JACKIE KELLEY ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS

HYDROLOGY EVALUATION

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WICHITA
JULY 1991

July 25, 1991

JACKIE KELLEY ADDITION
HYDROLOGY EVALUATION -

The area being platted is located in the S.E. 1/4 of Section 6, T. 27S., R. 1W., of the 6th P.M., Sedgwick County, Kansas, lying North of 21st ST. N. and approx. 1/2 mile West of Maize Road.

Exclusive of 21st ST. N. right-of-way, the area being platted and evaluated for changes in surface water run-off due to development equals 5.00 acres.

The land being platted is predominantly flat with some slope toward the N.W. Corner. For the developed conditions, part of the drainage will likely be diverted South, to the North ditch of 21st Street North.

INITIAL DATA - The following basic data will be used for the analysis of 100 yr. peak discharge for both present and developed conditions, using the SCS TR-55, Graphical Peak Method.

The SCS Soils Maps for Sedgwick County, indicate the existence of the following hydrologic soil group:

Vanoss (Vb) - Group B - 5.00 Ac. - 100% of total area

Under present conditions the land use is agricultural, with 5.00 acres in straight row crops (Wheat).

Under developed conditions the land use will be for a single family residence, and the balance of the area in lawn.

Peak discharge determinations are based on the 100 yr. - 24 hour rainfall of 7.8 inches. For determination of overland flow time, the 2 yr. - 24 hour rainfall intensity of 3.5 inches was used, per SCS TR-55 methodology.

PROCEDURES FOR PEAK DISCHARGE DETERMINATIONS -

PRESENT CONDITION peak discharges will be computed from the determinations made in the following order:

1. The present condition "C.N." was determined for the area of the plat. (Page #3)

2. The Tc is determined as the overland flow time across the property from East to West. (Page #4)

3. Calculate the present condition peak discharge at the West line of the plat. (Page #5)

POST DEVELOPED peak discharges will be computed from the determinations made in the following order:

1. The post-developed weighted "C.N." was determined for the area of the plat. (Page #6)

2. Calculate the post-developed condition peak discharge at the West line of the plat, using the same Tc. (Page #7)

SUMMARY -Computer print out of the calculations are shown on enclosed Pages #3 thru #7.

The results of the calculations indicate that the peak discharge from this parcel will be less under developed conditions than from present conditions (33 cfs vs. 20 cfs), due to the changes in land usage.

In reality, it is reasonable to assume that at the time of construction of the proposed home, it will be necessary to increase the pad elevation 1 or possibly 2 feet above the existing ground elevation to provide positive drainage away from the building. Subsequently, runoff from the area of improvement will be more effectively directed South, discharging into the North ditch of 21st Street North.

Based upon the results of the hydrology evaluation, it is apparent that it will not be necessary to provide detention facilities to regulate the peak discharge onto adjacent properties.

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JACKIE KELLEY ADDITION
PRE -DEV. CONDITIONS

RUNOFF CURVE NUMBER SUMMARY

Subarea Description	Area (acres)	CN (weighted)
SMALL GRAIN	5.00	78

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JACKIE KELLEY ADDITION
PRE-DEV. CONDITIONS

Tc COMPUTATIONS FOR:

SHEET FLOW (Applicable to Tc only)

		A-B	
Segment ID			
Surface description		SMALL GRAIN	
Manning's roughness coeff., n		0.0600	
Flow length, L (total < or = 300)	ft	260.0	
Two-yr 24-hr rainfall, P2	in	3.500	
Land slope, s	ft/ft	0.0119	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.20	= 0.20

SHALLOW CONCENTRATED FLOW

Segment ID			
Surface (paved or unpaved)?			
Flow length, L	ft	0.0	
Watercourse slope, s	ft/ft	0.0000	
Avg.V = Csf * (s)^0.5	ft/s	0.0000	
where: Unpaved Csf = 16.1345			
Paved Csf = 20.3282			
T = L / (3600*V)	hrs	0.00	= 0.00

CHANNEL FLOW

Segment ID			
Cross Sectional Flow Area, a	sq.ft	0.00	
Wetted perimeter, Pw	ft	0.00	
Hydraulic radius, r = a/Pw	ft	0.000	
Channel slope, s	ft/ft	0.0000	
Manning's roughness coeff., n		0.0000	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

TOTAL TIME (hrs) 0.20

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>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

JACKIE KELLEY ADDITION
PRE-DEV. CONDITIONS

CALCULATED
DISK FILE: C:\PONDPACK\KELLEY .GPD

Drainage Area	(acres)	5.00	---->	0.0078 sq.mi.
Runoff Curve Number	(CN)	78		
Time of Concentration,Tc	(hrs)	0.20		
Rainfall Distribution	(Type)	II		
Pond and Swamp Areas	(%)	0	--->	0.0 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	100		
Rainfall, P, 24-hr (in)	7.8		
Initial Abstraction, Ia (in)	0.564	0.564	0.564
Ia/p Ratio	0.072	0.000	0.000
Unit Discharge, * qu (csm/in)	800	0	0
Runoff, Q (in)	5.21	0.00	0.00
Pond & Swamp Adjustment Factor	1.00	1.00	1.00
PEAK DISCHARGE, qp (cfs)	33	0	0

Summary of Computations for qu

Ia/p	#1	0.100	0.000	0.000
C0	#1	2.553	0.000	0.000
C1	#1	-0.615	0.000	0.000
C2	#1	-0.164	0.000	0.000
qu (csm)	#1	799.912	0.000	0.000
Ia/p	#2	0.100	0.000	0.000
C0	#2	2.553	0.000	0.000
C1	#2	-0.615	0.000	0.000
C2	#2	-0.164	0.000	0.000
qu (csm)	#2	799.912	0.000	0.000
* qu (csm)		800	0	0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

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JACKIE KELLEY ADDITION
POST-DEV. CONDITIONS

RUNOFF CURVE NUMBER DATA

Composite Area: SMALL GRAIN

SURFACE DESCRIPTION	AREA (acres)	CN	
ROOF, DRIVES	0.10	98	
RES. B	4.90	61	
COMPOSITE AREA --->	5.00	61.7	(62)

Quick TR-55 Version: 5.43 S/N: 1240540379

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

JACKIE KELLEY ADDITION
POST-DEV. CONDITIONS

CALCULATED
DISK FILE: C:\PONDPACK\KELLEY1 .GPD

Drainage Area	(acres)	5.00	--->	0.0078 sq.mi.
Runoff Curve Number	(CN)	62		
Time of Concentration,Tc	(hrs)	.20		
Rainfall Distribution	(Type)	II		
Pond and Swamp Areas	(%)		--->	0.0 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	100		
Rainfall, P, 24-hr (in)	7.8		
Initial Abstraction, Ia (in)	1.226	1.226	1.226
Ia/p Ratio	0.157	0.000	0.000
Unit Discharge, * qu (csm/in)	771	0	0
Runoff, Q (in)	3.40	0.00	0.00
Pond & Swamp Adjustment Factor	1.00	1.00	1.00
PEAK DISCHARGE, qp (cfs)	20	0	0

Summary of Computations for qu

Ia/p	#1	0.100	0.000	0.000
C0	#1	2.553	0.000	0.000
C1	#1	-0.615	0.000	0.000
C2	#1	-0.164	0.000	0.000
qu (csm)	#1	799.912	0.000	0.000
Ia/p	#2	0.300	0.000	0.000
C0	#2	2.465	0.000	0.000
C1	#2	-0.623	0.000	0.000
C2	#2	-0.117	0.000	0.000
qu (csm)	#2	697.472	0.000	0.000
* qu (csm)		771	0	0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)

SEDGWICK COUNTY, KANSAS

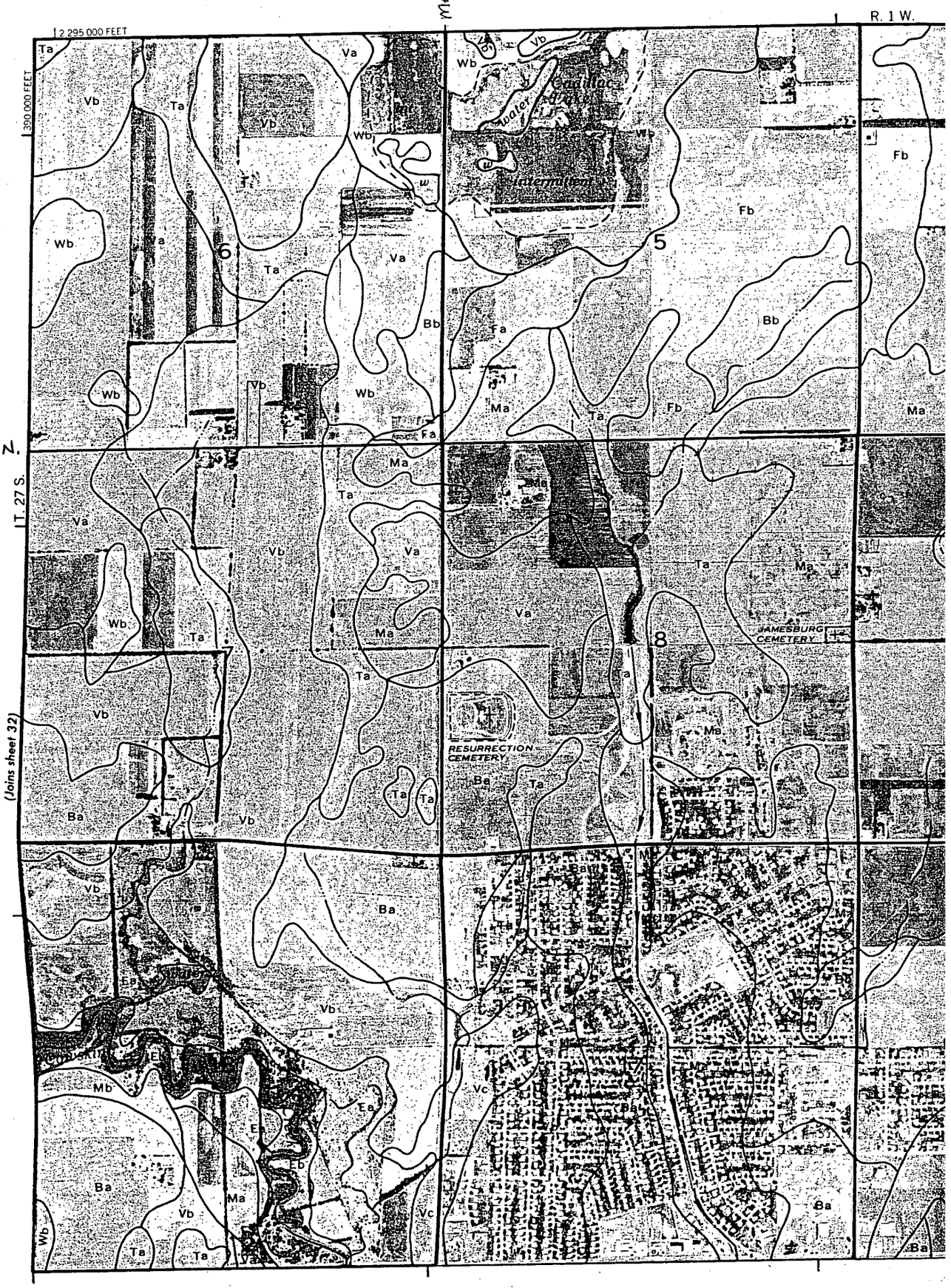

Table 37. Runoff Curve Numbers for Hydrologic Soil-Cover Complexes (Antecedent moisture condition II)

Land Use	Treatment or Practice	Hydrologic Condition	Hydrologic Soil Group A	B	C	D
Fallow	Straight Row	----	77	86	91	94
Row Crops	"	Poor	72	81	88	91
	"	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	"	Good	65	75	82	86
	"and Terraced	Poor	66	74	80	82
	" " "	Good	62	71	78	81
Small Grain	Straight Row	Poor	65	76	84	88
		Good	63	75	83	87
	Contoured	Poor	63	74	82	85
		Good	61	73	81	84
	"and Terraced	Poor	61	72	79	82
		Good	59	70	78	81
Close-seeded legumes 1/ or rotation meadow	Straight row	Poor	66	77	85	89
	" "	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	"	Good	55	69	78	83
	"and terraced	Poor	63	73	80	83
	"and terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	"	Fair	25	59	75	83
	"	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads (dirt) 2/		----	72	82	87	89
(hard surface) 2/		----	74	84	90	92

1/ Close-drilled or broadcast.

2/ Including right-of-way.

from SCS, 1972

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4. based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Runoff depth in inches for selected CN's and rainfall amounts.

Rainfall (inches)	Curve Number (CN)[1/]								
	60	65	70	75	80	85	90	95	98
1.0	0	0	0	0.03	0.08	0.17	0.32	.56	.79
1.2	0	0	0.03	0.07	0.15	0.28	0.46	.74	.99
1.4	0	0.02	0.06	0.13	0.24	0.39	0.61	.92	1.18
1.6	0.01	0.05	0.11	0.20	0.34	0.52	0.76	1.11	1.38
1.8	0.03	0.09	0.17	0.29	0.44	0.65	0.93	1.29	1.58
2.0	0.06	0.14	0.24	0.38	0.56	0.80	1.09	1.48	1.77
2.5	0.17	0.30	0.46	0.65	0.89	1.18	1.53	1.96	2.27
3.0	0.33	0.51	0.72	0.96	1.25	1.59	1.98	2.45	2.78
4.0	0.76	1.03	1.33	1.67	2.04	2.46	2.92	3.43	3.77
5.0	1.30	1.65	2.04	2.45	2.89	3.37	3.88	4.42	4.76
6.0	1.92	2.35	2.80	3.28	3.78	4.31	4.85	5.41	5.76
7.0	2.60	3.10	3.62	4.15	4.69	5.26	5.82	6.41	6.76
8.0	3.33	3.90	4.47	5.04	5.62	6.22	6.81	7.40	7.76
9.0	4.10	4.72	5.34	5.95	6.57	7.19	7.79	8.40	8.76
10.0	4.90	5.57	6.23	6.88	7.52	8.16	8.78	9.40	9.76
11.0	5.72	6.44	7.13	7.82	8.48	9.14	9.77	10.39	10.76
12.0	6.56	7.32	8.05	8.76	9.45	10.12	10.76	11.39	11.76

One inch is 25.4mm

[1/] To obtain runoff depths for CN's and other rainfall amounts not shown in this table, use an arithmetic interpolation.

TABLE 3-5

(After Soil Convervation Service)