
590	9	33791	215.5	27.70	0.47	9.0	22.9	27.70	0	0	9.0
600	9	33895	215.5	27.73	0.48	9.3	23.1	27.73	0	0	9.3
610	10	33999	215.5	27.77	0.49	9.6	23.3	27.77	0	0	9.6
620	10	34101	215.5	27.81	0.49	9.8	23.5	27.81	0	0	9.8
630	10	34204	215.5	27.84	0.50	10.1	23.8	27.84	0	0	10.1
640	11	34306	215.5	27.88	0.51	10.4	24.0	27.88	0	0	10.4

650	11	34407	215.5	27.91	0.52	10.6	24.2	27.91	0	0	10.6
660	11	34508	215.5	27.95	0.53	10.9	24.4	27.95	0	0	10.9
670	11	34608	215.5	27.98	0.54	11.2	24.6	27.98	0	0	11.2
680	12	34708	215.5	28.02	0.55	11.5	24.8	28.02	0	0	11.5
690	12	34807	215.6	28.05	0.56	11.7	25.0	28.05	0	0	11.7
700	12	34905	215.6	28.09	0.57	12.0	25.2	28.09	0	0	12.0
710	12	35002	215.6	28.12	0.57	12.3	25.3	28.12	0	0	12.3
720	13	35099	215.6	28.15	0.58	12.6	25.5	28.15	0	0	12.6
730	13	35195	215.6	28.18	0.59	12.8	25.7	28.18	0	0	12.8
740	13	35290	215.6	28.22	0.60	13.1	25.9	28.22	0	0	13.1
750	14	35385	215.6	28.25	0.61	13.4	26.1	28.25	0	0	13.4
760	14	35478	215.6	28.28	0.62	13.6	26.2	28.28	0	0	13.6
770	14	35571	215.6	28.31	0.62	13.9	26.4	28.31	0	0	13.9
780	14	35663	215.6	28.34	0.63	14.2	26.6	28.34	0	0	14.2
790	15	35753	215.6	28.38	0.64	14.4	26.8	28.38	0	0	14.4
800	15	35843	215.6	28.41	0.65	14.7	26.9	28.41	0	0	14.7
810	15	35932	215.7	28.44	0.65	15.0	27.1	28.44	0	0	15.0
820	15	36020	215.7	28.47	0.66	15.2	27.2	28.47	0	0	15.2
830	16	36107	215.7	28.50	0.67	15.5	27.4	28.50	0	0	15.5
840	16	36193	215.7	28.52	0.68	15.8	27.5	28.52	0	0	15.8
850	16	36277	215.7	28.55	0.68	16.0	27.7	28.55	0	0	16.0
860	16	36361	215.7	28.58	0.69	16.3	27.8	28.58	0	0	16.3
870	17	36443	215.7	28.61	0.70	16.5	28.0	28.61	0	0	16.5
880	17	36525	215.7	28.64	0.71	16.8	28.1	28.64	0	0	16.8
890	17	36605	215.7	28.66	0.71	17.0	28.3	28.66	0	0	17.0
900	17	36684	215.7	28.69	0.72	17.3	28.4	28.69	0	0	17.3
910	18	36761	215.7	28.72	0.73	17.5	28.5	28.72	0	0	17.5
920	18	36838	215.7	28.74	0.73	17.8	28.7	28.74	0	0	17.8
930	18	36913	215.7	28.77	0.74	18.0	28.8	28.77	0	0	18.0
940	18	36987	215.7	28.79	0.75	18.2	28.9	28.79	0	0	18.2
950	19	37060	215.8	28.82	0.75	18.5	29.0	28.82	0	0	18.5
960	19	37131	215.8	28.84	0.76	18.7	29.2	28.84	0	0	18.7
970	19	37201	215.8	28.86	0.76	18.9	29.3	28.86	0	0	18.9
980	19	37270	215.8	28.88	0.77	19.1	29.4	28.88	0	0	19.1
990	19	37337	215.8	28.91	0.78	19.4	29.5	28.91	0	0	19.4
1000	20	37403	215.8	28.93	0.78	19.6	29.6	28.93	0	0	19.6
1010	20	37467	215.8	28.95	0.79	19.8	29.7	28.95	0	0	19.8
1020	20	37530	215.8	28.97	0.79	20.0	29.8	28.97	0	0	20.0
1030	20	37592	215.8	28.99	0.80	20.2	29.9	28.99	0	0	20.2
1040	20	37652	215.8	29.01	0.80	20.4	30.0	29.01	0	0	20.4
1050	21	37710	215.8	29.03	0.81	20.6	30.1	29.03	0	0	20.6
1060	21	37767	215.8	29.05	0.81	20.8	30.2	29.05	0	0	20.8
1070	21	37823	215.8	29.07	0.82	20.9	30.3	29.07	0	0	20.9
1080	21	37877	215.8	29.09	0.82	21.1	30.4	29.09	0	0	21.1
1090	21	37929	215.8	29.10	0.83	21.3	30.5	29.10	0	0	21.3
1100	22	37980	215.8	29.12	0.83	21.5	30.5	29.12	0	0	21.5
1110	22	38029	215.8	29.14	0.84	21.6	30.6	29.14	0	0	21.6
1120	22	38077	215.8	29.15	0.84	21.8	30.7	29.15	0	0	21.8
1130	22	38123	215.8	29.17	0.84	22.0	30.8	29.17	0	0	22.0
1140	22	38168	215.8	29.18	0.85	22.1	30.8	29.18	0	0	22.1
1150	22	38211	215.9	29.20	0.85	22.2	30.9	29.20	0	0	22.2

1160	22	38252	215.9	29.21	0.86	22.4	31.0	29.21	0	0	22.4
1170	23	38292	215.9	29.22	0.86	22.5	31.0	29.22	0	0	22.5
1180	23	38330	215.9	29.23	0.86	22.7	31.1	29.23	0	0	22.7
1190	23	38366	215.9	29.25	0.87	22.8	31.1	29.25	0	0	22.8
1200	23	38400	215.9	29.26	0.87	22.9	31.2	29.26	0	0	22.9
1210	23	38433	215.9	29.27	0.87	23.0	31.2	29.27	0	0	23.0
1220	23	38465	215.9	29.28	0.87	23.1	31.3	29.28	0	0	23.1
1230	23	38494	215.9	29.29	0.88	23.2	31.3	29.29	0	0	23.2
1240	23	38522	215.9	29.30	0.88	23.3	31.4	29.30	0	0	23.3
1250	23	38548	215.9	29.31	0.88	23.4	31.4	29.31	0	0	23.4
1260	24	38572	215.9	29.31	0.88	23.5	31.5	29.31	0	0	23.5
1270	24	38595	215.9	29.32	0.89	23.6	31.5	29.32	0	0	23.6
1280	24	38616	215.9	29.33	0.89	23.6	31.5	29.33	0	0	23.6
1290	24	38635	215.9	29.33	0.89	23.7	31.6	29.33	0	0	23.7
1300	24	38652	215.9	29.34	0.89	23.8	31.6	29.34	0	0	23.8
1310	24	38668	215.9	29.34	0.89	23.8	31.6	29.34	0	0	23.8
1320	24	38682	215.9	29.35	0.89	23.9	31.6	29.35	0	0	23.9
1330	24	38694	215.9	29.35	0.89	23.9	31.6	29.35	0	0	23.9
1340	24	38704	215.9	29.36	0.89	23.9	31.7	29.36	0	0	23.9
1350	24	38713	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1360	24	38719	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1370	24	38724	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1380	24	38728	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1390	24	38729	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1400	24	38729	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1410	24	38727	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1420	24	38723	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1430	24	38717	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1440	24	38710	215.9	29.36	0.90	24.0	31.7	29.36	0	0	24.0
1450	24	38700	215.9	29.35	0.89	23.9	31.7	29.35	0	0	23.9
1460	24	38689	215.9	29.35	0.89	23.9	31.6	29.35	0	0	23.9
1470	24	38677	215.9	29.35	0.89	23.8	31.6	29.35	0	0	23.8
1480	24	38662	215.9	29.34	0.89	23.8	31.6	29.34	0	0	23.8
1490	24	38646	215.9	29.34	0.89	23.7	31.6	29.34	0	0	23.7
1500	24	38628	215.9	29.33	0.89	23.7	31.5	29.33	0	0	23.7
1510	24	38608	215.9	29.32	0.89	23.6	31.5	29.32	0	0	23.6
1520	23	38587	215.9	29.32	0.88	23.5	31.5	29.32	0	0	23.5
1530	23	38563	215.9	29.31	0.88	23.5	31.4	29.31	0	0	23.5
1540	23	38539	215.9	29.30	0.88	23.4	31.4	29.30	0	0	23.4
1550	23	38512	215.9	29.29	0.88	23.3	31.4	29.29	0	0	23.3
1560	23	38483	215.9	29.28	0.88	23.2	31.3	29.28	0	0	23.2
1570	23	38453	215.9	29.27	0.87	23.1	31.3	29.27	0	0	23.1
1580	23	38422	215.9	29.26	0.87	23.0	31.2	29.26	0	0	23.0
1590	23	38388	215.9	29.25	0.87	22.9	31.2	29.25	0	0	22.9
1600	23	38353	215.9	29.24	0.86	22.7	31.1	29.24	0	0	22.7
1610	23	38316	215.9	29.23	0.86	22.6	31.1	29.23	0	0	22.6
1620	22	38278	215.9	29.22	0.86	22.5	31.0	29.22	0	0	22.5
1630	22	38238	215.9	29.20	0.85	22.3	30.9	29.20	0	0	22.3
1640	22	38196	215.9	29.19	0.85	22.2	30.9	29.19	0	0	22.2
1650	22	38152	215.8	29.18	0.85	22.1	30.8	29.18	0	0	22.1
1660	22	38107	215.8	29.16	0.84	21.9	30.7	29.16	0	0	21.9

1670	22	38061	215.8	29.15	0.84	21.7	30.7	29.15	0	0	21.7
1680	21	38013	215.8	29.13	0.84	21.6	30.6	29.13	0	0	21.6
1690	21	37963	215.8	29.11	0.83	21.4	30.5	29.11	0	0	21.4
1700	21	37912	215.8	29.10	0.83	21.2	30.4	29.10	0	0	21.2
1710	21	37859	215.8	29.08	0.82	21.1	30.3	29.08	0	0	21.1
1720	21	37804	215.8	29.06	0.82	20.9	30.3	29.06	0	0	20.9
1730	21	37748	215.8	29.04	0.81	20.7	30.2	29.04	0	0	20.7
1740	20	37691	215.8	29.02	0.81	20.5	30.1	29.02	0	0	20.5
1750	20	37647	215.8	29.01	0.80	20.4	30.0	29.01	0	0	20.4
1760	20	37576	215.8	28.99	0.80	20.1	29.9	28.99	0	0	20.1
1770	20	37532	215.8	28.97	0.79	20.0	29.8	28.97	0	0	20.0
1780	20	37462	215.8	28.95	0.79	19.8	29.7	28.95	0	0	19.8
1790	20	37418	215.8	28.93	0.78	19.6	29.6	28.93	0	0	19.6
1800	19	37350	215.8	28.91	0.78	19.4	29.5	28.91	0	0	19.4
1810	19	37306	215.8	28.90	0.77	19.3	29.4	28.90	0	0	19.3
1820	19	37239	215.8	28.87	0.77	19.0	29.3	28.87	0	0	19.0
1830	19	37194	215.8	28.86	0.76	18.9	29.3	28.86	0	0	18.9
1840	19	37130	215.8	28.84	0.76	18.7	29.2	28.84	0	0	18.7
1850	18	37084	215.8	28.82	0.75	18.5	29.1	28.82	0	0	18.5
1860	18	37022	215.7	28.80	0.75	18.3	29.0	28.80	0	0	18.3
1870	18	36976	215.7	28.79	0.75	18.2	28.9	28.79	0	0	18.2
1880	18	36916	215.7	28.77	0.74	18.0	28.8	28.77	0	0	18.0
1890	18	36869	215.7	28.75	0.74	17.9	28.7	28.75	0	0	17.9
1900	18	36811	215.7	28.73	0.73	17.7	28.6	28.73	0	0	17.7
1910	17	36763	215.7	28.72	0.73	17.5	28.5	28.72	0	0	17.5
1920	17	36707	215.7	28.70	0.72	17.4	28.4	28.70	0	0	17.4
1930	17	36659	215.7	28.68	0.72	17.2	28.4	28.68	0	0	17.2
1940	17	36605	215.7	28.66	0.71	17.0	28.3	28.66	0	0	17.0
1950	17	36556	215.7	28.65	0.71	16.9	28.2	28.65	0	0	16.9
1960	17	36503	215.7	28.63	0.70	16.7	28.1	28.63	0	0	16.7
1970	16	36455	215.7	28.61	0.70	16.6	28.0	28.61	0	0	16.6
1980	16	36403	215.7	28.60	0.70	16.4	27.9	28.60	0	0	16.4
1990	16	36355	215.7	28.58	0.69	16.3	27.8	28.58	0	0	16.3
2000	16	36304	215.7	28.56	0.69	16.1	27.7	28.56	0	0	16.1
2010	16	36256	215.7	28.55	0.68	16.0	27.7	28.55	0	0	16.0
2020	16	36207	215.7	28.53	0.68	15.8	27.6	28.53	0	0	15.8
2030	16	36159	215.7	28.51	0.67	15.7	27.5	28.51	0	0	15.7
2040	15	36110	215.7	28.50	0.67	15.5	27.4	28.50	0	0	15.5
2050	15	36063	215.7	28.48	0.67	15.4	27.3	28.48	0	0	15.4
2060	15	36015	215.7	28.46	0.66	15.2	27.2	28.46	0	0	15.2
2070	15	35968	215.7	28.45	0.66	15.1	27.1	28.45	0	0	15.1
2080	15	35921	215.7	28.43	0.65	14.9	27.1	28.43	0	0	14.9
2090	15	35875	215.6	28.42	0.65	14.8	27.0	28.42	0	0	14.8
2100	15	35828	215.6	28.40	0.65	14.7	26.9	28.40	0	0	14.7
2110	14	35782	215.6	28.39	0.64	14.5	26.8	28.39	0	0	14.5
2120	14	35736	215.6	28.37	0.64	14.4	26.7	28.37	0	0	14.4
2130	14	35691	215.6	28.35	0.63	14.3	26.6	28.35	0	0	14.3
2140	14	35646	215.6	28.34	0.63	14.1	26.6	28.34	0	0	14.1
2150	14	35601	215.6	28.32	0.63	14.0	26.5	28.32	0	0	14.0
2160	14	35556	215.6	28.31	0.62	13.9	26.4	28.31	0	0	13.9
2170	14	35512	215.6	28.29	0.62	13.7	26.3	28.29	0	0	13.7

2180	14	35468	215.6	28.28	0.61	13.6	26.2	28.28	0	0	13.6
2190	13	35425	215.6	28.26	0.61	13.5	26.1	28.26	0	0	13.5
2200	13	35381	215.6	28.25	0.61	13.4	26.1	28.25	0	0	13.4
2210	13	35338	215.6	28.23	0.60	13.2	26.0	28.23	0	0	13.2
2220	13	35295	215.6	28.22	0.60	13.1	25.9	28.22	0	0	13.1
2230	13	35252	215.6	28.20	0.60	13.0	25.8	28.20	0	0	13.0
2240	13	35210	215.6	28.19	0.59	12.9	25.7	28.19	0	0	12.9

INFLOW =IF T >1.25*Tp,THEN 4.34*Qp*EXP(-1.3*t/Tp)
IF T </=1.25*Tp,THEN Qp/2*(1-(COS(PI(in radians))*t/Tp))

NOTE: 48 hours = 2,880 minutes

100 YEAR STORM ROUTING

32.6 cfs	=	PEAK RUNOFF = Qp	
1024.3 min	=	TIME TO PEAK = Tp	
10 min	=	TIME STEP	
32.6 cfs	=	PEAK OUTFLOW	
216.4 ft	=	MAXIMUM STAGE	

EMERGENCY SPILLWAY

Length L (ft) =	20
Weir Coef Cw =	3
Elev	216

TIME min	INFLOW cfs	STORAGE cf	STAGE ft	OUTFLOW cfs	RISER WEIR STAGE ft	RISER WEIR (cfs)	RISER ORIFICE (cfs)	BARREL ORIFICE (cfs)	EMER SPILL STAGE ft	EMER SPILL FLOW cfs	OUTFLOW TOTAL cfs
0	0	0	212.0	0.00	-3.00	na	na	0.00	0	0	0.0
10	0	0	212.0	0.00	-3.00	na	na	0.00	0	0	0.0
20	0	5	212.0	0.00	-3.00	na	na	0.61	0	0	0.0
30	0	23	212.0	0.00	-2.99	na	na	1.22	0	0	0.0
40	0	64	212.0	0.00	-2.98	na	na	1.89	0	0	0.0
50	0	138	212.0	0.00	-2.97	na	na	2.62	0	0	0.0
60	0	252	212.1	0.00	-2.95	na	na	3.40	0	0	0.0
70	0	417	212.1	0.00	-2.92	na	na	4.22	0	0	0.0
80	0	642	212.1	5.07	-2.88	na	na	5.07	0	0	0.0
90	1	934	212.2	5.96	-2.84	na	na	5.96	0	0	0.0
100	1	1304	212.2	6.87	-2.79	na	na	6.87	0	0	0.0
110	1	1760	212.3	7.81	-2.72	na	na	7.81	0	0	0.0
120	1	2310	212.3	8.78	-2.65	na	na	8.78	0	0	0.0
130	1	2964	212.4	9.77	-2.57	na	na	9.77	0	0	0.0
140	1	3731	212.5	10.78	-2.47	na	na	10.78	0	0	0.0
150	2	4617	212.6	11.81	-2.37	na	na	11.81	0	0	0.0
160	2	5633	212.7	12.86	-2.25	na	na	12.86	0	0	0.0
170	2	6786	212.9	13.93	-2.12	na	na	13.93	0	0	0.0
180	2	8084	213.0	15.01	-1.98	na	na	15.01	0	0	0.0
190	3	9535	213.2	16.11	-1.83	na	na	16.11	0	0	0.0
200	3	11147	213.3	17.22	-1.66	na	na	17.22	0	0	0.0
210	3	12928	213.5	18.35	-1.48	na	na	18.35	0	0	0.0
220	4	14885	213.7	19.50	-1.28	na	na	19.50	0	0	0.0

230	4	17025	213.9	20.65	-1.07	na	na	20.65	0	0	0.0
240	4	19357	214.2	21.82	-0.85	na	na	21.82	0	0	0.0
250	5	21886	214.4	23.00	-0.61	na	na	23.00	0	0	0.0
260	5	24619	214.6	24.18	-0.36	na	na	24.18	0	0	0.0
270	5	27564	214.9	25.38	-0.09	na	na	25.38	0	0	0.0
280	6	30726	215.2	26.59	0.20	2.5	14.8	26.59	0	0	2.5
290	6	32639	215.4	27.29	0.37	6.3	20.2	27.29	0	0	6.3
300	6	32501	215.4	27.24	0.35	5.9	19.9	27.24	0	0	5.9
310	7	32785	215.4	27.34	0.38	6.6	20.6	27.34	0	0	6.6
320	7	32924	215.4	27.39	0.39	6.9	20.9	27.39	0	0	6.9
330	8	33116	215.4	27.46	0.41	7.4	21.4	27.46	0	0	7.4
340	8	33287	215.4	27.52	0.42	7.8	21.8	27.52	0	0	7.8
350	9	33467	215.4	27.58	0.44	8.2	22.2	27.58	0	0	8.2
360	9	33643	215.5	27.65	0.45	8.7	22.6	27.65	0	0	8.7
370	9	33821	215.5	27.71	0.47	9.1	22.9	27.71	0	0	9.1
380	10	33998	215.5	27.77	0.49	9.6	23.3	27.77	0	0	9.6
390	10	34175	215.5	27.83	0.50	10.0	23.7	27.83	0	0	10.0
400	11	34352	215.5	27.89	0.52	10.5	24.1	27.89	0	0	10.5
410	11	34528	215.5	27.95	0.53	11.0	24.4	27.95	0	0	11.0
420	12	34703	215.5	28.02	0.55	11.4	24.8	28.02	0	0	11.4
430	12	34877	215.6	28.08	0.56	11.9	25.1	28.08	0	0	11.9
440	13	35051	215.6	28.14	0.58	12.4	25.4	28.14	0	0	12.4
450	13	35224	215.6	28.19	0.59	12.9	25.8	28.19	0	0	12.9
460	14	35396	215.6	28.25	0.61	13.4	26.1	28.25	0	0	13.4
470	14	35567	215.6	28.31	0.62	13.9	26.4	28.31	0	0	13.9
480	15	35736	215.6	28.37	0.64	14.4	26.7	28.37	0	0	14.4
490	15	35905	215.7	28.43	0.65	14.9	27.0	28.43	0	0	14.9
500	16	36072	215.7	28.48	0.67	15.4	27.3	28.48	0	0	15.4
510	16	36237	215.7	28.54	0.68	15.9	27.6	28.54	0	0	15.9
520	17	36401	215.7	28.59	0.70	16.4	27.9	28.59	0	0	16.4
530	17	36564	215.7	28.65	0.71	16.9	28.2	28.65	0	0	16.9
540	18	36724	215.7	28.70	0.72	17.4	28.5	28.70	0	0	17.4
550	18	36883	215.7	28.76	0.74	17.9	28.7	28.76	0	0	17.9
560	19	37040	215.8	28.81	0.75	18.4	29.0	28.81	0	0	18.4
570	19	37195	215.8	28.86	0.76	18.9	29.3	28.86	0	0	18.9
580	20	37348	215.8	28.91	0.78	19.4	29.5	28.91	0	0	19.4
590	20	37499	215.8	28.96	0.79	19.9	29.8	28.96	0	0	19.9
600	21	37647	215.8	29.01	0.80	20.4	30.0	29.01	0	0	20.4
610	21	37794	215.8	29.06	0.82	20.9	30.2	29.06	0	0	20.9
620	22	37937	215.8	29.11	0.83	21.3	30.5	29.11	0	0	21.3
630	22	38079	215.8	29.15	0.84	21.8	30.7	29.15	0	0	21.8
640	23	38218	215.9	29.20	0.85	22.3	30.9	29.20	0	0	22.3
650	23	38354	215.9	29.24	0.86	22.7	31.1	29.24	0	0	22.7
660	23	38488	215.9	29.29	0.88	23.2	31.3	29.29	0	0	23.2
670	24	38619	215.9	29.33	0.89	23.6	31.5	29.33	0	0	23.6
680	24	38747	215.9	29.37	0.90	24.1	31.7	29.37	0	0	24.1
690	25	38873	215.9	29.41	0.91	24.5	31.9	29.41	0	0	24.5
700	25	38995	215.9	29.45	0.92	25.0	32.1	29.45	0	0	25.0
710	26	39115	215.9	29.49	0.93	25.4	32.3	29.49	0	0	25.4
720	26	39231	215.9	29.53	0.94	25.8	32.5	29.53	0	0	25.8
730	26	39344	216.0	29.56	0.95	26.2	32.6	29.56	0	0	26.2

740	27	39454	216.0	29.60	0.96	26.6	32.8	29.60	0	0	26.6
750	27	39561	216.0	29.63	0.97	27.0	32.9	29.63	0	0	27.0
760	27	39665	216.0	29.67	0.98	27.3	33.1	29.67	0	0	27.3
770	28	39765	216.0	29.70	0.99	27.7	33.2	29.70	0	0	27.7
780	28	39862	216.0	29.73	0.99	28.0	33.4	29.73	0	0	28.0
790	29	39956	216.0	29.76	1.00	28.4	33.5	29.76	0	0	28.4
800	29	40046	216.0	29.79	1.01	28.7	33.6	29.79	0	0	28.7
810	29	40132	216.0	29.82	1.02	29.0	33.8	29.82	0	0	29.0
820	29	40215	216.0	29.84	1.02	29.3	33.9	29.84	0	0	29.3
830	30	40295	216.0	29.87	1.03	29.6	34.0	29.87	0	0	29.6
840	30	40370	216.0	29.89	1.04	29.9	34.1	29.89	0	0	29.9
850	30	40452	216.0	29.92	1.05	30.2	34.2	29.92	0	0	29.9
860	31	40675	216.1	29.99	1.06	31.0	34.5	29.99	0.1	0.9774	31.0
870	31	40418	216.0	29.91	1.04	30.1	34.2	29.91	0.0	0.5209	30.4
880	31	40625	216.1	29.97	1.06	30.9	34.5	29.97	0.1	0.8797	30.9
890	31	40709	216.1	30.00	1.07	31.2	34.6	30.00	0.1	1.0432	31.0
900	31	40803	216.1	30.03	1.08	31.5	34.7	30.03	0.1	1.2369	31.3
910	32	40879	216.1	30.05	1.08	31.8	34.8	30.05	0.1	1.4006	31.5
920	32	40950	216.1	30.07	1.09	32.1	34.9	30.07	0.1	1.5586	31.6
930	32	41011	216.1	30.09	1.09	32.3	35.0	30.09	0.1	1.6996	31.8
940	32	41065	216.1	30.11	1.10	32.5	35.1	30.11	0.1	1.8295	31.9
950	32	41113	216.1	30.12	1.10	32.7	35.1	30.12	0.1	1.9448	32.1
960	32	41154	216.1	30.14	1.11	32.9	35.2	30.14	0.1	2.0475	32.2
970	32	41189	216.1	30.15	1.11	33.0	35.2	30.15	0.1	2.1361	32.3
980	32	41219	216.1	30.16	1.11	33.1	35.3	30.16	0.1	2.2116	32.4
990	32	41243	216.1	30.17	1.11	33.2	35.3	30.17	0.1	2.2731	32.4
1000	33	41262	216.1	30.17	1.11	33.3	35.3	30.17	0.1	2.3211	32.5
1010	33	41275	216.1	30.18	1.12	33.3	35.3	30.18	0.1	2.3553	32.5
1020	33	41283	216.1	30.18	1.12	33.3	35.4	30.18	0.1	2.3759	32.6
1030	33	41285	216.1	30.18	1.12	33.4	35.4	30.18	0.1	2.3827	32.6
1040	33	41283	216.1	30.18	1.12	33.3	35.4	30.18	0.1	2.3758	32.6
1050	33	41275	216.1	30.18	1.12	33.3	35.3	30.18	0.1	2.3553	32.5
1060	32	41262	216.1	30.17	1.11	33.3	35.3	30.17	0.1	2.3213	32.5
1070	32	41243	216.1	30.17	1.11	33.2	35.3	30.17	0.1	2.2737	32.4
1080	32	41220	216.1	30.16	1.11	33.1	35.3	30.16	0.1	2.2129	32.4
1090	32	41191	216.1	30.15	1.11	33.0	35.2	30.15	0.1	2.1388	32.3
1100	32	41156	216.1	30.14	1.11	32.9	35.2	30.14	0.1	2.0517	32.2
1110	32	41116	216.1	30.13	1.10	32.7	35.1	30.13	0	0	30.1
1120	32	42240	216.2	30.48	1.20	37.1	36.6	30.48	0	0	30.5
1130	32	43073	216.3	30.73	1.27	40.4	37.7	30.73	0	0	30.7
1140	32	43661	216.3	30.91	1.32	42.8	38.4	30.91	0	0	30.9
1150	31	44042	216.4	31.03	1.35	44.4	38.9	31.03	0	0	31.0
1160	31	44245	216.4	31.09	1.37	45.2	39.1	31.09	0	0	31.1
1170	31	44294	216.4	31.10	1.37	45.4	39.2	31.10	0	0	31.1
1180	31	44210	216.4	31.08	1.36	45.1	39.1	31.08	0	0	31.1
1190	31	44007	216.3	31.02	1.35	44.2	38.9	31.02	0	0	31.0
1200	30	43699	216.3	30.92	1.32	43.0	38.5	30.92	0	0	30.9
1210	30	43297	216.3	30.80	1.29	41.3	38.0	30.80	0	0	30.8
1220	30	42811	216.2	30.65	1.25	39.3	37.4	30.65	0	0	30.7
1230	29	42248	216.2	30.48	1.20	37.1	36.6	30.48	0	0	30.5
1240	29	41617	216.1	30.28	1.14	34.6	35.8	30.28	0	0	30.3

1250	29	40922	216.1	30.07	1.09	32.0	34.9	30.07	0	0	30.1
1260	28	40171	216.0	29.83	1.02	29.2	33.8	29.83	0	0	29.2
1270	28	39761	216.0	29.70	0.99	27.7	33.2	29.70	0	0	27.7
1280	28	40046	216.0	29.79	1.01	28.7	33.6	29.79	0	0	28.7
1290	27	39501	216.0	29.61	0.96	26.7	32.9	29.61	0	0	26.7
1300	27	39949	216.0	29.76	1.00	28.4	33.5	29.76	0	0	28.4
1310	27	39218	215.9	29.52	0.94	25.7	32.4	29.52	0	0	25.7
1320	26	39856	216.0	29.73	0.99	28.0	33.4	29.73	0	0	28.0
1330	26	38920	215.9	29.43	0.91	24.7	32.0	29.43	0	0	24.7

INFLOW =IF T >1.25*Tp,THEN 4.34*Qp*EXP(-1.3*t/Tp)
IF T </=1.25*Tp,THEN Qp/2*(1-(COS(PI(in radians))*t/Tp))

NOTE: 48 hours = 2,880 minutes

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9995169
R Square	0.999034
Adjusted R	0.998712
Standard E	0.0266367
Observatio	5

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regressio	1	2.201362	2.201362	3102.6431	1.27E-05
Residual	3	0.002129	0.00071		
Total	4	2.20349			

	Coefficients	*andard Erro*	*t Stat*	*P-value*	*ower 95%*	*per 95%*	*wer 95.0%*	*pper 95.0%*
Intercept	8.9765121	0.023336	384.6682	3.874E-08	8.902247	9.0508	8.90225	9.05078
X Variable	1.1673302	0.020957	55.70137	1.275E-05	1.100636	1.234	1.10064	1.23402

EROSION CONTROL POND CALCULATIONS
RISER/BARREL STRUCTURE

COOKE LCID
RALEIGH, NC
FILE: 9827.XLS
DATE: 18 JAN 1999

BRETHAUER CONSULTING ENGINEERING
1012 NORTH SALEM STREET
APEX, NC 27502
(919) 362-6645
fax (919) 363-2080

POND #2 - EAST SIDE

POST DEVELOPMENT HYDROLOGY

	10.00	acres	=	WATERSHED AREA "A"
	10.00	acres	=	DISTURBED AREA
	1,700	ft	=	HYDRAULIC LENGTH "L"
	289	ft	=	ELEVATION OF HIGHEST POINT IN WATERSHED
	215	ft	=	ELEVATION OF LOWEST POINT IN WATERSHED
	74	ft	=	CHANGE IN ELEVATION
Calculate	8.0	min	=	TIME OF CONCENTRATION = Tc = ((L^3/H)^0.385)/128
Check Min	8.0	min	=	TIME OF CONCENTRATION = Tc = minimum is 5 minutes
	195.0		=	g 25 year storm
	22.0		=	h 25 year storm
	6.50		=	INTENSITY = I = g/(h+Tc)
	0.6		=	SCS CURVE NUMBER
	0.40		=	RUNOFF COEFFICIENT

10 YEAR STORM - EC Design Storm

26.0	cfs	=	FLOW = Q = CIA

100 YEAR STORM - Emergency Spillway Design

290.0		=	g
25.0		=	h
8.78		=	INTENSITY = I = g/(h+Tc)
35.1	cfs	=	FLOW = Q = CIA

ESTIMATE VOLUME OF RUNOFF

	26.0	cfs	=	DESIGN FLOW
	1656.7	in	=	ULTIMATE SOIL STORAGE = S = (1000/CN)-10
	3.9	in	=	PRECIPITATION DEPTH = P = from TP-40 (6 HOUR)
	80.66	in	=	RUNOFF DEPTH = Q* = (P-0.2S)^2/(P+0.8S)
	2,927,866	cf	=	RUNOFF VOLUME = V = Q*/A
10 year	**1351.3**	min	=	TIME TO PEAK = Tp = V/(1.39Qp)
100 year	**999.4**	min	=	TIME TO PEAK = Tp = V/(1.39Qp)

ESTIMATED STORAGE

18,000	cf	=	Min Storage Volume (1,800 * Disturbed Acres)
3.0	ft		Storage Depth
134	ft	=	Storage Length
45	ft	=	Storage Width
3.0			Length to Width Ratio
3.0			Side Slopes (x:1)

PERMANENT STORAGE

ONTOUR (ft)	LENGTH (ft)	WIDTH (ft)	AREA (sf)	INCREM VOLUME (cf)	STORAGE ACCUM VOLUME (cf)			
212			4,400	0	0			
213			5,475	4,938	4,938			
214			6,550	6,013	10,950		CHECK	
215			7,625	7,088	18,038	>	18,000	ok

ONTOUR (ft)	LENGTH (ft)	WIDTH (ft)	AREA (sf)	INCREM VOLUME (cf)	S ACCUM VOLUME (cf)	Z STAGE (ft)	Y ln S	X ln Z	Z, est (ft)
215			7,625	3,813	3,813	0			
216			8,700	8,163	11,975	1	9.3906	0.0000	1.04
217			9,775	9,238	21,213	2	9.9623	0.6931	1.90
218			10,850	10,313	31,525	3	10.3585	1.0986	2.89
219			11,925	11,388	42,913	4	10.6669	1.3863	4.00
220			13,000	12,463	55,375	5	10.9219	1.6094	5.24

Regression Output

Ks=	######	= exp(intercept)
b=	0.9	= x variable
Constant =	9.4	= intercept

OUTLET CHARACTERISTICS

RISER

Diameter	D (in) =	36
Diameter	D (ft) =	3
Area	A (ft) =	7.07
Circumference	C (ft) =	9.42
Weir Coeff.	Cw =	3
Orifice Cof.	Co =	0.59
Crest		215

BARREL

Diameter	D (in) =	24
Diameter	D (ft) =	2
Area	A (ft) =	3.14
Orifice Cof.	Co =	0.59
Invert Elev		212

CHECK
Ariser/Abarrel = 2.25 = 1.5 (min)
OK

WEIR FLOW Q = CwLH^1.5
RISER ORIFICE Q = CdrLD(2gh)^1/2
EMERGENCY WEIR Q = CwL(Hs)^3/2
CULVERT SUBMERGED ORIFICE Q = CdA(2g(H-D/2))^1/2

10 YEAR STORM ROUTING

26.0 cfs	=	PEAK RUNOFF = Qp
1351.3 min	=	TIME TO PEAK = Tp
10 min	=	TIME STEP
30.2 cfs	=	PEAK OUTFLOW
216.1 ft	=	MAXIMUM STAGE

TIME min	INFLOW cfs	STORAGE cf	STAGE ft	OUTFLOW cfs	RISER WEIR STAGE ft	RISER WEIR (cfs)	RISER ORIFICE (cfs)	BARREL ORIFICE (cfs)	EMER SPILL STAGE ft	EMER SPILL FLOW cfs	OUTFLOW TOTAL cfs
0	0	0	212.0	0.00	0.00	na	na	0.00	0	0	0.0
10	0	0	212.0	0.00	-3.00	na	na	0.00	0	0	0.0
20	0	2	212.0	0.00	-3.00	na	na	0.16	0	0	0.0
30	0	11	212.0	0.00	-3.00	na	na	0.37	0	0	0.0
40	0	29	212.0	0.64	-3.00	na	na	0.64	0	0	0.0
50	0	63	212.0	0.95	-3.00	na	na	0.95	0	0	0.0
60	0	116	212.0	1.31	-2.99	na	na	1.31	0	0	0.0
70	0	191	212.0	1.71	-2.99	na	na	1.71	0	0	0.0
80	0	294	212.0	2.15	-2.98	na	na	2.15	0	0	0.0
90	0	429	212.0	2.62	-2.97	na	na	2.62	0	0	0.0
100	0	599	212.0	3.12	-2.96	na	na	3.12	0	0	0.0
110	0	809	212.1	3.66	-2.94	na	na	3.66	0	0	0.0
120	1	1062	212.1	4.23	-2.92	na	na	4.23	0	0	0.0
130	1	1363	212.1	4.82	-2.89	na	na	4.82	0	0	0.0

140	1	1717	212.1	5.45	-2.87	na	na	5.45	0	0	0.0
150	1	2126	212.2	6.10	-2.83	na	na	6.10	0	0	0.0
160	1	2595	212.2	6.77	-2.79	na	na	6.77	0	0	0.0
170	1	3128	212.3	7.47	-2.75	na	na	7.47	0	0	0.0
180	1	3729	212.3	8.20	-2.70	na	na	8.20	0	0	0.0
190	1	4402	212.4	8.95	-2.64	na	na	8.95	0	0	0.0
200	1	5150	212.4	9.72	-2.57	na	na	9.72	0	0	0.0
210	2	5978	212.5	10.52	-2.50	na	na	10.52	0	0	0.0
220	2	6888	212.6	11.34	-2.42	na	na	11.34	0	0	0.0
230	2	7886	212.7	12.17	-2.33	na	na	12.17	0	0	0.0
240	2	8974	212.8	13.03	-2.23	na	na	13.03	0	0	0.0
250	2	10156	212.9	13.91	-2.13	na	na	13.91	0	0	0.0
260	2	11436	213.0	14.81	-2.01	na	na	14.81	0	0	0.0
270	2	12817	213.1	15.73	-1.88	na	na	15.73	0	0	0.0
280	3	14303	213.3	16.67	-1.74	na	na	16.67	0	0	0.0
290	3	15897	213.4	17.62	-1.60	na	na	17.62	0	0	0.0
300	3	17603	213.6	18.60	-1.44	na	na	18.60	0	0	0.0
310	3	19423	213.7	19.59	-1.27	na	na	19.59	0	0	0.0
320	3	21361	213.9	20.59	-1.08	na	na	20.59	0	0	0.0
330	4	23420	214.1	21.62	-0.89	na	na	21.62	0	0	0.0
340	4	25604	214.3	22.66	-0.68	na	na	22.66	0	0	0.0
350	4	27915	214.5	23.72	-0.46	na	na	23.72	0	0	0.0
360	4	30356	214.8	24.79	-0.22	na	na	24.79	0	0	0.0
370	5	32931	215.0	25.88	0.03	0.1	5.5	25.88	0	0	0.1
380	5	35567	215.3	26.95	0.28	4.3	17.8	26.95	0	0	4.3
390	5	35864	215.3	27.07	0.31	4.9	18.7	27.07	0	0	4.9
400	5	35901	215.3	27.08	0.32	5.0	18.8	27.08	0	0	5.0
410	5	36031	215.3	27.14	0.33	5.3	19.2	27.14	0	0	5.3
420	6	36125	215.3	27.17	0.34	5.5	19.4	27.17	0	0	5.5
430	6	36233	215.3	27.22	0.35	5.8	19.7	27.22	0	0	5.8
440	6	36336	215.4	27.26	0.36	6.0	20.0	27.26	0	0	6.0
450	6	36441	215.4	27.30	0.37	6.3	20.3	27.30	0	0	6.3
460	7	36545	215.4	27.34	0.38	6.6	20.6	27.34	0	0	6.6
470	7	36649	215.4	27.38	0.39	6.8	20.9	27.38	0	0	6.8
480	7	36753	215.4	27.42	0.40	7.1	21.1	27.42	0	0	7.1
490	8	36857	215.4	27.46	0.41	7.4	21.4	27.46	0	0	7.4
500	8	36960	215.4	27.50	0.42	7.7	21.7	27.50	0	0	7.7
510	8	37064	215.4	27.54	0.43	7.9	21.9	27.54	0	0	7.9
520	8	37167	215.4	27.58	0.44	8.2	22.2	27.58	0	0	8.2
530	9	37270	215.4	27.62	0.45	8.5	22.4	27.62	0	0	8.5
540	9	37373	215.5	27.66	0.46	8.8	22.7	27.66	0	0	8.8
550	9	37475	215.5	27.70	0.47	9.1	22.9	27.70	0	0	9.1
560	10	37577	215.5	27.74	0.48	9.4	23.2	27.74	0	0	9.4
570	10	37679	215.5	27.78	0.49	9.7	23.4	27.78	0	0	9.7
580	10	37780	215.5	27.82	0.50	10.0	23.6	27.82	0	0	10.0
590	10	37881	215.5	27.86	0.51	10.3	23.9	27.86	0	0	10.3
600	11	37981	215.5	27.90	0.52	10.6	24.1	27.90	0	0	10.6
610	11	38081	215.5	27.94	0.53	10.9	24.3	27.94	0	0	10.9
620	11	38180	215.5	27.98	0.54	11.2	24.5	27.98	0	0	11.2
630	12	38278	215.5	28.02	0.55	11.5	24.8	28.02	0	0	11.5
640	12	38376	215.6	28.05	0.56	11.8	25.0	28.05	0	0	11.8

650	12	38473	215.6	28.09	0.57	12.1	25.2	28.09	0	0	12.1
660	13	38570	215.6	28.13	0.58	12.4	25.4	28.13	0	0	12.4
670	13	38666	215.6	28.17	0.59	12.7	25.6	28.17	0	0	12.7
680	13	38761	215.6	28.20	0.59	13.0	25.8	28.20	0	0	13.0
690	13	38855	215.6	28.24	0.60	13.3	26.0	28.24	0	0	13.3
700	14	38949	215.6	28.27	0.61	13.6	26.2	28.27	0	0	13.6
710	14	39042	215.6	28.31	0.62	13.9	26.4	28.31	0	0	13.9
720	14	39134	215.6	28.34	0.63	14.2	26.6	28.34	0	0	14.2
730	15	39225	215.6	28.38	0.64	14.5	26.8	28.38	0	0	14.5
740	15	39315	215.6	28.41	0.65	14.8	27.0	28.41	0	0	14.8
750	15	39404	215.7	28.45	0.66	15.1	27.1	28.45	0	0	15.1
760	16	39493	215.7	28.48	0.67	15.4	27.3	28.48	0	0	15.4
770	16	39580	215.7	28.51	0.67	15.7	27.5	28.51	0	0	15.7
780	16	39666	215.7	28.55	0.68	16.0	27.7	28.55	0	0	16.0
790	16	39752	215.7	28.58	0.69	16.3	27.8	28.58	0	0	16.3
800	17	39836	215.7	28.61	0.70	16.6	28.0	28.61	0	0	16.6
810	17	39919	215.7	28.64	0.71	16.8	28.2	28.64	0	0	16.8
820	17	40001	215.7	28.67	0.72	17.1	28.3	28.67	0	0	17.1
830	18	40082	215.7	28.70	0.72	17.4	28.5	28.70	0	0	17.4
840	18	40162	215.7	28.73	0.73	17.7	28.6	28.73	0	0	17.7
850	18	40241	215.7	28.76	0.74	18.0	28.8	28.76	0	0	18.0
860	18	40319	215.7	28.79	0.75	18.3	28.9	28.79	0	0	18.3
870	19	40395	215.8	28.82	0.75	18.5	29.1	28.82	0	0	18.5
880	19	40470	215.8	28.85	0.76	18.8	29.2	28.85	0	0	18.8
890	19	40544	215.8	28.88	0.77	19.1	29.4	28.88	0	0	19.1
900	19	40617	215.8	28.91	0.78	19.3	29.5	28.91	0	0	19.3
910	20	40688	215.8	28.93	0.78	19.6	29.6	28.93	0	0	19.6
920	20	40758	215.8	28.96	0.79	19.9	29.8	28.96	0	0	19.9
930	20	40827	215.8	28.98	0.80	20.1	29.9	28.98	0	0	20.1
940	20	40894	215.8	29.01	0.80	20.4	30.0	29.01	0	0	20.4
950	21	40960	215.8	29.03	0.81	20.6	30.1	29.03	0	0	20.6
960	21	41025	215.8	29.06	0.82	20.9	30.2	29.06	0	0	20.9
970	21	41088	215.8	29.08	0.82	21.1	30.4	29.08	0	0	21.1
980	21	41150	215.8	29.11	0.83	21.3	30.5	29.11	0	0	21.3
990	22	41211	215.8	29.13	0.83	21.6	30.6	29.13	0	0	21.6
1000	22	41270	215.8	29.15	0.84	21.8	30.7	29.15	0	0	21.8
1010	22	41327	215.8	29.17	0.85	22.0	30.8	29.17	0	0	22.0
1020	22	41383	215.9	29.19	0.85	22.2	30.9	29.19	0	0	22.2
1030	23	41438	215.9	29.21	0.86	22.4	31.0	29.21	0	0	22.4
1040	23	41491	215.9	29.23	0.86	22.6	31.1	29.23	0	0	22.6
1050	23	41543	215.9	29.25	0.87	22.8	31.2	29.25	0	0	22.8
1060	23	41593	215.9	29.27	0.87	23.0	31.3	29.27	0	0	23.0
1070	23	41641	215.9	29.29	0.88	23.2	31.3	29.29	0	0	23.2
1080	23	41688	215.9	29.31	0.88	23.4	31.4	29.31	0	0	23.4
1090	24	41734	215.9	29.32	0.89	23.6	31.5	29.32	0	0	23.6
1100	24	41777	215.9	29.34	0.89	23.8	31.6	29.34	0	0	23.8
1110	24	41820	215.9	29.35	0.89	23.9	31.7	29.35	0	0	23.9
1120	24	41860	215.9	29.37	0.90	24.1	31.7	29.37	0	0	24.1
1130	24	41899	215.9	29.38	0.90	24.2	31.8	29.38	0	0	24.2
1140	24	41936	215.9	29.40	0.91	24.4	31.9	29.40	0	0	24.4
1150	25	41973	215.9	29.41	0.91	24.5	31.9	29.41	0	0	24.5

1160	25	42006	215.9	29.42	0.91	24.7	32.0	29.42	0	0	24.7
1170	25	42039	215.9	29.44	0.92	24.8	32.0	29.44	0	0	24.8
1180	25	42069	215.9	29.45	0.92	24.9	32.1	29.45	0	0	24.9
1190	25	42100	215.9	29.46	0.92	25.0	32.1	29.46	0	0	25.0
1200	25	42125	215.9	29.47	0.92	25.1	32.2	29.47	0	0	25.1
1210	25	42154	215.9	29.48	0.93	25.3	32.2	29.48	0	0	25.3
1220	25	42174	215.9	29.49	0.93	25.3	32.3	29.49	0	0	25.3
1230	25	42202	215.9	29.50	0.93	25.4	32.3	29.50	0	0	25.4
1240	26	42215	215.9	29.50	0.93	25.5	32.3	29.50	0	0	25.5
1250	26	42246	215.9	29.51	0.94	25.6	32.4	29.51	0	0	25.6
1260	26	42246	215.9	29.51	0.94	25.6	32.4	29.51	0	0	25.6
1270	26	42286	215.9	29.53	0.94	25.8	32.5	29.53	0	0	25.8
1280	26	42265	215.9	29.52	0.94	25.7	32.4	29.52	0	0	25.7
1290	26	42326	215.9	29.54	0.94	25.9	32.5	29.54	0	0	25.9
1300	26	42267	215.9	29.52	0.94	25.7	32.4	29.52	0	0	25.7
1310	26	42375	215.9	29.56	0.95	26.1	32.6	29.56	0	0	26.1
1320	26	42240	215.9	29.51	0.94	25.6	32.4	29.51	0	0	25.6
1330	26	42448	216.0	29.59	0.96	26.4	32.7	29.59	0	0	26.4
1340	26	42161	215.9	29.48	0.93	25.3	32.2	29.48	0	0	25.3
1350	26	42577	216.0	29.63	0.97	27.0	32.9	29.63	0	0	27.0
1360	26	41982	215.9	29.41	0.91	24.6	31.9	29.41	0	0	24.6
1370	26	42829	216.0	29.73	0.99	28.0	33.4	29.73	0	0	28.0
1380	26	41603	215.9	29.27	0.87	23.1	31.3	29.27	0	0	23.1
1390	26	43330	216.0	29.91	1.04	30.1	34.2	29.91	0	0	29.9
1400	26	40941	215.8	29.03	0.81	20.5	30.1	29.03	0	0	20.5
1410	26	44151	216.1	30.21	1.12	33.7	35.5	30.21	0	0	30.2
1420	26	41543	215.9	29.25	0.87	22.8	31.2	29.25	0	0	22.8
1430	26	43328	216.0	29.91	1.04	30.1	34.2	29.91	0	0	29.9
1440	26	40841	215.8	28.99	0.80	20.2	29.9	28.99	0	0	20.2
1450	26	44160	216.1	30.21	1.12	33.7	35.5	30.21	0	0	30.2
1460	26	41418	215.9	29.21	0.86	22.4	30.9	29.21	0	0	22.4
1470	25	43344	216.0	29.91	1.04	30.2	34.2	29.91	0	0	29.9
1480	25	40688	215.8	28.93	0.78	19.6	29.6	28.93	0	0	19.6
1490	25	44165	216.1	30.21	1.13	33.8	35.5	30.21	0	0	30.2
1500	25	41224	215.8	29.13	0.84	21.6	30.6	29.13	0	0	21.6
1510	25	43382	216.0	29.93	1.05	30.3	34.3	29.93	0	0	29.9
1520	25	40488	215.8	28.86	0.76	18.9	29.3	28.86	0	0	18.9
1530	25	44159	216.1	30.21	1.12	33.7	35.5	30.21	0	0	30.2
1540	25	40958	215.8	29.03	0.81	20.6	30.1	29.03	0	0	20.6
1550	25	43442	216.1	29.95	1.05	30.6	34.4	29.95	0	0	29.9
1560	24	40243	215.7	28.77	0.74	18.0	28.8	28.77	0	0	18.0
1570	24	44136	216.1	30.20	1.12	33.6	35.5	30.20	0	0	30.2
1580	24	40617	215.8	28.91	0.78	19.3	29.5	28.91	0	0	19.3
1590	24	43521	216.1	29.98	1.06	30.9	34.5	29.98	0	0	30.0
1600	24	39952	215.7	28.66	0.71	17.0	28.2	28.66	0	0	17.0
1610	24	44096	216.1	30.19	1.12	33.5	35.4	30.19	0	0	30.2
1620	24	40204	215.7	28.75	0.74	17.9	28.7	28.75	0	0	17.9
1630	23	43608	216.1	30.01	1.07	31.3	34.6	30.01	0	0	30.0
1640	23	39610	215.7	28.53	0.68	15.8	27.6	28.53	0	0	15.8
1650	23	44041	216.1	30.17	1.11	33.2	35.3	30.17	0	0	30.2
1660	23	39723	215.7	28.57	0.69	16.2	27.8	28.57	0	0	16.2

1670	23	43689	216.1	30.04	1.08	31.7	34.8	30.04	0	0	30.0
1680	22	39209	215.6	28.37	0.64	14.4	26.7	28.37	0	0	14.4
1690	22	43974	216.1	30.14	1.11	32.9	35.2	30.14	0	0	30.1
1700	22	39198	215.6	28.37	0.64	14.4	26.7	28.37	0	0	14.4
1710	22	43747	216.1	30.06	1.08	31.9	34.8	30.06	0	0	30.1
1720	22	38767	215.6	28.20	0.60	13.0	25.8	28.20	0	0	13.0
1730	21	43908	216.1	30.12	1.10	32.6	35.1	30.12	0	0	30.1
1740	21	38644	215.6	28.16	0.58	12.6	25.6	28.16	0	0	12.6
1750	21	43773	216.1	30.07	1.09	32.0	34.9	30.07	0	0	30.1
1760	21	38295	215.5	28.02	0.55	11.5	24.8	28.02	0	0	11.5
1770	21	43836	216.1	30.09	1.09	32.3	35.0	30.09	0	0	30.1
1780	20	38104	215.5	27.95	0.53	10.9	24.4	27.95	0	0	10.9
1790	20	43757	216.1	30.06	1.09	32.0	34.9	30.06	0	0	30.1
1800	20	37807	215.5	27.83	0.50	10.0	23.7	27.83	0	0	10.0
1810	20	43758	216.1	30.06	1.09	32.0	34.9	30.06	0	0	30.1
1820	20	37578	215.5	27.74	0.48	9.4	23.2	27.74	0	0	9.4
1830	19	43700	216.1	30.04	1.08	31.7	34.8	30.04	0	0	30.0
1840	19	37306	215.5	27.64	0.45	8.6	22.5	27.64	0	0	8.6
1850	19	43665	216.1	30.03	1.08	31.6	34.7	30.03	0	0	30.0
1860	19	37057	215.4	27.54	0.43	7.9	21.9	27.54	0	0	7.9
1870	19	43607	216.1	30.01	1.07	31.3	34.6	30.01	0	0	30.0
1880	18	36794	215.4	27.44	0.40	7.2	21.2	27.44	0	0	7.2
1890	18	43549	216.1	29.99	1.06	31.1	34.5	29.99	0	0	30.0
1900	18	36536	215.4	27.34	0.38	6.6	20.6	27.34	0	0	6.6
1910	18	43480	216.1	29.96	1.06	30.8	34.4	29.96	0	0	30.0
1920	18	36273	215.4	27.23	0.35	5.9	19.8	27.23	0	0	5.9
1930	18	43404	216.1	29.94	1.05	30.4	34.3	29.94	0	0	29.9
1940	17	36008	215.3	27.13	0.33	5.3	19.1	27.13	0	0	5.3
1950	17	43318	216.0	29.90	1.04	30.1	34.2	29.90	0	0	29.9
1960	17	35739	215.3	27.02	0.30	4.6	18.3	27.02	0	0	4.6
1970	17	43222	216.0	29.87	1.03	29.7	34.0	29.87	0	0	29.7
1980	17	35590	215.3	26.96	0.29	4.3	17.9	26.96	0	0	4.3
1990	17	43077	216.0	29.82	1.02	29.1	33.8	29.82	0	0	29.1
2000	16	35619	215.3	26.97	0.29	4.4	18.0	26.97	0	0	4.4
2010	16	42876	216.0	29.74	1.00	28.2	33.4	29.74	0	0	28.2
2020	16	35734	215.3	27.02	0.30	4.6	18.3	27.02	0	0	4.6
2030	16	42648	216.0	29.66	0.98	27.3	33.1	29.66	0	0	27.3
2040	16	35886	215.3	27.08	0.31	5.0	18.8	27.08	0	0	5.0
2050	16	42407	216.0	29.57	0.95	26.3	32.7	29.57	0	0	26.3
2060	16	36055	215.3	27.15	0.33	5.4	19.2	27.15	0	0	5.4
2070	15	42157	215.9	29.48	0.93	25.3	32.2	29.48	0	0	25.3
2080	15	36232	215.3	27.22	0.35	5.8	19.7	27.22	0	0	5.8
2090	15	41901	215.9	29.38	0.90	24.2	31.8	29.38	0	0	24.2
2100	15	36413	215.4	27.29	0.37	6.2	20.2	27.29	0	0	6.2
2110	15	41639	215.9	29.29	0.88	23.2	31.3	29.29	0	0	23.2
2120	15	36595	215.4	27.36	0.38	6.7	20.7	27.36	0	0	6.7
2130	15	41374	215.9	29.19	0.85	22.2	30.9	29.19	0	0	22.2
2140	14	36777	215.4	27.43	0.40	7.2	21.2	27.43	0	0	7.2
2150	14	41105	215.8	29.09	0.82	21.2	30.4	29.09	0	0	21.2
2160	14	36957	215.4	27.50	0.42	7.6	21.6	27.50	0	0	7.6
2170	14	40835	215.8	28.99	0.80	20.2	29.9	28.99	0	0	20.2

2180	14	37131	215.4	27.57	0.44	8.1	22.1	27.57	0	0	8.1
2190	14	40565	215.8	28.89	0.77	19.2	29.4	28.89	0	0	19.2
2200	14	37299	215.5	27.64	0.45	8.6	22.5	27.64	0	0	8.6
2210	13	40297	215.7	28.79	0.75	18.2	28.9	28.79	0	0	18.2
2220	13	37456	215.5	27.70	0.47	9.0	22.9	27.70	0	0	9.0
2230	13	40034	215.7	28.69	0.72	17.2	28.4	28.69	0	0	17.2
2240	13	37601	215.5	27.75	0.48	9.4	23.2	27.75	0	0	9.4

INFLOW =IF T >1.25*Tp,THEN 4.34*Qp*EXP(-1.3*t/Tp)
IF T </=1.25*Tp,THEN Qp/2*(1-(COS(PI(in radians))*t/Tp))

NOTE: 48 hours = 2,880 minutes

100 YEAR STORM ROUTING

35.1 cfs	=	PEAK RUNOFF = Qp	
999.4 min	=	TIME TO PEAK = Tp	
8 min	=	TIME STEP	
35.1 cfs	=	PEAK OUTFLOW	
216.6 ft	=	MAXIMUM STAGE	

EMERGENCY SPILLWAY

Length L (ft) =	20
Weir Coef Cw =	3
Elev	216.5

TIME min	INFLOW cfs	STORAGE cf	STAGE ft	OUTFLOW cfs	RISER WEIR STAGE ft	RISER WEIR (cfs)	RISER ORIFICE (cfs)	BARREL ORIFICE (cfs)	EMER SPILL STAGE ft	EMER SPILL FLOW cfs	OUTFLOW TOTAL cfs
0	0	0	212.0	0.00	-3.00	na	na	0.00	0	0	0.0
8	0	0	212.0	0.00	-3.00	na	na	0.00	0	0	0.0
16	0	3	212.0	0.00	-3.00	na	na	0.18	0	0	0.0
24	0	13	212.0	0.00	-3.00	na	na	0.42	0	0	0.0
32	0	37	212.0	0.00	-3.00	na	na	0.72	0	0	0.0
40	0	80	212.0	0.00	-2.99	na	na	1.08	0	0	0.0
48	0	146	212.0	0.00	-2.99	na	na	1.49	0	0	0.0
56	0	242	212.0	0.00	-2.98	na	na	1.94	0	0	0.0
64	0	373	212.0	2.43	-2.97	na	na	2.43	0	0	0.0
72	0	543	212.0	2.97	-2.96	na	na	2.97	0	0	0.0
80	1	758	212.1	3.54	-2.94	na	na	3.54	0	0	0.0
88	1	1023	212.1	4.14	-2.92	na	na	4.14	0	0	0.0
96	1	1343	212.1	4.79	-2.90	na	na	4.79	0	0	0.0
104	1	1724	212.1	5.46	-2.87	na	na	5.46	0	0	0.0
112	1	2171	212.2	6.16	-2.83	na	na	6.16	0	0	0.0
120	1	2688	212.2	6.90	-2.78	na	na	6.90	0	0	0.0
128	1	3281	212.3	7.66	-2.73	na	na	7.66	0	0	0.0
136	2	3954	212.3	8.46	-2.68	na	na	8.46	0	0	0.0
144	2	4713	212.4	9.28	-2.61	na	na	9.28	0	0	0.0
152	2	5562	212.5	10.13	-2.54	na	na	10.13	0	0	0.0
160	2	6506	212.5	11.00	-2.45	na	na	11.00	0	0	0.0
168	2	7550	212.6	11.90	-2.36	na	na	11.90	0	0	0.0
176	3	8699	212.7	12.82	-2.26	na	na	12.82	0	0	0.0

184	3	9956	212.9	13.77	-2.14	na	na		13.77	0	0	0.0
192	3	11328	213.0	14.74	-2.02	na	na		14.74	0	0	0.0
200	3	12817	213.1	15.73	-1.88	na	na		15.73	0	0	0.0
208	4	14429	213.3	16.74	-1.73	na	na		16.74	0	0	0.0
216	4	16168	213.4	17.78	-1.57	na	na		17.78	0	0	0.0
224	4	18038	213.6	18.84	-1.40	na	na		18.84	0	0	0.0
232	4	20043	213.8	19.91	-1.21	na	na		19.91	0	0	0.0
240	5	22187	214.0	21.01	-1.00	na	na		21.01	0	0	0.0
248	5	24475	214.2	22.13	-0.79	na	na		22.13	0	0	0.0
256	5	26910	214.4	23.26	-0.55	na	na		23.26	0	0	0.0
264	6	29496	214.7	24.42	-0.31	na	na		24.42	0	0	0.0
272	6	32236	215.0	25.59	-0.04	na	na		25.59	0	0	0.0
280	6	35134	215.2	26.78	0.24	3.3	16.4		26.78	0	0	3.3
288	7	36592	215.4	27.36	0.38	6.7	20.7		27.36	0	0	6.7
296	7	36604	215.4	27.36	0.38	6.7	20.7		27.36	0	0	6.7
304	7	36770	215.4	27.43	0.40	7.2	21.2		27.43	0	0	7.2
312	8	36901	215.4	27.48	0.41	7.5	21.5		27.48	0	0	7.5
320	8	37041	215.4	27.53	0.43	7.9	21.9		27.53	0	0	7.9
328	9	37178	215.4	27.59	0.44	8.2	22.2		27.59	0	0	8.2
336	9	37316	215.5	27.64	0.45	8.6	22.5		27.64	0	0	8.6
344	9	37454	215.5	27.70	0.47	9.0	22.9		27.70	0	0	9.0
352	10	37592	215.5	27.75	0.48	9.4	23.2		27.75	0	0	9.4
360	10	37729	215.5	27.80	0.49	9.8	23.5		27.80	0	0	9.8
368	10	37867	215.5	27.86	0.51	10.2	23.8		27.86	0	0	10.2
376	11	38004	215.5	27.91	0.52	10.6	24.1		27.91	0	0	10.6
384	11	38141	215.5	27.96	0.53	11.0	24.5		27.96	0	0	11.0
392	12	38277	215.5	28.02	0.55	11.4	24.8		28.02	0	0	11.4
400	12	38413	215.6	28.07	0.56	11.9	25.1		28.07	0	0	11.9
408	13	38548	215.6	28.12	0.57	12.3	25.4		28.12	0	0	12.3
416	13	38683	215.6	28.17	0.59	12.7	25.6		28.17	0	0	12.7
424	13	38817	215.6	28.22	0.60	13.1	25.9		28.22	0	0	13.1
432	14	38951	215.6	28.27	0.61	13.6	26.2		28.27	0	0	13.6
440	14	39084	215.6	28.33	0.63	14.0	26.5		28.33	0	0	14.0
448	15	39216	215.6	28.38	0.64	14.4	26.8		28.38	0	0	14.4
456	15	39347	215.7	28.43	0.65	14.9	27.0		28.43	0	0	14.9
464	16	39478	215.7	28.48	0.66	15.3	27.3		28.48	0	0	15.3
472	16	39608	215.7	28.52	0.68	15.8	27.5		28.52	0	0	15.8
480	16	39736	215.7	28.57	0.69	16.2	27.8		28.57	0	0	16.2
488	17	39864	215.7	28.62	0.70	16.7	28.1		28.62	0	0	16.7
496	17	39991	215.7	28.67	0.72	17.1	28.3		28.67	0	0	17.1
504	18	40117	215.7	28.72	0.73	17.5	28.5		28.72	0	0	17.5
512	18	40241	215.7	28.76	0.74	18.0	28.8		28.76	0	0	18.0
520	19	40365	215.8	28.81	0.75	18.4	29.0		28.81	0	0	18.4
528	19	40487	215.8	28.86	0.76	18.9	29.2		28.86	0	0	18.9
536	20	40608	215.8	28.90	0.78	19.3	29.5		28.90	0	0	19.3
544	20	40728	215.8	28.95	0.79	19.8	29.7		28.95	0	0	19.8
552	20	40847	215.8	28.99	0.80	20.2	29.9		28.99	0	0	20.2
560	21	40964	215.8	29.04	0.81	20.6	30.1		29.04	0	0	20.6
568	21	41080	215.8	29.08	0.82	21.1	30.3		29.08	0	0	21.1
576	22	41194	215.8	29.12	0.83	21.5	30.5		29.12	0	0	21.5
584	22	41307	215.8	29.16	0.84	21.9	30.8		29.16	0	0	21.9

592	23	41419	215.9	29.21	0.86	22.4	30.9	29.21	0	0	22.4
600	23	41528	215.9	29.25	0.87	22.8	31.1	29.25	0	0	22.8
608	23	41637	215.9	29.29	0.88	23.2	31.3	29.29	0	0	23.2
616	24	41744	215.9	29.33	0.89	23.6	31.5	29.33	0	0	23.6
624	24	41849	215.9	29.37	0.90	24.0	31.7	29.37	0	0	24.0
632	25	41952	215.9	29.40	0.91	24.4	31.9	29.40	0	0	24.4
640	25	42054	215.9	29.44	0.92	24.9	32.1	29.44	0	0	24.9
648	25	42154	215.9	29.48	0.93	25.3	32.2	29.48	0	0	25.3
656	26	42252	215.9	29.51	0.94	25.6	32.4	29.51	0	0	25.6
664	26	42349	215.9	29.55	0.95	26.0	32.6	29.55	0	0	26.0
672	27	42444	216.0	29.58	0.96	26.4	32.7	29.58	0	0	26.4
680	27	42536	216.0	29.62	0.97	26.8	32.9	29.62	0.0	0	26.8
688	27	42627	216.0	29.65	0.97	27.2	33.0	29.65	0.0	0	27.2
696	28	42716	216.0	29.69	0.98	27.5	33.2	29.69	0.0	0	27.5
704	28	42804	216.0	29.72	0.99	27.9	33.3	29.72	0.0	0	27.9
712	28	42889	216.0	29.75	1.00	28.3	33.5	29.75	0.0	0	28.3
720	29	42972	216.0	29.78	1.01	28.6	33.6	29.78	0.0	0	28.6
728	29	43053	216.0	29.81	1.02	28.9	33.7	29.81	0.0	0	28.9
736	29	43132	216.0	29.84	1.02	29.3	33.9	29.84	0.0	0	29.3
744	30	43209	216.0	29.87	1.03	29.6	34.0	29.87	0.0	0	29.6
752	30	43284	216.0	29.89	1.04	29.9	34.1	29.89	0.0	0	29.9
760	30	43373	216.0	29.93	1.05	30.3	34.3	29.93	0.0	0	29.9
768	31	43594	216.1	30.01	1.07	31.3	34.6	30.01	0.0	0	30.0
776	31	43919	216.1	30.12	1.10	32.7	35.1	30.12	0.0	0	30.1
784	31	44327	216.1	30.27	1.14	34.5	35.8	30.27	0.0	0	30.3
792	32	44799	216.2	30.44	1.19	36.6	36.5	30.44	0.0	0	30.4
800	32	45320	216.2	30.63	1.24	39.0	37.3	30.63	0.0	0	30.6
808	32	45878	216.3	30.82	1.29	41.6	38.1	30.82	0.0	0	30.8
816	32	46463	216.4	31.03	1.35	44.5	38.9	31.03	0.0	0	31.0
824	33	47067	216.4	31.24	1.41	47.4	39.8	31.24	0.0	0	31.2
832	33	47682	216.5	31.46	1.47	50.5	40.6	31.46	0.0	0	31.5
840	33	48303	216.5	31.67	1.53	53.7	41.5	31.67	0.0	0	31.7
848	33	48925	216.6	31.89	1.60	57.0	42.3	31.89	0.1	1.7799	33.7
856	33	48688	216.6	31.81	1.57	55.8	42.0	31.81	0.1	1.1695	33.0
864	34	48879	216.6	31.87	1.59	56.8	42.2	31.87	0.1	1.6557	33.5
872	34	48895	216.6	31.88	1.59	56.8	42.2	31.88	0.1	1.6982	33.6
880	34	48973	216.6	31.90	1.60	57.3	42.3	31.90	0.1	1.9141	33.8
888	34	49014	216.6	31.92	1.60	57.5	42.4	31.92	0.1	2.0328	34.0
896	34	49067	216.6	31.94	1.61	57.8	42.5	31.94	0.1	2.1875	34.1
904	34	49107	216.6	31.95	1.61	58.0	42.5	31.95	0.1	2.3074	34.3
912	34	49148	216.6	31.96	1.62	58.2	42.6	31.96	0.1	2.4325	34.4
920	35	49183	216.6	31.98	1.62	58.4	42.6	31.98	0.1	2.5387	34.5
928	35	49215	216.6	31.99	1.62	58.6	42.7	31.99	0.1	2.641	34.6
936	35	49243	216.6	32.00	1.63	58.7	42.7	32.00	0.1	2.7297	34.7
944	35	49269	216.6	32.01	1.63	58.8	42.7	32.01	0.1	2.811	34.8
952	35	49290	216.6	32.01	1.63	59.0	42.8	32.01	0.1	2.8806	34.9
960	35	49309	216.6	32.02	1.63	59.1	42.8	32.02	0.1	2.9414	35.0
968	35	49324	216.6	32.03	1.64	59.1	42.8	32.03	0.1	2.9913	35.0
976	35	49337	216.6	32.03	1.64	59.2	42.8	32.03	0.1	3.0319	35.1
984	35	49346	216.6	32.03	1.64	59.3	42.8	32.03	0.1	3.0618	35.1
992	35	49352	216.6	32.03	1.64	59.3	42.8	32.03	0.1	3.0821	35.1

1000	35	49355	216.6	32.04	1.64	59.3	42.8	32.04	0.1	3.092	35.1
1008	35	49355	216.6	32.04	1.64	59.3	42.8	32.04	0.1	3.092	35.1
1016	35	49352	216.6	32.03	1.64	59.3	42.8	32.03	0.1	3.0818	35.1
1024	35	49346	216.6	32.03	1.64	59.3	42.8	32.03	0.1	3.0617	35.1
1032	35	49336	216.6	32.03	1.64	59.2	42.8	32.03	0.1	3.0314	35.1
1040	35	49324	216.6	32.03	1.64	59.1	42.8	32.03	0.1	2.9914	35.0
1048	35	49309	216.6	32.02	1.63	59.1	42.8	32.02	0.1	2.9413	35.0
1056	35	49291	216.6	32.01	1.63	59.0	42.8	32.01	0.1	2.8815	34.9
1064	35	49269	216.6	32.01	1.63	58.8	42.7	32.01	0.1	2.8119	34.8
1072	35	49244	216.6	32.00	1.63	58.7	42.7	32.00	0.1	2.7327	34.7
1080	35	49216	216.6	31.99	1.62	58.6	42.7	31.99	0.1	2.6439	34.6
1088	34	49185	216.6	31.98	1.62	58.4	42.6	31.98	0.1	2.5457	34.5
1096	34	49150	216.6	31.97	1.62	58.2	42.6	31.97	0.1	2.4382	34.4
1104	34	49112	216.6	31.95	1.61	58.0	42.5	31.95	0.1	2.3216	34.3
1112	34	49070	216.6	31.94	1.61	57.8	42.5	31.94	0.1	2.1961	34.1
1120	34	49024	216.6	31.92	1.61	57.5	42.4	31.92	0.1	2.0619	34.0
1128	34	48974	216.6	31.91	1.60	57.3	42.3	31.91	0.1	1.9191	33.8
1136	34	48920	216.6	31.89	1.60	57.0	42.3	31.89	0.1	1.7682	33.7
1144	33	48862	216.6	31.87	1.59	56.7	42.2	31.87	0.1	1.6095	33.5
1152	33	48798	216.6	31.84	1.58	56.3	42.1	31.84	0.1	1.4434	33.3
1160	33	48730	216.6	31.82	1.58	56.0	42.0	31.82	0.1	1.2704	33.1
1168	33	48655	216.6	31.80	1.57	55.6	41.9	31.80	0.1	1.0912	32.9
1176	32	48574	216.6	31.77	1.56	55.2	41.8	31.77	0.1	0.9069	32.7
1184	32	48486	216.6	31.74	1.55	54.7	41.7	31.74	0.1	0.7188	32.5
1192	32	48388	216.5	31.70	1.54	54.2	41.6	31.70	0.0	0	31.7
1200	32	48533	216.6	31.75	1.56	54.9	41.8	31.75	0.0	0	31.8
1208	31	48532	216.6	31.75	1.56	54.9	41.8	31.75	0.0	0	31.8
1216	31	48403	216.5	31.71	1.54	54.3	41.6	31.71	0.0	0	31.7
1224	31	48164	216.5	31.63	1.52	53.0	41.3	31.63	0.0	0	31.6
1232	31	47830	216.5	31.51	1.49	51.3	40.8	31.51	0.0	0	31.5
1240	30	47411	216.4	31.36	1.45	49.2	40.2	31.36	0.0	0	31.4
1248	30	46919	216.4	31.19	1.40	46.7	39.6	31.19	0.0	0	31.2
1256	30	46362	216.3	31.00	1.34	44.0	38.8	31.00	0.0	0	31.0
1264	29	45768	216.3	30.79	1.28	41.1	37.9	30.79	0.0	0	30.8
1272	29	45126	216.2	30.56	1.22	38.1	37.0	30.56	0.0	0	30.6
1280	29	44448	216.2	30.31	1.15	35.0	35.9	30.31	0.0	0	30.3
1288	29	43742	216.1	30.06	1.08	31.9	34.8	30.06	0.0	0	30.1
1296	28	43015	216.0	29.79	1.01	28.8	33.7	29.79	0.0	0	28.8
1304	28	42755	216.0	29.70	0.99	27.7	33.2	29.70	0.0	0	27.7
1312	28	42875	216.0	29.74	1.00	28.2	33.4	29.74	0.0	0	28.2
1320	27	42617	216.0	29.65	0.97	27.1	33.0	29.65	0.0	0	27.1
1328	27	42735	216.0	29.69	0.98	27.6	33.2	29.69	0.0	0	27.6

INFLOW =IF T >1.25*Tp,THEN 4.34*Qp*EXP(-1.3*t/Tp)
IF T </=1.25*Tp,THEN Qp/2*(1-(COS(PI(in radians))*t/Tp))

NOTE: 48 hours = 2,880 minutes

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9976501
R Square	0.9953058
Adjusted R	0.993741
Standard E	0.047762
Observatio	5

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regressio	1	1.451033	1.451033	636.08167	0.000137
Residual	3	0.006844	0.002281		
Total	4	1.457877			

	Coefficients	*andard Erro*	*t Stat*	*P-value*	*ower 95%*	*per 95%*	*wer 95.0%*	*per 95.0%*
Intercept	9.3525978	0.041843	223.5159	1.975E-07	9.219434	9.4858	9.21943	9.48576
X Variable	0.9477345	0.037578	25.22066	0.0001367	0.828145	1.0673	0.82815	1.06732