

CERTIFIED ENGINEERING DESIGN, P.A.

810 W. Douglas, Suite C
Wichita, KS 67203
(316) 262-8808 Office
(316) 262-1669 Fax

LETTER OF TRANSMITTAL

DATE: October 8, 2007

TO: Ms. Vicki Huang, P.E.
Engineering Division
City of Wichita
7th Floor, City Hall
455 North Main
Wichita, KS 67202

SUBJ: Speer Addition
Sedgwick County, Kansas

FROM: Harlan D. Foraker, P.E. *HDF*

COMMENTS: Attached please find a copy of the drainage plan and calculations for Speer Addition in Sedgwick County. Please review the drainage plan and contact me if you have any questions or comments at (316) 262-8808.

attachments



**Public Works, Engineering Division
Stormwater Management Subdivision Submittal Checklist**

Reviewer: _____	Date: <u>9-25-07</u>
Subdivision Name: <u>SPEED ADDITION</u>	Location: _____
Total Land Area Of Ownership: <u>4.6</u> Acres	
Type: <input checked="" type="checkbox"/> Residential <input checked="" type="checkbox"/> Commercial _____ Industrial _____ Recreation _____ Municipal _____ Other _____	
Applicant: <u>JULIE SPEER</u>	Contact: <u>JULIE SPEER</u> Phone #: <u>744-2007</u>
Engineer: <u>CERTIFIED ENG. DESIGN</u>	Contact: <u>HARLAN FORAKER</u> Phone #: <u>202-8808</u>

Please check the appropriate box:

I = Included; NA = Non-Applicable
(If "NA" is checked, an explanation must be entered)

Tab 1. Project Narrative	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Site Location Map, using USGS Map				<input checked="" type="checkbox"/>	
B. Discussion of development, existing conditions, and proposed impacts on stormwater, wetland, riparian, and flood plain				<input checked="" type="checkbox"/>	
C. Discussion of offsite conditions				<input checked="" type="checkbox"/>	
D. Summary of runoff calculations (pre/post development) No increase in peak discharge for all storm series				<input checked="" type="checkbox"/>	
E. Narrative description of the type and function of the permanent best management practices that are incorporated into the site design				<input checked="" type="checkbox"/>	
F. Copy of the plat				<input checked="" type="checkbox"/>	
G. Four Corner Lot Grading plan				<input checked="" type="checkbox"/>	
H. Professional Engineer seal, signature and date (on cover of report and all pull-outs)				<input checked="" type="checkbox"/>	

Tab 2. Existing Conditions Runoff Calculations	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Copy of applicable digital orthophoto showing proposed project boundaries (preferable in color)				<input checked="" type="checkbox"/>	
B. Runoff Method (Rational, Hydrograph Method)				<input checked="" type="checkbox"/>	
C. Existing topography (no greater than 2-foot contours, 1-foot recommended)				<input checked="" type="checkbox"/>	
D. Total Site Area and Total Impervious Area (acres)				<input checked="" type="checkbox"/>	
E. Benchmarks used for site control				<input checked="" type="checkbox"/>	
F. Perennial and intermittent streams labeled				<input checked="" type="checkbox"/>	
G. Predominant soils from USDA soil surveys, and/or on site soil borings				<input checked="" type="checkbox"/>	
H. Boundaries of existing predominant vegetation.				<input checked="" type="checkbox"/>	
I. Location and boundaries of natural feature protection and conservation areas such as wetlands, lakes, ponds, and other setbacks (e.g., stream buffers, drinking water well setbacks, septic setbacks, etc.) with the normal water elevation noted				<input checked="" type="checkbox"/>	
J. Location of existing roads, buildings, parking lots and other impervious areas				<input checked="" type="checkbox"/>	

Stormwater Management Subdivision Submittal Checklist

K. Location of existing utilities (e.g., water, sewer, gas, electric) and easements				✓	
L. Location of existing conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow				✓	
M. Flow paths				✓	
N. Location and dimensions of existing channels, bridges or culvert crossings				✓	
O. Existing conditions hydrologic analysis for runoff rates, volumes and velocities showing methodologies used and supporting calculations (2, 5, 10, 25 & 100 year, 24-hour storm events) or Critical Duration				✓	
P. Assumed pre-developed runoff curve numbers				✓	
Q. Existing time of concentrations used in calculations				✓	
R. Existing downstream capacity				✓	
S. Existing structural elevations (e.g., invert of pipes, manholes, etc.)				✓	
T. Cross-section data for open channels				✓	
U. Ground water elevations (basements)			No basements proposed		✓

Tab 3. Post-Development Hydrologic Analysis	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Proposed (post-development) conditions hydrologic and hydraulic analysis for runoff rates, volumes, HGL, and velocities showing the methodologies used and supporting calculations for all applicable design storms (2, 5, 10, 25 & 100 year, 24-hour storm events)				✓	
B. Proposed time of concentrations used in calculations				✓	
C. Assumed post-developed runoff curve numbers				✓	
D. Proposed contours with location of drainageways			MAINTAIN EXISTING CONTOURS		✓
E. Final sizing calculations for stormwater controls including contributing drainage area, storage, and outlet configuration				✓	
F. Stage-storage-discharge or outlet rating curves and inflow and outflow hydrographs for storage facilities			No STORAGE FACILITIES		✓
G. Final analysis of potential upstream/downstream impact/effects of project, where necessary					✓
H. Dam safety and breach analysis, where necessary					✓
I. Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.)			NEW ENTRANCE PIPE	✓	
J. Design water surface elevations, normal pool elevation and pond bottoms					✓
K. Structural details and specifications of structural control designs, outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.					✓
L. Proposed limits of clearing and grading					✓
M. Location of existing and proposed roads, buildings, parking lots and other impervious areas.				✓	
N. Location of existing and proposed utilities (e.g., water, sewer, gas, electric) and easements				✓	
O. Location of existing and proposed conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow				✓	
P. Preliminary location and dimensions of proposed channel modifications, such as bridge or culvert crossings				✓	
Q. Preliminary selection and location of stormwater					

Stormwater Management Subdivision Submittal Checklist

controls				✓	
R. Emergency overflow structure's flow path					✓
S. Detention facility provides one-foot of freeboard above the HWL and emergency outfall shown (top of berm elevation shown)					✓
T. The 10-year and 100-year HWL delineated on the plan for detention pond					✓
U. Minimum pad elevations table on the plat for structures located adjacent to channels or ponds				✓	
V. Stormwater Management Facilities located within a Reserve			No Reserves		✓

Tab 4. Floodplain Submittal	Applicant		Engr	
	I	NA	I	NA
A. Provide source of flood profile				✓
B. Nearest base flood elevations				✓
C. Delineation of pre-developed regulatory floodplain/floodway limits				✓
D. Delineation of post-developed regulatory floodplain and floodway limits				✓
E. Floodplain boundary determination per elevation (project limits shown)				✓
F. Provide source of floodway data table and discharges				✓
G. Provide all hydrologic and hydraulic study information for site-specific floodplain studies, unnumbered Zone A area elevation determinations and flood plain map revisions				✓
H. Provide regulatory floodway and four natural profile models (10,50,100, and 500-yr) for existing and future watershed conditions				✓
I. Location of floodplain/floodway limits and relationship of site to upstream/downstream properties (floodplain limits to be per elevation and scaled location)				✓
J. Flood plains and floodways located within a Reserve				✓

Tab 5. Evidence of Acquisition of Applicable Federal and State Permits	Applicant		Engr	
	I	NA	I	NA
A. USACE Regulatory Program permits (401 water quality certification)				✓
B. Kansas Division of Water Resources Permit (Stream Obstruction, Channel Change, Flood Plain Fill, Levee, Water Appropriations, Dam safety permit, etc.)				✓
C. FEMA Letter of Map Changes (LOMA, LOMR, LOMR-f, CLOMR, etc.)				✓
D. Kansas Department of Wildlife and Parks				✓
E. Kansas Department of Transportation				✓
F. United States Fish & Wildlife				✓
G. Environmental Protection Agency				✓

Stormwater Management Subdivision Submittal Checklist

Tab 6. Other	Applicant		Engr	
	I	NA	I	NA
A. Evidence of acquisition of all necessary legal agreements (e.g., easements, covenants, land trusts, etc.)				✓
B. Maintenance of stormwater management facility specified in the platters text as the responsibility of the Homeowner or Business Association				✓
C. CD of drainage plan in PDF format (one file)			✓	

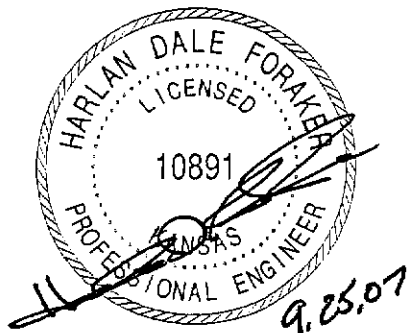
**DRAINAGE PLAN
AND
SUPPORTING CALCULATIONS
FOR
SPEER ADDITION
SEDGWICK COUNTY, KANSAS**

**PREPARED FOR:
MS. JULIE SPEER
3500 E. 45TH STREET NORTH
WICHITA, KS 67220**

SEPTEMBER 25, 2007

PREPARED BY:

**CERTIFIED ENGINEERING DESIGN, P.A.
810 WEST DOUGLAS, SUITE C
WICHITA, KANSAS 67203-6105
(316)262-8808 PHONE
(316)262-1669 FAX**



Speer Addition Drainage Plan(Con't)
Mr. Paul Ryn, P.E.
September 25, 2007

CERTIFIED ENGINEERING DESIGN, P.A
810 West Douglas, Suite C
Wichita, KS 67203-6105
(316)262-8808 Office
(316)262-1669 Fax

LETTER OF TRANSMITTAL

DATE: September 25, 2007

TO: Mr. Paul Ryn, P.E.
Sedgwick County Public Works
1144 South Seneca
Wichita, KS 67202

RE: Drainage Plan
Speer Addition
Wichita, KS

FROM: Harlan D. Foraker, P.E.

I. PROJECT NARRATIVE

The site is located east of Hillside Avenue on the north side of 45th Street North Street at an address of 3500 East 45th Street North and is currently undeveloped with native grass cover, some trees and the original farmhouse and a few outbuildings on the property. The predominant SCS soil type present within Speer Addition is Farnum Loam which is a SCS Type B Soil.

II. EXISTING & DEVELOPED CONDITIONS RUNOFF CALCULATIONS

The rational method will be used to determine the peak discharges from the subareas of the study area. Rational 'C' Factors were assigned to the existing site and proposed improvements from "Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation" for the City of Wichita, Kansas.

The rainfall intensity tables for the Sedgwick County, Kansas from the "Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita, Kansas" were utilized to determine the rainfall intensity for the 2, 5, 10, 25, 50 and 100 year design storms.

The Soil Conservation Service TR-55 manual was used to compute the Time of Concentration for the drainage subareas. A design assumptions was made as follows that the minimum subarea time of concentration is 15 minutes

Speer Addition Drainage Plan(Con't)
 Mr. Paul Ryn, P.E.
 September 25, 2007

Soil types were determined from the SCS Soil Survey for Sedgwick County, Kansas.

The developed drainage subareas have been delineated on the 1" = 50' site and topographic mapping survey performed for this site.

Design Storm Events Evaluated: 2, 5, 10, 25, 50 and 100 yr. storm events

The runoff calculations for the existing and developed conditions have been completed utilizing the 2, 5, 10, 25 and 50 year storm events. A check of the drainage system has been made using the 100 year storm event.

The following tables summarize the peak discharges for existing and developed conditions for Lots 1 and 2 within Speer Addition which have a total area of 4.60 acres.

EXISTING & DEVELOPED PEAK DISCHARGE USING THE RATIONAL METHOD					
Description	RATIONAL METHOD				
	C	Tc	I	Area	Q(cfs)
Lot 2 SubArea(2 yr.)	.22	22	3.49	2.65	2.0
Lot 2 SubArea(5 yr.)	.24	22	4.49	2.65	2.9
Lot 2 SubArea(10 yr.)	.30	22	5.24	2.65	4.2
Lot 2 SubArea(25 yr.)	.35	22	5.99	2.65	5.6
Lot 2 SubArea(50 yr.)	.40	22	6.86	2.65	7.3
Lot 2 SubArea(100 yr.)	.43	22	7.74	2.65	8.8
Lot 1 SubArea(2 yr.)	.22	19	3.70	1.95	1.6
Lot 1 SubArea(5 yr.)	.24	19	4.76	1.95	2.2
Lot 1 SubArea(10 yr.)	.30	19	5.55	1.95	3.3
Lot 1 SubArea(25 yr.)	.35	19	6.34	1.95	4.3
Lot 1 SubArea(50 yr.)	.40	19	7.27	1.95	5.7
Lot 1 SubArea(100 yr.)	.43	19	8.19	1.95	6.9

The existing runoff from the proposed development drains east to the west across the property and discharges as sheet flow from the west side of the property. The existing 2 year storm event peak discharge for the Lot 1 subbasin of 1.95 acres is 2.2 cfs. The existing 2 year storm event peak discharge for the Lot 2 subbasin of 2.65 acres is 2.9 cfs.

A detention pond wasnot proposed for this development because the relatively large lots with residential development will not generate a significant increase in the peak flow and the site should continue to drain in a manner using sheet flow. Concentrated flow should be avoided during the development of the lots and the sheet runoff should be collected in the ditches of the proposed private driveway for Lot 2..

Speer Addition Drainage Plan(Con't)

Mr. Paul Ryn, P.E.

September 25, 2007

The total 2 year existing peak discharge for Speer Addition is 3.5 cfs which is comprised of 2.3 cfs for Lot 2 and 1.3 cfs for Lot 1. The combined 100 year developed peak discharge for Nguyen Addition is 7.7 cfs which is 4.8 cfs for the north subbasin and 2.9 cfs for the south subbasin. The proposed developed peak runoff should be conveyed to the north ditch of 45th Street North within the ditches of the proposed driveway to service Lot 2 of Speer Addition. The peak developed runoff should be collected in the east and west ditches of the proposed driveway and directed south to the 45th Street ditch in order to prevent drainage problems on the residential property located to the west of Speer Addition.

An existing 24" entrance pipe is being utilized in the north ditch for 45th Street North under the entrance driveway to existing clinic. A proposed driveway on the west side of the property being developed should include the installation of a 30" entrance pipe to maintain the flow through the proposed entrance.

IV. FLOODPLAIN SUBMITTAL – No FEMA floodplain is located on this plat.

V. FEDERAL, STATE AND LOCAL PERMITS

- A. US Army Corp of Engineers-Not Applicable
- B. Kansas Dept. of Agriculture-Not Applicable
- C. FEMA- Not Applicable
- D. Kansas Department of Transportation-Not Applicable
- E. Sedgwick County Right-of-Way Permit-Not Applicable

VII. APPENDIX I:

All charts, graphs, tables including a 1"=50' scale drainage plan map are included for review.

SOIL LEGEND

<u>SYMBOL</u>	<u>HYDROLOGIC GROUP</u>	<u>NAME</u>
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loams, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loam, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loam
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 slopes
Wa	C	Waldeck sandy loam
Wb	D	Waurika silt loam

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.

DURATION IN MINUTES	RETURN PERIODS OF						
	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	4.67	6.23	8.00	9.34	10.67	12.23	13.79
6	4.35	5.80	7.45	8.70	9.94	11.39	12.84
7	4.09	5.46	7.02	8.19	9.36	10.72	12.09
8	3.88	5.18	6.66	7.77	8.89	10.18	11.48
9	3.71	4.95	6.36	7.43	8.49	9.72	10.96
10	3.56	4.75	6.11	7.13	8.15	9.33	10.52
11	3.43	4.58	5.89	6.87	7.85	8.99	10.14
12	3.32	4.40	5.69	6.64	7.59	8.69	9.80
13	3.21	4.29	5.51	6.43	7.35	8.42	9.50
14	3.12	4.17	5.36	6.25	7.14	8.18	9.23
15	3.04	4.06	5.21	6.08	6.95	7.97	8.98
16	2.96	3.96	5.09	5.93	6.78	7.77	8.76
17	2.90	3.86	4.97	5.79	6.62	7.59	8.55
18	2.83	3.78	4.86	5.67	6.48	7.42	8.37
19	2.77	3.70	4.76	5.55	6.34	7.27	8.19
20	2.72	3.63	4.66	5.44	6.22	7.12	8.03
21	2.67	3.56	4.57	5.34	6.10	6.99	7.88
22	2.62	3.49	4.49	5.24	5.99	6.86	7.74
23	2.57	3.43	4.41	5.15	5.89	6.74	7.60
24	2.53	3.38	4.34	5.07	5.79	6.63	7.48
25	2.49	3.32	4.27	4.99	5.70	6.53	7.36
26	2.45	3.23	4.21	4.91	5.61	6.43	7.25
27	2.42	3.18	4.15	4.84	5.53	6.33	7.14
28	2.38	3.05	4.09	4.77	5.45	6.25	7.04
29	2.35	2.97	4.02	4.68	5.38	6.16	6.95
30	2.32	2.89	3.92	4.56	5.31	6.08	6.79
31	2.29	2.82	3.82	4.44	5.19	6.00	6.62
32	2.26	2.75	3.73	4.33	5.07	5.87	6.45
33	2.24	2.68	3.64	4.23	4.95	5.73	6.30
34	2.19	2.62	3.55	4.13	4.83	5.60	6.16
35	2.14	2.57	3.47	4.04	4.73	5.47	6.02
36	2.09	2.51	3.40	3.95	4.62	5.35	5.89
37	2.05	2.46	3.33	3.87	4.52	5.23	5.76
38	2.00	2.41	3.26	3.79	4.43	5.13	5.64
39	1.96	2.36	3.19	3.71	4.34	5.02	5.53
40	1.92	2.32	3.13	3.64	4.26	4.92	5.42
41	1.89	2.27	3.07	3.57	4.18	4.83	5.32
42	1.85	2.23	3.01	3.51	4.10	4.74	5.22
43	1.82	2.19	2.96	3.44	4.02	4.65	5.13
44	1.78	2.15	2.91	3.38	3.95	4.56	5.03
45	1.75	2.11	2.86	3.32	3.88	4.48	4.95

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:					
<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
6. 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	0.18	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
<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

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		2	5	10	100
<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 basins 320 acres or larger.

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project SARRE ADDITION By _____ Date _____

Location 3500 E. 45TH ST. WASH Checked _____ Date _____

Circle one: Present Developed _____

Circle one: T_c T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID
1. Surface description (table 3-1)	5.00 FT Grass
2. Manning's roughness coeff., n (table 3-1) ..	0.15
3. Flow length, L (total L < 300 ft) ft	250
4. Two-yr 24-hr rainfall, P_2 in	3.5
5. Land slope, s <u>83-79/197</u> ft/ft	.0203
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t hr	0.32 + = 19 min

Shallow concentrated flow	Segment ID
7. Surface description (paved or unpaved)	
8. Flow length, L ft	
9. Watercourse slope, s ft/ft	
10. Average velocity, V (figure 3-1) ft/s	
11. $T_t = \frac{L}{3600 V}$ Compute T_t hr	+ =

Channel flow	Segment ID
12. Cross sectional flow area, a ft ²	
13. Wetted perimeter, p_w ft	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	
15. Channel slope, s ft/ft	
16. Manning's roughness coeff., n	
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft/s	
18. Flow length, L ft	
19. $T_t = \frac{L}{3600 V}$ Compute T_t hr	+ =
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) hr	= 19 min

*L₂ = 3.70' / 114
L₁₀₀ = 8.19' / 114*

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project SAGE ADULT By HOF Date _____

Location 3500 E. 45th St. North Checked _____ Date _____

Circle one: Present Developed _____

Circle one: T_c T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

<u>Sheet flow</u> (Applicable to T_c only)	Segment ID
1. Surface description (table 3-1)	SHOET Grass
2. Manning's roughness coeff., n (table 3-1) ..	0.15
3. Flow length, L (total L \leq 300 ft)	290
4. Two-yr 24-hr rainfall, P_2	35
5. Land slope, s <u>5/200</u>	0.025
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	0.974 + [] = 22.4

<u>Shallow concentrated flow</u>	Segment ID
7. Surface description (paved or unpaved)	
8. Flow length, L	
9. Watercourse slope, s	
10. Average velocity, V (figure 3-1)	
11. $T_t = \frac{L}{3600 V}$ Compute T_t	[] + [] = []

<u>Channel flow</u>	Segment ID
12. Cross sectional flow area, a	
13. Wetted perimeter, P_w	
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	
15. Channel slope, s	
16. Manning's roughness coeff., n	
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	
18. Flow length, L	
19. $T_t = \frac{L}{3600 V}$ Compute T_t	[] + [] = 22.4
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	

$L_c = 3.49 \text{ hr}$
 $L_{tot} = 7.79 \text{ hr}$