Professional Engineering Consultants, P.A.
303 S. TOPEKA ▪ WICHITA, KANSAS 67202 ▪ 316-262-2691 ▪ FAX 316-262-3003 ▪ www.pec1.com ▪ designers@pec1.com

Messiah Lutheran Church
Wichita, Sedgwick County, Kansas
10/24/00

Messiah Lutheran Church is an existing church on approximately 4.7 acres in the city of Wichita. It is in a completely developed neighborhood, with existing streets on three sides and residential homes to the south.

Hydrology

The proposed plat lies in the SE ¼, NE ¼, NE ¼, Section 16, T27S, R1W. The existing landscape is mostly turf with an existing church and a small parking lot. There are some trees around the building and along the western property lines.

Most of the site drains to the southeast to an existing drainage flume into Ridge Road. Since the site is developed, the existing flume will remain and the existing drainage patterns will be maintained. This includes draining a portion of the site to the adjacent streets.

Due to the developed nature of this site, only existing drainage calculations were done and it was assumed that the flume into Ridge Road was handling the runoff.

Runoff coefficients were estimated based on tables presented in the Design Aids section and existing land use. A map showing the basin boundaries and drainage calculations are included.

The analysis made is based on the available site data which includes the following: 1" = 50' topographic map with 0.5' contours of the site and adjacent areas, Sedgwick County Soil Survey Map and references noted herein.

Design Aids

This section includes material used to assist in designing the drainage system. A 1"=50' scale drainage plan map is enclosed in the pocket.

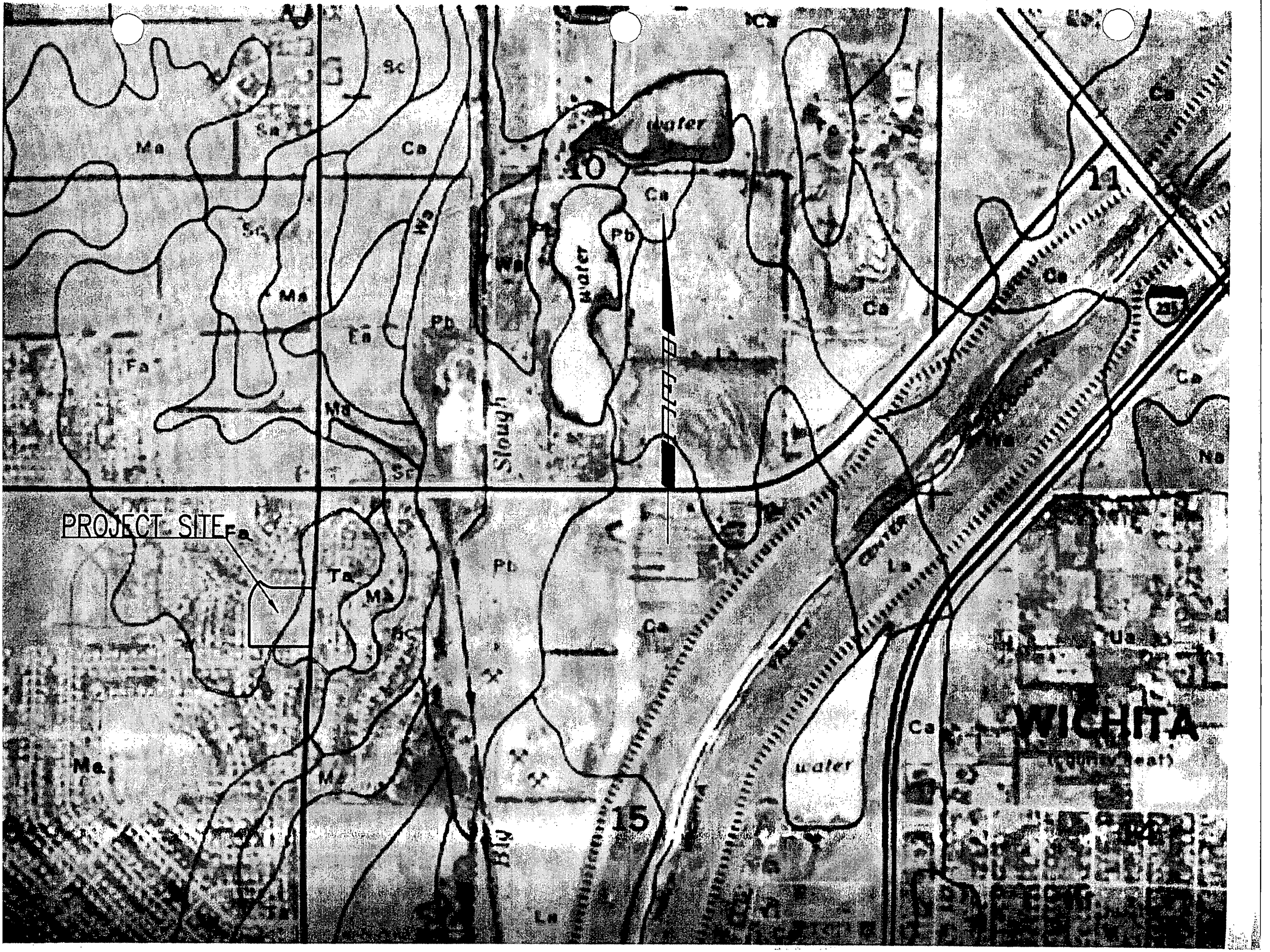
References

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 SITE
WICHITA
water
water
water
Slough
Big
10
11
15
Ca
Ma
Sc
Sa
Sr
Pb
Ea
Fa
Wa
Ta
Md
Na
La

Messiah Church 36-00550-5073

Location: SE¼, NE¼, NE¼ Sec 16 T27S, R1W

West of Ridge Rd, between Central & 13th St.

Existing Conditions:

An existing church & parking lot with some trees and the rest turf area.

Most of the site drains to an existing metal drainage structure in the south east corner of the property. The rest drains to Ridge Rd, 12th St. N or Brunswick Lane.

Soils found on this plat are: Farnum Loam, 0-1% slopes, well drained, hydrologic class "B"

Fa-

Ta - Tabler silty clay loam, nearly level, moderately well drained, hydrologic class "D"

Total area of plat = 4.66 acres

"B" Soil area = 3.0 acres

"D" Soil area = 1.66 acres

Time of Concentration = 16 minutes

$$t_c = \frac{\text{distance}}{\text{velocity}} = \frac{475 \text{ feet}}{0.5 \text{ ft/sec}} = 16 \text{ minutes}$$

$i_2 = 3.69$ in/hr
$i_5 = 4.49$ in/hr
$i_{10} = 5.07$ in/hr
$i_{100} = 7.21$ in/hr

Existing Conditions

Assume 12% impervious, residential

0.6 acres impervious
out of 4.66 total acres = 12% impervious
→ Use City of Wichita Drainage Criteria

Soil Group B	Soil Group D
less than 1%	less than 1%
$C_2 = 0.16$	$C_2 = 0.28$
$C_5 = 0.18$	$C_5 = 0.33$
$C_{10} = 0.24$	$C_{10} = 0.43$
$C_{100} = 0.37$	$C_{100} = 0.63$

Impervious Area (12%)

$C_2 = 0.87$
$C_5 = 0.88$
$C_{10} = 0.90$
$C_{100} = 0.93$

Basin A

Drainage basin that is directed to metal drainage structure under Ridge Rd including a portion of the residential lots to the south. (Backyards)

Area = 4.01 acres

"B" soil area = 2.04 acres

"D" soil area = 1.97 acres

Runoff Coefficients

$C_2 = (0.88)[2.04ac(0.16) + (1.97ac(0.28))]/4.01] + (0.12)(0.87) = 0.30$

$C_5 = (0.88)((2.04ac(0.18) + 1.97ac(0.33))/4.01) + (0.12)(0.88) = 0.33$

$C_{10} = (0.88)((2.04(0.24) + 1.97(0.43))/4.01) + (0.12)(0.90) = 0.40$

$C_{100} = (0.88)((2.04(0.37) + 1.97(0.63))/4.01) + (0.12)(0.93) = 0.55$

$Q = C \cdot i \cdot A$ (Rational Method)

$Q_2 = (0.30)(3.69\ in/hr)(4.01\ acres) = 4.4\ cfs$

$Q_5 = (0.33)(4.49\ in/hr)(4.01\ acres) = 5.9\ cfs$

$Q_{10} = (0.40)(5.07\ in/hr)(4.01\ acres) = 8.1\ cfs$

$Q_{100} = (0.55)(7.21\ in/hr)(4.01\ acres) = 15.9\ cfs$

The remaining plat area drains to one of the adjacent streets.

ATTACHMENT E

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

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
Forrest with Heavy Ground Litter or Meadow	0.08	0.11	0.14	0.16	0.18	0.19	0.20	0.22	0.23	0.25	0.35	0.42	0.50	0.55	0.60	0.66	0.70	0.75	0.80	1.10
Fallow or Minimum Tillage Cultivation	0.15	0.21	0.26	0.29	0.33	0.35	0.39	0.41	0.44	0.46	0.65	0.80	0.92	1.10	1.20	1.30	1.40	1.50	1.60	2.10
Short Grass Pasture or Lawns	0.23	0.32	0.38	0.44	0.50	0.53	0.58	0.62	0.66	0.70	1.00	1.20	1.40	1.60	1.80	1.90	2.00	2.10	2.20	3.20
Almost Bare Ground	0.32	0.44	0.53	0.62	0.69	0.75	0.82	0.87	0.92	0.98	1.40	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	4.40
Grassed Waterway	0.50	0.68	0.83	0.95	1.10	1.20	1.30	1.40	1.50	1.60	2.20	2.60	3.00	3.40	3.70	4.00	4.30	4.60	4.80	7.00
Paved Areas (Sheet Flow) or Shallow Gutter Flow	0.63	0.89	1.10	1.30	1.50	1.60	1.70	1.80	1.90	2.00	2.80	3.40	4.00	4.50	4.90	5.30	5.70	6.00	6.20	9.00

(3 pages)

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 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 Surface Characteristics	Percent Impervious	Frequency 2	5	10	25	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
Railroad Yard Areas:	30	0.43	0.45	0.50		0.62
7. 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 0.26	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	0.40	0.53
Slope more than 4%.	00	0.28	0.31	0.39		0.55

Land Use or Surface 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 large basins.

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY KANSAS
(revised June 1997)

This table contains average rainfall intensities in inches per hour.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:05	4.91	5.64	6.64	7.38	8.48	9.34	10.20
0:06	4.62	5.34	6.33	7.07	8.15	9.00	9.84
0:07	4.38	5.09	6.08	6.80	7.86	8.69	9.52
0:08	4.17	4.87	5.85	6.56	7.60	8.41	9.22
0:09	4.00	4.68	5.63	6.33	7.34	8.14	8.93
0:10	3.84	4.50	5.43	6.11	7.10	7.87	8.64
0:11	3.70	4.34	5.25	5.90	6.86	7.61	8.36
0:12	3.56	4.19	5.07	5.71	6.64	7.36	8.09
0:13	3.44	4.05	4.91	5.53	6.43	7.14	7.84
0:14	3.33	3.92	4.76	5.36	6.24	6.92	7.61
0:15	3.22	3.80	4.62	5.21	6.06	6.73	7.40
0:16	3.12	3.69	4.49	5.07	5.91	6.56	7.21
0:17	3.03	3.58	4.37	4.94	5.76	6.40	7.04
0:18	2.94	3.48	4.26	4.82	5.63	6.26	6.88
0:19	2.85	3.39	4.16	4.71	5.50	6.12	6.74
0:20	2.77	3.30	4.06	4.60	5.38	5.99	6.60
0:21	2.70	3.22	3.97	4.50	5.27	5.87	6.47
0:22	2.63	3.14	3.88	4.41	5.17	5.76	6.35
0:23	2.56	3.07	3.80	4.32	5.07	5.65	6.23
0:24	2.50	3.00	3.72	4.23	4.97	5.54	6.12
0:25	2.44	2.93	3.64	4.15	4.88	5.44	6.01
0:26	2.38	2.87	3.57	4.07	4.79	5.35	5.90
0:27	2.33	2.81	3.50	4.00	4.70	5.26	5.80
0:28	2.27	2.75	3.44	3.92	4.62	5.17	5.71
0:29	2.23	2.69	3.37	3.86	4.54	5.08	5.61
0:30	2.18	2.64	3.31	3.79	4.47	4.99	5.52
0:31	2.14	2.59	3.26	3.72	4.39	4.91	5.43
0:32	2.09	2.54	3.20	3.66	4.32	4.83	5.34
0:33	2.05	2.50	3.14	3.60	4.25	4.76	5.26
0:34	2.02	2.45	3.09	3.54	4.18	4.68	5.18
0:35	1.98	2.41	3.04	3.48	4.12	4.61	5.10
0:36	1.94	2.37	2.99	3.43	4.05	4.54	5.02
0:37	1.91	2.33	2.94	3.38	3.99	4.47	4.95
0:38	1.88	2.29	2.90	3.32	3.93	4.40	4.87
0:39	1.85	2.25	2.85	3.27	3.87	4.34	4.80
0:40	1.82	2.22	2.81	3.23	3.82	4.28	4.73
0:41	1.79	2.18	2.77	3.18	3.76	4.22	4.67
0:42	1.76	2.15	2.73	3.13	3.71	4.16	4.60
0:43	1.73	2.12	2.69	3.09	3.66	4.10	4.54
0:44	1.71	2.09	2.65	3.05	3.61	4.04	4.48
0:45	1.68	2.06	2.62	3.01	3.56	3.99	4.42
0:46	1.66	2.03	2.58	2.96	3.51	3.94	4.36
0:47	1.63	2.00	2.55	2.93	3.47	3.89	4.30
0:48	1.61	1.97	2.51	2.89	3.42	3.84	4.25
0:49	1.59	1.95	2.48	2.85	3.38	3.79	4.20
0:50	1.57	1.92	2.45	2.81	3.34	3.74	4.15

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY KANSAS
(revised June 1997)

This table contains average rainfall intensities in inches per hour.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:51	1.55	1.90	2.42	2.78	3.30	3.70	4.10
0:52	1.53	1.87	2.39	2.75	3.26	3.65	4.05
0:53	1.51	1.85	2.36	2.71	3.22	3.61	4.00
0:54	1.49	1.83	2.33	2.68	3.18	3.57	3.95
0:55	1.47	1.80	2.30	2.65	3.14	3.53	3.91
0:56	1.45	1.78	2.28	2.62	3.11	3.49	3.86
0:57	1.43	1.76	2.25	2.59	3.07	3.45	3.82
0:58	1.41	1.74	2.22	2.56	3.04	3.41	3.78
0:59	1.40	1.72	2.20	2.53	3.01	3.37	3.74
1:00	1.38	1.70	2.17	2.50	2.97	3.34	3.70
1:05	1.30	1.61	2.06	2.38	2.82	3.17	3.52
1:10	1.23	1.53	1.96	2.26	2.69	3.02	3.35
1:15	1.17	1.45	1.87	2.16	2.57	2.89	3.20
1:20	1.11	1.38	1.79	2.06	2.46	2.77	3.07
1:25	1.06	1.32	1.71	1.98	2.36	2.65	2.95
1:30	1.01	1.27	1.64	1.90	2.27	2.55	2.83
1:35	0.97	1.21	1.58	1.83	2.18	2.46	2.73
1:40	0.93	1.16	1.52	1.76	2.10	2.37	2.63
1:45	0.89	1.12	1.46	1.70	2.03	2.29	2.54
1:50	0.86	1.08	1.41	1.64	1.96	2.21	2.46
1:55	0.82	1.04	1.36	1.58	1.89	2.13	2.38
2:00	0.79	1.00	1.31	1.53	1.83	2.07	2.30
2:05	0.76	0.97	1.27	1.48	1.77	2.00	2.23
2:10	0.74	0.93	1.23	1.43	1.72	1.94	2.16
2:15	0.71	0.90	1.19	1.39	1.67	1.88	2.10
2:20	0.69	0.87	1.15	1.35	1.62	1.83	2.04
2:25	0.66	0.85	1.12	1.31	1.57	1.78	1.98
2:30	0.64	0.82	1.09	1.27	1.53	1.73	1.93
2:35	0.62	0.80	1.06	1.24	1.49	1.68	1.88
2:40	0.61	0.78	1.03	1.21	1.45	1.64	1.83
2:45	0.59	0.75	1.01	1.18	1.42	1.60	1.79
2:50	0.57	0.74	0.98	1.15	1.38	1.56	1.74
2:55	0.56	0.72	0.96	1.12	1.35	1.53	1.70
3:00	0.55	0.70	0.94	1.10	1.32	1.49	1.67
3:15	0.51	0.66	0.88	1.03	1.24	1.40	1.57
3:30	0.48	0.62	0.83	0.97	1.17	1.32	1.48
3:45	0.45	0.59	0.78	0.92	1.11	1.26	1.40
4:00	0.43	0.56	0.75	0.88	1.06	1.20	1.34
4:15	0.41	0.53	0.71	0.84	1.01	1.14	1.28
4:30	0.40	0.51	0.68	0.80	0.97	1.10	1.22
4:45	0.38	0.49	0.66	0.77	0.93	1.05	1.17
5:00	0.37	0.47	0.63	0.74	0.89	1.01	1.13
5:15	0.36	0.46	0.61	0.72	0.86	0.98	1.09
5:30	0.35	0.44	0.59	0.69	0.83	0.94	1.05
5:45	0.34	0.43	0.57	0.67	0.81	0.91	1.02
6:00	0.33	0.42	0.55	0.65	0.78	0.88	0.98