DESIGN NARRATIVE
and
TECHNICAL ADDENDUM
for
LONG'S WAY TRIBUTARY

March, 1998

Prepared For:

The Town of Parker
Douglas County
Urban Drainage and Flood Control District

Prepared By:

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RGCE Job No. 6040

This design narrative and technical addendum pertains to improvements in the Town of Parker, Colorado, east of Parker Road, north of Long's Way, and south of Plaza Drive. The improvements consists of:

1. One water quality pond east of Donley Drive that will capture and provide detention for the 10 year and 100 year storm event runoff.

2. The construction of two 30' Type R inlets in Donley Drive that will capture the 100 year storm event runoff peak discharge of 144 cfs.

3. The improvement of a drainage easement between Donley Drive and Parkglenn Way to convey emergency overflows from Donley Drive to Parkglenn Way.

4. The construction of one water quality/detention pond west of Parkglenn Way. Extended detention will be provided for the 10 and 100 year storm event. Peak discharges will be reduced from approximately 179 cfs to approximately 91 cfs at Parker Road.

5. The construction of a 42" RCP storm sewer from the detention pond outfall to Parker Road.

The improvements were called for in the Master Drainage Plan for Basin 4600-09 completed in December, 1994 by Kiowa Engineering. Minor changes made to the master plan recommendations include:

1. Routing the flows at Long's Way and Parkglenn Way into the proposed detention pond instead of bypassing the pond.

2. Deletion of the proposed concrete box culvert between Donley Drive and Parkglenn Way. The culvert was deleted because it was determined that the existing double 36" RCP's have adequate capacity to convey the 100 year peak discharge.

The major features and performance criteria of the detention ponds are as follows:

POND 303 (east of Donley Drive)

1. Will capture and provide extended detention for the 10 year and 100 year storm event.

2. Emergency overflow will be provided by the overflow inlet grate on the top of the outflow structure.

3. Total detention pond volume is 2.76 acre/foot.

4. 100 year detention volume is 2.5 acre/foot.

5. 10 year detention volume is 1.0 acre/foot.

6. Water quality capture volume is 0.26 acre/foot.

7. 100 year peak discharge is attenuated from 50 cfs into the pond to approximately 6.6 cfs out of the pond.

8. One foot of freeboard is provided to the top of the berm.

POND 302 (west of Parkglenn way)

1. Total detention pond volume is 4.7 acre/foot.

2. 100 year detention volume is 3.5 acre/foot.

3. 10 year detention volume is 1.8 acre/foot.

4. Water quality capture volume is 1.2 acre/foot.

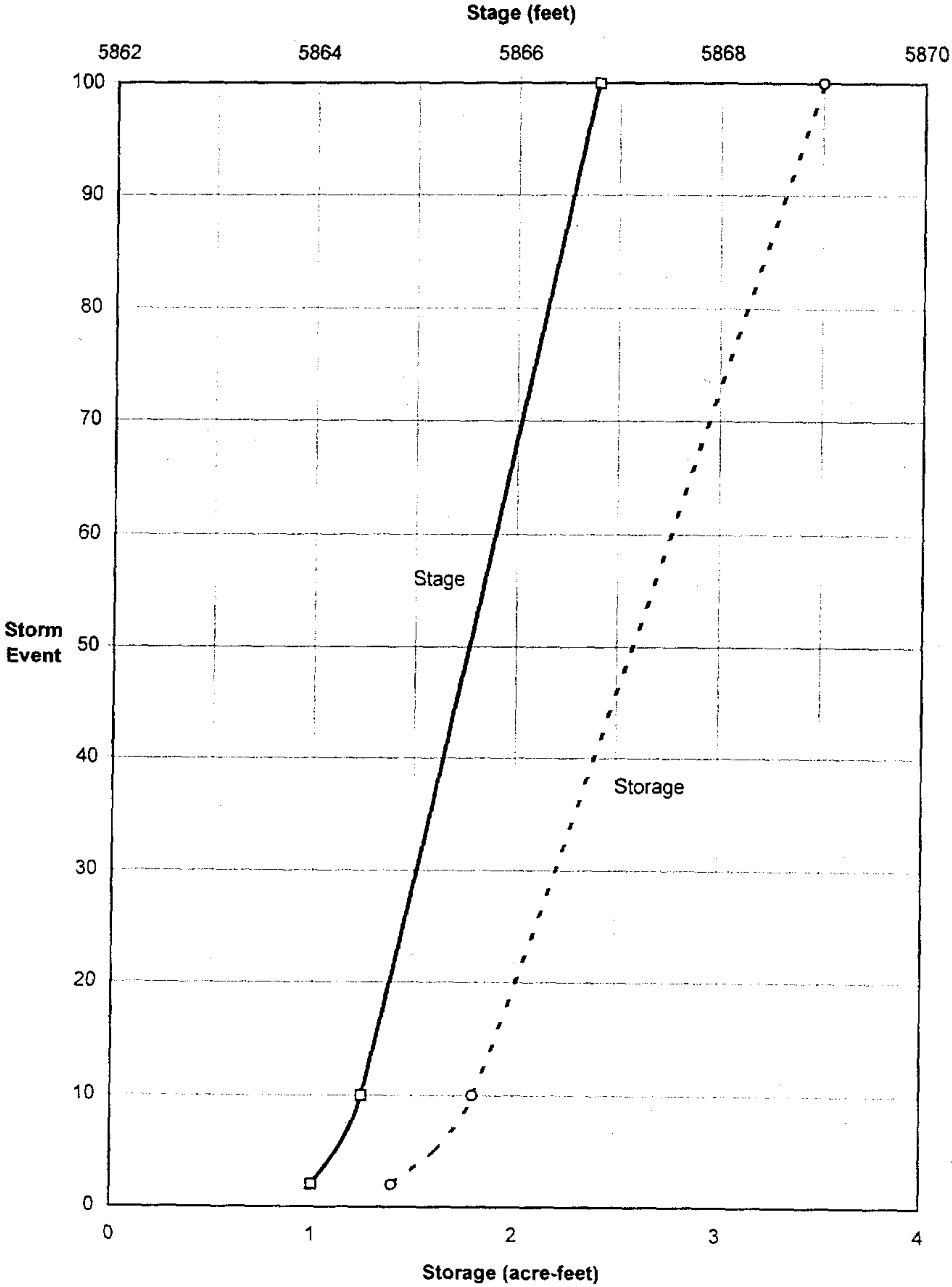
5. Extended detention provided for the 10 year storm event and 100 year storm event.

6. Two foot of freeboard is provided from the 100 year water surface elevation to the top of the embankment.

7. The emergency overflow weir discharges onto Long's Way.

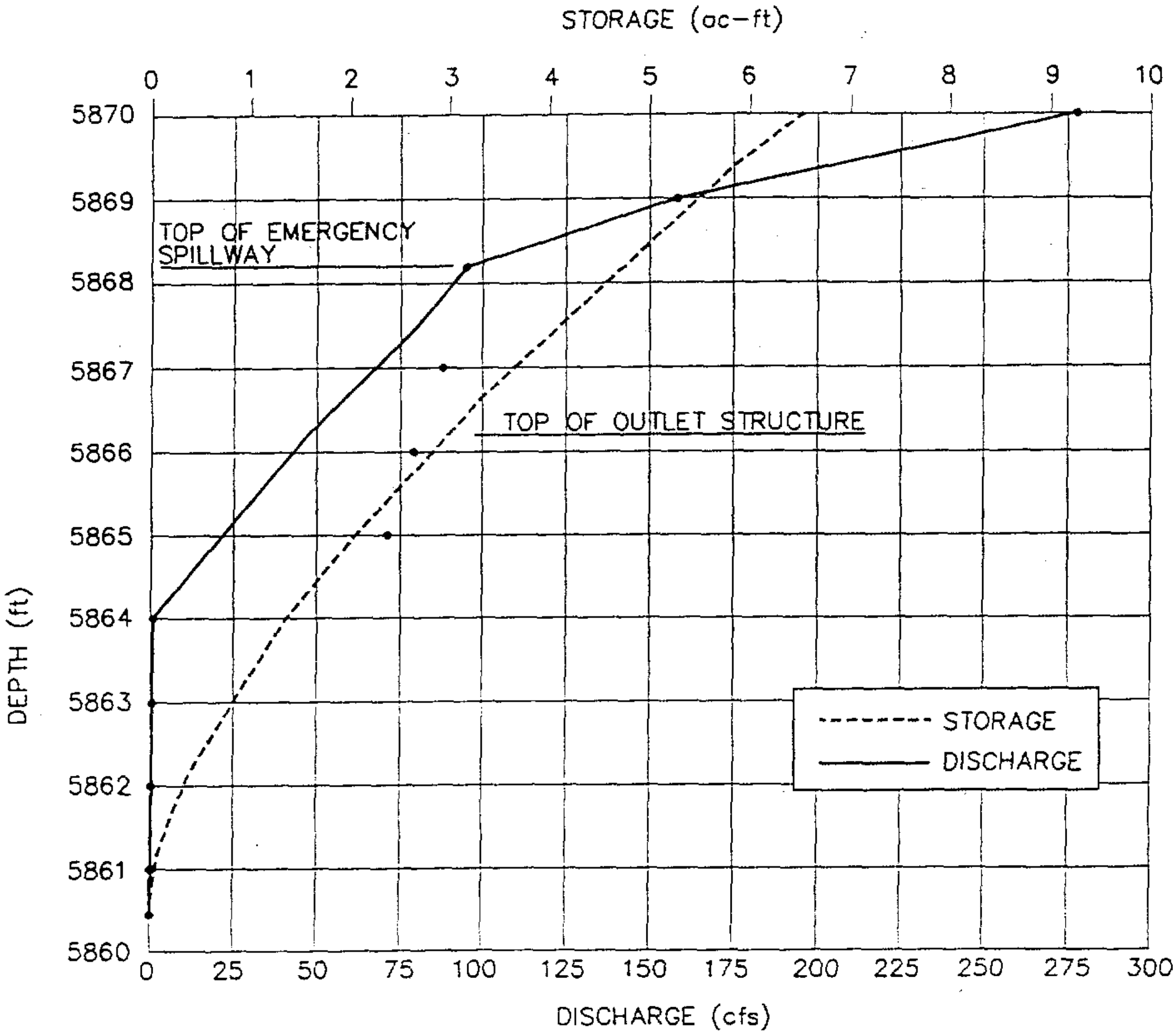
8. The 100 year inflow peak of 179 cfs is reduced 91 cfs.

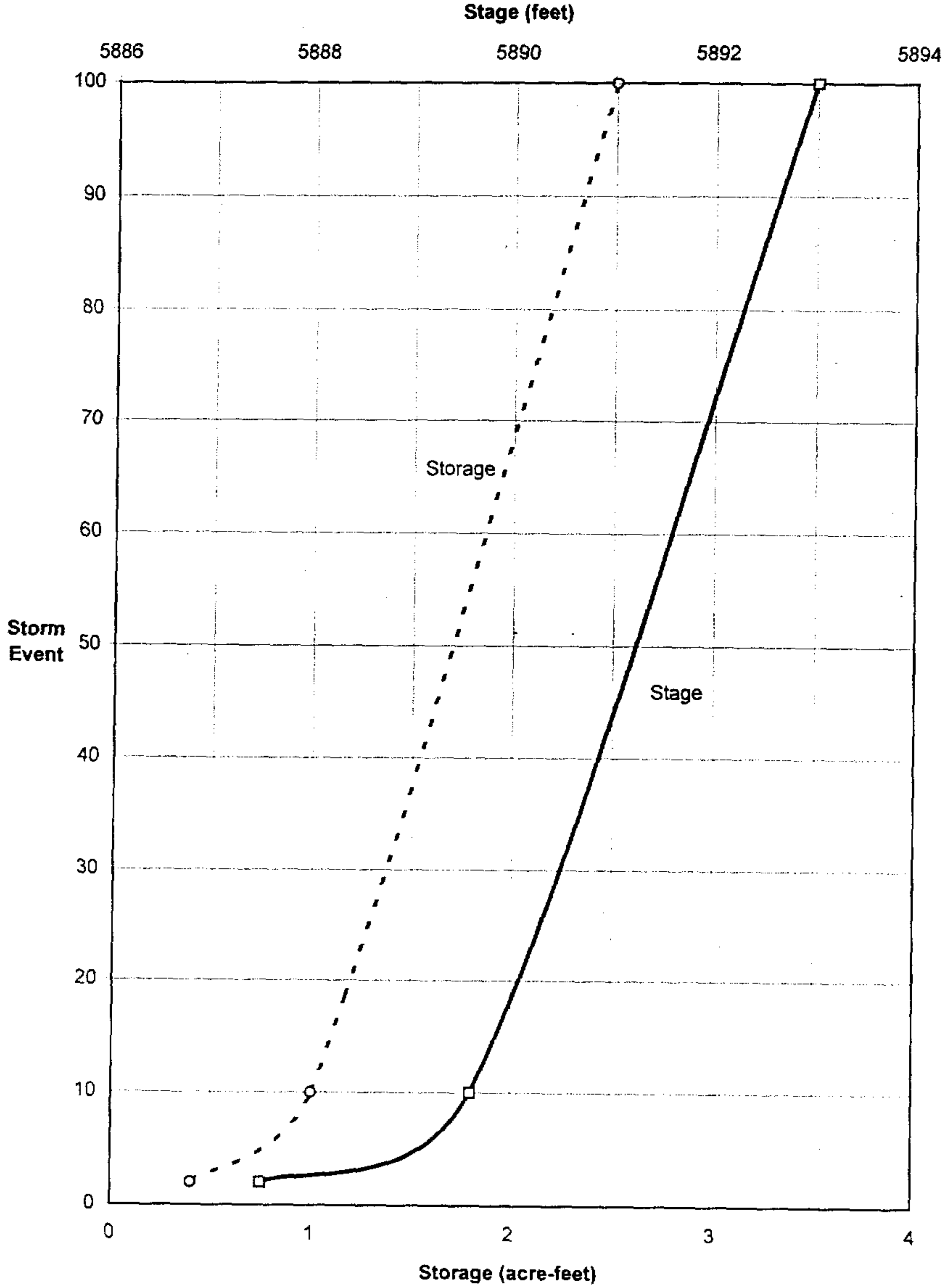
The attached technical documentation include hydraulic calculations, graphs, UDSWMM output, orchid survey, and geotechnical report.



Pond 302 Stage-Storage-Recurrence

STAGE-STORAGE-DISCHARGE CURVES
FOR LONGS WAY TRIBUTARY POND 302





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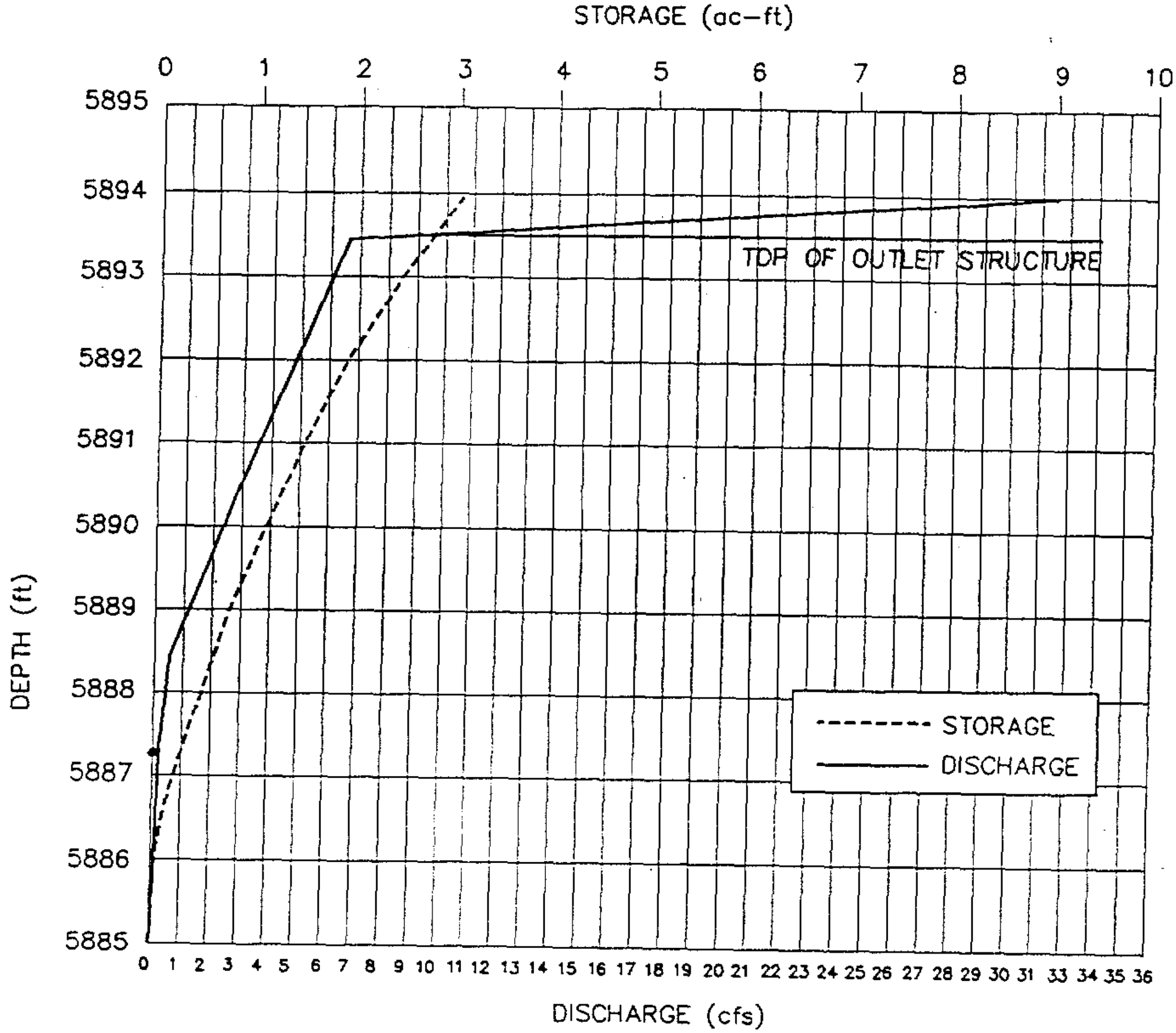

1

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY	METCALF + EDDY, INC.
	UNIVERSITY OF FLORIDA
	WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)
UPDATED BY	UNIVERSITY OF FLORIDA (JUNE 1973)
	HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
	MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
	BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

0TAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

1

WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

0NUMBER OF TIME STEPS 48
0INTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 28 SUBCATCHMENTS

TIME(HR/MIN)											
		1	2	3	4	5	6	7	8	9	10
		11	12	13	14	15	16	17	18	19	20
		21	23	24	25	26	27	28	29		
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	15.	2.	2.	5.	8.	4.	9.	2.	25.	5.	3.
		3.	1.	2.	2.	0.	2.	5.	1.	3.	2.
		3.	10.	1.	1.	3.	2.	7.	6.		

0	20.	7.	7.	23.	32.	17.	33.	6.	85.	19.	19.
		14.	7.	14.	10.	2.	9.	25.	7.	12.	9.
		12.	37.	4.	3.	11.	9.	26.	22.		
0	25.	15.	15.	55.	64.	35.	59.	11.	143.	36.	51.
		31.	17.	43.	25.	5.	21.	54.	21.	28.	26.
		28.	63.	7.	5.	22.	15.	51.	40.		
0	30.	15.	17.	73.	67.	39.	46.	10.	100.	32.	81.
		41.	25.	77.	40.	8.	30.	64.	38.	37.	43.
		36.	47.	5.	5.	21.	11.	51.	33.		
0	35.	11.	15.	66.	49.	30.	26.	8.	52.	21.	84.
		36.	27.	90.	45.	10.	28.	51.	48.	34.	50.
		33.	26.	2.	4.	15.	5.	36.	21.		
0	40.	9.	12.	53.	34.	21.	16.	6.	35.	14.	72.
		28.	25.	81.	43.	11.	23.	35.	48.	28.	48.
		27.	16.	2.	4.	10.	3.	24.	13.		
0	45.	6.	10.	41.	23.	14.	10.	3.	22.	8.	59.
		22.	22.	66.	38.	10.	19.	24.	44.	22.	43.
		22.	10.	0.	3.	6.	2.	16.	8.		
0	50.	5.	8.	32.	17.	9.	9.	2.	19.	6.	48.
		17.	19.	54.	33.	10.	15.	17.	38.	18.	38.
		18.	9.	0.	2.	4.	2.	11.	7.		
0	55.	4.	6.	26.	14.	7.	8.	2.	19.	6.	39.
		14.	17.	44.	29.	10.	13.	13.	33.	15.	33.
		15.	9.	0.	0.	4.	2.	9.	6.		
1	0.	3.	5.	23.	12.	7.	8.	2.	19.	6.	33.
		12.	15.	37.	26.	9.	11.	12.	30.	13.	30.
		13.	9.	0.	0.	4.	2.	9.	6.		
1	5.	3.	4.	20.	12.	7.	8.	2.	19.	6.	30.
		11.	14.	32.	24.	9.	9.	12.	27.	11.	27.
		12.	9.	0.	0.	4.	2.	9.	6.		
1	10.	3.	3.	17.	10.	6.	6.	2.	14.	5.	26.
		9.	13.	29.	22.	8.	8.	10.	24.	10.	24.
		10.	6.	0.	0.	3.	1.	8.	5.		
1	15.	2.	3.	14.	9.	5.	6.	0.	13.	4.	22.
		7.	11.	25.	20.	8.	6.	9.	22.	8.	22.
		8.	6.	0.	0.	3.	0.	7.	4.		
1	20.	2.	3.	13.	8.	5.	5.	0.	13.	4.	19.
		7.	10.	21.	18.	7.	6.	8.	20.	7.	20.
		7.	6.	0.	0.	3.	0.	6.	4.		
1	25.	2.	3.	12.	8.	5.	5.	0.	13.	4.	17.
		6.	9.	18.	16.	7.	5.	8.	18.	6.	18.
		6.	6.	0.	0.	2.	0.	6.	4.		
1	30.	2.	3.	11.	8.	5.	5.	0.	13.	4.	15.
		6.	8.	16.	15.	7.	5.	8.	16.	6.	16.
		6.	6.	0.	0.	2.	0.	6.	4.		
1	35.	2.	2.	11.	8.	5.	5.	0.	13.	4.	15.
		6.	7.	16.	14.	6.	5.	8.	15.	6.	15.
		6.	6.	0.	0.	2.	0.	6.	4.		
1	40.	2.	2.	11.	8.	5.	5.	0.	13.	4.	14.
		6.	6.	15.	13.	6.	5.	8.	14.	6.	14.
		6.	6.	0.	0.	2.	0.	6.	4.		
1	45.	2.	2.	11.	8.	5.	5.	0.	13.	4.	14.
		6.	6.	15.	12.	6.	5.	8.	13.	6.	13.
		6.	6.	0.	0.	2.	0.	6.	4.		
1	50.	2.	2.	11.	8.	5.	5.	0.	13.	4.	14.
		6.	6.	15.	11.	6.	5.	8.	12.	6.	12.
		6.	6.	0.	0.	2.	0.	6.	4.		
1	55.	2.	2.	10.	6.	4.	4.	0.	8.	3.	13.
		5.	5.	14.	10.	6.	4.	6.	11.	5.	11.
		5.	4.	0.	0.	2.	0.	5.	3.		
2	0.	0.	2.	8.	5.	3.	3.	0.	6.	2.	11.
		4.	5.	13.	9.	5.	4.	5.	10.	4.	10.
		4.	3.	0.	0.	1.	0.	4.	2.		

2	5.	0.	0.	6.	3.	2.	0.	0.	0.	0.	9.
		3.	4.	10.	8.	5.	3.	3.	9.	3.	8.
		3.	0.	0.	0.	0.	0.	2.	0.		
2	10.	0.	0.	4.	0.	0.	0.	0.	0.	0.	7.
		2.	3.	8.	6.	4.	2.	1.	7.	2.	7.
		2.	0.	0.	0.	0.	0.	0.	0.		
2	15.	0.	0.	2.	0.	0.	0.	0.	0.	0.	4.
		0.	2.	5.	5.	4.	0.	0.	6.	1.	5.
		1.	0.	0.	0.	0.	0.	0.	0.		
2	20.	0.	0.	1.	0.	0.	0.	0.	0.	0.	3.
		0.	2.	4.	4.	3.	0.	0.	4.	0.	4.
		0.	0.	0.	0.	0.	0.	0.	0.		
2	25.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.
		0.	1.	2.	3.	2.	0.	0.	3.	0.	3.
		0.	0.	0.	0.	0.	0.	0.	0.		
2	30.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	2.	2.	2.	0.	0.	3.	0.	2.
		0.	0.	0.	0.	0.	0.	0.	0.		
2	35.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	2.	2.	0.	0.	2.	0.	2.
		0.	0.	0.	0.	0.	0.	0.	0.		
2	40.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	2.	0.	1.
		0.	0.	0.	0.	0.	0.	0.	0.		

1

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond 8 Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	JK
202	103	0	1	CHANNEL	15.0	1380.	.0174	3.0	3.0	.069	6.00	0
203	134	0	2	PIPE	5.0	130.	.0194	1.0	1.0	.020	5.00	0
205	137	0	1	CHANNEL	.0	400.	.0040	4.0	4.0	.043	5.00	0
206	131	0	1	CHANNEL	.0	1500.	.0100	4.0	4.0	.065	3.00	0
207	108	0	1	CHANNEL	10.0	1440.	.0200	3.0	3.0	.057	5.00	0
209	115	0	1	CHANNEL	5.0	1660.	.0130	3.0	3.0	.057	7.00	0
210	111	0	1	CHANNEL	2.0	980.	.0204	4.0	4.0	.083	5.00	0
212	131	0	1	CHANNEL	10.0	1800.	.0150	4.0	4.0	.067	5.00	0
213	118	0	4	CHANNEL	10.0	2120.	.0160	3.0	3.0	.061	4.00	0
				OVERFLOW	34.0	2120.	.0160	5.0	5.0	.061	8.00	
214	119	0	4	CHANNEL	10.0	3780.	.0127	3.0	3.0	.056	4.00	0
				OVERFLOW	34.0	3780.	.0127	5.0	5.0	.056	8.00	
215	128	0	1	CHANNEL	.0	1550.	.0155	4.0	4.0	.090	3.00	0
216	128	0	1	CHANNEL	.0	1230.	.0178	4.0	4.0	.080	3.00	0
217	128	0	1	CHANNEL	2.0	910.	.0192	4.0	4.0	.098	5.00	0
218	113	0	1	CHANNEL	.0	200.	.0200	4.0	4.0	.084	3.00	0
219	138	0	2	PIPE	3.0	400.	.0200	1.0	1.0	.016	3.00	0
220	133	0	1	CHANNEL	5.0	1000.	.0130	4.0	4.0	.064	5.00	0
221	133	0	1	CHANNEL	.0	1400.	.0040	4.0	4.0	.045	5.00	0
222	123	0	1	CHANNEL	.0	1695.	.0240	4.0	4.0	.090	5.00	0
223	104	0	5	PIPE	5.0	1120.	.0106	.0	.0	.020	5.00	0
				OVERFLOW	.0	1120.	.0106	6.0	6.0	.020	2.00	
224	136	0	1	CHANNEL	.0	450.	.0170	4.0	4.0	.035	3.00	0
225	136	0	1	CHANNEL	.0	250.	.0480	4.0	4.0	.035	4.00	0
226	137	0	1	CHANNEL	.0	1350.	.0118	4.0	4.0	.045	3.00	0
227	104	0	1	CHANNEL	.0	500.	.0040	4.0	4.0	.045	5.00	0
228	139	0	1	CHANNEL	.0	500.	.0500	4.0	4.0	.045	5.00	0
301	102	8	2	PIPE	.1	1.	.0050	.0	.0	.020	5.50	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	.3	5.0	1.3	25.0	2.3	30.0	4.3	90.0	6.3 100.0
		9.0	400.0	12.4	500.0							
302	140	4	2	PIPE	.1	1.	.0050	.0	.0	.020	11.00	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	1.4	1.0	2.1	71.0	4.6	92.0			
303	129	4	2	PIPE	.1	1.	.0050	.0	.0	.020	11.00	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	2.5	1.0	3.2	16.2	4.4	16.2			
305	125	4	2	PIPE	.1	1.	.0050	.0	.0	.020	5.00	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	1.0	1.0	1.5	2.0	3.5	6.0			

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102        202      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
103        203      5     3                         .0      1.   .0010    .0    .0    .001   10.00   222
              DIVERSION TO GUTTER NUMBER 222 - TOTAL Q VS DIVERTED Q IN CFS
                   .0     .0    160.0     .0     200.0   40.0   300.0  140.0   400.0  217.0
104        212      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
105        205      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
107        206      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
111        220      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
113        228      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
116        213      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
118        214      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
122        301      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
130        303      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
129        218      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
128        210      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
133        209      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
127        126      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
125        215      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
126        302      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
124        305      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
131        207      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
132        224      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
134        223      5     3                         .0      1.   .0010    .0    .0    .001   10.00   226
              DIVERSION TO GUTTER NUMBER 226 - TOTAL Q VS DIVERTED Q IN CFS
                   .0     .0    130.0     .0     150.0   20.0   200.0   70.0   400.0  270.0
135        225      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
136        221      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
137        227      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
138        217      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
139        302      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
140        219      0     3                         .0      1.   .0010    .0    .0    .001   10.00     0
OTOTAL NUMBER OF GUTTERS/PIPES,  55
1

 BASIN 4600-09  FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
 KIOWA ENGINEERING  FILENAME 6040.SIN
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ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A. (AC)
102	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.8
103	202	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	166.4
104	223	227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
105	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	51.2
107	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	19.2
111	210	0	0	0	0	0	0	0	0	0	5	28	0	0	0	0	0	0	0	0	160.0
113	218	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	57.6
116	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	57.6
118	213	0	0	0	0	0	0	0	0	0	19	20	0	0	0	0	0	0	0	0	224.0
122	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	108.8
124	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	6.4
125	305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4
126	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4
127	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	6.4
128	215	216	217	0	0	0	0	0	0	0	6	27	0	0	0	0	0	0	0	0	102.4
129	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
130	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	12.8
131	206	212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236.8
132	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	25.6
133	220	221	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0	217.6

134	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166.4
135	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	12.8
136	224	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38.4
137	205	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51.2
138	219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
139	228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57.6
140	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
202	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.8
203	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166.4
205	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51.2
206	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19.2
207	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236.8
209	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
210	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102.4
212	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
213	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57.6
214	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	224.0
215	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4
216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
217	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
218	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
219	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
220	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160.0
221	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38.4
222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
223	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166.4
224	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.6
225	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
227	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51.2
228	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57.6
301	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.8
302	126	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
303	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
305	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4

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BASIN 4600-09 FUTURE MASTERPLAN Modified Pond 3 Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 5 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS
THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.

(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)		138	111	210	128	217
0	5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
0	10.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
0	15.	0. .0( )	12. .0( )	2. .4( )	12. .0( )	0. .0( )
0	20.	0. .0( )	57. .0( )	14. 1.1( )	42. .0( )	0. .0( )
0	25.	0. .0( )	128. .0( )	42. 1.8( )	74. .0( )	0. .0( )
0	30.	0. .0( )	148. .0( )	58. 2.1( )	57. .0( )	0. .0( )
0	35.	0. .0( )	113. .0( )	48. 1.9( )	31. .0( )	0. .1( )
0	40.	1. .0( )	77. .0( )	33. 1.6( )	20. .0( )	0. .1( )
0	45.	1. .0( )	51. .0( )	22. 1.4( )	13. .0( )	0. .2( )
0	50.	1. .0( )	36. .0( )	16. 1.2( )	11. .0( )	0. .2( )
0	55.	1. .0( )	30. .0( )	13. 1.1( )	11. .0( )	1. .2( )
1	0.	1. .0( )	28. .0( )	12. 1.0( )	11. .0( )	1. .3( )
1	5.	1. .0( )	27. .0( )	11. 1.0( )	11. .0( )	1. .3( )
1	10.	1. .0( )	24. .0( )	10. 1.0( )	9. .0( )	1. .3( )
1	15.	2. .0( )	21. .0( )	9. .9( )	7. .0( )	1. .4( )
1	20.	4. .0( )	19. .0( )	8. .9( )	7. .0( )	2. .5( )
1	25.	4. .0( )	18. .0( )	8. .9( )	8. .0( )	3. .6( )
1	30.	5. .0( )	19. .0( )	8. .9( )	9. .0( )	3. .6( )
1	35.	5. .0( )	19. .0( )	9. .9( )	9. .0( )	4. .7( )
1	40.	5. .0( )	20. .0( )	9. .9( )	10. .0( )	4. .7( )
1	45.	5. .0( )	20. .0( )	10. .9( )	10. .0( )	4. .7( )
1	50.	5. .0( )	20. .0( )	10. 1.0( )	10. .0( )	4. .7( )
1	55.	4. .0( )	18. .0( )	9. .9( )	8. .0( )	4. .7( )
2	0.	4. .0( )	15. .0( )	9. .9( )	7. .0( )	4. .7( )
2	5.	3. .0( )	11. .0( )	7. .8( )	4. .0( )	4. .7( )
2	10.	2. .0( )	6. .0( )	6. .7( )	4. .0( )	3. .6( )

2	15.	1. .0( )	4. .0( )	4. .7( )	3. .0( )	3. .6( )
2	20.	1. .0( )	4. .0( )	4. .6( )	2. .0( )	2. .5( )
2	25.	1. .0( )	3. .0( )	3. .5( )	2. .0( )	2. .5( )
2	30.	1. .0( )	2. .0( )	2. .5( )	2. .0( )	1. .4( )
2	35.	1. .0( )	2. .0( )	2. .5( )	1. .0( )	1. .4( )
2	40.	1. .0( )	2. .0( )	2. .4( )	1. .0( )	1. .4( )
2	45.	1. .0( )	2. .0( )	2. .4( )	1. .0( )	1. .4( )
2	50.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
2	55.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	0.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	5.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	10.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .4( )
3	15.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .4( )
3	20.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	25.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	30.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	35.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	40.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	45.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	50.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
3	55.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )
4	0.	1. .0( )	1. .0( )	1. .3( )	1. .0( )	1. .3( )

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BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
130	11.	(DIRECT FLOW)		0 25.
303	0.	.1	.4	1 15.
129	0.	(DIRECT FLOW)		1 15.
218	0.	.2		1 20.
113	32.	(DIRECT FLOW)		0 30.
228	33.	1.2		0 30.
127	5.	(DIRECT FLOW)		0 25.
139	33.	(DIRECT FLOW)		0 30.
126	5.	(DIRECT FLOW)		0 25.
122	73.	(DIRECT FLOW)		0 30.
302	5.	.1	1.4	1 35.
301	26.	.1	1.6	0 55.
140	5.	(DIRECT FLOW)		1 35.
124	7.	(DIRECT FLOW)		0 25.
102	26.	(DIRECT FLOW)		0 55.
219	5.	.5		1 35.
305	0.	.1	.1	0 45.
202	26.	.7		1 10.
138	5.	(DIRECT FLOW)		1 35.
125	0.	(DIRECT FLOW)		0 45.
105	143.	(DIRECT FLOW)		0 25.
103	70.	(DIRECT FLOW)		0 30.
217	4.	.7		1 55.
216	0.	.0		0 0.
215	0.	.2		2 40.
226	0.	.0		0 0.
205	123.	3.2		0 25.
203	71.	1.9		0 30.
135	22.	(DIRECT FLOW)		0 25.
132	63.	(DIRECT FLOW)		0 25.
128	74.	(DIRECT FLOW)		0 25.
137	123.	(DIRECT FLOW)		0 25.
134	71.	(DIRECT FLOW)		0 30.
225	22.	1.0		0 30.
224	57.	1.7		0 25.
210	58.	2.1		0 30.
227	124.	3.3		0 30.
223	70.	2.2		0 30.
116	36.	(DIRECT FLOW)		0 30.
136	78.	(DIRECT FLOW)		0 25.
111	148.	(DIRECT FLOW)		0 30.
104	194.	(DIRECT FLOW)		0 30.
107	36.	(DIRECT FLOW)		0 25.
213	25.	.8		0 45.
221	55.	2.4		0 35.
220	129.	2.5		0 35.
212	142.	2.2		0 35.
206	23.	1.7		0 35.
118	105.	(DIRECT FLOW)		0 35.
133	206.	(DIRECT FLOW)		0 30.
131	165.	(DIRECT FLOW)		0 35.
222	0.	.0		0 0.
214	74.	1.5		0 50.
209	181.	3.0		0 40.
207	142.	2.3		0 45.
123	0.	(DIRECT FLOW)		0 0.
121	11.	(DIRECT FLOW)		0 40.
120	48.	(DIRECT FLOW)		0 40.
119	107.	(DIRECT FLOW)		0 50.
115	228.	(DIRECT FLOW)		0 35.
112	118.	(DIRECT FLOW)		0 35.
110	84.	(DIRECT FLOW)		0 35.
108	195.	(DIRECT FLOW)		0 40.

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ENDPROGRAM PROGRAM CALLED

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ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY	METCALF + EDDY, INC.
	UNIVERSITY OF FLORIDA
	WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)
UPDATED BY	UNIVERSITY OF FLORIDA (JUNE 1973)
	HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
	MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
	BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

0TAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

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WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

0NUMBER OF TIME STEPS 48
0INTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 28 SUBCATCHMENTS

TIME(HR/MIN)		1	2	3	4	5	6	7	8	9	10
		11	12	13	14	15	16	17	18	19	20
		21	23	24	25	26	27	28	29		
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	15.	5.	4.	12.	20.	10.	23.	4.	62.	13.	8.
		7.	3.	5.	5.	1.	4.	13.	3.	7.	4.
		6.	26.	3.	2.	7.	6.	16.	15.		

0	20.	12.	12.	43.	54.	29.	52.	10.	131.	31.	36.
		25.	12.	28.	18.	4.	16.	43.	14.	22.	18.
		22.	57.	6.	5.	18.	14.	43.	35.		
0	25.	30.	32.	102.	113.	59.	98.	25.	241.	59.	91.
		57.	32.	74.	50.	11.	38.	89.	40.	56.	49.
		55.	105.	14.	10.	36.	25.	84.	66.		
0	30.	35.	42.	154.	127.	66.	76.	26.	167.	53.	156.
		81.	53.	130.	86.	22.	57.	108.	74.	83.	89.
		83.	78.	12.	12.	35.	18.	85.	55.		
0	35.	27.	36.	149.	93.	49.	42.	19.	84.	34.	171.
		75.	60.	154.	104.	29.	56.	84.	98.	79.	112.
		80.	41.	5.	9.	24.	9.	58.	33.		
0	40.	20.	28.	116.	62.	33.	25.	13.	52.	22.	147.
		58.	56.	137.	100.	31.	46.	57.	101.	64.	109.
		65.	25.	3.	7.	16.	5.	37.	21.		
0	45.	15.	23.	90.	43.	23.	19.	8.	42.	15.	119.
		45.	49.	112.	89.	30.	37.	40.	91.	51.	98.
		52.	19.	2.	6.	10.	4.	26.	15.		
0	50.	11.	18.	70.	31.	16.	15.	5.	34.	11.	97.
		35.	43.	91.	77.	29.	30.	30.	79.	41.	85.
		42.	16.	2.	4.	7.	4.	19.	11.		
0	55.	8.	14.	55.	24.	13.	14.	4.	33.	10.	79.
		28.	37.	76.	67.	27.	25.	23.	69.	33.	74.
		34.	15.	2.	2.	7.	3.	16.	10.		
1	0.	6.	10.	46.	22.	12.	14.	4.	32.	10.	66.
		23.	33.	64.	59.	26.	21.	20.	61.	28.	65.
		29.	15.	2.	2.	6.	3.	15.	10.		
1	5.	6.	9.	40.	21.	12.	14.	4.	33.	10.	58.
		20.	30.	56.	53.	24.	17.	20.	55.	24.	58.
		25.	15.	2.	2.	6.	3.	15.	10.		
1	10.	6.	8.	36.	21.	12.	14.	4.	33.	10.	52.
		18.	27.	50.	49.	23.	14.	19.	50.	22.	53.
		22.	15.	2.	2.	6.	3.	15.	10.		
1	15.	6.	8.	32.	21.	12.	14.	4.	33.	10.	47.
		16.	25.	46.	45.	22.	13.	19.	46.	19.	49.
		20.	15.	2.	2.	6.	3.	15.	10.		
1	20.	5.	7.	29.	19.	11.	12.	3.	26.	8.	43.
		15.	23.	42.	41.	21.	12.	18.	42.	16.	45.
		17.	12.	0.	2.	6.	3.	14.	9.		
1	25.	4.	6.	24.	16.	9.	9.	3.	20.	7.	36.
		13.	20.	37.	37.	20.	11.	15.	38.	14.	40.
		14.	9.	0.	1.	5.	2.	11.	7.		
1	30.	4.	5.	21.	14.	8.	8.	2.	19.	6.	30.
		11.	17.	32.	32.	19.	9.	13.	34.	12.	35.
		12.	9.	0.	0.	4.	2.	10.	6.		
1	35.	3.	4.	19.	13.	7.	8.	2.	19.	6.	27.
		10.	14.	28.	29.	17.	8.	12.	30.	11.	31.
		11.	9.	0.	0.	4.	2.	9.	6.		
1	40.	3.	4.	18.	12.	7.	8.	2.	19.	6.	25.
		10.	11.	26.	25.	16.	8.	12.	27.	10.	28.
		10.	9.	0.	0.	4.	2.	9.	6.		
1	45.	3.	4.	17.	12.	7.	8.	2.	19.	6.	23.
		9.	11.	24.	23.	15.	7.	11.	24.	9.	25.
		9.	9.	0.	0.	4.	2.	9.	6.		
1	50.	3.	4.	16.	12.	7.	8.	2.	19.	6.	22.
		9.	10.	23.	20.	14.	7.	11.	21.	9.	21.
		9.	9.	0.	0.	4.	2.	9.	6.		
1	55.	3.	4.	16.	11.	7.	8.	2.	17.	5.	21.
		9.	9.	23.	17.	13.	7.	11.	19.	9.	19.
		9.	8.	0.	0.	3.	2.	8.	6.		
2	0.	2.	3.	14.	10.	6.	6.	2.	14.	4.	20.
		8.	9.	21.	16.	13.	6.	10.	17.	8.	18.
		8.	6.	0.	0.	3.	1.	7.	5.		

2	5.	1. 6. 6.	2. 7. 2.	11. 19. 0.	6. 14. 0.	4. 12. 1.	2. 5. 0.	0. 6. 4.	3. 16. 2.	2. 6.	17. 15.
2	10.	0. 4. 4.	0. 6. 0.	7. 14. 0.	2. 11. 0.	2. 10. 0.	0. 3. 0.	0. 3. 1.	0. 13. 0.	0. 4.	12. 13.
2	15.	0. 2. 3.	0. 4. 0.	4. 9. 0.	0. 9. 0.	0. 9. 0.	0. 2. 0.	0. 0. 0.	0. 10. 0.	0. 3.	8. 10.
2	20.	0. 0. 2.	0. 3. 0.	3. 6. 0.	0. 7. 0.	0. 6. 0.	0. 1. 0.	0. 0. 0.	0. 8. 0.	0. 2.	5. 8.
2	25.	0. 0. 0.	0. 3. 0.	2. 4. 0.	0. 5. 0.	0. 5. 0.	0. 0. 0.	0. 0. 0.	0. 6. 0.	0. 0.	4. 6.
2	30.	0. 0. 0.	0. 2. 0.	0. 3. 0.	0. 4. 0.	0. 4. 0.	0. 0. 0.	0. 0. 0.	0. 5. 0.	0. 0.	2. 4.
2	35.	0. 0. 0.	0. 1. 0.	0. 2. 0.	0. 3. 0.	0. 3. 0.	0. 0. 0.	0. 0. 0.	0. 3. 0.	0. 0.	2. 3.
2	40.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 3. 0.	0. 0. 0.	0. 0. 0.	0. 3. 0.	0. 0.	0. 3.
2	45.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 2. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 0.	0. 2.
2	50.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 0. 0.	0. 0. 0.	0. 1. 0.	0. 0.	0. 1.
2	55.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0.	0. 0.

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BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

								SIDE SLOPES HORIZ TO VERT		OVERBANK/SURCHARGE		
GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	L	R	MANNING N	DEPTH (FT)	JK
202	103	0	1	CHANNEL	15.0	1380.	.0174	3.0	3.0	.069	6.00	0
203	134	0	2	PIPE	5.0	130.	.0194	1.0	1.0	.020	5.00	0
205	137	0	1	CHANNEL	.0	400.	.0040	4.0	4.0	.043	5.00	0
206	131	0	1	CHANNEL	.0	1500.	.0100	4.0	4.0	.065	3.00	0
207	108	0	1	CHANNEL	10.0	1440.	.0100	3.0	3.0	.057	5.00	0
209	115	0	1	CHANNEL	5.0	1660.	.0130	3.0	3.0	.057	7.00	0
210	111	0	1	CHANNEL	2.0	980.	.0204	4.0	4.0	.083	5.00	0
212	131	0	1	CHANNEL	10.0	1800.	.0150	4.0	4.0	.067	5.00	0
213	118	0	4	CHANNEL	10.0	2120.	.0160	3.0	3.0	.061	4.00	0
				OVERFLOW	34.0	2120.	.0160	5.0	5.0	.061	8.00	
214	119	0	4	CHANNEL	10.0	3780.	.0127	3.0	3.0	.056	4.00	0
				OVERFLOW	34.0	3780.	.0127	5.0	5.0	.056	8.00	
215	128	0	1	CHANNEL	.0	1550.	.0155	4.0	4.0	.090	3.00	0
216	128	0	1	CHANNEL	.0	1230.	.0178	4.0	4.0	.080	3.00	0
217	128	0	1	CHANNEL	2.0	910.	.0192	4.0	4.0	.098	5.00	0
218	113	0	1	CHANNEL	.0	200.	.0200	4.0	4.0	.084	3.00	0
219	138	0	2	PIPE	3.0	400.	.0200	1.0	1.0	.016	3.00	0
220	133	0	1	CHANNEL	5.0	1000.	.0130	4.0	4.0	.064	5.00	0
221	133	0	1	CHANNEL	.0	1400.	.0040	4.0	4.0	.045	5.00	0
222	123	0	1	CHANNEL	.0	1695.	.0240	4.0	4.0	.090	5.00	0
223	104	0	5	PIPE	5.0	1120.	.0106	.0	.0	.020	5.00	0
				OVERFLOW	.0	1120.	.0106	6.0	6.0	.020	2.00	
224	136	0	1	CHANNEL	.0	450.	.0170	4.0	4.0	.035	3.00	0
225	136	0	1	CHANNEL	.0	250.	.0480	4.0	4.0	.035	4.00	0
226	137	0	1	CHANNEL	.0	1350.	.0118	4.0	4.0	.045	3.00	0
227	104	0	1	CHANNEL	.0	500.	.0040	4.0	4.0	.045	5.00	0
228	139	0	1	CHANNEL	.0	500.	.0500	4.0	4.0	.045	5.00	0
301	102	8	2	PIPE	.1	1.	.0050	.0	.0	.020	5.50	0

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                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0       .3     5.0      1.3    25.0      2.3    30.0      4.3    90.0      6.3   100.0
                        9.0   400.0     12.4   500.0
302       140            4       2     PIPE                .1      1.    .0050      .0      .0     .020     11.00       0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0      1.4     1.0      2.1    71.0      4.6    92.0
303       129            4       2     PIPE                .1      1.    .0050      .0      .0     .020     11.00       0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0      2.5     1.0      3.2    16.2      4.4    16.2
305       125            4       2     PIPE                .1      1.    .0050      .0      .0     .020      5.00       0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0      1.0     1.0      1.5     2.0      3.5     6.0
102       202            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
103       203            5       3                         .0      1.    .0010      .0      .0     .001     10.00     222
                    DIVERSION TO GUTTER NUMBER 222 - TOTAL Q VS DIVERTED Q IN CFS
                         .0      .0    160.0      .0    200.0    40.0    300.0   140.0    400.0   217.0
104       212            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
105       205            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
107       206            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
111       220            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
113       228            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
116       213            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
118       214            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
122       301            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
130       303            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
129       218            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
128       210            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
133       209            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
127       126            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
125       215            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
126       302            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
124       305            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
131       207            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
132       224            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
134       223            5       3                         .0      1.    .0010      .0      .0     .001     10.00     226
                    DIVERSION TO GUTTER NUMBER 226 - TOTAL Q VS DIVERTED Q IN CFS
                         .0      .0    130.0      .0    150.0    20.0    200.0    70.0    400.0   270.0
135       225            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
136       221            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
137       227            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
138       217            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
139       302            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
140       219            0       3                         .0      1.    .0010      .0      .0     .001     10.00       0
0TOTAL NUMBER OF GUTTERS/PIPES,  55
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BASIN 4600-09 FUTURE MASTERPLAN Modified Pond & Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A. (AC)
102	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.8
103	202	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	166.4
104	223	227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
105	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	51.2
107	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	19.2
111	210	0	0	0	0	0	0	0	0	0	5	28	0	0	0	0	0	0	0	0	160.0
113	218	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	57.6
116	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	57.6
118	213	0	0	0	0	0	0	0	0	0	19	20	0	0	0	0	0	0	0	0	224.0
122	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	108.8
124	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	6.4
125	305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4
126	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4
127	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	6.4

128	215	216	217	0	0	0	0	0	0	0	6	27	0	0	0	0	0	0	0	0	102.4
129	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
130	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	12.8
131	206	212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236.8
132	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	25.6
133	220	221	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0	217.6
134	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166.4
135	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	12.8
136	224	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38.4
137	205	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51.2
138	219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
139	228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57.6
140	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
202	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.8
203	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166.4
205	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51.2
206	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19.2
207	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236.8
209	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
210	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102.4
212	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
213	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57.6
214	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	224.0
215	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4
216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
217	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
218	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
219	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
220	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160.0
221	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38.4
222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
223	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166.4
224	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.6
225	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
227	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51.2
228	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57.6
301	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.8
302	126	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64.0
303	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.8
305	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4

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BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 5 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS
THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.
(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)		138	111	210	128	217
0	5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
0	10.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
0	15.	0. .0( )	32. .0( )	6. .7( )	29. .0( )	0. .0( )
0	20.	0. .0( )	102. .0( )	30. 1.6( )	66. .0( )	0. .0( )
0	25.	0. .0( )	218. .0( )	75. 2.3( )	123. .0( )	0. .0( )
0	30.	1. .0( )	251. .0( )	101. 2.6( )	94. .0( )	0. .1( )
0	35.	7. .0( )	187. .0( )	79. 2.3( )	52. .0( )	1. .4( )
0	40.	35. .0( )	125. .0( )	55. 2.0( )	40. .0( )	10. 1.0( )
0	45.	48. .0( )	97. .0( )	48. 1.9( )	50. .0( )	27. 1.6( )
0	50.	42. .0( )	87. .0( )	52. 2.0( )	57. .0( )	38. 1.9( )
0	55.	38. .0( )	85. .0( )	56. 2.0( )	57. .0( )	40. 1.9( )
1	0.	30. .0( )	83. .0( )	55. 2.0( )	54. .0( )	36. 1.8( )
1	5.	25. .0( )	79. .0( )	52. 2.0( )	48. .0( )	31. 1.7( )
1	10.	21. .0( )	75. .0( )	48. 1.9( )	44. .0( )	26. 1.6( )
1	15.	19. .0( )	71. .0( )	44. 1.8( )	40. .0( )	22. 1.5( )
1	20.	17. .0( )	64. .0( )	39. 1.8( )	34. .0( )	20. 1.4( )
1	25.	15. .0( )	54. .0( )	34. 1.7( )	29. .0( )	18. 1.4( )
1	30.	13. .0( )	47. .0( )	30. 1.6( )	26. .0( )	16. 1.3( )
1	35.	11. .0( )	43. .0( )	27. 1.5( )	24. .0( )	14. 1.2( )
1	40.	10. .0( )	40. .0( )	25. 1.4( )	22. .0( )	12. 1.1( )
1	45.	9. .0( )	38. .0( )	23. 1.4( )	21. .0( )	10. 1.1( )
1	50.	8. .0( )	37. .0( )	21. 1.3( )	20. .0( )	9. 1.0( )

1	55.	7. .0( )	35. .0( )	20. 1.3( )	18. .0( )	8. 1.0( )
2	0.	7. .0( )	31. .0( )	18. 1.3( )	16. .0( )	8. .9( )
2	5.	6. .0( )	22. .0( )	15. 1.2( )	9. .0( )	7. .9( )
2	10.	5. .0( )	14. .0( )	11. 1.0( )	7. .0( )	7. .9( )
2	15.	3. .0( )	9. .0( )	9. .9( )	6. .0( )	5. .8( )
2	20.	2. .0( )	7. .0( )	7. .8( )	5. .0( )	4. .7( )
2	25.	1. .0( )	5. .0( )	5. .7( )	3. .0( )	3. .6( )
2	30.	1. .0( )	4. .0( )	4. .7( )	3. .0( )	2. .5( )
2	35.	1. .0( )	3. .0( )	3. .6( )	2. .0( )	2. .5( )
2	40.	1. .0( )	3. .0( )	3. .5( )	2. .0( )	2. .4( )
2	45.	1. .0( )	2. .0( )	2. .5( )	2. .0( )	1. .4( )
2	50.	1. .0( )	2. .0( )	2. .5( )	2. .0( )	1. .4( )
2	55.	1. .0( )	2. .0( )	2. .4( )	1. .0( )	1. .4( )
3	0.	1. .0( )	2. .0( )	2. .4( )	1. .0( )	1. .4( )
3	5.	1. .0( )	2. .0( )	2. .4( )	1. .0( )	1. .4( )
3	10.	1. .0( )	2. .0( )	2. .4( )	1. .0( )	1. .4( )
3	15.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	20.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	25.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	30.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	35.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .4( )
3	40.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .3( )
3	45.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .3( )
3	50.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .3( )
3	55.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .3( )
4	0.	1. .0( )	1. .0( )	1. .4( )	1. .0( )	1. .3( )

1

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
130	26.	(DIRECT FLOW)		0 30.
303	0.	.1	1.0	2 5.
129	0.	(DIRECT FLOW)		2 5.
218	0.	.4		2 10.
113	77.	(DIRECT FLOW)		0 30.
228	77.	1.7		0 30.
127	12.	(DIRECT FLOW)		0 30.
139	77.	(DIRECT FLOW)		0 30.
126	12.	(DIRECT FLOW)		0 30.
122	154.	(DIRECT FLOW)		0 30.
302	46.	.1	1.8	0 45.
301	63.	.1	3.4	0 55.
140	46.	(DIRECT FLOW)		0 45.
124	14.	(DIRECT FLOW)		0 25.
102	63.	(DIRECT FLOW)		0 55.
219	48.	1.7		0 45.
305	0.	.1	.4	1 20.
202	60.	1.2		1 0.
138	48.	(DIRECT FLOW)		0 45.
125	0.	(DIRECT FLOW)		1 20.
105	241.	(DIRECT FLOW)		0 25.
103	133.	(DIRECT FLOW)		0 30.
217	40.	1.9		0 55.
216	0.	.0		0 0.
215	0.	.4		2 30.
226	1.	.5		0 40.
205	204.	3.9		0 30.
203	135.	2.7		0 30.
135	36.	(DIRECT FLOW)		0 25.
132	105.	(DIRECT FLOW)		0 25.
128	123.	(DIRECT FLOW)		0 25.
137	204.	(DIRECT FLOW)		0 30.
134	135.	(DIRECT FLOW)		0 30.
225	36.	1.2		0 30.
224	93.	2.1		0 25.
210	101.	2.6		0 30.
227	209.	4.0		0 30.
223	128.	3.2		0 30.
116	83.	(DIRECT FLOW)		0 30.
136	127.	(DIRECT FLOW)		0 30.
111	251.	(DIRECT FLOW)		0 30.
104	336.	(DIRECT FLOW)		0 30.
107	59.	(DIRECT FLOW)		0 25.
213	64.	1.4		0 40.
221	96.	3.0		0 35.
220	220.	3.2		0 30.
212	265.	2.9		0 35.
206	40.	2.1		0 35.
118	246.	(DIRECT FLOW)		0 35.
133	366.	(DIRECT FLOW)		0 30.
131	306.	(DIRECT FLOW)		0 35.
222	0.	.0		0 0.
214	186.	2.5		0 50.
209	328.	3.9		0 35.
207	273.	3.2		0 40.
123	0.	(DIRECT FLOW)		0 0.
121	31.	(DIRECT FLOW)		0 40.
120	101.	(DIRECT FLOW)		0 40.
119	269.	(DIRECT FLOW)		0 45.
115	412.	(DIRECT FLOW)		0 35.
112	210.	(DIRECT FLOW)		0 35.
110	171.	(DIRECT FLOW)		0 35.
108	388.	(DIRECT FLOW)		0 40.

1

ENDPROGRAM PROGRAM CALLED

1

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY METCALF + EDDY, INC.
UNIVERSITY OF FLORIDA
WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)

UPDATED BY UNIVERSITY OF FLORIDA (JUNE 1973)
HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

0TAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

1

WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

0NUMBER OF TIME STEPS 48
0INTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 28 SUBCATCHMENTS

TIME(HR/MIN)		1	2	3	4	5	6	7	8	9	10
		11	12	13	14	15	16	17	18	19	20
		21	23	24	25	26	27	28	29		
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	10.	0.	0.	1.	0.	0.	0.	0.	1.	0.	1.
		0.	0.	0.	0.	0.	0.	1.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.		
0	15.	3.	3.	12.	6.	3.	6.	2.	9.	4.	9.
		5.	5.	3.	5.	3.	3.	17.	4.	4.	5.
		4.	6.	1.	1.	3.	2.	5.	4.		

0	20.	7.	8.	38.	22.	13.	19.	6.	35.	12.	34.
		17.	16.	12.	16.	8.	11.	43.	14.	13.	17.
		14.	19.	2.	1.	9.	6.	18.	12.		
0	25.	15.	19.	78.	48.	27.	39.	13.	72.	24.	76.
		35.	33.	34.	38.	18.	24.	82.	34.	30.	41.
		32.	38.	4.	3.	19.	12.	38.	25.		
0	30.	45.	54.	227.	109.	55.	79.	38.	146.	50.	184.
		92.	98.	78.	108.	65.	60.	177.	85.	83.	111.
		89.	79.	12.	8.	40.	26.	78.	52.		
0	35.	63.	80.	368.	189.	87.	117.	50.	232.	73.	343.
		157.	156.	141.	194.	105.	104.	203.	162.	140.	208.
		149.	113.	14.	11.	60.	35.	124.	79.		
0	40.	60.	79.	353.	194.	88.	106.	47.	216.	67.	381.
		163.	158.	211.	239.	113.	118.	157.	220.	156.	267.
		164.	100.	14.	11.	58.	33.	121.	76.		
0	45.	53.	70.	294.	168.	77.	85.	41.	172.	56.	342.
		146.	140.	241.	234.	109.	110.	112.	231.	145.	268.
		152.	80.	13.	11.	50.	29.	102.	64.		
0	50.	46.	62.	241.	141.	65.	68.	36.	136.	46.	291.
		126.	122.	230.	216.	100.	97.	82.	215.	129.	248.
		134.	62.	13.	11.	43.	25.	84.	53.		
0	55.	39.	54.	193.	116.	55.	54.	31.	207.	37.	242.
		107.	104.	209.	193.	90.	84.	59.	193.	113.	222.
		117.	48.	12.	11.	35.	20.	69.	43.		
1	0.	34.	46.	156.	95.	45.	42.	27.	84.	29.	201.
		90.	88.	185.	172.	81.	73.	47.	172.	98.	197.
		102.	35.	7.	11.	29.	14.	55.	34.		
1	5.	29.	41.	132.	81.	37.	33.	23.	71.	23.	170.
		78.	77.	164.	154.	73.	64.	43.	153.	87.	176.
		90.	29.	5.	12.	21.	11.	46.	26.		
1	10.	20.	34.	105.	67.	28.	27.	16.	57.	18.	144.
		65.	64.	145.	135.	64.	55.	33.	136.	75.	155.
		77.	24.	4.	11.	17.	9.	36.	21.		
1	15.	14.	26.	75.	50.	21.	20.	11.	41.	13.	112.
		50.	50.	127.	115.	54.	44.	23.	117.	62.	133.
		63.	17.	3.	7.	13.	7.	26.	16.		
1	20.	10.	18.	51.	36.	16.	15.	8.	32.	10.	85.
		38.	38.	108.	95.	45.	35.	17.	98.	50.	110.
		50.	13.	2.	4.	10.	5.	20.	12.		
1	25.	7.	12.	36.	26.	12.	11.	6.	23.	8.	64.
		26.	26.	91.	79.	37.	24.	13.	82.	40.	91.
		40.	10.	2.	3.	7.	4.	15.	9.		
1	30.	5.	9.	27.	20.	10.	9.	4.	19.	6.	46.
		19.	19.	75.	66.	31.	17.	11.	68.	32.	76.
		32.	8.	0.	3.	6.	3.	12.	7.		
1	35.	4.	7.	22.	16.	8.	8.	4.	16.	5.	36.
		15.	15.	63.	55.	25.	14.	11.	57.	22.	63.
		22.	7.	0.	2.	5.	3.	10.	6.		
1	40.	4.	6.	19.	14.	7.	7.	3.	15.	5.	30.
		13.	12.	53.	46.	17.	11.	10.	48.	17.	53.
		17.	7.	0.	2.	4.	2.	9.	5.		
1	45.	3.	5.	17.	13.	6.	7.	2.	14.	5.	26.
		11.	10.	44.	39.	13.	10.	10.	41.	14.	45.
		14.	6.	0.	0.	4.	2.	9.	5.		
1	50.	3.	4.	16.	12.	6.	7.	2.	14.	5.	23.
		10.	9.	35.	33.	10.	8.	10.	34.	12.	38.
		12.	6.	0.	0.	4.	2.	8.	5.		
1	55.	3.	4.	15.	11.	6.	7.	2.	14.	5.	22.
		9.	8.	30.	25.	8.	8.	10.	27.	10.	29.
		10.	6.	0.	0.	4.	2.	8.	5.		
2	0.	3.	4.	15.	11.	6.	7.	2.	14.	5.	21.
		9.	8.	27.	21.	7.	7.	10.	23.	9.	24.
		10.	6.	0.	0.	4.	2.	8.	5.		

2	5.	2. 7. 8.	3. 6. 5.	12. 24. 0.	10. 17. 0.	5. 6. 3.	6. 6. 2.	2. 6. 7.	12. 19. 4.	4. 8.	18. 20.
2	10.	1. 5. 6.	2. 4. 3.	8. 21. 0.	7. 13. 0.	4. 4. 2.	3. 5. 0.	0. 3. 5.	7. 16. 3.	2. 6.	13. 16.
2	15.	0. 4. 4.	2. 3. 1.	5. 16. 0.	4. 10. 0.	2. 3. 0.	2. 3. 0.	0. 0. 3.	4. 12. 2.	0. 4.	9. 12.
2	20.	0. 3. 3.	0. 2. 0.	3. 12. 0.	3. 7. 0.	1. 2. 0.	0. 2. 0.	0. 0. 2.	2. 9. 0.	0. 3.	6. 9.
2	25.	0. 2. 2.	0. 2. 0.	2. 9. 0.	2. 5. 0.	0. 2. 0.	0. 2. 0.	0. 0. 0.	0. 7. 0.	0. 2.	4. 7.
2	30.	0. 0. 2.	0. 0. 0.	0. 7. 0.	0. 4. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 5. 0.	0. 2.	3. 5.
2	35.	0. 0. 0.	0. 0. 0.	0. 5. 0.	0. 3. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 4. 0.	0. 0.	2. 4.
2	40.	0. 0. 0.	0. 0. 0.	0. 4. 0.	0. 2. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 3. 0.	0. 0.	0. 3.
2	45.	0. 0. 0.	0. 0. 0.	0. 3. 0.	0. 2. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 0.	0. 2.
2	50.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 2. 0.	0. 0.	0. 2.
2	55.	0. 0. 0.	0. 0. 0.	0. 1. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0. 0.	0. 0.	0. 0.

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BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	JK
202	103	0	1	CHANNEL	15.0	1380.	.0174	3.0	3.0	.069	6.00	0
203	134	0	2	PIPE	5.0	130.	.0194	1.0	1.0	.020	5.00	0
205	137	0	1	CHANNEL	.0	400.	.0040	4.0	4.0	.043	5.00	0
206	131	0	1	CHANNEL	.0	1500.	.0100	4.0	4.0	.065	3.00	0
207	108	0	1	CHANNEL	10.0	1440.	.0100	3.0	3.0	.057	5.00	0
209	115	0	1	CHANNEL	5.0	1660.	.0130	3.0	3.0	.057	7.00	0
210	111	0	1	CHANNEL	2.0	980.	.0204	4.0	4.0	.083	5.00	0
212	131	0	1	CHANNEL	10.0	1800.	.0150	4.0	4.0	.067	5.00	0
213	118	0	4	CHANNEL	10.0	2120.	.0160	3.0	3.0	.061	4.00	0
				OVERFLOW	34.0	2120.	.0160	5.0	5.0	.061	8.00	
214	119	0	4	CHANNEL	10.0	3780.	.0127	3.0	3.0	.056	4.00	0
				OVERFLOW	34.0	3780.	.0127	5.0	5.0	.056	8.00	
215	128	0	1	CHANNEL	.0	1550.	.0155	4.0	4.0	.090	3.00	0
216	128	0	1	CHANNEL	.0	1230.	.0178	4.0	4.0	.080	3.00	0
217	128	0	1	CHANNEL	2.0	910.	.0192	4.0	4.0	.098	5.00	0
218	113	0	1	CHANNEL	.0	200.	.0200	4.0	4.0	.084	3.00	0
219	138	0	2	PIPE	3.0	400.	.0200	1.0	1.0	.016	3.00	0
220	133	0	1	CHANNEL	5.0	1000.	.0130	4.0	4.0	.064	5.00	0
221	133	0	1	CHANNEL	.0	1400.	.0040	4.0	4.0	.045	5.00	0
222	123	0	1	CHANNEL	.0	1695.	.0240	4.0	4.0	.090	5.00	0
223	104	0	5	PIPE	5.0	1120.	.0106	.0	.0	.020	5.00	0
				OVERFLOW	.0	1120.	.0106	6.0	6.0	.020	2.00	
224	136	0	1	CHANNEL	.0	450.	.0170	4.0	4.0	.035	3.00	0
225	136	0	1	CHANNEL	.0	250.	.0480	4.0	4.0	.035	4.00	0
226	137	0	1	CHANNEL	.0	1350.	.0118	4.0	4.0	.045	3.00	0
227	104	0	1	CHANNEL	.0	500.	.0040	4.0	4.0	.045	5.00	0
228	139	0	1	CHANNEL	.0	500.	.0500	4.0	4.0	.045	5.00	0
301	102	8	2	PIPE	.1	1.	.0050	.0	.0	.020	5.50	0

```
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0        .3     5.0       1.3    25.0      2.3    30.0      4.3    90.0      6.3  100.0
                        9.0   400.0      12.4   500.0
302        140           4         2      PIPE                .1      1.     .0050      .0     .0      .020     11.00       0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0       1.4     1.0       2.1    71.0      4.6    92.0
303        129           4         2      PIPE                .1      1.     .0050      .0     .0      .020     11.00       0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0       2.5     1.0       3.2    16.2      4.4    16.2
305        125           4         2      PIPE                .1      1.     .0050      .0     .0      .020      5.00       0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                         .0      .0       1.0     1.0       1.5     2.0      3.5     6.0
102        202           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
103        203           5         3                          .0      1.     .0010      .0     .0      .001     10.00     222
                    DIVERSION TO GUTTER NUMBER 222 - TOTAL Q VS DIVERTED Q IN CFS
                         .0      .0     160.0      .0     200.0    40.0    300.0   140.0    400.0   217.0
104        212           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
105        205           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
107        206           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
111        220           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
113        228           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
116        213           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
118        214           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
122        301           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
130        303           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
129        218           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
128        210           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
133        209           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
127        126           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
125        215           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
126        302           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
124        305           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
131        207           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
132        224           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
134        223           5         3                          .0      1.     .0010      .0     .0      .001     10.00     226
                    DIVERSION TO GUTTER NUMBER 226 - TOTAL Q VS DIVERTED Q IN CFS
                         .0      .0     130.0      .0     150.0    20.0    200.0    70.0    400.0   270.0
135        225           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
136        221           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
137        227           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
138        217           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
139        302           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
140        219           0         3                          .0      1.     .0010      .0     .0      .001     10.00       0
0TOTAL NUMBER OF GUTTERS/PIPES,  55
1
```

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A. (AC)
102	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.2
103	202	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	164.5
104	223	227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
105	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	53.1
107	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	17.3
111	210	0	0	0	0	0	0	0	0	0	5	28	0	0	0	0	0	0	0	0	159.4
113	218	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	61.4
116	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	58.9
118	213	0	0	0	0	0	0	0	0	0	19	20	0	0	0	0	0	0	0	0	227.8
122	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	108.2
124	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	3.8
125	305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8
126	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8
127	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	3.8

128	215	216	217	0	0	0	0	0	0	0	6	27	0	0	0	0	0	0	0	0	104.3
129	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14.7
130	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	14.7
131	206	212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234.9
132	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	25.6
133	220	221	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0	220.2
134	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	164.5
135	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	15.4
136	224	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41.0
137	205	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
138	219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.3
139	228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61.4
140	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.3
202	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.2
203	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	164.5
205	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
206	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17.3
207	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234.9
209	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220.2
210	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104.3
212	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217.6
213	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58.9
214	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	227.8
215	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8
216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
217	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.3
218	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14.7
219	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.3
220	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	159.4
221	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41.0
222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
223	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	164.5
224	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.6
225	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.4
226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
227	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
228	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61.4
301	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.2
302	126	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.3
303	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14.7
305	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8

1

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond & Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 5 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS
THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.
(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)	138	111	210	128	217
0 5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
0 10.	0. .0( )	1. .0( )	0. .0( )	1. .0( )	0. .0( )
0 15.	0. .0( )	9. .0( )	1. .3( )	8. .0( )	0. .0( )
0 20.	0. .0( )	39. .0( )	8. .9( )	25. .0( )	0. .0( )
0 25.	0. .0( )	91. .0( )	25. 1.5( )	51. .0( )	0. .0( )
0 30.	0. .0( )	195. .0( )	61. 2.1( )	105. .0( )	0. .0( )
0 35.	4. .0( )	324. .0( )	113. 2.7( )	152. .0( )	1. .3( )
0 40.	62. .0( )	356. .0( )	146. 3.0( )	154. .0( )	15. 1.3( )
0 45.	82. .0( )	336. .0( )	157. 3.1( )	165. .0( )	50. 2.1( )
0 50.	75. .0( )	312. .0( )	163. 3.1( )	163. .0( )	70. 2.4( )
0 55.	90. .0( )	282. .0( )	159. 3.1( )	153. .0( )	79. 2.5( )
1 0.	75. .0( )	248. .0( )	147. 3.0( )	138. .0( )	81. 2.6( )
1 5.	90. .0( )	218. .0( )	135. 2.9( )	127. .0( )	82. 2.6( )
1 10.	75. .0( )	189. .0( )	125. 2.8( )	118. .0( )	82. 2.6( )
1 15.	90. .0( )	163. .0( )	116. 2.7( )	109. .0( )	82. 2.6( )
1 20.	74. .0( )	144. .0( )	108. 2.7( )	103. .0( )	82. 2.6( )
1 25.	83. .0( )	129. .0( )	101. 2.6( )	95. .0( )	79. 2.5( )
1 30.	67. .0( )	116. .0( )	94. 2.5( )	89. .0( )	76. 2.5( )
1 35.	71. .0( )	106. .0( )	88. 2.4( )	82. .0( )	71. 2.4( )
1 40.	34. .0( )	95. .0( )	78. 2.3( )	68. .0( )	58. 2.2( )
1 45.	31. .0( )	80. .0( )	65. 2.2( )	51. .0( )	41. 1.9( )
1 50.	11. .0( )	65. .0( )	50. 1.9( )	38. .0( )	29. 1.7( )

1	55.	19. .0( )	54. .0( )	39. 1.8( )	30. .0( )	21. 1.4( )
2	0.	3. .0( )	46. .0( )	32. 1.6( )	25. .0( )	15. 1.3( )
2	5.	16. .0( )	39. .0( )	26. 1.5( )	20. .0( )	12. 1.2( )
2	10.	0. .0( )	29. .0( )	21. 1.3( )	14. .0( )	10. 1.1( )
2	15.	13. .0( )	21. .0( )	16. 1.2( )	11. .0( )	8. 1.0( )
2	20.	0. .0( )	15. .0( )	12. 1.1( )	7. .0( )	7. .9( )
2	25.	7. .0( )	9. .0( )	9. .9( )	6. .0( )	5. .8( )
2	30.	0. .0( )	7. .0( )	7. .8( )	5. .0( )	4. .7( )
2	35.	3. .0( )	6. .0( )	6. .8( )	4. .0( )	3. .6( )
2	40.	0. .0( )	5. .0( )	5. .7( )	3. .0( )	2. .5( )
2	45.	2. .0( )	4. .0( )	4. .6( )	3. .0( )	2. .5( )
2	50.	0. .0( )	3. .0( )	3. .6( )	2. .0( )	2. .5( )
2	55.	2. .0( )	3. .0( )	3. .5( )	2. .0( )	1. .4( )
3	0.	0. .0( )	2. .0( )	2. .5( )	2. .0( )	1. .4( )
3	5.	2. .0( )	2. .0( )	2. .5( )	2. .0( )	1. .4( )
3	10.	0. .0( )	2. .0( )	2. .5( )	2. .0( )	1. .4( )
3	15.	2. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	20.	0. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	25.	2. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	30.	0. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	35.	2. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	40.	0. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	45.	2. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	50.	0. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
3	55.	2. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )
4	0.	0. .0( )	2. .0( )	2. .4( )	2. .0( )	1. .4( )

BASIN 4600-09 FUTURE MASTERPLAN Modified Pond @ Park Glen RGCE
KIOWA ENGINEERING FILENAME 6040.SIN

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
130	50.	(DIRECT FLOW)		0 35.
303	1.	.1	2.5	2 5.
129	1.	(DIRECT FLOW)		2 5.
218	1.	.5		2 10.
113	144.	(DIRECT FLOW)		0 35.
228	143.	2.2		0 40.
127	12.	(DIRECT FLOW)		1 5.
139	143.	(DIRECT FLOW)		0 40.
126	12.	(DIRECT FLOW)		1 5.
122	368.	(DIRECT FLOW)		0 35.
302	80.	.1	3.5	1 5. ←
301	214.	.1	7.3	0 55.
140	80.	(DIRECT FLOW)		1 5.
124	14.	(DIRECT FLOW)		0 35.
102	214.	(DIRECT FLOW)		0 55.
219	80.	3.0	.0	0 55.
305	1.	.1	.7	1 30.
202	201.	2.3		1 0.
138	90.	(DIRECT FLOW)		0 55.
125	1.	(DIRECT FLOW)		1 30.
105	232.	(DIRECT FLOW)		0 35.
103	312.	(DIRECT FLOW)		0 55.
217	80.	2.6		1 15.
216	0.	.0		0 0.
215	1.	.5		2 30.
226	31.	1.6		1 5.
205	229.	4.1		0 40.
203	163.	3.1		0 55.
135	60.	(DIRECT FLOW)		0 35.
132	113.	(DIRECT FLOW)		0 35.
128	165.	(DIRECT FLOW)		0 45.
137	234.	(DIRECT FLOW)		0 40.
134	163.	(DIRECT FLOW)		0 55.
225	60.	1.4		0 40.
224	107.	2.2		0 35.
210	163.	3.1		0 50.
227	226.	4.1		0 40.
223	130.	3.2		0 40.
116	164.	(DIRECT FLOW)		0 40.
136	166.	(DIRECT FLOW)		0 35.
111	356.	(DIRECT FLOW)		0 40.
104	356.	(DIRECT FLOW)		0 40.
107	73.	(DIRECT FLOW)		0 35.
213	141.	2.1		0 50.
221	143.	3.5		0 45.
220	345.	3.8		0 45.
212	327.	3.3		0 50.
206	57.	2.4		0 45.
118	551.	(DIRECT FLOW)		0 45.
133	552.	(DIRECT FLOW)		0 45.
131	381.	(DIRECT FLOW)		0 50.
222	131.	3.1		1 0.
214	469.	3.9		0 55.
209	529.	4.8		0 50.
207	367.	3.7		0 55.
123	131.	(DIRECT FLOW)		1 0.
121	113.	(DIRECT FLOW)		0 40.
120	231.	(DIRECT FLOW)		0 45.
119	665.	(DIRECT FLOW)		0 50.
115	633.	(DIRECT FLOW)		0 45.
112	350.	(DIRECT FLOW)		0 45.
110	381.	(DIRECT FLOW)		0 40.
108	610.	(DIRECT FLOW)		0 50.

1

ENDPROGRAM PROGRAM CALLED

ERO

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
erocorp@aol.com

Denver • Boise

6040
cc DLM

RECEIVED
DEC 3 1996

December 2, 1996

Mr. Stuart Gardner
RG Consulting Engineers, Inc.
1331 17th Street, Suite 710
Denver, Colorado 80202

RE: Ute Ladies'-tresses Orchid Survey at Long's Way Drainage Improvements

Dear Mr. Gardner,

Attached is a letter from the U.S. Fish and Wildlife Service accepting the Ute ladies'-tresses orchid survey. This permit lasts for three years. If construction does not occur within 3 years, then another survey may need to be conducted, especially if conditions on the site have changed. This letter will be included in a the wetland delineation report sent to the U.S. Army Corps of Engineers.

Please call me if you have any questions. Thank you.

Sincerely,

Denise E. Larson

Denise E. Larson
Ecologist

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Colorado Field Office
P.O. Box 25486
Denver Federal Center
Denver, Colorado 80225-0207

ES/CO: ES/Species/Plants/
Spiranthes diluvialis/
Survey Reports
Mail Stop 65412

NOV 18 1996

NOV 27

Denise E. Larson
ERO Resources Corporation
1740 High Street
Denver, Colorado 80218

Dear Ms. Larson:

Based on the authority conferred to the U.S. Fish and Wildlife Service (Service) by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), the Service reviewed your *Spiranthes diluvialis* (Ute Ladies'-tresses Orchid) Survey Report for the Town of Parker's proposed Long's Way Drainage project in the Douglas County, Colorado (Township 6 South, Range 66, Section 15). As described in your report, the proposed project involves several drainage way improvement structures near Long's Way and Parker Road in Parker. A detention pond is planned for the open area west of Parkglenn Way and north of Long's Way with an outfall structure from the pond to Parker Road.

The Service has reviewed your habitat survey and concurs with the determination that suitable habitat is not present in the area surveyed and no individuals of the orchid were identified. Therefore, the Service concurs that the project will not adversely affect the continued existence of the orchid.

The Service appreciates your submittal of the habitat survey for our review and comment. If the Service can be of further assistance, please contact Jan McKee at (303) 275-2370.

Sincerely,

LeRoy W. Carlson
Colorado Field Supervisor

cc: U.S. Army COE; Littleton, CO (Attn.: Rex Fletcher)
Reading file
Project file

Reference: JPM*ES\ORCHID\1995\SDERO41114.WPF

ERO

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
erocorp@aol.com

Denver • Boise

RECEIVED
NOV 7 1996

6040
cc DLM

November 4, 1996

Mr. Stuart Gardner
RG Consulting Engineers, Inc.
1331 17th Street, Suite 710
Denver, Colorado 80202

RE: Ute Ladies'-tresses Orchid Survey at Long's Way Drainage Improvements

Dear Mr. Gardner,

I just wanted to touch base with you on the environmental surveys of the Long's Way drainage project. Attached is a copy of the results of the orchid survey that I have sent to the U.S. Fish and Wildlife Service. No orchids were found. As for the wetland delineations, please let me know when the plans have been formalized and I will survey the areas affected by the project.

Please call me if you have any questions or comments.

Sincerely,

Denise E. Larson

Denise E. Larson
Ecologist

Enclosure

ERO
RESOURCES CORPORATION
Consultants in Natural Resources and the Environment

DLM
6040

RECEIVED
SEP 11 1996

September 9, 1996

Mr. Stuart Gardner
1331 Seventeenth Street, Suite 710
Denver, Colorado 80202

RE: Survey for Ute Ladies'-tresses

Dear Mr. Gardner:

As you requested, I have surveyed the proposed Longs Way tributary ponds and outfall sites for wetlands and the rare plant Ute ladies' tresses orchid (*Spiranthes diluvialis*). No orchids were found. However, two wetlands were found along drainages west of Parkglenn Road.

The first wetland (Site 1) occurs near Longs Way along a drainage ditch running from a culvert under Parkglenn Road to Parker Road. This highly disturbed wetland contains willows, cottonwoods, Russian olives, and a variety of mostly weedy herbaceous species. The second wetland (Site 2) occurs along a drainage ditch that flows from Parkglenn Road at the northeast corner of the property, veers north and then flows east to Parker Road. This wetland is similar to the first with a combination of trees, shrubs, and weedy herbaceous species.

Both of these wetlands are considered under the jurisdiction of the U.S. Army Corps of Engineers and would require a permit to dredge or fill. According to the preliminary plan, one possible outfall route would affect the northernmost wetland (Site 2). Part of the requirements for getting a permit from the Corps is to avoid affecting wetlands wherever possible. Avoiding this drainage would help fulfill the Corps requirements.

As we discussed on the phone, my work schedule for this project includes:

1. Within the next month, sending a letter to the USFWS stating that no Ute ladies'-tresses orchid has been found on this site.
2. Sending you a list of recommended native prairie and wetland species for revegetating the area.
3. Sending a permit request to the Corps after the final plans have been completed

If you have any questions, please give me a call.

Sincerely,

Denise E Larson

Denise E. Larson
Ecologist

5-05-199 3:57PM FROM

GEC
Ground
Engineering
Consultants, Inc.

Geotechnical Investigation
Longs Way Tributary Drainage Improvements
Parker, Colorado
(Draft Submittal)

Prepared for:

RG Consulting Engineers, Inc.
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Attention: Mr. David Mallory, P.E.

Job Number 97-185

April 30, 1997

Ground Engineering Consultants, Inc.

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PURPOSE AND SCOPE OF STUDY

This report presents the results of a geotechnical investigation for the proposed Longs Way Tributary Drainage Improvements in the City of Parker, Colorado. The project site is shown on Figure 1. The study was conducted in accordance with the contract dated May 14, 1997.

A field exploration program was conducted to obtain information on subsurface conditions. Material samples obtained during the subsurface investigation were tested in the laboratory to provide data on the classification and engineering characteristics of the on-site soils and bedrock. The results of the field and laboratory investigations are presented herein.

This report has been prepared to summarize the data obtained and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to the proposed improvements are included.

PROPOSED CONSTRUCTION

It is our understanding that the proposed project will consist of:

(1) Construction of a detention pond, the upper pond, approximately 24,000 square feet in area on the east side of Donley Drive,

(2) Removal and replacement of two (2) 10-foot drainage inlets at the location where the existing storm sewer crosses Donley Drive,

(3) Construction of a new pond, the lower pond, approximately 480 feet by 120 feet in area on the west side of Parkglen Way and north of Longs Way,

(4) Construction a 36-inch RCP outfall from the lower pond to Parker Road.

The proposed elevations for the upper pond will be approximately 5,895 feet at the top of berm and approximately 5,884 feet at the bottom of pond. The proposed elevations for the lower pond will be approximately 5,878 feet along Parkglen Way, approximately 5,870 feet at the top of the west berm, and approximately 5,861 feet at the bottom of pond. It is anticipated that cuts up to approximately 6 feet and fills up to approximately 11 feet will be performed for the upper pond, and cuts up to approximately 14 feet and fills up to approximately 8 feet will be performed for the lower pond. The ponds will be constructed with embankment slopes ranging from 4 (horizontal): 1 (vertical) to 3:1. Temporary excavations up to approximately 7 feet deep will be performed for installation of the 36-inch RCP outfall.

If proposed constructions or conditions are significantly different from those described above, we should be notified to reevaluate the recommendations contained in this report.

SITE CONDITIONS

The proposed site for the upper pond is located in a tributary valley approximately 200 feet east of Donley Drive. At the time of our field investigation, the site was vacant and covered with natural grasses, weeds, and scattered yuccas. The general topography at the site was gently to moderately sloping to the south, west, and north toward the site on an order of 3 to 8 percent. Two 36-inch RCPs existed to the west of the site carrying tributary water through the residential areas located to the west. At the time of our investigation, the tributary valley and RCPs were dry.

The site of the proposed removal and replacement of drainage inlets is located on the both sides of Donley Drive. At the time of our field investigation, Donley Drive was an asphalt paved 2-lane local street with concrete curb and gutter. Single family residences existed on the both sides of the street.

The proposed site of the lower pond and the 36-inch RCP outfall is located on the north side of Longs Way between Parker Road and Parkglen Way. At the time of our field investigation, the site was vacant and covered with natural grasses and weeds. The general topography at the site was gently to moderately sloping downward to the west on an order of 5 to 15 percent. Existing commercial buildings were located between the pond site and Parker Road. A drainage ditch approximately 60 feet wide and 6 to 10 feet deep existed in the southern section of the pond site. At the time of our investigation, the drainage ditch was dry.

FIELD INVESTIGATION

The field investigation for the project was conducted on March 21, 1997. Five (5) test holes were drilled at the site to explore the subsurface conditions. Two (2) of the test holes were drilled within the approximate limits of the proposed lower pond, one (1) test hole at the proposed alignment of 36-inch RCP outfall, one (1) test hole between the existing drainage inlets in Donley Drive, and the remaining one (1) test hole within the approximate limits of the proposed upper pond. The approximate locations of the test holes are shown on Figure 1. The test holes were advanced through the overburden soils and bedrock with 4-inch diameter continuous flight power augers. The test holes were logged by a representative of Ground Engineering Consultants, Inc.

Samples of the subsurface materials were taken with a 2-inch I.D. California liner sampler. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30 inches. The California liner test is similar to the standard penetration test described by ASTM Method D-1586. Penetration resistance values, when properly evaluated, indicate the relative density or consistency of the soils and bedrock. Depths at which the samples were taken and the penetration resistance value are shown on the logs of the exploratory holes in Figures 2 and 3. The associated legend and notes for the logs are also shown in Figure 4.

Measurements of the groundwater level were made in the test holes by lowering a weighted tape into the open holes shortly after completion of drilling.

LABORATORY INVESTIGATION

Samples obtained from our exploratory holes were examined and classified in the laboratory by the project engineer. Laboratory testing included standard property tests such as natural moisture contents, dry unit weights, grain size analyses, and liquid and plastic limits. Swell-consolidation testing was performed on selected samples of bedrock to determine the swell potential upon wetting and loading. Unconfined compressive strength was determined for several samples of the overburden soils and bedrock.

Results of the swell-consolidation tests are presented in Figures 5 through 7. Results of the laboratory testing program are summarized on Table 1. The laboratory testing was conducted in general accordance with applicable ASTM specifications.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the test holes generally consisted of a thin veneer of topsoil or a flexible composite pavement section overlying natural sand and clay and isolated areas of natural clay which was underlain by claystone bedrock. The flexible composite pavement section encountered in Donley Drive consisted of approximately 3 inches of asphalt over approximately 3 inches of base course. Bedrock was encountered in the test holes at depths ranging from approximately 3 to 19 feet below the existing ground surface.

Natural sand and clay was encountered near the ground surface in all of the test holes to depths ranging from approximately 3 to 12 feet. The sand and clay ranged from sandy clay to sand and clay with occasional silty sand lenses, and was medium to highly plastic, fine to medium to occasionally coarse grained, very stiff to hard, slightly moist to moist, light brown to brown in color, and occasionally calcareous.

Natural clay was encountered underlying the natural sand and clay in Test Holes 1 and 2 with a thickness of approximately 9 to 10 feet. The clay was slightly sandy with occasional clayey sand lenses, and was highly plastic, fine grained, very stiff, moist, and brown to occasionally olive in color.

Claystone bedrock was encountered in all of the test holes underlying the overburden soils at depths ranging from approximately 3 to 19 feet below the existing ground surface. The claystone bedrock was slightly sandy to sandy with occasional sandstone lenses, and was medium to highly plastic, fine grained, medium hard to very hard, moist, and brown to olive in color with iron staining.

At the time of drilling, free groundwater was not encountered in any of the test holes. However, groundwater levels may fluctuate seasonally and with changes in precipitation.

GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

Proper construction techniques concerning excavation and embankments should be followed to insure the safety and satisfactory long-term performance of the proposed facility. Geotechnical concerns during construction and our recommendations are provided as follows:

<u>Detention Ponds</u>:

(1) Based on the subsurface conditions encountered in the test holes, it appears that excavations for the upper and lower detention ponds will be performed in both natural soils and claystone bedrock. We believe that the excavations will be possible with conventional excavation equipment.

(2) The materials encountered in the test holes classify as Type B soils overlying bedrock in accordance with the OSHA Standards. *Temporary* excavation slopes up to 15 feet in total height may be constructed not steeper than a ratio of 1 (H) to 1 (V) in the natural soils and 3/4 (H) to 1 (V) in bedrock. Some minor surface sloughing may occur on the slope faces at the angle given above. However, large-scale slope failures are unlikely, unless the water seepage is present on the slopes.

(3) Any excavations in which people will be working must comply with all OSHA Standards and Regulations.

(4) ***Permanent*** unretained cut and fill slopes less than 15 feet in total height will be stable at a slope not steeper than a ratio of 3 (H) to 1 (V). The risk of slope instability will be significantly increased if seepage is encountered on the slope. No formal stability analysis was performed to evaluate the slope recommended herein. Published literature and our experience with similar cuts and fills indicate the recommended slope should have an adequate factor of safety.

(5) The undisturbed natural soils and bedrock encountered at the site are suitable for support of the proposed embankments and structures with an allowable bearing pressure of 2,500 psf.

(6) Prior to the placement of fill materials, all of the vegetation and topsoil should be removed from the fill areas. The underlying soils should be scarified to a minimum depth of 12 inches, properly mixed and moisture conditioned to an uniform moisture content within 1 percent below to 3 percent above the optimum, and recompacted to at least 95 percent of the standard Proctor dry density (ASTM D-698).

(7) Based on the results of our field and laboratory investigations, the on-site materials consist primarily of natural sand and clay, natural clay, and claystone bedrock. The majority of the on-site materials classify as A-7-5 to A-7-6 soils in accordance with the AASHTO classification system, or CL to CH soils in the Unified Soil Classification System. We believe that the on-site soils and bedrock under proper compaction are suitable for the fill of the proposed embankments.

(8) The natural moisture contents of the on-site materials were highly variable ranging from well below to well above the optimum. The on-site fill materials should be thoroughly broken apart, mixed, and moisture conditioned to an uniform moisture content within 1 percent below and 3 percent above the optimum, placed in uniform loose lifts not exceeding 8 inches, and compacted to at least 95 percent of the maximum standard Proctor dry density (ASTM D-698).

(9) Good surface drainage should be provided around all cut and fill slopes to direct surface runoff away from the face of slope. Cut and fill slopes and other stripped areas should be properly protected against erosion.

(10) Although groundwater was not encountered in any of the test holes during our field investigation, high natural moisture contents found in some of the soil samples indicates that groundwater may be encountered on top of the natural clay and claystone bedrock in the wet or raining seasons. A temporary dewatering system may be required during construction, if groundwater is encountered in the excavations.

(11) A representative of the soil engineer should observe and test the compaction of the fills during construction.

Drainage Inlets and Outfall:

(1) Based on the subsurface conditions encountered in the test holes, it appears that excavations for the drainage inlets and outfall will be performed in natural soils. We believe that the excavations will be possible with conventional trenching equipment.

(2) The materials encountered in the test holes classify as Type B soils in accordance with the OSHA Standards. Temporary excavation slopes up to 15 feet in total height may be constructed not steeper than a ratio of 1 (H) to 1 (V) in the natural soils. Shoring may be required if space limitations inhibit the construction of the slopes at this recommended angle. Some minor surface sloughing may occur on the slope faces at the angle given above. However, large-scale slope failures are unlikely, unless the water seepage is present on the slopes.

(3) Slope instability caused by adjacent buildings or traffic loadings should be considered.

(4) Any excavations in which people will be working must comply with all OSHA Standards and Regulations, especially the OSHA Regulation, 29CFR, part of 1926 OSHA Standards-Excavations, adopted March 5, 1990.

(5) Although groundwater was not encountered in any of the test holes during our field investigation, high natural moisture contents found in some of the soil samples indicates that groundwater may be encountered on top of the natural clay and claystone bedrock in the wet or raining seasons. A temporary dewatering system may be required during construction, if groundwater is encountered in the excavations.

(6) Good surface drainage should be provided around the excavations to direct surface runoff away from the excavations, and to prevent water from ponding on the site.

(7) The on-site materials excavated from the trenches may be used for backfill. However, the natural moisture contents of the on-site materials were highly variable ranging from well below to well above the optimum. The on-site backfill materials should be thoroughly broken apart, mixed. and moisture conditioned to an uniform moisture content within 1 percent below and 3 percent above the optimum, placed in uniform loose lifts not exceeding 8 inches, and compacted to at least 95 percent of the maximum standard Proctor dry density (ASTM D-698).

(8) A representative of the soil engineer should observe and test the compaction of the backfills during the construction.

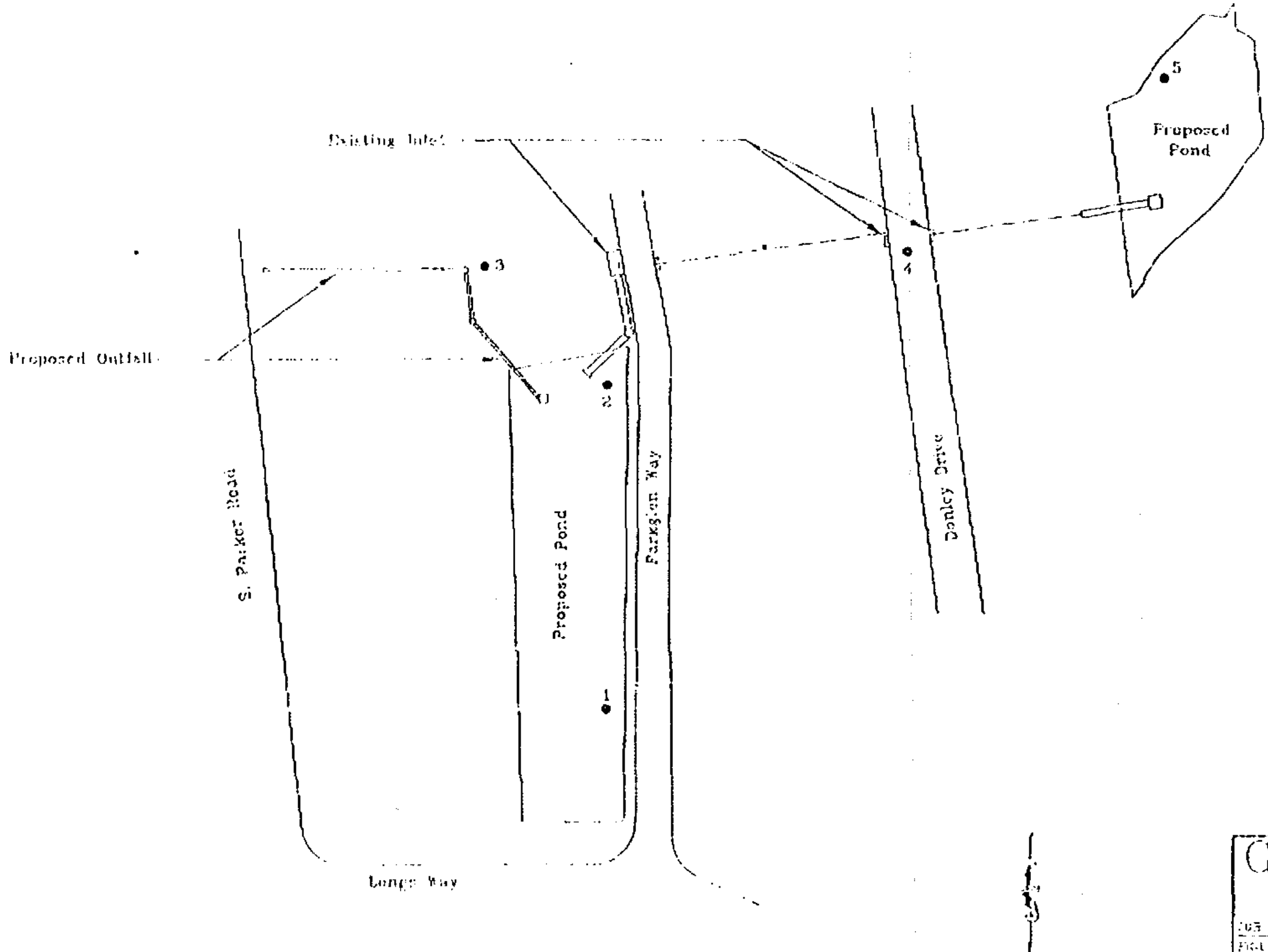
LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area for use by the client for construction purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory holes drilled at the location indicated on the exploratory hole plan. The nature and extent of variations between the exploratory holes may not become evident until excavation is performed. If during construction, soil, bedrock, and groundwater conditions appear to be different from those described herein, this office should be advised at once so that reevaluation of the recommendations may be made. We recommend on-site observation of excavations and backfill operations by a soil engineer.

Sincerely,
GROUND ENGINEERING CONSULTANTS, INC.

Hsien-Hsiang (Sean) Chiang

Reviewed by James A. Noll, P.E.



1
● Indicates test hole number and approximate location

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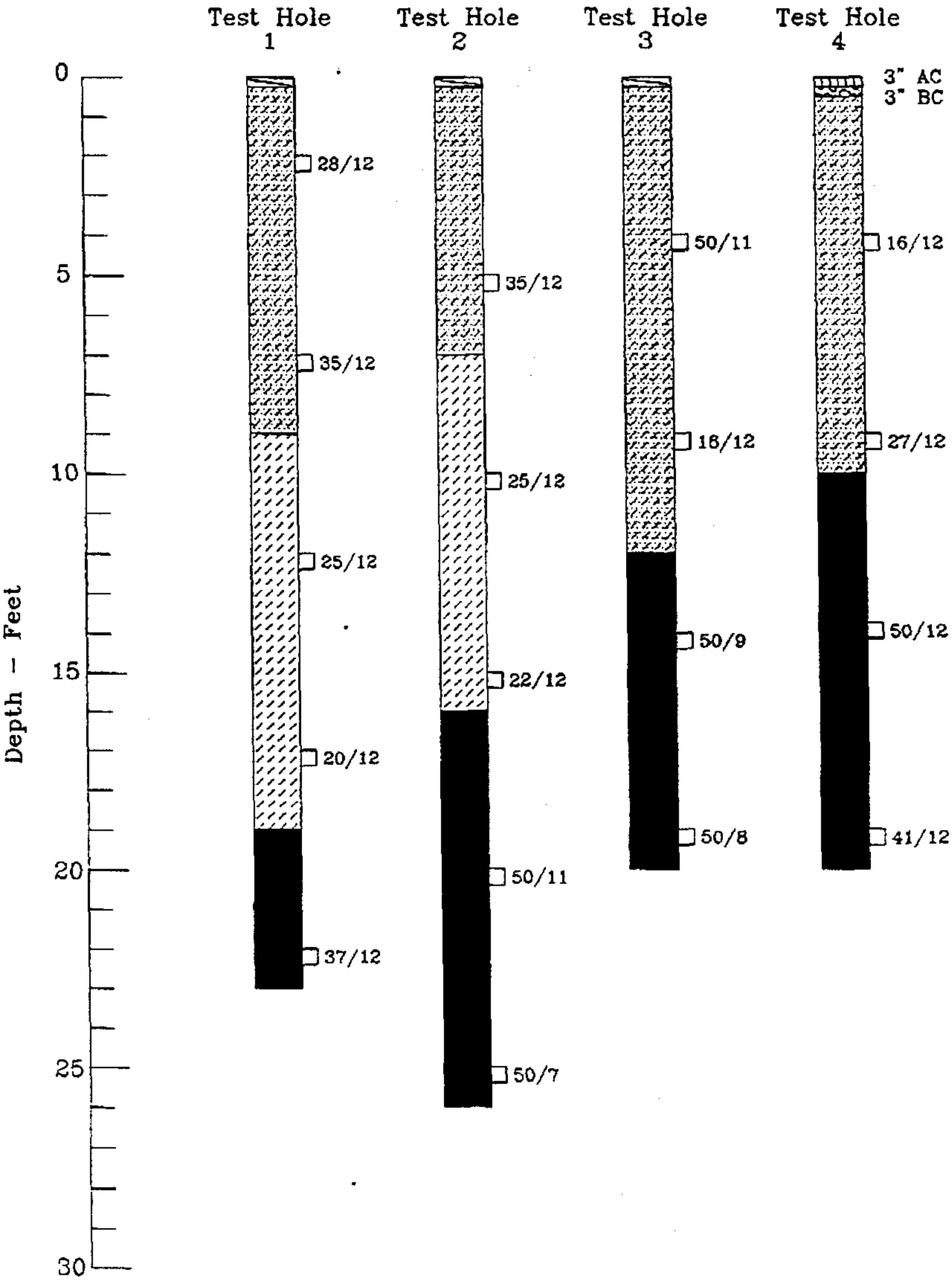
JOB NO. 97-135	SCALE: NTS
FIGURE: 1	DRAWN BY: AJS
CADFILE NAME: 185SITE.DWG	APPROVED: JN

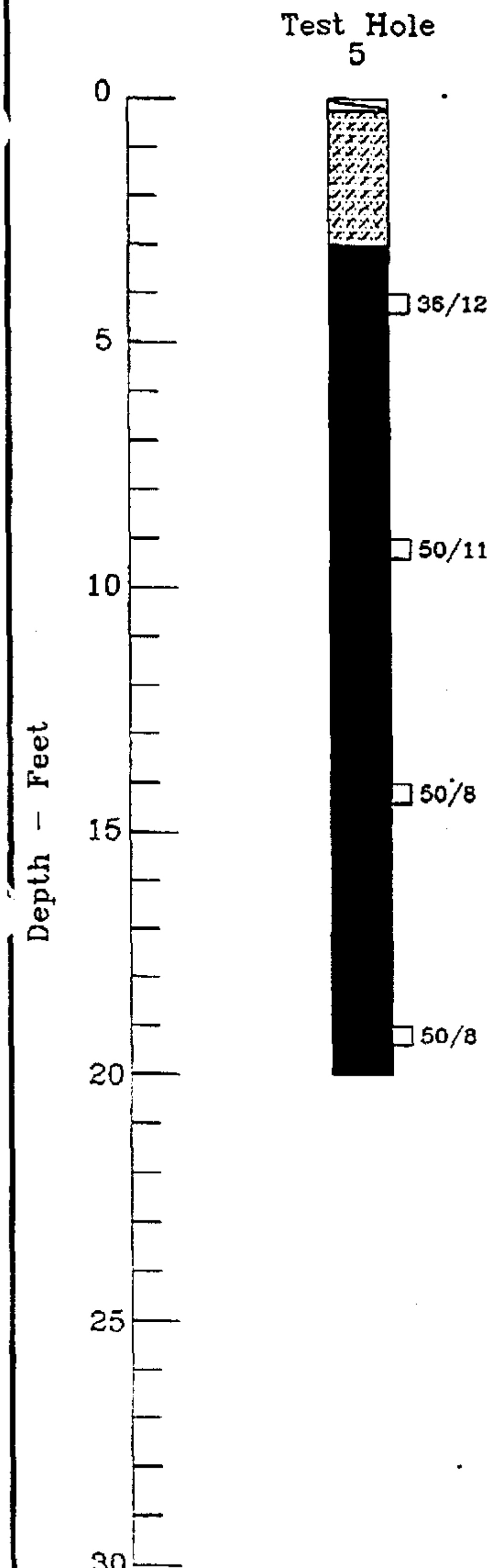
LOCATIONS OF TEST HOLES



GROUND ENGINEERING CONSULTANTS, INC.

LOGS OF TEST HOLES

JOB NO. 97-185	DRAWN BY: TAS
FIGURE: 2	APPROVED BY: JN
CADFILE NAME: 185LOG1.DWG	



GROUND ENGINEERING CONSULTANTS, INC.

LOGS OF TEST HOLES

JOB NO. 97-185	DRAWN BY: TAS
FIGURE: 3	APPROVED BY: JN
CADFILE NAME: 185LOG2.DWG	

LEGEND:

Topsoil.

Asphalt Concrete.

Aggregate Base Course.

Sand and Clay: Sandy clay to sand and clay with occasional silty sand lenses, medium to highly plastic, fine to medium to occasionally coarse grained, very stiff to hard, slightly moist to moist, light brown to brown, occasionally calcareous.

Clay: Slightly sandy with occasional clayey sand lenses, highly plastic, fine grained, very stiff, moist, brown to occasionally olive.

Claystone Bedrock: Slightly sandy to sandy with occasional sandstone lenses, medium to highly plastic, fine grained, medium hard to very hard, moist, brown to olive with iron staining.

Drive sample, 2-inch I.D. California liner sample

23/12 Drive sample blow count, Indicates 23 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches.

NOTES:

1) Test holes were drilled on 3/21/97 with 4-inch diameter continuous flight power augers.

2) Locations of the test holes were measured approximately by pacing from features shown on the site plan provided.

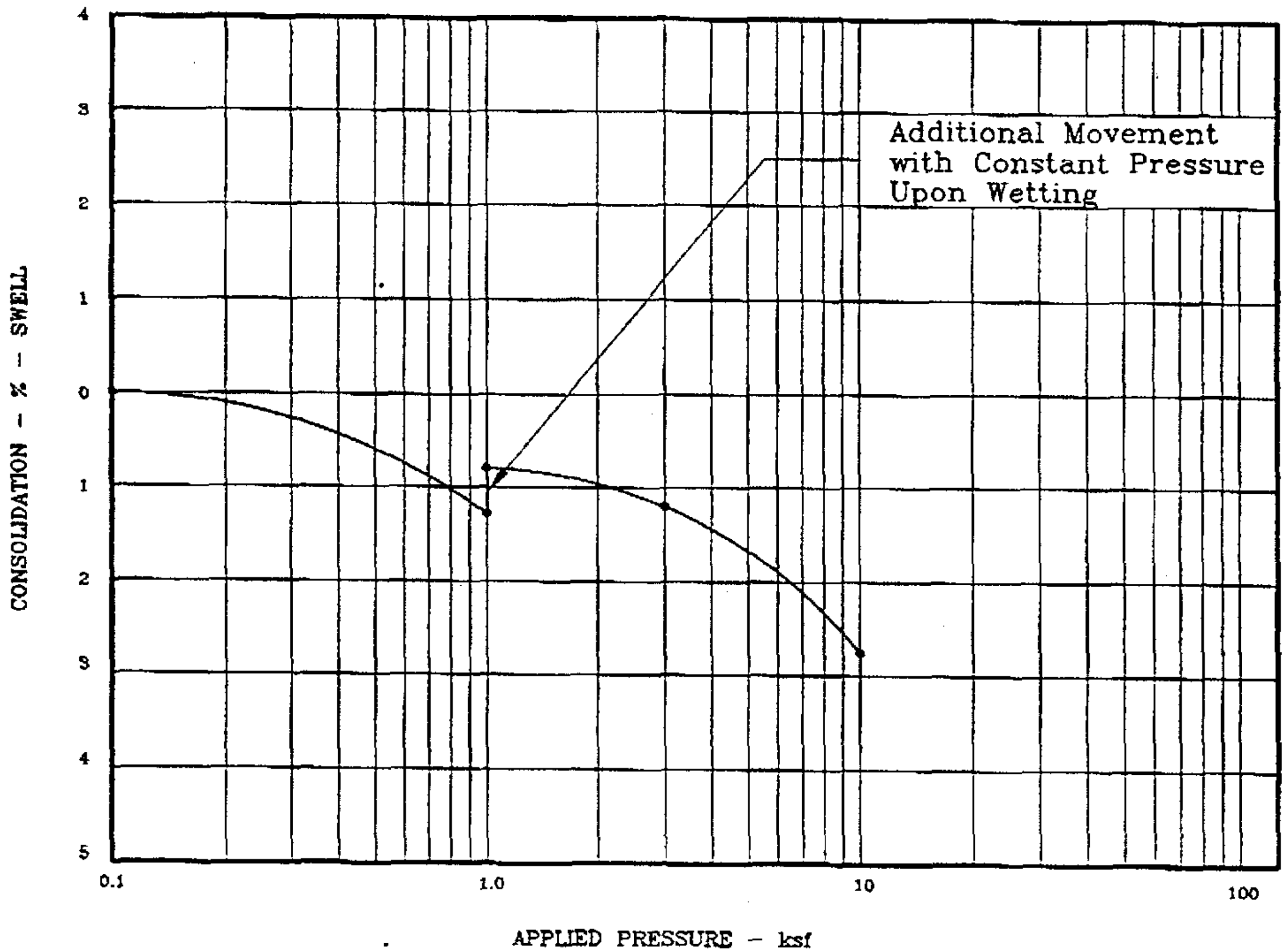
3) Elevations of the test holes were not measured and the logs of the test holes are drawn to depth.

4) The test hole locations and elevations should be considered accurate only to the degree implied by the method used.

5) The lines between materials shown on the test hole logs represent the approximate boundaries between material types and the transitions may be gradual.

6) Groundwater was not encountered during drilling. Groundwater levels can fluctuate seasonally and in response to landscape irrigation.

GEC GROUND ENGINEERING CONSULTANTS, INC.	
LEGEND AND NOTES	
JOB NO. 97-185	DRAWN BY: TAS
FIGURE: 4	APPROVED BY: JN
CADFILE NAME: 185LEG.DWG	



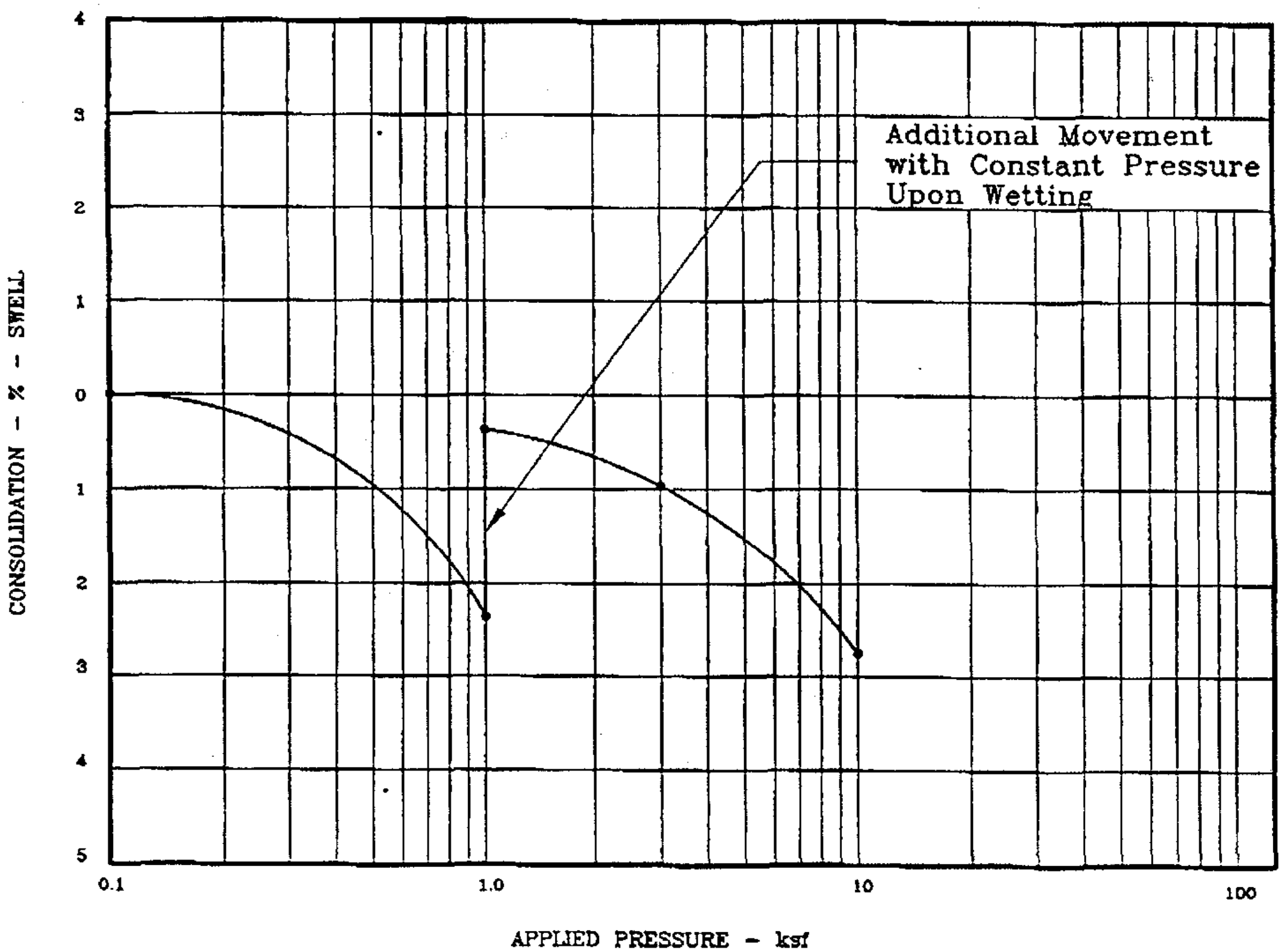
Moisture Content = 28.5 percent

Dry Unit Weight = 95.2 pcf

Sample of: Sandstone/Claystone Bedrock

From: Test Hole 2 at 25 ft

GEC GROUND ENGINEERING CONSULTANTS, INC.	
SWELL-CONSOLIDATION TEST RESULTS	
JOB NO. 97-185	DRAWN BY: TAS
FIGURE: 5	APPROVED BY: JN
CADFILE NAME: 185SWL1.DWG	



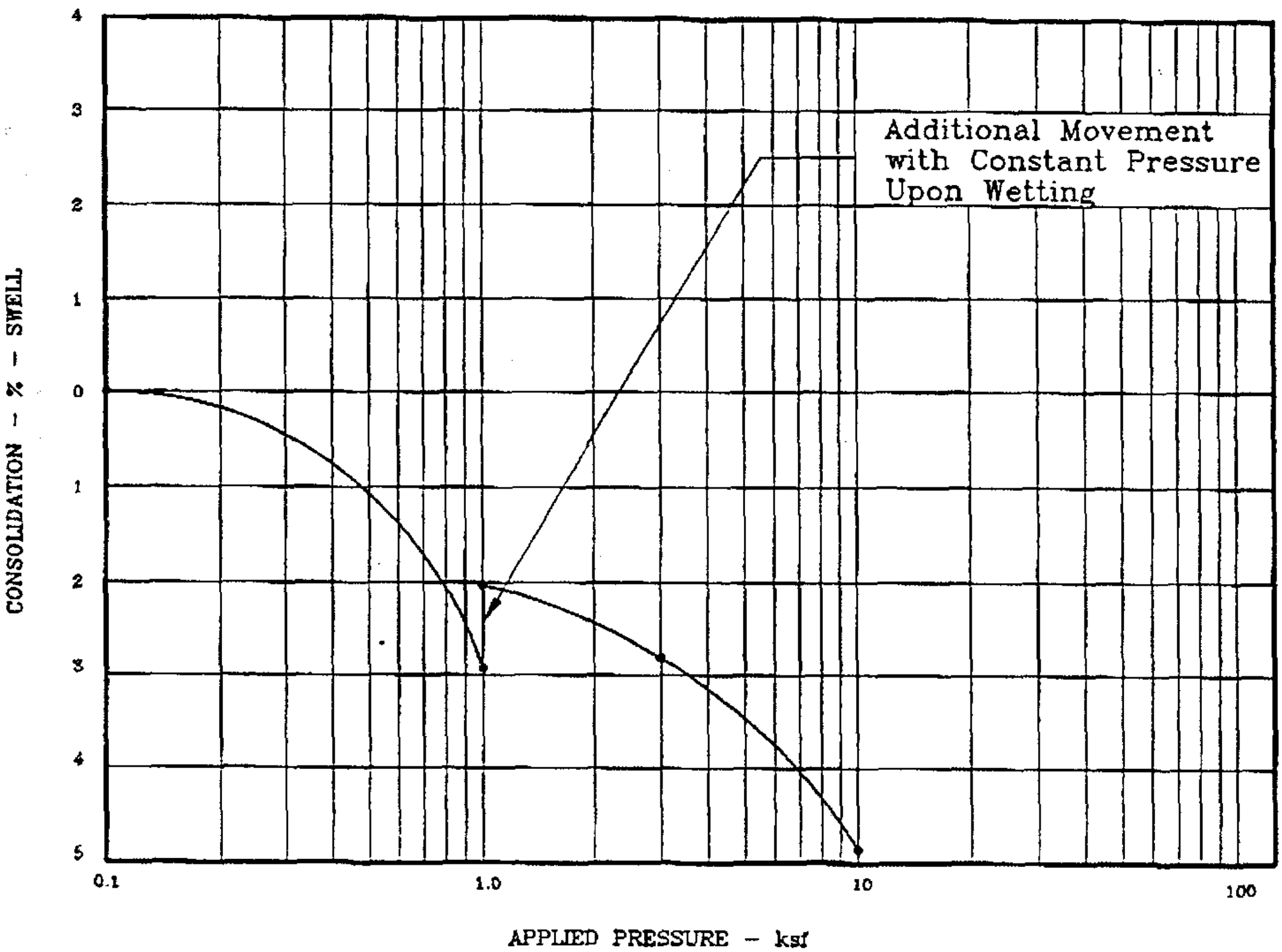
Moisture Content = 35.0 percent

Dry Unit Weight = 86.6 pcf

Sample of: Sandy Claystone Bedrock

From: Test Hole 3 at 19 ft

GEC GROUND ENGINEERING CONSULTANTS, INC.	
SWELL-CONSOLIDATION TEST RESULTS	
JOB NO. 97-185	DRAWN BY: TAS
FIGURE: 6	APPROVED BY: JN
CADFILE NAME: 185SWL2.DWG	



Moisture Content = 50.7 percent

Dry Unit Weight = 71.8 pcf

Sample of: Claystone Bedrock

From: Test Hole 4 at 19 ft

GEC GROUND ENGINEERING CONSULTANTS, INC.	
SWELL-CONSOLIDATION TEST RESULTS	
JOB NO. 97-185	DRAWN BY: TAS
FIGURE: 7	APPROVED BY: JN
CADFILE NAME: 185SWL3.DWG	

GROUND

ENGINEERING CONSULTANTS

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

Sample Location		Natural Moisture Content (%)	Natural Dry Density (pcf)	Percent Passing No. 200 Sieve	Atterberg Limits		Percent Swell (1000 psf surcharge)	Unconfined Compressive Strength (psf)	Soil or Bedrock Type
Test Hole No.	Depth (feet)				Liquid Limit (%)	Plasticity Index (%)			
1	2	6.9		54	29	14			Sand and Clay
1	12	24.2	99.4	81	60	41		9,210	Slightly Sandy Clay
1	22	40.0	80.9	68	66	31		6,235	Sandy Claystone Bedrock
2	5	4.0	101.3	16		NP			Silty Sand
2	10	28.5	94.2	81	62	42		7,455	Slightly Sandy Clay
2	25	28.5	95.2	42	52	25	0.5		Sandstone/Claystone Bedrock
3	4	14.3	108.0	62	48	28		26,890	Sandy Clay
3	9	29.0	90.3	62	59	37		2,775	Sandy Clay
3	19	35.0	86.6	78	74	40	2.0		Sandy Claystone Bedrock
4	4	21.1	103.1	61	45	28		5,020	Sandy Clay
4	19	50.7	71.8	84	96	56	0.9		Claystone Bedrock
5	4	30.9	88.5	84	72	40		10,620	Claystone Bedrock
5	14	37.1	84.4	65	69	35		11,495	Sandy Claystone Bedrock

rev 1/98

DATE 3/19/97 PROJECT Longs Way Trib

JOB NO. 6040 TASK

BY BHH

CHK'D

SHEET 1/

Source: Urban Storm Drainage Criteria Manual Vol 3

POND 302 OUTLET DESIGN

WATER QUALITY CAPTURE VOLUME:

— from SWMM runs:

design pt	subbasins	Acreage
DP127	25	3.8 AC
DP 113	1, 2, (7)	61.4 AC
		65.2 AC

(7) flows into upper pond #303 then into DP113 (Area included in total!)

65.3 AC used in calculations

— % impervious is 40% for all subbasins (from CUHP (100 YR, 2HR) run)

— FIG 5-1:

req'd storage = 0.18 in

$$WQCV = \left(\frac{0.18}{12}\right)\left(65.3^{Ac}\right) = 0.98\ Ac\text{-}ft$$

* add 20% for sediment storage

WQCV = **1.2 Ac-ft**

(continued →)

DATE ____________ PROJECT ____________

JOB NO. ____________ TASK ____________

BY ____________

CHK'D ____________ SHEET 21

size the riser pipe:

From spreadsheet of stage elev and volume, a depth of 5864' − 5860.5' = 3.5' provides 1.41 Ac-ft (Need at least 1.2 Ac-ft = WQCV)

FIG 5-3: req'd Area/row = 1.50 in^2

FIG 5-2: A 4" riser with 8 - 1/2" dia holes provides 1.56 in^2 Area/row } ←

DATE ____ PROJECT ____
JOB NO. ____ TASK ____
BY ____
CHK'D ____ SHEET 3/

discharge :

water quality structure:

riser 1.2 Ac-ft / 40 hrs = 0.36 cfs (Ave)

assume 0 cfs at bottom of riser pipe (el. 5860.5)
1 cfs at top (el. 5864)

height of outlet = 3.5', Q increases 0.29cfs / ft of stage (1/3.5)

box inlet from el 5864 → 5865

$Q = CLH^{3/2}$ weir equation

box will act as a weir up to 1' above box, then be submerged. The RCP with inlet control will then need to be considered. Size inlet grate in box to pass ~77cfs (per SWMM run)

from fig 4-1, Drainage Criteria Manual, HW = 1' ⇒ Q = 4 cfs/ft² of open area

CDOT TYPE D inlet, standard grate: 3.8 ft² clear

For 1 grate, 3.8 (4) = 15.2 cfs

77/15.2 = 5.07 ⇒ **Use 6** (will pass 91.2 cfs)

RCP outfall with inlet control

using design chart 1. D = 36" - 3' use scale (1)

elev (ft)	HW (ft)	HW/D	Q (cfs)
5865	65-57=6	2	70
66	7	2.33	78
67	8	2.67	88
68	9	3	~~92~~ 91
69	10	3.33	~~99~~ 91
70	11	3.67	~~100~~ 91

(68–70: inlet grate controls)

DATE ______ PROJECT ______
JOB NO. ______ TASK ______
BY ______
CHK'D ______ SHEET 4/

Spillway flow

Breadth = 10+6 = 16'

[use 4:1 side slopes along spillway, so access across spillway is available.]

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

(Table 5-3 (King & Brater)) → for $H = 1 \Rightarrow C = 2.63$

$H = 2 \Rightarrow C = 2.63$

Spillway crest should be at or above 100 yr water surface.

Size spillway to pass $2 \times Q_{100} = 2 \times 77 = 154$ cfs

$$154 = 2.63(L)(1)^{3/2}$$

$L = 58.6$ → **L = 60'**, **H = 1'**

Using H = 2':

$$154 = 2.63(L)(2)^{3/2}$$

$L = 20.7$ ⇒ **L = 25'**, **H = 2'** ←

Summary of Storage

	Volumes (Ac-ft)	
top of berm 5870		
	1.06	
	0.97	
top of pool / spillway crest 5868		
	3.15	4.68
top of water qual. 5864		
	1.41	
bottom of pond 5860.5		

Depth = 1' $Q = 2.63(25)(1)^{3/2} = 66$

Depth = 2' $Q = 2.63(25)(2)^{3/2} = 186$

DATE 2/24/98 PROJECT Lones Way Tributary

JOB NO. 6040 TASK Pond 302

BY GEW

CHK'D

SHEET 1/1

10-YEAR OUTLET

WQCV = 5863.7

10-YR WSEL = 5866.2

2.5'

$Q_{max} = C_d A \sqrt{2gh}$

$C_d = 0.62$ (STANDARD)

$g = 32.2$

h = HEIGHT ABOVE ℄

$Q_{10} = 46$ cfs

PER SWMM RUN

$46 = 0.62 (A) \sqrt{2(32.2)(2.5)}$

$7.419 = 12.69(A)$

$A = 5.85$ ft²

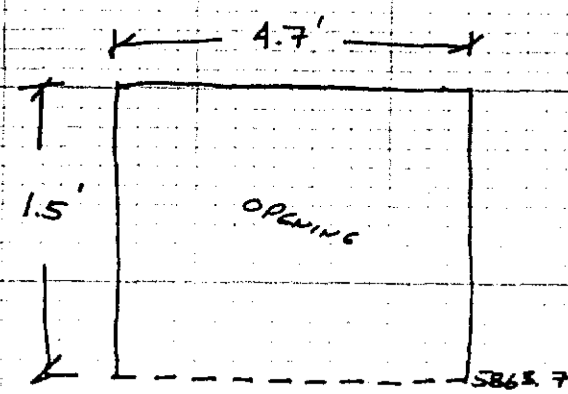
TRY 3.9' × 1.5'

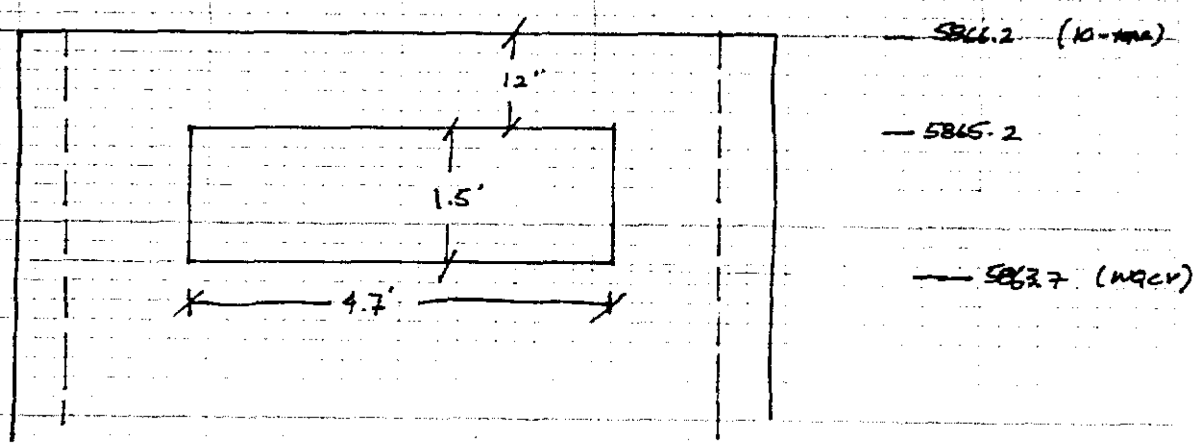
$46 = 0.62 (A) \sqrt{64.4 (2.5 - 0.75)}$

$46 = 6.58 A$

$A = 6.99$ ft² 4.7' × 1.5'

5866.2





DATE 3/4/98 PROJECT Lower Way Tributary

JOB NO. 6040 TASK Pond 302

BY GEW — 10-year outlet

CHK'D

SHEET 2/2

10-year outlet (cont')

Per Structural Detail of top "Beam"

$Q_{max} = CA\sqrt{2gh}$ $C = 0.62$, $g = 32.2$

$46 = 0.62A\sqrt{64.4h}$ h = W.S.EL above ℄

$h = 16\frac{1}{2} + (13\frac{1}{2}/2)$

$74.19 = A\sqrt{64.4(1.94)}$ $h = 1.94'$

$74.19 = A(11.18)$

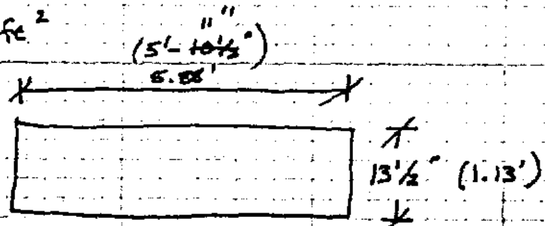
$A = 6.64\ ft^2$

16½" needed from top of "Box" (Grate) to top of rectangular orifice

Top of Box (top of grate)

	5866.2	
−	1.38	(16½" cover)
	5864.83	
	5863.7	(fixed bottom of orifice)
	1.13'	

Opening vertical 13½"



DATE 2/12/98 PROJECT Longs Way Tributary

JOB NO. TASK Pond - 302 - Outlet Structure

BY

CHK'D SHEET 3/

10 YEAR OUTLET

WQCV ELEV = 5863.7
10 YR ELEV = 5866.2
2.5

$Q = CLH^{3/2}$ (Broad - crest weir)

$46 = 3.32(L)2.5^{3/2}$

$46 = 13.12 (L)$

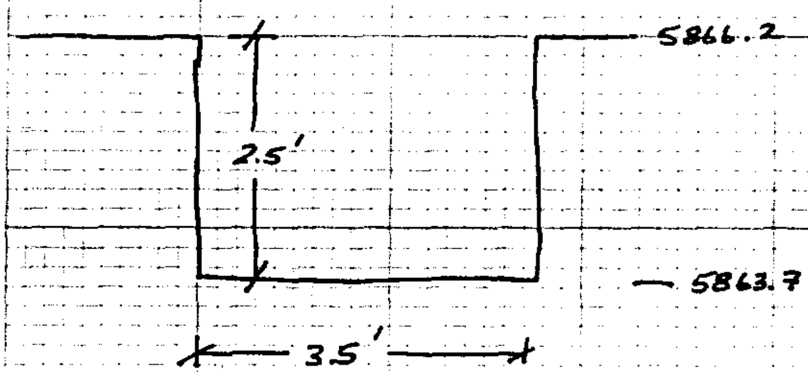
$L = 3.5'$

H = 2.5

Wall thickness = 0.5

C = 3.32
See Table 21-15

Q = 46 cfs
Per 10-yr SWMM run



21-47. Broad-Crested Weir

This is a weir with a horizontal or nearly horizontal crest. The crest must be sufficiently long in the direction of flow that the nappe is supported and hydrostatic pressure developed on the crest for at least a short distance. A broad-crested weir is nearly rectangular in cross section. Unless otherwise noted, it will be assumed to have vertical faces, a plane horizontal crest, and sharp right-angled edges.

Figure 21-70 shows a broad-crested weir that, because of its sharp upstream edge, has contraction of the nappe. This causes a zone of reduced pressure at the leading edge. When the head H on a broad-crested weir reaches one to two times its breadth b, the nappe springs free, and the weir acts as a sharp-crested weir.

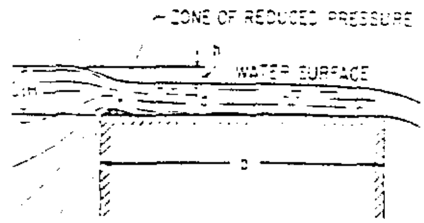


Fig. 21-70. Broad-crested weir.

Discharge over a broad-crested weir is given by Eq. (21-115) since the velocity of approach was ignored in experiments performed to determine the coefficient of discharge. These coefficients probably apply more accurately, therefore, where the velocity of approach is not high. Values of the discharge coefficient, compiled by King, appear in Table 21-15 (H. W. King and E. F. Brater, "Handbook of Hydraulics," McGraw-Hill Book Company, New York).

$Q = CLH^{3/2}$

21-48. Weirs of Irregular Section

This group includes those weirs whose cross section deviates from typical broad-crested or ogee-crested weirs. Weirs of irregular section, fairly common in waterworks projects, are used as spillways and control structures. Experimental data are available on the more common shapes. (See, for example, H. W. King and E. F. Brater, "Handbook of Hydraulics," McGraw-Hill Book Company, New York.)

TABLE 21-15 Values of C in $Q = CLH^{3/2}$ for Broad-Crested Weirs

Measured head H, ft	Breadth of crest of weir, ft										
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

DATE FEBRUARY 24, 1998 PROJECT PLAZA DRIVE TRIBUTARY

JOB NO. 6040 TASK TYPE D INLET MODIFICATIONS

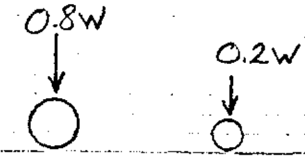
BY GDS LOADS FOR CENTER BEAM

CHK'D

SHEET 1/1

DESIGN FOR 10,000 lb MAINT. VEHICLE

LIVE LOAD



$W = 10$ kip

$P_L = 0.8(10 \text{ kip}) = 8$ kip

DEAD

$\omega_{D_{GRATE}} = 256\text{ lb} / 27\text{ in} = 9.48 \text{ lb/in} \text{ -OR- } 114 \text{ lb/ft}$

$\omega_{D_{BEAM}} = 13 \text{ lb/ft}$

$\omega_D = \text{GRATE} + \text{BEAM}$

$= 114 \text{ lb/ft} + 13 \text{ lb/ft}$

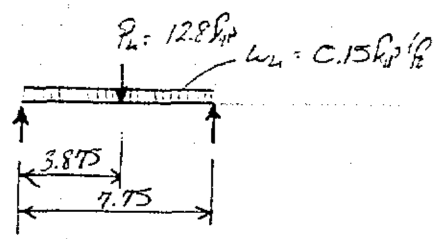
$= 127 \text{ lb/ft}$

USE AISC LRFD LOAD FACTORS

$1.6L + 1.2D$

$P_u = 1.6(8 \text{ kip}) = 12.8 \text{ kip}$

$\omega_u = 1.2(0.127 \text{ kip/ft}) = 0.15 \text{ kip/ft}$



$M_u = \dfrac{P_u l}{4} + \dfrac{w_u l^2}{8}$

$= \dfrac{12.8 \text{ kip}(7.75 \text{ ft})}{4} + \dfrac{0.15 \text{ kip/ft}(7.75 \text{ ft})^2}{8}$

$M_u = 25.9$ kip-ft

DATE FEBRUARY 24, 1998	PROJECT PLAZA DRIVE TRIBUTARY
JOB NO. 6040	TASK TYPE D INLET MODIFICATIONS
BY GDS	CENTER BEAM MEMBER SELECTION
CHK'D	SHEET 2/6

$$Z_x \text{ REQ} = \frac{M_u(12)}{0.9(F_y)}$$

$$= \frac{25.9 \text{ kip-ft}(12 \text{ in/ft})}{0.9(36 \text{ kip/in}^2)} = 9.6 \text{ in}^3$$

SELECT W SHAPE WITH $d_{MAX} = 8 \text{ in}$ AND $Z_x \geq 9.6 \text{ in}^3$

TRY A W 8x13

$L_p = 3.5 \text{ ft}$

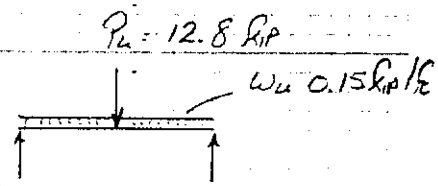
$L_b = 2.3 \text{ ft}$

$$\phi M_n = \frac{\phi_b Z_x F_y}{12} = 0.9(11.4 \text{ in}^3)(36 \text{ kip/in}^2) = 30.7 \text{ kip-ft}$$

$\phi M_n = 30.7 \text{ kip-ft} > M_u = 25.9 \text{ kip-ft}$ O.K.

NOTE: FOR $L_b = 2.3 \text{ ft}$ THE GRATES MUST BE BOLTED DOWN

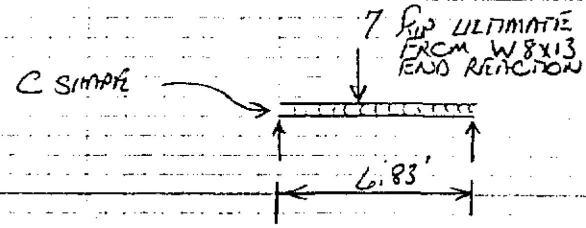
END REACTIONS



$$R_u = \frac{P_u + w_u(l)}{2} = \frac{12.8 + 0.15(7.75)}{2}$$

$= 7$ kip END REACTION

END SUPPORT SELECTION



$l = 7'\text{-}4'' - 2(3'')$

$= 6'\text{-}10''$

$$M_{u_{EST}} = \frac{P_u l}{4} = \frac{(7\,kip)(6.83\,ft)}{4} = 11.95\ kip\text{-}ft.\ \text{EST.}$$

$$Z_x\ REQ = \frac{M_u(12)}{\phi_b(F_y)} = \frac{(12\,kip\text{-}ft)(12\,in/ft)}{0.9(36\,kip/in^2)} = 4.44\,in^3\ REQ.$$

TRY A C7x9.8

$M_u = 11.95\ kip\text{-}ft$

$$L_p = \frac{300 r_y}{\sqrt{F_y}} = \frac{300(0.968)}{(36)^{1/2}} = 48\,in$$

$L_b = 3.4\,ft < L_p = 4\,ft.$

$\phi M_n = \phi Z_x F_y (ft/12in)$

$= 0.9(7.12\,in^3)(36\,kip/in^2)(1/12) = 19.2\ kip\text{-}ft$

$\phi M_n = 19.2\ kip\text{-}ft > M_u = 12\ kip\text{-}ft$ O.K

DONT USE C SHAPE - USE CONCRETE BEAM

DATE February 24 1998 PROJECT Plaza Drive Tributary

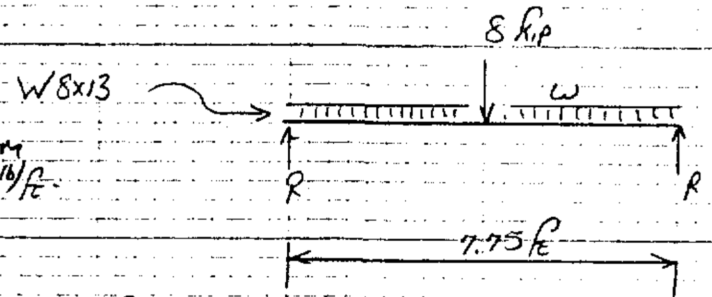
JOB NO. 6040 TASK Type D Inlet Modifications

BY GDS Concrete Beam for End Support

CHK'D SHEET 4/6

Try Using Reinforced Concrete Beam to Support Center

End Reactions for Concrete Beam

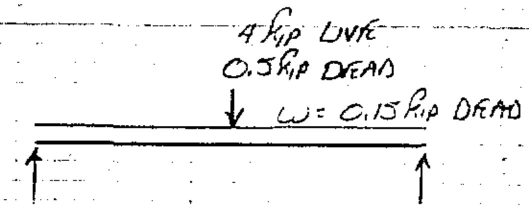


ω = Grate + Beam
= 113 lb/ft + 13 lb/ft
= 126 lb/ft

$R_{LIVE} = \frac{8\ kip}{2} = 4\ kip$

$R_{DEAD} = \frac{(113\ lb/ft + 13\ lb/ft)(7.75\ ft)}{2} = 0.488\ kip$

Conc. Beam Supporting Center Beam



$M_L = \frac{Pl}{4} = \frac{4\ kip(6.66\ ft)}{4}$

= 6.67 kip-ft Live

$M_D = \frac{Pl}{4} + \frac{\omega l^2}{8}$

$= \frac{0.5\ kip(6.66\ ft)}{4} + \frac{0.15\ kip/ft(6.67\ ft)^2}{8}$

= 1.65 kip-ft Dead

$M_u = 1.3\ [M_D + 1.67(M_L)] = 1.3[1.65\ kip\text{-}ft + 1.67(6.67\ kip\text{-}ft)]$

$M_u = 16.63\ kip\text{-}ft$

DATE FEBRUARY 24 1998 PROJECT PLAZA DRIVE TRIBUTARY

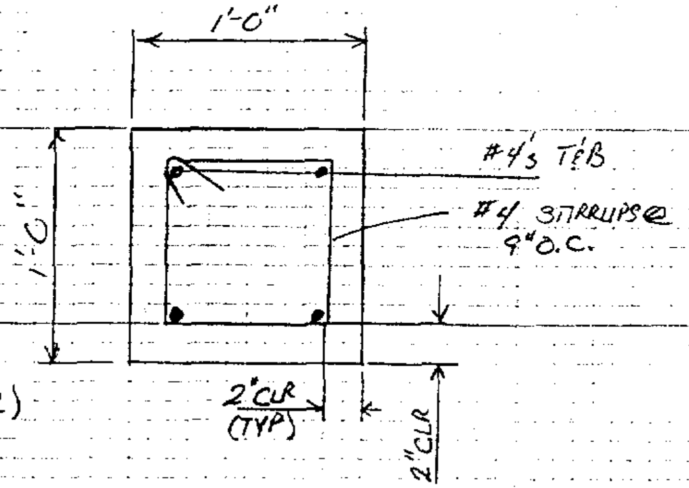
JOB NO. 6040 TASK TYPE D INLET MODIFICATIONS

BY GDS CONCRETE BEAM REINFORCEMENT

CHK'D

SHEET 5/6

CONCRETE BEAM DESIGN



TRY 2-#4's @ 0.40 IN^2

$D = 12 IN$

$d = 12IN - 2IN - 1/2(4/8 IN)$

$= 9.75 IN$

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{0.4(60)}{0.85(3)(12)}$

$= 0.784 IN$

$\phi M_n = \phi A_s f_y (d - 1/2 a)$

$= 0.9(0.40 IN^2)(60)(9.75 - 1/2(0.78))$

$= 202$ KIP-IN

-OR-

16.84 KIP-FT.

$\phi M_n = 16.8$ KIP-FT $> M_u = 16.63$ KIP-FT.

$\rho = \frac{A_s}{bd} = \frac{0.4 IN^2}{12(9.75_{IN})} = 0.0034$

$\rho_{min} = \frac{200}{f_y} = \frac{200}{60000} = 0.003\overline{3}$

CHECK SHEAR

$V = 1.3\left[\left(\frac{w_D l}{2} + \frac{P_D}{2}\right) + 1.67 \frac{P_L}{2}\right]$

DATE FEBRUARY 24, 1998 PROJECT PLAZA DRIVE TRIBUTARY

JOB NO. 6040 TASK TYPE D INLET MODIFICATIONS

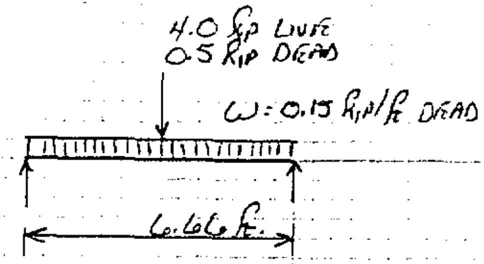
BY GDS W8X13 TO CONC CONNECTION

CHK'D

SHEET 6/6

EVALUATE EMBEDDED PLATE WITH

R_u CONCRETE AASHTO LOAD FACTOR



$R_D = \frac{\omega l}{2} + \frac{P}{2}$

$= \frac{0.15(6.66 ft)}{2} + \frac{0.5}{2}$ Kip

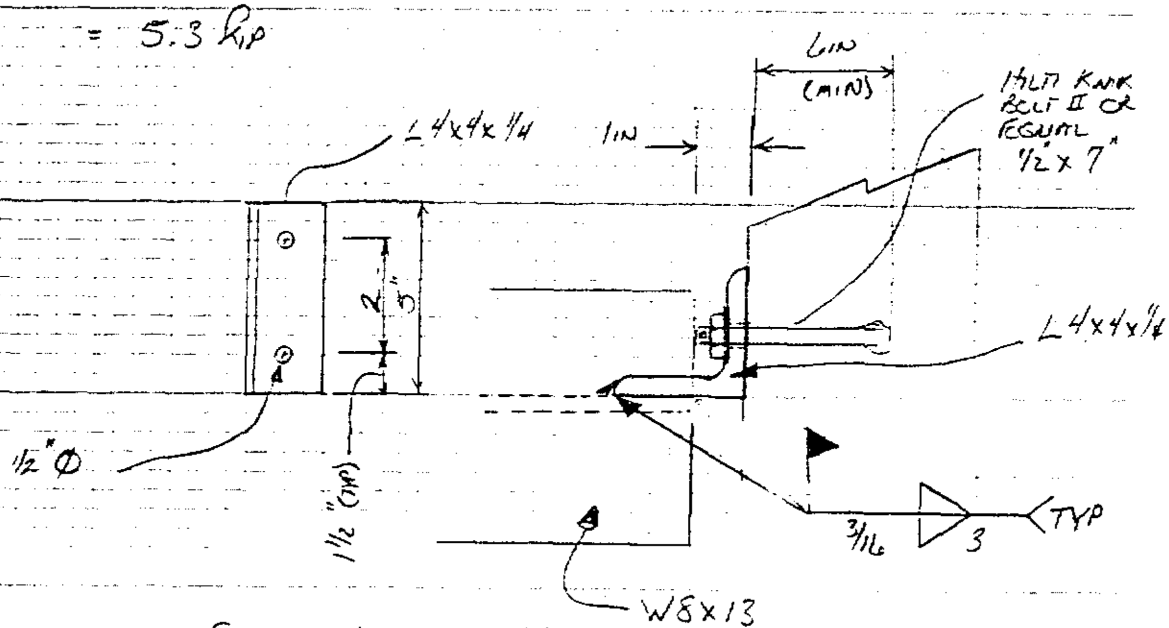
$= 0.75$ Kip

$R_L = \frac{P}{2} \quad \frac{4}{2}$ Kip $= 2$ Kip

$P_u = \gamma[\beta_D D + \beta_L (L)]$

$= 1.3[1.0(0.75 \text{ Kip}) + 1.67(2 \text{ Kip})]$

$= 5.3$ Kip



$= 5 \text{ Kip}(1\tfrac{1}{2} \text{ in}) - Nd(1\tfrac{1}{4}) = 0$

$Nd = 5(1\tfrac{1}{2}/1\tfrac{1}{4}) = 6$ Kip

$V = \tfrac{1}{2}(5.3 \text{ Kip}) = 2.65$ Kip

$\left(\frac{2.65 \text{ Kip}}{0.8(9.2)}\right)^{5/3} + \left(\frac{6}{8.65}\right)^{5/3} = 0.72 \leq 1.0$ O.K

USE 2 - 1/2 x 6" KWICK BOLT II OR EQUIV.

DATE FEBRUARY 24 1998

JOB NO. 6C40

BY GDS

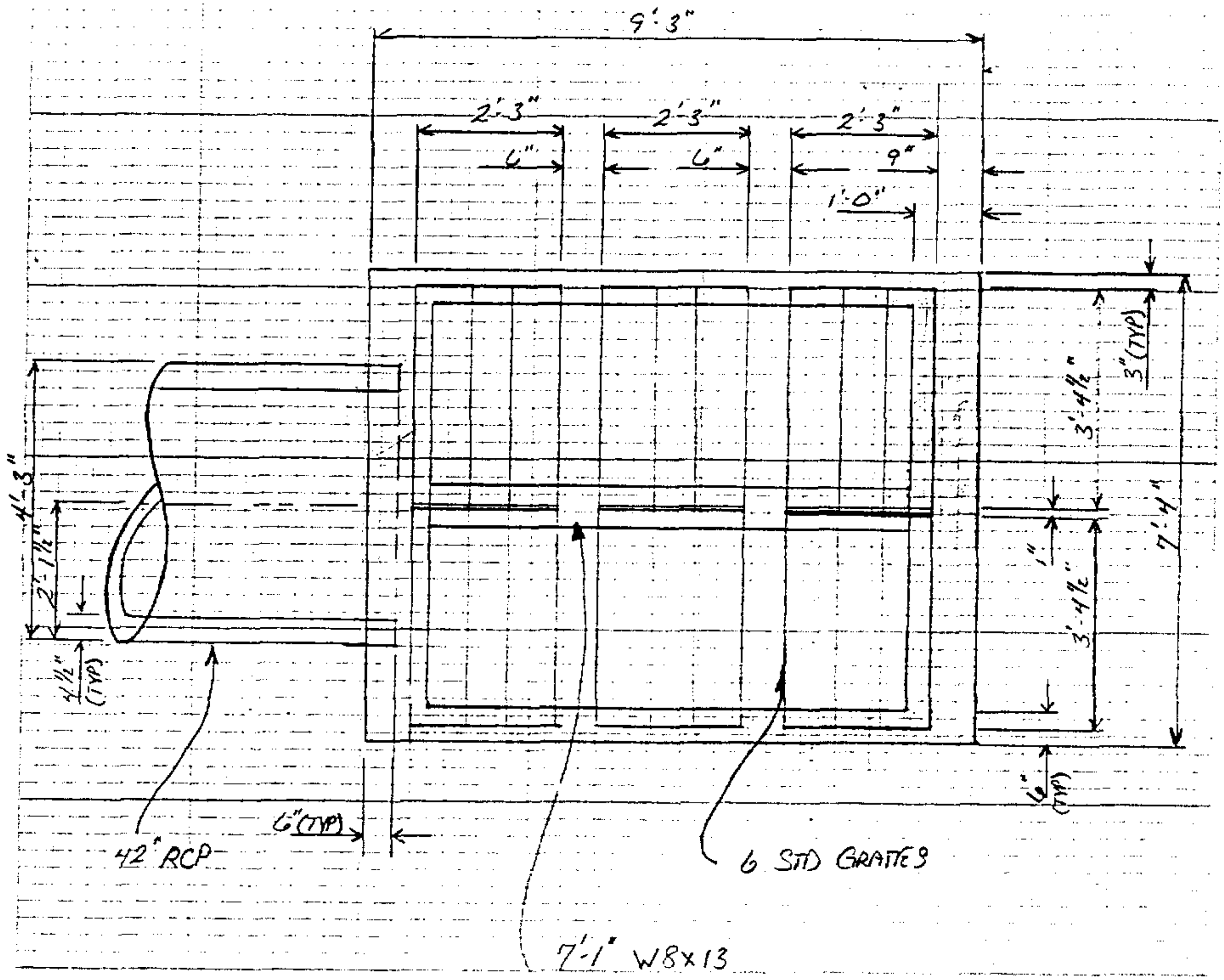
CHK'D

PROJECT PLAZA DRIVE TRIBUTARY

TASK TYPE D INLET MODIFICATIONS

GEOMETRY

SHEET

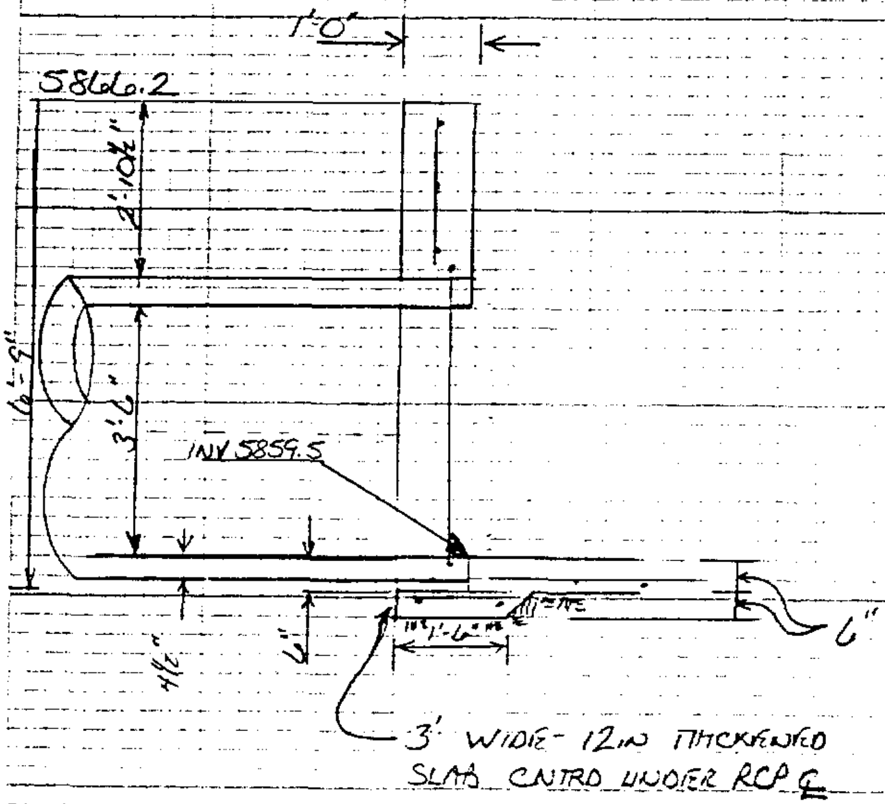


DATE February 24, 1998 PROJECT Plaza Drive Tributary

JOB NO. 6040 TASK Type D inlet modifications

BY GDS Section at RCP outlet

CHK'D ______ SHEET ______



DATE 2/11/98

JOB NO. 6040

BY GEW

CHK'D

PROJECT LONGS WAY TRIBUTARY

TASK POND 303 – OUTLET STRUCTURE

SHEET 4/4

POND 303 OUTLET DESIGN

THIS POND WAS DESIGNED TO RETAIN 100-YEAR FLOWS, WHILE ONLY RELEASING AT A SLOW RATE -- TO ALLOW 100-YEAR FLOW IN DOULEY DRIVE TO BE CONVEYED IN THE STORM SEWER

FROM ORIGINAL SWMM RUN — 100 YR VOLUME = 2.4 AC·FT
10 YR VOLUME = 1.8 AC·FT
2 YR VOLUME = 1.4 AC·FT

FROM SWMM DESIGN POINT 130
SUBBASIN 7
ACREAGE 14.7 AC

FROM CUHP RUN
40% IMPERVIOUSNESS

→ ADD 20% TO WQCV FOR SEDIMENTATION ←

FROM FIGURE 5.1
REQ'D STORAGE = 0.18 in/ACRE OF TRIBUTARY AREA

$WQCV = \frac{0.18}{12}(14.7\,Ac) = 0.22$ AC·FT
SEDIMENTATION VOLUME 20% = 0.04 AC·FT
0.26 AC·FT TOTAL

FROM STAGE, VOLUME PONDING FOR 303 (ELEVATION)
WQCV = 5887.24'

TOTAL 100-YR = 2.4 + 0.26 = 2.66 AC·FT — ELEV = 5893.51'
TOTAL 10-YR = 1.8 + 0.26 = 2.06 AC·FT — ELEV = 5890.48'

SIZE VERTICAL RISER PIPE

BOTTOM POND = 5885'

USE 2.33' DEPTH @ OUTLET (D_{WQ})
(28")

FROM FIGURE 5.3
0.40 in²/ROW

4" RISER PIPE w/ 8 - ¼ HOLES PER ROW ($0.049\,in^2 \times 8 = 0.39\,in^2/row$)
USE 8 ROWS SPACED @4" = 28" IN HEIGHT

DISCHARGE THRU RISER PIPE 0.26 AC·FT / 40 HR = 0.08 cfs
(40 HOUR CONTROLLED RELEASE)

DATE 3/4/98 PROJECT LONGS WAY TRIBUTARY

JOB NO. 6040 TASK POND 303 - OUTLET STRUCTURE

BY GEW

CHK'D

SHEET 3/4

RELEASE FROM DETENTION POND

10-YEAR & 100-YEAR RELEASE IS CONTROLLED BY ORIFICE IN OUTLET BOX @ ELEVATION 5887.2

MAXIMUM RELEASE RATE TO BE 5 cfs FOR MAJOR STORM EVENT

$Q_{max} = 5$ cfs

$C_d = 0.62$ STANDARD ORIFICE

$g = 32.2$

$h = 93.5 - 87.2$
$= 6.3'$

$Q_{max} = C_d A\sqrt{2gh}$

$5 = 0.62(A)(20.14)$

$A = 0.40\ ft^2$ $A = \pi R^2$

$R = 0.36'$ $(4.28'')$

USE 10" ORIFICE → $A = 0.55\ ft^2$

$Q = C_d A\sqrt{2gh}$

$Q = 0.62(0.55)\sqrt{2g(6.3 - 0.42)}$

$Q = 6.6$ cfs

OK USE 10" DIAMETER ORIFICE

$Q_{100} = 6.6$ cfs

$Q_{10} = C_d A\sqrt{2gh}$ $h = [(90.5 - 87.2) - 0.42) = 2.88'$

$Q_{10} = 0.62(0.55)\sqrt{2g(2.88)}$

$Q_{10} = 4.6$ cfs

IN CASE OF BLOCKAGE OR EVENT LARGER THAN 100-YEAR EVENT FLOW WILL GO INTO TOP OF THE OUTLET STRUCTURE BOX.

FOR 1 GRATE 15.2 cfs

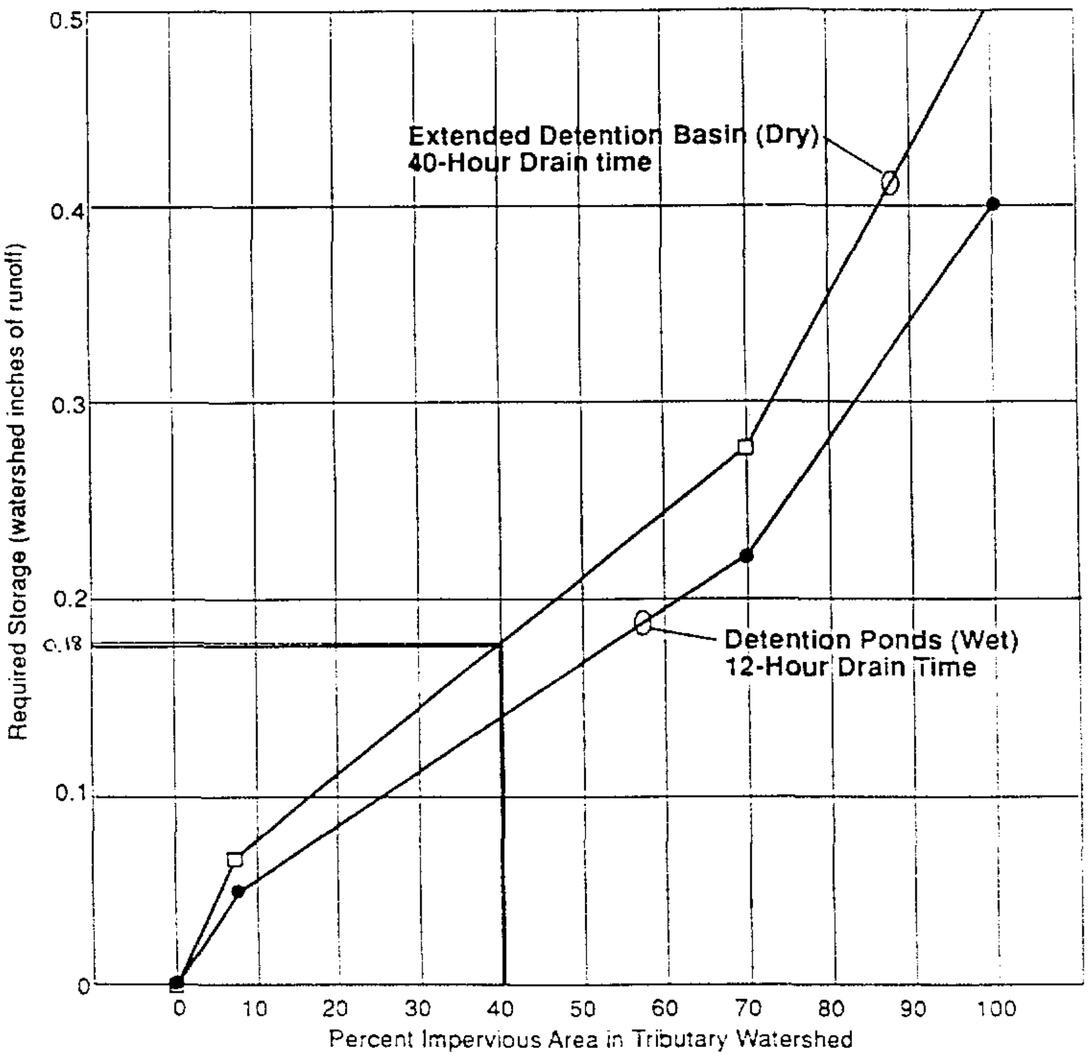
CDOT TYPE D = USE 2 GRATES ∴ Q_{max} 30.4 cfs
(2 GRATE MIN.)

(from CUHP program)

```
1        BASIN 4600-09 (100-YR FU) 2-HR
1100-YR A  .03 .08 .12 .21 .37 .65 .37 .21 .16 .13 .10 .10 .10 .05 .05 .03 .03
1100-YR A  .03 .03 .03 .03 .03 .03 .03

 71 1 1 5. 1        1 SUBBASIN ID=  1
0.031 0.34 0.1940.000.029 20.0 0.40 0.10 3.85.0018 0.55
 71 1 1 5. 2        2 SUBBASIN ID=  2
0.042 0.42 0.2540.000.022 22.8 0.40 0.10 3.34.0018 0.52
 70 1 1 5. 3        3 SUBBASIN ID=  3
0.169 0.67 0.3340.000.029      0.40 0.10 4.41.0018 0.59
 71 1 1 5. 4        4 SUBBASIN ID=  4
0.088 0.47 0.2556.400.031 23.3 0.40 0.10 4.42.0018 0.60
 71 1 1 5. 5        5 SUBBASIN ID=  5
0.037 0.49 0.3675.0 0.036 23.3 0.40 0.10 3.88.0018 0.54
 71 1 1 5. 6        6 SUBBASIN ID=  6
0.042 0.32 0.1875.0 0.026 19.4 0.40 0.10 4.26.0018 0.58
 71 1 1 5. 7        7 SUBBASIN ID=  7
0.023 0.27 0.1640.000.033 17.9 0.40 0.10 3.15.0018 0.51
 71 1 1 5. 8        8 SUBBASIN ID=  8
0.083 0.37 0.1375.000.034 20.9 0.40 0.10 4.29.0018 0.57
 71 1 1 5. 9        9 SUBBASIN ID=  9
0.027 0.32 0.1975.000.014 19.4 0.40 0.10 4.50.0018 0.60
 70 1 1 5. 10      10 SUBBASIN ID= 10
0.183 0.89 0.4148.700.016      0.40 0.10 4.08.0018 0.57
 71 1 1 5. 11      11 SUBBASIN ID= 11
0.084 0.50 0.2945.800.014 24.8 0.40 0.10 4.41.0018 0.59
 71 1 1 5. 12      12 SUBBASIN ID= 12
0.085 0.78 0.4539.200.013 24.8 0.40 0.10 4.18.0018 0.58
 71 1 1 5. 13      13 SUBBASIN ID= 13
0.132 1.05 0.6370.400.016 40.8 0.40 0.10 4.35.0018 0.59
 70 1 1 5. 14      14 SUBBASIN ID= 14
0.156 1.04 0.5338.200.021      0.40 0.10 3.91.0018 0.56
 71 1 1 5. 15      15 SUBBASIN ID= 15
0.077 0.78 0.5227.500.009 33.0 0.40 0.10 3.42.0018 0.53
 71 1 1 5. 16      16 SUBBASIN ID= 16
0.063 0.61 0.3549.400.014 27.4 0.40 0.10 4.50.0018 0.60
 71 1 1 5. 17      17 SUBBASIN ID= 17
0.066 0.49 0.3472.800.022 14.8 0.40 0.10 4.50.0018 0.60
 70 1 1 5. 18      18 SUBBASIN ID= 18
0.143 1.01 0.7347.200.015      0.40 0.10 3.88.0018 0.56
 71 1 1 5. 19      19 SUBBASIN ID= 19
0.089 0.66 0.3340.000.030 29.3 0.40 0.10 3.79.0018 0.55
 70 1 1 5. 20      20 SUBBASIN ID= 20
0.175 1.06 0.6440.000.023      0.40 0.10 3.93.0018 0.56
 71 1 1 5. 21      21 SUBBASIN ID= 21
0.092 0.64 0.4240.000.041 28.8 0.40 0.10 3.54.0018 0.54
 71 1 1 5. 23      23 SUBBASIN ID= 23
0.040 0.29 0.1375.000.016 18.6 0.40 0.10 4.50.0018 0.60
 71 1 1 5. 24      24 SUBBASIN ID= 24
0.006 0.09 0.0540.000.019 12.7 0.40 0.10 4.50.0018 0.60
 71 1 1 5. 25      25 SUBBASIN ID= 25
0.006 0.25 0.1740.000.038 17.3 0.40 0.10 4.50.0018 0.60
 71 1 1 5. 26      26 SUBBASIN ID =26
0.024 0.38 0.2675.000.027 21.1 0.40 0.10 4.26.0018 0.58
 71 1 1 5. 27      27 SUBBASIN ID =27
0.013 0.27 0.1475.0 0.031 18.1 0.40 0.10 4.03.0018 0.57
 71 1 1 5. 28      28 SUBBASIN ID =28
0.049 0.42 0.2375.0 0.018 22.2 0.40 0.10 4.50.0018 0.60
 71 1 1 5. 29      29 SUBBASIN ID =29
0.031 0.38 0.1675.0 0.027 21.1 0.40 0.10 4.50.0018 0.60
E
```

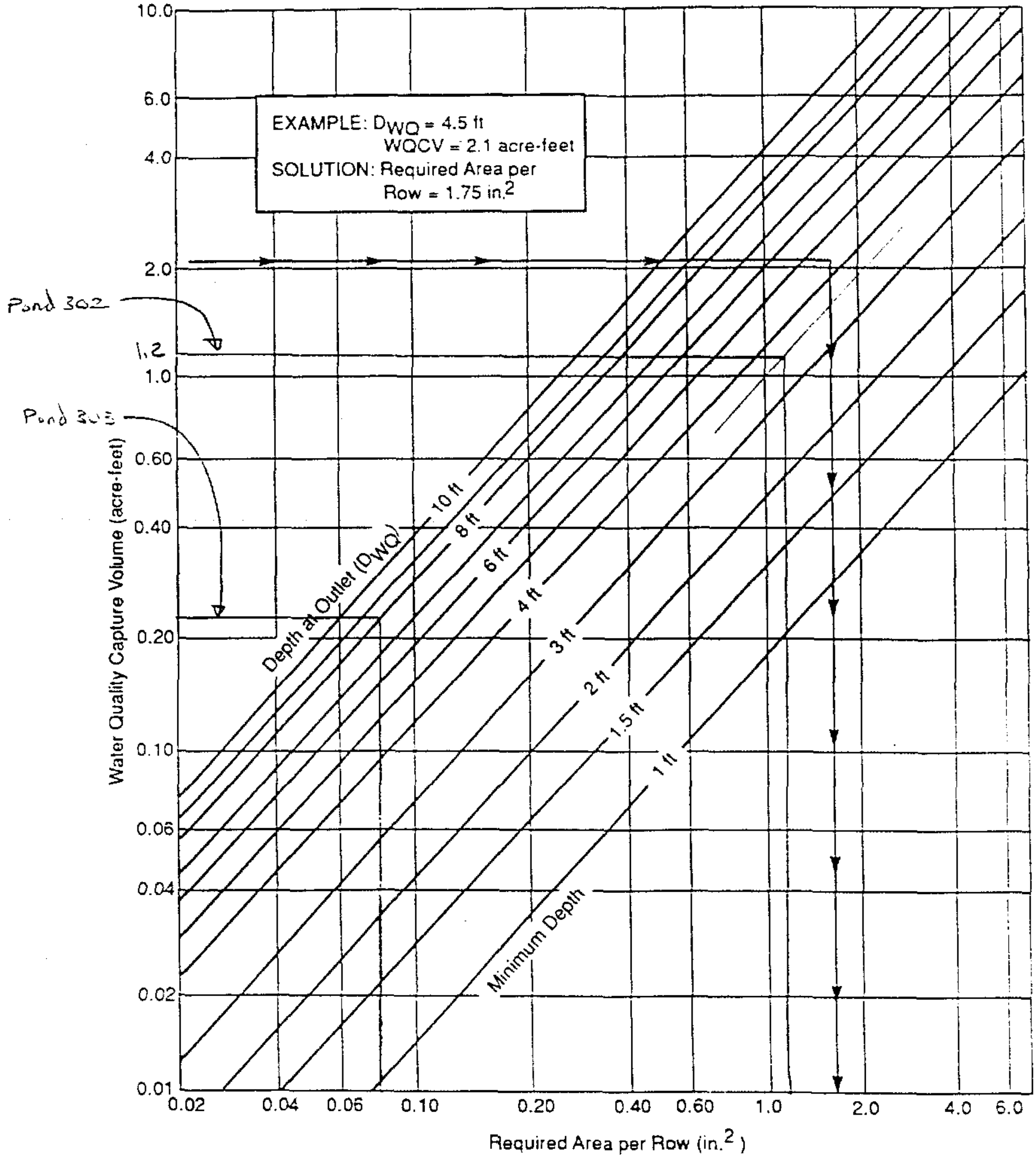
↑ impervious percentage



Source: Urbanos, Guo, Tucker (1989)

Note: Watershed inches of runoff shall apply to the entire watershed tributary to the BMP Facility.

FIGURE 5-1. WATER QUALITY CAPTURE VOLUME (WQCV)



Source: *Douglas County Storm Drainage and Technical Criteria*, 1986.

FIGURE 5-3. WATER QUALITY OUTLET SIZING: DRY EXTENDED DETENTION BASIN WITH A 40-HOUR DRAIN TIME OF THE CAPTURE VOLUME

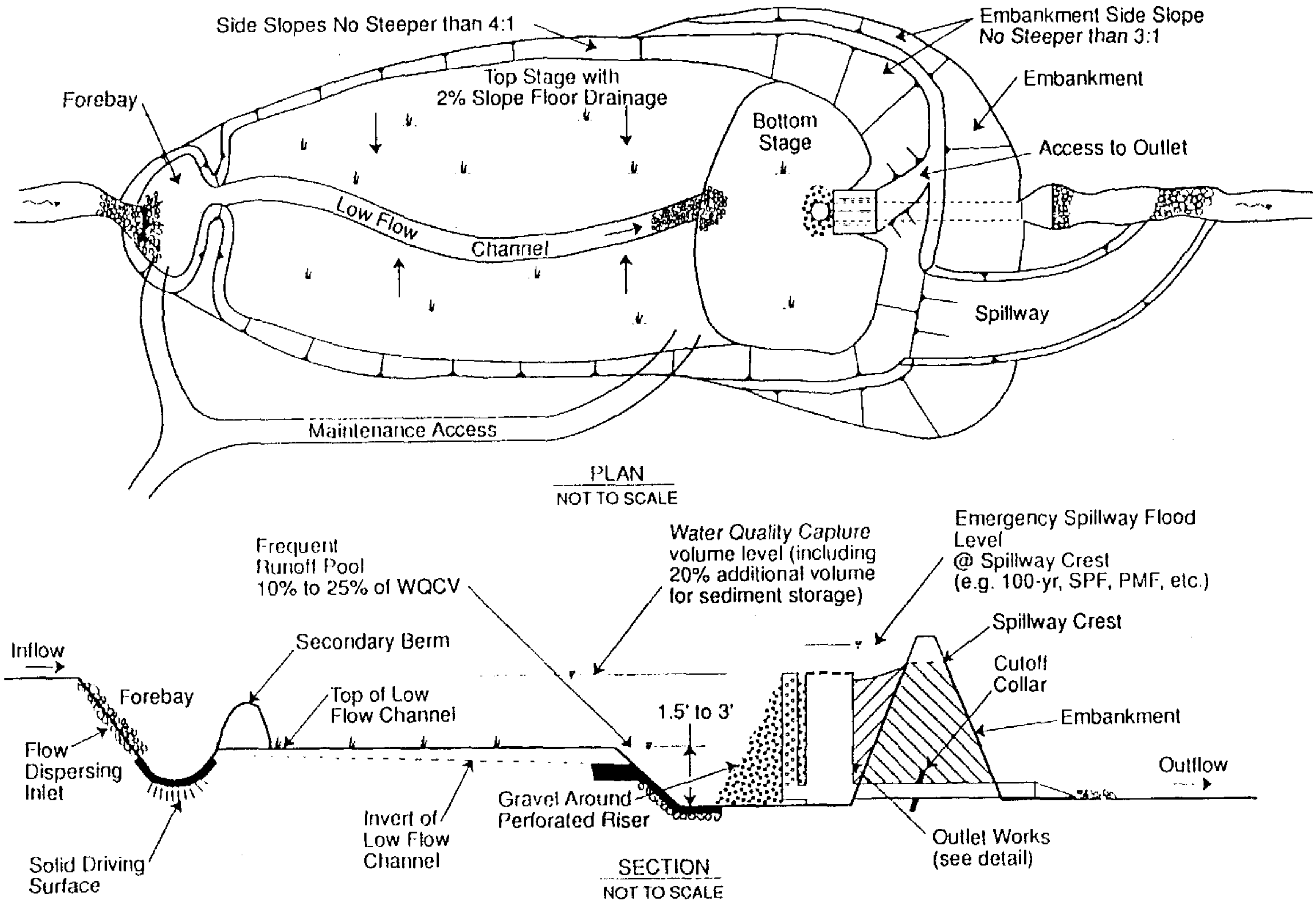
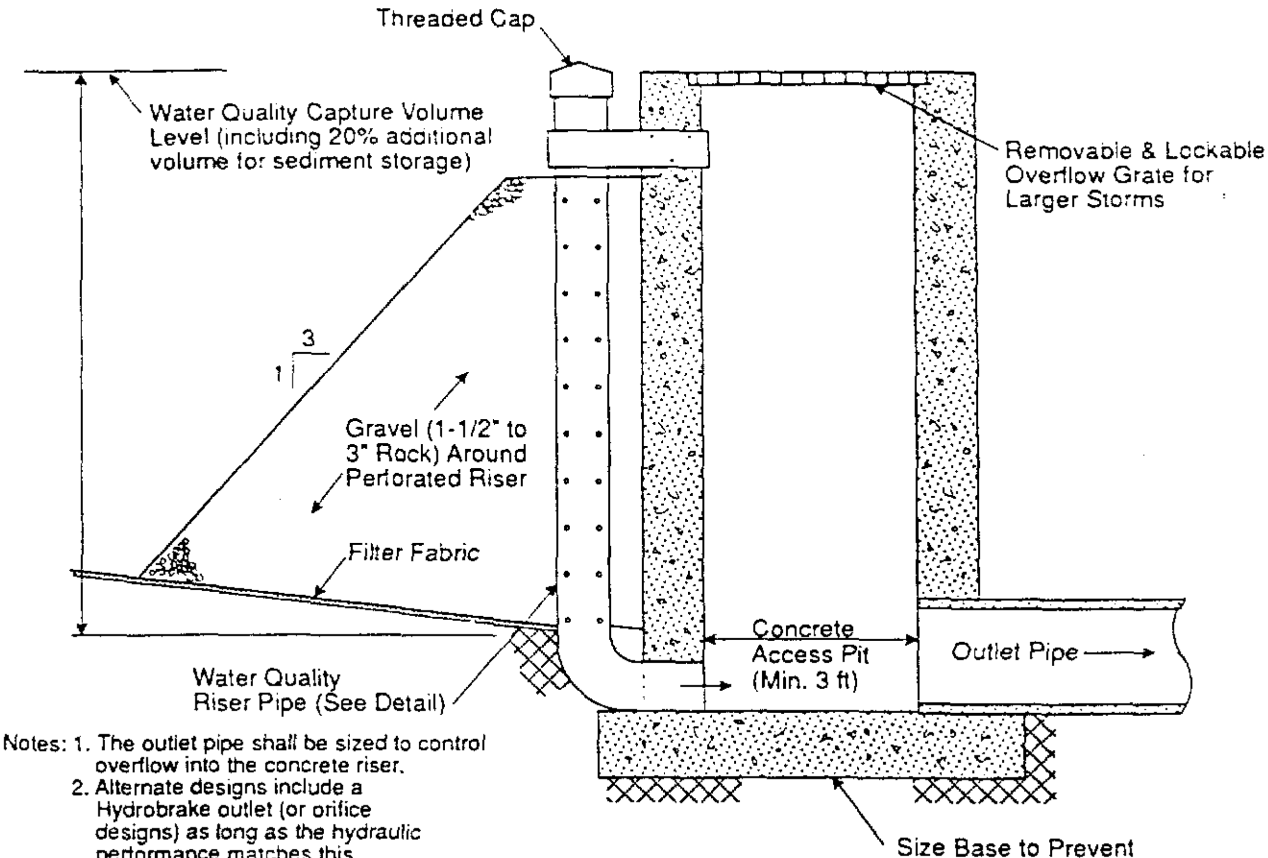


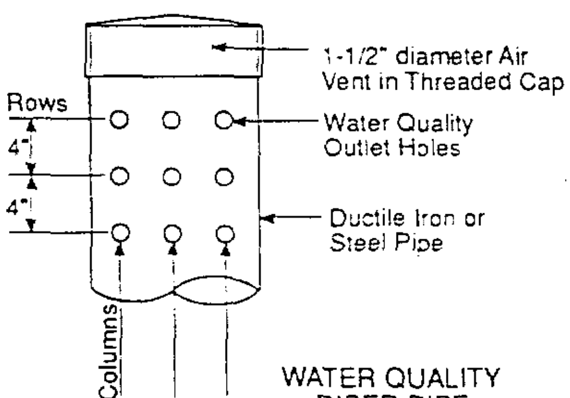
FIGURE 5-1. PLAN AND SECTION OF A DRY EXTENDED DETENTION BASIN



Notes: 1. The outlet pipe shall be sized to control overflow into the concrete riser.
2. Alternate designs include a Hydrobrake outlet (or orifice designs) as long as the hydraulic performance matches this configuration.

OUTLET WORKS
NOT TO SCALE

Notes: 1. Minimum number of holes = 8
2. Minimum hole diameter = 1/8" dia.



WATER QUALITY RISER PIPE
NOT TO SCALE

Maximum Number of Perforated Columns				
Riser Diameter (in.)	Hole Diameter, in.			
	1/4"	1/2"	3/4"	1"
4	8	8	--	--
6	12	12	9	--
8	16	16	12	8
10	20	20	14	10
12	24	24	18	12

Hole Diameter (in.)	Area of Hole (in.2)
1/8	0.013
1/4	0.049
3/8	0.110
1/2	0.196
5/8	0.307
3/4	0.442
7/8	0.601
1	0.785

FIGURE 5-2. WATER QUALITY OUTLET FOR A DRY EXTENDED DETENTION BASIN

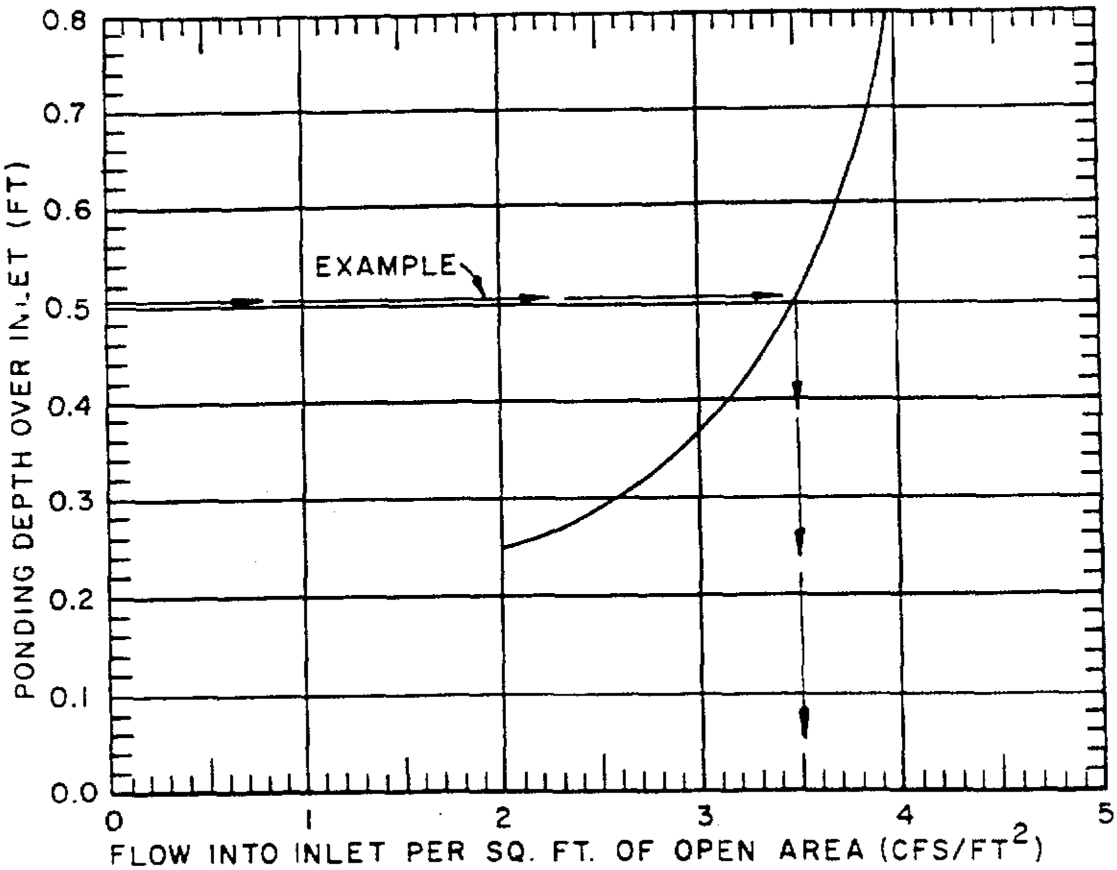
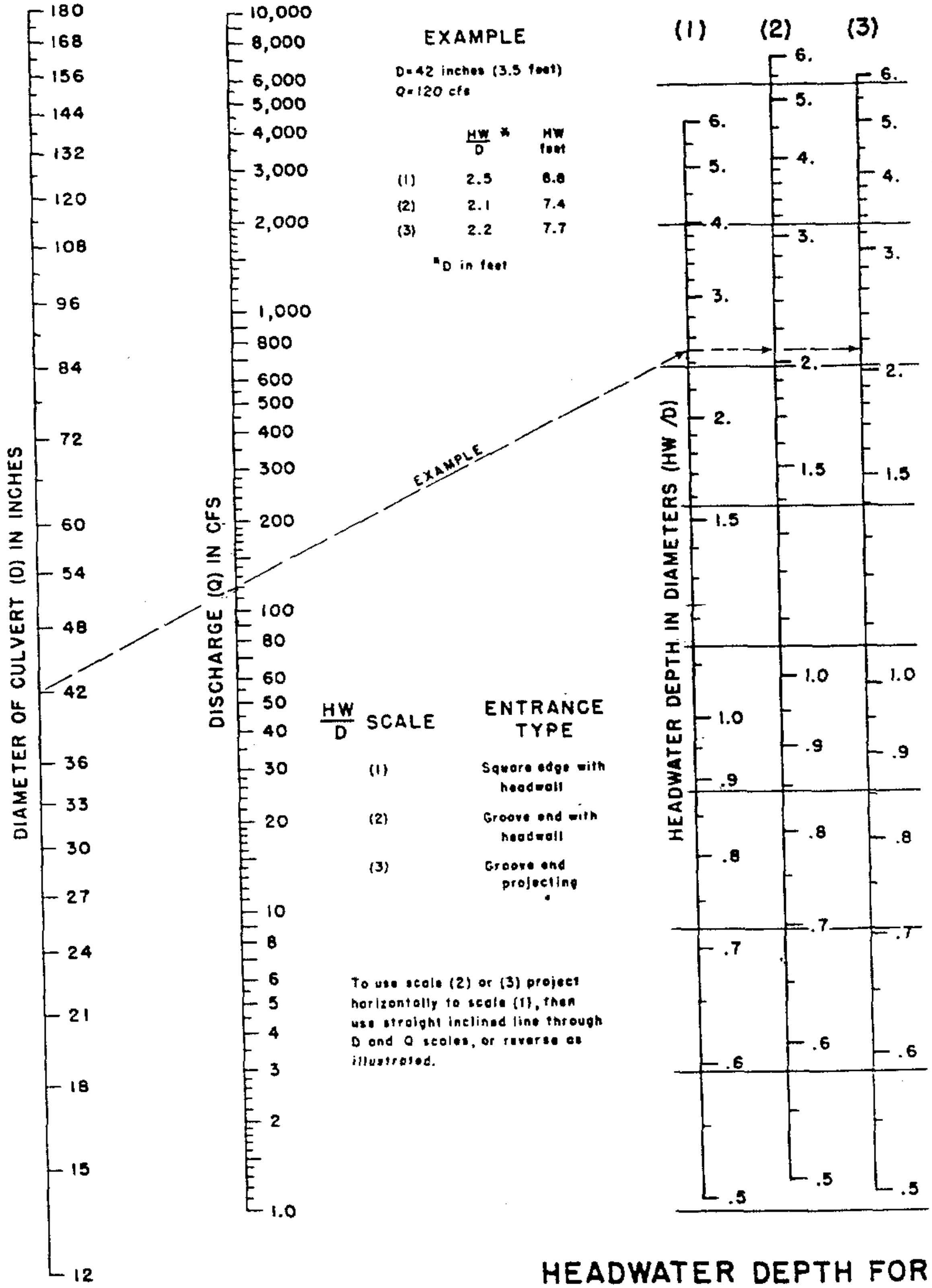


FIGURE 4-1. CAPACITY OF GRATED INLET IN SUMP

CHART 10



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

from King & Brater Handbook of Hydraulics

Table 5-3. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs

Measured head in feet, H	Breadth of crest of weir in feet										
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

Table 5-4. Values of C in the Formula $Q = CLH^{3/2}$ for Models of Broad-crested Weirs with Rounded Upstream Corner

Name of experimenter	Radius of curve in feet	Breadth of weir in feet, B	Height of weir in feet, P	Head in feet, H									
				0.4	0.6	0.8	1.0	1.5	2.0	2.5	3.0	4.0	5.0
Bazin..........	0.33	2.62	2.46	2.93	2.97	2.98	3.01	3.04					
Bazin..........	0.33	6.56	2.46	2.70	2.82	2.87	2.89	2.92					
U. S. Deep Waterways...	0.33	2.62	4.57	....	2.77	2.80	2.83	2.92	3.00	3.08	3.17	3.34	3.50
U. S. Deep Waterways...	0.33	6.56	4.56	....	....	2.83	2.83	2.83	2.82	2.82	2.82	2.82	2.81

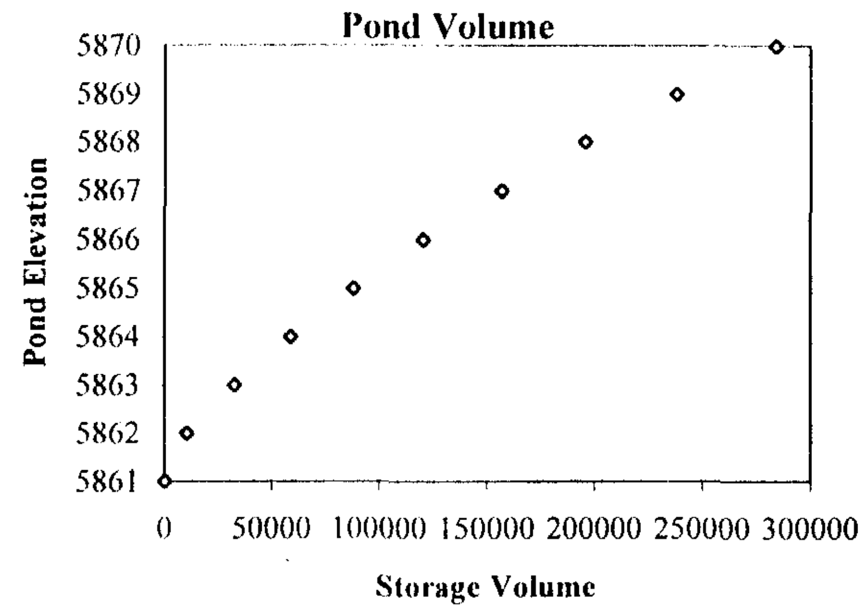
PONDING VOLUME
(AT ELEVATION)

RGCE JOB NO.: 6040
DESCRIPTION: Longs Way Tributary (POND 302)
PREPARED BY: GEW
DATE: 2/10/98

DETENTION POND VOLUME CALCULATIONS
(USING AREAS (contour intervals) TO OBTAIN VOLUME)

PONDING VOLUME =(A + B +(Square Root of (A * B))) * (0.333 * D)

A = AREA OF CONTOUR AT FIRST ELEVATION (sq. ft.)
B = AREA OF CONTOUR AT SECOND ELEVATION (sq. ft.)
D = ELEVATION DIFFERENCE BETWEEN CONTOUR A & B (ft.)



PONDING VOLUME					
ELEVATION (@ bottom)	AREA (sq. ft.)	DEPTH (ft)	VOLUME (cu. ft.)	CUMULATIVE VOLUME	CUM. VOL. (ACRES)
5860.5	0				
		0.5	437	437	0.01
5861	2625				
		1	9963	10400	0.24
5862	20040				
		1	22307	32707	0.75
5863	24700				
		1	26208	58915	1.35
5864	27800				
		1	29346	88262	2.03
5865	30980				
		1	32475	120737	2.77
5866	34060				
		1	35711	156448	3.59
5867	37460				
		1	39109	195556	4.49
5868	40860				
		1	42516	238072	5.47
5869	44280				
		1	45983	284055	6.52
5870	47800				
		0	0	0	0.00
		0	0	0	0.00

POND VOLUME = 284055

Volume	WQCV = 51401.00	10-year	129809	100-year =	203861
WSEL =	WQCV = 5863.71	10-year	5866.25	100-year =	5868.20
		WQCV added		WQCV added	

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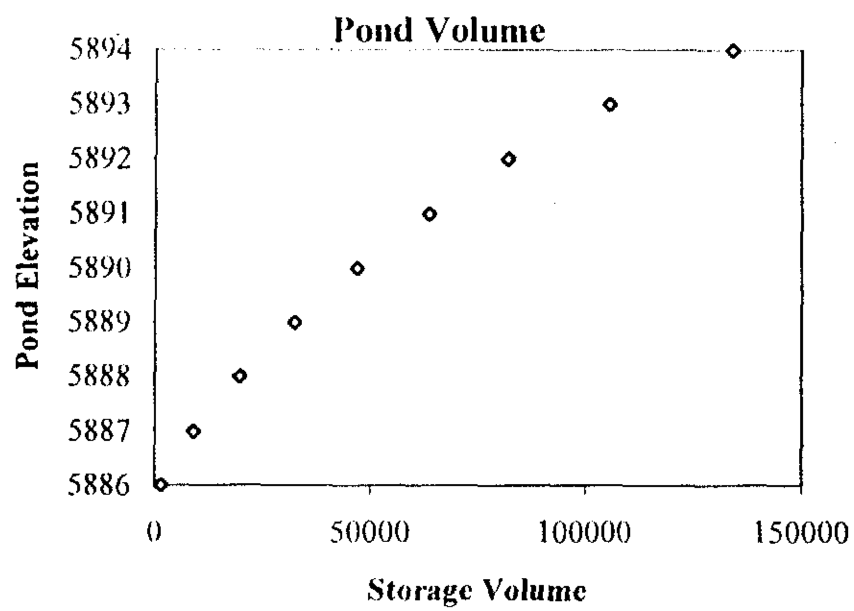
PONDING VOLUME
(AT ELEVATION)

RGCE JOB NO.: 6040
DESCRIPTION: Longs Way Tributary (POND 303)
PREPARED BY: GEW
DATE: 2/10/98

DETENTION POND VOLUME CALCULATIONS
(USING AREAS (contour intervals) TO OBTAIN VOLUME)

PONDING VOLUME =(A + B +(Square Root of (A * B))) * (0.333 * D)

A = AREA OF CONTOUR AT FIRST ELEVATION (sq. ft.)
B = AREA OF CONTOUR AT SECOND ELEVATION (sq. ft.)
D = ELEVATION DIFFERENCE BETWEEN CONTOUR A & B (ft.)



PONDING VOLUME					
ELEVATION (@ bottom)	AREA (sq. ft.)	DEPTH (ft)	VOLUME (cu. ft.)	CUMULATIVE VOLUME	CUM. VOL. (ACRES)
5885	0				
		1	1532	1532	0.04
5886	4600				
		1	7209	8741	0.20
5887	10200				
		1	10999	19740	0.45
5888	11840				
		1	12687	32427	0.74
5889	13580				
		1	14515	46942	1.08
5890	15500				
		1	16434	63376	1.45
5891	17420				
		1	18530	81906	1.88
5892	19700				
		1	23705	105611	2.42
5893	28000				
		1	28505	134116	3.08
5894	29070				
		0	0	0	0.00
		0	0	0	0.00
		0	0	0	0.00

POND VOLUME = 134116

Volume WQCV = 11326.00 10-year 54886 100-year = 120226
WSEL = WQCV = 5887.24 10-year 5890.48 100-year = 5893.51
WQCV added WQCV added

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DATE 9/8/97

JOB NO.

BY

CHK'D

PROJECT

TASK HGL calculations

SHEET

Used Flowmaster

Pond 302 outfall

type D inlet

use inlet control nomograph

~~[illegible]~~ 42" RCP → 2 existing pipes

Q_{100} = 80 + other flows

each pipe will carry ≈ 50 cfs ±

Nomograph → 1.4 D = 0.9 (4') = 3.6'

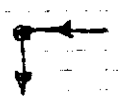
∴ 100 yr HGL is 3.6' above invert.

type D → MH-1

42" RCP

Depth = 2.72'

H_L MH-1



K = 1.0 (using special shaping in MH)

V = 9.96

H_L = 1.54'

MH-1 → MH-2

42" RCP pressure conditions ft/ft

L = 116.53

H_L = 0.74'

DATE ______ PROJECT ______

JOB NO. ______ TASK ______

BY ______

CHK'D ______ SHEET ______

H_L MH-2

K = 0.5 V = 8.32

H_L = 0.54'

MH-2 → outlet structure
pressure conditions

H_L = 0.33'

H_L outlet structure

K = 1.3
V = 8.32

H_L = 1.4'

DATE ______ PROJECT ______

JOB NO. ______ TASK ______

BY ______

CHK'D ______ SHEET ______

Pond 302 INFLOW PIPE

FES → MH-4

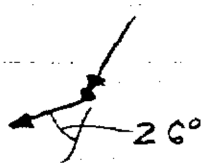
48" 1.06% depth = **3.19'**

H_L thru MH-4

$K = 0.15$

$V_c = 12.22$

H_L = **0.35'**



MH-4 → special struct

48" 4% depth = **2'**

~~H_L special struct.~~

$K = 1.3$ $V_c = 12.22$ **$H_L = 3'$**

existing 36" RCP's (2)

$Q = \frac{144}{2} = 72$ cfs

$S = ?$ 4% ± assumed depth = 1.57'

DATE ______ PROJECT ______
JOB NO. ______ TASK ______
BY ______
CHK'D ______ SHEET ______

Donley Drive Storm Sewer (Profile C)

Exist. 36" RCP

assume 6%± slope

depth = 1.39'

H_L thru 30' inlet

use $K = 1.0 \pm$

$V = 10.79$

$H_L = 1.81'$

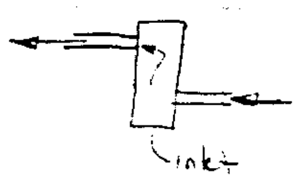
west inlet → east inlet

36" @ 1%

pressure conditions

depth = 0.44'

H_L thru 30' inlet



$K = 1.0 \pm$

$v = 10.19$

$H_L = 1.61'$

exist. 36" RCP

$S = 4\%$

$Q \approx 1$ cfs

depth = 0.18'

FLOW FROM MH-2 TO OUTLET STRUCTURE
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	134
Flow Element	Pressure Pipe
Method	Manning's Formula
Solve For	Pressure at 1

Input Data		
Pressure at 2	0.00	feet H20
Elevation at 1	0.00	ft
Elevation at 2	0.00	ft
Length	52.68	ft
Mannings Coefficient	0.013	
Diameter	42.00	in
Discharge	80.0000	cfs

Results		
Pressure at 1	0.33	feet H20
Headloss	0.33	ft
Energy Grade at 1	1.41	ft
Energy Grade at 2	1.07	ft
Hydraulic Grade at 1	0.33	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	9.62	ft^2
Wetted Perimeter	11.00	ft
Velocity	8.32	ft/s
Velocity Head	1.07	ft
Friction Slope	0.006323	ft/ft

POND 302 INFLOW PIPE
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	HR-134
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010600	ft/ft
Diameter	48.00	in
Discharge	144.00	cfs

Results		
Depth	3.19	ft
Flow Area	10.74	ft²
Wetted Perimeter	8.83	ft
Top Width	3.22	ft
Critical Depth	3.55	ft
Percent Full	79.69	
Critical Slope	0.008972	ft/ft
Velocity	13.41	ft/s
Velocity Head	2.79	ft
Specific Energy	5.98	ft
Froude Number	1.29	
Maximum Discharge	159.08	cfs
Full Flow Capacity	147.88	cfs
Full Flow Slope	0.010051	ft/ft
Flow is supercritical.		

$V_c = 12.22$

POND 302 INFLOW PIPE
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	HR-134
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.040000	ft/ft
Diameter	48.00	in
Discharge	144.00	cfs

Results		
Depth	2.00	ft
Flow Area	6.30	ft²
Wetted Perimeter	6.29	ft
Top Width	4.00	ft
Critical Depth	3.55	ft
Percent Full	50.07	
Critical Slope	0.008972	ft/ft
Velocity	22.87	ft/s
Velocity Head	8.13	ft
Specific Energy	10.13	ft
Froude Number	3.21	
Maximum Discharge	309.02	cfs
Full Flow Capacity	287.27	cfs
Full Flow Slope	0.010051	ft/ft
Flow is supercritical.		

$V_c = 12.22$

FLOWS DOWN STREAM OF PROFILE C
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	HR-134
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.060000	ft/ft
Diameter	36.00	in
Discharge	72.00	cfs

Results		
Depth	1.39	ft
Flow Area	3.22	ft^2
Wetted Perimeter	4.50	ft
Top Width	2.99	ft
Critical Depth	2.68	ft
Percent Full	46.47	
Critical Slope	0.010313	ft/ft
Velocity	22.38	ft/s
Velocity Head	7.79	ft
Specific Energy	9.18	ft
Froude Number	3.81	
Maximum Discharge	175.74	cfs
Full Flow Capacity	163.37	cfs
Full Flow Slope	0.011654	ft/ft
Flow is supercritical.		

VELOCITY @ CRITICAL S D/S OF PROFILE C
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	HR-134
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010313	ft/ft
Diameter	36.00	in
Discharge	72.00	cfs

Results		
Depth	2.68	ft
Flow Area	6.67	ft^2
Wetted Perimeter	7.44	ft
Top Width	1.84	ft
Critical Depth	2.68	ft
Percent Full	89.46	
Critical Slope	0.010313	ft/ft
Velocity	10.79	ft/s
Velocity Head	1.81	ft
Specific Energy	4.49	ft
Froude Number	1.00	
Maximum Discharge	72.86	cfs
Full Flow Capacity	67.73	cfs
Full Flow Slope	0.011654	ft/ft
Flow is subcritical.		

PROFILE C FLOWS
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	134
Flow Element	Pressure Pipe
Method	Manning's Formula
Solve For	Pressure at 1

Input Data		
Pressure at 2	0.00	feet H20
Elevation at 1	0.00	ft
Elevation at 2	0.00	ft
Length	38.14	ft
Mannings Coefficient	0.013	
Diameter	36.00	in
Discharge	72.0000	cfs

Results		
Pressure at 1	0.44	feet H20
Headloss	0.44	ft
Energy Grade at 1	2.06	ft
Energy Grade at 2	1.61	ft
Hydraulic Grade at 1	0.44	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Velocity	10.19	ft/s
Velocity Head	1.61	ft
Friction Slope	0.011654	ft/ft

pond 303 outfall pipe
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\hr134.fm2
Worksheet	HR-134
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.007000	ft/ft
Diameter	36.00	in
Discharge	1.00	cfs

Results		
Depth	0.28	ft
Flow Area	0.33	ft²
Wetted Perimeter	1.86	ft
Top Width	1.74	ft
Critical Depth	0.31	ft
Percent Full	9.30	
Critical Slope	0.004557	ft/ft
Velocity	3.02	ft/s
Velocity Head	0.14	ft
Specific Energy	0.42	ft
Froude Number	1.22	
Maximum Discharge	60.03	cfs
Full Flow Capacity	55.80	cfs
Full Flow Slope	0.000002	ft/ft
Flow is supercritical.		