HUDSON CREEK DRAINAGE BASIN

FEB 24 1999

CITY OF BRYAN
DEVELOPMENT SERVICES

DESIGN
25 YR FULLY DEV.

COMPUTE RUNOFF FOR PREDEV. CONDITIONS
FOR 5 YR, 10 YR & 25 YR FREQ. AREA = 6.3 AC.

C = 0.20 5 & 10 YR :: WOODLANDS & PASTURE LAND, SANDY SOIL
C = 0.22 25 YR SLOPE 2-7%

$$T_c = \frac{900}{1\ FT/SEC} \frac{1}{60\ SEC/MIN} = 15$$

$$I_5 = \frac{76}{(15+8.5)^{0.785}} = 6.4$$

$$I_{10} = \frac{80}{(15+8.5)^{0.763}} = 7.2$$

$$I_{25} = \frac{89}{(15+8.5)^{0.754}} = 8.2$$

$$Q_{E5} = 0.20 \times 6.4 \times 6.3 = 8.1 \text{ CFS}$$

$$Q_{E10} = 0.20 \times 7.2 \times 6.3 = 9.1 \text{ CFS}$$

$$Q_{E25} = 0.22 \times 8.2 \times 6.3 = 11.4 \text{ CFS}$$

COMPUTE Q FOR 25 YR RUNOFF DEV. CONDITION

C = 0.55 APARTMENT HIGH DENSITY SLOPE 2-7%

$$T_c = \frac{900}{3 \times 60} = 5 \text{ MIN}$$

$$I_{25} = \frac{89}{(5+8.5)^{0.754}} = 12.5$$

$$Q_{D25} = 0.55 \times 12.5 \times 6.3 = 43.3 \text{ CFS}$$

STATE OF TEXAS
THOMAS R. LANGFORD, III
67630
REGISTERED PROFESSIONAL ENGINEER

2-21-99

No. 5505 Engineer's Computation Pad
ALVIN

COMPUTE RESTRICTOR SIZE
AND 100 YR OVERFLOW

LIMIT OUTFALL TO

8.1 CFS	5 YR	DETENTION REQUIRED 1.8 AC·FT
9.1 CFS	10 YR	DETENTION REQUIRED 2.3 AC·FT
11.4 CFS	25 YR	DETENTION REQUIRED 2.6 AC·FT

W.S. FOR 25 YR EVENT 306.50

HEAD AT OUTFALL PIPE = 6.25'

TOTAL HEADLOSS FOR Q = 11.4 CFS (USING 38 LF 12" RCP)

$$H_T = \left[\frac{2.52\,(1+K_e)}{D^4} + \frac{466\,n^2 L}{D^{5.3}}\right]\frac{Q^2}{100}$$

$$H_T = \left(\frac{2.52\,(1+.9)}{1^4} + \frac{466\,(0.011^2)\,(38)}{1^{5.3}}\right)\frac{11.4^2}{100}$$

$H_T = 19.0 > 6.25$ OUTFALL IS LESS THAN ALLOWABLE

ACTUAL Q W/ $H_T = 6.25$ IS 9.5 CFS

W.S. FOR 10 YR EVENT 306.00

HEAD AT OUTFALL PIPE = 5.75

TOTAL HEADLOSS FOR Q = 9.1 CFS

$$H_T = \left[\frac{2.52\,(1.9)}{1^4} + \frac{466\,(0.011^2)\,(38)}{1^{5.3}}\right]\frac{9.1^2}{100}$$

$H_T = 5.74$ ✓

No. 5505 Engineer's Computation Pad
ALVIN

SMALL WATERSHED METHOD
RUNOFF HYDROGRAPH BY SMALL WATERSHED METHOD

February 16, 1999
5-YEAR RUNOFF
CARRIAGE INN
BRYAN, TEXAS

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Peak Flow Rate (cfs)	34
Drainage Area (acres)	6.30
Total Rainfall Depth (inches)	6.94
Percent of Impervious Cover in Watershed (%)	0.5
Soil Conservation Service Curve Number	84
Time Interval for Computations (minutes)	15.00

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PROGRAM RESULTS:

Total Runoff Depth (inches)	5.09
Total Runoff Volume (ac-ft)	2.7
Time to Peak (hours)	0.68

COMPUTED HYDROGRAPH:

Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow
0.00	0	0.75	34	1.50	9	2.25	2	3.00	0
0.25	10	1.00	22	1.75	5	2.50	1	3.25	0
0.50	29	1.25	14	2.00	3	2.75	1		

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SMALL WATERSHED METHOD COMPUTER PROGRAM, Version 1.0 Copyright 1987
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069
(713) 440-3787. A complete program manual is available.

DETENTION BASIN SIZING
DETENTION BASIN SIZING BY TRIANGULAR HYDROGRAPHS

February 16, 1999
5-YEAR DETENTION STORAGE
CARRIAGE INN
BRYAN, TEXAS

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Detention Basin Drainage Area (acres)	6.3
Peak Inflow Rate into Basin (cubic feet per second)	Q_D = 34.3 – dev Q
Peak Release Rate from Basin (cubic feet per second)	Q_E = 8.1 – E
Total Inflow Volume into Basin (acre-feet)	2.70
Available Storage Depth of Basin (feet)	6.00
Required Freeboard in Basin (feet)	1.0
Side Slopes of Basin (horizontal/vertical)	3.00
Width of Maintenance Berm around Basin (feet)	20.0

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PROGRAM RESULTS:

DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
Required Detention Volume (acre-feet)	1.6	1.8	2.1
Detention Volume Per Acre (ac-ft per ac)	0.25	0.29	0.33
Basin Surface Area w/o Maint. Berm (ac)	0.38	0.43	0.47
Basin Surface Area w/ Maint. Berm (ac)	0.61	0.68	0.74
Basin Excavation Volume (cubic yards)	3204	3674	4142

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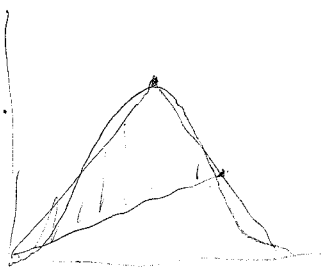

SMALL WATERSHED METHOD
RUNOFF HYDROGRAPH BY SMALL WATERSHED METHOD

February 16, 1999
10-YEAR RUNOFF
CARRIAGE INN
BRYAN, TEXAS

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Peak Flow Rate (cfs)	38
Drainage Area (acres)	6.30
Total Rainfall Depth (inches)	8.43
Percent of Impervious Cover in Watershed (%)	0.5
Soil Conservation Service Curve Number	84
Time Interval for Computations (minutes)	15.00

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PROGRAM RESULTS:

Total Runoff Depth (inches)	6.52
Total Runoff Volume (ac-ft)	3.4
Time to Peak (hours)	0.78

COMPUTED HYDROGRAPH:

Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow
0.00	0	1.00	31	2.00	6	3.00	1		
0.25	9	1.25	21	2.25	4	3.25	1		
0.50	27	1.50	14	2.50	3	3.50	0		
0.75	38	1.75	9	2.75	2	3.75	0		

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DETENTION BASIN SIZING
DETENTION BASIN SIZING BY TRIANGULAR HYDROGRAPHS

February 16, 1999
10-YEAR DETENTION STORAGE
CARRIAGE INN
BRYAN, TEXAS

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Detention Basin Drainage Area (acres).....	6.3
Peak Inflow Rate into Basin (cubic feet per second).....	38.1
Peak Release Rate from Basin (cubic feet per second)....	9.1
Total Inflow Volume into Basin (acre-feet).....	3.40
Available Storage Depth of Basin (feet).....	6.00
Required Freeboard in Basin (feet).....	1.0
Side Slopes of Basin (horizontal/vertical).....	3.00
Width of Maintenance Berm around Basin (feet).....	20.0

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PROGRAM RESULTS:

DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
Required Detention Volume (acre-feet)	2.0	2.3	2.6
Detention Volume Per Acre (ac-ft per ac)	0.31	0.36	0.41
Basin Surface Area w/o Maint. Berm (ac)	0.46	0.52	0.58
Basin Surface Area w/ Maint. Berm (ac)	0.71	0.79	0.86
Basin Excavation Volume (cubic yards)	3964	4558	5152

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SMALL WATERSHED METHOD
RUNOFF HYDROGRAPH BY SMALL WATERSHED METHOD

February 16, 1999
25-YEAR RUNOFF
CARRIAGE INN
BRYAN, TEXAS

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Peak Flow Rate (cfs)	43
Drainage Area (acres)	6.30
Total Rainfall Depth (inches)	9.86
Percent of Impervious Cover in Watershed (%)	0.5
Soil Conservation Service Curve Number	84
Time Interval for Computations (minutes)	15.00

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PROGRAM RESULTS:

Total Runoff Depth (inches)	7.90
Total Runoff Volume (ac-ft)	4.1
Time to Peak (hours)	0.83

COMPUTED HYDROGRAPH:

Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow
0.00	0	1.00	39	2.00	8	3.00	2	4.00	0
0.25	9	1.25	27	2.25	6	3.25	1		
0.50	28	1.50	18	2.50	4	3.50	1		
0.75	42	1.75	12	2.75	3	3.75	1		

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DETENTION BASIN SIZING
DETENTION BASIN SIZING BY TRIANGULAR HYDROGRAPHS

February 16, 1999
25-YEAR DETENTION STORAGE
CARRIAGE INN
BRYAN, TEXAS

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Detention Basin Drainage Area (acres)	6.3
Peak Inflow Rate into Basin (cubic feet per second) Q_D	43.3
Peak Release Rate from Basin (cubic feet per second) Q_E	11.4
Total Inflow Volume into Basin (acre-feet)	4.10
Available Storage Depth of Basin (feet)	6.00
Required Freeboard in Basin (feet)	1.0
Side Slopes of Basin (horizontal/vertical)	3.00
Width of Maintenance Berm around Basin (feet)	20.0

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PROGRAM RESULTS:

DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
Required Detention Volume (acre-feet)	2.2	2.6	3.0
Detention Volume Per Acre (ac-ft per ac)	0.35	0.42	0.48
Basin Surface Area w/o Maint. Berm (ac)	0.51	0.58	0.66
Basin Surface Area w/ Maint. Berm (ac)	0.78	0.87	0.96
Basin Excavation Volume (cubic yards)	4455	5219	5981

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STORM SEWER CALCS
CARRIAGE INN
BRYAN, TEXAS

DRAINAGE AREA	FROM	TO	AREA	AREA TOTAL	Tc	C	I	Q	PIPE	GRADE	VEL	CAP.
1	CB1	CB2	0.67	0.67	13.0	0.55	8.81	3.24	18	0.20	3.13	5.5
2	CB2	CB3	0.3	1.01	14.1	0.55	8.49	4.72	18	0.20	3.13	5.5
3	CB4	CB5	0.28	1.29	14.5	0.55	8.38	5.95	18	0.25	3.50	6.2
4	CB5	CB3	0.81	2.10	15.3	0.55	8.17	9.43	24	0.20	3.80	11.9
5	CB3	CB6	0.65	2.85	16.1	0.55	7.95	12.46	24	0.22	3.98	12.5
6	CB6	OUTFALL	0.82	3.67	16.5	0.55	7.85	15.85	30	0.15	3.82	18.7
7	CB7	CB8	0.37	0.37	10.4	0.55	9.70	1.97	12	0.32	3.02	2.4
8	CB8	CB9	0.37	0.74	10.9	0.55	9.53	3.88	18	0.20	3.13	5.5
9	CB9	CB10	0.37	1.11	11.3	0.55	9.36	5.72	18	0.22	3.28	5.8
10	CB10	CB11	0.37	1.48	11.8	0.55	9.21	7.50	24	0.20	3.80	11.9
11	CB11	CB12	0.13	1.61	12.6	0.55	8.93	7.91	24	0.20	3.80	11.9
12	CB12	OUTFALL	0.07	1.68	12.9	0.55	8.85	8.18	24	0.20	3.80	11.9