MID-KANSAS ENGINEERING CONSULTANTS P.A.
3500 NORTH ROCK ROAD, BLDG. #800
WICHITA, KANSAS 67226 1-316-682-6561

CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 1/27/86
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East 3rd
Reference Jasmine Court - Line 1

Line 1

Drainage Area = 0.89 acre, T_c = 15 min, Q_2 = 2.2 cfs

Q_{100} = 4.8 cfs

Ponding: Δx = 5', h_m = 0.35' < 0.5', d_m = 0.4' < d = 0.5' OK

Line 1

Drainage Area = 2.33 acres, L = 750', Ave S_o = 0.007 ft/ft

Q_{STREET} = 31.12 cfs; $Q_{per\ lane}$ = 15.56 cfs, $T_c = T_{ic} + T_T = 15 + 4 = 19$ min

Q_{100} = 11.44 cfs, Area of Street Flow = ½(.455)(14.56) = 3.31 sq. ft.

$V = \frac{11.44}{3.31} = 3.45$ fps $T_T = \frac{750}{3.45 \times 60} = 3.62$ min ≈ 4

Ponding: w/ 2 L = 5' inlets, h = 0.4' < d = 0.5', d_{max} = 0.51' < 0.55' not over curb

Top of Curb = 187.76 / Assume 4 cfs to NE Inlet & 7.44 cfs to SW Inlet; Approx Pipe Sizes = 15" RCP @ 0.49% between Inlets & 18" RCP @ 0.50% to Pond. ℄ Elev @ N.E. Inlet = $187.76 - (3.92 + \frac{15+2\frac{1}{2}}{12}) = 182.90$

℄ Elev In @ SW Inlet = 182.90 - .084(31) = 182.78

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CALCULATIONS & SKETCHES

Proj. No. _____
By _____ Date _____
Chkd By _____ Date _____
Sheet _____ Of _____

Location Mulberry East 3rd
Reference _____

℄ Elev Out @ SW Inlet = 182.53. ℄ Elev @ Pond ≈ 182.53 − (.005 × 190) = 181.58 > 179 ≈ Max Elev of Pond

Let ℄ Elev @ Pond = 177, $S \approx \frac{182.5-177}{190} = 0.0289$

Revise Pipe Sizes: 12" RCP @ 1.7% between Inlets & 15" RCP @ 1.3% to Pond ℄ Elev.'s: NE Inlet = 183.15; SW Inlet, In = 182.72 SW Inlet, Out = 182.47 ℄ Elev @ Pond = 178.25

Ponding: One L_i=5' inlet; h = 0.62' > d = 0.5' ⇒ Use orifice formula, d = 0.98 > 0.6' out of R.O.W.

Try L_i = 10', h = 0.4' < d = 0.5' ⇒ d_{max} = 0.52' < 0.60 w/in R.O.W.

Top of Curb = 187.99; ℄ out Inlet ≈ $187.99 - \left(3 + \frac{15+2\frac{3}{4}}{12}\right) = 183.55$

℄ out @ Pond = 177 Approx $S = \frac{183.55 - 177 - .1}{236.5} = 0.0273'/'$

Use 2.72% ℄ out @ Pond = 177; ℄ out @ MH = 177 + (0.0272 × 965) = 179.62, ℄ in @ MH = 179.72, ℄ out @ Inlet = 179.72 + (.0272 × 140) = 183.53

JASCT2.3RD

Run 1

NUMBER OF PIPES = 4
NUMBER OF JUNCTION NODES = 2
THE FLOW CONVERSION FACTOR = 1

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE	FGN
1	0	1	2.0	18.2	120.0	1.5	0.0	187.72
2	1	2	31.0	12.0	120.0	1.5	0.0	
3	0	2	2.0	18.2	120.0	1.5	0.0	187.72
4	2	0	190.0	15.0	120.0	1.5	0.0	181

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	183.1
2	0.0	182.5

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 5 - ACCURACY ATTAINED = 8.076421E-05

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	0	1	2.97	0.00	0.06	0.00
2	1	2	2.97	0.16	0.33	0.00
3	0	2	8.72	0.01	0.54	0.00
4	2	0	11.68	4.06	2.11	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	183.1	0.0	2.0	187.7
2	182.5	0.0	2.0	187.2

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	2.96
3	8.71
4	-11.69

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CALCULATIONS & SKETCHES

Proj. No. _____
By EBN Date 3/27/86
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference Storm Water Sewers - Line 2

Revised Areas: A = 3.57 acres, B = 3.08 acres, C = 2.51 acres, D = 0.72 acres

Revised T_c: A & B, $T_T = 5.29 + \frac{200}{3.91 \times 60} = 6.14$ min, $T_c = 15 + 6.14 =$ 21.14 ≈ 21 min.

For Area A: $Q_2 = (.6)(3.56)(3.57) = 7.63$ cfs ; $Q_{100} = (.6)(7.88)(3.57) =$ 16.88 cfs

For Area B: $Q_2 = (.6)(3.56)(3.08) = 6.58$ cfs ; $Q_{100} = (.6)(7.88)(3.08) = 14.56$ cfs

Check Q_{LANE} & Q_{STREET} @ $S_o = 0.52\%$. $Q_{LANE} = 7.95$ cfs > $Q_2 = 7.63$ cfs OK

Area C: $L = 1000'$ Ave $S_o = 0.75\%$, Ave $Q_{LANE} = 9.55$ cfs

Assume $T_c \approx 20$ min ; $i = 8.03$ in/hr $Q_{100} = 12.09$

Street Flow Area = $\frac{1}{2}(15.30)(.4980) = 3.66$ sq. ft. $V = \frac{12.09}{3.66} = 3.31$ fps

$T_T = \frac{1000}{3.31 \times 60} = 5.04$ min $T_c = 15 + 5 = 20$ min

$Q_2 = (.6)(3.63)(2.51) = 5.47$ cfs ;

@ Min. $Q_{LANE} = 8.43$ cfs > 5.47 cfs

Area D: $L = 380'$; $S_o = 0.485\%$ $Q_{LANE} = 7.68$ cfs

Assume $T_c = 18$ min $Q_{100} = 3.61$ cfs Street Flow Area = $\frac{1}{2}(10.56)(.33) = 1.74$ sq. ft.

$V = \frac{3.61}{1.74} = 2.07$ fps $T_T = \frac{380}{2.07 \times 60} = 3.05$ min $\Rightarrow T_c = 15 + 3 = 18$ min

$Q_2 = (.6)(.72)(3.78) = 1.63$ cfs < 7.68 cfs = Q_{LANE}

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CALCULATIONS & SKETCHES

Proj. No. ____
By FBW Date 3/28/86
Chkd By ____ Date ____
Sheet 2 Of ____

Location Mulberry East Third
Reference Storm Sewers Line 2

Check Ponding: Total Q_{100} for E. Lane = (.6)(3.57+2.51)(7.88) = 28.75 ; Total Q_{100} for W. Lane = (.6)(3.08+.72)(7.88) = 17.97 cfs

Total Street Flow, Q_{100} = 28.75 + 17.97 = 46.72 cfs

Using Orifice Formula, determine reqd. area to keep d_{max} = 0.75'

$$A = Q / .67[64.32(d - \tfrac{b}{2})]^{1/2} = 46.72 / .67[64.32(.75 - \tfrac{.5}{2})]^{1/2}$$

A = 12.29 sq. ft $L = \frac{12.29}{.5} = 24.59' \approx 25'$

or 2 - L_i = 10' & 1 L_i = 5'

Check $d_{max} = \left[\left[\frac{Q}{.67A}\right]^2 / 64.32\right] - \frac{b}{2}$ = 0.73' < 0.75' OK

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/25/26
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry Third
Reference Jasmine Culvert
Line 2

Determine approximate ℄ elev.: TC = 188.20, For RCB w/ 3' Rise, ℄ = 188.20 - (2.09 + 3.67) = 182.45. This is 186.00 - 182.45 = 3.55' below design water surface of pond N.G.

Pour curb monolithic with RCB, let bottom elev of high edge of curb = 188.20 - 0.55 + (1.833 x .03125) - .4167 = 187.29 = Top of RCB; ℄ Elev @ Back of E. Curb = (187.29 + (.005 x 25)) - 3.67 = 183.61

℄ @ E. ROW = 183.61 + (17 x .005) = 183.72. This is 186.00 - 183.72 = 2.28 below water surface. Will need soil saver

℄ @ W. curb = 183.61 - (.005 x 41) = 183.53

℄ Out = 183.53 - (.005 x 17) = 183.44

Size ditch based on Q_{100} = 508.81 cfs obtained from Rational Formula. For V = 4 fps, max. Area = $\frac{508.81}{4}$ = 127.20

Ditch: d = 3', Side Slope = 4:1, B = 30', Area = 126.00 sq. ft., S = 0.30%

Q_{100} = 510.82 cfs V = 4.05 fps ≈ 4 fps

Length from Lake to soil saver = 140'

℄ Elev @ Top of soil saver = 186 - (140 x .003) = 185.58

Ht. of soil saver = 185.58 - 183.72 = 1.86' OK

Size RCB initially based on Q_{100} = 508.81 cfs

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CALCULATIONS & SKETCHES

Proj. No. ____ By FBN Date 3/25/86 Chkd By ____ Date ____ Sheet 2 Of ____

Location Mulberry Third
Reference Jasmine Culvert Line 2

For Inlet Control: $HW = 188.58 - \underbrace{1}_{\text{freeboard}} - 183.72 = 3.86' \Rightarrow \frac{HW}{D} = 1.29$

w/wingwall flare 30° to 75°, $\frac{Q}{B} = 20$ cfs/', $B = \frac{508.8}{20} = 25.29'$

Try 3 - 8' x 3' RCB $B = 24'$

For Outlet Control: Area = 72 sq. ft, $L = 75'$, $K_e = 0.5$ $H = 1.29$

$\frac{Q}{B} = \frac{509}{24} = 21.2$ $d_c = 2.5'$; $\frac{d_c + d}{2} = \frac{5.5}{2} = 2.75'$

$HW = H + h + L S_o = 1.29 + 2.75 - (.005 \times 75) = 3.67' < 3.86'$ OK

Determine Q's thru RCB. Partial Flow Conditions:

Elev	d/D	q/Q	Q	q
186.5	.93	1.2	616.72	740.06 cfs *

Culvert Inlet Control:

Elev	HW/D	Q/B	Q cfs
187	1.09	17	408
187.5	1.26	19	456
188.0	1.43	22.5	540
188.5	1.59	25	600

* Use Q @ 186.50 = 360 cfs for TR-20

Pond is approx. equivalent to 320' x 120' Pond

Elev	Storage, acre-ft
186.5	0.40
187.0	0.82
187.5	1.26
188.0	1.70
188.5	2.17

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/26/86
Chkd By _____ Date _____
Sheet 3 Of _____

Location Mulberry Third
Reference Jasmine ✓ Culvert
Line 2

Additional Area: Area = 8.31 acres = 0.013 sq. mi., C = 0.57, CN = 92, T_c = 25 min = .42 hr

Based on SCS TR20 Run MULGOF2, try 3 - 7'x3' RCBs

Partial Flow Conditions:

Elev	d/D	q/Q	Q	q
186.5	.93	1.2	526	631 cfs *

Culvert Inlet Control:

Elev	HW/D	Q/B	Q
187.0	1.09	17	357
187.5	1.26	19	399
188.0	1.43	22.5	472.5
188.5	1.59	25.0	525.0

* Use Q@ 186.5 = 315 cfs for TR20

Ditch Design: Design water surface @ Pond [14] = 179.00
℄ Out of RCB = 183.44; L = 655' Assuming outlet of
Ditch @ Elev = 178 Approx. S = $\frac{183.44 - 178}{655}$ = 0.0083'/'

Make S = 0.003'/'; Ht. reqd. to be taken up by ditch checks =
182.96 - 178.00 = 4.96
5.44 - (655 x .003) = 3.48', Need Two Ditch Checks @ 1.74' each
(624 - 5.74) =

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBH Date 3/28/96
Chkd By _____ Date _____
Sheet 4 Of _____

Location Mulberry Third
Reference Jasmine Culvert
Line 2

Run MULGOF2F w/ Additional Areas Flowing to Ditch

W. of Jasmine Areas A, B, C, & D = 9.87 acres = 0.015 sq. mi; CN = 87
T_c = 21 min = 0.35 hr

Back of Lots, Area = 2.41 + 1.12 = 3.53 acres; CN = 87

Golf Course, Area = 13.35 acres; CN = 84

Ave CN = $\frac{3.53}{16.88}(87) + \frac{13.35}{16.88}(84) = 84.63$, Area = 16.88 acres = 0.026 sq. mi.

T_c = 24 min = 0.40 hr

XSECTN (18) L = 655' Bottom Ditch Æ = 178.90

Bankful Elev. 182.50

Elev	Q	End Area
178.90	0	0
179.40	22.46	16.0
179.90	73.10	34.0
180.40	147.62	54.0
180.90	245.25	76.0
181.40	366.15	100.0
181.90	510.82	126.0
182.40	679.97	154.0
182.90	874.41	184.0

XSECTN (16) L = 140', Æ = 185.90
Bankful Elev. = 188.50

Elev.	Q	End Area
185.90	0	0
186.40	22.46	16.0
186.90	73.10	34.0
187.40	147.62	54.0
187.90	245.25	76.0
188.40	366.15	100.00
188.90	510.82	126.0

Revise Culvert Based on Q_{100} = 503.81 + 2.04 = 305 cfs

Inlet Control: HW = 3.86'; $\frac{HW}{D}$ = 1.29; $\frac{Q}{B}$ = 20 $B = \frac{305}{20} = 15.25' \Rightarrow$

16' ⇒ 2 - 8'x3' RCB's

Outlet Control: Area = 48 sq. ft, L = 75', K_e = 0.5, H = 1.12'

$\frac{Q}{B} = \frac{305}{16} = 19.06$; d_c = 2.3 $\frac{d_c + d}{2} = \frac{2.3 + 3.0}{2} = 2.65'$

$HW = H + h - LS_o = 1.12 + 2.65 - (.005 \times 75) = 3.40' < 3.86'$ OK

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/28/86
Chkd By _____ Date _____
Sheet 5 Of _____

Location Mulberry 3rd
Reference Jasmine Culvert
LINE 2

2 - 8'x3' RCB's

Elev	HW/D	Q/B	Q
186.50			245*
187.00	1.09	17	272
187.50	1.26	19	304
188.00	1.43	22.5	360
188.50	1.59	25.0	400

3 - 5x3' RCB's

Elev	HW/D	Q/B	Q
186.50			227*
187.00	1.09	17	255
187.50	1.26	19	285
188.00	1.43	22.5	337.5
188.50	1.59	25	375

Revise Ditch: Based on TR-20 Run MULGO1F2J, Q_{100} = 372.86 cfs

For V = 4 fps, $A = \frac{372.86}{4} = 90.82$ sq. ft

Try S = 0.34%, D = 3, Side Slopes = 4:1, B = 18', Area = 90.00 sq. ft.

Q = 366.06 cfs, $V = \frac{366.05}{90.00} = 4.07$ fps ≈ 4 fps

2 Ditch ckg's @ approx. $(5.44 - (655 \times .0034)) \div 2 = 1.61'$ each

Rock Road S. Culvert
Double 8x3 RCB

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**********80-00 LIST OF INPUT DATA FOR TR-20 HYDROLOGY**********

 0B TR-20                    FULLPRINT          SUMMARY                    10
 1TLE 011 MULGOF2M  MULBERRY: XSECT.'S 2 & 15, PONDS 2 & 13, AND RCB      20
 2TLE     12   USING 100YR,   6HR RAINFALL    DOUBLE 9 X 3 RCB           30
 5 RAINFL 7                  1.0                                         40
 8              0.0         0.50        1.30        4.10        5.00     50
 8              5.50        5.90        5.90        5.90        5.90     60
 9 ENDTBL                                                               70
 2 XSECTN   002             1.00      200.00                            80
 8                        197.00        0.00        0.00                90
 8                        197.50       17.31        9.00               100
 8                        198.00       57.85       20.00               110
 8                        198.50      120.04       33.00               120
 8                        199.00      204.76       48.00               130
 8                        199.50      313.40       65.00               140
 8                        200.00      447.53       84.00               150
 9 ENDTBL                                                               160
 3 STRUCT     02                                                        170
 8                        195.0         0.0        0.00                180
 8                        195.5        59.52       1.61                190
 8                        196.0       168.35       3.00                200
 8                        196.5       309.28       4.39                210
 8                        197.0       476.17       6.59                220
 8                        197.5       665.46       8.31                230
 9 ENDTBL                                                               240
 2 XSECTN   015             1.00      156.50                            250
 8                        193.25        0.00        0.00                260
 8                        193.75       18.07       13.00               270
 8                        194.25       59.26       28.00               280
 8                        194.75      120.61       45.00               290
 8                        195.25      201.94       64.00               300
 8                        195.75      303.77       85.00               310
 8                        196.25      426.88      108.00               320
 8                        196.75      572.10      133.00               330
 9 ENDTBL                                                               340
 3 STRUCT     12                                                        350
 8                        186.92        0.0        0.00                360
 8                        187.42      209.61       0.03                370
 8                        187.92      328.00       0.11                380
 8                        188.42      332.00       0.26                390
 8                        189.92      336.00       1.25                420
 8                        190.42      384.00       1.84                430
 8                        190.92      416.00       2.63                440
 8                        191.42      448.00       3.62                450
 8                        191.92      480.00       5.00                460
 9 ENDTBL                                                               450
 3 STRUCT     13                                                        500
```

```
**********80-80 LIST OF INPUT DATA (CONTINUED)**********

                          186.0        0.0        0.00                        510
8                         186.5      270.00       0.49                        520
8                         187.0      306.00       0.82                        530
8                         187.5      342.00       1.26                        540
8                         188.0      405.00       1.70                        550
8                         188.5      455.00       2.17                        560
9 ENDTBL                                                                      570
6 RUNOFF 1 002       6     0.116      93.0        0.57   1         1          580
6 REACH  3 002   6   5  1015.0                            1         1          590
6 RUNOFF 1    02     6     0.074      93.0        0.38   1         1          600
6 ADDHYD 4    02 5 6 7                                   1         1          610
6 RESVOR 2    02 7   5    195.0                          1         1          620
6 REACH  3 015   5   4    200.0                          1         1          630
6 RUNOFF 1    12     6     0.033      84.0        1.05   1         1          640
6 ADDHYD 4    12 4 6 7                                   1         1          650
6 RESVOR 2    12 7   5    186.92                         1         1          660
6 RUNOFF 1    13     6     0.013      92.0        0.42   1         1          670
6 ADDHYD 4    13 5 6 7                                   1         1          680
6 RESVOR 2    13 7   5    186.00                         1         1          690
  ENDATA                                                                      700
7 INCREM 6                 0.04                                               710
7 COMPUT 7 002       13              1.0        1.0    7 2  01  06            720
  ENDCMP 1                                                                    730
  ENDJOB 2                                                                    740

**********END OF 80-80 LIST**********
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LE NO. 11

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:

CHESTER, PA (NORTHEAST) -- 215-499-3933, FORT WORTH, TX (SOUTH) -- 334-5242 (FTS)
LINCOLN, NB (MIDWEST) -- 541-5318 (FTS), PORTLAND, OR (WEST) -- 423-4099 (FTS)
OR HYDROLOGY UNIT, ENGINEERING DIVISION, LANHAM, MD -- 436-7383 (FTS).

PROGRAM CHANGES SINCE MAY 1982:

12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD
CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION
5/02/83 - CORRECT COMPUTATIONS FOR ---
1. DIVISION OF BASEFLOW IN DIVERT OPERATION
2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
3. CROSS SECTION DATA PLOTTING POSITION
4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTIPEAK HYDROGRAPH
6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
7. BASEFLOW ENTERED WITH READHYD
8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS
ENHANCEMENTS ---
1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S
09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS
CORRECT COMBINATION OF RATING TABLES FOR DIVERT
CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS
ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

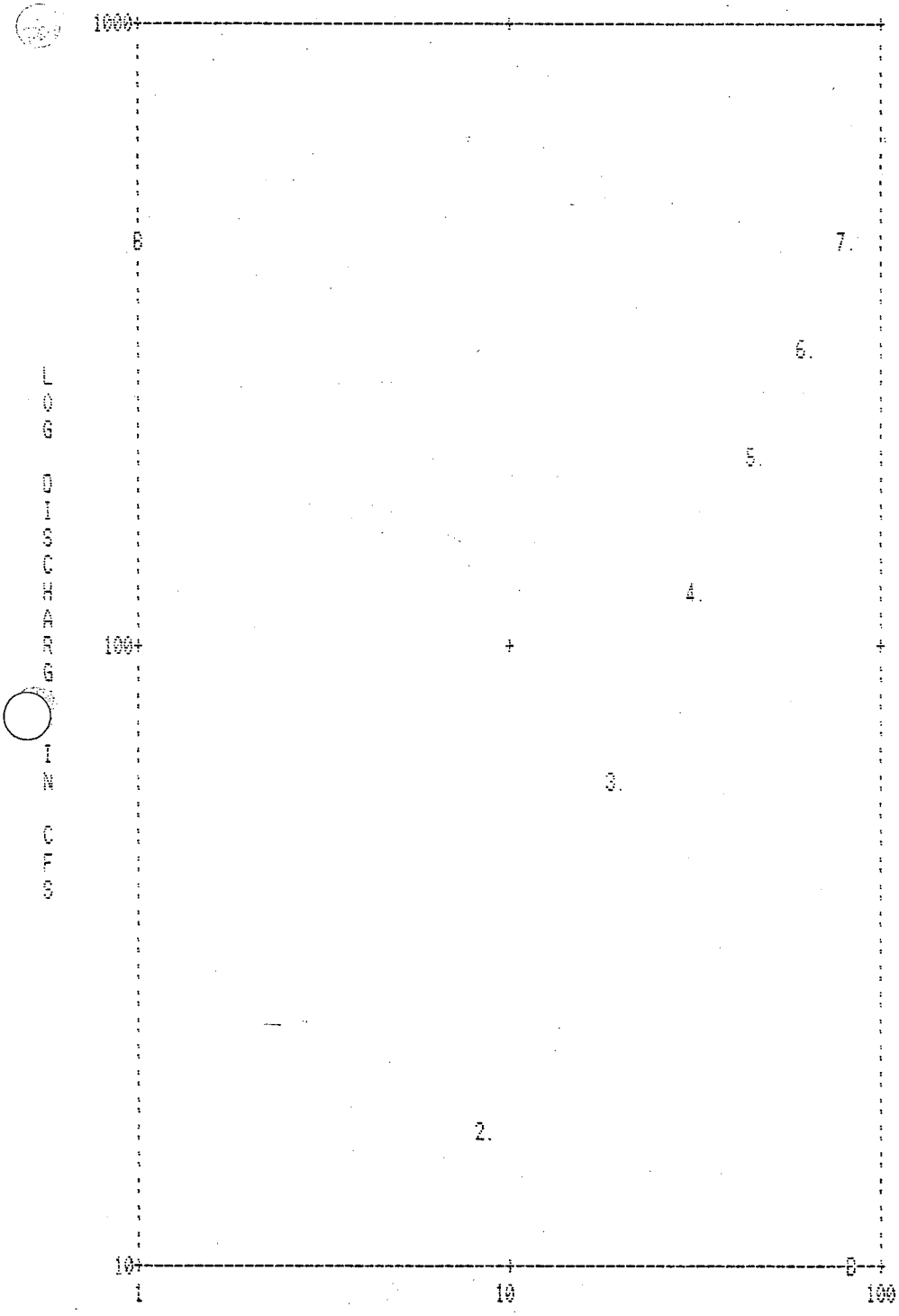
CUMULATIVE RAINFALL TABLE 7 TIME INCREMENT= 1.00

```
8          .0000     .5000    1.3000    4.1000    5.0000
8         5.5000    5.9000    5.9000    5.9000    5.9000
9 ENDTBL                                                  70
```

CROSS-SECTION DATA, CROSS-SECTION NO. 2 DRAINAGE AREA= 1.00 BANKFULL ELEV.= 200.00

	ELEVATION	DISCHARGE	END AREA
8	197.00	.00	.00
8	197.50	17.31	9.00
8	198.00	57.85	20.00
8	198.50	120.04	33.00
8	199.00	204.76	48.00
8	199.50	313.40	65.00
8	200.00	447.53	84.00

9 ENDTBL



CROSS SECTION 2 END AREA VS DISCHARGE

REFERENCE NO'S	DISCHARGE (CFS)	END AREA (SQ.FT.)	M
1	.00	.00	1.51
2	17.31	9.00	1.51
3	57.85	20.00	1.51
4	120.04	33.00	1.49
5	204.76	48.00	1.46
6	313.49	65.00	1.44
7	447.53	84.00	1.42

LEGEND

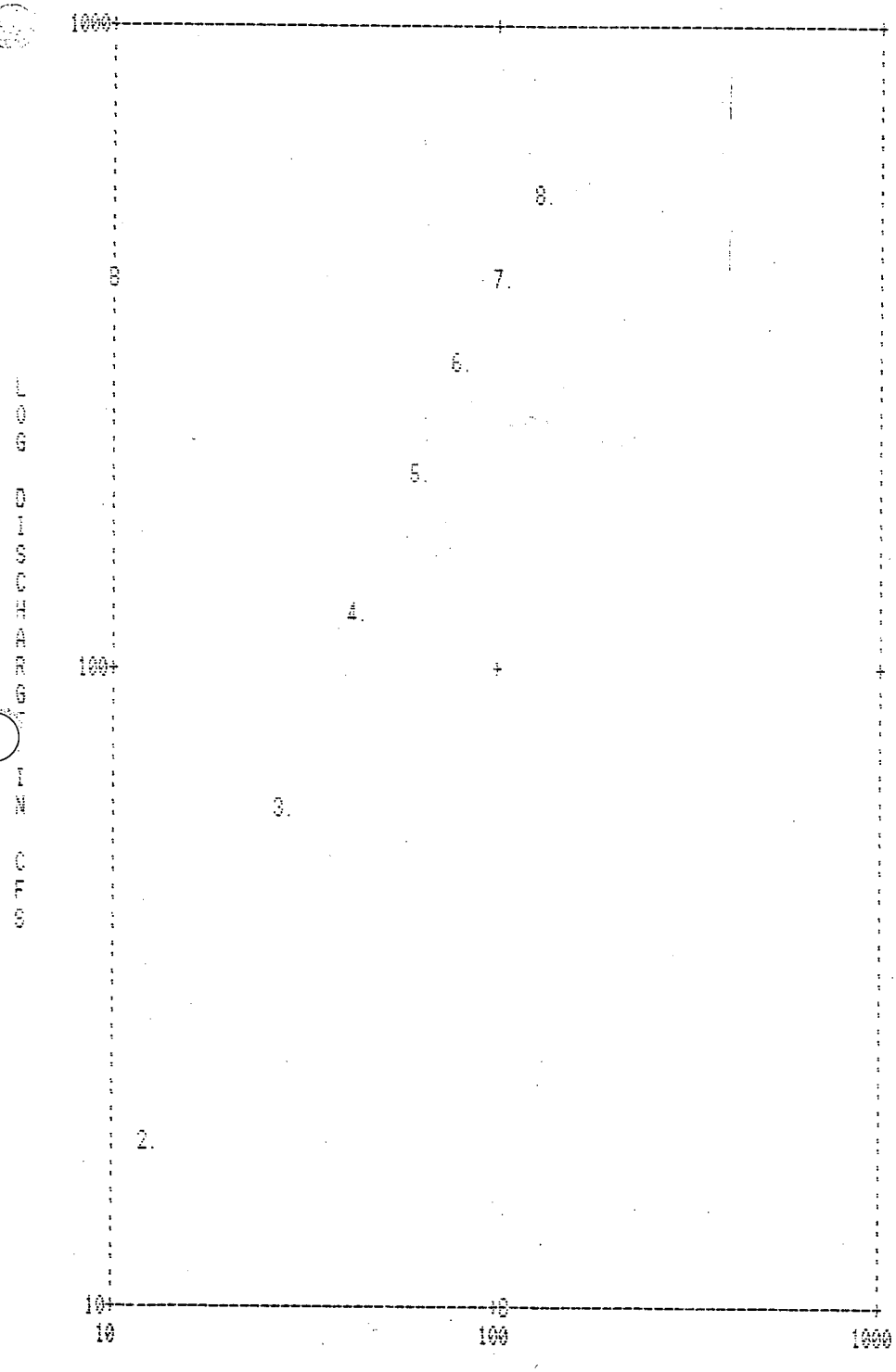
+ = GRID REFERENCE
. = LOCATION OF PLOTTED VALUE
3 = REFERENCE NO. OF PLOTTED VALUE
X = MULTIPLE REFERENCE NUMBERS
B = BANKFULL RELATION SHOWN ON AXIS
AREA= 84.0 SQ FT DISCHARGE= 447.5 CFS

STRUCTURE DATA, STRUCTURE NO. 2

	ELEVATION	DISCHARGE	STORAGE
S	195.00	.00	.00
S	195.50	59.52	1.61
S	196.00	168.35	3.00
S	196.50	309.99	4.99

```
 8                      197.00      476.17       6.65
 8                      197.50      665.46       8.31
 9 ENDTBL
```

```
 CROSS-SECTION DATA,  CROSS-SECTION NO.  15        DRAINAGE AREA=   1.00     BANKFULL ELEV.=  196.50
 8                      ELEVATION   DISCHARGE    END AREA
 8                      193.25         .00          .00
 8                      193.75       18.97        13.00
 8                      194.25       59.26        28.00
 8                      194.75      120.61        45.00
 8                      195.25      201.94        64.00
 8                      195.75      303.77        85.00
 8                      196.25      426.88       108.00
 8                      196.75      572.10       133.00
 9 ENDTBL
```



CROSS SECTION 15 END AREA VS DISCHARGE

REFERENCE NO'S	DISCHARGE (CFS)	END AREA (SQ.FT.)	M
1	.00	.00	1.55
2	10.07	13.00	1.55
3	59.26	28.00	1.55
4	139.61	45.00	1.52
5	201.94	54.00	1.50
6	303.77	85.00	1.48
7	426.88	108.00	1.46
8	572.10	133.00	1.45

LEGEND

+ = GRID REFERENCE
. = LOCATION OF PLOTTED VALUE
8 = REFERENCE NO. OF PLOTTED VALUE
X = MULTIPLE REFERENCE NUMBERS
B = BANKFULL RELATION SHOWN ON AXIS
AREA= 108.0 SQ FT DISCHARGE= 426.9 CFS

STRUCTURE DATA, STRUCTURE NO. 12

	ELEVATION	DISCHARGE	STORAGE
8	186.92	.00	.00
8	187.42	209.61	.03
8	187.92	328.80	.11
8	188.42	390.00	.25

```
 3                      189.92      336.00       1.25
 8                      190.42      384.00       1.84
 8                      190.92      416.00       2.63
 8                      191.42      448.00       3.62
 8                      191.92      480.00       5.00
 9 ENDTBL
```

```
   STRUCTURE DATA,  STRUCTURE NO. 13
                          ELEVATION   DISCHARGE    STORAGE
 9                         186.00         .00         .00
 8                         186.50      270.00         .40
 8                         187.00      306.00         .82
 8                         187.50      342.00        1.26
 8                         188.00      405.00        1.70
 8                         188.50      455.00        2.17
  9 ENDTBL
```

```
   STANDARD CONTROL OPERATION RUNOFF   CROSS SECTION   2                                                    RECORD ID      580
          OUTPUT HYDROGRAPH = 6                          DATA FIELD VALUES =       .1160      93.0000        .5700
          OUTPUT OPTIONS IN EFFECT  PEAK  VOL   SUM

   STANDARD CONTROL OPERATION REACH    CROSS SECTION   2                                                    RECORD ID      590
          INPUT HYDROGRAPH = 6       OUTPUT HYDROGRAPH = 5  DATA FIELD VALUES =    1015.0000        .0000        .0000
          OUTPUT OPTIONS IN EFFECT  PEAK  VOL   SUM

   STANDARD CONTROL OPERATION RUNOFF   STRUCTURE  2                                                         RECORD ID      600
          OUTPUT HYDROGRAPH = 6                          DATA FIELD VALUES =       .0740      93.0000        .3800
          OUTPUT OPTIONS IN EFFECT  PEAK  VOL   SUM

   STANDARD CONTROL OPERATION ADDHYD   STRUCTURE  2                                                         RECORD ID      610
          INPUT HYDROGRAPHS = 5,6    OUTPUT HYDROGRAPH = 7  DATA FIELD VALUES =       .0000        .0000        .0000
          OUTPUT OPTIONS IN EFFECT  PEAK  VOL   SUM

   STANDARD CONTROL OPERATION RESVOR   STRUCTURE  2                                                         RECORD ID      620
          INPUT HYDROGRAPH = 7       OUTPUT HYDROGRAPH = 5  DATA FIELD VALUES =     195.0000        .0000        .0000
          OUTPUT OPTIONS IN EFFECT  PEAK  VOL   SUM
```

STANDARD CONTROL OPERATION REACH CROSS SECTION 15 RECORD ID 630
INPUT HYDROGRAPH = 5 OUTPUT HYDROGRAPH = 4 DATA FIELD VALUES = 200.0000 .0000 .0000
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

STANDARD CONTROL OPERATION RUNOFF STRUCTURE 12 RECORD ID 640
OUTPUT HYDROGRAPH = 6 DATA FIELD VALUES = .0330 84.0000 1.0500
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

STANDARD CONTROL OPERATION ADDHYD STRUCTURE 12 RECORD ID 650
INPUT HYDROGRAPHS = 4,6 OUTPUT HYDROGRAPH = 7 DATA FIELD VALUES = .0000 .0000 .0000
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

STANDARD CONTROL OPERATION RESVOR STRUCTURE 12 RECORD ID 660
INPUT HYDROGRAPH = 7 OUTPUT HYDROGRAPH = 5 DATA FIELD VALUES = 186.5200 .0000 .0000
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

STANDARD CONTROL OPERATION RUNOFF STRUCTURE 13 RECORD ID 670
OUTPUT HYDROGRAPH = 6 DATA FIELD VALUES = .0130 92.0000 .4200
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

STANDARD CONTROL OPERATION ADDHYD STRUCTURE 13 RECORD ID 680
INPUT HYDROGRAPHS = 5,6 OUTPUT HYDROGRAPH = 7 DATA FIELD VALUES = .0000 .0000 .0000
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

STANDARD CONTROL OPERATION RESVOR STRUCTURE 13 RECORD ID 690
INPUT HYDROGRAPH = 7 OUTPUT HYDROGRAPH = 5 DATA FIELD VALUES = 186.0000 .0000 .0000
OUTPUT OPTIONS IN EFFECT PEAK VOL SUM

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .04 HOURS RECORD ID 710

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 2 TO STRUCTURE 13 RECORD ID 720
STARTING TIME = .00 RAIN DEPTH = 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 7 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 6 MAIN TIME INCREMENT = .04 HOURS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 6
AREA= .12 SQ MI INPUT RUNOFF CURVE= 93. TIME OF CONCENTRATION= .57 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0422 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.06	193.96	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 5.00 WATERSHED INCHES, 300.60 CFS-HRS, 31.45 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 2
INPUT HYDROGRAPH= 6 OUTPUT HYDROGRAPH= 5
LENGTH = 1015.00 FEET INPUT = RATING CURVE REPRESENTATIVE OF REACH

COEFFICIENTS USED IN ROUTING RELATED TO CROSS SECTION AREA, X= .71 M= 1.46

MODIFIED ATT-KIN ROUTING COEFFICIENT = .61 PEAK TRAVEL TIME = .05 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.12	193.42	199.93

RUNOFF VOLUME ABOVE BASEFLOW = 5.00 WATERSHED INCHES, 300.60 CFS-HRS, 31.45 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 2
OUTPUT HYDROGRAPH= 6
AREA= .07 SQ MI INPUT RUNOFF CURVE= 93. TIME OF CONCENTRATION= .30 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0422 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.00	127.83	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 5.00 WATERSHED INCHES, 242.63 CFS-HRS, 20.05 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 2
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.05	318.80	196.53

RUNOFF VOLUME ABOVE BASEFLOW = 5.00 WATERSHED INCHES, 623.23 CFS-HRS, 51.50 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 2
INPUT HYDROGRAPH= 7 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 195.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.15	309.05	196.50

RUNOFF VOLUME ABOVE BASEFLOW = 5.00 WATERSHED INCHES, 623.22 CFS-HRS, 51.50 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 15
INPUT HYDROGRAPH= 5 OUTPUT HYDROGRAPH= 4
LENGTH = 200.00 FEET INPUT = RATING CURVE REPRESENTATIVE OF REACH

COEFFICIENTS USED IN ROUTING RELATED TO CROSS SECTION AREA, X= .43 M= 1.48

MODIFIED ATT-KIN ROUTING COEFFICIENT = 1.00 PEAK TRAVEL TIME = .00 HOURS

*** WARNING REACH 15 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.15	309.05	196.77

RUNOFF VOLUME ABOVE BASEFLOW = 5.00 WATERSHED INCHES, 623.22 CFS-HRS, 51.50 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 12
OUTPUT HYDROGRAPH= 6
AREA= .03 SQ MI INPUT RUNOFF CURVE= 84. TIME OF CONCENTRATION= 1.05 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0412 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.36	39.43	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 4.10 WATERSHED INCHES, 87.37 CFS-HRS, 7.22 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 12
INPUT HYDROGRAPHS= 4,6 OUTPUT HYDROGRAPH= 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.17	345.92	190.02

RUNOFF VOLUME ABOVE BASEFLOW = 4.94 WATERSHED INCHES, 710.59 CFS-HRS, 59.72 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 12
INPUT HYDROGRAPH= 7 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 186.92

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.29	332.34	188.55

RUNOFF VOLUME ABOVE BASEFLOW = 4.93 WATERSHED INCHES, 710.21 CFS-HRS, 58.69 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 13
OUTPUT HYDROGRAPH= 6
AREA= .01 SQ MI INPUT RUNOFF CURVE= 92. TIME OF CONCENTRATION= .42 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0400 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.02	22.10	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 4.97 WATERSHED INCHES, 41.68 CFS-HRS, 3.44 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 13
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.14	352.11	187.58

RUNOFF VOLUME ABOVE BASEFLOW = 4.94 WATERSHED INCHES, 751.90 CFS-HRS, 62.14 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 13
INPUT HYDROGRAPH= 7 OUTPUT HYDROGRAPH= 5
SURFACE ELEVATION= 186.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
3.29	348.04	187.55

RUNOFF VOLUME ABOVE BASEFLOW = 4.94 WATERSHED INCHES, 752.01 CFS-HRS, 62.15 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1 RECORD ID 730

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID 740

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 6													
XSECTION 2	RUNOFF	.12	7	2	.04	.0	5.90	6.00	5.08	---	3.06	193.96	1672.1
XSECTION 2	REACH	.12	7	2	.04	.0	5.90	6.00	5.08	198.93	3.12	193.42	1667.4
STRUCTURE 2	RUNOFF	.07	7	2	.04	.0	5.90	6.00	5.08	---	3.00	127.93	1727.5
STRUCTURE 2	ADDHYD	.19	7	2	.04	.0	5.90	6.00	5.08	196.53	3.05	318.89	1677.9
STRUCTURE 2	RESVOR	.19	7	2	.04	.0	5.90	6.00	5.08	196.50	3.15	309.05	1626.6
XSECTION 15	REACH	.19	7	2	.04	.0	5.90	6.00	5.08	195.77	3.15	309.05	1626.6
STRUCTURE 12	RUNOFF	.03	7	2	.04	.0	5.90	6.00	4.10	---	3.36	39.43	1195.9
STRUCTURE 12	ADDHYD	.22	7	2	.04	.0	5.90	6.00	4.94	190.02	3.17	345.92	1551.2
STRUCTURE 12	RESVOR	.22	7	2	.04	.0	5.90	6.00	4.93	188.55	3.29	332.34	1490.3
STRUCTURE 13	RUNOFF	.01	7	2	.04	.0	5.90	6.00	4.97	---	3.02	22.19	1700.2
							Double 8x3 RCB			Prop. E.R.O.W. 191.95, Rock Road			
STRUCTURE 13	ADDHYD	.24	7	2	.04	.0	5.90	6.00	4.94	187.58	3.14	352.11	1492.9
STRUCTURE 13	RESVOR	.24	7	2	.04	.0	5.90	6.00	4.94	187.55	3.29	348.04	1474.8
							Double 9x3 RCB			Prop. E. R.O.W. Elev 188.50 Jasmine Drive			

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS
(A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK
A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

		HYDROGRAPH INFORMATION							ROUTING PARAMETERS									PEAK TRAVEL TIME	
XSEC ID	REACH LENGTH (FT)	INFLOW PEAK (CFS)	INFLOW TIME (HR)	OUTFLOW PEAK (CFS)	OUTFLOW TIME (HR)	OUTFLOW+ INTERV PEAK (CFS)	OUTFLOW+ INTERV TIME (HR)	BASE-FLOW (CFS)	VOLUME ABOVE BASE (IN)	MAIN TIME INCR (HR)	ITER-ATION #	Q AND A EQUATION COEFF (X)	Q AND A EQUATION POWER (M)	LENGTH FACTOR (K*)	PEAK RATIO O/I (Q*)	S/Q *PEAK (K) (SEC)	ATT-KIN COEFF (C)	STOR-AGE (HR)	KINE-MATIC (HR)
ALTERNATE 1 STORM 6																			
2	1015	194	3.1	193	3.1	---	---	0	5.09	.04	1	.715	1.46	.007	.999	165	.61	.04	.05
15	200	309	3.2	309	3.2	---	---	0	5.09	.04	0	.428	1.48	.001	1.000	38	1.00?	.00	.00

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 6
STRUCTURE 13	24		
ALTERNATE	1		348.64
STRUCTURE 12	22		
ALTERNATE	1		332.34
STRUCTURE 2	19		
ALTERNATE	1		309.05
XSECTION 2	12		
ALTERNATE	1		193.42
XSECTION 15	19		
ALTERNATE	1		309.05

END OF 1 JOBS IN THIS RUN

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WICHITA, KANSAS 67226 1-316-682-6561

CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 11/26/85
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference Areas V, VI, VII VIII & XIX - Oakmont & Sweet Bay Entrance - Line 3

Determine Q_{STREET} & T_c for Area V. L = 1,050'

Diff. in elev. = 8' $S_o \approx \frac{8}{1050} = 0.0076$ ft/ft ; $Q_{STREET} = 21.54$ cfs

or 10.77 cfs per lane $T_c = T_{ic} + T_T = 15 + 4 = 19$ min

$Q_{100} = (1.6)(8.19)(2.36) = 11.60$ cfs ; Area of Street Flow = $\frac{1}{2}(.4500)(14.38) = 3.23$ sq ft

$V = \frac{11.60}{3.23} = 3.59$ fps ; $T_T = \frac{1050}{3.59 \times 60} = 4.88$ min ≈ 5 min $T_c = 20$ min

Determine Q_{STREET} & T_c for Area VII. L = 425'

Diff in Elev = 2' ; $S \approx \frac{2}{425} = 0.0047$ Use $S_o = 0.42\%$

$Q_{STREET} = 16.01$ cfs or 8.0 cfs per lane

Try $T_c = T_i + T_T = 15 + 3 = 18$ min $Q_{100} = (1.6)(8.37)(1.05) = 5.27$ cfs

Street Flow Area = $\frac{1}{2}(.375)(11.98) = 2.25$ sq. ft. ; $V = \frac{5.27}{2.25} = 2.35$ fps

$T_T = \frac{425}{2.35 \times 60} = 3.02$ min $T_c = 18$ min

Determine T_c for Area IX. L = 1350' ; Diff. in elev = 16'

$S_o = \frac{16}{1350} = .0119$ ft/ft $\approx 1.20\%$ C = 0.7 $T_c = 25$ min

Determine Q_i @ inlets

Area V. $L_i = 10'$, $S_o = 0.76\%$, $Q_i = 5.96$ cfs

Area VI. East $L_i = 10'$, $S = 0.76\%$, $Q_i \approx 6.00$ cfs

Area VI West $L_i = 5'$, $S_o = 0.42\%$, $Q_i = 2.30$ cfs

Area VII $L_i = 5'$ $S = 1.0\%$, $Q_i = 1.81$

Approx. Q_{100} to 5 inlets = 35.40 - 16.07 = 19.33

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CALCULATIONS & SKETCHES

Proj. No. _____
By FSN Date 11/26/85
Chkd By _____ Date _____
Sheet 2 Of _____

Location Mulberry East Third
Reference Areas I, III, VII, VIII & IX – Line 3

Check Ponding @ S. Inlets

Try 2 Li = 5' inlets. h_m = .58 > d = .5'

by orifice formula, d = .77' < .80 i.e. w/in R.O.W OK

Ditch to Exist. Culv: D = 1.75', Side Slope = 4:1, B = 4.0', S = 0.002'/'

Q = 37.6 cfs > Q_{100} = 35.4 cfs

Ditch Curve: R = 30', D = 190.59', Δ = 76°30', L = 40.05

T = 23.65', C = 37.15', M = 6.44', E = 8.20'

27 RCP from Ditch to Inlet @ 37th & Swt. Bay. S = 0.008'/'

L = 25'

Exist CMPA ℄ Elev = 184.77, ℄ Elev @ Outlet of 27" RCP =

184.77 + .002(43.51 + 154.25) = 185.17. ℄ Elev @ Curb Inlet @ 37th &

Swt. Bay = 185.17 + 0.007(30) = 185.38

27" RCP from Inlet @ 37th & Swt. Bay (Sta. 2+28.01) to Inlet @ Sta

3+72.01 : S = 0.0032, L = 144; ℄ Elev Out @ Sta 3+72.01 = 185.84

24" RCP from Sta. 3+72.01 to Sta. 4+99.01 : S = 0.004'/', L = 127';

℄ Elev In, Sta 3+70.35 = 186.09; ℄ Elev Out, Sta. 4+97.5 = 186.60

21" RCP from Sta 4+99.01 to Sta 5+59.51 : S = 0.0032'/', L = 60.5';

℄ Elev. In, Sta 4+97.25 = 186.85; ℄ Elev Out, Sta 5+57.75 = 187.04

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CALCULATIONS & SKETCHES

Proj. No. ____
By FBN Date 1/27/86
Chkd By ____ Date ____
Sheet 3 Of ____

Location Mulberry East 3rd
Reference SWS - Line 3

Check Depth of Cover under Curb: $191.98 - 187.04 - \frac{21+2.75}{12} = 2.97' >$ 2.92' OK

18" RCP from Sta 5+59.51 to Sta. 6+20.01 : S = 0.0032', L = 60.5'
℄ Elev. In, Sta. 5+57.75 = 187.29 ; ℄ Elev. = 187.48

21" RCP from Sta. 4+97.25 Line 3 to Sta 0+42 Line 3a: S = 0.002',
L = 42' ℄ Elev In, Sta 4+97.25 = 186.70 ; ℄ Elev Out, Sta 0+42 = 186.83 Check Cover $191.64 - 186.83 - (\frac{21+2+3.75}{12}) = 2.83' > 2.92'$ - NG
Diff. = 0.09'. Lower ℄ Elev. In, Sta 4+97.25 by 0.10' to 186.60 ;
℄ Elev Out, Sta 0+42, Line 3a = 186.73

18" RCP From Sta 0+42, Line 3a, to Sta 0+71, Line 3a: S = 0.002',
L = 29' ; ℄ Elev In, Sta 0+42 = 186.98 ; ℄ Elev Out, Sta 0+71 = 187.04

Revise Curb Inlet @ St. Sta. 0+78 (Sweet Bay)
Take 34" x 22" HERCP out of South side of Inlet instead of W. side. Pipe will go SW. @ S45°00'W toward future on 39th St. W.
Determine width of inlet read. Note: 34" x 22" HERCP's are no longer made. Use 38"x24" HERCP Wall thickness = 3.75'
Total Width = $\frac{38+3.75+3.75}{12} = 3.79' < 4.25'$ = Dia. of 42" RCP Use 6'-4"
Width. for Inlet @ St. Sta. 2+21 (Sweet Bay)

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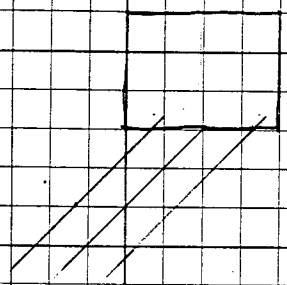
Proj. No. ____
By FBN Date 4/3/86
Chkd By ____ Date ____
Sheet 4 Of ____

Location Mulberry 3rd
Reference Line 3

Inlet @ St. Sta. 0+78



@ 45°, Total Width = $\frac{3.79}{\sin 45°} = 5.36'$

Plus 3" Clearance Each Side & 8" walls

$5.36' + \frac{3+3+8+8}{12} = 7.19' > 7.17'$ Use

W = 8'-4"

Revised Slope for 38"x 24" HERCP = 0.46%, At Out = 185.38 − (.0046 x 45) = 185.17 Approx S for Revised Ditch = $\frac{185.17 - 184.76}{186.71} = 0.0022'/'$

Redesign ditch: D = 2.0', Side Slope = 3:1, B = 4.0, S = 0.22%

Q = 45.01 cfs > 35.4 cfs

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 4/7/86
Chkd By _____ Date _____
Sheet _____ Of _____

Location Mulberry Third
Reference S.W.S. Line 3
Exist. 29"x 18" CMPA

$L = 40.3'$, $S = \frac{184.787 - 184.123}{40.3} = 0.016$ ft/ft Elev. $I_n = 184.77$

Roadway Elev = 187.90, Max. HW = 187.90 - 184.77 = 3.13'

$\frac{HW}{D} = 1.295$ For Inlet Control; Projecting End Condition:

$Q_{available} = 13$ cfs

Q_{reqd}: $T_c = 25$ min, Total Area = 7.13 + 10.74 + 3.5 (Areas G-J | Area K | Other Area)

Proposed Future: $Q_{25} = 3.32[(7.13 \times .63) + .3(10.74 + 3.5)] = 29.10$ cfs

$Q_{100} = 7.36[(7.13 \times .63) + .3[10.74 + 3.5)] = 64.50$ cfs

$T_c = 23$ min

Possible Future: $Q_{25} = 3.43[(7.13 \times .63) + .7(10.74 + 3.5)] = 49.60$ cfs

$Q_{100} = 7.60[(7.13 \times .63) + .7(10.74 + 3.5)] = 109.90$ cfs

For Proposed Future $Q_{25} = 29.10$ cfs Need 2 more

29"x 18" CMPA's or 3-18" RCP's

For Possible Future $Q_{100} = 109.90$ cfs

$HW = 3.13 + 1.5 = 4.63'$; $\frac{HW}{D} = \frac{4.63'}{3} = 1.54 \Rightarrow$ 1-60"x38" HERCP

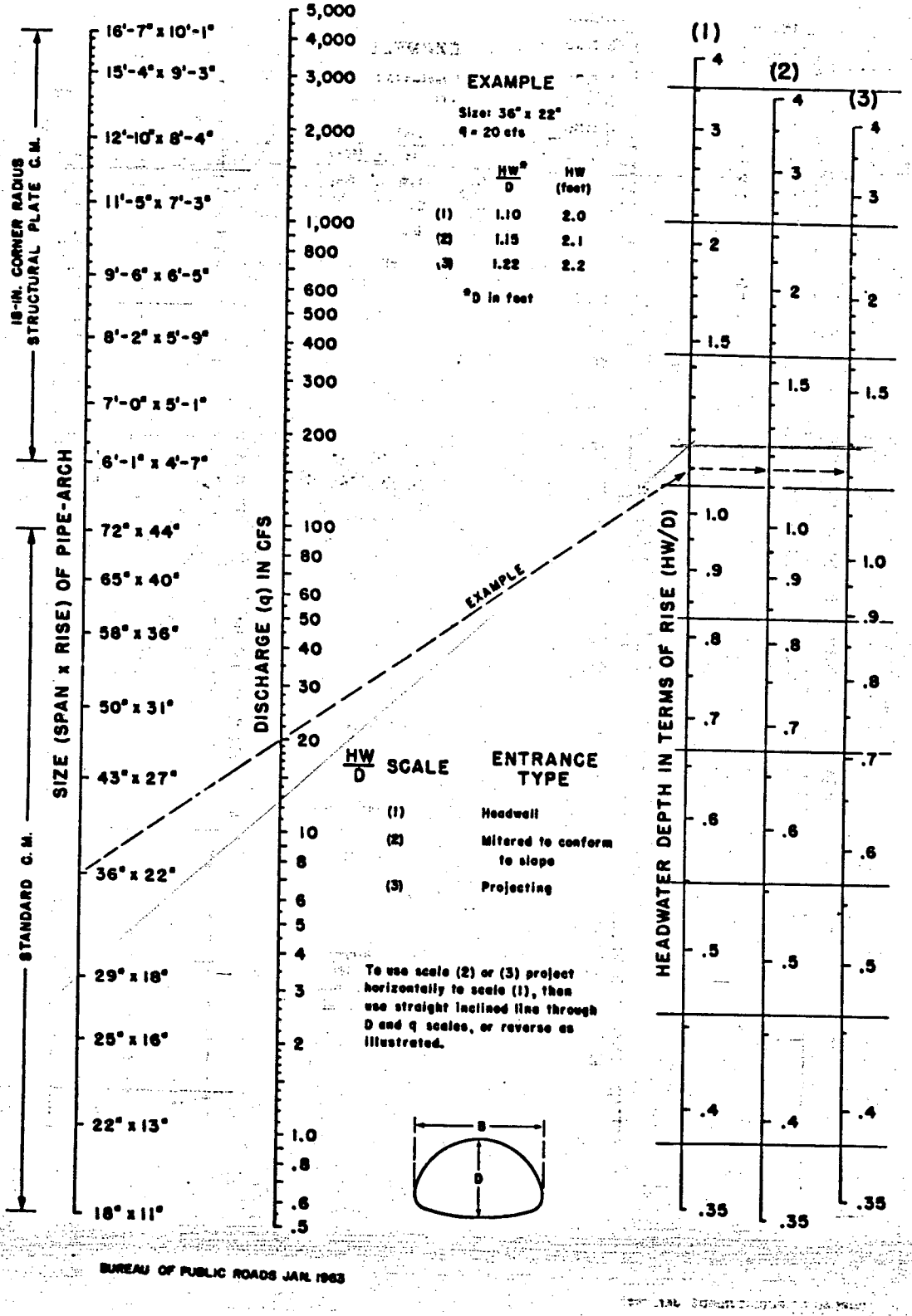

Exhibit 14-10. Headwater depth for C.M. pipe-arch culverts with inlet control.

NUMBER OF PIPES = 14
NUMBER OF JUNCTION NODES = 7
THE FLOW CONVERSION FACTOR = 1

SWTBYENT.3RD

Run 4

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE	FGN
1	0	1	2.0	18.2	120.0	1.5	0.0	192.39
2	1	6	35.0	12.0	120.0	1.5	0.0	
3	0	2	2.0	26.6	120.0	1.5	0.0	192.39
4	2	3	60.5	18.0	120.0	1.5	0.0	
5	0	3	2.0	18.2	120.0	1.5	0.0	191.98
6	3	4	60.5	21.0	120.0	1.5	0.0	
7	0	4	2.0	18.2	120.0	1.5	0.0	191.64
8	4	7	127.0	24.0	120.0	1.5	0.0	
9	0	5	2.0	18.2	120.0	1.5	0.0	188.08
10	5	0	50.0	27.0	120.0	1.5	0.0	186.5
11	0	6	2.0	18.2	120.0	1.5	0.0	191.64
12	6	4	42.0	21.0	120.0	1.5	0.0	
13	0	7	2.0	18.2	120.0	1.5	0.0	189.89
14	7	5	144.0	27.0	120.0	1.5	0.0	

JUNCT. NO.	DEMAND	ELEVATION
1	-3.1	187.8
2	-6.0	186.7
3	0.0	186.8
4	-1.8	186.3
5	-3.5	185.2
6	-2.2	187.0
7	0.0	185.8

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 7 - ACCURACY ATTAINED = 1.227881E-03

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	0	1	0.52	0.00	0.00	0.00
2	1	6	3.62	0.25	0.49	0.00
3	0	2	0.22	0.00	0.00	0.00
4	2	3	6.22	0.17	0.29	0.00
5	0	3	2.47	0.00	0.04	0.00
6	3	4	8.69	0.15	0.30	0.00
7	0	4	4.59	0.00	0.15	0.00
8	4	7	20.42	0.77	0.98	0.00
9	0	5	0.50	0.00	0.00	0.00
10	5	0	29.10	0.33	1.25	0.00
11	0	6	-0.48	0.00	0.00	0.00
12	6	4	5.33	0.04	0.11	0.00
13	0	7	4.69	0.00	0.16	0.00
14	7	5	25.10	0.72	0.93	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	187.8	-3.1	2.0	192.4
2	186.7	-6.0	2.5	192.4
3	186.8	0.0	2.2	191.9

6	187.0	-2.2	2.0	191.6
7	185.8	0.0	1.7	189.7

THE NET SYSTEM DEMAND =-16.6
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-),

PIPE NO.	FLOW
1	.51
3	.22
5	2.46
7	4.59
9	.5
10	-29.11
11	-.49
13	4.68

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 11/26/85
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference Areas X, ~~XI~~, ~~XII~~ & ~~XIII~~ - Sweet Bay South
LINE 4

Determine T_c for Area X, $L = 870'$; Diff. in elev = 9'

$S_o = \frac{9}{870} = 0.0103$ Use $S_o = 1.0\%$, $C = 0.4$; $T_c = 37$ min; Use $T_c = 30$ min

Determine Q_{STREET} & T_c for Area XI. $L = 625'$,

Diff. in Elev. = 3' $S_o = \frac{3}{625} = 0.0048$ Use $S_o = 0.42\%$

$Q_{STREET} = 16.01$ cfs or 8.00 cfs per lane

Assume $T_c = T_{ic} + T_T = 15 + 4 = 19$ min; $Q_{100} = 0.6(8.19)(1.16) = 5.70$ cfs

Street Flow Area = $\frac{1}{2}(.3850)(12.30) = 2.37$ sq. ft., $V = \frac{5.70}{2.37} = 2.41$ fps

$T_T = \frac{625}{2.41 \times 60} = 4.32$ min $\simeq 4$ min OK

Determine Q_{STREET} & T_c for Area XII, $L = 550'$,

Diff. in Elev = 4', $S_o = \frac{4}{550} = 0.0073 \simeq 0.7\%$

$Q_{STREET} = 20.67$ cfs or 10.33 cfs per lane

Try $T_c = 15 + 3 = 18$ min $Q_{100} = 0.6(8.37)(1.75) = 8.79$ cfs

Street Flow Area = $\frac{1}{2}(.4125)(13.18) = 2.72$ sq. ft.; $V = \frac{8.79}{2.72} = 3.23$ fps

$T_T = \frac{550}{3.23 \times 60} = 2.83 \simeq 3$ min

Check Ponding @ $Q_{100} = 15.87$ cfs

Try 2 Li = 5 Inlets. $H_m = .5 = d = .5$ $d_{max} = .65' < .80$

w/in ROW

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/21/86
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry 3rd
Reference Line 4J

Check Loading Capacity of Pipe Per ACPA Design Data 17

Assume 38" x 24" HERCP w/ Class B bedding Wall Thickness = 3.25"

$H = 1'$ $B_c = 38 + 7.5 = 45.5"$ $B_d = 38 + 24 + 2(18) = 98"$

Assume compacted sand backfill with asphalt topping.

$w = 135\ \#/cf.$ $H/B_d = \frac{12}{98} = .12$ $C_d = .12$ $W_d = (.12)(135)(\frac{98}{12})^2 = 1080\ \#/'$

$\frac{H}{B_c} = .26$ $C_c = 0.26$ $W_c = (.26)(435)(\frac{45.5}{12})^2 = 505\ \#/'$

Use $W_d = 505\ \#/'$ From ACPA Design Data 32 $H = 1.0$, $B_c = 3.79$

Single 16,000 lb dual wheel load, 30% impact, $W_L = 3450\ \#/'$

$L_f = 1.9$ for Class B bedding

$D\text{-load} = \frac{3450 + 505}{1.9 * 3.17} = 657\ \#/l.f./ft.$ of inside horiz. span

$D_{0.01} = 657 \times 1.0 = 657\ \#/l.f./ft$ of inside horiz. span

From Table III, min. 0.1 crack D-load for ASTM C507 HE-II pipe = 1000 #/l.f./ft. of Inside Horiz. Span > 657 #/l.f./ft.

Check 45" x 29" HERCP Wall Thickness 4.50" $H = 0.5'$

$B_c = 45" + 9" = 54"$ $B_d = 45 + 24 + 2(18) = 105"$; $H/B_d = \frac{6}{105}$, $C_d = .06$

$W_d = (.06)(135)(\frac{105}{12})^2 = 620\ \#/'$; $H/B_c = (0.11)(135)(\frac{54}{12})^2 = 303.75\ \#/' = W_c$

$W_L = 3560\ \#/'$ $D\text{-load} = \frac{3560 + 304}{1.5 * 3.75} = 686.9\ \#/'/'$ of inside horiz. span <

1000 #/'/' of inside horiz. span = $D_{0.01}$

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/24/86
Chkd By _____ Date _____
Sheet _____ Of _____

Location Mulberry 3rd
Reference Line 4

Design Ditch: S = 0.5% B = 4' Side Slope = 4:1, B = 1.2'

Q = 26.40 cfs V = 2.5 fps < 4.0 fps OK

Top Elev of N. Drop Inlet = ℄ Elev outlet of Ditch =

189.54 + 0.30 − (10 × 10) − .5 = 188.34

Top Elev of S. Drop Inlet = ℄ Elev inlet of ditch = 188.34 + (98 x .005) =

188.83

NUMBER OF PIPES = 8
NUMBER OF JUNCTION NODES = 4
THE FLOW CONVERSION FACTOR = 1

SWT84CTR.3RD Run 6

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE	FGN ELEV
1	0	1	2.0	12.0	120.0	1.5	0.0	190.00
2	1	2	98.0	15.0	120.0	1.5	0.0	
3	0	2	2.0	36.0	120.0	1.5	0.0	189.84
4	2	3	24.3	36.0	120.0	1.5	0.0	
5	0	3	2.0	23.9	120.0	1.5	0.0	189.66
6	3	4	41.3	36.0	120.0	1.5	0.0	
7	0	4	2.0	23.9	120.0	1.5	0.0	189.66
8	4	0	26.3	36.0	120.0	1.5	0.0	187.36

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	186.5
2	0.0	185.8
3	0.0	185.6
4	0.0	185.2

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 8 - ACCURACY ATTAINED = 5.015396E-04

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	0	1	2.19	0.01	0.18	0.00
2	1	2	2.19	0.09	0.07	0.00
3	0	2	20.45	0.00	0.20	0.00
4	2	3	22.65	0.02	0.24	0.00
5	0	3	10.74	0.00	0.28	0.00
6	3	4	33.39	0.09	0.52	0.00
7	0	4	19.11	0.01	0.88	0.00
8	4	0	52.50	0.13	1.28	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	186.5	0.0	1.4	189.8
2	185.8	0.0	1.7	189.6
3	185.6	0.0	1.6	189.4
4	185.2	0.0	1.5	188.8

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	2.19
3	20.45
5	10.74
7	19.11
8	-52.51

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 11/26/85
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference ~~Areas XX, XXI, XXII & XXIII~~ Sweet Bay East
Areas W & X LINE 5

Determine Q_{STREET} & T_c for Area ~~XX~~. $L = 325'$

Diff. in elev. 0.5' $S_o = \frac{.5}{325} = 0.0015$ Assume $S = 0.42\%$

$Q_{STREET} = 16.01$ cfs or 8.00 cfs per lane

Assume $T_c = 18$ min $Q_{100} = (.6)(.65)(8.37) = 3.26$ cfs

Street flow area = 1.56 sq. ft. ; $V = \frac{3.26}{1.56} = 2.09$ fps. $T_t = 2.59 \approx 3$ min

Determine Q_{STREET} & T_c for Area XXI. $L = 475'$

Diff. in elev. = 2 $S_o = \frac{2}{475} = 0.0042$ Use $S_o = 0.42\%$

$Q_{STREET} = 16.01$ cfs or 8.00 cfs per lane

$T_c = 18$ min

Check Ponding. $L_i = 10'$ $Q_{100} = 18.46$ cfs $h_m = .56' > d = .5'$

by orifice formula: $d = .72' < .80'$ w/in R.O.W. ok

Areas: W = 1.31 acres X = 1.33 acres, $L = 412'$, $T_c = 18$ min

Area W: $Q_2 = (.6)(1.31)(3.78) = 2.97$ cfs, $Q_{100} = (.6)(1.31)(8.37) = 6.58$ cfs

Try Pipe = 12" RCP @ 0.7%

Area X: $Q_2 = (.6)(1.33)(3.78) = 3.02$ cfs, $Q_{100} = (.6)(1.33)(8.37) = 6.68$ cfs

Total $Q_2 = 5.99$ cfs Try Pipe = 18" RCP @ 0.84%

℄ Out of W. inlet = $190.28 - (2.92 + \frac{12+2}{12}) = 186.19$

℄ In of E. inlet = $186.19 - (412 \times .007^{1.5}) = 185.90$

℄ Out of E. inlet = $185.90 - .5 = 185.40$

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/28/86
Chkd By _____ Date _____
Sheet 2 Of _____

Location Mulberry 3rd
Reference Areas W & X LINE 5

℄ In Area Inlet = 185.40 - (.0084 × 142) = 184.21

Approx. Length to Ditch = 350'

Approx Length to 390'

℄ @ Ditch ≈ 180.70 $S = \frac{184.21 - 180.70}{350} = 0.01'$

Flow elev in ditch = 180.70 + 3 = 183.70

NUMBER OF PIPES = 6
NUMBER OF JUNCTION NODES = 3
THE FLOW CONVERSION FACTOR = 1

LINES.3RD Run 3

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE	FGN
1	0	1	2.0	18.2	120.0	1.5	0.0	190.28
2	1	2	42.0	15.0	120.0	1.5	0.0	
3	0	2	2.0	16.2	120.0	1.5	0.0	190.26
4	2	3	142.0	15.0	120.0	1.5	0.0	
5	0	3	2.0	13.0	120.0	1.5	0.0	190.12
6	3	0	350.0	12.0	120.0	1.5	0.0	183.70

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	186.2
2	0.0	185.4
3	0.0	184.1

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 6 - ACCURACY ATTAINED = 3.057869E-06

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	0	1	2.05	0.00	0.03	0.00
2	1	2	2.05	0.04	0.07	0.00
3	0	2	3.92	0.00	0.11	0.00
4	2	3	5.97	0.87	0.55	0.00
5	0	3	7.05	0.03	1.36	0.00
6	3	0	13.02	3.76	1.26	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	186.2	0.0	1.8	190.2
2	185.4	0.0	2.1	190.1
3	184.1	0.0	2.0	188.7

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	2.05
3	3.91
5	7.05
6	-13.03

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBW Date 11/26/85
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference Areas ~~XXIV~~, ~~XXV~~, ~~XXVI~~, & ~~XXVII~~ – Sweet Bay North
LINE 6'

Determine Q_{STREET} & T_c for Area ~~XXVI~~. $L = 450'$

Diff. in elev. = 8', $S_o = \frac{8}{450} = 0.0178$ Use $S_o = 1.7\%$

$Q_{STREET} = 32.22$ cfs or 16.11 cfs per lane

Assume $T_c = 17$ min $Q_{100} = (.6)(8.55)(1.21) = 6.21$ cfs

Street flow area = 1.56 sq. ft.; $V = 3.98$ fps. $T_T = 1.88$ min OK

Determine Q_{STREET} & T_c for Area ~~XXVII~~ $L = 475'$

Diff. in elev. = 7'. $S_o = \frac{7}{475} = 0.0147$. Use $S_o = 1.44\%$

$Q_{STREET} = 29.65$ cfs or 14.82 cfs per lane

Assume $T_c = 17$ min $Q_{100} = (.6)(8.55)(1.27) = 6.51$ cfs

Street flow area = 1.66 sq. ft; $V = 3.92$ fps; $T_T = 2.02$ min OK

Check Ponding $L_i = 15'$ (1 $L_i = 10'$ & 1 $L_i = 5'$) $Q_{100} = 22.26$ cfs

$h_m = .48' < d = .5'$ $d_{max} = 0.63' < .80$ w/in R.O.W. OK

Actual: $S = 0.89\%$, $L = 650'$, $Q_{LANE} = 10.40$ cfs; $Q_{STREET} = 20.81$ cfs

Assume $T_c = 18$ min, $Q_{100} = (.6)(8.37)(1.60) = 8.63$ cfs < 10.40 cfs OK

Street flow area = $\frac{1}{2}(.4)(12.8) = 2.56$ sq. ft; $V = \frac{8.03}{2.56} = 3.14$ fps

$T_T = \frac{650}{3.14 \times 60} = 3.45$ min $T_c = T_i + T_T = 15 + 3 = 18$ min

NUMBER OF PIPES = 4
NUMBER OF JUNCTION NODES = 2
THE FLOW CONVERSION FACTOR = 1

SWTBYCIR.3RD

Run 2

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE
1	0	1	2.0	18.2	120.0	1.5	0.0
2	1	2	35.0	18.0	120.0	1.5	0.0
3	0	2	2.0	18.2	120.0	1.5	0.0
4	2	0	180.0	18.0	120.0	1.5	0.0

FGN
18608
18608
181

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	180.4
2	0.0	180.2

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 5 - ACCURACY ATTAINED = 8.182851E-06

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	0	1	5.93	0.00	0.25	0.00
2	1	2	5.93	0.09	0.26	0.00
3	0	2	9.50	0.01	0.64	0.00
4	2	0	15.43	2.65	1.78	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	180.4	0.0	2.3	185.8
2	180.2	0.0	2.3	185.4

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	5.93
3	9.5
4	-15.44

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 11/26/85
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference Areas ~~XIV~~, ~~XV~~, ~~XVI~~, ~~XVII~~ & ~~XVIII~~ - Cedaridge Circle East LINES 7 & 8

Determine T_c for Area ~~XIV~~. $L = 400'$, Diff. in elev. = 4'

$S_A = \frac{4}{400} = 1.0\%$ $C = 0.7$ $T_c = 15$ min

Determine Q_{STREET} & T_c for Area ~~XV~~. $L = 875'$

Diff. in elev = 8' $S_o = \frac{8}{875} = 0.0091$. Use $S_o = 0.9\%$

$Q_{STREET} = 23.41$ cfs or 11.72 cfs per lane

Assume $T_c = 19$ min ; $Q_{100} = (0.6)(8.19)(1.89) = 9.28$ cfs

Street Flow Area = 2.59 sq. ft $V = \frac{9.28}{2.59} = 3.59$ fps $T_T = \frac{8.75}{3.59 \times 60} = 4.06$ min

Determine Q_{STREET} & T_c for Area ~~XVII~~; $L = 525'$

Diff. in elev = 7' $S_o = \frac{7}{525} = 0.0133 \approx 1.3\%$

Try $T_c = 18$ min $Q_{100} = 0.6(8.37)(1.06) = 5.32$ cfs

$Q_{STREET} = 28.17$ cfs or 14.09 cfs per lane; Street flow area = 1.54 sq ft

$V = 3.45$ fps $T_T = 2.53 \approx 3$ min $T_c = 18$ min

Check Ponding. $Q_{100} = 22.91$ cfs w/ 2 $L_i = 5'$ N $h_m = .62' > d = .5$

by orifice formula $d = .98 > .80$ out of R.O.W. N.G

Try $L_i = 10'$ on N & $L_i = 5'$ on South $h_m = .45' < d = .5$

$d_{max} = .67' < .80$ w/in ROW OK

Top of Curb Elev = 184.79, Max ℄ Elev for S. inlet = $184.79 - (2.92 + \left(\frac{36+4}{12}\right)) = 178.54$ Too Deep; Try 2-27" RCPs; Max. ℄ = 179.29

Still Too Deep Try 2-34"x 22" HERCP = 179.71 Must use ditch

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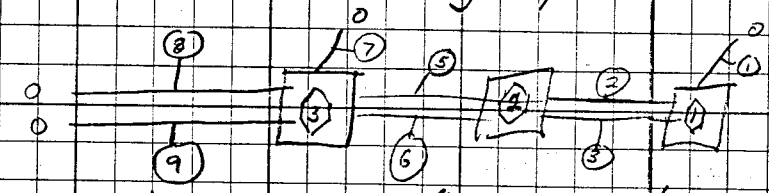
CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 1/25/86
Chkd By _____ Date _____
Sheet _____ Of _____

Location Mulberry East 3rd
Reference LINES 7 & 8

In order to day light pipe The 178 contour is approx. 775' from S. inlet. Slope of pipe & ditch = $\frac{179.71 - 178}{775}$ = 0.0022'/. Initial try w/ PIPES CORCIRE. 3RD

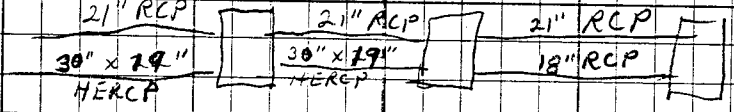


222'
34"x22" HERCP = 24" RCP

36'
34"x22" HERCP

151'
30"x19" HERCP

Based on Run 7 the optimum configuration is as follow



W/ 21" RCP, Max Ø @ S. Inlet = 184.73 - (2.92 + $\frac{21+2.75}{12}$) = 179.83

W/ 30" x 19" HERCP, Max Ø Elev @ S Inlet = 184.7 - (2.92 + $\frac{19+3.25}{12}$) = 180.02

Use 179.83 Max Ø @ S. Inlet. Ø Elev In, N inlet = 179.83 - (.0022 x 36) = 179.75 ; Ø Elev Out, N. inlet = 179.65 ; Ø Elev, Area inlet = 179.71 - (.0022 x 141) = 179.34 ; Ø Elev Out, Area inlet = 179.24.

Approx Ø Elev @ Ditch = 179.24 - (.0022 x 83) = 179.06

Approx. Grd. Surf. Elev = 181.90, Depth of Ditch = 181.90 - 179.11 = 2.79

Dist. reqd to reach 178 contour ≈ $\frac{1.79}{.002}$ = 555'

Approx Measured Straight Line Dist. to 178 contour = 540'

CDRCIRE.3RP Run 7

NUMBER OF PIPES = 9
NUMBER OF JUNCTION NODES = 3
THE FLOW CONVERSION FACTOR = 1

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE	FGN
1	1	0	2.0	38.2	120.0	1.5	0.0	187.8
2	1	2	151.0	21.0	120.0	1.5	0.0	
3	1	2	151.0	18.0	120.0	1.5	0.0	
4	2	0	2.0	26.6	120.0	1.5	0.0	184.77
5	2	3	36.0	24.0	120.0	1.5	0.0	
6	2	3	36.0	21.0	120.0	1.5	0.0	
7	3	0	2.0	26.6	120.0	1.5	0.0	184.77
8	0	3	222.0	24.0	120.0	1.5	0.0	
9	0	3	222.0	21.0	120.0	1.5	0.0	180.65

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	183.0
2	0.0	179.7
3	0.0	179.6

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 11 - ACCURACY ATTAINED = 8.97732E-05

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	1	0	-30.28	0.00	0.34	0.00
2	1	2	17.83	1.37	1.28	0.00
3	1	2	12.45	1.49	1.16	0.00
4	2	0	5.09	0.00	0.04	0.00
5	2	3	14.37	0.11	0.49	0.00
6	2	3	10.83	0.13	0.47	0.00
7	3	0	-18.82	0.01	0.55	0.00
8	0	3	-25.45	2.03	1.53	0.00
9	0	3	-18.57	2.17	1.39	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	183.0	0.0	1.9	187.5
2	179.7	0.0	2.2	184.8
3	179.6	0.0	2.0	184.2

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	30.28
4	-5.09
7	18.82
8	-25.45
9	-18.57

CORCT.3RD

NUMBER OF PIPES = 2
NUMBER OF JUNCTION NODES = 1
THE FLOW CONVERSION FACTOR = 1

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE
1	1	0	160.0	15.0	120.0	1.5	0.0
2	1	0	2.0	18.2	120.0	1.5	0.0

FGN
180.6
182.69

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	179.1

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 8 - ACCURACY ATTAINED = 2.208557E-05

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	1	0	6.46	1.14	0.65	0.00
2	1	0	-6.46	0.01	0.30	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	179.1	0.0	1.4	182.4

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	-6.47
2	6.46

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 11/26/85
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third
Reference Area XIX - Cedaridge Circle West - Line 9

Determine Q_{STREET} & T_c. $L = 500'$; Diff in elev = 7'

$S_o = \frac{7}{500} = 0.014$ $Q_{STREET} = 29.24$ cfs or 14.62 cfs per lane

Try $T_c = 17$ min $Q_{100} = (3.08)(.6)(8.55) = 15.80$ cfs or 7.90 per lane

Street flow area = 1.93 sq. ft.; $V = \frac{7.90}{1.93} = 4.09$ fps $T_t = 2.03$ min

Check Ponding. $Q_{100} = 15.80$ cfs $L_i = 10'$ $h_m = .5' \leq d = .5$

$d_{max} = .64 < .80$ w/in R.O.W. OK

NUMBER OF PIPES = 2
NUMBER OF JUNCTION NODES = 1
THE FLOW CONVERSION FACTOR = 1

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	HW-C VALUE	SUM-M FACT.	PUMP TYPE
1	0	1	2.0	26.6	120.0	1.5	0.0
2	1	0	202.0	21.0	120.0	1.5	0.0

FGN
181.65
179.0

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	177.5

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = 3.947401E-03

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD
1	0	1	15.17	0.00	0.36	0.00
2	1	0	15.17	1.36	0.93	0.00

JUNCTION NO.	ELEVATION (FT.)	DEMAND	PRESSURE (PSI.)	HYDRAULIC GRADE
1	177.5	0.0	1.6	181.3

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	15.17
2	-15.18

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CALCULATIONS & SKETCHES

Proj. No. _____
By FBN Date 3/10/86
Chkd By _____ Date _____
Sheet 1 Of _____

Location Mulberry East Third & Rock Road
Reference Culverts @ Sta. 66+75

Culverts @ Sta. 66+75, Rock Road

Proposed Top of Curb for Rock Road @ proposed culvert, Elev 192.50

∴ top of culvert must be @ 192.50 - 2.08' = 190.42

Top slab thickness = 8" = 0.67' ; Rise = 3' ; Max. ℄ Elev = 190.42 - 3.67 = 186.75'. Determine Q_{100} based on Rational Formula.

T_c = 45 min ; Area = 142.38 acres ; C = 0.64 ; i_{100} = 4.95 in/hr

Q_{100} = 451.1 cfs

A. For Inlet Control: Using 1' Freeboard, $\frac{HW}{D} = \frac{192.5 - 1 - 186.75}{3} = 1.58$

Assume headwall flare 30° to 75°. From attached chart, page 2, $\frac{Q}{B}$ = 25.5 cfs/', $B = \frac{451.1}{25.5} = 17.7' \approx 18'$

Look @ 2 - 9'x3' RCBC's

B. For Outlet Control

Area = 54 sq. ft ; k_e = 0.5 , L = 110' From a Hached chart, page 3, H = 2' , $\frac{Q}{B} = \frac{451}{18} = 25$ cfs/' From attached chart, page 4, d_c = 2.75' , $\frac{d_c + d}{2} = \frac{3 + 2.75}{2} = 2.88'$; $HW = H + h_o - L S_o = 2 + 2.88 - 110(.005)$ = 4.33' < 4.75' OK ; Max. allowable TW = 4.75' - 2 + .55 = 3.30'

Max. allowable TW Elev = 186.75 + 3.30 = 190.05

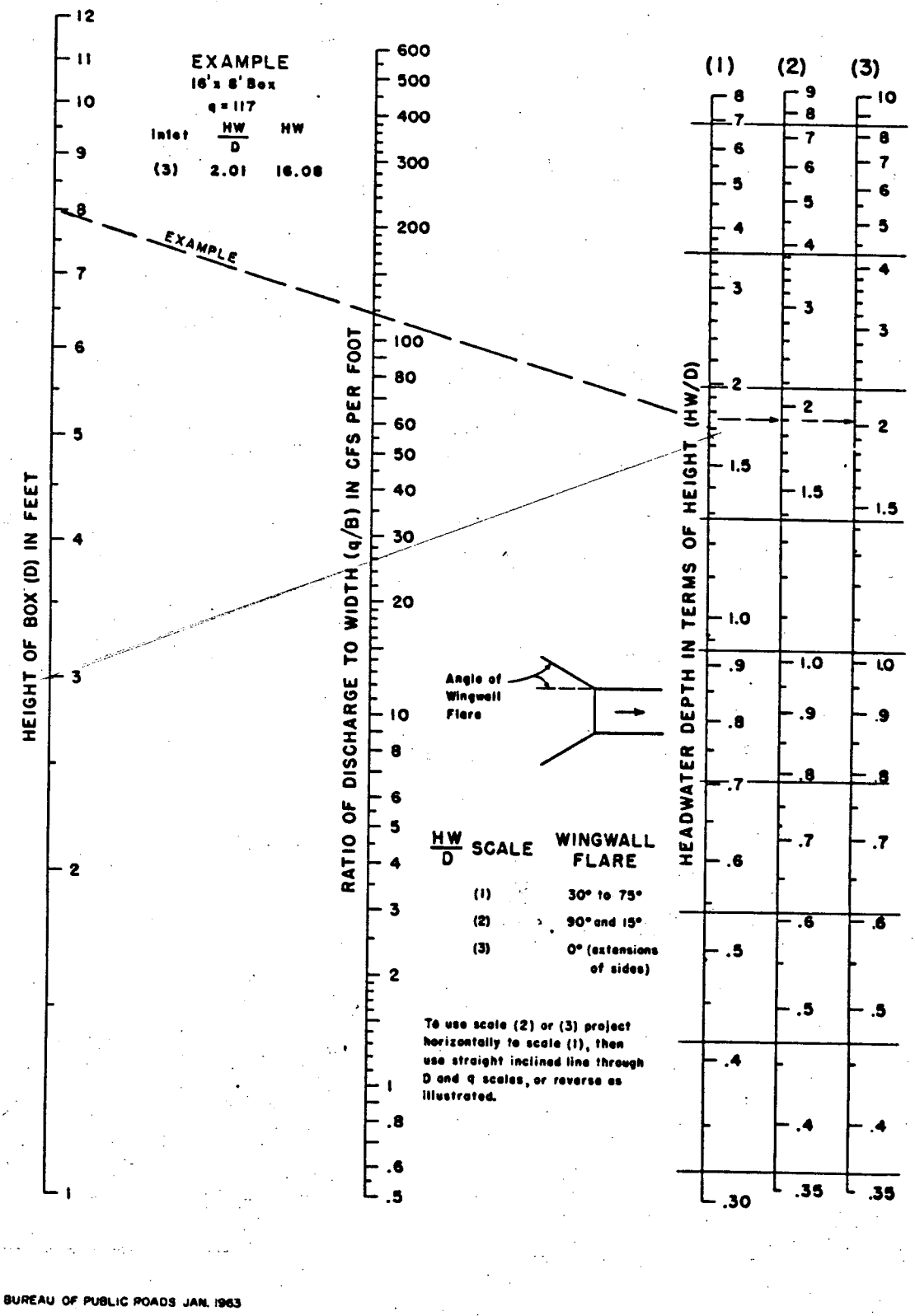


Exhibit 14-6. Headwater depth for box culverts with inlet control.

NEH Notice 4-102, August 1972

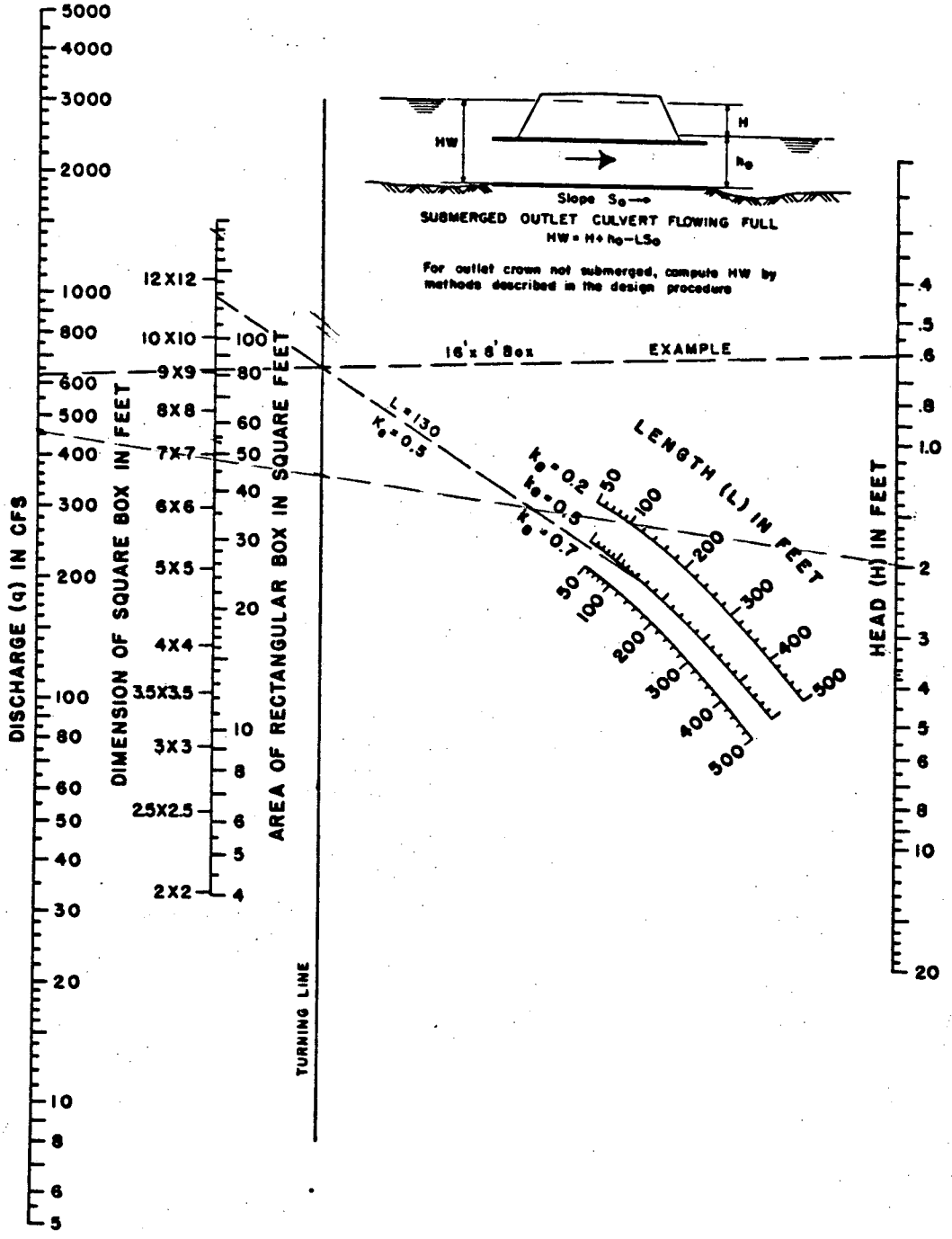
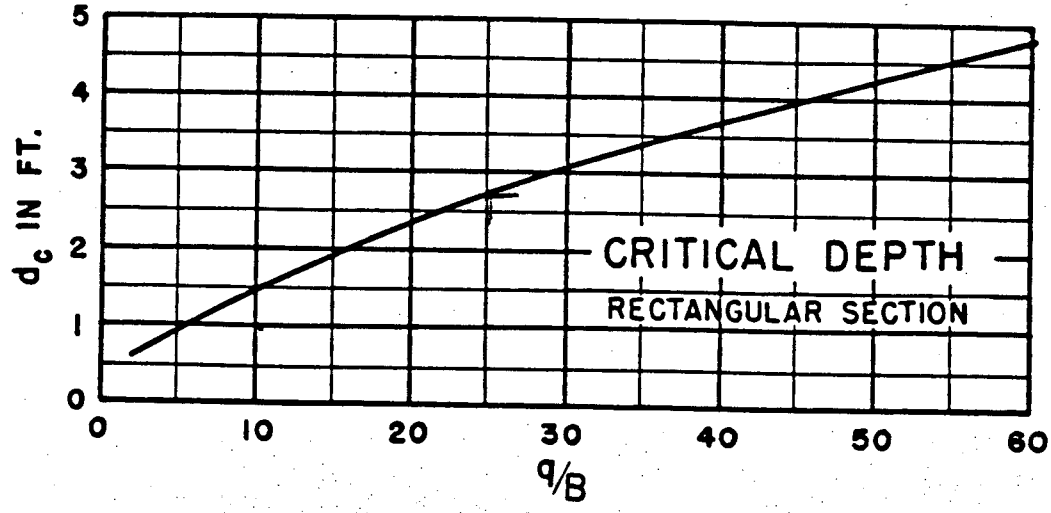


Exhibit 14-11. Head for concrete box culverts flowing full n = 0.012.

NEH Notice 4-102, August 1972



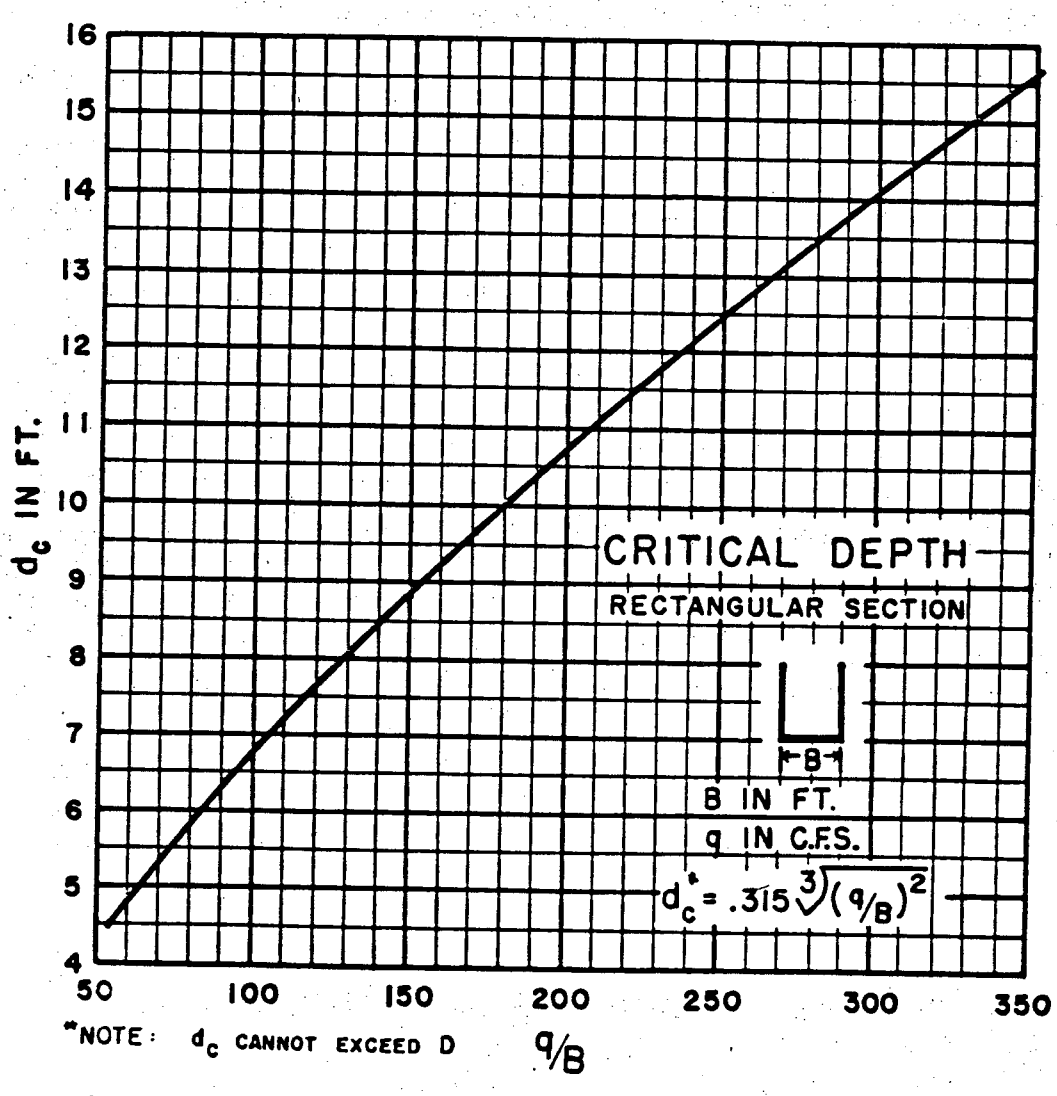


Exhibit 14-16. Critical depths-rectangular section.

ELEVATION REFERENCE MARKS

REFERENCE MARKS	ELEVATION FEET (NGVD)	DESCRIPTION OF LOCATION
RM 20	1395.60	City of Wichita disk located 32 feet east of Oliver Street centerline, 24 feet north of 13th Street centerline.
RM 21	1408.48	U.S. Coast and Geodetic Survey disk stamped "P 39 1934" located 36 feet south of 17th Street centerline, 32 feet west of Oliver Street centerline.
RM 22	1347.08	City of Wichita disk located 39 feet north of 29th Street centerline, 33 feet east of Oliver Street centerline.
RM 23	1386.80	City of Wichita disk located 40 feet south of 13th Street centerline, 42.5 feet east of Woodlawn Avenue centerline.
RM 24	1388.05	City of Wichita disk located 45.4 feet north of 21st Street centerline, 45 feet east of Woodlawn Avenue centerline.