FINAL STORMWATER MANAGEMENT REPORT

Jindra Property
1214 Boyce Avenue
Baltimore County, Maryland

APPROVED FOR FINAL SWM PLAN.
8/21/18

August 2018

Prepared by:

Richardson Engineering, LLC
30 East Padonia Road, Suite 500
Timonium, MD 21093
410-560-1502
Project No. 18068

8/16/18

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NUMBER 16597, EXPIRATION DATE: 08-01-2019.

STATE OF MARYLAND
DONALD N. MITTEN
NO. 16581
REGISTERED
PROFESSIONAL ENGINEER

TABLE OF CONTENTS

INTRODUCTION

This report discusses the final phase of the stormwater management design for the proposed residential development at 1214 Boyce Avenue in Baltimore County, Maryland. The area of the site is 3.318 Ac. +/-. The site currently exists as a single residential lot. There is an existing residential building and an existing driveway on the site.

Soil types throughout the site are HSG 'B' (GfC, MaC and MdE).

The site is in the Jones Falls Watershed (Basin #02130904) and therefore 100 year management is required.

STORMWATER MANAGEMENT DESIGN

Environmental Site Design (ESD)

The area of the limit of disturbance is 48,100 sf / 1.104 Ac. +/-. The existing impervious area on site is 0.0 Ac. +/- or 0% of the limit of disturbance. Since the existing impervious area is less than 40% of the disturbed area, this development is classified as "new development".

Any increase to the overall impervious area will be subject to "new development" conditions where Environmental Site Design (ESD) must be implemented to the Maximum Extent Practicable (MEP) when providing water quality (WQv) and channel protection (Cpv) treatment as described in Chapter 5 of the current Stormwater Design Manual. Stormwater management for the proposed improvements to the site is based on the following:

Site Area:	144,548 sf (3.318 ac)
Limit of Disturbance (LOD):	48,100 sf (1.104 ac)
Existing Impervious (within LOD):	0 sf (0.0 ac)
Proposed Impervious (within LOD):	12,640 sf (0.290 ac)
Total Impervious subject to treatment:	12,640 sf (0.290 ac)
Total Impervious being treated:	

Sheet Flow to Conservation Area:	7,580 sf (0.174 ac)
(Level Spreader)	
Fee in lieu:	5,200 sf (0.119 ac)
	12,780 sf (0.293 ac)
ESDv Calculations:	
Percent Impervious (%):	12,780 / 48,100 = 26.57%
Rv:	0.29
Soils (sf):	'B' 48,100
P_E (inches):	1.6
ESDv (cf):	1,860

Sheetflow to Conservation Area (N-3)

The runoff from the impervious area of the proposed rooftop and driveway will be conveyed overland to establish "sheetflow to conservation area". A forest buffer easement has been established to create a minimum flow length through the conservation easement to the property line of 400-ft. The effective width for each lot is greater than 100-ft. Having a conservation width exceed 100-ft allows a maximum P_E of 1.0" (from Table 5.8) to be applied to the contributing drainage area conveyed to the level spreader.

Drainage Area to buffer (sf)	=	124,425
Impervious Area to buffer (sf)	=	7,580
I	=	6.09%
Soils:		124,425 sf HSG 'B'
Rv	=	0.05 + 0.009(I)
	=	0.10
P_E	=	1"
WQ provided by Sheetflow	=	(Rv X P_E X DA)/12
To Conservation Area	=	1037cf

Preliminary ESD Options

The following is a list of ESD practices and the practicability of each for providing the ESD storage volume:

PRACTICE	CRITERIA	REASON NOT USED
Green Roof (A-1)	Slope < 30% or 4:12 Additional heavy structural design necessary	Not applicable, excessive construction costs for owner & total redesign.
Permeable pavement (A-2)	Slope < 5%; HSG A, B, or C Soil boring and infiltration test required Subbase invert at least 4' above groundwater table 10' from buildings	
Reinforced turf (A-3)	Slope <5% Not on compacted fill Not suitable for heavy traffic	No space is allowed for 'overflow parking' conditions.
Disconnection of rooftop runoff (N-1)	Slope < 5% DA < 500 sq ft; Pervious area length > 15 ft Disconnection >10 ft from down gradient impervious area Not on compacted fill; No hotspots	D.A. > 500 s.f. per downspout. Site slope around house >5%
Disconnection of non-rooftop runoff (N-2)	Slope <5% DA <1000 sq ft; Pervious area length >10 ft Disconnection >10 ft from down gradient impervious area	Site slope >5%.
Sheet flow to Conservation Area (N-3)	Area ≥ 20,000 sf ft Minimum width 50'; Maximum Pe= 1.0" Use level spreader for slopes > 5%	**Viable option.**
Rainwater Harvesting (M-1)	Periodic maintenance required. Capture 0.2" rainfall.	Owners tend to neglect. No use for it as there are very limited pervious areas needing water. Not enough toilets to use as grey water.
Submerged Gravel Wetland (M-2)	Slope < 2% HSG C or D soils should have high ground water	Viable option, but micro-bioretention facility used.
Landscape Infiltration (M-3)	DA < 10,000 sq ft HSG A or B Dewater ESD in 48 hrs Not on compacted fill	Drainage area greater than 10,000sf. Other practices better suited to project.
Infiltration Berms (M-4)	Maintain sheet flow Asymmetric in shape Not on compacted fill	Other practices better suited to project.
Dry Wells (M-5)	DA < 1,000 sq ft HSG A or B Dewater ESD in 48 hrs	Other practices better suited to project.
Micro Bioretention (M-6)	DA < 20,000 sq ft 75% ESD required to be stored Filter beds 24"-48" deep, utilization of underdrain	Viable option but rock was found at proposed location.

Rain Garden (M-7)	Slopes < 5% DA < 2,000 sq ft for residential HSG A or B Dewater ESD in 48 hrs Not on compacted fill	Drainage area greater than 2000 sf.
Swales (M-8)	Slopes < 4% ESD velocity ≤ 1.0 fps 6" of freeboard	Other practices better suited to project.
Enhanced Filters (M-9)	Slopes < 5% DA < 2000 sq ft for residential, HSG A or B	Other practices better suited to project.

Overbank Flood Protection

Being located in the Jones Falls watershed, this development requires quantity management for the 100-year (Qf) storm events for all new impervious area. The following are the results of TR-20 studies. All values are cfs.

	Existing Conditions		Proposed Conditions	
Area	10Yr. Q(cfs)	100Yr. Q(cfs)	10 Yr. Q(cfs)	100 Yr. Q(cfs)
1	8.33	24.25	9.17	25.29
1 Bypass	0.55	2.05	0.64	1.84
1 & 1 Bypass	8.88	26.30		
Structure Release			5.99	9.46
Structure Release & 1 Bypass			6.16	10.21
2	5.22	13.25	4.71	12.20
2 Bypass	0.35	1.17	0.30	0.97
2 & 2 Bypass	5.57	14.42		
Structure Release			4.17	10.18
Structure Release & 2 Bypass			4.31	10.56
3	1.28	4.48	2.74	7.82

4	41.46	111.64	42.00	112.98
Combined 1-4	55.67	153.38	54.07	140.41

OUTFALL SUITABILITY

Drainage for the site in existing and proposed conditions flow overland in a westerly direction towards the adjacent property.

There are 4 Design Points being considered for stormwater management.

Design point 1 – outfall of a detention facility that is to provide 100 year management at the adjacent property.

Design point 2 – outfall of culvert for the proposed driveway at the adjacent property. This culvert will attenuate the flows for 100 year storms.

Design point 3 – outfall of sheet flow to conservation area (level spreader) at adjacent property and existing stream.

Design point 4 – confluence of the three design points described above with the proposed driveway that is to be directed to Boyce Avenue.

Flows from the property line will travel approximately 150 feet to an unnamed tributary. This unnamed tributary floes approximately 3600 to the waters of Roland Run and then approximately 5800 to Lake Roland. Runoff from the site will pose no hazard to people or houses, therefore it is determined that the site is a class 'a' hazard.

CONCLUSION

A portion of the ESD requirements area to be met with structural practices. A fee-in-lieu will be requested to compensate for the 5,200 sf of impervious area that is unable to be treated.

Richardson Engineering, LLC
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TR-55 DESIGN COMPUTATION

By: se
Date: May 25, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **#1** **Existing:** [X] Proposed [ ] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.41	39.81
B	Lawn		0	61			2.82	171.93
B	Woods		0	55			1.54	84.93
			Total Square Miles:		0.0075	Total Acres:	**4.77**	296.67

Weighted RCN= 62.21 , **Use** **62**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Grass, Dense	100	0.400			12.0		0.1748
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	515				7.9	4.53	0.0315
	paved unpaved							
	paved unpaved							
	paved unpaved							
	Open Channel						0.00	
	Stormdrain						0.00	
							Total	0.2063

Initial Abstraction Ia = 1.215 in. (Table 5-1) **Use Tc=** **0.21** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.215	1.215	1.215			1.215
Ia/P =	0.450	0.372	0.243			0.140
Peak Qu (csm/in.) =	480	620	740			775
Runoff Q (in) =	0.29	0.52	1.46			4.09
Peak Dischg. (CFS)=	1.04	2.40	8.05			23.63

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TR-55 DESIGN COMPUTATION

By: se
Date: May 25, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp1 bypass** **Existing:** [X] Proposed [ ] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.00	0.00
B	Lawn		0	61			0.00	0.00
B	Woods		0	55			0.53	29.08
			Total Square Miles:		0.0008	Total Acres:	**0.53**	29.08

Weighted RCN= 55.00 , **Use** **55**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Grass, Dense	100	0.400			8.5		0.2006
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	245				13.0	5.82	0.0117
	paved unpaved							
	paved unpaved							
	paved unpaved							
	Open Channel						0.00	
	Stormdrain						0.00	
							Total	0.2123

Initial Abstraction Ia = 1.636 in. (Table 5-1) **Use Tc=** **0.21** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.636	1.636	1.636			1.636
Ia/P =	0.606	0.500	0.327			0.189
Peak Qu (csm/in.) =	350	360	660			740
Runoff Q (in) =	0.12	0.27	0.98			3.24
Peak Dischg. (CFS)=	0.04	0.08	0.54			1.98

```
**********************************************************************************
*                                  * TR 20 S/N    :                              *
*                                  * HMVersion    :  3.40                        *
*              TR 20               * Date         :  6/14/**                     *
*                                  * Time         : 14:30:37                     *
*    Project Formulation Hydrology * Input file   : 18068/18068ex1.txt           *
*                                  * Output file  : 18068/18068ex1.out          *
*                                  *                                            *
*                                  *                                            *
**********************************************************************************
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XXXXXXX  XXXXXX    XXXXX    XXXXX
   X     X     X  X     X  X    XX
   X     X     X        X  X   X X
   X     XXXXXX      X     X  X  X
   X     X   X     X       X X   X
   X     X    X   X        XX    X
   X     X     X  XXXXXXX   XXXXX
```

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::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                       FULLPRINT           SUMMARY
TITLE     1214 Boyce Avenue
TITLE     DP1
 6 RUNOFF 1 001       1 0.0075      62.0        0.21        1        1 DP 1
```

```
 6 RUNOFF 1 002       2 0.0008      55.0        0.21        1          1 DP 1byp
 6 ADDHYD 4 003   1 2 3
   ENDATA
 7 INCREM 6             0.05
 7 COMPUT 7 001   003   0.          2.7         1.0         2 2  01  01
   ENDCMP 1
 7 COMPUT 7 001   003   0.          3.27        1.0         2 2  01  02
   ENDCMP 1
 7 COMPUT 7 001   003   0.          5.01        1.0         2 2  01  10
   ENDCMP 1
 7 COMPUT 7 001   003   0.          8.65        1.0         2 2  01  99
   ENDCMP 1
   ENDJOB 2

**********END OF 80-80 LIST**********
```


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
```



```
EXECUTIVE CONTROL OPERATION INCREM                                          RECORD ID
                                MAIN TIME INCREMENT =    .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT                                          RECORD ID

                                FROM XSECTION    1
                                                 TO XSECTION    3
       STARTING TIME =    .00    RAIN DEPTH =  2.70    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
       ALTERNATE NO.= 1         STORM NO.= 1    MAIN TIME INCREMENT =    .05 HOURS


OPERATION RUNOFF   CROSS SECTION    1
          OUTPUT HYDROGRAPH=  1
          AREA=     .01 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .10 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                          .10                        (RUNOFF)
             12.10                         1.08                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .16 WATERSHED INCHES,       .77 CFS-HRS,       .06 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION    2
          OUTPUT HYDROGRAPH=  2
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
```

```
          14.95                        .01                      (RUNOFF)
          12.30                        .01                      (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .05 WATERSHED INCHES,      .03 CFS-HRS,      .00 ACRE-FEET;   BASEFLOW =    .00 CFS

OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 1,2    OUTPUT HYDROGRAPH= 3

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =        .11 CFS.

          PEAK TIME(HRS)            PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
            14.95                        .11                      (NULL)
            12.10                       1.09                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .15 WATERSHED INCHES,      .79 CFS-HRS,      .07 ACRE-FEET;   BASEFLOW =    .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                   RECORD ID
                               COMPUTATIONS COMPLETED FOR PASS   1

TR20 XEQ  6/14/**           1214 Boyce Avenue                                                  JOB  1   PASS   2
     REV 09/01/83           DP1                                                                         PAGE   3

TR20 XEQ  6/14/**           1214 Boyce Avenue                                                  JOB  1   PASS   2
     REV 09/01/83           DP1                                                                         PAGE   4

EXECUTIVE CONTROL OPERATION COMPUT                                                                   RECORD ID
                               FROM XSECTION   1
                                              TO XSECTION   3
      STARTING TIME =   .00    RAIN DEPTH =  3.27    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
      ALTERNATE NO.= 1         STORM NO.= 2    MAIN TIME INCREMENT =   .05 HOURS

OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=    .01 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)            PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
            12.07                       2.47                      (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .31 WATERSHED INCHES,     1.52 CFS-HRS,      .13 ACRE-FEET;   BASEFLOW =    .00 CFS
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```
OPERATION RUNOFF    CROSS SECTION    2
           OUTPUT HYDROGRAPH=  2
           AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .21 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .01 CFS.

           PEAK TIME(HRS)            PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              14.95                         .01                        (RUNOFF)
              12.10                         .09                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .14 WATERSHED INCHES,      .07 CFS-HRS,      .01 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD    CROSS SECTION    3
           INPUT HYDROGRAPHS= 1,2      OUTPUT HYDROGRAPH= 3

           PEAK TIME(HRS)            PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              12.07                        2.55                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .30 WATERSHED INCHES,     1.59 CFS-HRS,      .13 ACRE-FEET;   BASEFLOW =    .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                  RECORD ID
                                      COMPUTATIONS COMPLETED FOR PASS    2


TR20 XEQ  6/14/**              1214 Boyce Avenue                                                   JOB  1    PASS   3
     REV 09/01/83              DP1                                                                           PAGE   5


EXECUTIVE CONTROL OPERATION COMPUT                                                                  RECORD ID
                                      FROM XSECTION    1
                                                       TO XSECTION    3
       STARTING TIME =    .00     RAIN DEPTH =  5.01    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
       ALTERNATE NO.= 1           STORM NO.=10    MAIN TIME INCREMENT =    .05 HOURS


OPERATION RUNOFF    CROSS SECTION    1
           OUTPUT HYDROGRAPH=  1
           AREA=     .01 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=    .21 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

           PEAK TIME(HRS)            PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              12.05                        8.33                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.00 WATERSHED INCHES,     4.85 CFS-HRS,      .40 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF    CROSS SECTION    2
           OUTPUT HYDROGRAPH=  2
           AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .21 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS
```

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .03 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.03	(RUNOFF)
12.05	.55	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .64 WATERSHED INCHES, .33 CFS-HRS, .03 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.05	8.88	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .97 WATERSHED INCHES, 5.18 CFS-HRS, .43 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 3

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 8.65 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 62. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.04	24.25	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.06 WATERSHED INCHES, 14.81 CFS-HRS, 1.22 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .00 SQ MI INPUT RUNOFF CURVE= 55. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.05	2.05	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 2.35 WATERSHED INCHES, 1.21 CFS-HRS, .10 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.04	26.30	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 2.99 WATERSHED INCHES, 16.02 CFS-HRS, 1.32 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 4

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

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 1													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.16	---	12.10	1.08	143.4
XSECTION 2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.05	---	12.30	.01	16.0
XSECTION 3	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.15	---	12.10	1.09	130.7
ALTERNATE 1 STORM 2													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	3.27	24.00	.31	---	12.07	2.47	329.0
XSECTION 2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.14	---	12.10	.09	108.4
XSECTION 3	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.30	---	12.07	2.55	307.1
ALTERNATE 1 STORM 10													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	5.01	24.00	1.00	---	12.05	8.33	1110.2
XSECTION 2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.64	---	12.05	.55	688.4
XSECTION 3	ADDHYD	.01	2	2	.05	.0	5.01	24.00	.97	---	12.05	8.88	1069.7
ALTERNATE 1 STORM 99													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	8.65	24.00	3.06	---	12.04	24.25	3233.9
XSECTION 2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.35	---	12.05	2.05	2556.5
XSECTION 3	ADDHYD	.01	2	2	.05	.0	8.65	24.00	2.99	---	12.04	26.30	3168.4

TR20 XEQ 6/14/**
REV 09/01/83

1214 Boyce Avenue
DP1

JOB 1 SUMMARY
PAGE 8

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

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION	1	.01				
ALTERNATE	1		1.08	2.47	8.33	24.25
XSECTION	2	.00				
ALTERNATE	1		.01	.09	.55	2.05
XSECTION	3	.01				
ALTERNATE	1		1.09	2.55	8.88	26.30

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093
(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 1** Existing: ☐ **Proposed** ☒ Ultimate ☐

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.59	58.27
B	Lawn		0	61			2.87	174.92
B	Woods		0	55			1.14	62.78
			Total Square Miles:		0.0072	Total Acres:	**4.60**	295.98

Weighted RCN= 64.29 , **Use** **64**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Grass, Dense	100	0.400			12.0		0.1748
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	450				9.6	5.00	0.0250
C-D	paved x unpaved						0.00	
	paved unpaved							
	paved unpaved							
D-E	Open Channel						7.00	0.0000
							Total	0.1998

Initial Abstraction Ia = 1.111 in. (Table 5-1) **Use Tc=** **0.20** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.111	1.111	1.111			1.111
Ia/P =	0.411	0.340	0.222			0.128
Peak Qu (csm/in.) =	555	660	750			780
Runoff Q (in) =	0.35	0.60	1.61			4.34
Peak Dischg. (CFS)=	1.41	2.87	8.68			24.36

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TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 1 bypass** Existing: [ ] **Proposed** [X] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.03	2.81
B	Lawn		0	61			0.13	7.94
B	Woods		0	55			0.15	8.43
			Total Square Miles:		0.0005	Total Acres:	**0.31**	19.18

Weighted RCN= 61.46 , **Use** **61**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Storm Drain	70	0.012			3.3		0.0133
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	40				3.8	3.15	0.0035
	paved x unpaved						0.00	
	paved unpaved							
	paved unpaved							
	Open Channel	0					7.00	
							Total	0.0169

Initial Abstraction Ia = 1.254 in. (Table 5-1) **Use Tc=** **0.10** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.254	1.254	1.254			1.254
Ia/P =	0.465	0.384	0.250			0.145
Peak Qu (csm/in.) =	775	900	970			980
Runoff Q (in) =	0.27	0.49	1.41			4.00
Peak Dischg. (CFS)=	0.10	0.22	0.67			1.91

18068 **1214 Boyce Avenue** 7/31/2018 RiserD-3,6 06/05

Proposed Conditions - Study Point #1

Elevation - Storage Table

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Increment Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
50.75	0	0.0000					
52.00	590	0.0135	1.3	0.0068	0.0085	0.0085	369
54.00	2,800	0.0643	2.0	0.0389	0.0778	0.0863	3,759
56.00	5,915	0.1358	2.0	0.1000	0.2001	0.2864	12,474
58.00	9,450	0.2169	2.0	0.1764	0.3527	0.6391	27,839

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
53.00	0.0474	2,064
55.00	0.1863	8,116
57.00	0.4627	20,156

	volume [ft³]	volume [acre·ft]	elevation [ft]
Cpv:	19,280	0.4426	56.89

Elevation - Discharge Table

--- Riser Openings ---

	Circular Orifice	Rectang. Orifice	Weir 1	Weir 2 Riser Top	Emerg. Spillway
Elev. (invert or crest):	50.75				
Diam. (in.) or Width (ft):	15				
Height (ft.-rectang. orifice only):					
Orifice Coef., Co :	0.6				
Weir Coef., Cw					
Orifice Area for Riser Top Opening - Weir 2:					sf
Orifice Coef.:					
Trans. to orifice flow at h=					ft.

Barrel

Upstream Invert:	50.75
Diam.:	15 in.
Downstrm Invert:	49.00
Length:	74 ft.
Area of barrel (sf):	1.23
$AD^{0.5}$ =	1.37
Slope =	2.36%

Increment (feet): 1

Pond Elevation [ft.]	Circular Orifice Q, cfs	Rectang. Orifice Q, cfs	Weir 1 Q, cfs	Weir 2 Q, cfs	Total Q into Riser, cfs	Barrel HW Elev.	ES Q, cfs	Total Q, cfs	Conditions*
50.75	0.00				0.00	50.75		0.00	(1)
52.00	2.89				2.89	51.76		2.89	(1)
53.00	5.06				5.06	52.27		5.06	(1)
54.00	6.62				6.62	52.75		6.62	(1)
55.00	7.87				7.87	53.23		7.87	(1)
56.00	8.95				8.95	53.70		8.95	(1)
57.00	9.91				9.91	54.19		9.91	(1)
54.50	7.27				7.27	52.99		7.27	(1)
55.50	8.43				8.43	53.47		8.43	(1)
56.50	9.45				9.45	53.95		9.45	(1)
57.50	10.36				10.36	54.42		10.36	(1)
58.00	10.79				10.79	54.66		10.79	(1)

*Conditions

(1) Barrel in inlet control.
(2) Barrel in outlet control.
(3) Barrel headwater (water surface elevation in riser) is above Weir 1 crest elevation. Submerged weir equation used for Weir 1.
(4) Barrel headwater (water surface elevation in riser) is above riser crest (Weir 2) elevation. Submerged weir equation used for Weir 2.
(5) Opening in top of riser (Weir 2) is in orifice flow. Orifice equation used. Submerged orifice equation used if condition (4) applies. If condition (5) exists without condition (4), riser is entering orifice flow prior to barrel controlling flow. This is typically unstable and should be avoided.

Equations:

Orifice Flow: $Q = 0.6A(2gh)^{0.5}$ Submerged Orifice Flow: $Q = 0.6A[2g(h_1-h_2)]^{0.5}$

Weir Flow: $Q = 3.1LH^{1.5}$ Submerged Weir Flow: $Q = Qo[1-(h_2/h_1)^{1.5}]^{0.385}$

where h_1 is upstream head and h_2 is downstream head

Culvert - Inlet Control, Unsubmerged: $Hw = KD(Q/AD^{0.5})^M$, where K = .534 and M = .555 (Form 2)

Culvert - Inlet Control, Submerged: $Hw = cD(Q/AD^{0.5})^2 + DY - 0.5DS^2$, where c = 0.0398 and Y = 0.67

Slope, S, is generally insignificant and is not included in the table.

Culvert - Outlet Control: Total Losses, $H_L = [1 + K_e + (K_u n^2 L) / R^{1.33}](V^2/2g)$ for full flow

where Ke = 0.5, Ku = 29, n = .014, L = length, R = A/P and V = Q/A

For partial flow, $HW = H_L + (d_c + D) / 2$, where d_c = critical depth and D = pipe diameter

Emergency Spillway Flow: $Q = C[(a+b)/2 - .2H]H^{3/2}$, where a = weir width at base, b = weir width at water surface elevation (assumes 3:1 side slopes). C varies by height by the equation: C = 0.6H + 1.75, with a maximum of C = 3.1.

(Culvert equations from HDS-5, FHWA-NHI-01-020, Sept. 2001)

Notes:

1. For use with circular concrete pipes only.
2. Table assumes Weir 1 extends to the top of the riser. When entering length of weirs, do not include Weir 1 length as part of Weir 2 length so that flow is not counted twice.
3. When calculating transition to orifice flow for flow into top of riser, weir length is determined by adding length of Weir 1 and Weir 2.
4. Outlet control equations are applied only for headwater above 0.75D. For long pipes with minimal slope flowing partially full, more accurate methods may be needed.

```
*******************************************************************************
*                                  * TR 20 S/N    :                           *
*                                  * HMVersion    :  3.40                     *
*              TR 20               * Date         :  7/31/**                  *
*                                  * Time         :  9:30:47                  *
*    Project Formulation Hydrology * Input file   : 18068/18068pr1.txt        *
*                                  * Output file  : 18068/18068pr1.out       *
*                                  *                                          *
*                                  *                                          *
*******************************************************************************
```

```
   XXXXXXX  XXXXXX    XXXXX    XXXXX
      X     X     X  X     X  X    XX
      X     X     X        X  X   X X
      X     XXXXXX      X     X  X  X
      X     X   X     X       X X   X
      X     X    X   X        XX    X
      X     X     X  XXXXXXX   XXXXX
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation  :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                     FULLPRINT          SUMMARY
TITLE     1214 Boyce Avenue
TITLE     PROPOSED CONDITIONS - DP1
 3 STRUCT      01
```

```
8                       50.75       0.00        0.0000
8                       52.00       2.89        0.0085
8                       53.00       5.06        0.0474
8                       54.00       6.62        0.0863
8                       55.00       7.87        0.1863
8                       56.00       8.95        0.2864
8                       57.00       9.91        0.4627
8                       58.00      10.79        0.6391
9 ENDTBL
6 RUNOFF 1 001        1 0.0072      64.0        0.20        1         1 DP 1
6 RESVOR 2    01 1    2  50.75                              1         1
6 RUNOFF 1 002        3 0.0005      61.0        0.10        1         1 DP 1byp
6 ADDHYD 4 003   2 3 4                                      1         1
  ENDATA
7 INCREM 6            0.05
7 COMPUT 7 001   003  0.0           2.7         1.0         2 2  01  01
  ENDCMP 1
7 COMPUT 7 001   003  0.0           3.27        1.0         2 2  01  02
  ENDCMP 1
7 COMPUT 7 001   003  0.0           5.01        1.0         2 2  01  10
  ENDCMP 1
7 COMPUT 7 001   003  0.0           8.65        1.0         2 2  01  99
  ENDCMP 1
  ENDJOB 2
```

**********END OF 80-80 LIST**********

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

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 1
REV 09/01/83 PROPOSED CONDITIONS - DP1 PAGE 2

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 64. TIME OF CONCENTRATION= .20 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0267 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.07	1.49	

RUNOFF VOLUME ABOVE BASEFLOW = .20 WATERSHED INCHES, .94 CFS-HRS, .08 ACRE-FEET; BASEFLOW = .00 CFS

```
OPERATION RESVOR   STRUCTURE  1
          INPUT HYDROGRAPH= 1     OUTPUT HYDROGRAPH= 2
          SURFACE ELEVATION=   50.75

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.11                          1.39                        51.35

  RUNOFF VOLUME ABOVE BASEFLOW =   .20 WATERSHED INCHES,       .93 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  3
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 61.    TIME OF CONCENTRATION=   .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .01                        (RUNOFF)
             12.05                          .08                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .14 WATERSHED INCHES,       .05 CFS-HRS,      .00 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.11                          1.43                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .20 WATERSHED INCHES,       .98 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =    .00 CFS
```



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



```
EXECUTIVE CONTROL OPERATION COMPUT                                                      RECORD ID
                            FROM XSECTION   1
                                              TO XSECTION   3
        STARTING TIME =   .00    RAIN DEPTH =  3.27    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
```

ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 64. TIME OF CONCENTRATION= .20 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0267 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	3.03	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .38 WATERSHED INCHES, 1.75 CFS-HRS, .14 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 2
SURFACE ELEVATION= 50.75

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	2.85	51.98

RUNOFF VOLUME ABOVE BASEFLOW = .37 WATERSHED INCHES, 1.74 CFS-HRS, .14 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 3
AREA= .00 SQ MI INPUT RUNOFF CURVE= 61. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.01	(RUNOFF)
12.00	.19	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .29 WATERSHED INCHES, .09 CFS-HRS, .01 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.09	2.95	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .37 WATERSHED INCHES, 1.83 CFS-HRS, .15 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 2

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 3
REV 09/01/83 PROPOSED CONDITIONS - DP1 PAGE 6

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 5.01 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 64. TIME OF CONCENTRATION= .20 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0267 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.05	9.17	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.12 WATERSHED INCHES, 5.21 CFS-HRS, .43 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 2
SURFACE ELEVATION= 50.75

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.15	5.99	53.60

RUNOFF VOLUME ABOVE BASEFLOW = 1.12 WATERSHED INCHES, 5.20 CFS-HRS, .43 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 3
AREA= .00 SQ MI INPUT RUNOFF CURVE= 61. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .02 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.02	(RUNOFF)
12.00	.64	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .95 WATERSHED INCHES, .31 CFS-HRS, .03 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.14	6.16	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.11 WATERSHED INCHES, 5.51 CFS-HRS, .46 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 3

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 4
REV 09/01/83 PROPOSED CONDITIONS - DP1 PAGE 7

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 4
REV 09/01/83 PROPOSED CONDITIONS - DP1 PAGE 8

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 3

STARTING TIME = .00 RAIN DEPTH = 8.65 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 64. TIME OF CONCENTRATION= .20 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0267 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.04	25.29	

RUNOFF VOLUME ABOVE BASEFLOW = 3.27 WATERSHED INCHES, 15.21 CFS-HRS, 1.26 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 2
SURFACE ELEVATION= 50.75

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.22	9.46	56.53

RUNOFF VOLUME ABOVE BASEFLOW = 3.26 WATERSHED INCHES, 15.17 CFS-HRS, 1.25 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 3
AREA= .00 SQ MI INPUT RUNOFF CURVE= 61. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
11.99	1.84	

RUNOFF VOLUME ABOVE BASEFLOW = 2.97 WATERSHED INCHES, .96 CFS-HRS, .08 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.18	9.81	(NULL)
12.05	10.21	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 3.25 WATERSHED INCHES, 16.13 CFS-HRS, 1.33 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 4

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

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 1													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.20	---	12.07	1.49	206.4
STRUCTURE 1	RESVOR	.01	2	2	.05	.0	2.70	24.00	.20	51.35	12.11	1.39	193.3
XSECTION 2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.14	---	12.05	.08	163.1
XSECTION 3	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.20	---	12.11	1.43	186.0
ALTERNATE 1 STORM 2													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	3.27	24.00	.38	---	12.06	3.03	420.6
STRUCTURE 1	RESVOR	.01	2	2	.05	.0	3.27	24.00	.37	51.98	12.10	2.85	396.5
XSECTION 2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.29	---	12.00	.19	380.9
XSECTION 3	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.37	---	12.09	2.95	383.7

ALTERNATE 1 STORM 10

XSECTION	1	RUNOFF	.01	2	2	.05	.0	5.01	24.00	1.12	---	12.05	9.17	1273.5
STRUCTURE	1	RESVOR	.01	2	2	.05	.0	5.01	24.00	1.12	53.60	12.15	5.99	831.9
XSECTION	2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.95	---	12.00	.64	1278.4
XSECTION	3	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.11	---	12.14	6.16	799.9

ALTERNATE 1 STORM 99

XSECTION	1	RUNOFF	.01	2	2	.05	.0	8.65	24.00	3.27	---	12.04	25.29	3512.9
STRUCTURE	1	RESVOR	.01	2	2	.05	.0	8.65	24.00	3.26	56.53	12.22	9.46	1313.7
XSECTION	2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.97	---	11.99	1.84	3685.2
XSECTION	3	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.25	---	12.05	10.21	1325.6

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

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
STRUCTURE	1	.01				
ALTERNATE	1		1.39	2.85	5.99	9.46
XSECTION	1	.01				
ALTERNATE	1		1.49	3.03	9.17	25.29
XSECTION	2	.00				
ALTERNATE	1		.08	.19	.64	1.84
XSECTION	3	.01				
ALTERNATE	1		1.43	2.95	6.16	10.21

MAIN - UNEXPECTED RECORD FOUND(IGNORED) >>> <<<

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093
(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 2** **Existing:** [X] Proposed [ ] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.56	54.42
B	Lawn		0	61			0.86	52.72
B	Woods		0	55			0.85	46.75
			Total Square Miles:		0.0035	Total Acres:	**2.27**	153.89

Weighted RCN= 67.81 , **Use** **68**

TIME OF CONCENTRATIONS

ID	Type of Flow			L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow									
A-B	Grass, Dense			90	0.400			8.9		0.1811
	Shallow Conc. Flow (fig. 3-1)									
B-C		paved	x unpaved	255				7.0	4.27	0.0166
C-D	x	paved	unpaved	50				8.0	5.75	0.0024
D-E		paved	x unpaved	140				7.1	4.30	0.0090
		paved	unpaved							
									Total	0.2091

Initial Abstraction Ia = 0.950 in. (Table 5-1) **Use Tc=** **0.21** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	0.950	0.950	0.950			0.950
Ia/P =	0.352	0.290	0.190			0.110
Peak Qu (csm/in.) =	630	690	740			775
Runoff Q (in) =	0.47	0.76	1.87			4.76
Peak Dischg. (CFS)=	1.05	1.86	4.91			13.09

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
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(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 2 bypass** **Existing:** [X] Proposed [ ] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.01	1.21
B	Lawn		0	61			0.00	0.00
B	Woods		0	55			0.21	11.67
			Total Square Miles:		0.0004	Total Acres:	**0.22**	12.87

Weighted RCN= 57.36 , **Use** 57

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Woods	65	0.400			4.6		0.1817
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved						0.00	
C-D	x paved unpaved						0.00	
D-E	paved x unpaved						0.00	
	paved unpaved							
							Total	0.1817

Initial Abstraction Ia = 1.487 in. (Table 5-1) **Use Tc=** **0.18** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.487	1.487	1.487			1.487
Ia/P =	0.551	0.455	0.297			0.172
Peak Qu (csm/in.) =	350	475	715			775
Runoff Q (in) =	0.17	0.34	1.13			3.51
Peak Dischg. (CFS)=	0.02	0.06	0.28			0.96

```
**********************************************************************************
*                                  * TR 20 S/N    :                              *
*                                  * HMVersion    :  3.40                        *
*              TR 20               * Date         :  5/29/**                     *
*                                  * Time         : 15:22:59                     *
*    Project Formulation Hydrology * Input file   : 18068/18068ex2.txt           *
*                                  * Output file  : 18068/18068ex2.out          *
*                                  *                                            *
*                                  *                                            *
**********************************************************************************
```

```
XXXXXXX  XXXXXX    XXXXX    XXXXX
   X     X     X  X     X  X    XX
   X     X     X        X  X   X X
   X     XXXXXX      X     X  X  X
   X     X   X     X       X X   X
   X     X    X   X        XX    X
   X     X     X  XXXXXXX   XXXXX
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                   by                 :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                     FULLPRINT           SUMMARY
TITLE     1214 Boyce Avenue
TITLE     DP2
 6 RUNOFF 1 001       1 0.0035      68.0        0.21        1        1 DP 1
```

```
 6 RUNOFF 1 002       2 0.0004      57.0        0.18        1          1 DP 1byp
 6 ADDHYD 4 003   1 2 3
   ENDATA
 7 INCREM 6             0.05
 7 COMPUT 7 001   003   0.          2.7         1.0         2 2  01  01
   ENDCMP 1
 7 COMPUT 7 001   003   0.          3.27        1.0         2 2  01  02
   ENDCMP 1
 7 COMPUT 7 001   003   0.          5.01        1.0         2 2  01  10
   ENDCMP 1
 7 COMPUT 7 001   003   0.          8.65        1.0         2 2  01  99
   ENDCMP 1
   ENDJOB 2

**********END OF 80-80 LIST**********
```

TR20 XEQ 5/29/** 1214 Boyce Avenue JOB 1 PASS 1
REV 09/01/83 DP2 PAGE 1

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
```



```
EXECUTIVE CONTROL OPERATION INCREM                                          RECORD ID
                                MAIN TIME INCREMENT =    .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT                                          RECORD ID

                                FROM XSECTION   1
                                                TO XSECTION   3
      STARTING TIME =    .00    RAIN DEPTH =  2.70    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
      ALTERNATE NO.= 1          STORM NO.= 1    MAIN TIME INCREMENT =    .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 68.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.07                          1.14                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .30 WATERSHED INCHES,       .68 CFS-HRS,      .06 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  2
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=    .18 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0240 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.75                          .01                        (RUNOFF)
             12.10                          .02                        (RUNOFF)
```

RUNOFF VOLUME ABOVE BASEFLOW = .05 WATERSHED INCHES, .01 CFS-HRS, .00 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.07	1.15	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .28 WATERSHED INCHES, .70 CFS-HRS, .06 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 3.27 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 68. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	2.00	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .52 WATERSHED INCHES, 1.17 CFS-HRS, .10 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .00 SQ MI INPUT RUNOFF CURVE= 57. TIME OF CONCENTRATION= .18 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0240 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.01	(RUNOFF)
12.05	.07	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .18 WATERSHED INCHES, .05 CFS-HRS, .00 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3

INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	2.07	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .48 WATERSHED INCHES, 1.21 CFS-HRS, .10 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 2

TR20 XEQ 5/29/** 1214 Boyce Avenue JOB 1 PASS 3
REV 09/01/83 DP2 PAGE 4

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 5.01 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 68. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.05	5.22	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.37 WATERSHED INCHES, 3.09 CFS-HRS, .26 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .00 SQ MI INPUT RUNOFF CURVE= 57. TIME OF CONCENTRATION= .18 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0240 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .02 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.02	(RUNOFF)
12.05	.35	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .74 WATERSHED INCHES, .19 CFS-HRS, .02 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.05	5.57	(NULL)

```
  RUNOFF VOLUME ABOVE BASEFLOW =  1.30 WATERSHED INCHES,      3.28 CFS-HRS,      .27 ACRE-FEET;   BASEFLOW =     .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                          RECORD ID
                              COMPUTATIONS COMPLETED FOR PASS   3
```



```
EXECUTIVE CONTROL OPERATION COMPUT                                                                          RECORD ID
                                  FROM XSECTION   1
                                                    TO XSECTION   3
        STARTING TIME =    .00    RAIN DEPTH =  8.65    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1          STORM NO.=99    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
           OUTPUT HYDROGRAPH=  1
           AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 68.    TIME OF CONCENTRATION=   .21 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              12.04                          13.25                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.69 WATERSHED INCHES,      8.34 CFS-HRS,      .69 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
           OUTPUT HYDROGRAPH=  2
           AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=   .18 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0240 HOURS

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              12.03                          1.17                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.55 WATERSHED INCHES,       .66 CFS-HRS,      .05 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
           INPUT HYDROGRAPHS= 1,2     OUTPUT HYDROGRAPH= 3

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              12.04                          14.42                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.58 WATERSHED INCHES,      9.00 CFS-HRS,      .74 ACRE-FEET;   BASEFLOW =     .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                          RECORD ID
                              COMPUTATIONS COMPLETED FOR PASS   4
```

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

TR20 XEQ 5/29/** 1214 Boyce Avenue JOB 1 SUMMARY
REV 09/01/83 DP2 PAGE 6

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 1													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.30	---	12.07	1.14	324.9
XSECTION 2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.05	---	12.10	.02	43.6
XSECTION 3	ADDHYD	.00	2	2	.05	.0	2.70	24.00	.28	---	12.07	1.15	295.6
ALTERNATE 1 STORM 2													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.52	---	12.06	2.00	570.6
XSECTION 2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.18	---	12.05	.07	176.1
XSECTION 3	ADDHYD	.00	2	2	.05	.0	3.27	24.00	.48	---	12.06	2.07	530.5
ALTERNATE 1 STORM 10													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	5.01	24.00	1.37	---	12.05	5.22	1490.6
XSECTION 2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.74	---	12.05	.35	874.7
XSECTION 3	ADDHYD	.00	2	2	.05	.0	5.01	24.00	1.30	---	12.05	5.57	1427.5
ALTERNATE 1 STORM 99													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	8.65	24.00	3.69	---	12.04	13.25	3786.7
XSECTION 2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.55	---	12.03	1.17	2926.8
XSECTION 3	ADDHYD	.00	2	2	.05	.0	8.65	24.00	3.58	---	12.04	14.42	3698.3

TR20 XEQ 5/29/** 1214 Boyce Avenue JOB 1 SUMMARY
REV 09/01/83 DP2 PAGE 7

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

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99

XSECTION	1	.00			
ALTERNATE	1		1.14	2.00	5.22	13.25
XSECTION	2	.00			
ALTERNATE	1		.02	.07	.35	1.17
XSECTION	3	.00			
ALTERNATE	1		1.15	2.07	5.57	14.42

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093
(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 2** Existing: [ ] **Proposed** [X] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.46	44.62
B	Lawn		0	61			0.88	53.91
B	Woods		0	55			0.76	41.71
			Total Square Miles:		0.0033	Total Acres:	**2.10**	140.24

Weighted RCN= 66.86 , **Use** **67**

TIME OF CONCENTRATIONS

ID	Type of Flow			L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow									
A-B	Woods			90	0.400			8.9		0.1811
	Shallow Conc. Flow (fig. 3-1)									
B-C		paved	x unpaved	255				7.0	4.27	0.0166
C-D	x	paved	unpaved	50				8.0	5.75	0.0024
D-E		paved	x unpaved	130				7.3	4.36	0.0083
		paved	unpaved							
									Total	0.2083

Initial Abstraction Ia = 0.991 in. (Table 5-1) **Use Tc=** **0.21** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	0.991	0.991	0.991			0.991
Ia/P =	0.367	0.303	0.198			0.115
Peak Qu (csm/in.) =	660	715	750			780
Runoff Q (in) =	0.44	0.72	1.80			4.65
Peak Dischg. (CFS)=	0.95	1.68	4.42			11.89

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TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 2 bypass** Existing: [ ] **Proposed** [X] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.00	0.00
B	Lawn		0	61			0.04	2.65
B	Woods		0	55			0.12	6.72
			Total Square Miles:		0.0003	Total Acres:	**0.17**	9.37

Weighted RCN= 56.58 , **Use** **57**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Woods							
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved						0.00	
C-D	x paved unpaved						0.00	
D-E	paved x unpaved						0.00	
	paved unpaved							
							Total	0.0000

Initial Abstraction Ia = 1.535 in. (Table 5-1) **Use Tc=** **0.10** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.535	1.535	1.535			1.535
Ia/P =	0.569	0.469	0.306			0.177
Peak Qu (csm/in.) =	835	910	970			980
Runoff Q (in) =	0.15	0.32	1.08			3.42
Peak Dischg. (CFS)=	0.03	0.08	0.27			0.87

18068 **1214 Boyce Avenue** 6/18/2018 RiserD-3.6 06/05

Proposed Conditions - Study Point #2

Elevation - Storage Table

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Increment Volume [acre-ft]	Cumulative Volume [acre-ft]	Cumulative Volume [ft³]
351.00	25	0.0006					
352.00	405	0.0093	1.0	0.0049	0.0049	0.0049	215
354.00	2,735	0.0628	2.0	0.0360	0.0721	0.0770	3,355

Interpolated Values

elevation [ft]	volume [acre-ft]	volume [ft³]		volume [ft³]	volume [acre-ft]	elevation [ft]
353.00	0.0410	1,785	Cpv:	19,280	0.4426	#VALUE!

Elevation - Discharge Table

--- Riser Openings ---

	Circular Orifice	Rectang. Orifice	Weir 1	Weir 2 Riser Top	Emerg. Spillway
Elev. (invert or crest):	351.00				
Diam. (in.) or Width (ft):	21				
Height (ft.-rectang. orifice only):					
Orifice Coef., Co :	0.6				
Weir Coef., Cw				3.1	
Orifice Area for Riser Top Opening - Weir 2:				4 sf	
Orifice Coef.:				0.6	
Trans. to orifice flow at h=				#DIV/0! ft.	

Barrel	
Upstream Invert:	351.00
Diam.:	21 in.
Downstrm Invert:	350.00
Length:	35 ft.
Area of barrel (sf):	2.41
$AD^{0.5}$ =	3.18
Slope =	2.86%

Increment (feet): 1

Pond Elevation [ft.]	Circular Orifice Q, cfs	Rectang. Orifice Q, cfs	Weir 1 Q, cfs	Weir 2 Q, cfs	Total Q into Riser, cfs	Barrel HW Elev.	ES Q, cfs	Total Q, cfs	Conditions*
351.00	0.00				0.00	351.00		0.00	#DIV/0!
352.00	3.13				3.13	351.93		3.13	#DIV/0!
353.00	7.84				7.84	352.54		7.84	#DIV/0!
354.00	11.29				11.29	353.05		11.29	#DIV/0!
	0.00				0.00	351.00			

*Conditions

(1) Barrel in inlet control.
(2) Barrel in outlet control.
(3) Barrel headwater (water surface elevation in riser) is above Weir 1 crest elevation. Submerged weir equation used for Weir 1.
(4) Barrel headwater (water surface elevation in riser) is above riser crest (Weir 2) elevation. Submerged weir equation used for Weir 2.
(5) Opening in top of riser (Weir 2) is in orifice flow. Orifice equation used. Submerged orifice equation used if condition (4) applies. If condition (5) exists without condition (4), riser is entering orifice flow prior to barrel controlling flow. This is typically unstable and should be avoided.

Equations:

Orifice Flow: $Q = 0.6A(2gh)^{0.5}$ Submerged Orifice Flow: $Q = 0.6A[2g(h_1-h_2)]^{0.5}$

Weir Flow: $Q = 3.1LH^{1.5}$ Submerged Weir Flow: $Q = Qo[1-(h_2/h_1)^{1.5}]^{0.385}$

where h_1 is upstream head and h_2 is downstream head

Culvert - Inlet Control, Unsubmerged: $Hw = KD(Q/AD^{0.5})^M$, where K = .534 and M = .555 (Form 2)

Culvert - Inlet Control, Submerged: $Hw = cD(Q/AD^{0.5})^2 + DY - 0.5DS^2$, where c = 0.0398 and Y = 0.67

Slope, S, is generally insignificant and is not included in the table.

Culvert - Outlet Control: Total Losses, $H_L = [1 + K_e + (K_u n^2 L) / R^{1.33}](V^2/2g)$ for full flow

where Ke = 0.5, Ku = 29, n = .014, L = length, R = A/P and V = Q/A

For partial flow, $HW = H_L + (d_c + D) / 2$, where d_c = critical depth and D = pipe diameter

Emergency Spillway Flow: $Q = C[(a+b)/2 - .2H]H^{3/2}$, where a = weir width at base, b = weir width at water surface elevation (assumes 3:1 side slopes). C varies by height by the equation: C = 0.6H + 1.75, with a maximum of C = 3.1.

(Culvert equations from HDS-5, FHWA-NHI-01-020, Sept. 2001)

Notes:

1. For use with circular concrete pipes only.
2. Table assumes Weir 1 extends to the top of the riser. When entering length of weirs, do not include Weir 1 length as part of Weir 2 length so that flow is not counted twice.
3. When calculating transition to orifice flow for flow into top of riser, weir length is determined by adding length of Weir 1 and Weir 2.
4. Outlet control equations are applied only for headwater above 0.75D. For long pipes with minimal slope flowing partially full, more accurate methods may be needed.

```
**********************************************************************************
*                                  * TR 20 S/N    :                              *
*                                  * HMVersion    :  3.40                        *
*              TR 20               * Date         :  7/31/**                     *
*                                  * Time         :  9:14:32                     *
*    Project Formulation Hydrology * Input file   : 18068/18068p2a.txt           *
*                                  * Output file  : 18068/18068p2a.out          *
*                                  *                                            *
*                                  *                                            *
**********************************************************************************
```

```
XXXXXXX  XXXXXX    XXXXX    XXXXX
   X     X     X  X     X  X    XX
   X     X     X        X  X   X X
   X     XXXXXX      X     X  X  X
   X     X   X     X       X X   X
   X     X    X   X        XX    X
   X     X     X  XXXXXXX   XXXXX
```

```
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
:::                                     :::
:::  Full Microcomputer Implementation  :::
:::                 by                  :::
:::        Haestad Methods, Inc.        :::
:::                                     :::
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                     FULLPRINT           SUMMARY
TITLE     1214 Boyce Avenue
TITLE     PROPOSED CONDITIONS - DP2
 3 STRUCT      01
```

```
8                          351.00      0.00        0.0000
8                          352.00      3.13        0.0049
8                          353.00      7.84        0.0410
8                          354.00     11.29        0.0770
9 ENDTBL
6 RUNOFF 1 001        1 0.0033       67.0        0.21        1          1 DP 2
6 RESVOR 2    01 1    2 351.00                               1          1
6 RUNOFF 1 002        3 0.0003       57.0        0.10        1          1 DP 2byp
6 ADDHYD 4 003   2 3 4                                       1          1
  ENDATA
7 INCREM 6              0.05
7 COMPUT 7 001   003    0.0          2.7         1.0         2 2  01  01
  ENDCMP 1
7 COMPUT 7 001   003    0.0          3.27        1.0         2 2  01  02
  ENDCMP 1
7 COMPUT 7 001   003    0.0          5.01        1.0         2 2  01  10
  ENDCMP 1
7 COMPUT 7 001   003    0.0          8.65        1.0         2 2  01  99
  ENDCMP 1
  ENDJOB 2
```

**********END OF 80-80 LIST**********

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

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 1
REV 09/01/83 PROPOSED CONDITIONS - DP2 PAGE 2

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 67. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .06 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.06	(RUNOFF)
12.05	.94	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .27 WATERSHED INCHES, .59 CFS-HRS, .05 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1

INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 2
SURFACE ELEVATION= 351.00

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .94 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	.94	351.30

RUNOFF VOLUME ABOVE BASEFLOW = .27 WATERSHED INCHES, .58 CFS-HRS, .05 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 3
AREA= .00 SQ MI INPUT RUNOFF CURVE= 57. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
13.00	.01	(RUNOFF)
12.05	.02	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .04 WATERSHED INCHES, .01 CFS-HRS, .00 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4
♀◘

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 1
REV 09/01/83 PROPOSED CONDITIONS - DP2 PAGE 3

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .06 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.06	(NULL)
12.10	.95	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .25 WATERSHED INCHES, .59 CFS-HRS, .05 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 1

♀◘

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 2
REV 09/01/83 PROPOSED CONDITIONS - DP2 PAGE 4

```
EXECUTIVE CONTROL OPERATION COMPUT                                                                          RECORD ID
                                   FROM XSECTION    1
                                                   TO XSECTION    3
       STARTING TIME =    .00     RAIN DEPTH =  3.27    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
       ALTERNATE NO.= 1           STORM NO.= 2    MAIN TIME INCREMENT =    .05 HOURS


OPERATION RUNOFF    CROSS SECTION    1
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 67.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.06                          1.74                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .48 WATERSHED INCHES,      1.02 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RESVOR    STRUCTURE  1
          INPUT HYDROGRAPH= 1     OUTPUT HYDROGRAPH= 2
          SURFACE ELEVATION=  351.00

          PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.08                          1.71                       351.55

  RUNOFF VOLUME ABOVE BASEFLOW =   .48 WATERSHED INCHES,      1.02 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF    CROSS SECTION    2
          OUTPUT HYDROGRAPH=  3
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=   .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.50                          .01                        (RUNOFF)
             12.05                          .07                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .18 WATERSHED INCHES,       .03 CFS-HRS,      .00 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD    CROSS SECTION    3
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.08                          1.76                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .45 WATERSHED INCHES,      1.05 CFS-HRS,      .09 ACRE-FEET;   BASEFLOW =    .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                          RECORD ID
                                   COMPUTATIONS COMPLETED FOR PASS    2
```

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 3
REV 09/01/83 PROPOSED CONDITIONS - DP2 PAGE 6

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 3
STARTING TIME = .00 RAIN DEPTH = 5.01 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 67. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.05	4.71	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.31 WATERSHED INCHES, 2.78 CFS-HRS, .23 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 2
SURFACE ELEVATION= 351.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	4.17	352.22

RUNOFF VOLUME ABOVE BASEFLOW = 1.30 WATERSHED INCHES, 2.78 CFS-HRS, .23 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 3
AREA= .00 SQ MI INPUT RUNOFF CURVE= 57. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.01	(RUNOFF)
12.00	.30	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .74 WATERSHED INCHES, .14 CFS-HRS, .01 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.09	4.31	(NULL)

```
  RUNOFF VOLUME ABOVE BASEFLOW =  1.26 WATERSHED INCHES,      2.92 CFS-HRS,      .24 ACRE-FEET;   BASEFLOW =     .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                                          RECORD ID
                              COMPUTATIONS COMPLETED FOR PASS   3
```



```
EXECUTIVE CONTROL OPERATION COMPUT                                                                          RECORD ID
                                  FROM XSECTION   1
                                                    TO XSECTION   3
        STARTING TIME =    .00    RAIN DEPTH =  8.65    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1          STORM NO.=99    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 67.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          12.20                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.59 WATERSHED INCHES,      7.64 CFS-HRS,      .63 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RESVOR   STRUCTURE  1
          INPUT HYDROGRAPH= 1     OUTPUT HYDROGRAPH= 2
          SURFACE ELEVATION=  351.00

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.11                          10.18                       353.68
             12.53                           1.76                       351.56

  RUNOFF VOLUME ABOVE BASEFLOW =  3.59 WATERSHED INCHES,      7.64 CFS-HRS,      .63 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  3
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=   .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS
```

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .03 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.03	(RUNOFF)
12.00	.97	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 2.56 WATERSHED INCHES, .50 CFS-HRS, .04 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.09	10.56	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 3.50 WATERSHED INCHES, 8.14 CFS-HRS, .67 ACRE-FEET; BASEFLOW = .00 CFS

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 5
REV 09/01/83 PROPOSED CONDITIONS - DP2 PAGE 9

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 4

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 SUMMARY
REV 09/01/83 PROPOSED CONDITIONS - DP2 PAGE 10

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 1													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.27	---	12.05	.94	286.1
STRUCTURE 1	RESVOR	.00	2	2	.05	.0	2.70	24.00	.27	351.30	12.10?	.94?	285.6
XSECTION 2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.04	---	12.05	.02	62.5
XSECTION 3	ADDHYD	.00	2	2	.05	.0	2.70	24.00	.25	---	12.10	.95	265.0

ALTERNATE 1 STORM 2

XSECTION	1	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.48	---	12.06	1.74	527.8
STRUCTURE	1	RESVOR	.00	2	2	.05	.0	3.27	24.00	.48	351.55	12.08	1.71	518.5
XSECTION	2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.18	---	12.05	.07	217.9
XSECTION	3	ADDHYD	.00	2	2	.05	.0	3.27	24.00	.45	---	12.08	1.76	488.0

ALTERNATE 1 STORM 10

XSECTION	1	RUNOFF	.00	2	2	.05	.0	5.01	24.00	1.31	---	12.05	4.71	1425.9
STRUCTURE	1	RESVOR	.00	2	2	.05	.0	5.01	24.00	1.30	352.22	12.10	4.17	1264.0
XSECTION	2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.74	---	12.00	.30	1007.2
XSECTION	3	ADDHYD	.00	2	2	.05	.0	5.01	24.00	1.26	---	12.09	4.31	1196.8

ALTERNATE 1 STORM 99

XSECTION	1	RUNOFF	.00	2	2	.05	.0	8.65	24.00	3.59	---	12.04	12.20	3696.8
STRUCTURE	1	RESVOR	.00	2	2	.05	.0	8.65	24.00	3.59	353.68	12.11	10.18	3085.0
XSECTION	2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.56	---	12.00	.97	3247.1
XSECTION	3	ADDHYD	.00	2	2	.05	.0	8.65	24.00	3.50	---	12.09	10.56	2933.9

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

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
STRUCTURE	1	.00				
ALTERNATE	1		.94	1.71	4.17	10.18
XSECTION	1	.00				
ALTERNATE	1		.94	1.74	4.71	12.20
XSECTION	2	.00				
ALTERNATE	1		.02	.07	.30	.97
XSECTION	3	.00				
ALTERNATE	1		.95	1.76	4.31	10.56

MAIN - UNEXPECTED RECORD FOUND(IGNORED) >>> <<<

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093
(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 3** **Existing:** [X] Proposed [ ] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.00	0.00
B	Lawn		0	61			0.00	0.00
B	Woods		0	55			1.02	56.34
			Total Square Miles:		0.0016	Total Acres:	**1.02**	56.34

Weighted RCN= 55.00 , **Use** **55**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Woods	100	0.400			17.0		0.1521
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	55				27.3	8.43	0.0018
	x paved unpaved						0.00	
	paved x unpaved						0.00	
	paved unpaved							
							Total	0.1539

Initial Abstraction Ia = 1.636 in. (Table 5-1) **Use Tc=** **0.15** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.636	1.636	1.636			1.636
Ia/P =	0.606	0.500	0.327			0.189
Peak Qu (csm/in.) =	400	440	790			860
Runoff Q (in) =	0.12	0.27	0.98			3.24
Peak Dischg. (CFS)=	0.08	0.19	1.25			4.46

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093
(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 3** Existing: ☐ **Proposed** ☒ Ultimate ☐

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			0.19	18.99
B	Lawn		0	61			0.32	19.79
B	Woods		0	55			0.87	47.74
			Total Square Miles:		0.0022	Total Acres:	**1.39**	86.53

Weighted RCN= 62.42 , **Use** **62**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Woods	55	0.400			8.2		0.1262
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	15				122.0	17.82	0.0002
C-D	paved x unpaved	125				3.4	2.98	0.0117
	paved x unpaved						0.00	
	paved unpaved							
D-E	Storm Drain	130					7.00	0.0052
	Open Channel							
							Total	0.1432

Initial Abstraction Ia = 1.204 in. (Table 5-1) **Use Tc=** **0.14** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.204	1.204	1.204			1.204
Ia/P =	0.446	0.368	0.240			0.139
Peak Qu (csm/in.) =	590	750	860			875
Runoff Q (in) =	0.30	0.53	1.47			4.12
Peak Dischg. (CFS)=	0.38	0.86	2.75			7.80

```
**********************************************************************************
*                                    * TR 20 S/N    :                            *
*                                    * HMVersion    :  3.40                      *
*               TR 20                * Date         :  8/16/**                   *
*                                    * Time         :  8:08:52                   *
*    Project Formulation Hydrology   * Input file   : 18068/18068da3.txt         *
*                                    * Output file  : 18068/18068da3.out         *
*                                    *                                           *
*                                    *                                           *
**********************************************************************************
```

```
xxxxxxx  xxxxxx    xxxxx    xxxxx
   x     x     x  x     x  x    xx
   x     x     x        x   x   x x
   x     xxxxxx      x     x  x  x
   x     x   x     x       x x   x
   x     x    x   x        xx    x
   x     x     x  xxxxxxx   xxxxx
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                  by                  :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                    FULLPRINT          SUMMARY
TITLE     1214 Boyce Avenue
TITLE     DP1
 6 RUNOFF 1 001       1 0.0016      55.0        0.15        1         1 DP 3 ex
```

```
 6 RUNOFF 1 002       2 0.0022      62.0        0.14        1          1 DP 3 pr
   ENDATA
 7 INCREM 6             0.05
 7 COMPUT 7 001   002   0.           2.7         1.0         2 2  01  01
   ENDCMP 1
 7 COMPUT 7 001   002   0.           3.27        1.0         2 2  01  02
   ENDCMP 1
 7 COMPUT 7 001   002   0.           5.01        1.0         2 2  01  10
   ENDCMP 1
 7 COMPUT 7 001   002   0.           8.65        1.0         2 2  01  99
   ENDCMP 1
   ENDJOB 2

*******************************END OF 80-80 LIST*********************************
```

TR20 XEQ 8/16/** 1214 Boyce Avenue JOB 1 PASS 1
REV 09/01/83 DP1 PAGE 1

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

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 55. TIME OF CONCENTRATION= .15 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0200 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.01	(RUNOFF)
12.10	.03	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .05 WATERSHED INCHES, .05 CFS-HRS, .00 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .00 SQ MI INPUT RUNOFF CURVE= 62. TIME OF CONCENTRATION= .14 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0187 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .03 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.03	(RUNOFF)

12.05 .40 (RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .16 WATERSHED INCHES, .23 CFS-HRS, .02 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 3.27 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 55. TIME OF CONCENTRATION= .15 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0200 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .02 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.02	(RUNOFF)
12.05	.21	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .14 WATERSHED INCHES, .15 CFS-HRS, .01 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .00 SQ MI INPUT RUNOFF CURVE= 62. TIME OF CONCENTRATION= .14 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0187 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .05 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.05	(RUNOFF)
12.05	.86	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .32 WATERSHED INCHES, .45 CFS-HRS, .04 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 2

```
TR20 XEQ  8/16/**              1214 Boyce Avenue                                        JOB  1   PASS   3
     REV 09/01/83              DP1                                                                PAGE   4


EXECUTIVE CONTROL OPERATION COMPUT                                                              RECORD ID
                                  FROM XSECTION   1
                                                  TO XSECTION   2
        STARTING TIME =   .00     RAIN DEPTH =  5.01    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1          STORM NO.=10    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=   .15 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0200 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          1.28                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .64 WATERSHED INCHES,       .66 CFS-HRS,      .05 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  2
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=   .14 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0187 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.02                          2.74                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.01 WATERSHED INCHES,      1.43 CFS-HRS,      .12 ACRE-FEET;   BASEFLOW =    .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                              RECORD ID
                                  COMPUTATIONS COMPLETED FOR PASS   3

♀


TR20 XEQ  8/16/**              1214 Boyce Avenue                                        JOB  1   PASS   4
     REV 09/01/83              DP1                                                                PAGE   5


EXECUTIVE CONTROL OPERATION COMPUT                                                              RECORD ID
                                  FROM XSECTION   1
                                                  TO XSECTION   2
        STARTING TIME =   .00     RAIN DEPTH =  8.65    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1          STORM NO.=99    MAIN TIME INCREMENT =   .05 HOURS
```

```
OPERATION RUNOFF    CROSS SECTION    1
           OUTPUT HYDROGRAPH=  1
           AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=   .15 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0200 HOURS

           PEAK TIME(HRS)           PEAK DISCHARGE(CFS)        PEAK ELEVATION(FEET)
              12.02                        4.48                     (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.36 WATERSHED INCHES,     2.43 CFS-HRS,     .20 ACRE-FEET;   BASEFLOW =    .00 CFS

OPERATION RUNOFF    CROSS SECTION    2
           OUTPUT HYDROGRAPH=  2
           AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=   .14 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0187 HOURS

           PEAK TIME(HRS)           PEAK DISCHARGE(CFS)        PEAK ELEVATION(FEET)
              12.01                        7.82                     (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.07 WATERSHED INCHES,     4.36 CFS-HRS,     .36 ACRE-FEET;   BASEFLOW =    .00 CFS


EXECUTIVE CONTROL OPERATION ENDCMP                                                                      RECORD ID
                                       COMPUTATIONS COMPLETED FOR PASS   4



EXECUTIVE CONTROL OPERATION ENDJOB                                                                      RECORD ID



TR20 XEQ  8/16/**          1214 Boyce Avenue                                                   JOB  1   SUMMARY
     REV 09/01/83          DP1                                                                          PAGE   6


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 1													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.05	---	12.10	.03	17.4
XSECTION 2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.16	---	12.05	.40	181.5
ALTERNATE 1 STORM 2													
XSECTION 1	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.14	---	12.05	.21	133.0
XSECTION 2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.32	---	12.05	.86	391.5
ALTERNATE 1 STORM 10													

XSECTION	1	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.64	---	12.04	1.28	802.2
XSECTION	2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	1.01	---	12.02	2.74	1246.5

ALTERNATE 1 STORM 99

XSECTION	1	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.36	---	12.02	4.48	2797.0
XSECTION	2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	3.07	---	12.01	7.82	3554.5

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

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION	1	.00				
ALTERNATE	1		.03	.21	1.28	4.48
XSECTION	2	.00				
ALTERNATE	1		.40	.86	2.74	7.82

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093
(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 25, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **#4** **Existing:** [X] Proposed [ ] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			3.82	374.13
B	Lawn		0	61			15.83	965.74
B	Woods		0	55			3.70	203.65
			Total Square Miles:		0.0365	Total Acres:	**23.35**	1543.53

Weighted RCN= 66.10 , **Use** **66**

TIME OF CONCENTRATIONS

ID	Type of Flow			L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow									
A-B	Woods			100	0.400			11.0		0.1810
	Shallow Conc. Flow (fig. 3-1)									
B-C	paved	x	unpaved	115				9.6	5.00	0.0064
C-D	paved	x	unpaved	515				6.0	3.95	0.0362
	paved		unpaved							
	paved		unpaved							
D-E	Open Channel			1,040					3.10	0.0932
	Stormdrain								0.00	
									Total	0.3168

Initial Abstraction Ia = 1.026 in. (Table 5-1) **Use Tc=** **0.32** Tt=

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.026	1.026	1.026			1.026
Ia/P =	0.380	0.314	0.205			0.119
Peak Qu (csm/in.) =	390	500	600			645
Runoff Q (in) =	0.41	0.68	1.74			4.56
Peak Dischg. (CFS)=	5.86	12.46	38.13			107.27

Richardson Engineering, LLC
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(410) 560-1502 Fax (443) 901-1208

TR-55 DESIGN COMPUTATION

By: se
Date: May 24, 2018
Rev:
Date:
Check:
Date:
Sheet 1 of

Project: **1214 Boyce Avenue** Job Number: 18068

Drainage Area: **dp 4** Existing: [ ] **Proposed** [X] Ultimate [ ]

Soil Group	Land Use or Zoning	Hydrologic Condition	% Imperv.	RCN Table 2-2	RCN Figure 2-3	RCN Figure 2-4	Area (Acre)	RCN x Area
	Impervious		100	98			3.88	380.33
B	Lawn		0	61			16.02	977.31
B	Woods		0	55			3.70	203.65
			Total Square Miles:		0.0369	Total Acres:	**23.61**	1561.29

Weighted RCN= 66.14 , **Use** **66**

TIME OF CONCENTRATIONS

ID	Type of Flow	L(ft.)	n	A	WP	Slope (Percent)	Vel. (fps)	Time (Hours)
	Sheet Flow							
A-B	Woods	100	0.400			11.0		0.1810
	Shallow Conc. Flow (fig. 3-1)							
B-C	paved x unpaved	115				9.6	5.00	0.0064
C-D	paved x unpaved	515				6.0	3.95	0.0362
	paved x unpaved						0.00	
	paved unpaved							
D-E	Storm Drain	1,040					3.10	0.0932
	Open Channel							
							Total	0.3168

Initial Abstraction Ia = 1.024 in. (Table 5-1) **Use Tc= ##** Tt= 0.32

Rainfall Freq. =	1 Year	2 Years	10 Years	25 Years	50 Years	100 Years
Rainfall, P =	2.7	3.27	5.01			8.65
Ia	1.024	1.024	1.024			1.024
Ia/P =	0.379	0.313	0.204			0.118
Peak Qu (csm/in.) =	470	540	610			650
Runoff Q (in) =	0.41	0.69	1.75			4.56
Peak Dischg. (CFS)=	7.17	13.64	39.26			109.40

```
**********************************************************************************
*                                  * TR 20 S/N    :                              *
*                                  * HMVersion    :  3.40                        *
*              TR 20               * Date         :  8/16/**                     *
*                                  * Time         :  8:09:13                     *
*    Project Formulation Hydrology * Input file   : 18068/18068da4.txt           *
*                                  * Output file  : 18068/18068da4.out          *
*                                  *                                            *
*                                  *                                            *
**********************************************************************************
```

```
 xxxxxxx  xxxxxx    xxxxx    xxxxx
    x     x     x  x     x  x    xx
    x     x     x        x   x   x x
    x     xxxxxx      x     x  x  x
    x     x   x     x       x x   x
    x     x    x   x        xx    x
    x     x     x  xxxxxxx   xxxxx
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation  :::
:::                  by                  :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                      FULLPRINT           SUMMARY
TITLE     1214 Boyce Avenue
TITLE     DP4
 6 RUNOFF 1 001       1 0.0365      66.10       0.32        1         1 DP 4ex
```

```
 6 RUNOFF 1 002       2 0.0369      66.14       0.32       1          1 DP 4pr
   ENDATA
 7 INCREM 6             0.05
 7 COMPUT 7 001   002   0.           2.7         1.0        2 2  01  01
   ENDCMP 1
 7 COMPUT 7 001   002   0.           3.27        1.0        2 2  01  02
   ENDCMP 1
 7 COMPUT 7 001   002   0.           5.01        1.0        2 2  01  10
   ENDCMP 1
 7 COMPUT 7 001   002   0.           8.65        1.0        2 2  01  99
   ENDCMP 1
   ENDJOB 2

*********************************END OF 80-80 LIST*********************************
```


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

EXECUTIVE CONTROL OPERATION INCREM RECORD ID

MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.14	7.48	

RUNOFF VOLUME ABOVE BASEFLOW = .25 WATERSHED INCHES, 5.86 CFS-HRS, .48 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.14	7.60	

RUNOFF VOLUME ABOVE BASEFLOW = .25 WATERSHED INCHES, 5.95 CFS-HRS, .49 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 1

♀◘

TR20 XEQ 8/16/** 1214 Boyce Avenue JOB 1 PASS 2
REV 09/01/83 DP4 PAGE 3

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 2
STARTING TIME = .00 RAIN DEPTH = 3.27 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.12	14.37	

RUNOFF VOLUME ABOVE BASEFLOW = .44 WATERSHED INCHES, 10.42 CFS-HRS, .86 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.12	14.58	

RUNOFF VOLUME ABOVE BASEFLOW = .44 WATERSHED INCHES, 10.57 CFS-HRS, .87 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID

COMPUTATIONS COMPLETED FOR PASS 2

♀◘

TR20 XEQ 8/16/** 1214 Boyce Avenue JOB 1 PASS 3
REV 09/01/83 DP4 PAGE 4

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1

TO XSECTION 2

STARTING TIME = .00 RAIN DEPTH = 5.01 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.11	41.46	

RUNOFF VOLUME ABOVE BASEFLOW = 1.24 WATERSHED INCHES, 29.21 CFS-HRS, 2.41 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.11	42.00	

RUNOFF VOLUME ABOVE BASEFLOW = 1.24 WATERSHED INCHES, 29.59 CFS-HRS, 2.45 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 3

TR20 XEQ 8/16/** 1214 Boyce Avenue JOB 1 PASS 4
REV 09/01/83 DP4 PAGE 5

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 2

STARTING TIME = .00 RAIN DEPTH = 8.65 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.09	111.64	

RUNOFF VOLUME ABOVE BASEFLOW = 3.47 WATERSHED INCHES, 81.78 CFS-HRS, 6.76 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2

OUTPUT HYDROGRAPH= 2
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET) (RUNOFF)
12.09	112.98	

RUNOFF VOLUME ABOVE BASEFLOW = 3.48 WATERSHED INCHES, 82.78 CFS-HRS, 6.84 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 4

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

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 1													
XSECTION 1	RUNOFF	.04	2	2	.05	.0	2.70	24.00	.25	---	12.14	7.48	204.9
XSECTION 2	RUNOFF	.04	2	2	.05	.0	2.70	24.00	.25	---	12.14	7.60	205.9
ALTERNATE 1 STORM 2													
XSECTION 1	RUNOFF	.04	2	2	.05	.0	3.27	24.00	.44	---	12.12	14.37	393.8
XSECTION 2	RUNOFF	.04	2	2	.05	.0	3.27	24.00	.44	---	12.12	14.58	395.2
ALTERNATE 1 STORM 10													
XSECTION 1	RUNOFF	.04	2	2	.05	.0	5.01	24.00	1.24	---	12.11	41.46	1136.0
XSECTION 2	RUNOFF	.04	2	2	.05	.0	5.01	24.00	1.24	---	12.11	42.00	1138.2
ALTERNATE 1 STORM 99													
XSECTION 1	RUNOFF	.04	2	2	.05	.0	8.65	24.00	3.47	---	12.09	111.64	3058.7
XSECTION 2	RUNOFF	.04	2	2	.05	.0	8.65	24.00	3.48	---	12.09	112.98	3061.9

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

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION	1	.04				
ALTERNATE	1		7.48	14.37	41.46	111.64
XSECTION	2	.04				
ALTERNATE	1		7.60	14.58	42.00	112.98

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

```
**********************************************************************************
*                                    * TR 20 S/N    :                            *
*                                    * HMVersion    :  3.40                      *
*               TR 20                * Date         :  8/16/**                   *
*                                    * Time         :  8:12:23                   *
*    Project Formulation Hydrology   * Input file   : 18068/excombo.txt          *
*                                    * Output file  : 18068/excombo.out          *
*                                    *                                           *
*                                    *                                           *
**********************************************************************************
```

```
XXXXXXX  XXXXXX    XXXXX    XXXXX
   X     X     X  X     X  X    XX
   X     X     X        X  X   X X
   X     XXXXXX      X     X  X  X
   X     X   X     X       X X   X
   X     X    X   X        XX    X
   X     X     X  XXXXXXX   XXXXX
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation  :::
:::                  by                  :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                      FULLPRINT          SUMMARY
TITLE     1214 Boyce Avenue
TITLE     DP4 Combined Existing Conditions
 6 RUNOFF 1 001       1 0.0075      62.0        0.21        1        1 DP 1 ex
```

```
 6 RUNOFF 1 002        2 0.0008      55.0        0.21       1         1 DP 1 ex
 6 ADDHYD 4 003    1 2 3                                    1         1
 6 RUNOFF 1 004        4 0.0035      68.0        0.21       1         1 DP 2 ex
 6 ADDHYD 4 005    3 4 5                                    1         1
 6 RUNOFF 1 006        6 0.0004      57.0        0.18       1         1 DP 2 ex
 6 ADDHYD 4 007    5 6 7                                    1         1
 6 RUNOFF 1 008        1 0.0016      55.0        0.15       1         1 DP 3 ex
 6 ADDHYD 4 009    7 1 2                                    1         1
 6 RUNOFF 1 010        3 0.0365      66.0        0.32       1         1 DP 4 ex
 6 ADDHYD 4 011    2 3 4                                    1         1
   ENDATA
 7 INCREM 6            0.05
 7 COMPUT 7 001    011   0.          2.7         1.0        2 2  01  01
   ENDCMP 1
 7 COMPUT 7 001    011   0.          3.27        1.0        2 2  01  02
   ENDCMP 1
 7 COMPUT 7 001    011   0.          5.01        1.0        2 2  01  10
   ENDCMP 1
 7 COMPUT 7 001    011   0.          8.65        1.0        2 2  01  99
   ENDCMP 1
   ENDJOB 2

**********************************END OF 80-80 LIST**********************************
```


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

TR20 XEQ 8/16/** 1214 Boyce Avenue JOB 1 PASS 1
REV 09/01/83 DP4 Combined Existing Conditions PAGE 2

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID

FROM XSECTION 1
TO XSECTION 11
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 62. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .10 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.10	(RUNOFF)
12.10	1.08	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .16 WATERSHED INCHES, .77 CFS-HRS, .06 ACRE-FEET; BASEFLOW = .00 CFS

```
OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  2
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                           .01                        (RUNOFF)
             12.30                           .01                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .05 WATERSHED INCHES,       .03 CFS-HRS,      .00 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 1,2     OUTPUT HYDROGRAPH= 3

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .11 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                           .11                        (NULL)
             12.10                          1.09                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .15 WATERSHED INCHES,       .79 CFS-HRS,      .07 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
```



```
          OUTPUT HYDROGRAPH=  4
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 68.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.07                          1.14                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .30 WATERSHED INCHES,       .68 CFS-HRS,      .06 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 3,4     OUTPUT HYDROGRAPH= 5

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.08                          2.20                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .19 WATERSHED INCHES,      1.48 CFS-HRS,      .12 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  6
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=    .18 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0240 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.
```

```
          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.75                          .01                        (RUNOFF)
             12.10                          .02                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .05 WATERSHED INCHES,       .01 CFS-HRS,       .00 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.08                         2.22                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .19 WATERSHED INCHES,      1.49 CFS-HRS,       .12 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .15 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0200 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                          .01                        (RUNOFF)
             12.10                          .03                        (RUNOFF)
```



```
  RUNOFF VOLUME ABOVE BASEFLOW =    .05 WATERSHED INCHES,       .05 CFS-HRS,       .00 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 7,1     OUTPUT HYDROGRAPH= 2

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.08                         2.25                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .17 WATERSHED INCHES,      1.54 CFS-HRS,       .13 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  3
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=    .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.14                         7.38                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .25 WATERSHED INCHES,      5.81 CFS-HRS,       .48 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
```

```
          INPUT HYDROGRAPHS= 2,3      OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.12                          9.43                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .23 WATERSHED INCHES,      7.35 CFS-HRS,      .61 ACRE-FEET;   BASEFLOW =     .00 CFS

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



```
EXECUTIVE CONTROL OPERATION COMPUT                                                                          RECORD ID

                                    FROM XSECTION   1
                                      TO XSECTION  11
        STARTING TIME =    .00    RAIN DEPTH =  3.27    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1          STORM NO.= 2    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=     .01 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.07                          2.47                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .31 WATERSHED INCHES,      1.52 CFS-HRS,      .13 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  2
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .01                        (RUNOFF)
             12.10                          .09                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .14 WATERSHED INCHES,       .07 CFS-HRS,      .01 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 1,2      OUTPUT HYDROGRAPH= 3

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.07                          2.55                       (NULL)
```

```
  RUNOFF VOLUME ABOVE BASEFLOW =    .30 WATERSHED INCHES,      1.59 CFS-HRS,       .13 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
          OUTPUT HYDROGRAPH=  4
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 68.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.06                          2.00                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .52 WATERSHED INCHES,      1.17 CFS-HRS,       .10 ACRE-FEET;   BASEFLOW =     .00 CFS
```



```
OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 3,4     OUTPUT HYDROGRAPH= 5

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.07                          4.53                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .36 WATERSHED INCHES,      2.76 CFS-HRS,       .23 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  6
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=    .18 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0240 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                          .01                        (RUNOFF)
             12.05                          .07                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .18 WATERSHED INCHES,       .05 CFS-HRS,       .00 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.07                          4.61                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .36 WATERSHED INCHES,      2.80 CFS-HRS,       .23 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .15 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0200 HOURS
```

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .02 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.02	(RUNOFF)
12.05	.21	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .14 WATERSHED INCHES, .15 CFS-HRS, .01 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 9
INPUT HYDROGRAPHS= 7,1 OUTPUT HYDROGRAPH= 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.07	4.82	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .33 WATERSHED INCHES, 2.95 CFS-HRS, .24 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 10
OUTPUT HYDROGRAPH= 3
AREA= .04 SQ MI INPUT RUNOFF CURVE= 66. TIME OF CONCENTRATION= .32 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0427 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.12	14.24	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .44 WATERSHED INCHES, 10.34 CFS-HRS, .85 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 11
INPUT HYDROGRAPHS= 2,3 OUTPUT HYDROGRAPH= 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.11	18.64	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .41 WATERSHED INCHES, 13.29 CFS-HRS, 1.10 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP RECORD ID
COMPUTATIONS COMPLETED FOR PASS 2

```
EXECUTIVE CONTROL OPERATION COMPUT                                                                   RECORD ID
                                  FROM XSECTION   1
                                                     TO XSECTION  11
      STARTING TIME =    .00     RAIN DEPTH =  5.01    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
      ALTERNATE NO.= 1           STORM NO.=10     MAIN TIME INCREMENT =    .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
         OUTPUT HYDROGRAPH=  1
         AREA=    .01 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=   .21 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

         PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
            12.05                           8.33                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.00 WATERSHED INCHES,      4.85 CFS-HRS,      .40 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
         OUTPUT HYDROGRAPH=  2
         AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=   .21 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .03 CFS.

         PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
            14.95                           .03                        (RUNOFF)
            12.05                           .55                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .64 WATERSHED INCHES,       .33 CFS-HRS,      .03 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
         INPUT HYDROGRAPHS= 1,2     OUTPUT HYDROGRAPH= 3

         PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
            12.05                           8.88                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .97 WATERSHED INCHES,      5.18 CFS-HRS,      .43 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
         OUTPUT HYDROGRAPH=  4
         AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 68.    TIME OF CONCENTRATION=   .21 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

         PEAK TIME(HRS)             PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
            12.05                           5.22                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.37 WATERSHED INCHES,      3.09 CFS-HRS,      .26 ACRE-FEET;   BASEFLOW =    .00 CFS
```

```
OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 3,4     OUTPUT HYDROGRAPH= 5

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.05                          14.09                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.09 WATERSHED INCHES,      8.28 CFS-HRS,      .68 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  6
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=   .18 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0240 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .02 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .02                        (RUNOFF)
             12.05                          .35                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .74 WATERSHED INCHES,       .19 CFS-HRS,      .02 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.05                          14.44                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.08 WATERSHED INCHES,      8.47 CFS-HRS,      .70 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=   .15 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0200 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.04                          1.28                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .64 WATERSHED INCHES,       .66 CFS-HRS,      .05 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 7,1     OUTPUT HYDROGRAPH= 2

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.05                          15.71                      (NULL)
```



```
  RUNOFF VOLUME ABOVE BASEFLOW =  1.02 WATERSHED INCHES,      9.13 CFS-HRS,      .75 ACRE-FEET;   BASEFLOW =    .00 CFS
```

```
OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  3
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=   .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.11                          41.26                      (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.23 WATERSHED INCHES,     29.07 CFS-HRS,     2.40 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.08                          55.67                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.18 WATERSHED INCHES,     38.19 CFS-HRS,     3.16 ACRE-FEET;   BASEFLOW =     .00 CFS


EXECUTIVE CONTROL OPERATION ENDCMP                                                                    RECORD ID
                                COMPUTATIONS COMPLETED FOR PASS   3
```



```
EXECUTIVE CONTROL OPERATION COMPUT                                                                    RECORD ID
                                FROM XSECTION   1
                                                TO XSECTION  11
        STARTING TIME =    .00    RAIN DEPTH =  8.65    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1          STORM NO.=99    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=     .01 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          24.25                      (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.06 WATERSHED INCHES,     14.81 CFS-HRS,     1.22 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  2
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.05                           2.05                      (RUNOFF)
```

```
  RUNOFF VOLUME ABOVE BASEFLOW =  2.35 WATERSHED INCHES,      1.21 CFS-HRS,      .10 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 1,2     OUTPUT HYDROGRAPH= 3

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          26.30                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.99 WATERSHED INCHES,     16.02 CFS-HRS,     1.32 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
          OUTPUT HYDROGRAPH=  4
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 68.    TIME OF CONCENTRATION=    .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          13.25                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.69 WATERSHED INCHES,      8.34 CFS-HRS,      .69 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 3,4     OUTPUT HYDROGRAPH= 5
```



```
          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          39.55                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.20 WATERSHED INCHES,     24.37 CFS-HRS,     2.01 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  6
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=    .18 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0240 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.03                           1.17                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.55 WATERSHED INCHES,       .66 CFS-HRS,      .05 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          40.71                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.18 WATERSHED INCHES,     25.02 CFS-HRS,     2.07 ACRE-FEET;   BASEFLOW =     .00 CFS
```

```
OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 55.    TIME OF CONCENTRATION=    .15 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0200 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.02                          4.48                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.36 WATERSHED INCHES,      2.43 CFS-HRS,       .20 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 7,1     OUTPUT HYDROGRAPH= 2

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                         45.20                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.08 WATERSHED INCHES,     27.46 CFS-HRS,      2.27 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  3
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=    .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS
```

TR20 XEQ 8/16/** 1214 Boyce Avenue JOB 1 PASS 4
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```
          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.09                         111.35                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.46 WATERSHED INCHES,     81.53 CFS-HRS,      6.74 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.07                         153.38                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.36 WATERSHED INCHES,    108.99 CFS-HRS,      9.01 ACRE-FEET;   BASEFLOW =     .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP                                                              RECORD ID
                            COMPUTATIONS COMPLETED FOR PASS   4



EXECUTIVE CONTROL OPERATION ENDJOB                                                              RECORD ID
```

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 1													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.16	---	12.10	1.08	143.4
XSECTION 2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.05	---	12.30	.01	16.0
XSECTION 3	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.15	---	12.10	1.09	130.7
XSECTION 4	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.30	---	12.07	1.14	324.9
XSECTION 5	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.19	---	12.08	2.20	186.8
XSECTION 6	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.05	---	12.10	.02	43.6
XSECTION 7	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.19	---	12.08	2.22	182.1
XSECTION 8	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.05	---	12.10	.03	17.4
XSECTION 9	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.17	---	12.08	2.25	162.9
XSECTION 10	RUNOFF	.04	2	2	.05	.0	2.70	24.00	.25	---	12.14	7.38	202.3
XSECTION 11	ADDHYD	.05	2	2	.05	.0	2.70	24.00	.23	---	12.12	9.43	187.5
ALTERNATE 1 STORM 2													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	3.27	24.00	.31	---	12.07	2.47	329.0
XSECTION 2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.14	---	12.10	.09	108.4
XSECTION 3	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.30	---	12.07	2.55	307.1
XSECTION 4	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.52	---	12.06	2.00	570.6
XSECTION 5	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.36	---	12.07	4.53	384.3
XSECTION 6	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.18	---	12.05	.07	176.1
XSECTION 7	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.36	---	12.07	4.61	377.6
XSECTION 8	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.14	---	12.05	.21	133.0
XSECTION 9	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.33	---	12.07	4.82	349.4
XSECTION 10	RUNOFF	.04	2	2	.05	.0	3.27	24.00	.44	---	12.12	14.24	390.2
XSECTION 11	ADDHYD	.05	2	2	.05	.0	3.27	24.00	.41	---	12.11	18.64	370.6
ALTERNATE 1 STORM 10													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	5.01	24.00	1.00	---	12.05	8.33	1110.2
XSECTION 2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.64	---	12.05	.55	688.4
XSECTION 3	ADDHYD	.01	2	2	.05	.0	5.01	24.00	.97	---	12.05	8.88	1069.7
XSECTION 4	RUNOFF	.00	2	2	.05	.0	5.01	24.00	1.37	---	12.05	5.22	1490.6
XSECTION 5	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.09	---	12.05	14.09	1194.0
XSECTION 6	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.74	---	12.05	.35	874.7
XSECTION 7	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.08	---	12.05	14.44	1183.5

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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 10													
XSECTION 8	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.64	---	12.04	1.28	802.2
XSECTION 9	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.02	---	12.05	15.71	1138.2
XSECTION 10	RUNOFF	.04	2	2	.05	.0	5.01	24.00	1.23	---	12.11	41.26	1130.4
XSECTION 11	ADDHYD	.05	2	2	.05	.0	5.01	24.00	1.18	---	12.08	55.67	1106.7
ALTERNATE 1 STORM 99													
XSECTION 1	RUNOFF	.01	2	2	.05	.0	8.65	24.00	3.06	---	12.04	24.25	3233.9
XSECTION 2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.35	---	12.05	2.05	2556.5
XSECTION 3	ADDHYD	.01	2	2	.05	.0	8.65	24.00	2.99	---	12.04	26.30	3168.4
XSECTION 4	RUNOFF	.00	2	2	.05	.0	8.65	24.00	3.69	---	12.04	13.25	3786.7
XSECTION 5	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.20	---	12.04	39.55	3351.4
XSECTION 6	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.55	---	12.03	1.17	2926.8
XSECTION 7	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.18	---	12.04	40.71	3337.3
XSECTION 8	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.36	---	12.02	4.48	2797.0
XSECTION 9	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.08	---	12.04	45.20	3275.4
XSECTION 10	RUNOFF	.04	2	2	.05	.0	8.65	24.00	3.46	---	12.09	111.35	3050.6
XSECTION 11	ADDHYD	.05	2	2	.05	.0	8.65	24.00	3.36	---	12.07	153.38	3049.3

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

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
XSECTION 1	.01				
ALTERNATE 1		1.08	2.47	8.33	24.25
XSECTION 2	.00				

ALTERNATE	1		.01	.09	.55	2.05
XSECTION	3	.01				
ALTERNATE	1		1.09	2.55	8.88	26.30
XSECTION	4	.00				
ALTERNATE	1		1.14	2.00	5.22	13.25
XSECTION	5	.01				
ALTERNATE	1		2.20	4.53	14.09	39.55
XSECTION	6	.00				
ALTERNATE	1		.02	.07	.35	1.17
XSECTION	7	.01				
ALTERNATE	1		2.22	4.61	14.44	40.71
XSECTION	8	.00				
ALTERNATE	1		.03	.21	1.28	4.48
XSECTION	9	.01				
ALTERNATE	1		2.25	4.82	15.71	45.20
XSECTION	10	.04				
ALTERNATE	1		7.38	14.24	41.26	111.35
XSECTION	11	.05				
ALTERNATE	1		9.43	18.64	55.67	153.38

END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

```
**********************************************************************
*                                * TR 20 S/N    :                    *
*                                * HMVersion    :  3.40              *
*              TR 20             * Date         :  7/31/**           *
*                                * Time         :  9:38:49           *
*    Project Formulation Hydrology * Input file  : 18068/prcombo.txt  *
*                                * Output file  : 18068/prcombo.out  *
*                                *                                   *
*                                *                                   *
**********************************************************************
```

```
XXXXXXX  XXXXXX    XXXXX    XXXXX
   X     X     X  X     X  X    XX
   X     X     X        X  X   X X
   X     XXXXXX      X     X  X  X
   X     X   X     X       X X   X
   X     X    X   X        XX    X
   X     X     X  XXXXXXX   XXXXX
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                  by                  :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
JOB TR-20                    FULLPRINT          SUMMARY
TITLE     1214 Boyce Avenue
TITLE     PROPOSED CONDITIONS - DP1
 3 STRUCT      01
```

```
8                       350.75      0.00        0.0000
8                       352.00      2.89        0.0085
8                       353.00      5.06        0.0474
8                       354.00      6.62        0.0863
8                       355.00      7.87        0.1863
8                       356.00      8.95        0.2864
8                       357.00      9.91        0.4627
8                       358.00     10.79        0.6391
9 ENDTBL
3 STRUCT        02
8                       351.00      0.00        0.0000
8                       352.00      3.13        0.0049
8                       353.00      7.84        0.0410
8                       354.00     11.29        0.0770
9 ENDTBL
6 RUNOFF 1 001        1 0.0072      64.0        0.20        1         1 DP 1
6 RESVOR 2    01 1    2 350.75                              1         1
6 RUNOFF 1 002        3 0.0033      67.0        0.21        1         1 DP 2
6 RESVOR 2    02 3    4 351.00                              1         1
6 ADDHYD 4 003    2 4 5
6 RUNOFF 1 004        6 0.0005      61.0        0.10        1         1 DP 1 BYP
6 ADDHYD 4 005    5 6 7
6 RUNOFF 1 006        1 0.0003      57.0        0.10        1         1 DP 2 BYP
6 ADDHYD 4 007    7 1 2
6 RUNOFF 1 008        3 0.0022      62.0        0.14        1         1 DP 3
6 ADDHYD 4 009    2 3 4
6 RUNOFF 1 010        5 0.0369      66.0        0.32        1         1 DP 4
6 ADDHYD 4 011    4 5 6
  ENDATA
7 INCREM 6              0.05
7 COMPUT 7 001    011   0.0          2.7        1.0        2 2  01  01
  ENDCMP 1
7 COMPUT 7 001    011   0.0          3.27       1.0        2 2  01  02
  ENDCMP 1
7 COMPUT 7 001    011   0.0          5.01       1.0        2 2  01  10
  ENDCMP 1
7 COMPUT 7 001    011   0.0          8.65       1.0        2 2  01  99
  ENDCMP 1
  ENDJOB 2
```

**********END OF 80-80 LIST**********

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

EXECUTIVE CONTROL OPERATION INCREM RECORD ID
MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 11

```
 STARTING TIME =    .00    RAIN DEPTH =  2.70    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
 ALTERNATE NO.= 1          STORM NO.= 1    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
           OUTPUT HYDROGRAPH=  1
           AREA=     .01 SQ MI   INPUT RUNOFF CURVE= 64.    TIME OF CONCENTRATION=    .20 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0267 HOURS

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
              12.07                          1.49                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .20 WATERSHED INCHES,       .94 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RESVOR   STRUCTURE  1
           INPUT HYDROGRAPH= 1     OUTPUT HYDROGRAPH= 2
           SURFACE ELEVATION=  350.75

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
              12.11                          1.39                        351.35

  RUNOFF VOLUME ABOVE BASEFLOW =    .20 WATERSHED INCHES,       .93 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
           OUTPUT HYDROGRAPH=  3
           AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 67.    TIME OF CONCENTRATION=    .21 HOURS
           INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .06 CFS.

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
              14.95                          .06                         (RUNOFF)
              12.05                          .94                         (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .27 WATERSHED INCHES,       .59 CFS-HRS,      .05 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RESVOR   STRUCTURE  2
           INPUT HYDROGRAPH= 3     OUTPUT HYDROGRAPH= 4
           SURFACE ELEVATION=  351.00

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .06 CFS.
```



```
           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
              14.95                          .06                         (NULL)
              12.05                          .94                         (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .27 WATERSHED INCHES,       .59 CFS-HRS,      .05 ACRE-FEET;   BASEFLOW =     .00 CFS
```

```
OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 2,4     OUTPUT HYDROGRAPH= 5

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.10                          2.31                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .22 WATERSHED INCHES,      1.52 CFS-HRS,      .13 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
          OUTPUT HYDROGRAPH=  6
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 61.    TIME OF CONCENTRATION=   .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .01                        (RUNOFF)
             12.05                          .08                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .14 WATERSHED INCHES,       .05 CFS-HRS,      .00 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.09                          2.36                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .22 WATERSHED INCHES,      1.56 CFS-HRS,      .13 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  1
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=   .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             13.00                          .01                        (RUNOFF)
             12.05                          .02                        (RUNOFF)
```



```
  RUNOFF VOLUME ABOVE BASEFLOW =   .04 WATERSHED INCHES,       .01 CFS-HRS,      .00 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 7,1     OUTPUT HYDROGRAPH= 2

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.09                          2.37                       (NULL)
```

```
  RUNOFF VOLUME ABOVE BASEFLOW =    .22 WATERSHED INCHES,      1.57 CFS-HRS,       .13 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  3
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=    .14 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0187 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .03 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                          .03                        (RUNOFF)
             12.05                          .40                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .16 WATERSHED INCHES,       .23 CFS-HRS,       .02 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.08                         2.70                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .21 WATERSHED INCHES,      1.80 CFS-HRS,       .15 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  5
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=    .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.14                         7.46                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =    .25 WATERSHED INCHES,      5.87 CFS-HRS,       .49 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
          INPUT HYDROGRAPHS= 4,5     OUTPUT HYDROGRAPH= 6
♀◘


TR20 XEQ  7/31/**              1214 Boyce Avenue                                                    JOB  1   PASS   1
     REV 09/01/83              PROPOSED CONDITIONS - DP1                                                     PAGE   5


          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.12                         9.96                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =    .24 WATERSHED INCHES,      7.67 CFS-HRS,       .63 ACRE-FEET;   BASEFLOW =     .00 CFS


EXECUTIVE CONTROL OPERATION ENDCMP                                                                    RECORD ID
                                  COMPUTATIONS COMPLETED FOR PASS   1

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TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 2
REV 09/01/83 PROPOSED CONDITIONS - DP1 PAGE 6

EXECUTIVE CONTROL OPERATION COMPUT RECORD ID
FROM XSECTION 1
TO XSECTION 11
STARTING TIME = .00 RAIN DEPTH = 3.27 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .01 SQ MI INPUT RUNOFF CURVE= 64. TIME OF CONCENTRATION= .20 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0267 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	3.03	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .38 WATERSHED INCHES, 1.75 CFS-HRS, .14 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 2
SURFACE ELEVATION= 350.75

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.10	2.85	351.98

RUNOFF VOLUME ABOVE BASEFLOW = .37 WATERSHED INCHES, 1.74 CFS-HRS, .14 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 3
AREA= .00 SQ MI INPUT RUNOFF CURVE= 67. TIME OF CONCENTRATION= .21 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0280 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	1.74	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .48 WATERSHED INCHES, 1.02 CFS-HRS, .08 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 2
INPUT HYDROGRAPH= 3 OUTPUT HYDROGRAPH= 4
SURFACE ELEVATION= 351.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.06	1.74	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .48 WATERSHED INCHES, 1.02 CFS-HRS, .08 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 3
INPUT HYDROGRAPHS= 2,4 OUTPUT HYDROGRAPH= 5

TR20 XEQ 7/31/** 1214 Boyce Avenue JOB 1 PASS 2
REV 09/01/83 PROPOSED CONDITIONS - DP1 PAGE 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.08	4.53	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .41 WATERSHED INCHES, 2.76 CFS-HRS, .23 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 4
OUTPUT HYDROGRAPH= 6
AREA= .00 SQ MI INPUT RUNOFF CURVE= 61. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.95	.01	(RUNOFF)
12.00	.19	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .29 WATERSHED INCHES, .09 CFS-HRS, .01 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 5
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.08	4.65	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .40 WATERSHED INCHES, 2.85 CFS-HRS, .24 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF CROSS SECTION 6
OUTPUT HYDROGRAPH= 1
AREA= .00 SQ MI INPUT RUNOFF CURVE= 57. TIME OF CONCENTRATION= .10 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .01 CFS.

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
14.50	.01	(RUNOFF)
12.05	.07	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .18 WATERSHED INCHES, .03 CFS-HRS, .00 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD CROSS SECTION 7
INPUT HYDROGRAPHS= 7,1 OUTPUT HYDROGRAPH= 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.08	4.70	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .40 WATERSHED INCHES, 2.89 CFS-HRS, .24 ACRE-FEET; BASEFLOW = .00 CFS

```
OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  3
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=    .14 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0187 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .05 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             14.95                          .05                        (RUNOFF)
             12.05                          .86                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .32 WATERSHED INCHES,       .45 CFS-HRS,      .04 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.07                         5.51                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .38 WATERSHED INCHES,      3.34 CFS-HRS,      .28 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  5
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=    .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.12                        14.40                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .44 WATERSHED INCHES,     10.46 CFS-HRS,      .86 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
          INPUT HYDROGRAPHS= 4,5     OUTPUT HYDROGRAPH= 6

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.11                        19.43                        (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =   .42 WATERSHED INCHES,     13.79 CFS-HRS,     1.14 ACRE-FEET;   BASEFLOW =     .00 CFS


EXECUTIVE CONTROL OPERATION ENDCMP                                                          RECORD ID
                            COMPUTATIONS COMPLETED FOR PASS   2
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TR20 XEQ  7/31/**           1214 Boyce Avenue                                          JOB  1    PASS   3
     REV 09/01/83           PROPOSED CONDITIONS - DP1                                            PAGE   9


EXECUTIVE CONTROL OPERATION COMPUT                                                            RECORD ID
                                   FROM XSECTION   1
                                                   TO XSECTION  11
       STARTING TIME =    .00     RAIN DEPTH =  5.01    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
       ALTERNATE NO.= 1           STORM NO.=10     MAIN TIME INCREMENT =    .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
         OUTPUT HYDROGRAPH=  1
         AREA=    .01 SQ MI   INPUT RUNOFF CURVE= 64.    TIME OF CONCENTRATION=   .20 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0267 HOURS

         PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
           12.05                          9.17                          (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.12 WATERSHED INCHES,      5.21 CFS-HRS,      .43 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RESVOR   STRUCTURE  1
         INPUT HYDROGRAPH= 1     OUTPUT HYDROGRAPH= 2
         SURFACE ELEVATION=  350.75

         PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
           12.15                          5.99                          353.60

  RUNOFF VOLUME ABOVE BASEFLOW =  1.12 WATERSHED INCHES,      5.20 CFS-HRS,      .43 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
         OUTPUT HYDROGRAPH=  3
         AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 67.    TIME OF CONCENTRATION=   .21 HOURS
         INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

         PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
           12.05                          4.71                          (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.31 WATERSHED INCHES,      2.78 CFS-HRS,      .23 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RESVOR   STRUCTURE  2
         INPUT HYDROGRAPH= 3     OUTPUT HYDROGRAPH= 4
         SURFACE ELEVATION=  351.00

         PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
           12.05                          4.71                          (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.31 WATERSHED INCHES,      2.78 CFS-HRS,      .23 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
         INPUT HYDROGRAPHS= 2,4     OUTPUT HYDROGRAPH= 5
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```
          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.08                          10.15                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.18 WATERSHED INCHES,      7.98 CFS-HRS,      .66 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
          OUTPUT HYDROGRAPH=  6
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 61.    TIME OF CONCENTRATION=    .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .02 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .02                        (RUNOFF)
             12.00                          .64                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .95 WATERSHED INCHES,       .31 CFS-HRS,       .03 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.07                          10.62                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.17 WATERSHED INCHES,      8.29 CFS-HRS,      .68 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=    .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .01 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .01                        (RUNOFF)
             12.00                          .30                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =   .74 WATERSHED INCHES,       .14 CFS-HRS,       .01 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 7,1     OUTPUT HYDROGRAPH= 2

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.06                          10.85                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.16 WATERSHED INCHES,      8.43 CFS-HRS,      .70 ACRE-FEET;   BASEFLOW =     .00 CFS
```

```
OPERATION RUNOFF   CROSS SECTION   8
          OUTPUT HYDROGRAPH=  3
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=    .14 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0187 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.02                          2.74                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.01 WATERSHED INCHES,      1.43 CFS-HRS,      .12 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.05                         13.48                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.13 WATERSHED INCHES,      9.86 CFS-HRS,      .81 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  5
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=    .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.11                         41.71                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.23 WATERSHED INCHES,     29.38 CFS-HRS,     2.43 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
          INPUT HYDROGRAPHS= 4,5     OUTPUT HYDROGRAPH= 6

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.09                         54.07                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  1.21 WATERSHED INCHES,     39.25 CFS-HRS,     3.24 ACRE-FEET;   BASEFLOW =     .00 CFS


EXECUTIVE CONTROL OPERATION ENDCMP                                                          RECORD ID
                          COMPUTATIONS COMPLETED FOR PASS   3
```

```
EXECUTIVE CONTROL OPERATION COMPUT                                        RECORD ID
                              FROM XSECTION   1
                                TO XSECTION  11
        STARTING TIME =   .00    RAIN DEPTH =  8.65    RAIN DURATION=  1.00    RAIN TABLE NO.= 2    ANT. MOIST. COND= 2
        ALTERNATE NO.= 1         STORM NO.=99    MAIN TIME INCREMENT =   .05 HOURS


OPERATION RUNOFF   CROSS SECTION   1
          OUTPUT HYDROGRAPH=  1
          AREA=    .01 SQ MI   INPUT RUNOFF CURVE= 64.    TIME OF CONCENTRATION=   .20 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0267 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          25.29                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.27 WATERSHED INCHES,     15.21 CFS-HRS,     1.26 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RESVOR   STRUCTURE  1
          INPUT HYDROGRAPH= 1     OUTPUT HYDROGRAPH= 2
          SURFACE ELEVATION=  350.75

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.22                          9.46                        356.53

  RUNOFF VOLUME ABOVE BASEFLOW =  3.26 WATERSHED INCHES,     15.17 CFS-HRS,     1.25 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RUNOFF   CROSS SECTION   2
          OUTPUT HYDROGRAPH=  3
          AREA=    .00 SQ MI   INPUT RUNOFF CURVE= 67.    TIME OF CONCENTRATION=   .21 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0280 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          12.20                       (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.59 WATERSHED INCHES,      7.64 CFS-HRS,      .63 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION RESVOR   STRUCTURE  2
          INPUT HYDROGRAPH= 3     OUTPUT HYDROGRAPH= 4
          SURFACE ELEVATION=  351.00

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK ELEVATION(FEET)
             12.04                          12.20                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.59 WATERSHED INCHES,      7.64 CFS-HRS,      .63 ACRE-FEET;   BASEFLOW =    .00 CFS


OPERATION ADDHYD   CROSS SECTION   3
          INPUT HYDROGRAPHS= 2,4     OUTPUT HYDROGRAPH= 5
```

```
          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.05                          20.86                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.37 WATERSHED INCHES,     22.81 CFS-HRS,     1.88 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   4
          OUTPUT HYDROGRAPH=  6
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 61.    TIME OF CONCENTRATION=    .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             11.99                          1.84                        (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.97 WATERSHED INCHES,       .96 CFS-HRS,      .08 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   5
          INPUT HYDROGRAPHS= 5,6     OUTPUT HYDROGRAPH= 7

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.04                          22.38                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.35 WATERSHED INCHES,     23.77 CFS-HRS,     1.96 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   6
          OUTPUT HYDROGRAPH=  1
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 57.    TIME OF CONCENTRATION=    .10 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0133 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =          .03 CFS.

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             14.95                          .03                         (RUNOFF)
             12.00                          .97                         (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  2.56 WATERSHED INCHES,       .50 CFS-HRS,      .04 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   7
          INPUT HYDROGRAPHS= 7,1     OUTPUT HYDROGRAPH= 2

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.04                          23.24                       (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.33 WATERSHED INCHES,     24.26 CFS-HRS,     2.01 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION   8
```



```
          OUTPUT HYDROGRAPH=  3
          AREA=     .00 SQ MI   INPUT RUNOFF CURVE= 62.    TIME OF CONCENTRATION=    .14 HOURS
```

```
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0187 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.01                          7.82                      (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.07 WATERSHED INCHES,      4.36 CFS-HRS,      .36 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION   9
          INPUT HYDROGRAPHS= 2,3     OUTPUT HYDROGRAPH= 4

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.03                         31.02                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.29 WATERSHED INCHES,     28.62 CFS-HRS,     2.37 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION RUNOFF   CROSS SECTION  10
          OUTPUT HYDROGRAPH=  5
          AREA=     .04 SQ MI   INPUT RUNOFF CURVE= 66.    TIME OF CONCENTRATION=   .32 HOURS
          INTERNAL HYDROGRAPH TIME INCREMENT=  .0427 HOURS

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.09                        112.57                      (RUNOFF)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.46 WATERSHED INCHES,     82.43 CFS-HRS,     6.81 ACRE-FEET;   BASEFLOW =     .00 CFS


OPERATION ADDHYD   CROSS SECTION  11
          INPUT HYDROGRAPHS= 4,5     OUTPUT HYDROGRAPH= 6

          PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
             12.07                        140.41                      (NULL)

  RUNOFF VOLUME ABOVE BASEFLOW =  3.41 WATERSHED INCHES,    111.05 CFS-HRS,     9.18 ACRE-FEET;   BASEFLOW =     .00 CFS


EXECUTIVE CONTROL OPERATION ENDCMP                                                                    RECORD ID
                            COMPUTATIONS COMPLETED FOR PASS   4



EXECUTIVE CONTROL OPERATION ENDJOB                                                                    RECORD ID
```


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	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM	PRECIPITATION BEGIN	PRECIPITATION AMOUNT	PRECIPITATION DURATION	RUNOFF AMOUNT	PEAK DISCHARGE ELEVATION	PEAK DISCHARGE TIME	PEAK DISCHARGE RATE	PEAK DISCHARGE RATE

			(SQ MI)			(HR)	(HR)	(IN)	(HR)	(IN)	(FT)	(HR)	(CFS)	(CSM)
ALTERNATE	1	STORM	1											
XSECTION	1	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.20	---	12.07	1.49	206.4
STRUCTURE	1	RESVOR	.01	2	2	.05	.0	2.70	24.00	.20	351.35	12.11	1.39	193.3
XSECTION	2	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.27	---	12.05	.94	286.1
STRUCTURE	2	RESVOR	.00	2	2	.05	.0	2.70	24.00	.27	---	12.05	.94	286.1
XSECTION	3	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.22	---	12.10	2.31	220.3
XSECTION	4	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.14	---	12.05	.08	163.1
XSECTION	5	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.22	---	12.09	2.36	214.5
XSECTION	6	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.04	---	12.05	.02	62.5
XSECTION	7	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.22	---	12.09	2.37	209.9
XSECTION	8	RUNOFF	.00	2	2	.05	.0	2.70	24.00	.16	---	12.05	.40	181.5
XSECTION	9	ADDHYD	.01	2	2	.05	.0	2.70	24.00	.21	---	12.08	2.70	200.1
XSECTION	10	RUNOFF	.04	2	2	.05	.0	2.70	24.00	.25	---	12.14	7.46	202.3
XSECTION	11	ADDHYD	.05	2	2	.05	.0	2.70	24.00	.24	---	12.12	9.96	197.6
ALTERNATE	1	STORM	2											
XSECTION	1	RUNOFF	.01	2	2	.05	.0	3.27	24.00	.38	---	12.06	3.03	420.6
STRUCTURE	1	RESVOR	.01	2	2	.05	.0	3.27	24.00	.37	351.98	12.10	2.85	396.5
XSECTION	2	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.48	---	12.06	1.74	527.8
STRUCTURE	2	RESVOR	.00	2	2	.05	.0	3.27	24.00	.48	---	12.06	1.74	527.8
XSECTION	3	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.41	---	12.08	4.53	431.8
XSECTION	4	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.29	---	12.00	.19	380.9
XSECTION	5	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.40	---	12.08	4.65	422.9
XSECTION	6	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.18	---	12.05	.07	217.9
XSECTION	7	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.40	---	12.08	4.70	415.8
XSECTION	8	RUNOFF	.00	2	2	.05	.0	3.27	24.00	.32	---	12.05	.86	391.5
XSECTION	9	ADDHYD	.01	2	2	.05	.0	3.27	24.00	.38	---	12.07	5.51	408.5
XSECTION	10	RUNOFF	.04	2	2	.05	.0	3.27	24.00	.44	---	12.12	14.40	390.2
XSECTION	11	ADDHYD	.05	2	2	.05	.0	3.27	24.00	.42	---	12.11	19.43	385.6
ALTERNATE	1	STORM	10											
XSECTION	1	RUNOFF	.01	2	2	.05	.0	5.01	24.00	1.12	---	12.05	9.17	1273.5
STRUCTURE	1	RESVOR	.01	2	2	.05	.0	5.01	24.00	1.12	353.60	12.15	5.99	831.9
XSECTION	2	RUNOFF	.00	2	2	.05	.0	5.01	24.00	1.31	---	12.05	4.71	1425.9
STRUCTURE	2	RESVOR	.00	2	2	.05	.0	5.01	24.00	1.31	---	12.05	4.71	1425.9

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	STANDARD CONTROL	DRAINAGE	RAIN TABLE	ANTEC MOIST	MAIN TIME	PRECIPITATION	RUNOFF	PEAK DISCHARGE

ID		OPERATION	AREA (SQ MI)	#	COND	INCREM (HR)	BEGIN (HR)	AMOUNT (IN)	DURATION (HR)	AMOUNT (IN)	ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
ALTERNATE	1	STORM	10											
XSECTION	3	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.18	---	12.08	10.15	966.4
XSECTION	4	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.95	---	12.00	.64	1278.4
XSECTION	5	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.17	---	12.07	10.62	965.1
XSECTION	6	RUNOFF	.00	2	2	.05	.0	5.01	24.00	.74	---	12.00	.30	1007.2
XSECTION	7	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.16	---	12.06	10.85	960.2
XSECTION	8	RUNOFF	.00	2	2	.05	.0	5.01	24.00	1.01	---	12.02	2.74	1246.5
XSECTION	9	ADDHYD	.01	2	2	.05	.0	5.01	24.00	1.13	---	12.05	13.48	998.8
XSECTION	10	RUNOFF	.04	2	2	.05	.0	5.01	24.00	1.23	---	12.11	41.71	1130.4
XSECTION	11	ADDHYD	.05	2	2	.05	.0	5.01	24.00	1.21	---	12.09	54.07	1072.8
ALTERNATE	1	STORM	99											
XSECTION	1	RUNOFF	.01	2	2	.05	.0	8.65	24.00	3.27	---	12.04	25.29	3512.9
STRUCTURE	1	RESVOR	.01	2	2	.05	.0	8.65	24.00	3.26	356.53	12.22	9.46	1313.7
XSECTION	2	RUNOFF	.00	2	2	.05	.0	8.65	24.00	3.59	---	12.04	12.20	3696.8
STRUCTURE	2	RESVOR	.00	2	2	.05	.0	8.65	24.00	3.59	---	12.04	12.20	3696.8
XSECTION	3	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.37	---	12.05	20.86	1986.6
XSECTION	4	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.97	---	11.99	1.84	3685.2
XSECTION	5	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.35	---	12.04	22.38	2035.0
XSECTION	6	RUNOFF	.00	2	2	.05	.0	8.65	24.00	2.56	---	12.00	.97	3247.1
XSECTION	7	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.33	---	12.04	23.24	2056.8
XSECTION	8	RUNOFF	.00	2	2	.05	.0	8.65	24.00	3.07	---	12.01	7.82	3554.5
XSECTION	9	ADDHYD	.01	2	2	.05	.0	8.65	24.00	3.29	---	12.03	31.02	2297.6
XSECTION	10	RUNOFF	.04	2	2	.05	.0	8.65	24.00	3.46	---	12.09	112.57	3050.6
XSECTION	11	ADDHYD	.05	2	2	.05	.0	8.65	24.00	3.41	---	12.07	140.41	2786.0

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

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	10	99
STRUCTURE	2	.00				
ALTERNATE	1		.94	1.74	4.71	12.20
STRUCTURE	1	.01				
ALTERNATE	1		1.39	2.85	5.99	9.46
XSECTION	1	.01				

ALTERNATE	1		1.49	3.03	9.17	25.29
XSECTION	2	.00				
ALTERNATE	1		.94	1.74	4.71	12.20
XSECTION	3	.01				
ALTERNATE	1		2.31	4.53	10.15	20.86
XSECTION	4	.00				
ALTERNATE	1		.08	.19	.64	1.84
XSECTION	5	.01				
ALTERNATE	1		2.36	4.65	10.62	22.38
XSECTION	6	.00				
ALTERNATE	1		.02	.07	.30	.97
XSECTION	7	.01				
ALTERNATE	1		2.37	4.70	10.85	23.24
XSECTION	8	.00				
ALTERNATE	1		.40	.86	2.74	7.82
XSECTION	9	.01				
ALTERNATE	1		2.70	5.51	13.48	31.02
XSECTION	10	.04				
ALTERNATE	1		7.46	14.40	41.71	112.57
XSECTION	11	.05				
ALTERNATE	1		9.96	19.43	54.07	140.41

MAIN - UNEXPECTED RECORD FOUND(IGNORED) >>> <<<
♀◘
END OF 1 JOBS IN THIS RUN
Stop - Program terminated.

Richardson Engineering, LLC
30 E. Padonia Road, Suite 500
Timonium, MD 21093

Project: **Jindra Property**
Project No.: **18068**
BMP Type: **Level Spreader / Culverts**
Prepared By: se
Date: July 31, 2018

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

This form is Richardson Engineering's OPINION OF PROBABLE CONSTRUCTION COSTS. Richardson Engineering is not a construction cost estimator or construction contractor, nor should Richardson Engineering's rendering an opinion of probable construct costs be considered equivalent. This is based solely upon Richardson Engineering's experience with construction and requires Richardson Engineering to make a number of assumptions of factors over which Richardson Engineering has no control. Richardson Engineering cannot guarantee the accuracy of this opinion, and in recognition of this, and by using this opinion, the Client waives any claim against Richardson Engineering relative to the accuracy of Richardson Engineering's opinion of probable costs.

GROUP/ITEM	QUANTITY	UNIT	UNIT PRICE	ITEM TOTAL
Level Spreader / Culverts				
Clearing and Grubbing	0.15	A.C.	$3,000	$450.00
Excavation	15	CY	$8.00	$120.00
No. 57 Stone (washed)	0	TON	$24.00	$0.00
Pea Gravel (washed)	0	TON	$40.00	$0.00
Hardwood Mulch	0	CY	$18.00	$0.00
Planting Soil	0	CY	$24.00	$0.00
Mix #2 Concrete (for miscellaneous)	1	CY	$100.00	$100.00
Shrubs	0	EA	$50.00	$0.00
Grasses	0	EA	$6.00	$0.00
Trees	0	EA	$100.00	$0.00
Type 'Y-1' Inlet	1	EA	$2,500.00	$2,500.00
Type 'S' Inlet - Double	1	EA	$3,000.00	$3,000.00
Manhole 48"	0	EA	$2,500	$0.00
Manhole 60"	0	EA	$3,000	$0.00
15" HDPE	151	LF	$25	$3,775.00
15" RCP	68	LF	$30	$2,040.00
21"RCP	31	LF	$40.00	$1,240.00
15" Endsection	2	LS	$750.00	$1,500.00
18" Endsection	0	LS	$800.00	$0.00
21" Endsection	2	LS	$1,000.00	$2,000.00
4" Underdrain	0	LF	$25.00	$0.00
Gabion Outfall	1	EA	$1,500.00	$1,500.00
Level Spreader	1	EA	$1,000.00	$1,000.00
Riprap Outfall Protection	50	SF	$10.00	$500.00
Subtotal				**$19,725.00**
Mobilization (10% of Total)	1	LS		$1,970.00
Construction Stakeout (5% total)	1	LS		$990.00

	Subtotal:	$22,685.00
10%	Contingency:	$2,269.00
	Grand Total:	$24,954.00
	USE	**$25,000**

APPROVED FOR SWM PERMIT SECURITY, 8/21/18

Stormwater Management Data Sheet

Project Name Jindra Property

Nearest Road Boyce Avenue **SWM Permit #** _____

Owner Beatrice Jindra **Phone** 410.591.6552

Address 1214 Boyce Avenue
Towson, Maryland 21204

Engineer Richardson Engineering LLC **Phone** 410.560.1502

Old ADC Grid 26 J 5 **Key Sheet** ONE **Position Sheet** 39-40 NW 5

Watershed Jones Falls **Election District** 9 **Councilmanic District** 2

MD State 83 N (Y) Coordinate 633,240 **MD State 83 E (X) Coordinate** 1,414,690

Facility type *(choose only 1)* ESD

☐ **Public or** ☑ **Private Facility** **MD-378 small pond** ☐ **Yes or** ☑ **No**

Barrel Type _____ **Barrel Diameter** _____ **Projected Completion Date** _____ *(month/yr)*

Drainage Area (Ft^2) 124,425 **Drainage Area** (Ac) 2.86

Impervious Surface treated (Ft^2) 7,580 **Impervious Removed** (Ft^2) _____

Total Site Area (L.O.D.) (Ac) 3.32 **RCN** _____ **ESD Volume Required** *(Pe in inches)* _____

Volume Required (Ac-ft): **ESD_v** _____ **WQ_v** _____ **Re_v** _____ **Cp_v** _____ **100-yr** _____

Volume Required (Cu-ft): **ESD_v** _____ **WQ_v** _____ **Re_v** _____ **Cp_v** _____ **100-yr** _____

Volume Provided (Ac-ft): **ESD_v** _____ **WQ_v** _____ **Re_v** _____ **Cp_v** _____ **100-yr** _____

Volume Provided (Cu-ft): **ESD_v** _____ **WQ_v** _____ **Re_v** _____ **Cp_v** _____ **100-yr** _____

Construction Purpose *(choose only 1)* ☐ **Conversion,** ☑ **New Development,** ☐ **Redevelopment,** ☐ **Restoration**

Number of BMPs on Site *(by type)* _____

Comments Sheet flow to Conservation Area (Level Spreader)

As-Built Information (to be completed at time of As-Built)

Engineer _____ **Phone** _____

As-Built Date _____ *(month/day/yr)* **SWM Permit #** _____

Number of BMPs on Site *(by type)* _____

Impervious Surface treated (Ft^2) _____ **Impervious Removed** (Ft^2) _____

Drainage Area (Ft^2) _____ **Drainage Area** (Ac) _____ **ESD Volume Provided** *(Pe in inches)* _____

Volume Provided (Ac-ft): **ESD_v** _____ **WQ_v** _____ **Re_v** _____ **Cp_v** _____ **100-yr** _____

Volume Provided (Cu-ft): **ESD_v** _____ **WQ_v** _____ **Re_v** _____ **Cp_v** _____ **100-yr** _____

Office Use Only

Facility # _____ **Project I.D.** _____

Reviewer _____ **SCD Plan #** _____

EPS Approval Date ____/____/____ **SCD Approval Date** ____/____/____

Facility data sheet revised 9/1/17