Creekside at Pembrook
Wichita, Sedgwick County, Kansas
04/29/04

Creekside at Pembrook is an 18.6 acre, single family, residential development within the city limits of Wichita in Sedgwick County, Kansas. The 47 lot development consists of streets, storm sewer and a detention pond. This report contains a drawing of the drainage plan, supporting calculations and data for the Creekside at Pembrook Drainage Plan.

Hydrology

The proposed plat lies in the NE 1/4, Section 2, T27S, R1E. The soil on-site is comprised of Elandco silt loam, Farnum loam, Irwin silty clay loam, which are classified in hydrologic groups B, B and D, respectively. The land is currently used for agricultural purposes and has short grass and bare ground throughout except for along the drainage channel on the west property line which is heavily wooded. The site is bordered to the north by an agricultural field, to the east by Oliver, and to the south and west by Greenbriar Manor. A natural drainage channel runs along the west property line from the north to the south property lines and has approximately 303 acres of contributing area including this site. Existing Basin A drains off the site to Oliver on the east and Existing Basin B drains into the natural drainage channel on the west. Proposed Basin 1 flows to a proposed pond and eventually to the natural drainage channel on the west where it combines with Basin 2. Basin 3 drains to the same outfall as Existing Basin A.

The Rational Method was used to calculate runoff quantities. Runoff coefficients were estimated based on tables presented in the Design Aids section of this report using fully developed conditions. Time of concentration was based on slope, flow velocity and length of flow through each basin and was not allowed to be less than 15 minutes. The HEC-1 computer program was used to route the runoff through the ponds and determine the post-development conditions leaving the site.

The analysis was made based on the available site data which includes the following: 1" = 60' topographic map with 1' contours of the site, a Sedgwick County Soil Survey Map and noted references.

Storm Sewer Design

For the storm sewer hydrologic analysis, the Rational Method was again used. Runoff coefficients were estimated using the charts in the design aids section of this report. For this development, a uniform assumption of the minimum time of concentration of 15 minutes was deemed appropriate. Travel time for flow through defined channels, pipes, etc, for these basins was estimated on the basis of Manning's Equation.

In the hydraulic analysis, the storm sewers are designed for the minor storm, with major storm overflows to be routed through easements and rights-of-way to an appropriate outlet. The minor storm has a recurrence interval of two years. The major storm evaluated has a recurrence interval of one hundred years. To simplify this analysis, the time of concentration is identical for both the major and minor storms.

For each inlet, street flooding and inlet capacity were checked for the minor storm. Conveyance in the street is based on the Modified Manning's Equation, as expressed in the Design of Urban Highway Drainage – The State of the Art, Equation (5-1), pages 5-9. It has been assumed that Tc for street flow is equal to Tc for pipe flow. This is a simplifying, but conservative, assumption since pipe flow velocities generally exceed street flow velocities. For local streets, curb-deep flow is tolerable for the minor storm. For collector streets, a single eight-foot lane should remain unflooded for the minor storm.

Inlet capacities were determined by the methods described in Drainage of Highway Pavements, Hydraulic Engineering Circular #12, using Chart #12 as found in the Design Aids section. City of Wichita Type 1A inlets and 3/8 inch per foot cross slopes have been assumed. Minimum walk grade has been assumed to be 0.3 feet above the top of curb, unless otherwise noted. Streets have been assumed to have 6-5/8 inch standard curb, unless otherwise noted.

Hydraulic computation for the storm sewer pipe system was performed using PEC's STORM computer program. This program uses Manning's Equation to calculate friction losses for pipes flowing full. Minor losses are computed by momentum principles at each structure. All pipe area is assumed to be reinforced concrete with a Manning's "n" of 0.013. It is desirable to keep the hydraulic grade line at least one foot below the top of curb for the minor storm. The calculations and the STORM analyses for the storm sewers are included in this report.

Design Aids

This section includes material used to assist in designing the drainage system. A 1" = 60' scale Drainage Plan map (Attachment A) and a 1" = 60' scale Four-Corner Plan map (Attachment B) are enclosed in the pockets.

References

Design of Urban Highway Drainage – The State of the Art, by Reitz & Jens, Inc., April 1980.

Drainage of Highway Pavements, Hydraulic Engineering Circular #12, by Tye Engineering, Inc., March 1984.

Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita, Kansas, 1985.

Soil Survey of Sedgwick County, Kansas, US Department of Agriculture, Soil Conservation Service, 1979.

Project:	**Creekside at Pembrook**
Date:	4/28/2004
Prep. By:	BLB

Manual Input

OFFSITE

Total Area 3.68 Acres

Soil Group	**A**	**B**	**C**	**D**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
	0%	50%	0%	50%	100%
Acres	0.00	1.84	0.00	1.84	3.68

Land Use	**Commercial**	**Industrial**	**Multi-Family**	**Public**	**Single Family**	**Vacant/Agriculture**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
Future	0%	0%	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	0.00	0.00	3.68	3.68

	Existing	
Length of Flow	700	ft
Slope	1.69	%
Waterflow Desc	bare / short grass	
Avg Velocity	0.55	ft/sec
Tc	0.35	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.54	3.25	3.68	6.46
5	0.56	3.90	3.68	8.04
10	0.61	4.50	3.68	10.10
25	0.64	5.23	3.68	12.32
50	0.67	5.87	3.68	14.47
100	0.70	6.39	3.68	16.46

Project: **Creekside at Pembrook**
Date: 4/28/2004
Prep. By: BLB

Manual Input

Basin A

Total Area 1.10 Acres

Soil Group	**A**	**B**	**C**	**D**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
	0%	50%	0%	50%	100%
Acres	0.00	0.55	0.00	0.55	1.10

Land Use	**Commercial**	**Industrial**	**Multi-Family**	**Public**	**Single Family**	**Vacant/Agriculture**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)
Existing	0%	0%	0%	0%	0%	100%
Acres	0.00	0.00	0.00	0.00	0.00	1.10

	Existing		
Length of Flow	575	ft	
Slope	0.59	%	
Waterflow Desc	bare / short grass		
Avg Velocity	0.55	ft/sec	
Tc	0.29	hours	15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Existing Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.54	3.61	1.10	2.14
5	0.56	4.31	1.10	2.65
10	0.61	4.95	1.10	3.32
25	0.64	5.75	1.10	4.05
50	0.67	6.44	1.10	4.75
100	0.70	7.00	1.10	5.39

Project: **Creekside at Pembrook**
Date: 4/28/2004
Prep. By: BLB

Manual Input

Basin B

Total Area 21.36 Acres

Soil Group	**A**	**B**	**C**	**D**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
	0%	100%	0%	0%	100%
Acres	0.00	21.36	0.00	0.00	21.36

Land Use	**Commercial**	**Industrial**	**Multi-Family**	**Public**	**Single Family**	**Vacant/Agriculture**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)
Existing	0%	0%	0%	0%	0%	100%
Acres	0.00	0.00	0.00	0.00	0.00	21.36

	Existing		
Length of Flow	1375	ft	
Slope	1.45	%	
Waterflow Desc	bare / short grass		
Avg Velocity	0.30	ft/sec	
Tc	1.27	hours	15 min <= Tc <= 24 hrs

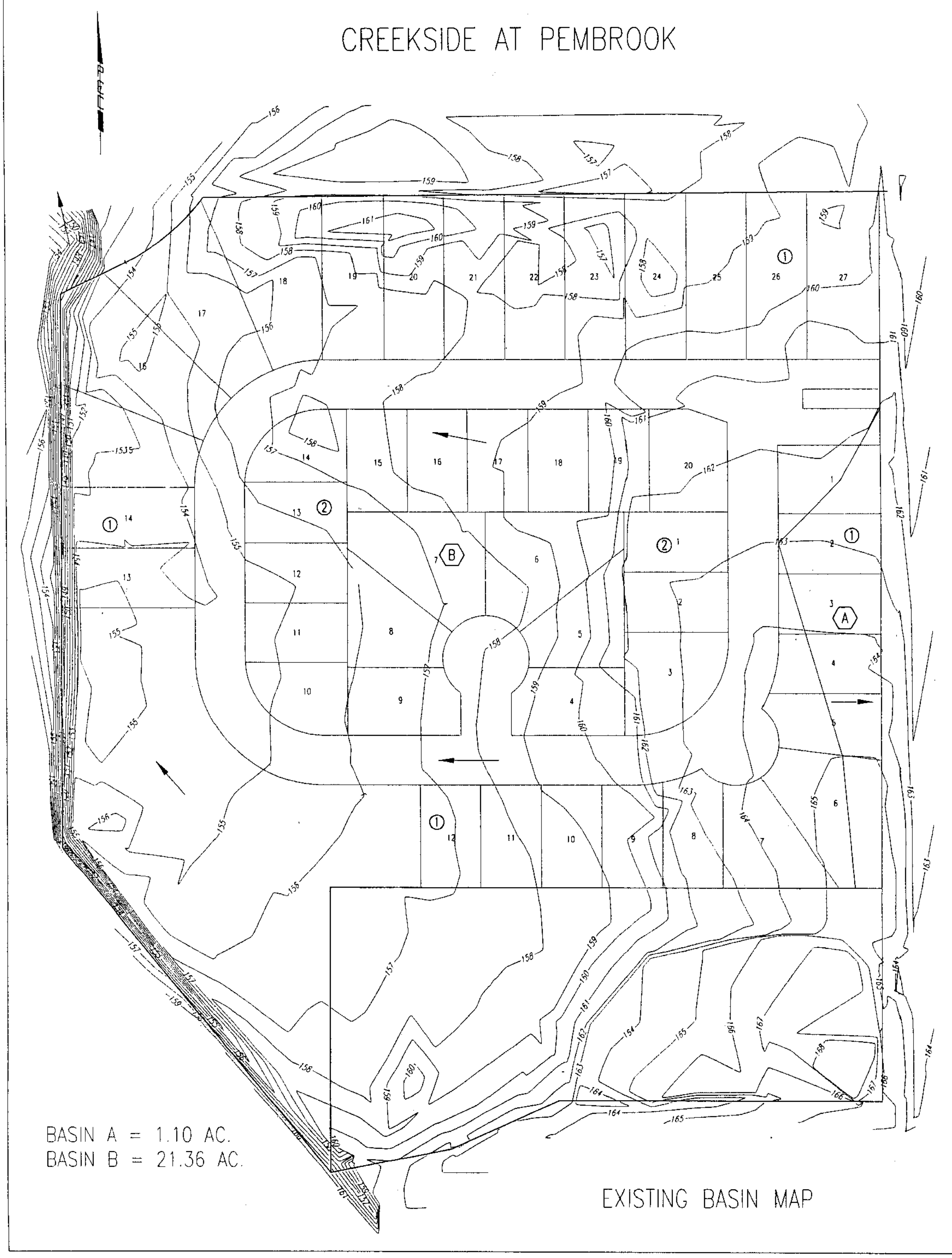
Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Existing Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.54	1.41	21.36	16.26
5	0.56	1.85	21.36	22.13
10	0.61	2.19	21.36	28.53
25	0.64	2.58	21.36	35.27
50	0.67	2.93	21.36	41.93
100	0.70	3.26	21.36	48.74

CREEKSIDE AT PEMBROOK



BASIN A = 1.10 AC.
BASIN B = 21.36 AC.

EXISTING BASIN MAP

Project:	**Creekside at Pembrook**
Date:	4/28/2004
Prep. By:	BLB

Manual Input

Basin 1

Total Area 4.48 Acres

Soil Group	**A** (% of Total Area)	**B** (% of Total Area)	**C** (% of Total Area)	**D** (% of Total Area)	**Total**
	0%	60%	0%	40%	100%
Acres	0.00	2.69	0.00	1.79	4.48

Land Use	**Commercial** (% of Total Area)	**Industrial** (% of Total Area)	**Multi-Family** (% of Total Area)	**Public** (% of Total Area)	**Single Family** (% of Total Area)	**Vacant/Agriculture** (% of Total Area)
Future	0%	0%	0%	0%	100%	0%
Acres	0.00	0.00	0.00	0.00	4.48	0.00

	Future	
Length of Flow	925	ft
Slope	1.51	%
Waterflow Desc	lawns / short grass	
Avg Velocity	0.24	ft/sec
Tc	1.07	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients . * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	1.61	4.48	3.61
5	0.54	2.07	4.48	5.01
10	0.62	2.44	4.48	6.78
25	0.66	2.86	4.48	8.46
50	0.70	3.25	4.48	10.19
100	0.76	3.60	4.48	12.26

Project: **Creekside at Pembrook**
Date: 4/28/2004
Prep. By: BLB

Manual Input

Basin 2

Total Area 12.51 Acres

Soil Group	**A** (% of Total Area)	**B** (% of Total Area)	**C** (% of Total Area)	**D** (% of Total Area)	**Total**
	0%	100%	0%	0%	100%
Acres	0.00	12.51	0.00	0.00	12.51

Land Use	**Commercial** (% of Total Area)	**Industrial** (% of Total Area)	**Multi-Family** (% of Total Area)	**Public** (% of Total Area)	**Single Family** (% of Total Area)	**Vacant/Agriculture** (% of Total Area)
Future	0%	0%	0%	0%	80%	20%
Acres	0.00	0.00	0.00	0.00	10.01	2.50

	Future		
Length of Flow	1175	ft	
Slope	1.16	%	
Waterflow Desc	lawns / short grass		15 min <= Tc <= 24 hrs
Avg Velocity	0.24	ft/sec	
Tc	1.36	hours	

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.51	1.33	12.51	8.45
5	0.54	1.76	12.51	11.98
10	0.62	2.08	12.51	16.08
25	0.66	2.43	12.51	19.94
50	0.69	2.79	12.51	24.22
100	0.75	3.10	12.51	29.01

Project: **Creekside at Pembrook**
Date: 4/28/2004
Prep. By: BLB

Manual Input

Basin 3

Total Area 1.49 Acres

Soil Group	**A**	**B**	**C**	**D**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
	0%	60%	0%	40%	100%
Acres	0.00	0.89	0.00	0.60	1.49

Land Use	**Commercial**	**Industrial**	**Multi-Family**	**Public**	**Single Family**	**Vacant/Agriculture**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)
Future	0%	0%	0%	0%	100%	0%
Acres	0.00	0.00	0.00	0.00	1.49	0.00

	Future	
Length of Flow	600	ft
Slope	0.67	%
Waterflow Desc	lawns / short grass	
Avg Velocity	0.24	ft/sec
Tc	0.69	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	2.21	1.49	1.65
5	0.54	2.72	1.49	2.19
10	0.62	3.17	1.49	2.93
25	0.66	3.71	1.49	3.65
50	0.70	4.19	1.49	4.37
100	0.76	4.60	1.49	5.21

32.0 Maximum Q (cfs)
5.000 Weir Width (feet)
154.00 Weir Elevation

Q (cfs)	Weir Width (feet)	Weir Elevation	q	Critical Depth (feet)	Energy Head (feet)	**Water Surface Elevation**
0.0	5.000	154.00	0.0	0.00	0.00	**154.00**
3.2	5.000	154.00	0.6	0.23	0.35	**154.35**
6.4	5.000	154.00	1.3	0.37	0.56	**154.56**
9.6	5.000	154.00	1.9	0.49	0.73	**154.73**
12.8	5.000	154.00	2.6	0.59	0.88	**154.88**
16.0	5.000	154.00	3.2	0.68	1.02	**155.02**
19.2	5.000	154.00	3.8	0.77	1.16	**155.16**
22.4	5.000	154.00	4.5	0.85	1.28	**155.28**
25.6	5.000	154.00	5.1	0.93	1.40	**155.40**
28.8	5.000	154.00	5.8	1.01	1.52	**155.52**
32.0	5.000	154.00	6.4	1.08	1.63	**155.63**

Circular Pond Sizing with Elevations

Floor Area (Acres)	1.04
Floor Elevation (ft)	142.00
Static Pool Elevation (ft)	152.00
Side Slopes to Static (_ :1)	2
Side Slopes beyond Static (_ :1)	4

	Elevation (ft)	Radius (ft)	Area (ft^2)	Area (Acres)	Storage (ft^3)	Storage (C.Y.)
	142.00	120.08	45302.40	1.04	0.00	0.00
	143.00	122.08	46823.99	1.07	46063.19	1706.04
	144.00	124.08	48370.71	1.11	93673.11	3469.37
	145.00	126.08	49942.56	1.15	142867.44	5291.39
	146.00	128.08	51539.55	1.18	193683.90	7173.48
	147.00	130.08	53161.67	1.22	246160.17	9117.04
	148.00	132.08	54808.92	1.26	300333.96	11123.48
	149.00	134.08	56481.31	1.30	356242.97	13194.18
	150.00	136.08	58178.82	1.34	413924.89	15330.55
	151.00	138.08	59901.47	1.38	473417.43	17533.98
Static Pool	152.00	140.08	61649.26	1.42	534758.28	19805.86
	153.00	144.08	65220.22	1.50	607874.41	22513.87
	154.00	148.08	68891.71	1.58	685164.69	25376.47
	155.00	152.08	72663.74	1.67	766779.91	28399.26
	156.00	156.08	76536.30	1.76	852870.88	31587.81
	157.00	160.08	80509.39	1.85	943588.39	34947.72
	158.00	164.08	84583.00	1.94	1039083.24	38484.56
	159.00	168.08	88757.15	2.04	1139506.21	42203.93
	160.00	172.08	93031.84	2.14	1245008.12	46111.41

SUB-BASIN CALCULATIONS

Runoff Coefficients

C2	0.44
C100	0.61

Intensity

Tc	15 min
i2	3.5 in/hr
i100	7.8 in/hr

Basin	Node	Area	Q2	Q100
2A	N/A	4.08	6.28	29.90
2B	110	0.82	1.26	6.01
2C	120	1.20	1.85	8.79
2D	130	0.66	1.02	4.84
2E	122	0.65	1.00	4.76
2F	140	1.08	1.66	7.91
2G	123	1.10	1.69	8.06
2H	124	0.45	0.69	3.30
2I	125	0.54	0.83	3.96
2J	150	0.88	1.36	6.45
2K	160	1.04	1.60	7.62

INLET SIZING

Curb Inlets

Node	Qin	Qmax (L=5')	Qmax (L=10')	Use L=
110	0.82	11	22	5
120	1.20	11	22	5
124	0.45	11	22	5
125	0.54	11	22	5
150	0.88	11	22	5
160	1.04	11	22	5

Area Inlets

Node	Q100	Size	Perimeter	Ponding Depth
122	4.76	2' x 2'	8	0.34
123	8.06	2' x 2'	8	0.48
130	4.84	2' x 2'	8	0.34
140	7.91	2' x 2'	8	0.48

Neenah R4826 2' x 2' Area Inlet

1.3 SF of open area

8 F Perimeter

STREET FLOW CHECKS

Basin	Node	Q2	Q100
2B	110	1.26	6.01
2C	120	1.85	8.79
2H	124	0.69	3.30
2I	125	0.83	3.96
2J	150	1.36	6.45
2K	160	1.60	7.62

2 Year

Node	Q2	Street Slope	d	dmax	Comment
120	1.85	0.96	0.22	0.55	OK

* By inspection, all nodes are OK

100 Year

Location	Q100	Qpipe	Qstreet	S	Qmax	Comment
Approaching node 120	8.79	1.85	6.94	0.96	79.41	OK

* By inspection, all nodes are OK

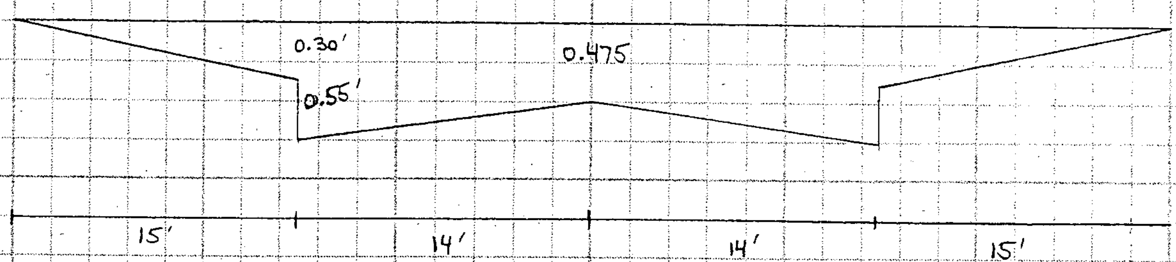
Professional Engineering Consultants, P.A.

S. TOPEKA • WICHITA, KANSAS 67202
316-262-2691 • FAX 316-262-3003
www.pec1.com • designers@pec1.com

Project ______________________ Date __________

Item ______________________ By __________

DETERMINE CAPACITIES OF STANDARD CURB STREETS w/ 0.3' WALK GRADE FOR 100-YR STORM ANALYSIS (58' ROW, 29' BK-BK)



$$\frac{(2 \times 14.5 \times 0.030) + (2 \times 3.05 \times 0.013) + (2 \times 12 \times 0.016)}{59.1} = 0.02256 = n$$

$(2 \times \frac{1}{2} \times 15 \times 0.30) + (28 \times 0.85) - (2 \times \frac{1}{2} \times 14 \times 0.375) = 23.05 \text{ SF} = A$

$59.1 \text{ ft} = P$

$23.05 / 59.1 = 0.390 = R$

$(0.390)^{2/3} = 0.534 = R^{2/3}$

$\frac{1.486}{n} A R^{2/3} S^{1/2} = Q$

$\left(\frac{1.486}{0.02256}\right)(23.05)(0.534) S^{1/2} = \underline{\underline{810.47\, S^{1/2} = Q}}$

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1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN    1998             *                                                  *   HYDROLOGIC ENGINEERING CENTER      *
 *             VERSION 4.1              *                                                  *         609 SECOND STREET            *
 *                                      *                                                  *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE    28APR04  TIME  15:06:58 *                                                  *          (916) 756-1104              *
 *                                      *                                                  *                                      *
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                    X     X  XXXXXXX   XXXXX         X
                    X     X  X        X     X       XX
                    X     X  X        X              X
                    XXXXXXX  XXXX     X      XXXXX   X
                    X     X  X        X              X
                    X     X  X        X     X        X
                    X     X  XXXXXXX   XXXXX        XXX
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 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL    LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
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1                                        HEC-1 INPUT                                                    PAGE  1

  LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    1          ID      Creekside at Pembrook 36-04165-3104
    2          ID      Proposed Drainage at Northwest corner of site
    3          ID      By BLB      DATE 04-28-04
*** LIST ***
*** FREE ***
               *DIAGRAM
    4          IT      15 27SEP99    1200       0 28SEP99    2000
    5          IN      15 27SEP99    1200
    6          IO       0       5
    7          JR    PREC     7.8
               *
               *
               *  OFFSITE

    8          KK     OFF
    9          KO       5
   10          BA  0.0058
   11          PB    1.00
   12          PC   0.000   0.003   0.006   0.008   0.011   0.014   0.017   0.019   0.022   0.025
   13          PC   0.029   0.032   0.035   0.038   0.042   0.045   0.048   0.052   0.056   0.060
   14          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
   15          PC   0.110   0.115   0.120   0.127   0.134   0.140   0.147   0.155   0.163   0.172
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  16         PC   0.181   0.193   0.204   0.220   0.235   0.259   0.283   0.387   0.663   0.699
  17         PC   0.735   0.754   0.772   0.786   0.799   0.810   0.820   0.828   0.835   0.843
  18         PC   0.850   0.858   0.865   0.873   0.880   0.885   0.889   0.894   0.898   0.903
  19         PC   0.907   0.912   0.916   0.921   0.925   0.929   0.934   0.938   0.943   0.947
  20         PC   0.952   0.955   0.958   0.961   0.964   0.967   0.970   0.973   0.976   0.979
  21         PC   0.982   0.985   0.988   0.991   0.994   0.997   1.000
  22         LS       0      80      10
  23         UD   0.200
             *
             *
             *
             *  Basin #2

  24         KK    BAS2
  25         KO       5
  26         BA  0.0195
  27         PB    1.00
  28         PC   0.000   0.003   0.006   0.008   0.011   0.014   0.017   0.019   0.022   0.025
  29         PC   0.029   0.032   0.035   0.038   0.042   0.045   0.048   0.052   0.056   0.060
  30         PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  31         PC   0.110   0.115   0.120   0.127   0.134   0.140   0.147   0.155   0.163   0.172
  32         PC   0.181   0.193   0.204   0.220   0.235   0.259   0.283   0.387   0.663   0.699
  33         PC   0.735   0.754   0.772   0.786   0.799   0.810   0.820   0.828   0.835   0.843
  34         PC   0.850   0.858   0.865   0.873   0.880   0.885   0.889   0.894   0.898   0.903
  35         PC   0.907   0.912   0.916   0.921   0.925   0.929   0.934   0.938   0.943   0.947
  36         PC   0.952   0.955   0.958   0.961   0.964   0.967   0.970   0.973   0.976   0.979
  37         PC   0.982   0.985   0.988   0.991   0.994   0.997   1.000
  38         LS       0      85      25
  39         UD   0.950
             *
             *
             *
1                                         HEC-1 INPUT                                          PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  40         KK   OFF&2
  41         KO       5
  42         HC       2       0
             *
             *
             *

  43         KK    POND
  44         RS       1    ELEV   142.0
  45         SA    1.58    1.67    1.76    1.85
  46         SE   154.0   155.0   156.0   157.0
  47         SQ       0     3.2     6.4     9.6    12.8    16.0    19.2    22.4    25.6    28.8
  48         SQ    32.0
  49         SE   154.0  154.35  154.56  154.73  154.88  155.02  155.16  155.28  155.40  155.52
  50         SE   155.6
             *
             *
             *  Basin #1

  51         KK    BAS1
  52         KO       5
  53         BA  0.0070
  54         PB    1.00
```

```
        55          PC   0.000   0.003   0.006   0.008   0.011   0.014   0.017   0.019   0.022   0.025
        56          PC   0.029   0.032   0.035   0.038   0.042   0.045   0.048   0.052   0.056   0.060
        57          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
        58          PC   0.110   0.115   0.120   0.127   0.134   0.140   0.147   0.155   0.163   0.172
        59          PC   0.181   0.193   0.204   0.220   0.235   0.259   0.283   0.387   0.663   0.699
        60          PC   0.735   0.754   0.772   0.786   0.799   0.810   0.820   0.828   0.835   0.843
        61          PC   0.850   0.858   0.865   0.873   0.880   0.885   0.889   0.894   0.898   0.903
        62          PC   0.907   0.912   0.916   0.921   0.925   0.929   0.934   0.938   0.943   0.947
        63          PC   0.952   0.955   0.958   0.961   0.964   0.967   0.970   0.973   0.976   0.979
        64          PC   0.982   0.985   0.988   0.991   0.994   0.997   1.000
        65          LS       0      85      25
        66          UD   0.750
                    *
                    *
                    *

        67          KK  BAS1&P
        68          KO       5
        69          HC       2       0
                    *
                    *
                    *
        70          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    8        OFF
              .
              .
   24         .         BAS2
              .            .
              .            .
   40      OFF&2............
              V
              V
   43        POND
              .
              .
   51         .         BAS1
              .            .
              .            .
   67      BAS1&P............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                            ****************************************
*                                       *                            *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                            *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998               *                            *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1                *                            *        609 SECOND STREET             *
*                                       *                            *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   28APR04  TIME  15:06:58   *                            *          (916) 756-1104              *
*                                       *                            *                                      *
*****************************************                            ****************************************
```

```
                    Creekside at Pembrook 36-04165-3104
                    Proposed Drainage at Northwest corner of site
                    By BLB      DATE 04-28-04

   6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          0  PRINT CONTROL
                    IPLOT          5  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                    NMIN          15  MINUTES IN COMPUTATION INTERVAL
                    IDATE    27SEP99  STARTING DATE
                    ITIME       1200  STARTING TIME
                       NQ        129  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE    28SEP99  ENDING DATE
                   NDTIME       2000  ENDING TIME
                   ICENT          19  CENTURY MARK

             COMPUTATION INTERVAL     .25 HOURS
                  TOTAL TIME BASE   32.00 HOURS

       ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT

     JP        MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS

     JR        MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                   7.80


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
   8 KK   *     OFF    *
          *            *
          **************

   9 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          5  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
  24 KK       *    BAS2    *
              *            *
              **************

  25 KO          OUTPUT CONTROL VARIABLES
                      IPRNT            5  PRINT CONTROL
                      IPLOT            5  PLOT CONTROL
                      QSCAL           0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
  40 KK       *   OFF&2    *
              *            *
              **************

  41 KO          OUTPUT CONTROL VARIABLES
                      IPRNT            5  PRINT CONTROL
                      IPLOT            5  PLOT CONTROL
                      QSCAL           0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
  43 KK       *    POND    *
              *            *
              **************

            HYDROGRAPH ROUTING DATA

  44 RS          STORAGE ROUTING
                     NSTPS            1  NUMBER OF SUBREACHES
                      ITYP         ELEV  TYPE OF INITIAL CONDITION
                    RSVRIC       142.00  INITIAL CONDITION
                         X          .00 WORKING R AND D COEFFICIENT

  45 SA               AREA        1.6       1.7       1.8       1.9

  46 SE          ELEVATION     154.00    155.00    156.00    157.00

  47 SQ          DISCHARGE         0.        3.        6.       10.       13.       16.       19.       22.       26.       29.
                                  32.

  49 SE          ELEVATION     154.00    154.35    154.56    154.73    154.88    155.02    155.16    155.28    155.40    155.52
                               155.60

                                                    ***

                                     COMPUTED STORAGE-ELEVATION DATA
```

STORAGE	.00	1.62	3.34	5.14
ELEVATION	154.00	155.00	156.00	157.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	.56	.90	1.18	1.43	1.62	1.66	1.89	2.10	2.30
OUTFLOW	.00	3.20	6.40	9.60	12.80	15.54	16.00	19.20	22.40	25.60
ELEVATION	154.00	154.35	154.56	154.73	154.88	155.00	155.02	155.16	155.28	155.40

STORAGE	2.51	2.64	3.34	5.14
OUTFLOW	28.80	32.00	48.00	88.00
ELEVATION	155.52	155.60	156.00	157.00

****

HYDROGRAPH AT STATION POND
PLAN 1, RATIO = 7.80

****

DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE
27 SEP 1200	1	0.	.0	154.0	*	27 SEP 2245	44	2.	.3	154.2	*	28 SEP 0930	87	2.	.4	154.3
27 SEP 1215	2	0.	.0	154.0	*	27 SEP 2300	45	2.	.3	154.2	*	28 SEP 0945	88	2.	.4	154.2
27 SEP 1230	3	0.	.0	154.0	*	27 SEP 2315	46	2.	.4	154.2	*	28 SEP 1000	89	2.	.4	154.2
27 SEP 1245	4	0.	.0	154.0	*	27 SEP 2330	47	3.	.4	154.3	*	28 SEP 1015	90	2.	.4	154.2
27 SEP 1300	5	0.	.0	154.0	*	27 SEP 2345	48	3.	.5	154.3	*	28 SEP 1030	91	2.	.4	154.2
27 SEP 1315	6	0.	.0	154.0	*	28 SEP 0000	49	6.	.8	154.5	*	28 SEP 1045	92	2.	.3	154.2
27 SEP 1330	7	0.	.0	154.0	*	28 SEP 0015	50	10.	1.2	154.8	*	28 SEP 1100	93	2.	.3	154.2
27 SEP 1345	8	0.	.0	154.0	*	28 SEP 0030	51	15.	1.6	155.0	*	28 SEP 1115	94	2.	.3	154.2
27 SEP 1400	9	0.	.0	154.0	*	28 SEP 0045	52	19.	1.9	155.2	*	28 SEP 1130	95	2.	.3	154.2
27 SEP 1415	10	0.	.0	154.0	*	28 SEP 0100	53	23.	2.1	155.3	*	28 SEP 1145	96	2.	.3	154.2
27 SEP 1430	11	0.	.0	154.0	*	28 SEP 0115	54	24.	2.2	155.3	*	28 SEP 1200	97	2.	.3	154.2
27 SEP 1445	12	0.	.0	154.0	*	28 SEP 0130	55	24.	2.2	155.3	*	28 SEP 1215	98	2.	.3	154.2
27 SEP 1500	13	0.	.0	154.0	*	28 SEP 0145	56	22.	2.1	155.3	*	28 SEP 1230	99	2.	.3	154.2
27 SEP 1515	14	0.	.0	154.0	*	28 SEP 0200	57	20.	2.0	155.2	*	28 SEP 1245	100	2.	.3	154.2
27 SEP 1530	15	0.	.0	154.0	*	28 SEP 0215	58	18.	1.8	155.1	*	28 SEP 1300	101	1.	.3	154.2
27 SEP 1545	16	0.	.0	154.0	*	28 SEP 0230	59	16.	1.6	155.0	*	28 SEP 1315	102	1.	.2	154.2
27 SEP 1600	17	0.	.0	154.0	*	28 SEP 0245	60	14.	1.5	154.9	*	28 SEP 1330	103	1.	.2	154.1
27 SEP 1615	18	0.	.0	154.0	*	28 SEP 0300	61	12.	1.4	154.8	*	28 SEP 1345	104	1.	.2	154.1
27 SEP 1630	19	0.	.0	154.0	*	28 SEP 0315	62	11.	1.3	154.8	*	28 SEP 1400	105	1.	.2	154.1
27 SEP 1645	20	0.	.0	154.0	*	28 SEP 0330	63	9.	1.2	154.7	*	28 SEP 1415	106	1.	.2	154.1
27 SEP 1700	21	0.	.1	154.0	*	28 SEP 0345	64	8.	1.1	154.7	*	28 SEP 1430	107	1.	.1	154.1
27 SEP 1715	22	0.	.1	154.0	*	28 SEP 0400	65	8.	1.0	154.6	*	28 SEP 1445	108	1.	.1	154.1
27 SEP 1730	23	0.	.1	154.0	*	28 SEP 0415	66	7.	.9	154.6	*	28 SEP 1500	109	1.	.1	154.1
27 SEP 1745	24	0.	.1	154.0	*	28 SEP 0430	67	6.	.9	154.5	*	28 SEP 1515	110	1.	.1	154.1
27 SEP 1800	25	0.	.1	154.0	*	28 SEP 0445	68	6.	.8	154.5	*	28 SEP 1530	111	1.	.1	154.1
27 SEP 1815	26	0.	.1	154.0	*	28 SEP 0500	69	5.	.8	154.5	*	28 SEP 1545	112	0.	.1	154.1
27 SEP 1830	27	0.	.1	154.0	*	28 SEP 0515	70	5.	.7	154.5	*	28 SEP 1600	113	0.	.1	154.0
27 SEP 1845	28	0.	.1	154.1	*	28 SEP 0530	71	4.	.7	154.4	*	28 SEP 1615	114	0.	.1	154.0
27 SEP 1900	29	1.	.1	154.1	*	28 SEP 0545	72	4.	.7	154.4	*	28 SEP 1630	115	0.	.1	154.0
27 SEP 1915	30	1.	.1	154.1	*	28 SEP 0600	73	4.	.6	154.4	*	28 SEP 1645	116	0.	.1	154.0
27 SEP 1930	31	1.	.1	154.1	*	28 SEP 0615	74	4.	.6	154.4	*	28 SEP 1700	117	0.	.0	154.0
27 SEP 1945	32	1.	.1	154.1	*	28 SEP 0630	75	3.	.6	154.4	*	28 SEP 1715	118	0.	.0	154.0
27 SEP 2000	33	1.	.1	154.1	*	28 SEP 0645	76	3.	.5	154.3	*	28 SEP 1730	119	0.	.0	154.0
27 SEP 2015	34	1.	.1	154.1	*	28 SEP 0700	77	3.	.5	154.3	*	28 SEP 1745	120	0.	.0	154.0
27 SEP 2030	35	1.	.1	154.1	*	28 SEP 0715	78	3.	.5	154.3	*	28 SEP 1800	121	0.	.0	154.0
27 SEP 2045	36	1.	.2	154.1	*	28 SEP 0730	79	3.	.5	154.3	*	28 SEP 1815	122	0.	.0	154.0
27 SEP 2100	37	1.	.2	154.1	*	28 SEP 0745	80	3.	.5	154.3	*	28 SEP 1830	123	0.	.0	154.0
27 SEP 2115	38	1.	.2	154.1	*	28 SEP 0800	81	3.	.5	154.3	*	28 SEP 1845	124	0.	.0	154.0

27 SEP 2130	39	1.	.2	154.1	*	28 SEP 0815	82	3.	.5	154.3	*	28 SEP 1900	125	0.	.0	154.0
27 SEP 2145	40	1.	.2	154.1	*	28 SEP 0830	83	3.	.5	154.3	*	28 SEP 1915	126	0.	.0	154.0
27 SEP 2200	41	1.	.2	154.1	*	28 SEP 0845	84	3.	.4	154.3	*	28 SEP 1930	127	0.	.0	154.0
27 SEP 2215	42	1.	.3	154.2	*	28 SEP 0900	85	2.	.4	154.3	*	28 SEP 1945	128	0.	.0	154.0
27 SEP 2230	43	2.	.3	154.2	*	28 SEP 0915	86	2.	.4	154.3	*	28 SEP 2000	129	0.	.0	154.0
					*						*					

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	32.00-HR
+ (CFS)	(HR)					
		(CFS)				
+ 24.	13.25		12.	4.	3.	3.
		(INCHES)	4.533	6.208	6.275	6.275
		(AC-FT)	6.	8.	8.	8.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	32.00-HR
+ (AC-FT)	(HR)				
2.	13.25	1.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	32.00-HR
+ (FEET)	(HR)				
155.34	13.25	154.83	154.33	154.25	154.25

CUMULATIVE AREA = .03 SQ MI

*** ***

```
         **************
         *            *
 51 KK   *     BAS1   *
         *            *
         **************

 52 KO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          5  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE
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*** ***

```
         **************
         *            *
 67 KK   *   BAS1&P   *
         *            *
         **************

 68 KO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          5  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE
```

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 7.80
HYDROGRAPH AT					
+	OFF	.01	1	FLOW	17.
				TIME	12.00
HYDROGRAPH AT					
+	BAS2	.02	1	FLOW	29.
				TIME	12.75
2 COMBINED AT					
+	OFF&2	.03	1	FLOW	32.
				TIME	12.75
ROUTED TO					
+	POND	.03	1	FLOW	24.
				TIME	13.25
			** PEAK STAGES IN FEET **		
			1	STAGE	155.34
				TIME	13.25
HYDROGRAPH AT					
+	BAS1	.01	1	FLOW	12.
				TIME	12.50
2 COMBINED AT					
+	BAS1&P	.03	1	FLOW	32.
				TIME	13.00

*** NORMAL END OF HEC-1 ***

```
100 j,  149.0000  100    1   12    11
110 t,Creekside at Pembrook SWS Line #1
120 i,  160      0.00      0.00      0.00      0.00      1.60     15.00    158.72
130 i,  150      0.00      0.00      0.00      0.00      1.36     15.00    158.72
140 i,  140      0.00      0.00      0.00      0.00      1.66     15.00    158.00
150 i,  130      0.00      0.00      0.00      0.00      1.02     15.00    158.00
160 i,  125      0.00      0.00      0.00      0.00      0.83     15.00    161.62
170 i,  124      0.00      0.00      0.00      0.00      0.69     15.00    161.62
180 i,  123      0.00      0.00      0.00      0.00      1.69     15.00    158.00
190 i,  122      0.00      0.00      0.00      0.00      1.00     15.00    158.00
200 i,  120      0.00      0.00      0.00      0.00      1.85     15.00    158.72
210 i,  110      0.00      0.00      0.00      0.00      1.26     15.00    158.72
220 m,  121    162.26
230 m,  100    149.00
240 p,  160  150     30.00    15 0.013    0.00    0.00
250 p,  150  140    130.00    15 0.013    0.00    0.00
260 p,  140  130    170.00    15 0.013    0.00    0.00
270 p,  130  120    100.00    15 0.013    0.00    0.00
280 p,  125  124     30.00    15 0.013    0.00    0.00
290 p,  124  123    125.00    15 0.013   90.00    0.00
300 p,  123  122    170.00    15 0.013    0.00    0.00
310 p,  122  121     75.00    15 0.013   75.00    0.00
320 p,  121  120    320.00    15 0.013   75.00    0.00
330 p,  120  110     30.00    24 0.013   45.00    0.00
340 p,  110  100    120.00    24 0.013    0.00    0.00
350 e
```

STORM11.OUT

Date: 04-29-2004
Time: 11:57:49

Creekside at Pembrook SWS Line #1

Input File: c:\storm\sws1

Storm Frequency = 2-Year

* * * H Y D R O L O G Y * * *

Node	to Node	Tributary Area							Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
160	150	.00	.00	.00	.0	15.00	3.83	1.60	15.00	3.83	1.60	1.60	15"	1.30	30.00	.38	15.38
150	140	.00	.00	.00	.0	15.00	3.83	1.36	15.38	3.78	1.34	2.94	15"	2.40	130.00	.90	16.29
140	130	.00	.00	.00	.0	15.00	3.83	1.66	16.29	3.69	1.60	4.54	15"	3.70	170.00	.77	17.05
130	120	.00	.00	.00	.0	15.00	3.83	1.02	17.05	3.61	.96	5.50	15"	4.48	100.00	.37	17.42
125	124	.00	.00	.00	.0	15.00	3.83	.83	15.00	3.83	.83	.83	15"	.68	30.00	.74	15.74
124	123	.00	.00	.00	.0	15.00	3.83	.69	15.74	3.75	.67	1.50	15"	1.23	125.00	1.70	17.44
123	122	.00	.00	.00	.0	15.00	3.83	1.69	17.44	3.57	1.58	3.08	15"	2.51	170.00	1.13	18.57
122	121	.00	.00	.00	.0	15.00	3.83	1.00	18.57	3.46	.90	3.98	15"	3.25	75.00	.39	18.95
121	120	.00	.00	.00	.0	.00	.00	.00	18.95	3.43	.00	3.98	15"	3.25	320.00	1.64	20.59
120	110	.00	.00	.00	.0	15.00	3.83	1.85	20.59	3.28	1.59	10.63	24"	3.39	30.00	.15	20.74
110	100	.00	.00	.00	.0	15.00	3.83	1.26	20.74	3.27	1.08	11.71	24"	3.73	120.00	.54	21.28

Input File: c:\storm\sws1

Date: 04-29-2004
Time: 11:57:49

Creekside at Pembrook SWS Line #1

Storm Frequency = 2-Year

* * * H Y D R A U L I C S * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
160	.00061	.0184	.0000	.0000	.0000	.0000	.0000	.0184	152.1940	158.7200	6.53
150	.00208	.2701	.0000	.0063	.0000	.0000	.1330	.4094	152.1756	158.7200	6.54
140	.00495	.8407	.0000	.0123	.0000	.0000	.2648	1.1179	151.7663	158.0000	6.23
130	.00726	.7259	.0000	.0100	.0000	.0000	.2300	.9658	150.6484	158.0000	7.35
125	.00017	.0050	.0000	.0000	.0000	.0000	.0000	.0050	152.1023	161.6200	9.52
124	.00054	.0678	.0000	.0016	.0000	.0000	.0343	.1038	152.0974	161.6200	9.52
123	.00227	.3865	.0000	.0074	.0000	.0117	.1563	.5619	151.9936	158.0000	6.01
122	.00380	.2853	.0000	.0066	.0000	.0000	.1471	.4390	151.4317	158.0000	6.57
120	.00221	.0663	.0000	.0269	.0000	.0000	.1372	.2303	149.6825	158.7200	9.04
110	.00268	.3216	.0000	.0038	.0000	.0387	.0881	.4522	149.4522	158.7200	9.27
121	.00380	1.2172	.0000	.0000	.0082	.0657	.0191	1.3102	150.9927	162.2600	11.27
100	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	149.0000	149.0000	.00

County	Expected 24-hour Storm Rainfall in Inches — Storm Frequency in Years: 100	50	25	10	5	2	Normal Annual Precipitation Inches
Pawnee	6.6	6.0	5.2	4.5	3.7	2.8	23.3
Phillips	6.0	5.5	4.8	4.1	3.4	2.5	23.6
Pottawatomie	7.5	6.6	5.9	5.1	4.3	3.4	33.6
Pratt	7.2	6.4	5.6	4.8	4.1	3.0	24.6
Rawlins	5.5	5.0	4.3	3.6	3.1	2.3	21.0
Reno	7.4	6.6	5.8	5.0	4.2	3.2	27.7
Republic	6.8	6.0	5.4	4.6	3.9	2.9	28.6
Rice	7.3	6.4	5.6	4.8	4.1	3.0	26.6
Riley	7.4	6.5	5.8	5.1	4.3	3.3	33.5
Rooks	6.1	5.7	4.9	4.1	3.4	2.5	23.9
Rush	6.5	5.9	5.0	4.3	3.6	2.7	23.3
Russell	6.7	5.9	5.2	4.4	3.7	2.8	26.8
Saline	7.3	6.4	5.7	4.9	4.1	3.1	28.4
Scott	5.7	5.3	4.5	3.8	3.2	2.4	20.2
Sedgwick	7.8	7.0	6.1	5.3	4.5	3.5	30.6
Seward	6.0	5.7	4.8	4.2	3.5	2.6	19.8
Shawnee	7.8	6.8	6.1	5.3	4.5	3.5	34.7
Sheridan	5.7	5.3	4.5	3.8	3.2	2.4	21.3
Sherman	5.3	4.8	4.2	3.5	3.0	2.2	16.7
Smith	6.3	5.7	5.0	4.2	3.5	2.6	24.4
Stafford	7.1	6.2	5.5	4.7	4.0	2.9	25.1
Stanton	5.6	5.2	4.5	3.8	3.2	2.4	15.8
Stevens	5.9	5.5	4.7	4.1	3.4	2.5	19.7
Sumner	8.0	7.1	6.2	5.4	4.6	3.6	34.0

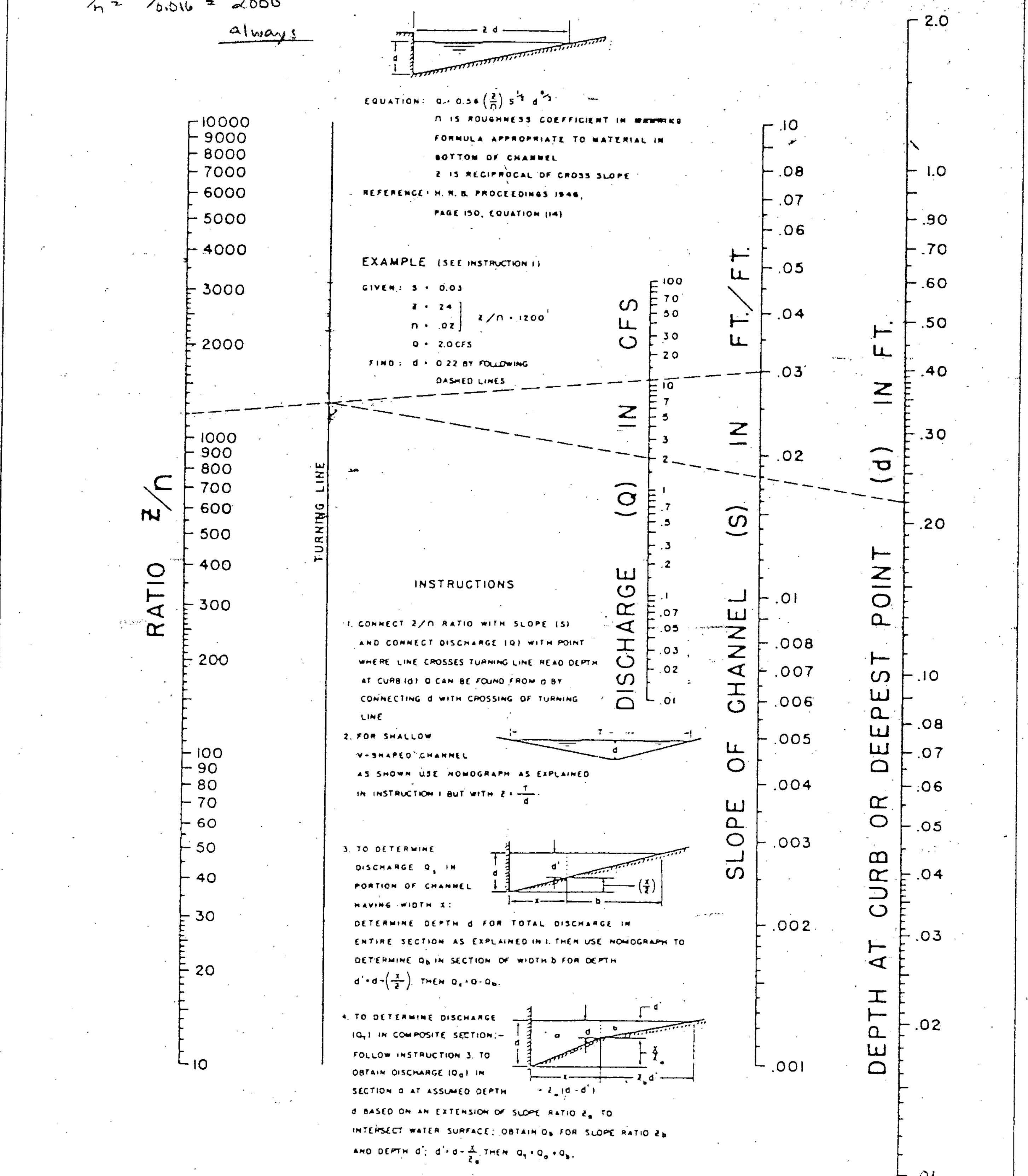
X-slope = 3/8"/ft = 0.03125%

z = 1/x-slope = 1/0.03125 = 32

n = 0.016

z/n = 32/0.016 = 2000

always



BUREAU OF PUBLIC ROADS
REV. JAN. 1968

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

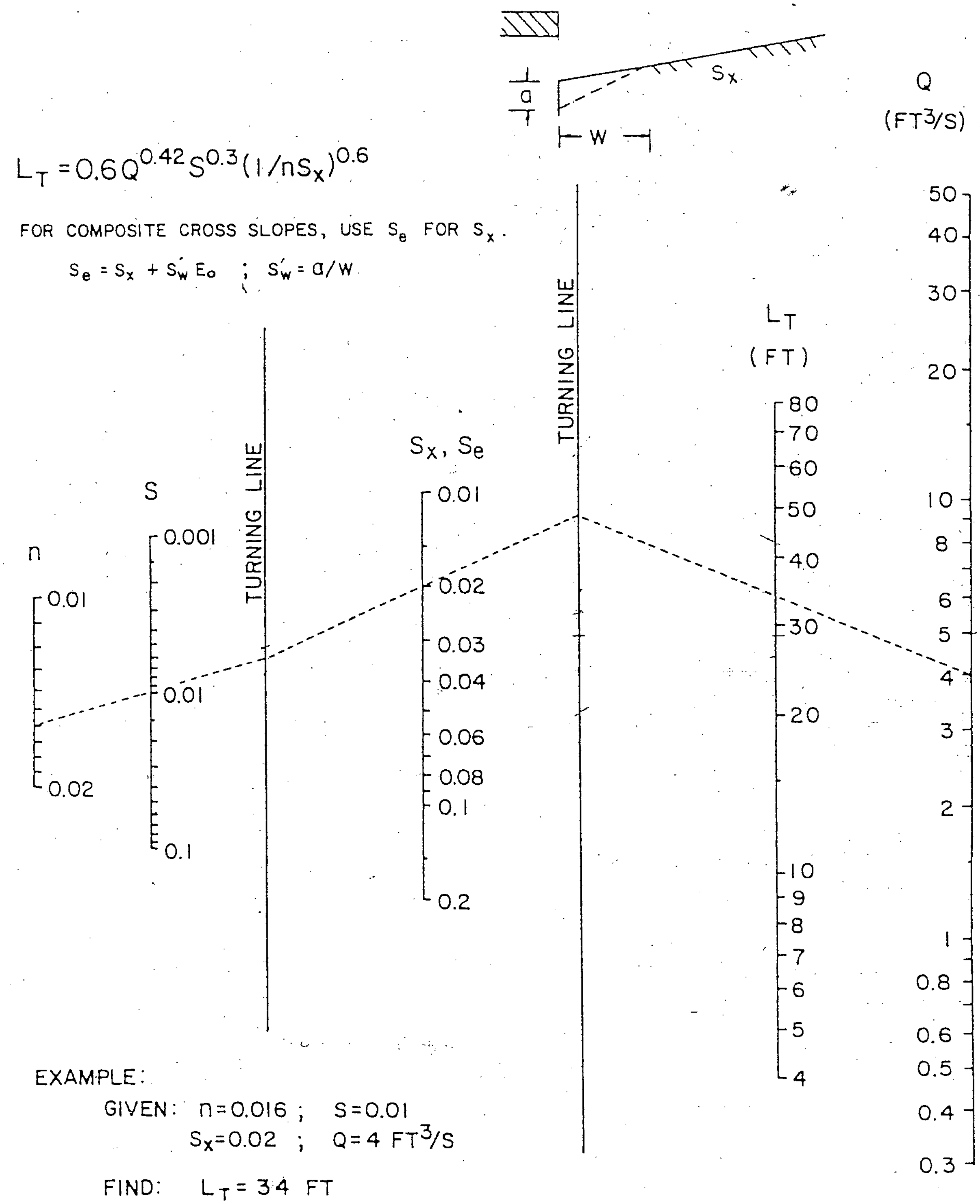


CHART 9. Curb–opening and slotted drain inlet length for total interception.

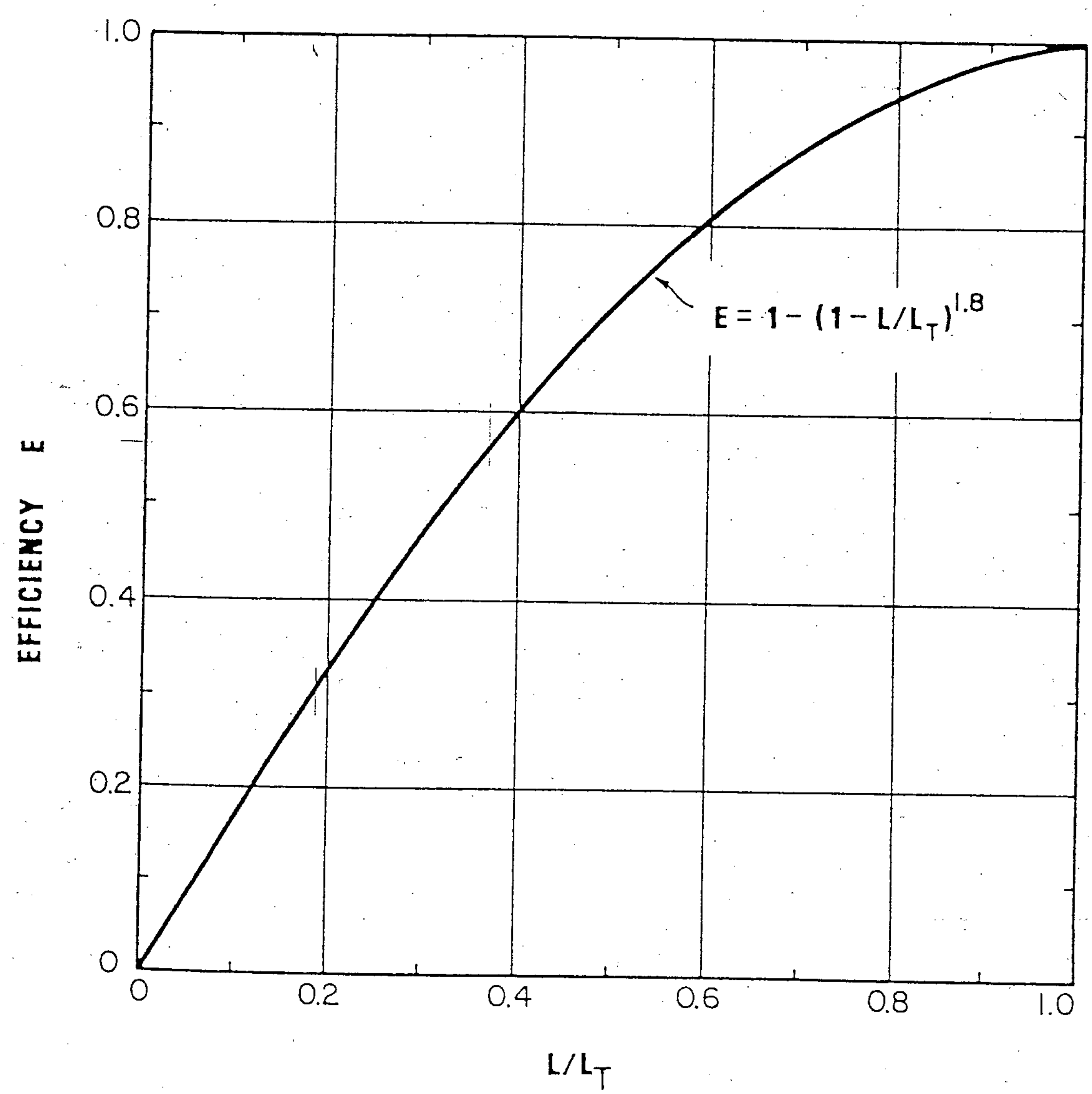


CHART 10. Curb–opening and slotted drain inlet interception efficiency.

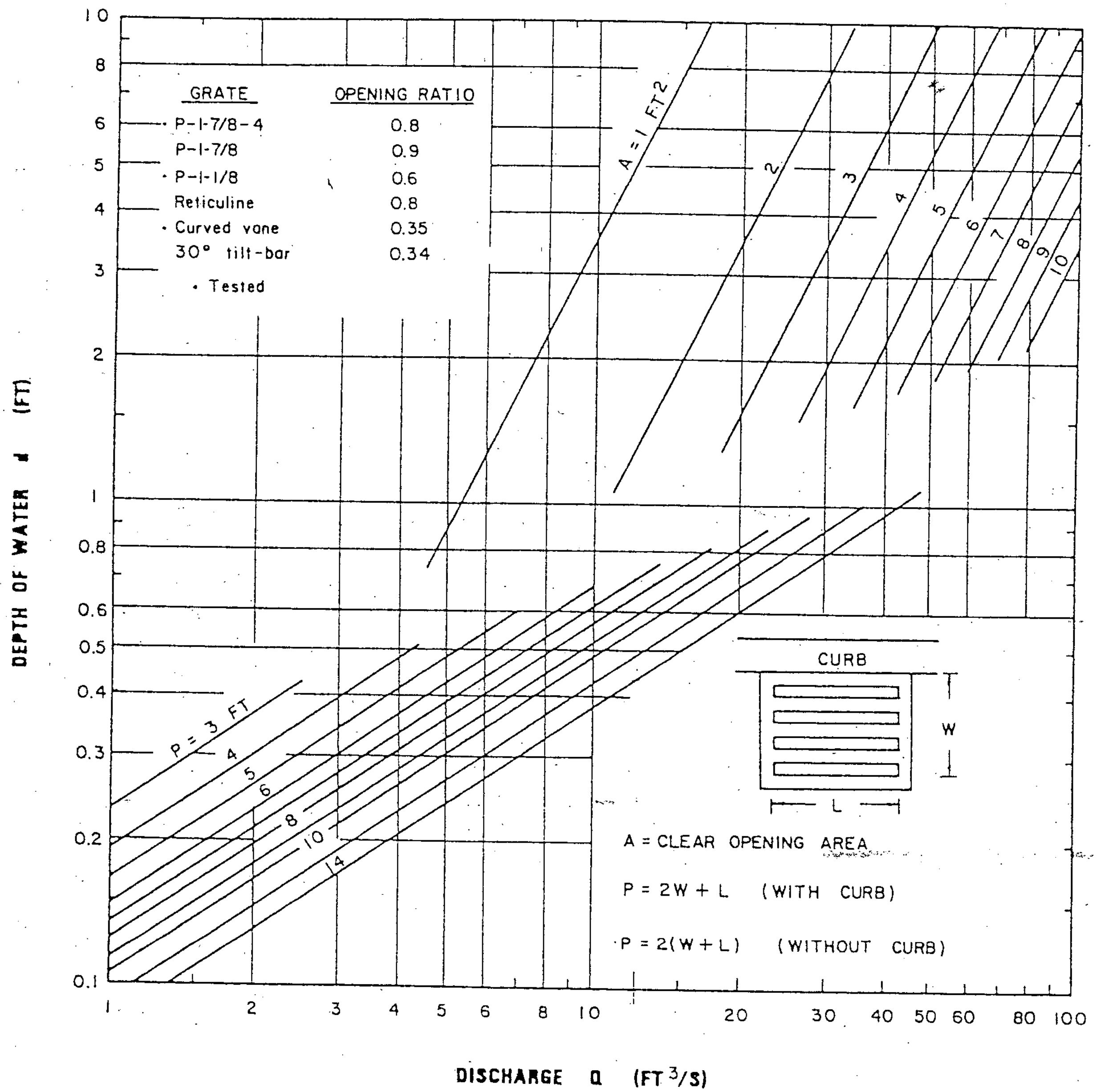


CHART 11. Grate inlet capacity in sump conditions.

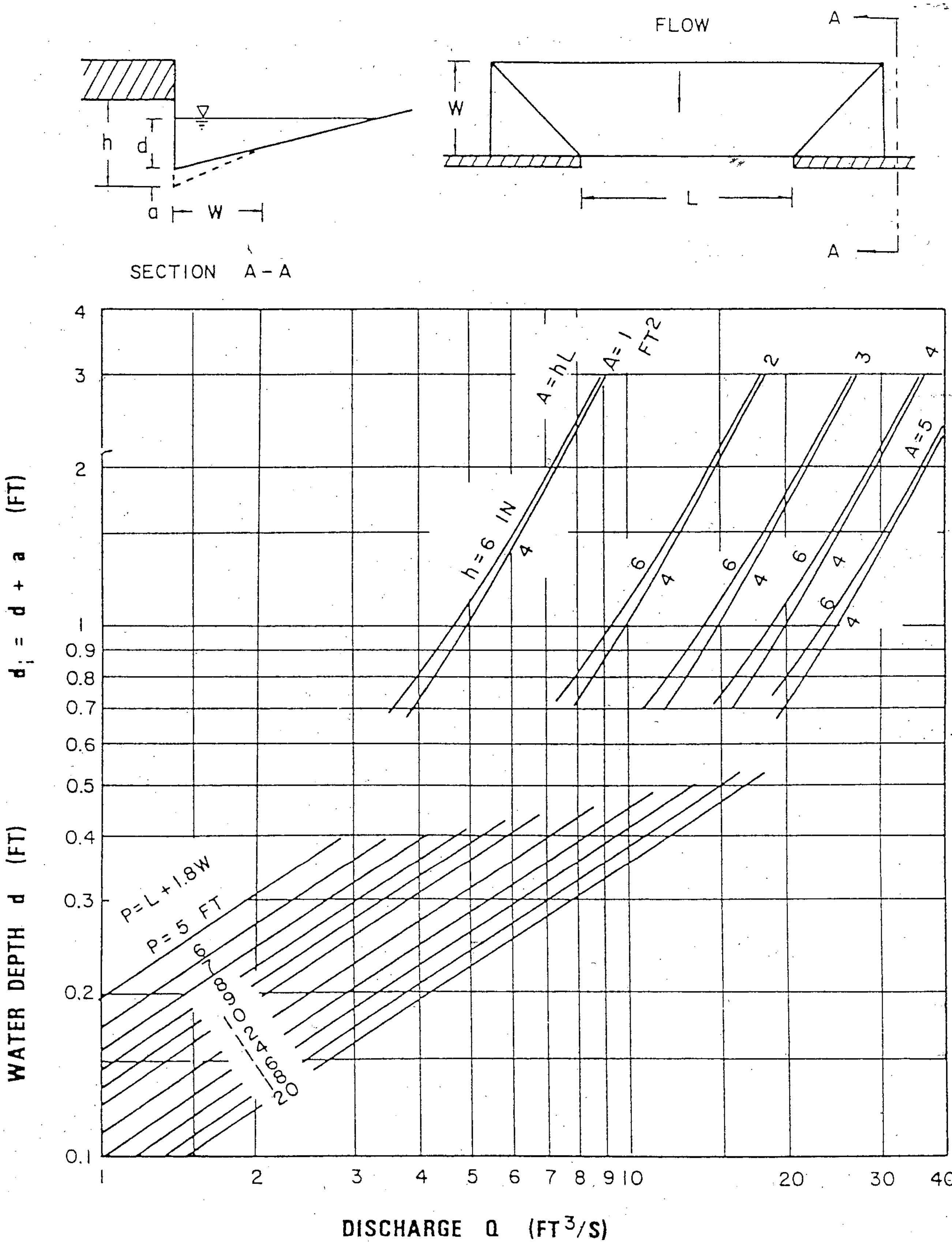


CHART 12. Depressed curb–opening inlet capacity in sump locations.

April 15, 1986

ATTACHMENT A
DRAINAGE CRITERIA MANUAL

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

(t_c) DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	i = 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

DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
91	1.00	1.23	1.65	1.92	2.24	2.57	2.86
92	1.00	1.22	1.63	1.90	2.22	2.55	2.83
93	0.99	1.21	1.62	1.89	2.20	2.53	2.81
94	0.98	1.20	1.61	1.87	2.19	2.51	2.79
95	0.97	1.19	1.59	1.85	2.17	2.49	2.76
96	0.96	1.18	1.58	1.84	2.15	2.46	2.74
97	0.96	1.17	1.57	1.82	2.13	2.44	2.72
98	0.95	1.16	1.56	1.81	2.12	2.42	2.70
99	0.94	1.15	1.54	1.80	2.10	2.41	2.67
100	0.93	1.14	1.53	1.78	2.08	2.39	2.65
101	0.93	1.13	1.52	1.77	2.07	2.39	2.65
102	0.92	1.13	1.51	1.75	2.05	2.35	2.61
103	0.91	1.12	1.50	1.74	2.04	2.33	2.59
104	0.90	1.11	1.49	1.73	2.02	2.31	2.57
105	0.90	1.10	1.47	1.72	2.01	2.30	2.55
106	0.89	1.09	1.46	1.70	1.99	2.28	2.54
107	0.88	1.09	1.45	1.69	1.98	2.26	2.52
108	0.88	1.08	1.44	1.68	1.96	2.25	2.50
109	0.87	1.07	1.43	1.67	1.95	2.23	2.48
110	0.87	1.06	1.42	1.65	1.93	2.21	2.46
111	0.86	1.06	1.41	1.64	1.92	2.20	2.45
112	0.85	1.05	1.40	1.63	1.91	2.18	2.43
113	0.85	1.04	1.39	1.62	1.89	2.17	2.41
114	0.84	1.03	1.38	1.61	1.88	2.15	2.40
115	0.84	1.03	1.37	1.60	1.87	2.14	2.38
116	0.83	1.02	1.36	1.59	1.86	2.12	2.36
117	0.82	1.01	1.36	1.58	1.84	2.11	2.35
118	0.82	1.01	1.35	1.57	1.83	2.09	2.33
119	0.81	1.00	1.34	1.56	1.82	2.08	2.32
120	0.81	0.99	1.33	1.55	1.81	2.07	2.30

DURATION IN HOURS	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
2	0.81	0.99	1.33	1.55	1.81	2.07	2.30
3	0.59	0.72	0.97	1.13	1.32	1.51	1.68
4	0.47	0.58	0.78	0.91	1.06	1.21	1.35
5	0.40	0.49	0.66	0.77	0.89	1.02	1.14
6	0.35	0.42	0.57	0.67	0.78	0.89	0.99
8	0.28	0.34	0.46	0.53	0.62	0.71	0.79
10	0.23	0.29	0.39	0.45	0.52	0.60	0.67
12	0.20	0.25	0.33	0.39	0.45	0.52	0.58
18	0.15	0.18	0.24	0.28	0.33	0.38	0.42
24	0.12	0.15	0.20	0.23	0.27	0.31	0.34

ATTACHMENT B

DRAINAGE CRITERIA MANUAL

INCREMENTAL INFILTRATION VALUES IN INCHES

Time Minutes**	SCS Hydrologic Soil Group A	B	C	D
5	.33	.26	.19	.12
10	.25	.17	.09	.04
15	.18	.11	.05	.02
20	.13	.07	.03	.02
25	.10	.05	.03	.02
30	.08	.05	.03	.02
35	.08	.05	.03	.02
40	.08	.05	.03	.02
45	.08	.05	.03	.02
50	.08	.05	.03	.02
55	.08	.05	.03	.02
60	.08	.05	.03	.02
65	.08	.05	.03	.02
70	.08	.05	.03	.02
75	.08	.05	.03	.02
80	.08	.05	.03	.02
85	.08	.05	.03	.02
90	.08	.05	.03	.02
95	.08	.05	.03	.02
100	.08	.05	.03	.02
105	.08	.05	.03	.02
110	.08	.05	.03	.02
115	.08	.05	.03	.02
120	.08	.05	.03	.02

**Time at end of the time increment

NOTE: Values for 125 minutes and additional 5 minute increments shall be the same as those shown for 120 minutes.

ATTACHMENT C

DRAINAGE CITERIA MANUAL

DEPRESSION STORAGE LOSSES

Surface Type	Total Loss (Inches)
Impervious:	
Paved Areas	0.1
Flat Roofs	0.1
Sloped Roofs	0.05
Pervious:	
Lawns and Grass	0.3
Wooded Areas and Open Fields	0.4

(3 pages)

ATTACHMENT D

DRAINAGE CRITERIA

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

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
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:					
Single Family (Soil Group D)					
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
Multi-Family (Soil Group D)					
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
Single Family (Soil Group C)					
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
Multi-Family (Soil Group C)					
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
Single-Family (Soil Group B)					
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
Multi-Family (Soil Group B)					
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 rface Characteristics	Percent Impervious	Frequency 2	5	10	100
Single Family (Soil Group A)					
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
Multi-Family (Soil Group A)					
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):					
Soil Group A					
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
Soil Group B					
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
Soil Group C					
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

Land Use or rface Characteristics	Percent Impervious	Frequency 2	5	10	100
Soil Group D					
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.

ATTACHMENT E

DRAINAGE CRITERIA

AVERAGE OVERLAND FLOW VELOCITY FOR USE WITH URBANIZED AREAS

Surface Type	VELOCITY IN FEET/SECOND FOR SLOPES IN PERCENT SHOWN																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	20.0
Forest with Heavy Ground Litter or Meadow	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.16	0.21	0.28	0.33	0.39	0.46	0.53	0.60	0.72	1.10
Fallow or Minimum Tillage Cultivation	0.06	0.08	0.10	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.29	0.40	0.51	0.66	0.78	0.91	1.05	1.20	1.44	2.10
Short Grass Pasture or Lawns	0.09	0.13	0.15	0.18	0.20	0.21	0.23	0.25	0.26	0.28	0.45	0.60	0.77	0.96	1.17	1.33	1.50	1.68	1.98	3.20
Almost Bare Ground	0.16	0.22	0.28	0.31	0.35	0.38	0.41	0.44	0.46	0.49	0.70	0.85	1.05	1.26	1.50	1.75	2.03	2.32	2.79	4.40
Grassed Waterway	0.35	0.48	0.58	0.67	0.77	0.84	0.91	0.98	1.05	1.12	1.54	1.82	2.10	2.38	2.78	3.20	3.66	4.14	4.56	7.00
Paved Areas (Sheet Flow) or Shallow Gutter Flow	0.44	0.62	0.77	0.91	1.05	1.12	1.19	1.26	1.33	1.40	2.00	2.55	3.20	3.83	4.41	5.04	5.70	6.00	6.20	9.00

ATTACHMENT F

DETERMINATION OF DIMENSIONLESS WATERSHED CONVEYANCE FACTOR (ϕ)

$$\phi = \phi_1 + \phi_2$$

ϕ_1	Classification
0.6	Extensive channel improvement and storm sewer system, closed conduit channel system
0.7	Moderate channel improvement and storm sewer system.
0.8	Some channel improvement and storm sewers, mainly cleaning and enlargement of existing channel.
0.9	Little channel improvement and storm sewers.
1.0	Natural channel conditions.

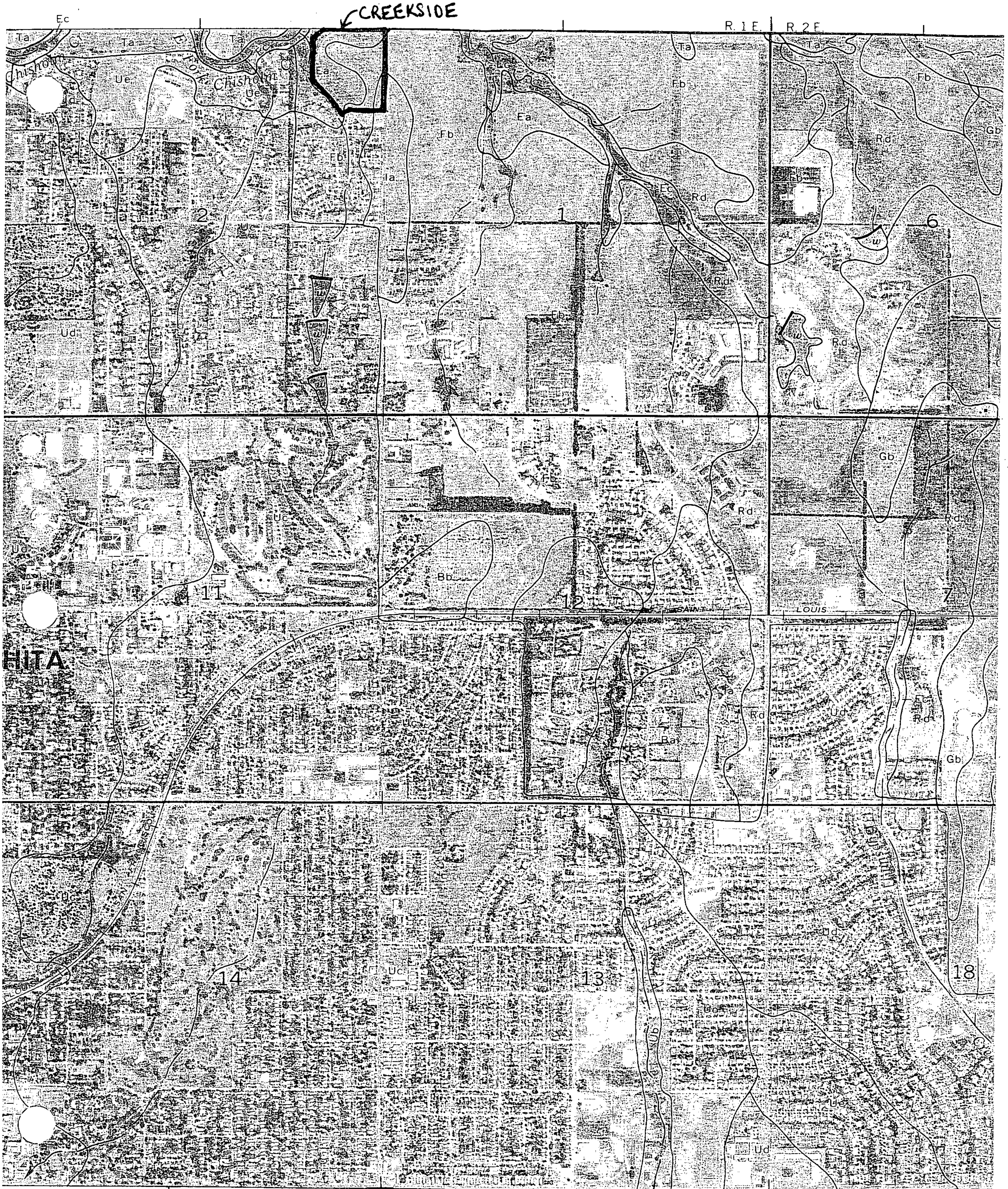
ϕ_2	Classification
0.0	No channel vegetation.
0.1	Light channel vegetation.
0.2	Moderate channel vegetation.
0.3	Heavy channel vegetation.

EXHIBIT NO. 1

SOIL LEGEND

SYMBOL	HYDROLOGIC GROUP	NAME
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loans, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loan, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loan
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 lopes
Wa	C	Waldeck sandy loam

SEDGWICK COUNTY, KANSAS — SHEET NUMBER 35



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7th Floor City Hall
455 N. Main
Wichita,Ks. 67202

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PROJECT: Creekside at Pembrook

ATTENTION: Vicky Huang

DATE: 6/28/04

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