



## **United Warehouse Addition** **Sedgwick County, Kansas**

07/17/99

United Warehouse Addition is a industrial plat just north of Wichita in Sedgwick County, Kansas. The plat encompasses approximately 20 acres, comprised of one lot. The drainage plan, supporting computations and data for the United Warehouse drainage plan are presented herein.

### **Hydrology**

The proposed plat lies in the E ½, NE ¼, NW ¼, Section 28, T26S, R1E of the 6<sup>th</sup> P.M. The existing landscape is nearly level cultivated farmland, with a drainage ditch approximately 580' from the western property boundary. The nearly level area is made up of Tabler silty clay loam, which is hydraulic group D. Since the property is nearly level, water tends to pond on-site. In larger storms the property drains to the west and to the drainage channel.

The expected use for this site is an industrial warehouse that would include a large building with parking lots, making about 70% of the site impervious. Due to the large change in impervious area, a detention pond has been designed to the southwest of the property.

The detention facility was designed as a dry pond to limit excavation and decrease the amount of maintenance that would be required. It also is a conveyance for the water to the existing drainage easement. The proposed pond would be roughly 200' x 550', with 4:1 side slopes and a bottom slope of 0.005 ft/ft towards a 5' weir outfall at an elevation of 1320.0 MSL. The design high water for the pond is 1322.8 MSL, which is about the same elevation as existing ground. Berms around the pond site would need to be built to protect the surrounding property. These berms would not impede the drainage for the surrounding property since all the property drains primarily to the west.

A minimum opening for Lot 1, Block 1 of United Warehouse Addition is recommended to be at least 1325.0 MSL. This allows for an improved drainage channel and possible detention pond in the existing drainage easement along the west side of Section 28, T26S, R1E.

There was no off-site drainage included in this plan because the off-site drainage is routed west along 45<sup>th</sup> Street North and then south through the drainage easement, bypassing this piece of property. A map showing the property topography and proposed drainage improvements, drainage calculations and the HEC-1 model are included.

Runoff coefficients were estimated based on tables presented in the Design Aids section and existing land use. The Rational Method was used to calculate the runoff for existing conditions as well as developed conditions. HEC-1 was used to model the detention pond needed to control the increased runoff from this site.

The analysis made is based on the available site data which includes the following: 1" = 100' topographic map with 2' contours of the site and adjacent areas, USGS topographic map, 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"=100' scale drainage plan map is enclosed in the pocket.

### **References**

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.

## United Warehouse Addition

E 1/2, NE 1/4, NW 1/4, Section 28, T26S, R1E of the 6th P.M.

### Existing Conditions

Cultivated farmland  
Soil - Tabler Silty Clay Loam (Soil Type "D")  
Nearly level

Rational Method (Q=AiC)

Area = 20 Acres

$t_c$  = 25 Min

(Drainage from northeast corner to southwest corner,  
1500ft at 1 ft/sec)

$C_2$  = 0.3

$i_2$  = 2.93

$Q_2$  = 17.6 cfs

$C_{100}$  = 0.65

$i_{100}$  = 5.97

$Q_{100}$  = 77.6 cfs

### Developed Conditions

Industrial Site  
70-80% Impervious

Rational Method (Q=AiC)

Area = 20 Acres

$t_c$  = 15 Min

(Drainage from northeast corner to southwest corner,  
1500ft at 2 ft/sec)

$C_2$  = 0.68

$i_2$  = 3.80

$Q_2$  = 51.7 cfs

$C_{100}$  = 0.80

$i_{100}$  = 7.36

$Q_{100}$  = 117.8 cfs

### Pond Design

Area = 200'x550' = 2.5 Acres

Dry Detention Basin

Weir Outfall

$$Q = CLh^{3/2}$$

L = 5 ft

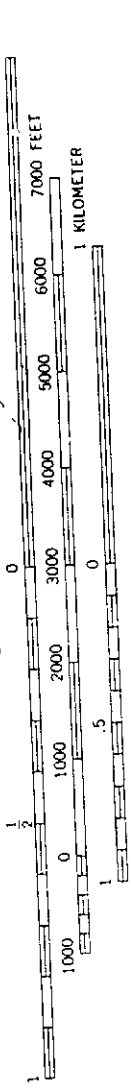
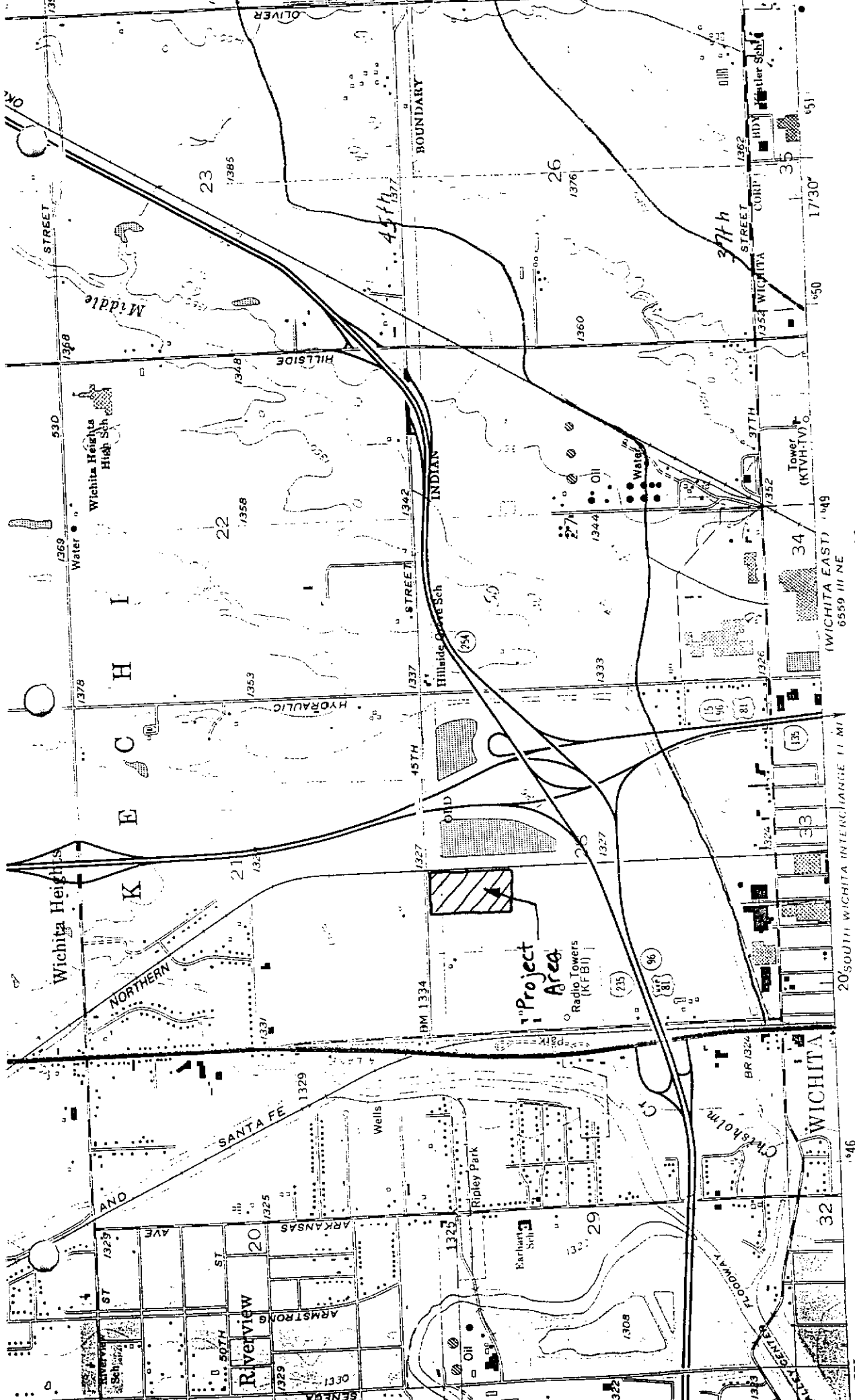
C = 3

Outfall Elevation = 1320.0

Designed High Water = 1322.8

Peak Outfall = 71 cfs (100-yr storm)

Elevation	Pond Area	$Q_{out}$
MSL	Acres	cfs
1320	0	0.0
1321	0.5	15.0
1322	1.5	42.4
1322.8	2.22	71.0
1323	2.4	77.9
1324	2.5	120.0



CONTOUR INTERVAL 10 FEET  
 DOTTED LINES REPRESENT 5-FOOT CONTOURS  
 NATIONAL GEODETIC VERTICAL DATUM OF 1929

Revised 1960

south zone

1982 MAGNETIC NORTH

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

REVISIONS SHOWN IN PURPLE

QUADRANGLE LO

KANSAS

# United Warehouse Addition

```
*****  
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *  
* MAY 1991 *  
* VERSION 4.0.1E *  
* Lahey F77L-EM/32 version 5.01 *  
* Dodson & Associates, Inc. *  
* RUN DATE 07/16/99 TIME 17:04:40 *  
*****
```

```
*****  
* U.S. ARMY CORPS OF ENGINEERS *  
* HYDROLOGIC ENGINEERING CENTER *  
* 609 SECOND STREET *  
* DAVIS, CALIFORNIA 95616 *  
* (916) 551-1748 *  
*****
```

```
  X  X  XXXXXX  XXXX  X  
  X  X  X      X  X  XX  
  X  X  X      X  X  X  
  XXXXXX  XXXX  X  XXXX  X  
  X  X  X      X  X  X  
  X  X  X      X  X  X  
  X  X  XXXXXX  XXXX  XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1EW.

THE DEFINITIONS OF VARIABLES -RTIME- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.  
THE DEFINITION OF -AMSK- 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

# United Warehouse Addition

HEC-1 INPUT

PAGE 1

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

```

1 ID United Warehouse Addition
2 ID 2, 10, 25 & 100 year storms
3 ID Professional Engineering Consultants
4 ID Wichita, Ks
5 ID KER 6/15/99
6 ID File: T:\DAR\HEC1\UNITEDWH.IH1
7 IT 6 12DEC97 0600 0 13DEC97 1154
8 IN 30 12DEC97 0600
9 IO 3 0
10 JR PREC .448718 .679487 .78947 1.000
* 20 Acre Industrial Site with offsite drainage pond

```

\*DIAGRAM

```

11 KK BAS1 Existing Drainage - Soil Type "D"
12 BA .03125
13 PB 7.8
14 PC 0.08 .09 .10 .11 .12 .133 .147 .163 .181 .204
15 PC .235 .283 .663 .735 .772 .799 .820 .835 .850 .865
16 PC .880 .890 .900 .910 .916 .925 .934 .943 .952 .958
17 PC .964 .970 .976 .982 .988 .994 1.000
18 LS 0 75 0
19 UD .25

```

\*DIAGRAM

```

20 KK DEVI Industrial Park - 70-80% Impervious
21 BA .03125
22 PB 7.8
23 PC 0.08 .09 .10 .11 .12 .133 .147 .163 .181 .204
24 PC .235 .283 .663 .735 .772 .799 .820 .835 .850 .865
25 PC .880 .890 .900 .910 .916 .925 .934 .943 .952 .958
26 PC .964 .970 .976 .982 .988 .994 1.000
27 LS 0 93 0
28 UD .15

```

```

29 KK POND
30 RS 1 ELEV 1320
31 SA 0 .5 1.4 2.4 2.5
32 SE 1320 1321 1322 1323 1324
33 SQ 0 15 42.4 77.9 120
34 SE 1320 1321 1322 1323 1324
*
35 ZZ

```

# United Warehouse Addition

## SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
11	BAS1	
	.	
20	.	DEVI
	.	V
	.	V
29	.	POND

(\*\*\*) RUNOFF ALSO COMPUTED AT THIS LOCATION

# United Warehouse Addition

\*\*\*\*\*  
\* FLOOD HYDROGRAPH PACKAGE (HEC-1) \*  
\* MAY 1991 \*  
\* VERSION 4.0.1E \*  
\* Lahey F77L-EM/32 version 5.01 \*  
\* Dodson & Associates, Inc. \*  
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\* (916) 551-1748 \*  
\*\*\*\*\*

United Warehouse Addition  
2, 10, 25 & 100 year storms  
Professional Engineering Consultants  
Wichita, Ks  
KER 6/15/99  
File: T:\DAR\HEC1\UNITEDWH.IH1

9 IO OUTPUT CONTROL VARIABLES  
IPRNT 3 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
  
IT HYDROGRAPH TIME DATA  
NMIN 6 MINUTES IN COMPUTATION INTERVAL  
IDATE 12DEC97 STARTING DATE  
ITIME 0600 STARTING TIME  
NQ 300 NUMBER OF HYDROGRAPH ORDINATES  
HDDATE 13DEC97 ENDING DATE  
NDTIME 1154 ENDING TIME  
ICENT 19 CENTURY MARK  
  
COMPUTATION INTERVAL 0.10 HOURS  
TOTAL TIME BASE 29.90 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  
0.45 0.68 0.79 1.00

\*\*\*\*\*

\*\*\*\*\*  
\* BAS1 \* Existing Drainage - Soil Type 'D'  
\* \*  
\*\*\*\*\*

8 IN TIME DATA FOR INPUT TIME SERIES  
JMIN 30 TIME INTERVAL IN MINUTES  
JXDATE 12DEC97 STARTING DATE  
JXTIME 600 STARTING TIME

## SUBBASIN RUNOFF DATA

12 BA SUBBASIN CHARACTERISTICS  
TAREA 0.03 SUBBASIN AREA

## PRECIPITATION DATA

13 PB STORM 7.80 BASIN TOTAL PRECIPITATION

14 PI INCREMENTAL PRECIPITATION PATTERN





# United Warehouse Addition

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

27 LS SCS LOSS RATE  
 STRTL 0.15 INITIAL ABSTRACTION  
 CRVNER 93.00 CURVE NUMBER  
 RTIMP 0.00 PERCENT IMPERVIOUS AREA

28 UD SCS DIMENSIONLESS UNITGRAPE  
 FLAG 0.15 LAG

\*\*\*

UNIT HYDROGRAPH  
 10 END-OF-PERIOD ORDINATES

36.	76.	52.	21.	10.	4.	2.	1.	0.	0.
TOTAL RAINFALL =		7.80, TOTAL LOSS =		0.84, TOTAL EXCESS =		6.96			
PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW							
		6-HR	24-HR	72-HR	29.90-HR				
+	(CFS)	(HR)	(CFS)						
+	121.	6.00	19.	6.	5.	5.			
			(INCHES)	5.610	6.964	6.964	6.964		
			(AC-FT)	9.	12.	12.	12.		
CUMULATIVE AREA =		0.03 SQ MI							

\*\*\*

HYDROGRAPH AT STATION DEVI  
 FOR PLAN 1, RATIO = 0.45

TOTAL RAINFALL =		3.50, TOTAL LOSS =		0.77, TOTAL EXCESS =		2.73			
PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW							
		6-HR	24-HR	72-HR	29.90-HR				
+	(CFS)	(HR)	(CFS)						
+	50.	6.00	8.	2.	2.	2.			
			(INCHES)	2.239	2.735	2.735	2.735		
			(AC-FT)	4.	5.	5.	5.		
CUMULATIVE AREA =		0.03 SQ MI							

\*\*\*

HYDROGRAPH AT STATION DEVI  
 FOR PLAN 1, RATIO = 0.68

TOTAL RAINFALL =		5.30, TOTAL LOSS =		0.81, TOTAL EXCESS =		4.49			
PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW							
		6-HR	24-HR	72-HR	29.90-HR				
+	(CFS)	(HR)	(CFS)						
+	80.	6.00	12.	4.	3.	3.			
			(INCHES)	3.652	4.493	4.493	4.493		
			(AC-FT)	6.	7.	7.	7.		
CUMULATIVE AREA =		0.03 SQ MI							

\*\*\*

HYDROGRAPH AT STATION DEVI  
 FOR PLAN 1, RATIO = 0.79

TOTAL RAINFALL =		6.16, TOTAL LOSS =		0.82, TOTAL EXCESS =		5.34			
PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW							
		6-HR	24-HR	72-HR	29.90-HR				
+	(CFS)	(HR)	(CFS)						
+	94.	6.00	15.	4.	4.	4.			
			(INCHES)	4.325	5.338	5.338	5.338		



# United Warehouse Addition

(AC-FT) 7. 9. 9. 9.

CUMULATIVE AREA = 0.03 SQ MI

\*\*\* \*\*

HYDROGRAPH AT STATION DEVI  
FOR PLAN 1, RATIO = 1.00

TOTAL RAINFALL = 7.80, TOTAL LOSS = 0.84, TOTAL EXCESS = 6.96

PEAK FLOW + (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	29.90-HR
121.	6.00	(CFS)			
		(INCHES)	19.	6.	5.
		(AC-FT)	5.610	6.964	6.964
			9.	12.	12.

CUMULATIVE AREA = 0.03 SQ MI

\*\*\*\*\*

```

*****
*      *
29 KK  * POND *
*      *
*****
    
```

## HYDROGRAPH ROUTING DATA

30 RS	STORAGE ROUTING	1 NUMBER OF SUBREACHES				
	NSTPS	ELEV	TYPE OF INITIAL CONDITION			
	ITTP	1320.00	INITIAL CONDITION			
	RSVVIC	0.00 WORKING R AND D COEFFICIENT				
	X					
31 SA	AREA	0.0	0.5	1.4	2.4	2.5
32 SE	ELEVATION	1320.00	1321.00	1322.00	1323.00	1324.00
33 SQ	DISCHARGE	0.	15.	42.	78.	120.
34 SE	ELEVATION	1320.00	1321.00	1322.00	1323.00	1324.00

\*\*\*

## COMPUTED STORAGE-ELEVATION DATA

STORAGE	0.00	0.17	1.08	2.96	5.41
ELEVATION	1320.00	1321.00	1322.00	1323.00	1324.00

## COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.17	1.08	2.96	5.41
OUTFLOW	0.00	15.00	42.40	77.90	120.00
ELEVATION	1320.00	1321.00	1322.00	1323.00	1324.00

\*\*\* \*\*

HYDROGRAPH AT STATION POND  
FOR PLAN 1, RATIO = 0.45

PEAK FLOW + (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	29.90-HR
34.	6.20	(CFS)			
		(INCHES)	8.	2.	2.
		(AC-FT)	2.238	2.735	2.735
			4.	5.	5.

PEAK STORAGE + (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	29.90-HR
1.	6.20				
			0.	0.	0.

# United Warehouse Addition

PEAK STAGE	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (FEET)	(HR)				
1321.69	6.20	1320.44	1320.14	1320.11	1320.11

CUMULATIVE AREA = 0.03 SQ MI

\*\*\*

HYDROGRAPH AT STATION POND  
FOR PLAN 1, RATIO = 0.68

PEAK FLOW	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (CFS)	(HR)				
50.	6.20	12.	4.	3.	3.
(INCHES)		3.650	4.493	4.493	4.493
(AC-FT)		6.	7.	7.	7.

PEAK STORAGE	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (AC-FT)	(HR)				
1.	6.20	0.	0.	0.	0.

PEAK STAGE	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (FEET)	(HR)				
1322.22	6.20	1320.67	1320.22	1320.17	1320.17

CUMULATIVE AREA = 0.03 SQ MI

\*\*\*

HYDROGRAPH AT STATION POND  
FOR PLAN 1, RATIO = 0.79

PEAK FLOW	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (CFS)	(HR)				
57.	6.20	15.	4.	4.	4.
(INCHES)		4.322	5.338	5.338	5.338
(AC-FT)		7.	9.	9.	9.

PEAK STORAGE	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (AC-FT)	(HR)				
2.	6.20	0.	0.	0.	0.

PEAK STAGE	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (FEET)	(HR)				
1322.41	6.20	1320.77	1320.25	1320.20	1320.20

CUMULATIVE AREA = 0.03 SQ MI

\*\*\*

HYDROGRAPH AT STATION POND  
FOR PLAN 1, RATIO = 1.00

PEAK FLOW	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (CFS)	(HR)				
71.	6.20	19.	6.	5.	5.
(INCHES)		5.607	6.964	6.964	6.964
(AC-FT)		9.	12.	12.	12.

PEAK STORAGE	TIME	6-HR	24-HR	72-HR	29.90-HR
+ (AC-FT)	(HR)				
3.	6.20	0.	0.	0.	0.

PEAK STAGE TIME MAXIMUM AVERAGE STAGE

# United Warehouse Addition

	(FEET)	(HR)	6-HR	24-HR	72-HR	29.90-HR
+	1322.79	6.20	1320.96	1320.32	1320.25	1320.25

CUMULATIVE AREA = 0.03 SQ MI

# United Warehouse Addition

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	RATIO 2	RATIO 3	RATIO 4
				0.45	0.68	0.79	1.00
HYDROGRAPH AT							
+	BAS1	0.03	1 FLOW	19.	43.	55.	79.
			TIME	6.10	6.10	6.10	6.10
HYDROGRAPH AT							
+	DEV1	0.03	1 FLOW	50.	80.	94.	121.
			TIME	6.00	6.00	6.00	6.00
ROUTED TO							
+	POND	0.03	1 FLOW	34.	50.	57.	71.
			TIME	6.20	6.20	6.20	6.20
** PEAK STAGES IN FEET **							
	1	STAGE		1321.69	1322.22	1322.41	1322.79
		TIME		6.20	6.20	6.20	6.20

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



SEDGWICK COUNTY, KANSAS

TABLE 16.--SOIL AND WATER FEATURES

Presence of an entry indicates the feature is not a concern. The definitions of "flooding" and "water table" in the Glossary explain such terms as "rare," "brief," and "perched." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Albion: 1Aa: Albion part-----	B	None-----	---	---	>6.0	---	---	>60	---
Shellabarger part-----	B	None-----	---	---	>6.0	---	---	>60	---
1Ab: Albion part-----	B	None-----	---	---	>6.0	---	---	>60	---
Shellabarger part-----	B	None-----	---	---	>6.0	---	---	>60	---
Blanket: Ba, Bb-----	C	None-----	---	---	>6.0	---	---	>60	---
Canadian: Ca-----	B	Rare-----	---	---	>6.0	---	---	>60	---
1Cb: Canadian part---	B	Rare-----	---	---	>6.0	---	---	>60	---
Waldeck part---	C	Occasional	Brief-----	Mar-Oct	2.0-6.0	Apparent	Oct-Apr	>60	---
Carwile: Cc-----	D	Occasional	Brief to very long.	Apr-Oct	2.0-6.0	Apparent	Oct-Apr	>60	---
Clark: 1Cd: Clark part-----	B	None-----	---	---	>6.0	---	---	>60	---
Dst part-----	B	None-----	---	---	>6.0	---	---	>60	---
Clute: Ca-----	C	None-----	---	---	>6.0	---	---	20-40	Rippable
Elandoo: Ea, Eb, Ec-----	B	Rare to common.	Brief-----	Oct-May	>6.0	---	---	>60	---
Fannum: Fa, Fb, Fc-----	B	None-----	---	---	>6.0	---	---	>60	---
Goessel: Ga, Gb-----	D	None-----	---	---	>6.0	---	---	>60	---
Irwin: Ia, Ib, Ic-----	D	None-----	---	---	>6.0	---	---	>40	Hard
Lesno: La-----	C	Occasional	Very brief	Mar-Jul	2.0-6.0	Apparent	Jan-Dec	>60	---
Lincoln: Lb-----	A	Common-----	Very brief to brief.	Apr-Oct	5.0-8.0	Apparent	Nov-May	>60	---
Milan: Ma, Mb, Mc-----	B	None-----	---	---	>6.0	---	---	>60	---

See footnote at end of table.

## SOIL SURVEY

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Naron: Na-----	B	None-----	---	---	>6.0	---	---	>60	---
Owens: Oc-----	D	None-----	---	---	>6.0	---	---	10-20	Rippable
<sup>1</sup> Od: Owens part-----	D	None-----	---	---	>6.0	---	---	10-20	Rippable
Rock outcrop part.									
Pits: Pa.									
Plavna: Pb-----	D	Frequent-----	Brief to long.	Mar-Oct	0-4.0	Apparent	Jan-Dec	>60	---
Pratt: Pc-----	A	None-----	---	---	>6.0	---	---	>60	---
<sup>1</sup> pd: Pratt part-----	A	None-----	---	---	>6.0	---	---	>60	---
Tivoli part-----	A	None-----	---	---	>6.0	---	---	>60	---
Renfrow: Ra, Rb-----	D	None-----	---	---	>6.0	---	---	>60	---
<sup>1</sup> Rc: Renfrow part-----	D	None-----	---	---	>6.0	---	---	>60	---
Owens part-----	D	None-----	---	---	>6.0	---	---	10-20	Rippable
Rosehill: Rd-----	D	None-----	---	---	>6.0	---	---	20-40	Rippable
Shellabarger: Sa, Sb, Sc-----	B	None-----	---	---	>6.0	---	---	>60	---
Tabler: Ta-----	D	None-----	---	---	2.5-3.5	Perched	Oct-Apr	>60	---
<sup>1</sup> Tb: Tabler part-----	D	None-----	---	---	2.5-3.5	Perched	Oct-Apr	>60	---
Drummond part-----	D	Rare-----	---	---	2.0-6.0	Apparent	Nov-Apr	>60	---
Urban land: <sup>1</sup> Ua: Urban land part.									
Canadian part-----	B	Rare-----	---	---	>6.0	---	---	>60	---
<sup>1</sup> Ub: Urban land part.									
Elandco part-----	B	Rare to common.	Brief-----	Oct-May	>6.0	---	---	>60	---
<sup>1</sup> Uc: Urban land part.									
Farnum part-----	B	None-----	---	---	>6.0	---	---	>60	---

See footnote at end of table.

SEDGWICK COUNTY, KANSAS

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth Ft	Kind	Months	Depth In	Hardness
Urban land: 1Gd: Urban land part. Irwin part-----	D	None-----	---	---	>6.	---	---	>40	Hard
1Ge: Urban land part. Tabler part-----	D	None-----	---	---	2.5-3.5	Perched	Oct-Apr	>60	---
Vanoss: Va, Vb, Vc, Vd---	B	None-----	---	---	>6.0	---	---	>60	---
Vernon: Ve, Vf-----	D	None-----	---	---	>6.0	---	---	>60	---
Waldeck: Wa-----	C	Occasional	Brief-----	Mar-Oct	2.0-6.0	Apparent	Oct-Apr	>60	---
Waurika: WB-----	D	None-----	---	---	1.0-2.0	Perched	Mar-May	>60	---

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

## ATTACHMENT D

## DRAINAGE CRITERIA

## CITY OF WICHITA, KANSAS

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

<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>
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
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):					
<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	0.26	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 large basins.



# RAINFALL INTENSITY TABLE

SEDGWICK COUNTY  
KANSAS

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	4.77	5.52	6.56	7.32	8.44	9.32	10.20
0:06	4.53	5.26	6.27	7.02	8.11	8.96	9.81
0:07	4.33	5.04	6.03	6.76	7.82	8.65	9.48
0:08	4.16	4.85	5.82	6.52	7.55	8.36	9.17
0:09	4.00	4.67	5.61	6.30	7.30	8.09	8.87
0:10	3.85	4.50	5.42	6.08	7.06	7.82	8.58
0:11	3.71	4.34	5.23	5.88	6.83	7.56	8.30
0:12	3.58	4.19	5.06	5.69	6.60	7.32	8.04
0:13	3.45	4.05	4.90	5.51	6.40	7.10	7.79
0:14	3.34	3.92	4.75	5.34	6.21	6.89	7.57
0:15	3.23	3.80	4.61	5.19	6.04	6.70	7.36
0:16	3.13	3.69	4.48	5.05	5.88	6.53	7.17
0:17	3.03	3.58	4.36	4.92	5.73	6.37	7.00
0:18	2.94	3.48	4.25	4.80	5.60	6.22	6.84
0:19	2.86	3.39	4.14	4.69	5.47	6.09	6.70
0:20	2.78	3.30	4.05	4.58	5.35	5.96	6.56
0:21	2.70	3.21	3.95	4.48	5.24	5.84	6.43
0:22	2.63	3.14	3.87	4.39	5.14	5.72	6.30
0:23	2.56	3.06	3.78	4.30	5.04	5.61	6.19
0:24	2.50	2.99	3.71	4.21	4.94	5.51	6.07
0:25	2.44	2.93	3.63	4.13	4.85	5.41	5.97
0:26	2.38	2.86	3.56	4.05	4.76	5.31	5.86
0:27	2.33	2.80	3.49	3.98	4.68	5.22	5.76
0:28	2.28	2.75	3.43	3.91	4.59	5.13	5.66
0:29	2.23	2.69	3.36	3.84	4.52	5.04	5.57
0:30	2.19	2.64	3.30	3.77	4.44	4.96	5.48
0:31	2.14	2.59	3.24	3.71	4.37	4.88	5.39
0:32	2.10	2.54	3.19	3.64	4.30	4.80	5.31
0:33	2.06	2.50	3.14	3.58	4.23	4.73	5.22
0:34	2.02	2.45	3.08	3.53	4.16	4.65	5.14
0:35	1.99	2.41	3.03	3.47	4.10	4.58	5.07
0:36	1.95	2.37	2.99	3.42	4.03	4.51	4.99
0:37	1.92	2.33	2.94	3.36	3.97	4.45	4.92
0:38	1.89	2.30	2.89	3.31	3.91	4.38	4.84
0:39	1.86	2.26	2.85	3.27	3.86	4.32	4.77
0:40	1.83	2.23	2.81	3.22	3.80	4.26	4.71
0:41	1.80	2.19	2.77	3.17	3.75	4.20	4.64
0:42	1.77	2.16	2.73	3.13	3.70	4.14	4.58
0:43	1.75	2.13	2.69	3.08	3.65	4.08	4.52
0:44	1.72	2.10	2.65	3.04	3.60	4.03	4.46
0:45	1.70	2.07	2.62	3.00	3.55	3.97	4.40

# RAINFALL INTENSITY TABLE

SEDGWICK COUNTY  
KANSAS

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
0:46	1.67	2.04	2.58	2.96	3.50	3.92	4.34
0:47	1.65	2.01	2.55	2.92	3.46	3.87	4.29
0:48	1.63	1.98	2.51	2.88	3.41	3.82	4.23
0:49	1.60	1.96	2.48	2.85	3.37	3.78	4.18
0:50	1.58	1.93	2.45	2.81	3.33	3.73	4.13
0:51	1.56	1.91	2.42	2.78	3.29	3.68	4.08
0:52	1.54	1.88	2.39	2.74	3.25	3.64	4.03
0:53	1.52	1.86	2.36	2.71	3.21	3.60	3.98
0:54	1.50	1.84	2.33	2.68	3.17	3.55	3.94
0:55	1.48	1.81	2.30	2.65	3.13	3.51	3.89
0:56	1.46	1.79	2.28	2.62	3.10	3.47	3.85
0:57	1.45	1.77	2.25	2.59	3.06	3.43	3.80
0:58	1.43	1.75	2.23	2.56	3.03	3.40	3.76
0:59	1.41	1.73	2.20	2.53	3.00	3.36	3.72
1:00	1.39	1.71	2.18	2.50	2.96	3.32	3.68
1:05	1.32	1.62	2.06	2.37	2.81	3.15	3.49
1:10	1.25	1.53	1.96	2.25	2.67	3.00	3.33
1:15	1.18	1.46	1.87	2.15	2.55	2.86	3.17
1:20	1.13	1.39	1.78	2.05	2.44	2.74	3.04
1:25	1.07	1.33	1.70	1.97	2.34	2.63	2.91
1:30	1.03	1.27	1.63	1.89	2.24	2.52	2.80
1:35	0.98	1.22	1.57	1.81	2.16	2.43	2.69
1:40	0.94	1.17	1.51	1.75	2.08	2.34	2.60
1:45	0.91	1.13	1.46	1.69	2.01	2.26	2.51
1:50	0.87	1.09	1.41	1.63	1.94	2.18	2.42
1:55	0.84	1.05	1.36	1.57	1.88	2.11	2.35
2:00	0.81	1.02	1.32	1.52	1.82	2.05	2.28
2:05	0.79	0.98	1.28	1.48	1.76	1.99	2.21
2:10	0.76	0.95	1.24	1.43	1.71	1.93	2.14
2:15	0.74	0.92	1.20	1.39	1.67	1.88	2.08
2:20	0.72	0.90	1.17	1.36	1.62	1.82	2.03
2:25	0.70	0.87	1.14	1.32	1.58	1.78	1.98
2:30	0.68	0.85	1.11	1.29	1.54	1.73	1.93
2:35	0.66	0.83	1.08	1.25	1.50	1.69	1.88
2:40	0.64	0.81	1.05	1.22	1.46	1.65	1.83
2:45	0.62	0.79	1.03	1.19	1.43	1.61	1.79
2:50	0.61	0.77	1.00	1.17	1.40	1.57	1.75
2:55	0.59	0.75	0.98	1.14	1.37	1.54	1.71
3:00	0.58	0.73	0.96	1.12	1.34	1.51	1.68

# RAINFALL INTENSITY TABLE

SEDGWICK COUNTY  
KANSAS

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
3:15	0.54	0.69	0.90	1.05	1.26	1.42	1.58
3:30	0.51	0.65	0.85	0.99	1.19	1.34	1.49
3:45	0.48	0.61	0.80	0.94	1.12	1.27	1.41
4:00	0.46	0.58	0.76	0.89	1.07	1.21	1.34
4:15	0.44	0.55	0.73	0.85	1.02	1.15	1.28
4:30	0.42	0.53	0.70	0.81	0.98	1.10	1.23
4:45	0.40	0.51	0.67	0.78	0.94	1.06	1.18
5:00	0.38	0.49	0.64	0.75	0.90	1.02	1.13
5:15	0.37	0.47	0.62	0.72	0.87	0.98	1.09
5:30	0.35	0.45	0.60	0.70	0.83	0.94	1.05
5:45	0.34	0.44	0.58	0.67	0.81	0.91	1.01
6:00	0.33	0.42	0.56	0.65	0.78	0.88	0.98
6:30	0.31	0.40	0.52	0.61	0.73	0.83	0.92
7:00	0.30	0.38	0.50	0.58	0.69	0.78	0.87
7:30	0.28	0.36	0.47	0.55	0.66	0.74	0.83
8:00	0.27	0.34	0.45	0.52	0.62	0.70	0.78
8:30	0.26	0.33	0.43	0.50	0.60	0.67	0.75
9:00	0.25	0.31	0.41	0.48	0.57	0.64	0.72
9:30	0.24	0.30	0.39	0.46	0.55	0.62	0.69
10:00	0.23	0.29	0.38	0.44	0.52	0.59	0.66
10:30	0.22	0.28	0.36	0.42	0.50	0.57	0.63
11:00	0.21	0.27	0.35	0.41	0.49	0.55	0.61
11:30	0.21	0.26	0.34	0.39	0.47	0.53	0.59
12:00	0.20	0.25	0.33	0.38	0.45	0.51	0.57
13:00	0.19	0.24	0.31	0.36	0.43	0.48	0.53
14:00	0.18	0.22	0.29	0.34	0.40	0.45	0.50
15:00	0.17	0.21	0.27	0.32	0.38	0.43	0.47
16:00	0.16	0.20	0.26	0.30	0.36	0.40	0.45
17:00	0.15	0.19	0.25	0.29	0.34	0.38	0.43
18:00	0.15	0.18	0.24	0.27	0.33	0.37	0.41
19:00	0.14	0.18	0.23	0.26	0.31	0.35	0.39
20:00	0.14	0.17	0.22	0.25	0.30	0.34	0.37
21:00	0.13	0.16	0.21	0.24	0.29	0.32	0.36
22:00	0.13	0.16	0.20	0.23	0.28	0.31	0.34
23:00	0.12	0.15	0.19	0.22	0.27	0.30	0.33
24:00	0.12	0.15	0.19	0.22	0.26	0.29	0.32