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STORM DRAINAGE STUDY

Target
Wichita, Kansas

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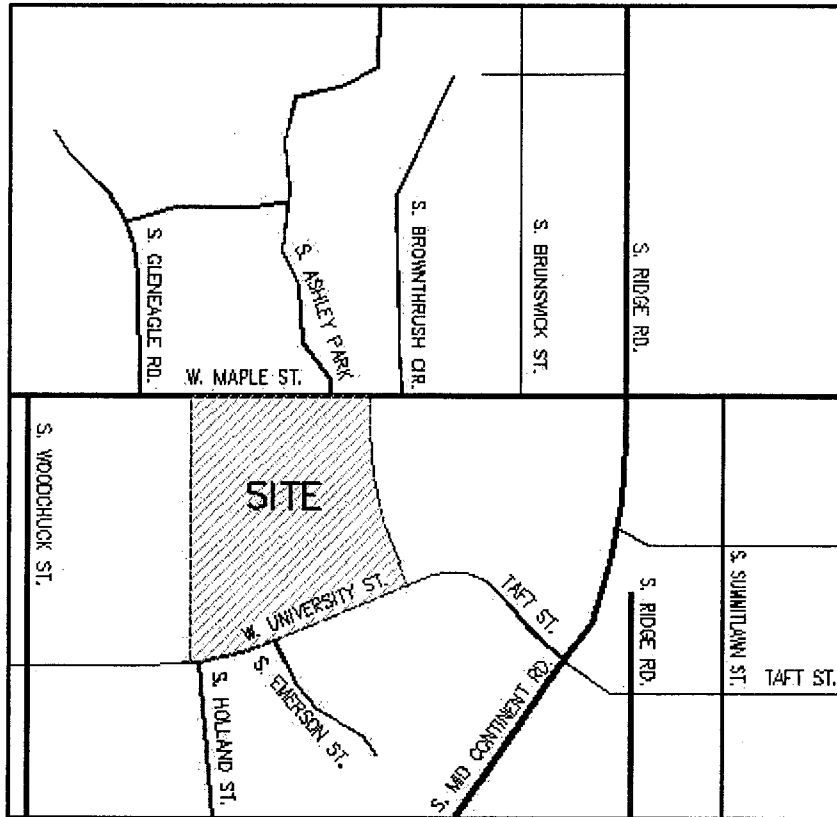


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VICINITY MAP



VICINITY MAP

NOT TO SCALE

GENERAL LOCATION AND DESCRIPTION

The purpose of this report is to outline the anticipated drainage patterns within the proposed Ashley Park Towne Centre retail development and Target store in the city of Wichita, Sedgwick County, Kansas.

LOCATION

The Ashley Park retail development (Project) is located in a portion of the northeast quarter of Section 28, Township 27 South, Range 1 West, City of Wichita, County of Sedgwick, State of Kansas (see Vicinity Map). West Maple Street borders the project area on the north, Benton Elementary on the west, West University Avenue on the south and a drainage channel on the east. The project is just east of Woodchuck Street and west of an existing Lowe's store. The property is currently undeveloped with weeds and grasses.

DESCRIPTION OF PROPERTY

The Project area is roughly 18 acres surrounded by various developments. The existing site is relatively flat with an average slope of 2% to the east. Soils onsite are generally NRCS Type C sandy clays. An existing drainage channel borders the property on the east and will accept the Project's stormwater discharges as outlined in this report.

DRAINAGE BASINS AND SUB-BASINS

BASIN DESCRIPTION

The Flood Insurance Rate Map (FIRM) 2003280020 B dated May 15, 1986, by FEMA, shows the project area to be outside the 100-year and 500-year flood plain. The development is tributary to the Hoover Street Drainage Dugan Tributary. The limits of the detailed FIRM study do not extend north into the drainage channel to the east of the project, but does recognize it as a conveyance element. There are no irrigation facilities within the Project area that will influence or be influenced by the local drainage.

DRAINAGE DESIGN CRITERIA

REGULATIONS

The proposed development conforms to the City of Wichita Storm Sewer Policy for Drainage Criteria and Documentation. No additional provisions or deviations are requested for the proposed development.

DEVELOPMENT DESIGN CRITERIA REFERENCE AND CONSTRAINTS

The FIRM maps listed in Section II-A show the site to be outside any known 100-year and 500-year flood plain. The proposed storm facilities are in compliance with the City of Wichita Storm Sewer Policy for Drainage Criteria and Documentation (the "CRITERIA") and the Urban Storm Drainage Criteria Manual (the "MANUAL"). Developed runoff will be routed to on-site storm inlets, captured and controlled by curb and gutter, conveyed with storm sewer, detained within the project area in a local Detention Pond, and released downstream at historical values.

HYDROLOGIC CRITERIA

The 10-year and 100-year design storm events are used in determining rainfall and runoff for the proposed drainage system. Attachment A of the CRITERIA is the source for rainfall data for the 10-year and 100-year design storm events. Design runoff is calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Sub-basin imperviousness was determined using Attachment D of the CRITERIA for neighborhood commercial developments. Detention storage volumes for the 10-year and 100-year storm events are provided in accordance with the FAA method.

HYDRAULIC CRITERIA

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Pipe capacity was determined using Storm CAD software by Haestad Methods. Inlet capacity was determined per the CRITERIA. Flood plain identification was determined using FIRM maps by FEMA.

VARIANCES FROM CRITERIA

No variances from the CRITERIA are requested.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

Ashley Park consists of a Target store and three one-acre pad sites. The first 100 feet of the pad sites are expected to drain north to Maple Street, while the south 100 feet drains toward the Target parking area. Sub-basins were delineated for each inlet within the parking area and access drive to the south. Sub-basin A consists of the main parking areas draining east into the detention pond. Sub-basin B consists of the building roof, the south truck drive and the parking area east of the building draining east then north into the south portion of the detention pond. Imperviousness and runoff coefficients were based upon the CRITERIA Attachment D. All parking and pad sites were modeled as 70% impervious, consistent with Business, neighborhood areas. The pond area, basin B5, was modeled as urban lawn area, soil group C, slope 1%-4%. Sub-basin OS2 was modeled as 50% imperviousness in type C soil, which corresponds to "Single-Family Soil Group C 1/8 acre." Storm Line A drains sub-basin A while Storm Line B drains sub-basin B. Two off-site sub-basins, OS1 and OS2, drain away from the site into Maple Street and University Street, respectively. Detention will be provided for sub-basins A and B in a proposed pond adjacent to the existing drainage channel on the east limits of the property. Detention releases will be provided for the 10 and 100 year storm events through a 2 stage outlet structure that discharges into the drainage channel

SPECIFIC DETAILS

The Detention Pond will provide 10-year and 100-year detention for all areas within the project with the exception of OS1 and OS2. The total tributary area to the pond is all of sub-basins A and B totaling 16.2 acres. The pond water surface elevations were determined to be 1324.62 for the 100-year volume of 2.15 acre-feet and 1323.44 for the 10-year volume of 1.48 acre-feet. The invert of the pond outlet is 1318.00. The peak release rates for the 10-year and 100-year discharge rates were determined by the tributary acreage multiplied by 0.4cfs/acre and times 0.6 cfs/ac, respectively. The resulting 10-year and 100-year release rates are 6.5 cfs and 9.7 cfs, respectively. The 10-year release is an 8" wide by 24" tall slot in the front of the outlet structure box beginning at the invert of the pond (1318.00). At the 10-year water surface elevation, the outlet structure then acts as a weir with orifice control for the 100-year discharge

limit. The two-stage outlet structure discharges into an 18" pipe with a 14" diameter orifice plate to limit the 100-year discharge to 9.7 cfs at the 100-year water surface elevation. All pond volume and discharge calculations were prepared with Hydraflow Hydrographs by Intelisolve and are included in the Appendix.

Sub-basin A consists of seven contributing inflow points connected by a single storm line A. Each inflow point has been assigned a Design Point number and storm flows were calculated for the 10 and 100-year storm events. Storm Line A will discharge a peak flow into the detention pond of 61.3 cfs for the 100-year event.

Sub-basin B consists of four contributing inflow points connected by a single storm line B. Each inflow point has been assigned a Design Point number and storm flows were calculated for the 10 and 100-year storm events. Storm Line B will discharge a peak flow into the detention pond of 57.4 cfs for the 100-year event. Individual basin runoff calculations can be found in the appendix.

CONCLUSIONS

The drainage design presented within this report conforms to the City of Wichita Storm Drainage Criteria for the proposed development. Developed runoff generated on-site will be collected and conveyed by the proposed improvements to a proposed detention pond that will discharge stormwater in accordance with the Rational Hydrograph method (Hydraflow software).

REFERENCES

Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita, Kansas, July 1, 1987.

Urban Drainage and Flood Control District Drainage Criteria Manual (UDFCDCM), Vol. 1, 2 and 3 prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

Flood Insurance Rate Map, City of Wichita, Sedgwick County, Kansas, Map Number 2003280020 B, May 15, 1986, prepared by the Federal Emergency Management Agency (FEMA).

APPENDICES

Target - Wichita, Kansas

DESIGN POINT	SUB-BASIN DATA		INITIAL / OVERLAND TIME			TRAVEL TIME			T(c) CHECK		FINAL T(c) min.				
	DRAIN BASIN	AREA ac.	C(S)	Length ft.	Slope f/ft	T(i) min	Length ft.	Slope f/ft	Coef.	Velocity fps		T(t) min.			
													COMP. T(c)	TOTAL LENGTH	
1	A1	1.20	0.69	80	0.020	5.3	50	0.008	20.00	1.8	0.5	5.8	130	10.7	5.8
2	A2	1.84	0.69	80	0.020	5.3	180	0.008	20.00	1.8	1.7	7.0	260	11.4	7.0
3	A3	1.61	0.69	80	0.020	5.3	220	0.008	20.00	1.8	2.0	7.3	300	11.7	7.3
4	A4	1.14	0.69	80	0.020	5.3	200	0.008	20.00	1.8	1.9	7.2	280	11.6	7.2
5	A5	1.13	0.69	100	0.020	6.0	150	0.008	20.00	1.8	1.4	7.4	250	11.4	7.4
6	A6	0.84	0.69	120	0.020	6.5	200	0.008	20.00	1.8	1.9	8.4	320	11.8	8.4
7	A7	0.63	0.69	40	0.020	3.8	200	0.008	20.00	1.8	1.9	5.7	240	11.3	5.7
8	B1	1.59	0.69	60	0.020	4.6	120	0.008	20.00	1.8	1.1	5.7	180	11.0	5.7
9	B2	2.73	0.85	80	0.050	2.4	200	0.020	20.00	2.8	1.2	5.0	280	11.6	5.0
10	B3	0.64	0.69	50	0.020	4.2	140	0.008	20.00	1.8	1.3	5.5	190	11.1	5.5
11	B4	1.60	0.69	140	0.020	7.1	120	0.008	20.00	1.8	1.1	8.2	260	11.4	8.2
12	B5	1.23	0.29	40	0.050	5.5	50	0.020	20.00	2.8	0.3	5.8	90	10.5	5.8
13	OS1	1.59	0.69	100	0.020	6.0	700	0.008	20.00	1.8	6.5	12.5	800	14.4	12.5
14	OS2	0.87	0.58	100	0.020	7.6	150	0.008	20.00	1.8	1.4	9.0	250	11.4	9.0

Target - Wichita, Kansas
 Runoff Calculations
 Time of Concentration

Forest & Meadow 2.50
 Fallow or Cultivation 5.00
 Short Grass Pasture & Lawns 7.00
 Nearly Bare Ground 10.00
 Watercourse Coefficient 15.00
 Grassed Waterway 20.00
 Paved Area & Shallow Gutter 20.00

Target - Wichita, Kansas

10/28/2003
1:47 PM
Calculated by: RJP

Target - Wichita, Kansas
Runoff Calculations
(Rational Method Procedure)

Design Storm 5 Year

BASIN INFORMATION			DIRECT RUNOFF				TOTAL RUNOFF				REMARKS	
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A	I in/hr		Q cfs
1	A1	1.20	0.69	5.8	0.83	6.35	5.3					
2	A2	1.84	0.69	7.0	1.27	6.06	7.7					
3	A3	1.61	0.69	7.3	1.11	5.97	6.6					
4	A4	1.14	0.69	7.2	0.79	6.02	4.7					
5	A5	1.13	0.69	7.4	0.78	5.96	4.7					
6	A6	0.84	0.69	8.4	0.58	5.73	3.3					
7	A7	0.63	0.69	5.7	0.44	6.37	2.8	8.4	5.80	5.73	33.2	Discharge into Pond from Storm Line A
8	B1	1.59	0.69	5.7	1.10	6.36	7.0					
9	B2	2.73	0.85	5.0	2.32	6.53	15.1					
10	B3	0.64	0.69	5.5	0.44	6.41	2.8					
11	B4	1.60	0.69	8.2	1.11	5.76	6.4					
12	B5	1.23	0.29	5.8	0.36	6.34	2.3	8.2	5.32	5.76	30.7	Discharge into Pond from Storm Line B
13	OS1	1.59	0.69	12.5	1.10	4.95	5.4					
14	OS2	0.87	0.58	9.0	0.50	5.58	2.8					

Target - Wichita, Kansas

**Target - Wichita, Kansas
Runoff Calculations**
(Rational Method Procedure)

Design Storm 100 Year

BASIN INFORMATION				DIRECT RUNOFF				TOTAL RUNOFF				REMARKS	
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A	I in/hr	Q cfs		
1	A1	1.20	0.80	5.8	0.96	10.05	9.7						
2	A2	1.84	0.80	7.0	1.47	9.62	14.1						
3	A3	1.61	0.80	7.3	1.29	9.48	12.2						
4	A4	1.14	0.80	7.2	0.91	9.55	8.7						
5	A5	1.13	0.80	7.4	0.91	9.47	8.6						
6	A6	0.84	0.80	8.4	0.67	9.12	6.1						
7	A7	0.63	0.80	5.7	0.51	10.08	5.1	8.4	6.72	9.12	61.3	Discharge into Pond from Storm Line A	
8	B1	1.59	0.80	5.7	1.28	10.06	12.8						
9	B2	2.73	0.93	5.0	2.54	10.32	26.2						
10	B3	0.64	0.80	5.5	0.51	10.14	5.2						
11	B4	1.60	0.80	8.2	1.28	9.17	11.8						
12	B5	1.23	0.53	5.8	0.65	10.04	6.5	8.2	6.26	9.17	57.4	Discharge into Pond from Storm Line B	
13	OS1	1.59	0.80	12.5	1.28	7.95	10.1						
14	OS2	0.87	0.73	9.0	0.63	8.90	5.6						

Target - Wichita, Kansas

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**Target - Wichita, Kansas
Runoff Calculations**
(Rational Method Procedure)

Design Storm 10 Year

DESIGN POINT	BASIN INFORMATION			DIRECT RUNOFF			TOTAL RUNOFF			REMARKS		
	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A		I in/hr	Q cfs
1	A1	1.20	0.73	5.8	0.88	7.21	6.3					
2	A2	1.84	0.73	7.0	1.34	6.89	9.2					
3	A3	1.61	0.73	7.3	1.18	6.79	8.0					
4	A4	1.14	0.73	7.2	0.83	6.84	5.7					
5	A5	1.13	0.73	7.4	0.83	6.78	5.6					
6	A6	0.84	0.73	8.4	0.61	6.52	4.0					
7	A7	0.63	0.73	5.7	0.46	7.23	3.4	8.4	6.13	6.52	40.0	Discharge into Pond from Storm Line A
8	B1	1.59	0.73	5.7	1.16	7.22	8.4					
9	B2	2.73	0.90	5.0	2.45	7.41	18.2					
10	B3	0.64	0.73	5.5	0.47	7.28	3.4					
11	B4	1.60	0.73	8.2	1.17	6.56	7.7					
12	B5	1.23	0.37	5.8	0.46	7.20	3.3	8.2	5.71	6.56	37.5	Discharge into Pond from Storm Line B
13	OS1	1.59	0.73	12.5	1.16	5.65	6.6					
14	OS2	0.87	0.64	9.0	0.55	6.35	3.5					

RUNOFF SUMMARY TABLE

DESIGN POINT	BASIN DESIGNATION	CONTRIBUTING AREA (ACRES)	COEFFICIENT (2 YEAR)	COEFFICIENT (5 YEAR)	COEFFICIENT (10 YEAR)	COEFFICIENT (100 YEAR)	TIME OF CONCENTRATION	RUNOFF (2 YEAR)	RUNOFF (5 YEAR)	RUNOFF (10 YEAR)	RUNOFF (100 YEAR)
1	A1	1.20	0.68	0.69	0.73	0.80	5.8	4.43	5.28	6.34	9.68
2	A2	1.84	0.68	0.69	0.73	0.80	7.0	6.44	7.68	9.24	14.13
3	A3	1.61	0.68	0.69	0.73	0.80	7.3	5.57	6.65	7.99	12.24
4	A4	1.14	0.68	0.69	0.73	0.80	7.2	3.97	4.74	5.70	8.72
5	A5	1.13	0.68	0.69	0.73	0.80	7.4	3.90	4.66	5.60	8.58
6	A6	0.84	0.68	0.69	0.73	0.80	8.4	2.77	3.32	3.99	6.12
7	A7	0.63	0.68	0.69	0.73	0.80	5.7	2.34	2.79	3.35	5.12
8	B1	1.59	0.68	0.69	0.73	0.80	5.7	5.88	7.00	8.40	12.84
9	B2	2.73	0.80	0.85	0.90	0.93	5.0	12.15	15.14	18.19	26.18
10	B3	0.64	0.68	0.69	0.73	0.80	5.5	2.38	2.83	3.40	5.19
11	B4	1.60	0.68	0.69	0.73	0.80	8.2	5.33	6.37	7.67	11.76
12	B5	1.23	0.26	0.29	0.37	0.53	5.8	1.73	2.26	3.28	6.54
13	OS1	1.59	0.68	0.69	0.73	0.80	12.5	4.52	5.44	6.58	10.14
14	OS2	0.87	0.55	0.58	0.64	0.73	9.0	2.25	2.80	3.52	5.62

Target - Wichita, Kansas

Attachment A, Drainage Criteria Manual, City of Wichita, Kansas

TIME	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
5	5.57	6.53	7.41	8.52	9.48	10.32
10	4.52	5.34	6.09	7.04	7.86	8.54
15	3.83	4.56	5.22	6.06	6.78	7.37
20	3.33	4.00	4.60	5.35	6.00	6.53
25	2.96	3.57	4.13	4.81	5.41	5.90
30	2.67	3.24	3.76	4.39	4.94	5.40
40	2.24	2.76	3.22	3.76	4.25	4.66
50	1.95	2.41	2.83	3.32	3.75	4.13
60	1.69	2.15	2.53	2.98	3.37	3.73

ATTACHMENT A
DRAINAGE CRITERIA MANUAL

CITY OF WICHITA, KANSAS

RAINFALL INTENSITY TABLE FOR SEDGWICK COUNTY, KANSAS

The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40 Modified to NWS Hydro-35, 1977 During First Hour

<u>DURATION IN MINUTES</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
11	3.27	4.36	5.16	5.89	6.81	7.61	8.27
12	3.18	4.21	4.99	5.71	6.60	7.38	8.02
13	3.05	4.08	4.84	5.53	6.41	7.17	7.79
14	2.96	3.95	4.69	5.37	6.23	6.97	7.57
15	2.87	3.83	4.56	5.22	6.06	6.78	7.37
16	2.78	3.72	4.43	5.08	5.90	6.60	7.18
17	2.71	3.61	4.31	4.95	5.75	6.44	7.00
18	2.63	3.51	4.20	4.83	5.61	6.29	6.84
19	2.56	3.42	4.10	4.71	5.47	6.14	6.68
20	2.50	3.33	4.00	4.60	5.35	6.00	6.53
21	2.44	3.25	3.90	4.50	5.23	5.87	6.39
22	2.38	3.17	3.81	4.40	5.12	5.75	6.26
23	2.32	3.10	3.73	4.31	5.01	5.63	6.13
24	2.27	3.03	3.65	4.22	4.91	5.52	6.01
25	2.22	2.96	3.57	4.13	4.81	5.41	5.90
26	2.20	2.90	3.50	4.05	4.72	5.31	5.79
27	2.16	2.84	3.43	3.98	4.63	5.21	5.69
28	2.14	2.78	3.37	3.90	4.55	5.12	5.59
29	2.11	2.72	3.30	3.83	4.47	5.03	5.49
30	2.08	2.67	3.24	3.76	4.39	4.94	5.40
31	2.05	2.62	3.19	3.70	4.32	4.86	5.32
32	2.02	2.57	3.10	3.63	4.25	4.79	5.22
33	1.99	2.52	3.05	3.57	4.18	4.71	5.14
34	1.96	2.48	3.01	3.51	4.11	4.63	5.07
35	1.93	2.44	2.98	3.46	4.05	4.56	5.00
36	1.91	2.39	2.93	3.41	3.99	4.50	4.93
37	1.89	2.35	2.88	3.36	3.93	4.43	4.86
38	1.87	2.32	2.84	3.31	3.87	4.37	4.79
39	1.85	2.28	2.80	3.26	3.82	4.31	4.73
40	1.83	2.24	2.76	3.22	3.76	4.25	4.66
41	1.81	2.21	2.72	3.17	3.71	4.19	4.60
42	1.79	2.18	2.68	3.13	3.66	4.13	4.54
43	1.77	2.14	2.64	3.09	3.61	4.08	4.49
44	1.75	2.11	2.61	3.05	3.57	4.03	4.43
45	1.73	2.08	2.57	3.01	3.52	3.98	4.38

ATTACHMENT A CONTINUED
Page 2

DURATION IN MINUTES	RETURN PERIODS OF						
	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
46	1.70	2.05	2.54	2.97	3.48	3.93	4.33
47	1.67	2.02	2.50	2.93	3.44	3.88	4.28
48	1.66	2.00	2.47	2.90	3.39	3.84	4.23
49	1.64	1.97	2.44	2.86	3.35	3.79	4.18
50	1.61	1.95	2.41	2.83	3.32	3.75	4.13
51	1.59	1.92	2.38	2.79	3.28	3.71	4.09
52	1.56	1.89	2.35	2.76	3.24	3.67	4.05
53	1.54	1.86	2.33	2.73	3.20	3.63	4.00
54	1.52	1.84	2.30	2.70	3.17	3.59	3.96
55	1.50	1.81	2.27	2.67	3.14	3.55	3.92
56	1.47	1.79	2.25	2.64	3.10	3.51	3.88
57	1.45	1.76	2.22	2.61	3.07	3.48	3.84
58	1.43	1.74	2.20	2.59	3.04	3.44	3.81
59	1.42	1.72	2.18	2.56	3.01	3.41	3.77
60	1.40	1.69	2.15	2.53	2.98	3.37	3.73
61	1.38	1.67	2.13	2.51	2.95	3.34	3.70
62	1.36	1.65	2.11	2.48	2.92	3.31	3.67
63	1.34	1.63	2.09	2.46	2.89	3.28	3.63
64	1.33	1.61	2.07	2.44	2.86	3.25	3.60
65	1.31	1.59	2.05	2.41	2.84	3.22	3.57
66	1.30	1.57	2.03	2.39	2.81	3.19	3.54
67	1.28	1.56	2.01	2.37	2.79	3.16	3.51
68	1.26	1.54	1.99	2.35	2.76	3.13	3.48
69	1.25	1.52	1.97	2.33	2.74	3.10	3.45
70	1.24	1.50	1.95	2.31	2.71	3.08	3.42
71	1.22	1.49	1.93	2.28	2.69	3.05	3.39
72	1.21	1.47	1.92	2.26	2.67	3.02	3.36
73	1.20	1.46	1.90	2.25	2.64	3.00	3.34
74	1.18	1.44	1.88	2.23	2.63	2.98	3.31
75	1.17	1.43	1.86	2.21	2.61	2.95	3.29
76	1.16	1.41	1.85	2.19	2.58	2.93	3.26
77	1.15	1.40	1.83	2.17	2.55	2.90	3.24
78	1.13	1.38	1.82	2.15	2.53	2.88	3.22
79	1.12	1.37	1.80	2.14	2.50	2.86	3.19
80	1.11	1.36	1.79	2.12	2.48	2.84	3.16
81	1.10	1.34	1.77	2.10	2.46	2.82	3.13
82	1.09	1.33	1.76	2.08	2.43	2.79	3.10
83	1.08	1.32	1.74	2.06	2.41	2.76	3.07
84	1.07	1.31	1.73	2.04	2.39	2.74	3.04
85	1.06	1.30	1.72	2.02	2.37	2.71	3.01
86	1.05	1.28	1.70	2.00	2.34	2.69	2.99
87	1.04	1.27	1.69	1.99	2.32	2.66	2.96
88	1.03	1.26	1.68	1.97	2.30	2.64	2.93
89	1.02	1.25	1.68	1.95	2.28	2.62	2.91
90	1.01	1.24	1.66	1.93	2.26	2.59	2.88

ATTACHMENT D

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

RECOMMENDED RUNOFF COEFFICIENTS FOR RATIONAL METHOD
AND PERCENT IMPERVIOUS FOR UNIT HYDROGRAPH METHOD

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
1. Business:					
Downtown Areas	95	0.84	0.85	0.87	0.91
Neighborhood Areas	70	0.68	0.69	0.73	0.80
2. Residential:					
<u>Single Family (Soil Group D)</u>					
1/8 Acre	50	0.57	0.61	0.66	0.79
1/4 Acre	38	0.50	0.54	0.62	0.76
1/3 Acre	30	0.46	0.50	0.59	0.73
1/2 Acre	25	0.42	0.48	0.56	0.72
3/4 Acre	22	0.42	0.46	0.55	0.71
1 Acre	20	0.41	0.45	0.54	0.71
<u>Multi-Family (Soil Group D)</u>					
Multi-Unit (detached)	60	0.62	0.66	0.72	0.82
Multi-Unit (attached)	65	0.64	0.68	0.73	0.83
Apartments	75	0.70	0.73	0.79	0.86
<u>Single Family (Soil Group C)</u>					
1/8 Acre	50	0.55	0.58	0.64	0.73
1/4 Acre	38	0.48	0.51	0.57	0.68
1/3 Acre	30	0.43	0.46	0.53	0.65
1/2 Acre	25	0.40	0.43	0.50	0.63
3/4 Acre	22	0.39	0.42	0.49	0.62
1 Acre	20	0.37	0.40	0.48	0.61
<u>Multi-Family (Soil Group C)</u>					
Multi-Unit (detached)	60	0.60	0.63	0.69	0.77
Multi-Unit (attached)	65	0.63	0.66	0.71	0.79
Apartments	75	0.68	0.72	0.77	0.83
<u>Single-Family (Soil Group B)</u>					
1/8 Acre	50	0.52	0.54	0.59	0.67
1/4 Acre	38	0.44	0.46	0.52	0.61
1/3 Acre	30	0.39	0.41	0.47	0.57
1/2 Acre	25	0.36	0.38	0.44	0.54
3/4 Acre	22	0.34	0.36	0.42	0.52
1 Acre	20	0.33	0.35	0.40	0.51
<u>Multi-Family (Soil Group B)</u>					
Multi-Unit (detached)	60	0.58	0.60	0.65	0.72
Multi-Unit (attached)	65	0.61	0.64	0.68	0.75
Apartments	75	0.67	0.70	0.74	0.80

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
<u>Single Family (Soil Group A)</u>					
1/8 Acre	50	0.47	0.50	0.54	0.60
1/4 Acre	38	0.39	0.41	0.45	0.52
1/3 Acre	30	0.33	0.35	0.39	0.47
1/2 Acre	25	0.30	0.31	0.35	0.44
3/4 Acre	22	0.28	0.29	0.33	0.42
1 Acre	20	0.26	0.28	0.32	0.40
<u>Multi-Family (Soil Group A)</u>					
Multi-Unit (detached)	60	0.55	0.57	0.61	0.67
Multi-Unit (attached)	65	0.58	0.60	0.64	0.70
Apartments	75	0.65	0.68	0.72	0.77
3. Industrial:					
Light Areas	70	0.68	0.69	0.73	0.80
Heavy Areas	80	0.74	0.76	0.79	0.84
4. Playgrounds:					
	15	0.33	0.35	0.42	0.55
5. Schools:					
	40	0.49	0.51	0.56	0.66
6. Railroad Yard Areas:					
	30	0.43	0.45	0.50	0.62
Undeveloped Urban Areas:					
Offsite Flow Analysis (when land use not defined)	45	0.52	0.54	0.59	0.68
8. Streets:					
Paved	99	0.87	0.88	0.90	0.93
Gravel	00	0.24	0.26	0.33	0.48
9. Drive, Parking Lots and Walks:					
	96	0.87	0.87	0.88	0.89
10. Roofs:					
	90	0.80	0.85	0.90	0.93
11. Urban Lawn Areas (See Note No. 1 below):					
<u>Soil Group A</u>					
Slope less than 1%	00	0.08	0.09	0.13	0.23
Slope 1% to 4%	00	0.12	0.13	0.17	0.27
Slope more than 4%	00	0.16	0.17	0.21	0.31
<u>Soil Group B</u>					
Slope less than 1%	00	0.16	0.18	0.24	0.37
Slope 1% to 4%	00	0.20	0.22	0.28	0.41
Slope more than 4%	00	0.24	0.26	0.32	0.45
<u>Soil Group C</u>					
Slope less than 1%	00	0.24	0.27	0.35	0.51
Slope 1% to 4%	00	0.26	0.29	0.37	0.53
Slope more than 4%	00	0.28	0.31	0.39	0.55

<u>Land Use or Surface Characteristics</u>	<u>Percent Impervious</u>	<u>Frequency</u>			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
<u>Soil Group D</u>					
Slope less than 1%	00	0.28	0.33	0.43	0.63
Slope 1% to 4%	00	0.30	0.35	0.45	0.65
Slope more than 4%	00	0.32	0.37	0.47	0.67

Note No. 1: Coefficients shown in the above table are for pervious open space areas with thick turf which includes pervious areas in parks and cemeteries. Coefficients shown above must be increased 0.02 for use with agricultural pasture areas. Coefficients shown above must be reduced by 0.04 for use with agricultural cultivated areas. Group A soils are well-drained, coarse textured sands with high infiltration rates. Group B soils are moderately well-drained, moderately coarse textured soils with moderate infiltration rates. Group C soils are moderately poor-drained, moderately fine textured soils with slow infiltration rates. Group D soils are poor-drained, fine textured soils with very slow infiltration rates.

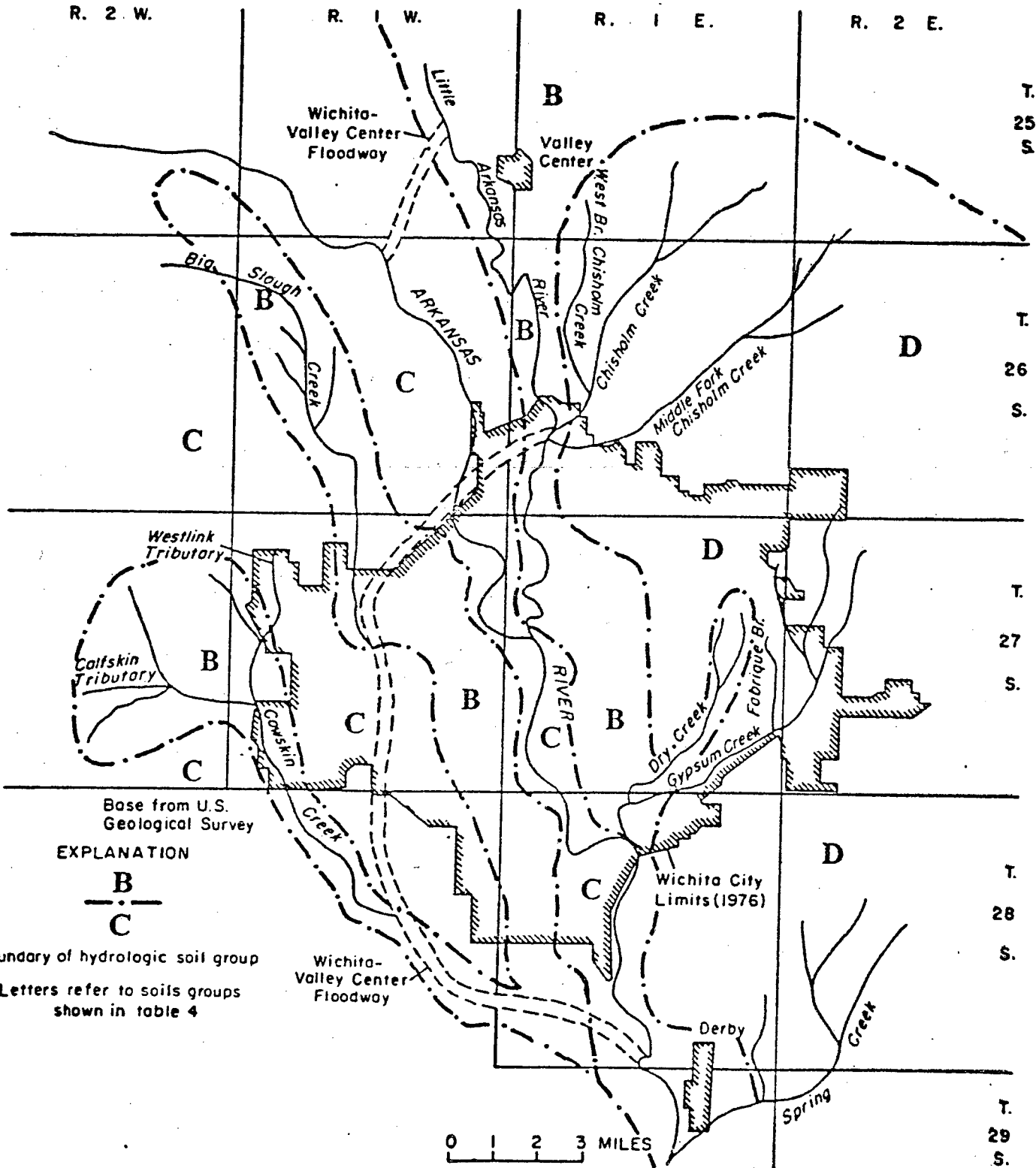
GENERAL NOTE: These Rational Formula Coefficients may not be valid for basins 320 acres or larger.

EXHIBIT NO. 1

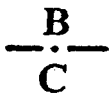
SOIL LEGEND

<u>SYMBOL</u>	<u>HYDROLOGIC GROUP</u>	<u>NAME</u>
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loams, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loam, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loam
Cb	B	Canadian-Waldeck fine sandy loams
Cc	D	Carwile fine sandy loam
Cd	B	Clark-Ost clay loams, 1 to 4 percent slopes
Ce	C	Clime silty clay, 3 to 6 percent slopes
Ea	B	Elandco silt loam
Eb	B	Elandco silt loam, occasionally flooded
Ec	B	Elandco silt loam, frequently flooded
Fa	B	Farnum loam, 0 to 1 percent slopes
Fb	B	Farnum loam, 1 to 3 percent slopes
Fc	B	Farnum loam, sandy substratum, 0 to 1 percent slopes
Ga	D	Goessel silty clay, 0 to 1 percent slopes
Gb	D	Goessel silty clay, 1 to 2 percent slopes
Ia	D	Irwin silty clay loam, 1 to 3 percent slopes
Ib	D	Irwin silty clay loam, 3 to 6 percent slopes
Ic	D	Irwin silty clay loam, 2 to 6 percent slopes, eroded
La	C	Lesho loam
Lb	A	Lincoln soils
Ma	B	Milan loam, 1 to 3 percent slopes
Mb	B	Milan form, 3 to 6 percent slopes
Mc	B	Milan clay loam, 2 to 6 percent slopes, eroded
Na	B	Naron fine sandy loam
Oc	D	Owens clay loam, 1 to 3 percent slopes
Od	D	Owens-Rock outcrop complex, 3 to 10 percent slopes
Pa		Pits
Pb	D	Plevna fine sandy loam
Pc	A	Pratt loamy fine sand, undulating
Pd	A	Pratt-Tivoli complex, rolling
Ra	D	Renfrow silty clay loam, 1 to 3 percent slopes
Rb	D	Renfrow silty clay loam, 3 to 6 percent slopes
Rc	D	Renfrow-Owens clay loams, 1 to 4 percent slopes
Rd	D	Rosehill silty clay, 1 to 3 percent slopes
Sa	B	Shellabarger sandy loam, 1 to 3 percent slopes
Sb	B	Shellabarger sandy loam, 3 to 6 percent slopes
Sc	B	Shellabarger sandy loam, 3 to 6 percent slopes, eroded
Ta	D	Tabler silty clay loam
Tb	D	Tabler-Drummond complex
Ua	B	Urban land-Canadian complex
Ub	B	Urban land-Elandco complex
Uc	B	Urban land-Farnum complex, 0 to 3 percent slopes
Ud	D	Urban land-Irwin complex, 1 to 3 percent slopes
Ue	D	Urban land-Tabler complex
Va	B	Vanoss silt loam, 0 to 1 percent slopes
Vb	B	Vanoss silt loam, 1 to 3 percent slopes
Vc	B	Vanoss silt loam, 3 to 6 percent slopes
Vd	B	Vanoss silt loam, 3 to 6 percent slopes, eroded
Ve	D	Vernon sandy loam, 1 to 3 percent slopes
Vf	D	Vernon sandy loam, 3 to 6 percent slopes
Wa	C	Waldeck sandy loam
Wb	D	Waurika silt loam

EXHIBIT NO. 2



EXPLANATION

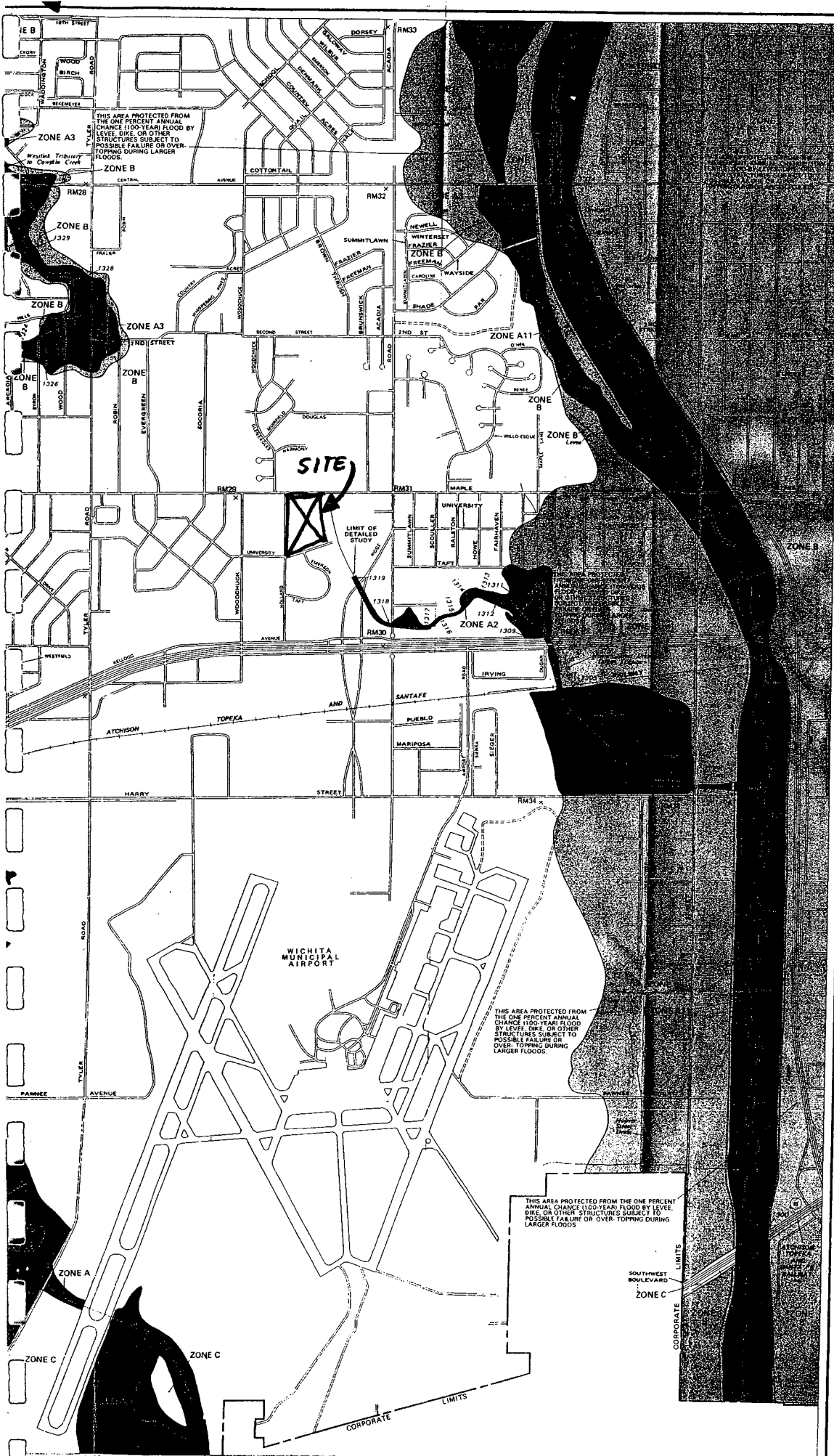


Boundary of hydrologic soil group

Letters refer to soils groups shown in table 4

Wichita-Valley Center Floodway

0 1 2 3 MILES



KEY TO MAP

- 500-Year Flood Boundary
- 100-Year Flood Boundary
- Zone Designations
- 100-Year Flood Boundary
- 500-Year Flood Boundary
- Base Flood Elevation Line With Elevation In Feet**
- Base Flood Elevation In Feet Where Uniform Within Zone**
- Elevation Reference Mark
- Zone D Boundary
- Road Mile

***EXPLANATION OF ZONE DESIGNATIONS**

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
A1	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A4	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
A4-30	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all topographic features outside special flood hazard areas.

For adjoining map panels, see separately printed Map Index.

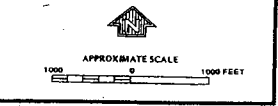
INITIAL IDENTIFICATION:
DECEMBER 27, 1976

FLOOD HAZARD BOUNDARY MAP REVISIONS:
APRIL 1, 1977

FLOOD INSURANCE RATE MAP EFFECTIVE:
MAY 15, 1988

FLOOD INSURANCE RATE MAP REVISIONS:

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.



NATIONAL FLOOD INSURANCE PROGRAM

FIRM FLOOD INSURANCE RATE MAP

CITY OF WICHITA, KANSAS
SEDGWICK COUNTY

PANEL 20 OF 40
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
200328 0020 B

EFFECTIVE DATE:
MAY 15, 1988

Federal Emergency Management Agency

THIS AREA SHOWN AS INSET ON PANEL 200328 0020

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
2	Rational	-----	-----	33.86	-----	39.67	45.14	-----	-----	63.02	Sub-Basins A1-A7
3	Rational	-----	-----	13.29	-----	15.63	17.86	-----	-----	25.07	Sub-Basins B1, B3-B4
4	Rational	-----	-----	12.92	-----	15.14	17.18	-----	-----	23.93	Sub-basin B2
5	Rational	-----	-----	1.90	-----	2.22	2.53	-----	-----	3.53	Sub-Basin B5
6	Combine	2, 3, 4, 5	-----	55.31	-----	64.83	73.78	-----	-----	103.04	Pond Inflows
7	Reservoir	6	-----	4.45	-----	5.83	6.89	-----	-----	9.50	Pond

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
2	Rational	45.14	1	7	37,917	---	----	----	Sub-Basins A1-A7
3	Rational	17.86	1	11	23,578	---	----	----	Sub-Basins B1, B3-B4
4	Rational	17.18	1	5	10,307	---	----	----	Sub-basin B2
5	Rational	2.53	1	6	1,820	---	----	----	Sub-Basin B5
6	Combine	73.78	1	7	73,623	2, 3, 4, 5	----	----	Pond Inflows
7	Reservoir	6.89	1	31	<u>64,602</u> <i>V₁₀</i>	6	23.27	64,330	Pond

Hydrograph Report

Hyd. No. 2

Sub-Basins A1-A7

Hydrograph type	= Rational	Peak discharge	= 45.14 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 8.4 ac	Runoff coeff.	= 0.79
Intensity	= 6.802 in/hr	Time of conc. (Tc)	= 7 min
IDF Curve	= Wichita-Hydroflow.idf	Asc/Rec limb fact	= 1/3

Hydrograph Volume = 37,917 cuft

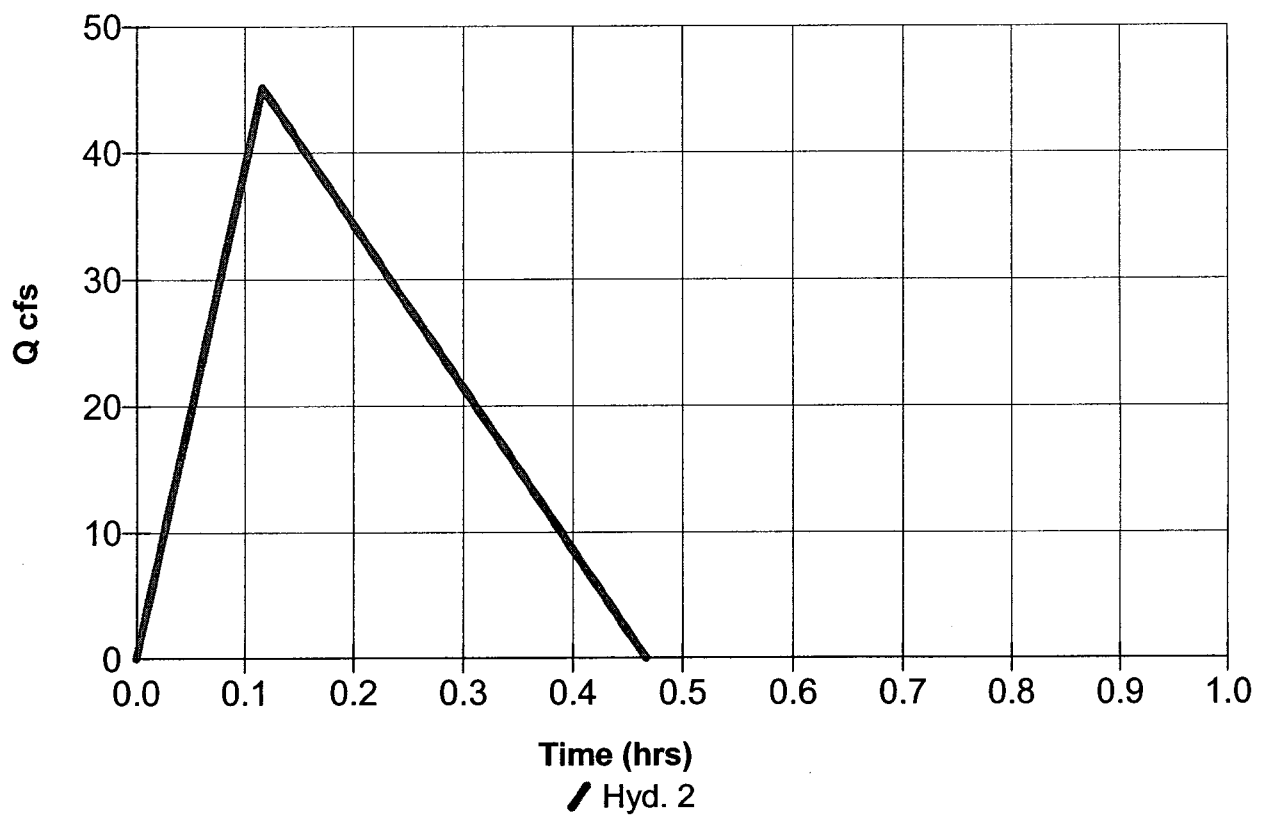
Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

0.02	6.45
0.03	12.90
0.05	19.35
0.07	25.79
0.08	32.24
0.10	38.69
0.12	45.14 <<
0.13	42.99
0.15	40.84
0.17	38.69
0.18	36.54
0.20	34.39
0.22	32.24
0.23	30.09
0.25	27.94
0.27	25.79
0.28	23.64
0.30	21.50
0.32	19.35
0.33	17.20
0.35	15.05
0.37	12.90
0.38	10.75
0.40	8.60
0.42	6.45
0.43	4.30
0.45	2.15

...End

Hyd. No. 2 - Rational - 10 Yr - Qp = 45.14 cfs - Sub-Basins A1-A7



Hydrograph Report

Hyd. No. 3

Sub-Basins B1, B3-B4

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 3.8 ac
Intensity = 5.888 in/hr
IDF Curve = Wichita-Hydroflow.idf

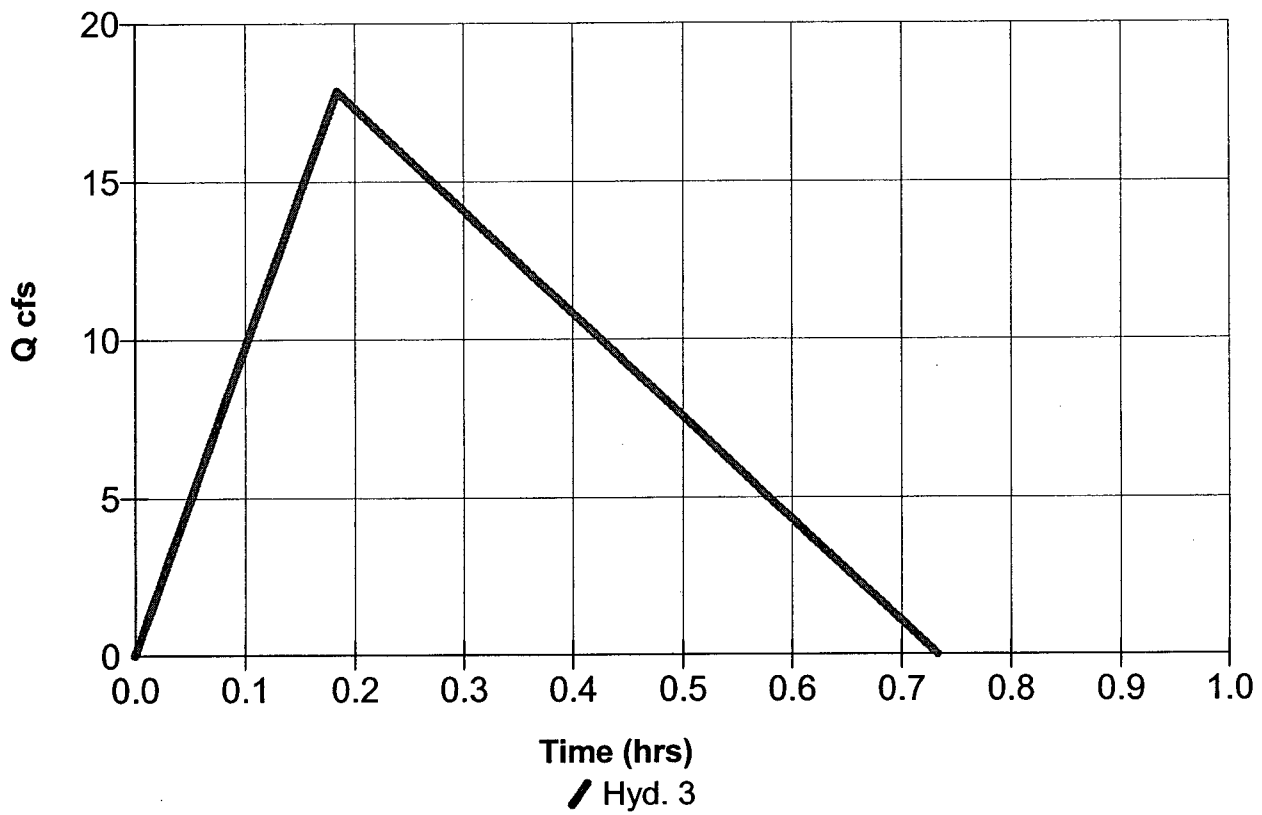
Peak discharge = 17.86 cfs
Time interval = 1 min
Runoff coeff. = 0.79
Time of conc. (Tc) = 11 min
Asc/Rec limb fact = 1/3

Hydrograph Volume = 23,578 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.02 1.62	0.58 4.87
0.03 3.25	0.60 4.33
0.05 4.87	0.62 3.79
0.07 6.50	0.63 3.25
0.08 8.12	0.65 2.71
0.10 9.74	0.67 2.17
0.12 11.37	0.68 1.62
0.13 12.99	0.70 1.08
0.15 14.61	0.72 0.54
0.17 16.24	
0.18 17.86 <<	
0.20 17.32	...End
0.22 16.78	
0.23 16.24	
0.25 15.70	
0.27 15.16	
0.28 14.61	
0.30 14.07	
0.32 13.53	
0.33 12.99	
0.35 12.45	
0.37 11.91	
0.38 11.37	
0.40 10.83	
0.42 10.28	
0.43 9.74	
0.45 9.20	
0.47 8.66	
0.48 8.12	
0.50 7.58	
0.52 7.04	
0.53 6.50	
0.55 5.95	
0.57 5.41	

Hyd. No. 3 - Rational - 10 Yr - Qp = 17.86 cfs - Sub-Basins B1, B3-B4



Hydrograph Report

Hyd. No. 4

Sub-basin B2

Hydrograph type	= Rational	Peak discharge	= 17.18 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.85
Intensity	= 7.403 in/hr	Time of conc. (Tc)	= 5 min
IDF Curve	= Wichita-Hydroflow.idf	Asc/Rec limb fact	= 1/3

Hydrograph Volume = 10,307 cuft

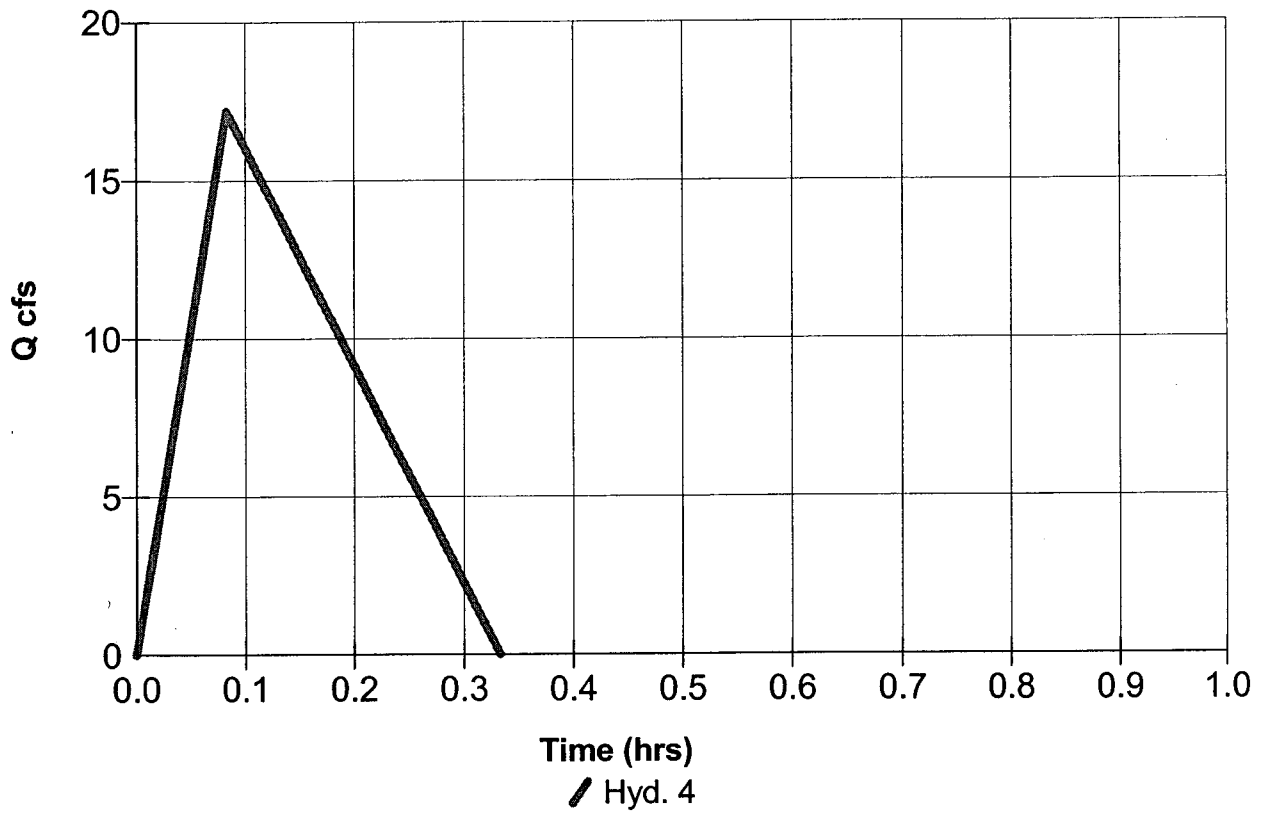
Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

0.02	3.44
0.03	6.87
0.05	10.31
0.07	13.74
0.08	17.18 <<
0.10	16.03
0.12	14.89
0.13	13.74
0.15	12.60
0.17	11.45
0.18	10.31
0.20	9.16
0.22	8.02
0.23	6.87
0.25	5.73
0.27	4.58
0.28	3.44
0.30	2.29
0.32	1.15

...End

Hyd. No. 4 - Rational - 10 Yr - Qp = 17.18 cfs - Sub-basin B2



Hydrograph Report

Hyd. No. 5

Sub-Basin B5

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 1.2 ac
Intensity = 7.088 in/hr
IDF Curve = Wichita-Hydroflow.idf

Peak discharge = 2.53 cfs
Time interval = 1 min
Runoff coeff. = 0.29
Time of conc. (Tc) = 6 min
Asc/Rec limb fact = 1/3

Hydrograph Volume = 1,820 cuft

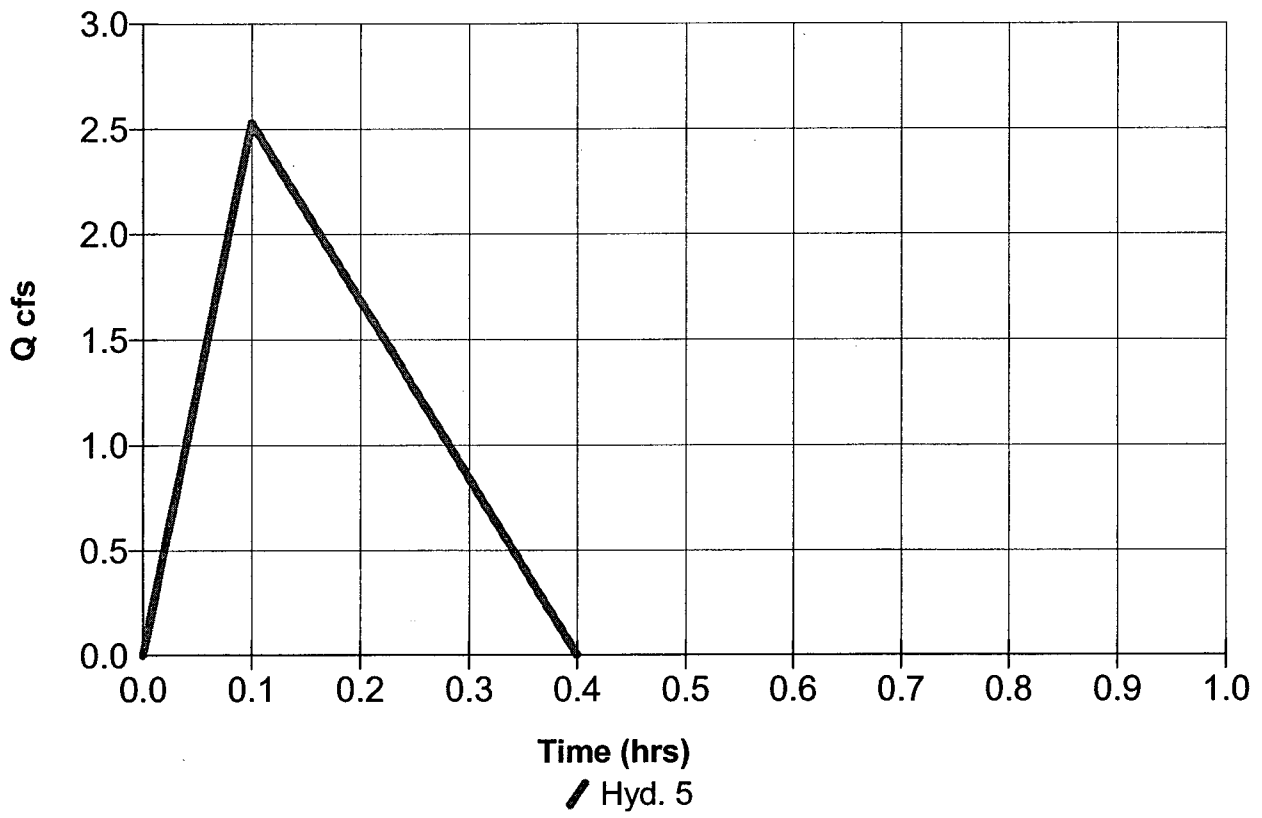
Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

0.02	0.42
0.03	0.84
0.05	1.26
0.07	1.69
0.08	2.11
0.10	2.53 <<
0.12	2.39
0.13	2.25
0.15	2.11
0.17	1.97
0.18	1.83
0.20	1.69
0.22	1.54
0.23	1.40
0.25	1.26
0.27	1.12
0.28	0.98
0.30	0.84
0.32	0.70
0.33	0.56
0.35	0.42
0.37	0.28
0.38	0.14

...End

Hyd. No. 5 - Rational - 10 Yr - $Q_p = 2.53$ cfs - Sub-Basin B5



Hydrograph Report

Hyd. No. 6

Pond Inflows

Hydrograph type = Combine
Storm frequency = 10 yrs
Inflow hyds. = 2, 3, 4, 5

Peak discharge = 73.78 cfs
Time interval = 1 min

Hydrograph Volume = 73,623 cuft

Hydrograph Discharge Table

Time (hrs)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 = (cfs)	Outflow (cfs)
0.02	6.45	1.62	3.44	0.42	11.93
0.03	12.90	3.25	6.87	0.84	23.86
0.05	19.35	4.87	10.31	1.26	35.79
0.07	25.79	6.50	13.74	1.69	47.72
0.08	32.24	8.12	17.18 <<	2.11	59.65
0.10	38.69	9.74	16.03	2.53 <<	67.00
0.12	45.14 <<	11.37	14.89	2.39	73.78 <<
0.13	42.99	12.99	13.74	2.25	71.97
0.15	40.84	14.61	12.60	2.11	70.16
0.17	38.69	16.24	11.45	1.97	68.35
0.18	36.54	17.86 <<	10.31	1.83	66.54
0.20	34.39	17.32	9.16	1.69	62.56
0.22	32.24	16.78	8.02	1.54	58.58
0.23	30.09	16.24	6.87	1.40	54.61
0.25	27.94	15.70	5.73	1.26	50.63
0.27	25.79	15.16	4.58	1.12	46.65
0.28	23.64	14.61	3.44	0.98	42.68
0.30	21.50	14.07	2.29	0.84	38.70
0.32	19.35	13.53	1.15	0.70	34.72
0.33	17.20	12.99	0.00	0.56	30.75
0.35	15.05	12.45	0.00	0.42	27.92
0.37	12.90	11.91	0.00	0.28	25.09
0.38	10.75	11.37	0.00	0.14	22.25
0.40	8.60	10.83	0.00	0.00	19.42
0.42	6.45	10.28	0.00	0.00	16.73
0.43	4.30	9.74	0.00	0.00	14.04
0.45	2.15	9.20	0.00	0.00	11.35
0.47	0.00	8.66	0.00	0.00	8.66
0.48	0.00	8.12	0.00	0.00	8.12
0.50	0.00	7.58	0.00	0.00	7.58
0.52	0.00	7.04	0.00	0.00	7.04
0.53	0.00	6.50	0.00	0.00	6.50
0.55	0.00	5.95	0.00	0.00	5.95
0.57	0.00	5.41	0.00	0.00	5.41
0.58	0.00	4.87	0.00	0.00	4.87
0.60	0.00	4.33	0.00	0.00	4.33
0.62	0.00	3.79	0.00	0.00	3.79
0.63	0.00	3.25	0.00	0.00	3.25

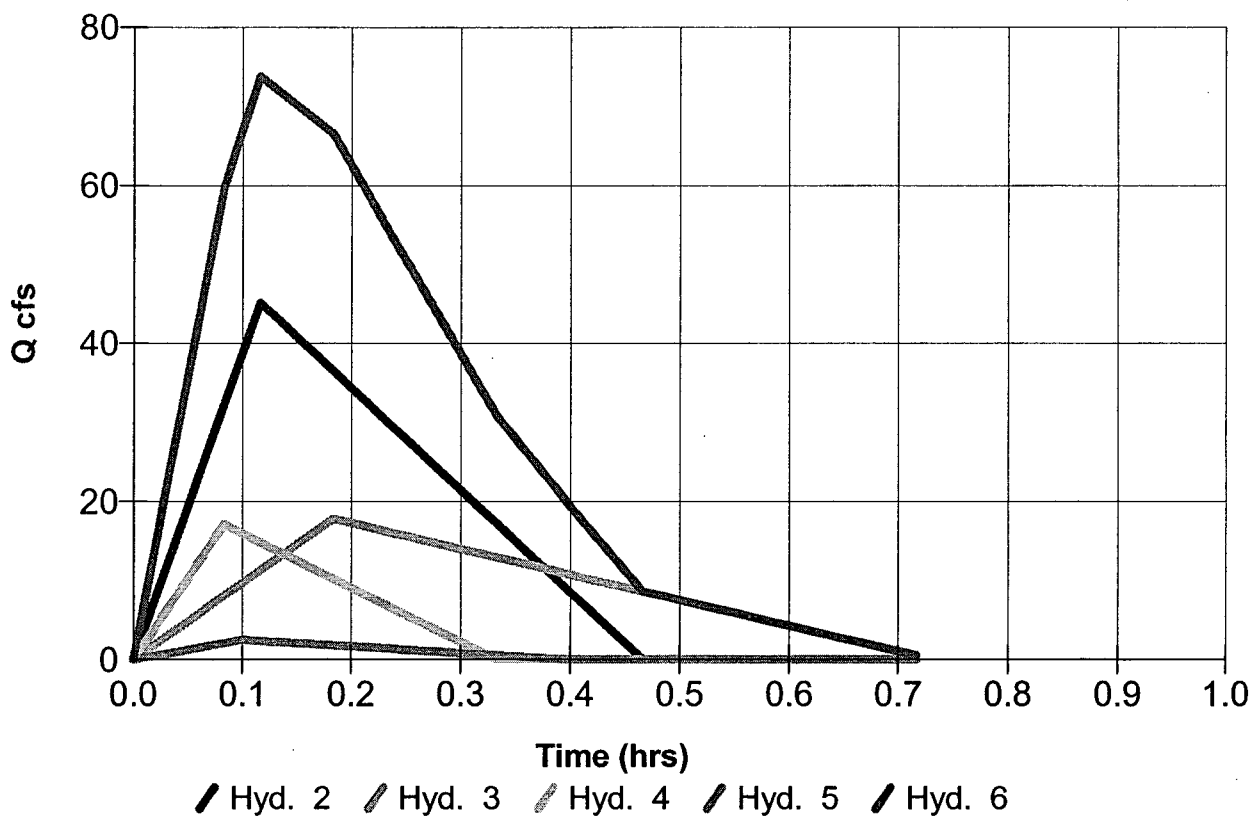
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Hydrograph Discharge Table

Time (hrs)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 = (cfs)	Outflow (cfs)
0.65	0.00	2.71	0.00	0.00	2.71
0.67	0.00	2.17	0.00	0.00	2.17
0.68	0.00	1.62	0.00	0.00	1.62
0.70	0.00	1.08	0.00	0.00	1.08

...End

Hyd. No. 6 - Combine - 10 Yr - $Q_p = 73.78$ cfs - Pond Inflows



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
2	Rational	63.02	1	7	52,939	---	----	----	Sub-Basins A1-A7
3	Rational	25.07	1	11	33,086	---	----	----	Sub-Basins B1, B3-B4
4	Rational	23.93	1	5	14,358	---	----	----	Sub-basin B2
5	Rational	3.53	1	6	2,538	---	----	----	Sub-Basin B5
6	Combine	103.04	1	7	102,922	2, 3, 4, 5	----	----	Pond Inflows
7	Reservoir	9.50	1	31	93,531	6	23.97	88,837	Pond

V₁₀₀

Hydrograph Report

Hyd. No. 2

Sub-Basins A1-A7

Hydrograph type	= Rational	Peak discharge	= 63.02 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 8.4 ac	Runoff coeff.	= 0.79
Intensity	= 9.497 in/hr	Time of conc. (Tc)	= 7 min
IDF Curve	= Wichita-Hydroflow.idf	Asc/Rec limb fact	= 1/3

Hydrograph Volume = 52,939 cuft

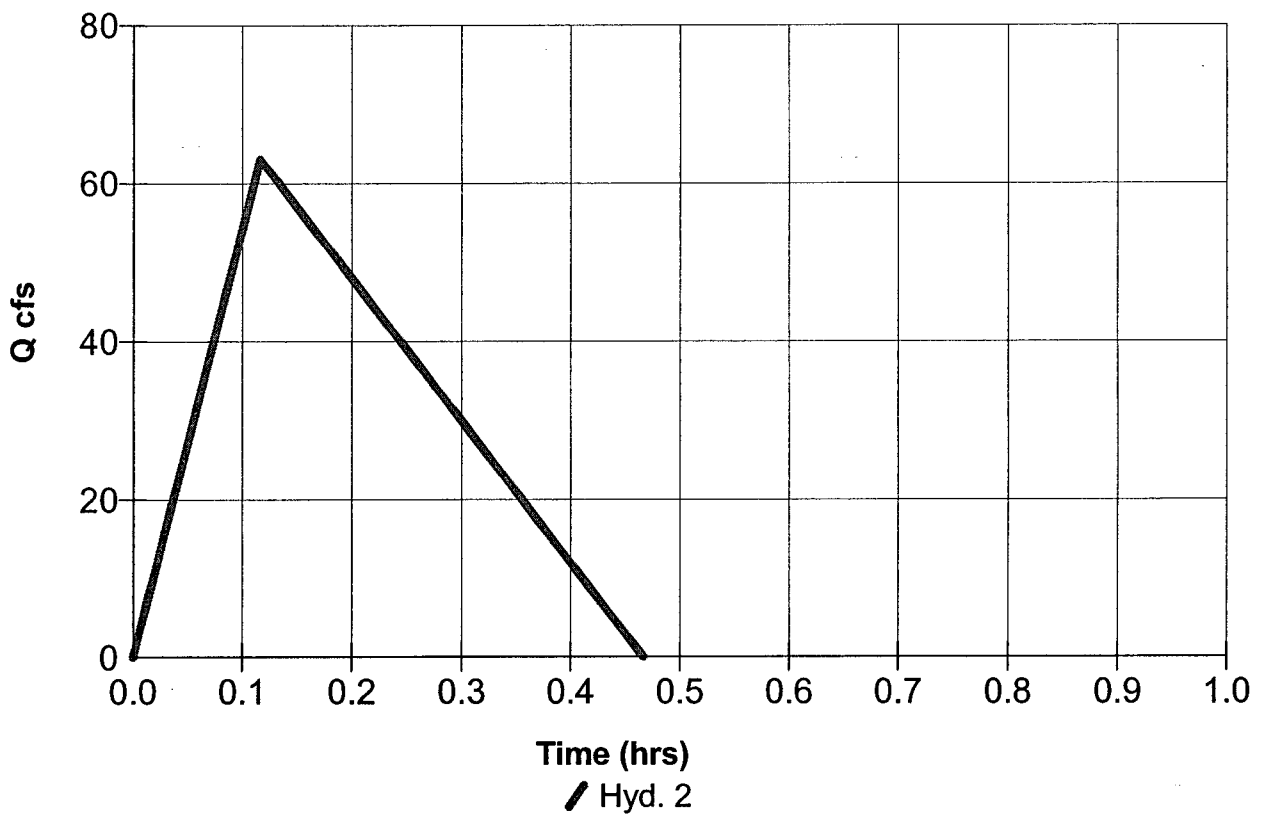
Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

0.02	9.00
0.03	18.01
0.05	27.01
0.07	36.01
0.08	45.02
0.10	54.02
0.12	63.02 <<
0.13	60.02
0.15	57.02
0.17	54.02
0.18	51.02
0.20	48.02
0.22	45.02
0.23	42.01
0.25	39.01
0.27	36.01
0.28	33.01
0.30	30.01
0.32	27.01
0.33	24.01
0.35	21.01
0.37	18.01
0.38	15.01
0.40	12.00
0.42	9.00
0.43	6.00
0.45	3.00

...End

Hyd. No. 2 - Rational - 100 Yr - Qp = 63.02 cfs - Sub-Basins A1-A7



Hydrograph Report

Hyd. No. 3

Sub-Basins B1, B3-B4

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 3.8 ac
Intensity = 8.263 in/hr
IDF Curve = Wichita-Hydroflow.idf

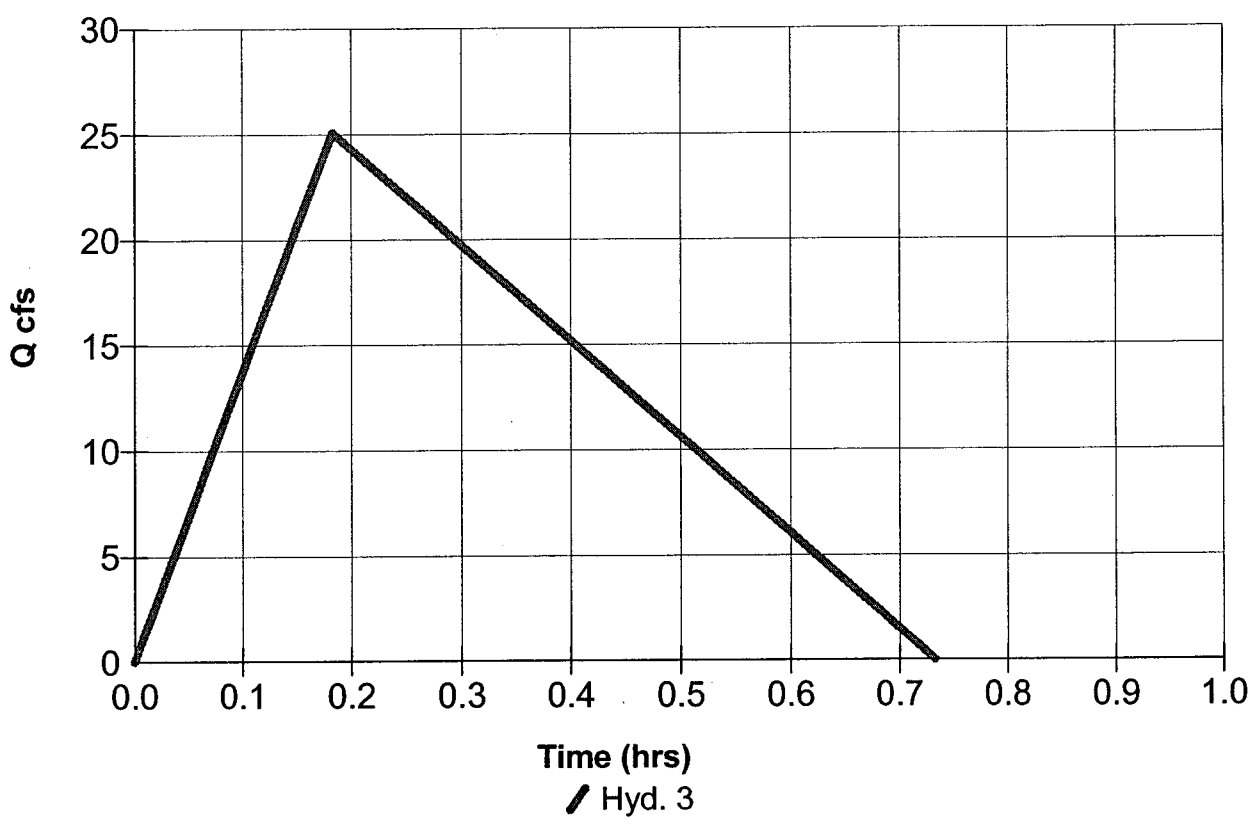
Peak discharge = 25.07 cfs
Time interval = 1 min
Runoff coeff. = 0.79
Time of conc. (Tc) = 11 min
Asc/Rec limb fact = 1/3

Hydrograph Volume = 33,086 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.02 2.28	0.58 6.84
0.03 4.56	0.60 6.08
0.05 6.84	0.62 5.32
0.07 9.11	0.63 4.56
0.08 11.39	0.65 3.80
0.10 13.67	0.67 3.04
0.12 15.95	0.68 2.28
0.13 18.23	0.70 1.52
0.15 20.51	0.72 0.76
0.17 22.79	
0.18 25.07 <<	
0.20 24.31	...End
0.22 23.55	
0.23 22.79	
0.25 22.03	
0.27 21.27	
0.28 20.51	
0.30 19.75	
0.32 18.99	
0.33 18.23	
0.35 17.47	
0.37 16.71	
0.38 15.95	
0.40 15.19	
0.42 14.43	
0.43 13.67	
0.45 12.91	
0.47 12.15	
0.48 11.39	
0.50 10.63	
0.52 9.87	
0.53 9.11	
0.55 8.36	
0.57 7.60	

Hyd. No. 3 - Rational - 100 Yr - $Q_p = 25.07$ cfs - Sub-Basins B1, B3-B4



Hydrograph Report

Hyd. No. 4

Sub-basin B2

Hydrograph type	= Rational	Peak discharge	= 23.93 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.85
Intensity	= 10.313 in/hr	Time of conc. (Tc)	= 5 min
IDF Curve	= Wichita-Hydroflow.idf	Asc/Rec limb fact	= 1/3

Hydrograph Volume = 14,358 cuft

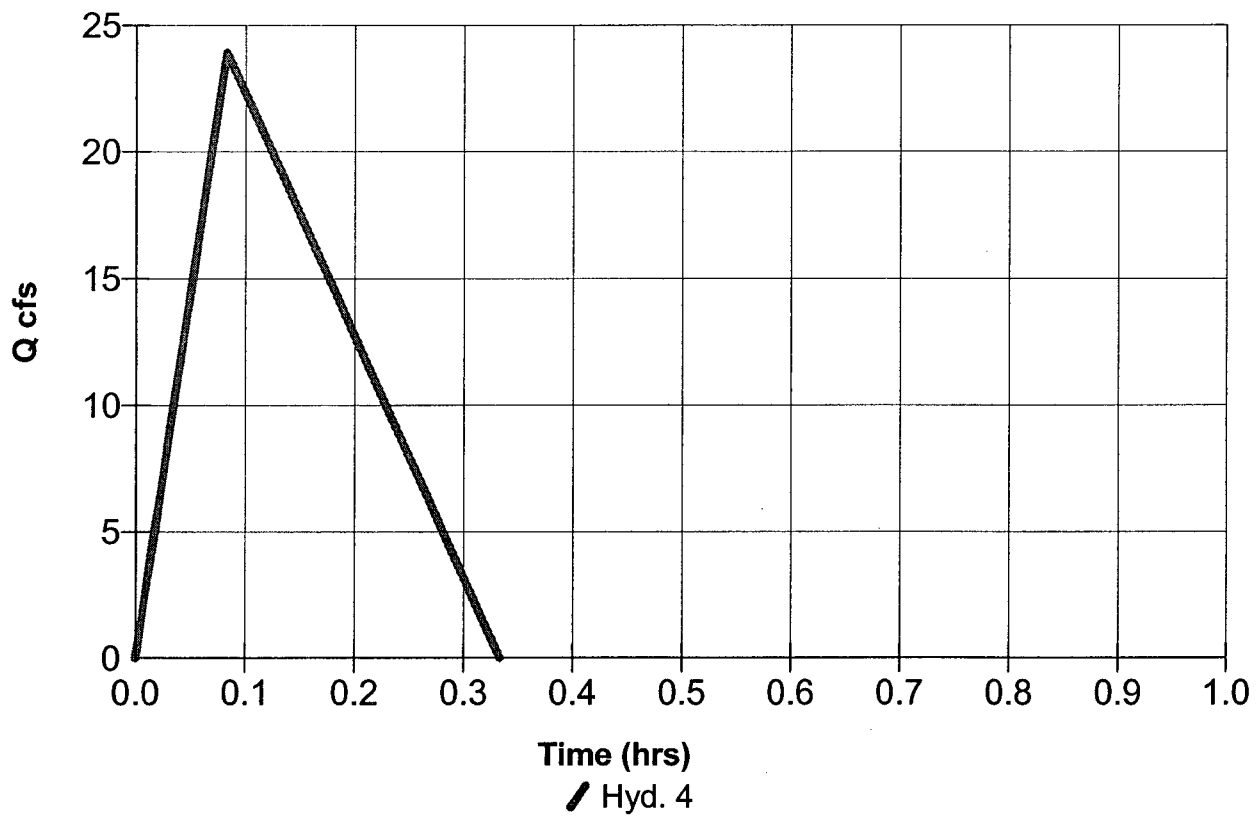
Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

0.02	4.79
0.03	9.57
0.05	14.36
0.07	19.14
0.08	23.93 <<
0.10	22.34
0.12	20.74
0.13	19.14
0.15	17.55
0.17	15.95
0.18	14.36
0.20	12.76
0.22	11.17
0.23	9.57
0.25	7.98
0.27	6.38
0.28	4.79
0.30	3.19
0.32	1.60

...End

Hyd. No. 4 - Rational - 100 Yr - Qp = 23.93 cfs - Sub-basin B2



Hydrograph Report

Hyd. No. 5

Sub-Basin B5

Hydrograph type	= Rational	Peak discharge	= 3.53 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 1.2 ac	Runoff coeff.	= 0.29
Intensity	= 9.884 in/hr	Time of conc. (Tc)	= 6 min
IDF Curve	= Wichita-Hydroflow.idf	Asc/Rec limb fact	= 1/3

Hydrograph Volume = 2,538 cuft

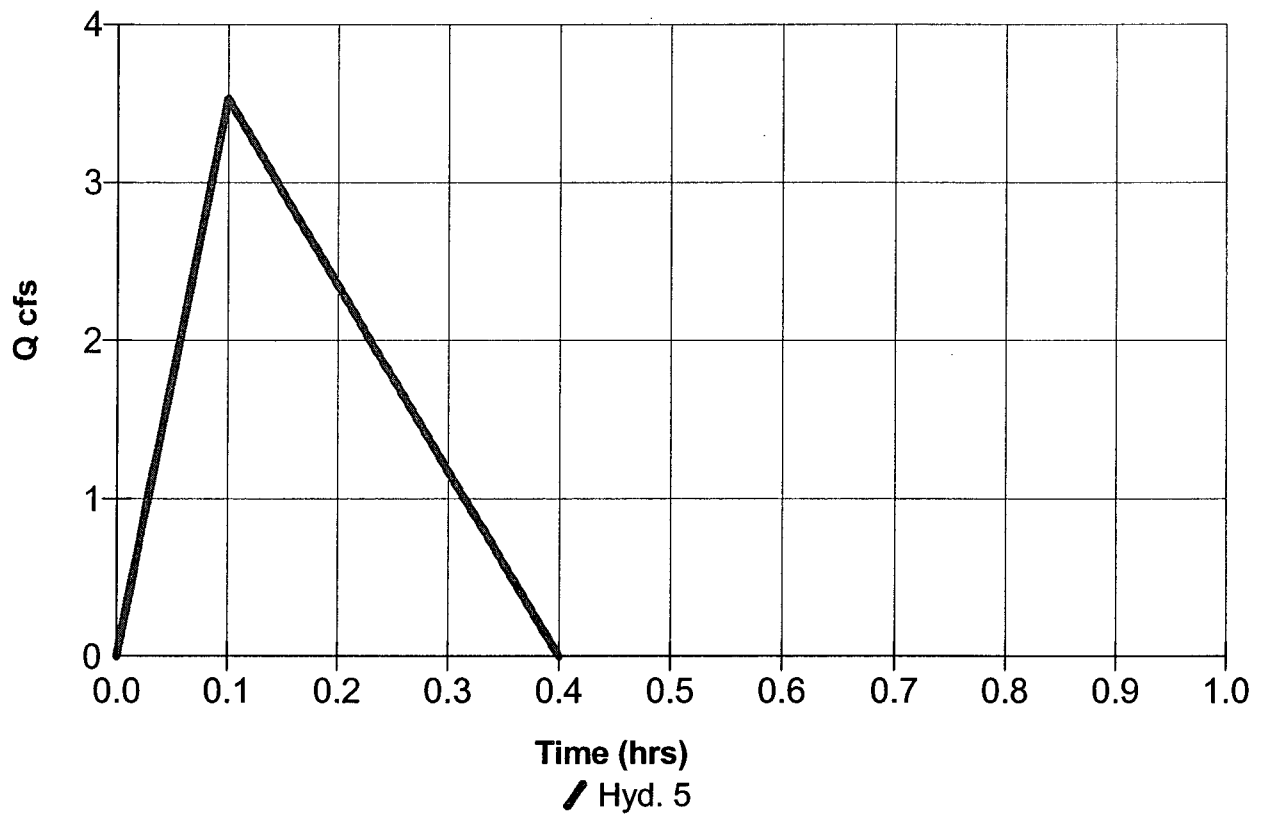
Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

0.02	0.59
0.03	1.18
0.05	1.76
0.07	2.35
0.08	2.94
0.10	3.53 <<
0.12	3.33
0.13	3.13
0.15	2.94
0.17	2.74
0.18	2.55
0.20	2.35
0.22	2.15
0.23	1.96
0.25	1.76
0.27	1.57
0.28	1.37
0.30	1.18
0.32	0.98
0.33	0.78
0.35	0.59
0.37	0.39
0.38	0.20

...End

Hyd. No. 5 - Rational - 100 Yr - Qp = 3.53 cfs - Sub-Basin B5



Hydrograph Report

Hyd. No. 6

Pond Inflows

Hydrograph type = Combine
Storm frequency = 100 yrs
Inflow hyds. = 2, 3, 4, 5

Peak discharge = 103.04 cfs
Time interval = 1 min

Hydrograph Volume = 102,922 cuft

Hydrograph Discharge Table

Time (hrs)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 = (cfs)	Outflow (cfs)
0.02	9.00	2.28	4.79	0.59	16.66
0.03	18.01	4.56	9.57	1.18	33.31
0.05	27.01	6.84	14.36	1.76	49.97
0.07	36.01	9.11	19.14	2.35	66.62
0.08	45.02	11.39	23.93 <<	2.94	83.28
0.10	54.02	13.67	22.34	3.53 <<	93.55
0.12	63.02 <<	15.95	20.74	3.33	103.04 <<
0.13	60.02	18.23	19.14	3.13	100.53
0.15	57.02	20.51	17.55	2.94	98.02
0.17	54.02	22.79	15.95	2.74	95.50
0.18	51.02	25.07 <<	14.36	2.55	92.99
0.20	48.02	24.31	12.76	2.35	87.44
0.22	45.02	23.55	11.17	2.15	81.88
0.23	42.01	22.79	9.57	1.96	76.33
0.25	39.01	22.03	7.98	1.76	70.78
0.27	36.01	21.27	6.38	1.57	65.23
0.28	33.01	20.51	4.79	1.37	59.68
0.30	30.01	19.75	3.19	1.18	54.12
0.32	27.01	18.99	1.60	0.98	48.57
0.33	24.01	18.23	0.00	0.78	43.02
0.35	21.01	17.47	0.00	0.59	39.06
0.37	18.01	16.71	0.00	0.39	35.11
0.38	15.01	15.95	0.00	0.20	31.15
0.40	12.00	15.19	0.00	0.00	27.20
0.42	9.00	14.43	0.00	0.00	23.43
0.43	6.00	13.67	0.00	0.00	19.67
0.45	3.00	12.91	0.00	0.00	15.91
0.47	0.00	12.15	0.00	0.00	12.15
0.48	0.00	11.39	0.00	0.00	11.39
0.50	0.00	10.63	0.00	0.00	10.63
0.52	0.00	9.87	0.00	0.00	9.87
0.53	0.00	9.11	0.00	0.00	9.11
0.55	0.00	8.36	0.00	0.00	8.36
0.57	0.00	7.60	0.00	0.00	7.60
0.58	0.00	6.84	0.00	0.00	6.84
0.60	0.00	6.08	0.00	0.00	6.08
0.62	0.00	5.32	0.00	0.00	5.32
0.63	0.00	4.56	0.00	0.00	4.56

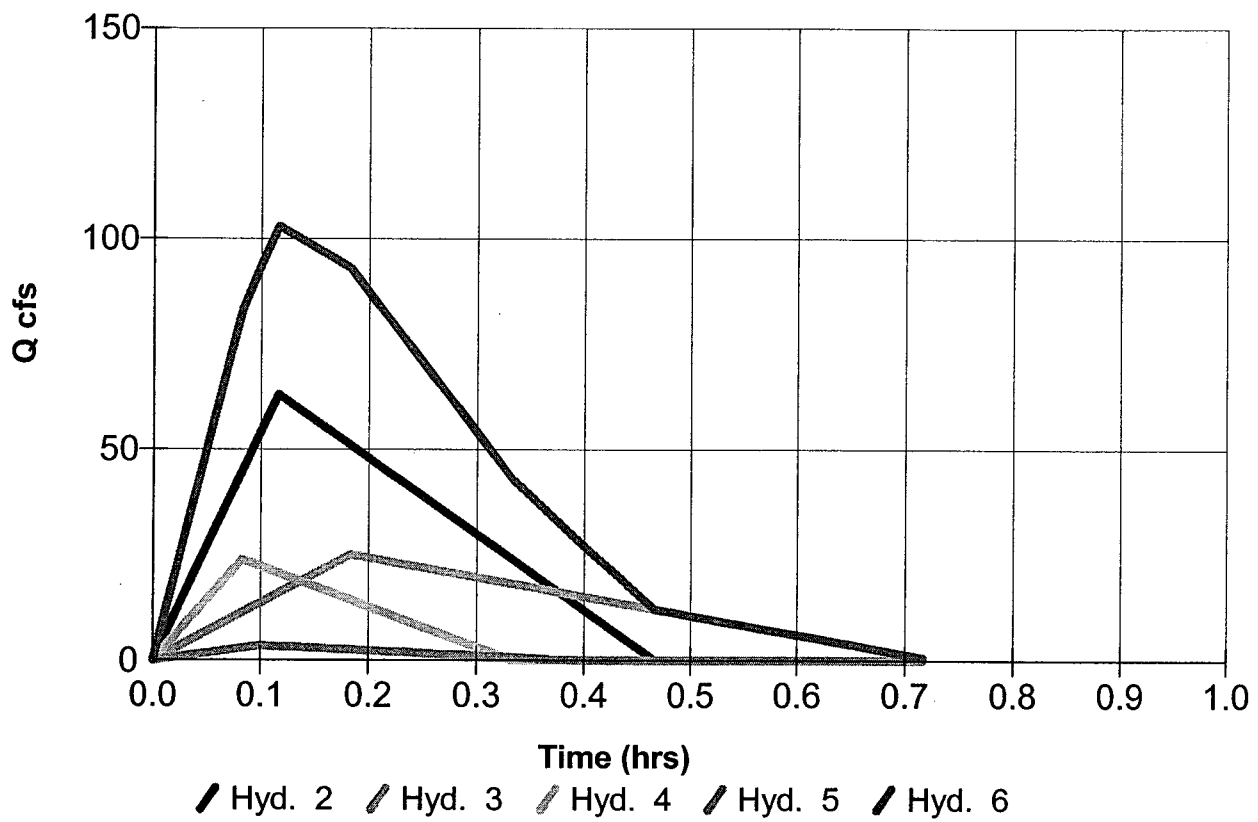
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Hydrograph Discharge Table

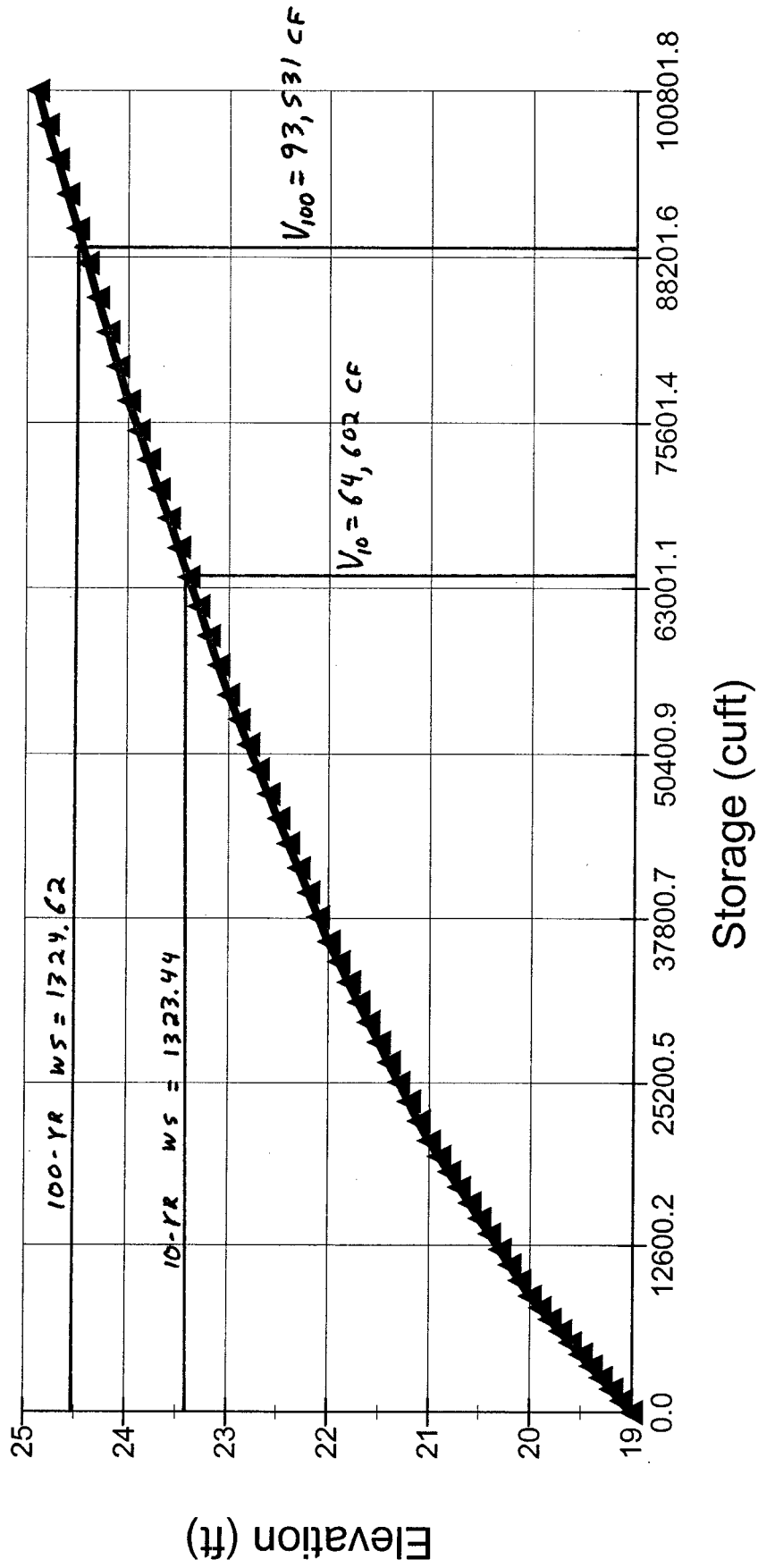
Time (hrs)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 = (cfs)	Outflow (cfs)
0.65	0.00	3.80	0.00	0.00	3.80
0.67	0.00	3.04	0.00	0.00	3.04
0.68	0.00	2.28	0.00	0.00	2.28
0.70	0.00	1.52	0.00	0.00	1.52

...End

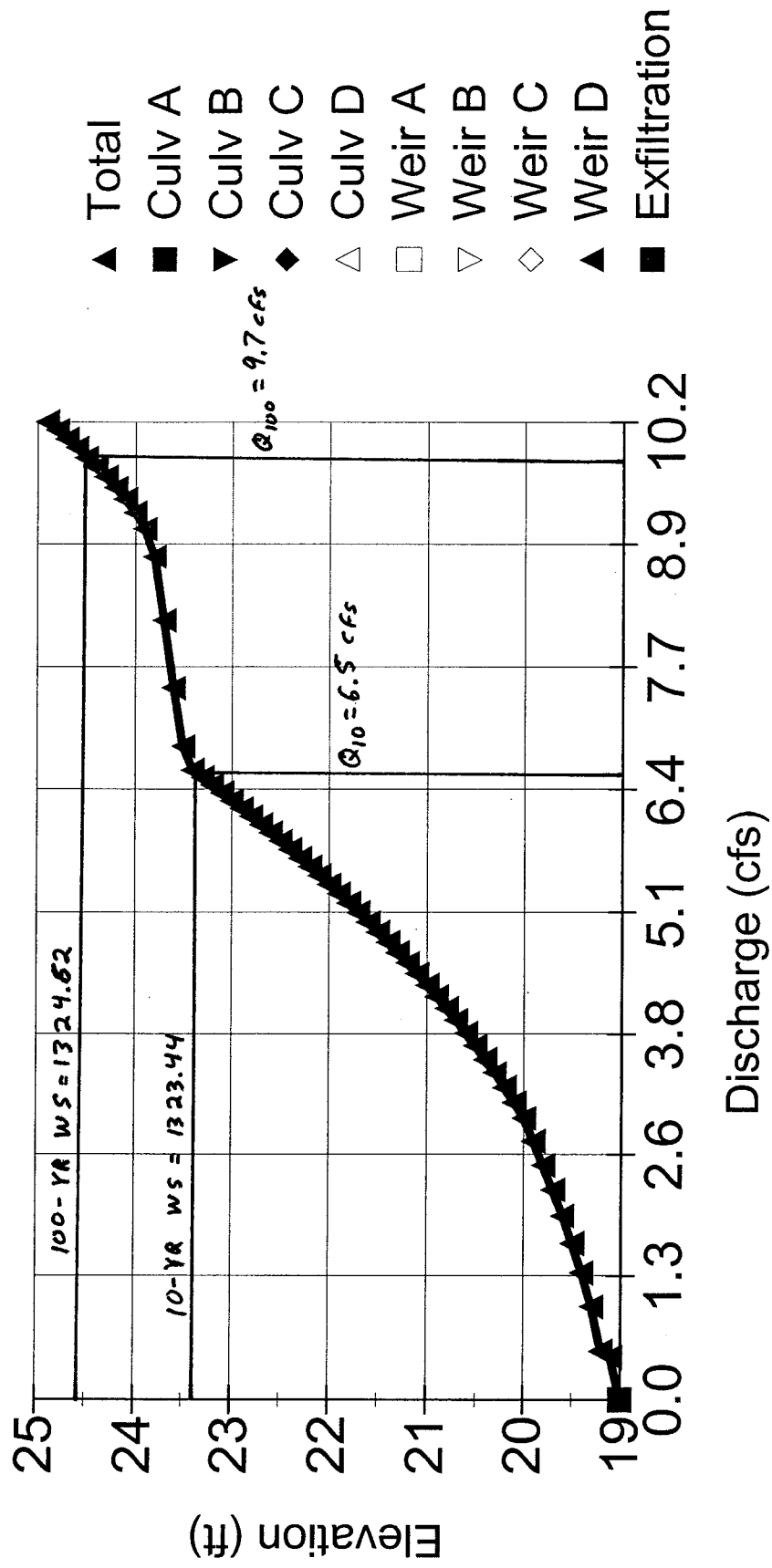
Hyd. No. 6 - Combine - 100 Yr - Qp = 103.04 cfs - Pond Inflows



Pond



Pond



Reservoir Report

Reservoir No. 1 - Pond

Hydraflow Hydrographs by Intelisolve

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	19.00	7,080	0	0
1.00	20.00	10,302	8,691	8,691
2.00	21.00	13,637	11,970	20,661
3.00	22.00	17,074	15,356	36,016
4.00	23.00	20,613	18,844	54,860
5.00	24.00	24,252	22,433	77,292
6.00	25.00	27,992	26,122	103,414

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 14.0	24.0	0.0	0.0
Span in	= 14.0	6.0	0.0	0.0
No. Barrels	= 1	1	0	0
Invert El. ft	= 18.00	18.00	0.00	0.00
Length ft	= 100.0	1.0	0.0	0.0
Slope %	= 0.01	1.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 8.00	0.00	0.00	0.00
Crest El. ft	= 23.44	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Civ A cfs	Civ B cfs	Civ C cfs	Civ D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	19.00	0.00	0.00	---	---	0.00	---	---	---	---	0.00
1.00	8,691	20.00	2.94	2.94	---	---	0.00	---	---	---	---	2.94
2.00	20,661	21.00	4.34	4.34	---	---	0.00	---	---	---	---	4.34
3.00	36,016	22.00	5.39	5.39	---	---	0.00	---	---	---	---	5.39
4.00	54,860	23.00	6.27	6.27	---	---	0.00	---	---	---	---	6.27
5.00	77,292	24.00	9.27	1.80	---	---	7.47	---	---	---	---	9.27
6.00	103,414	25.00	10.32	0.56	---	---	9.74	---	---	---	---	10.30

PROJECT NO: 060303000
 SHEET NO: 060303000
 SHEET NAME: DRAINAGE PLAN
 SHEET NUMBER: D1.0

NO. REVISIONS
 1 TARGET C.P.R.
 DATE: 11/17/03

