MUNICIPAL ENGINEERS, P.A.
Civil Engineers & Land Surveyors

September 18, 1999

Ms. Vicki Huang, P.E.
City Engineer's Office
City Hall - 7th Floor
455 North Main Street
Wichita, Kansas 67201

Re: Drainage Calculations for Smithmoor Commercial Addition

Dear Mr. Huang:

It is my understanding that the Storm Water Utility Engineer has expressed concerns regarding pre and post-development flows from the referenced Addition towards north across Harry Street. I have prepared additional calculations which show minimal impact of this development on flows towards north across Harry Street.

Please review this and call me if you have additional comments.

Sinceely,
MUNICIPAL ENGINEERS, P.A.

Babar M. Khan, P.E.

254 Laura, Suite 201 • Wichita, Kansas 67211 • (316) 262-3842 • Fax (316) 262-8634
e-mail: mepa@southwind.net

B.K
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SMITHMOOR COMMERCIAL ADDITION

DRAINAGE CALCULATIONS

OBJECTIVE: COMPARE PRE AND POST-DEVELOPMENT FLOWS FROM THIS ADDITION, GOING NORTH ACROSS HARRY STREET.

PRE - DEVELOPMENT FLOWS:

(SEE ATTACHED EXHIBIT 'A')

a) DRAINAGE BASIN 'DA1':

$A = 12.4$ Ac

$L = 850' \pm$

$F = 7.5' \pm$

$S = 7.5/850 = 0.9\%$

FROM EXHIBIT 'B'

$V = 0.45'/\text{SEC}$

$$T_c = \frac{850}{0.45 \times 60} = 31 \text{ MIN.}$$

FROM EXHIBIT 'C':

$I_{10} = 5.32"/\text{HR}$

SOIL HYDRO GROUP = D

FROM EXHIBIT 'D':

$C_{100} = 0.61$

$Q_{100} = 12.4 \times 0.61 \times 5.32$

$= 40.2$ CFS ←

b) DRAINAGE BASIN 'DA2':

$A = 9.1$
$L = 1200' \pm$
$F = 6' \pm$

$S = 0.5\%$

$V = 0.34$ (FROM EXHIBIT 'B')

$T_c = \frac{1200}{0.34 \times 60} = 59$ MIN

$I_{100} = 3.77''/HR$

$C_{100} = 0.61$

$Q_{100} = 9.1 \times 3.77 \times 0.61$

$= 20.9$ CFS ←

POST DEVELOPMENT FLOWS:

(SEE EXHIBIT 'E')

a) DRAINAGE BASIN 'DA1':

$A = 8.5$ Ac
(4 Ac. GO, 4.5 Ac LC.)

C_{100} (COMPOSITE) $= 0.71$

$T_c = 15$ MIN.

$Q_{100} = 8.5 \times 7.37 \times 0.71$
$= 44$ CFS ←

b) DRAINAGE BASIN 'DA2A':

$A = 2.5$ Ac
$C_{100} = 0.8$
$T_c = 15$ MIN.

$Q_{100} = 0.8 \times 7.37 \times 2.5$

$= 14.7$ CFS ←

CONCLUSION:

FROM DRAINAGE BASIN 'DA1'

PRE-DEV. FLOWS = 40.2 CFS

POST-DEV. FLOWS = 44.0 CFS

INCREASE IS MINIMAL.

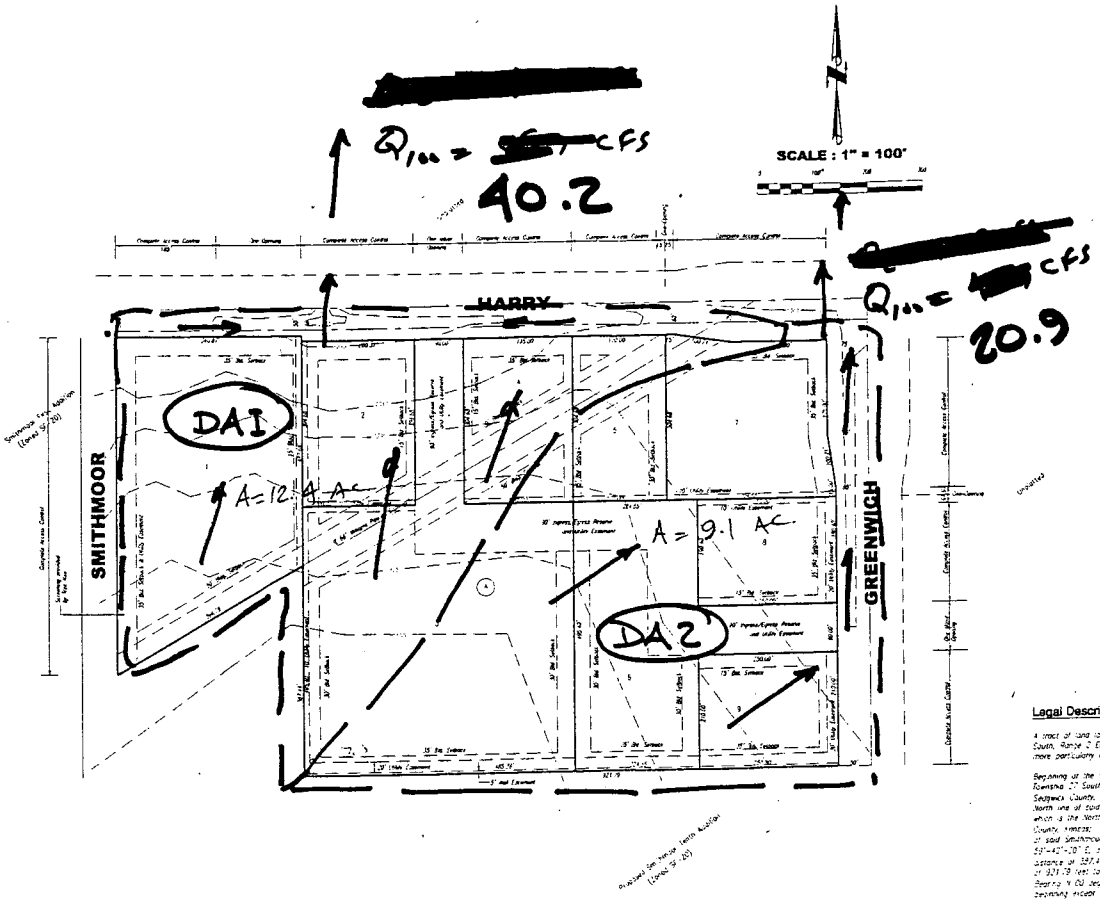
FROM DRAINAGE BASIN 'DA2' & 'DA2A'

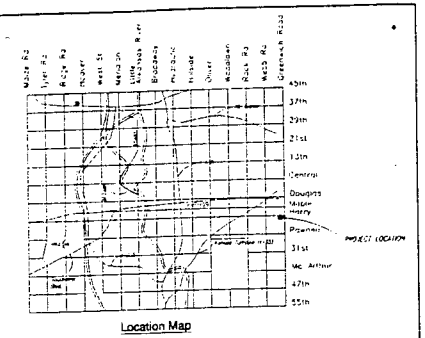
PRE-DEV. FLOWS = 20.9 CFS

POST-DEV. FLOWS = 14.7 CFS.

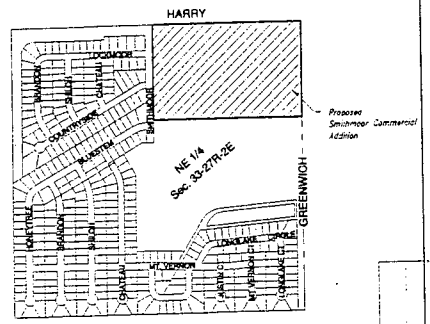
FLOW IS REDUCED.

*OVER ALL IMPACT ON FLOWS TOWARDS NORTH, ACROSS HARLEY STREET IS MINIMAL.





Location Map



Development Plan

Legal Description

A tract of land located in the Northeast Quarter of Section 33, Township 27 South, Range 2 East of the 6th Principal Meridian, in Sedgwick County, Kansas, more particularly described as follows:

Beginning at the Northeast corner of the Northeast Quarter of Section 33, Township 27 South, Range 2 East of the 6th Principal Meridian in Wichita, Sedgwick County, Kansas; Thence Bearing S 89 degrees-41'-29" W along the North line of said Northeast Quarter, a distance of 1,260.93 feet to a point, which is the Northeast corner of Smithmoor First Addition in Wichita, Sedgwick County, Kansas; Thence Bearing S 00 degrees-41'-07" E, along the East line of said Smithmoor First Addition, a distance of 619.35 feet; Thence Bearing N 89-42'-01" E, a distance of 394.78 feet; Thence Bearing S 00-21'-00" E, a distance of 337.44 feet; Thence Bearing N 89 degrees-41'-29" E, a distance of 331.79 feet to a point on the East line of said Northeast Quarter; Thence Bearing N 00 degrees-41'-07" E, a distance of 360.18 feet to the point of beginning except road right of way for North and Greenwich.

Subdivider
Smith & Company
P.O. Box 789
Andover, Kansas 67002

Surveyor/Engineer
Saber M. Khan P.E., L.S.
Municipal Engineers, P.A.
254-Laura, Suite 201
Wichita, Kansas 67211

Total Area
23.8 ± Acres (Net)

Zoning
GO & LC

Min. Lot Size
43,000 S.F.

Total Number of Lots
9

Benchmarks

1. City Disk on Signal Base at the Northeast corner of Harry and Greenwich Roads. Elev. = 1343.83

PRE-DEVELOPED CONDITION

DRAINAGE PLAN

SMITHMOOR COMMERCIAL ADDITION
TO
WICHITA, SEDGWICK COUNTY, KANSAS

EXHIBIT 'A'

MUNICIPAL ENGINEERS, P.A.

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then computed by dividing the total overland flow length by the average velocity.

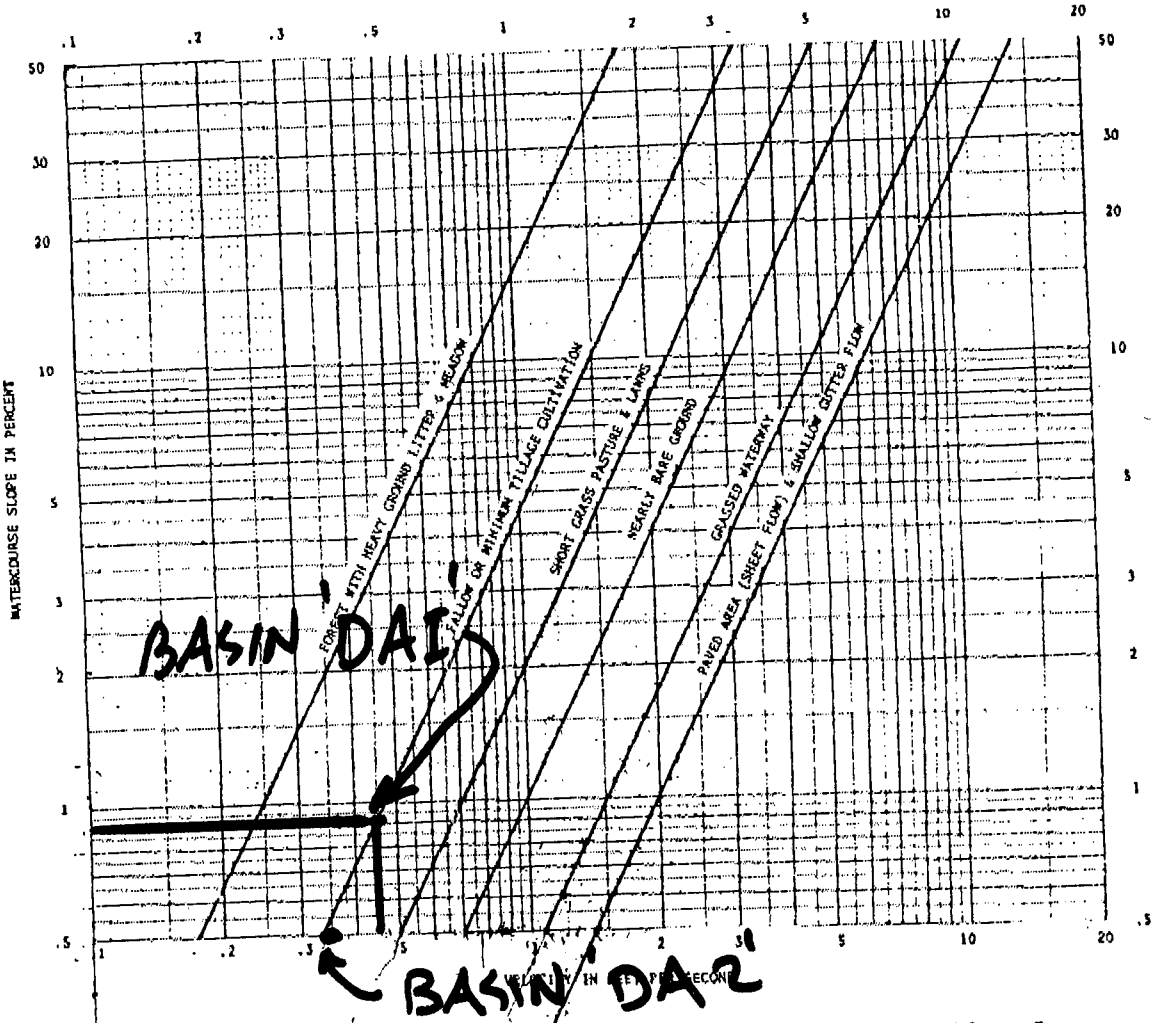


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

EXHIBIT 'B'

April 15, 1998 (7/9)

ATTACHMENT A
DRAINAGE CRITERIA MANUAL

CITY OF WICHITA, KANSAS

RAINFALL INTENSITY TABLE FOR SEDGWICK COUNTY, KANSAS

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

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

EXHIBIT 'C'

(8/9)

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

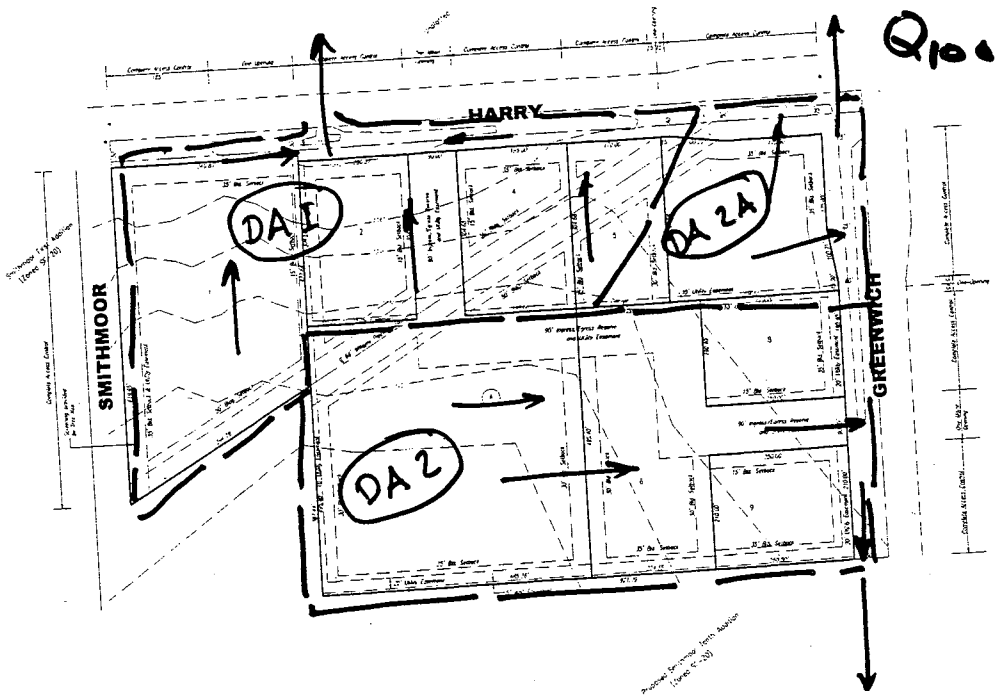
Note No. 1: Coefficients shown in the above table are for pervious open space areas with thick turf which includes pervious areas in parks and cemeteries. Coefficients shown above must be increased 0.02 for use with agricultural pasture areas. Coefficients shown above must be reduced by 0.04 for use 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.

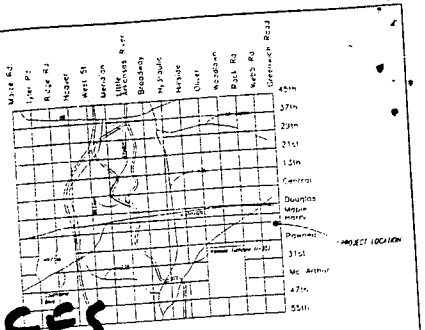
GENERAL NOTE: These Rational Formula Coefficients may not be valid for basins 320 acres or larger.

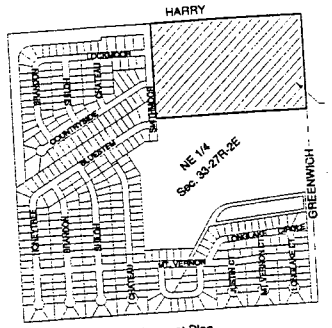
EXHIBIT 'D'

$Q_{100} = 44$ CFS

$Q_{100} = 14.7$ CFS







POST-DEVELOPMENT CONDITIONS

DRAINAGE PLAN

SMITHMOOR COMMERCIAL ADDITION
TO
WICHITA, SEDGWICK COUNTY, KANSAS

EXHIBIT 'E'

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Subdivider
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P.O. Box 785
Andover, Kansas 67002

Surveyor/Engineer
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Municipal Engineers, P.A.
254-Laura, Suite 200
Wichita, Kansas 67211

Total Area
33.8 ± Acres (Net)

Zoning
GO & LC

Min. Lot Size
40,000 S.F.

Total Number of Lots
9

Benchmarks

1. City Disk on Signal Base at the Northeast corner of Harry and Greenwich Roads.
   Elev. = 1343.83

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254-LAURA, SUITE 200
WICHITA, KANSAS 67211
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