

DRAINAGE PLAN AND SUPPORTING CALCULATIONS

**FOR
BRAUM 1ST ADDITION
AN ADDITION TO
WICHITA, SEDGWICK COUNTY, KANSAS**

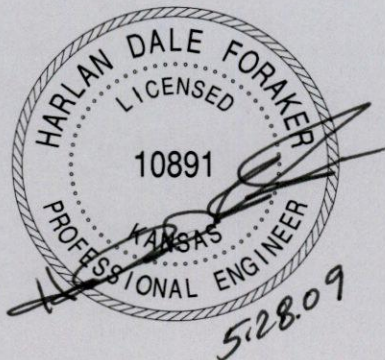
**PREPARED FOR:
SAVOY COMPANY, P.A.
433 SOUTH HYDRAULIC
WICHITA, KS 67211**

MAY 28, 2009

JUN 01 2009

PREPARED BY:

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



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Public Works, Engineering Division Final Drainage Plan Submittal Checklist

Reviewer: _____	Date: <u>5-28-09</u>
Subdivision Name: <u>BEAUM 1ST ADDITION</u>	Location: <u>S. OF 1ST bet. DODGE AND SENGCA</u>
Total Land Area Of Ownership: <u>1.36</u> Acres	
Type: _____ Residential ☒ Commercial _____ Industrial _____ Recreation _____ Municipal _____ Other _____	
Applicant: <u>RETAIL BUILDINGS, INC.</u>	Contact: <u>ELAINE BEAUM, PRES.</u> Phone #: _____
Engineer: <u>CERTIFIED ENG. DESIGN, P.A.</u>	Contact: <u>HARLAN FORAKER</u> Phone # <u>262-8808</u>

Please check the appropriate box:

I = Included; NA = Non-Applicable; R= Required prior to development
(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	✓				
B. Discussion of development, existing conditions, and proposed impacts on stormwater, wetland, riparian, and flood plain	✓				
C. Discussion of offsite conditions		✓			
D. Summary of runoff calculations (pre/post development) No increase in peak discharge for all storm series	✓				
E. Narrative description of the type and function of the permanent best management practices that are incorporated into the site design	✓				
F. Copy of the plat	✓				
G. Preliminary grading plan (The final grading plan shall be sealed, signed and dated prior to Engineering receiving the final sanitary sewer plans. One plan sheet and PDF shall be submitted to the Subdivision Engineer.)	✓				
H. Professional Engineer seal, signature and date on cover of report	✓				
I. CD of drainage plan in PDF format (one file) and one paper copy bound with this checklist included behind the cover	✓				

Tab 2. Existing Conditions Runoff Calculations	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Copy of applicable orthophoto showing proposed project boundaries (preferable in color)	✓				
B. Runoff Method (Rational, Hydrograph Method, or other approved methods by Engineering)	✓				
C. Existing topography (no greater than 2-foot contours, 1-foot recommend)	✓				
D. Total Site Area and Total Impervious Area (acres)	✓				
E. Benchmarks used for site control	✓				
F. Streams, creeks, and waterway labeled			N/A		
G. Predominant soils from USDA soil surveys, and/or on site soil borings	✓				
H. Location and boundaries of natural features such as wetlands, lakes, and ponds with the normal water elevation noted			N/A		
I. Location of existing roads, buildings, parking lots and other impervious areas.	✓				



Final Drainage Plan Submittal Checklist
Adopted: February 23, 2007

J. Location of existing utilities (e.g., water, sewer, gas, electric) and easements	✓			
K. Location of existing conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow	✓			
L. Flow paths	✓			
M. Location and dimensions of existing channels, bridges or culvert crossings			N/A	
N. 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	✓			
O. Assumed pre-developed runoff curve numbers	✓			
P. Existing time of concentrations used in calculations	✓			
Q. Evaluate immediate downstream drainage capacity, not to exceed more than 0.25 miles downstream of site		✓		
R. Existing structural elevations (e.g., invert of pipes, manholes, etc.)	✓			
S. Cross-section data for open channels		✓		
T. Ground water elevations, if applicable		✓		

Tab 3. Post-Development Hydrologic Analysis	Applicant		Explanation / Location in Plan	Engr	
	I	NA		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 for detention facilities (to equal area used in outlet rating curves)		✓	PROPOSED SPOT ELEVATIONS SHOWN		
E. Preliminary 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		✓			
G. Final analysis of potential upstream/downstream impact/effects of project, where necessary		✓			
H. Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.)	✓				
I. Design water surface elevations and normal pool elevation for ponds.		✓			
J. Typical detail for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc. To include height, width, elevation, and/or diameter.					
K. Proposed limits of clearing and grading		✓			
L. Location of existing and proposed roads, buildings, parking lots and other impervious areas.	✓				
M. Location of existing and proposed utilities (e.g., water, sewer) and easements	✓				
N. Location of existing and proposed conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow	✓				
O. Preliminary location and dimensions of proposed channel modifications, such as bridge or culvert crossings		✓			



P. Preliminary selection and location of stormwater controls					
Q. Emergency overflow structure's flow path	✓				
R. Detention facility provides one-foot of freeboard above the HWL and emergency outfall shown (top of berm elevation shown)		✓			
S. The 100-year 24-hour HWL delineated on the plan for detention pond		✓			
T. Lowest opening elevations table on the plat for structures located adjacent to channels or ponds		✓			
U. Stormwater Management Facilities located within a Reserve		✓			
V. Maintenance responsibility of stormwater management facility shall be specified in the plat text. (e.g. HOA, Lot Owners Association, or lot)		✓			
W. Off-site drainage easements or agreements required, where necessary		✓			

Tab 4. Floodplain Submittal	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Provide source of flood profile		✓	ZONE X 500 yr FLOODPLAIN		
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 or required permits		✓			
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, where necessary		✓			

Tab 5. Federal, State and Local Permits (to be provided prior to construction unless otherwise specified)	Applicant			Engr	
	I/R	NA	Explanation / Location in Plan	I/R	NA
A. US Army Corps of Engineers - Regulatory program permits (404 water quality certification)		✓			
B. Kansas Department of Agriculture - Division of Water Resources Permits (Stream Obstruction, Channel Change, Flood Plain Fill, Levee, Water Appropriations, Dam safety permit, etc.)		✓			
C. Federal Emergency Management Agency (FEMA) Letter of Map Changes (LOMA, LOMR, LOMR-f, CLOMR, etc.) Shall be included and approved when project modifies the limits of the floodway.		✓			
D. Kansas Department of Transportation		✓			
E. Sedgwick County Right-of-way Permit		✓			

Braum 1st Addition Drainage Plan(Con't)
Mr. Scott Lindebak, P.E.
May 28, 2009

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: May 28, 2009

TO: Mr. Scott Lindebak, P.E.
Engineering Division
City of Wichita
7th Floor, City Hall
455 North Main
Wichita, KS 67202

RE: Drainage Plan
Braum 1st Addition-1st Street and Seneca
Wichita, KS

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

I. PROJECT NARRATIVE

The site is located on the west side of Seneca Street North immediately south of 1st Street West. The address of the existing residence is 200 N. Dodge Street North. The site currently has a commercial metal building and parking lot in the southwest corner of the property. To the north across 1st Street there is an apartment building. To the west across Dodge Street are single family residential houses. To the east across Seneca Street are commercial buildings. To the south are commercial buildings. The SCS soil present is Urban land-Canadian complex which is a SCS Class B soil.

II. EXISTING CONDITIONS RUNOFF CALCULATIONS

The rational method will be used to determine the peak discharges from 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. Rainfall Intensity tables from the same policy were utilized to determine the rainfall intensity for the 2, 5, 10, 25, 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 assumption was made as follows: that the minimum subarea time of concentration is 15 minutes.

Soil types were determined from the Natural Resources Conservation Service's Soil Survey web site. The SCS soil present is Urban land-Canadian complex which is a SCS Class B soil. Urban land-Canadian complex (0 to 3 percent) represents 100% of the total area.

The developed drainage subareas have been delineated on the 1" = 20' site and topographic mapping survey performed for this site.

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

The runoff calculations for the property have been completed utilizing the all 5 storm events.

The parcel has 4 sub-basins shown on the drainage plan.

Sub-basin A originates from the southeast corner of sub-basin, then water flows north to the street gutter that carries the water west to the City of Wichita storm sewer inlet and also from the southeast corner of the Sub-basin A, then flowing west to the street gutter that carries the water north to the City of Wichita storm sewer inlet.

Sub-basin B originates from the southwest corner of the sub-basin, then water flows north to the street gutter that carries the water east to the west edge of Seneca Street where it follows the street gutter north to a City of Wichita storm sewer inlet and also from the southwest corner of Sub-basin B, then flowing east to the west edge of Seneca Street where it follows the street gutter north to a City of Wichita storm sewer inlet.

Sub-basin C originates from the northeast corner of the sub-basin, then water flows west to the street gutter that carries the water south along the east edge of Dodge into a City of Wichita storm sewer inlet.

Sub-basin D originates from the northwest corner of the sub-basin, then water flows east to the street gutter that carries the water south along the west edge of Seneca Street into a City of Wichita storm sewer inlet.

Braum 1st Addition Drainage Plan(Con't)

Mr. Scott Lindebak, P.E.

May 28, 2009

The following tables summarize the peak discharge for the drainage area which includes Sub-basin A. The drainage sub-basin includes 0.30 acres within the proposed Braum 1st Addition.

EXISTING PEAK RUNOFF DRAINAGE FOR SUB-BASIN A

Description	C	Tc	I	Area	Q(cfs)
Existing Drainage Area(2 yr.)	.33	33	2.50	0.30	0.25
Existing Drainage Area(5 yr.)	.35	33	3.14	0.30	0.33
Existing Drainage Area(10 yr.)	.40	33	3.60	0.30	0.43
Existing Drainage Area(25 yr.)	.44	33	4.25	0.30	0.56
Existing Drainage Area(100 yr.)	.51	33	5.26	0.30	0.80

The following tables summarize the peak discharge for the drainage area which includes Sub-basin B. The drainage sub-basin includes 0.44 acres within the proposed Braum 1st Addition.

EXISTING PEAK RUNOFF DRAINAGE FOR SUB-BASIN B

Description	C	Tc	I	Area	Q(cfs)
Existing Drainage Area(2 yr.)	.33	37	2.33	0.44	0.34
Existing Drainage Area(5 yr.)	.35	37	2.94	0.44	0.45
Existing Drainage Area(10 yr.)	.40	37	3.38	0.44	0.59
Existing Drainage Area(25 yr.)	.44	37	3.99	0.44	0.77
Existing Drainage Area(100 yr.)	.51	37	4.95	0.44	1.11

The following tables summarize the peak discharge for the drainage area Sub-basin C. The drainage sub-basin includes 0.45 acres within the proposed Braum 1st Addition.

EXISTING PEAK RUNOFF DRAINAGE FOR SUB-BASIN C

Description	C	Tc	I	Area	Q(cfs)
Existing Drainage Area(2 yr.)	.33	31	2.59	0.45	0.38
Existing Drainage Area(5 yr.)	.35	31	3.26	0.45	0.51
Existing Drainage Area(10 yr.)	.40	31	3.72	0.45	0.67
Existing Drainage Area(25 yr.)	.44	31	4.39	0.45	0.87
Existing Drainage Area(100 yr.)	.51	31	5.43	0.45	1.25

Braum 1st Addition Drainage Plan(Con't)
Mr. Scott Lindebak, P.E.
May 28, 2009

The following tables summarize the peak discharge for the drainage area Sub-basin D. The drainage sub-basin includes 0.25 acres within the proposed Braum 1st Addition.

EXISTING PEAK RUNOFF DRAINAGE FOR SUB-BASIN C

Description	C	Tc	I	Area	Q(cfs)
Existing Drainage Area(2 yr.)	.33	33	2.50	0.25	0.21
Existing Drainage Area(5 yr.)	.35	33	3.14	0.25	0.27
Existing Drainage Area(10 yr.)	.40	33	3.60	0.25	0.36
Existing Drainage Area(25 yr.)	.44	33	4.25	0.25	0.47
Existing Drainage Area(100 yr.)	.51	33	5.26	0.25	0.67

III. POST DEVELOPMENT HYDROLOGIC ANALYSIS

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

The runoff calculations for the property have been completed utilizing the all 5 storm events.

Sub-basin A originates from the southeast corner of sub-basin, then water flows northwest via the asphalt parking lot where it exits through the entrance on 1st Street. The water then flows along the street gutter west until it connects with the City of Wichita storm sewer inlet at the corner of 1st Street and Dodge Street.

Sub-basin B originates from the northwest corner of the sub-basin, then water flows southeast via the asphalt parking lot where it exits through the north entrance on Seneca Street. Then the water follows the street gutter north to a City of Wichita storm sewer inlet.

Sub-basin C originates from the east side of the sub-basin, then water flows west and northwest via the asphalt parking lot where it exits through the entrance on Dodge Street. The water then flows along the street gutter north and connects with the City of Wichita storm sewer inlet at the corner of 1st Street and Dodge or south and connects with the City of Wichita storm sewer inlet.

Sub-basin D originates from the west edge of the sub-basin, then water flows east via the asphalt parking lot where it exits through the south entrance on Seneca Street. The water then follows the street gutter north to a City of Wichita storm sewer inlet.

Braum 1st Addition Drainage Plan(Con't)

Mr. Scott Lindebak, P.E.

May 28, 2009

The following table summarizes the peak discharge for developed conditions for Sub-basin A and includes 0.30 acres within the proposed Braum 1st Addition.

PROPOSED PEAK RUNOFF FOR DRAINAGE SUB-BASIN A

Description	C	Tc	I	Area	Q(cfs)
Developed Drainage Area(2 yr.)	.39	15	3.80	0.30	0.45
Developed Drainage Area(5 yr.)	.39	15	4.62	0.30	0.55
Developed Drainage Area(10 yr.)	.41	15	5.21	0.30	0.64
Developed Drainage Area(25 yr.)	.43	15	6.06	0.30	0.78
Developed Drainage Area(100 yr.)	.43	15	7.40	0.30	0.96

The following table summarizes the peak discharge for developed conditions for Sub-basin B and includes 0.44 acres within the proposed Braum 1st Addition.

PROPOSED PEAK RUNOFF FOR DRAINAGE SUB-BASIN B

Description	C	Tc	I	Area	Q(cfs)
Developed Drainage Area(2 yr.)	.40	15	3.80	0.44	0.67
Developed Drainage Area(5 yr.)	.40	15	4.62	0.44	0.82
Developed Drainage Area(10 yr.)	.41	15	5.21	0.44	0.95
Developed Drainage Area(25 yr.)	.43	15	6.06	0.44	1.15
Developed Drainage Area(100 yr.)	.44	15	7.40	0.44	1.42

The following table summarizes the peak discharge for developed conditions for Sub-basin C and includes 0.45 acres within the proposed Braum 1st Addition.

PROPOSED PEAK RUNOFF FOR DRAINAGE SUB-BASIN C

Description	C	Tc	I	Area	Q(cfs)
Developed Drainage Area(2 yr.)	.40	15	3.80	0.45	0.68
Developed Drainage Area(5 yr.)	.40	15	4.62	0.45	0.84
Developed Drainage Area(10 yr.)	.41	15	5.21	0.45	0.97
Developed Drainage Area(25 yr.)	.43	15	6.06	0.45	1.17
Developed Drainage Area(100 yr.)	.44	15	7.40	0.45	1.45

The following table summarizes the peak discharge for developed conditions for Sub-basin D and includes 0.25 acres within the proposed Braum 1st Addition.

PROPOSED PEAK RUNOFF FOR DRAINAGE SUB-BASIN D

Description	C	Tc	I	Area	Q(cfs)
Developed Drainage Area(2 yr.)	.38	15	3.80	0.25	0.36
Developed Drainage Area(5 yr.)	.38	15	4.62	0.25	0.44
Developed Drainage Area(10 yr.)	.40	15	5.21	0.25	0.52
Developed Drainage Area(25 yr.)	.42	15	6.06	0.25	0.64
Developed Drainage Area(100 yr.)	.43	15	7.40	0.25	0.80

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

VI. SUMMARY DISCUSSION:

The proposed plat will consolidate the current 7 lots into 1 lot. As a result of the new proposed development there has been a slight increase in the developed peak runoff from each of the sub-basins. Overall the increase in the developed peak runoff is approximately 0.80 cubic feet per second for the 100 year design storm. The nearest storm sewer present in Seneca Street at the northwest corner of Seneca and Douglas Streets. There is a 8" and 10" storm sewer in Dodge Avenue to the west of this property. The area of drainage subareas A, B, C and D is 0.30 acres, 0.44 acres, 0.45 acres and 0.25 acres, respectively. It is proposed to drain each of these subareas through proposed driveways and be collected in the exiting storm sewer systems in Dodge Avenue, 1st Street and Seneca Street.

VII. APPENDIX I:

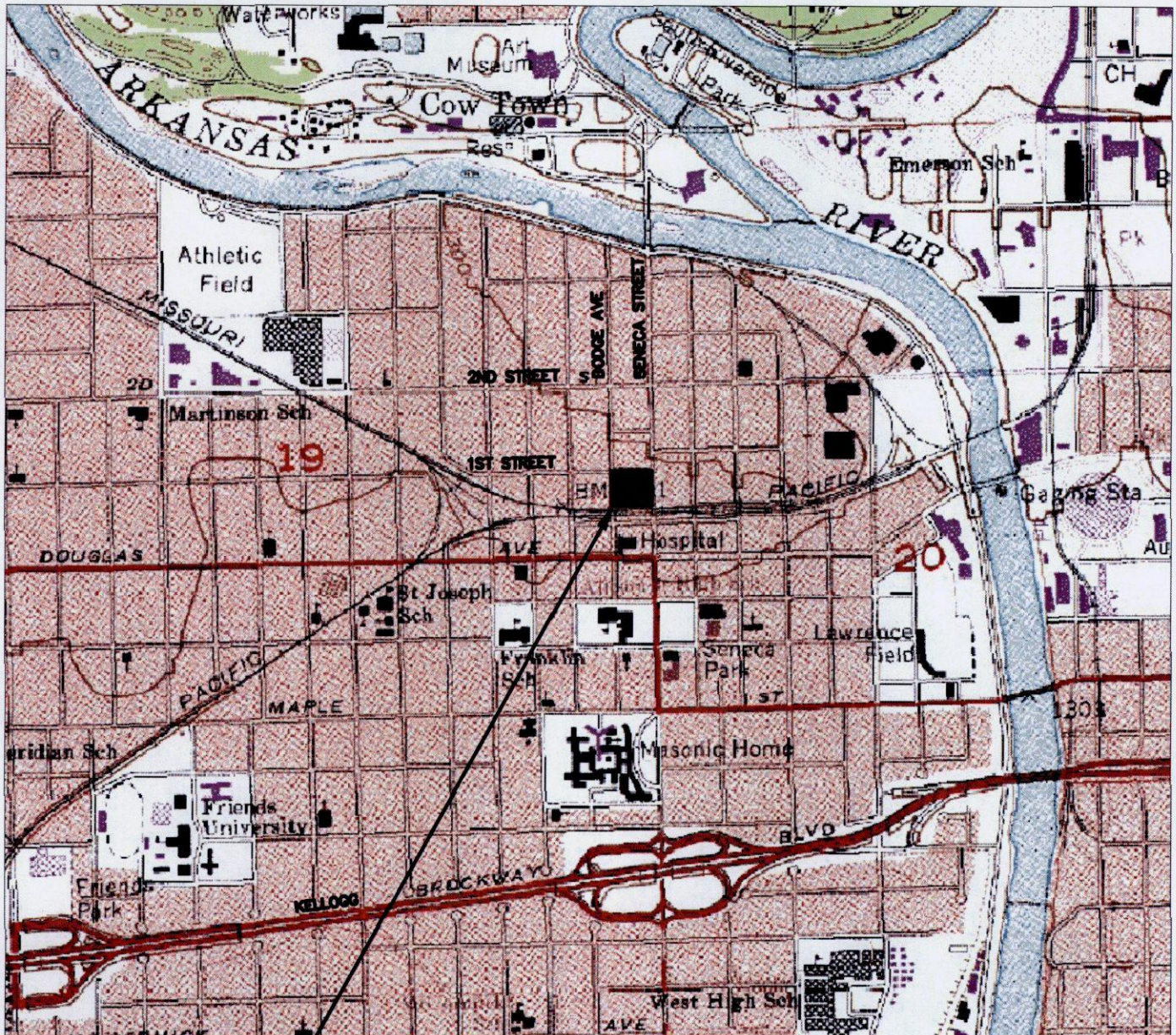
All charts, graphs, tables including a 1"=20' scale drainage plan map are included for review.

Braum 1st Addition Drainage Plan(Con't)
Mr. Scott Lindebak, P.E.
May 28, 2009

APPENDIX

BRAUM 1ST ADDITION

NE 1/4, SE 1/4, Sec 19, Township 27 South,
Range 1 East Wichita, Sedgwick County, Kansas

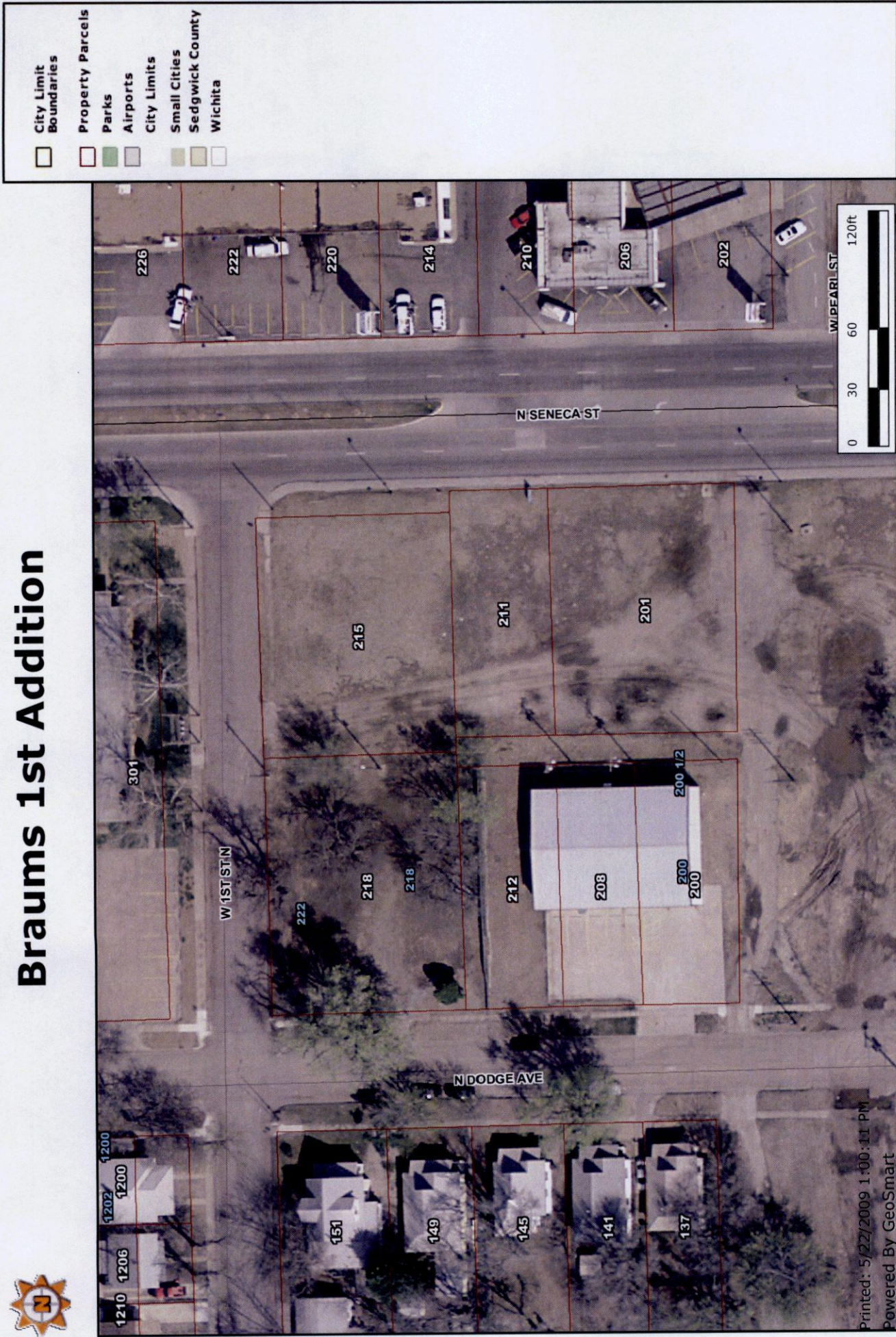


PROJECT LOCATION

BRAUMS 1ST ADDITION - USGS PROJECT LOCATION MAP			
CERTIFIED ENGINEERING DESIGN, P.A.			
CE D	810 WEST DOUGLAS, SUITE C		SHEET
	WICHITA, KANSAS 67203		1
	PH: (316) 262-8808		TOTAL
FAX: (316) 262-1669		1	



Braums 1st Addition



Printed: 5/22/2009 1:00:11 PM

Powered By GeoSmart



Every reasonable effort has been made to assure the accuracy of the maps and associated data provided herein. This information is provided with the understanding that the data are susceptible to a degree of error, and conclusions drawn from such information are the responsibility of the reader. The City of Wichita makes no warranty, representation or guaranty as to the content, accuracy, timeliness or completeness of any of the data provided herein. Some data provided here and used for the preparation of these maps has been obtained from public records not created or maintained by the City of Wichita. The City of Wichita shall assume no liability for any decisions made or actions taken or not taken by the reader in reliance upon any information or data furnished hereunder. The user should consult with the appropriate departmental staff member, e.g. Planning, Parks & Recreation, etc. to confirm the accuracy of information appearing in the visual presentations accessible through these web pages.



A vertical scale bar with markings at 0, 300, and 600 meters, and 1000 and 2000 feet.

The map displays a street grid for Zone X in the City of Wichita. Key features include:

- Streets:** N Elizabeth Ave, N Pearl St, N Handley St, N Exposition Ave, N Dodge Ave, N Millwood Ave, N Glenn Ave, N Charles St, N Clarence St, N Athenian Ave, N Saint Clair Ave, N Meridian Ave, W First St, W Burton Ave, W Douglas Ave, W Texas Ave, W Maple St, W Mentor Ave, W University Ave, W Dayton Ave, W Stillwell Ave, W Kellogg St, W Munnell Ave, W McCormick Ave, W Irving St, S Marys Dr, S Dodge Ave, S Martinson Ave, S Elizabeth Ave, S Fern Ave, S Glenn Ave, S Bonn Ave, S Clare Ave, S Charles St, S Vine Ave, S Seneca St, S Dodge Ave.
- Highways:** 54, 400.
- Proposed Right-of-Way Lines:** 64,000m E and 64,500m E.
- Other Labels:** HF0455, 19, 30, City of Wichita 200328, Zone X.
- Annotations:** A red arrow points to a location on N Elizabeth Ave. A black arrow points to a location on S Dodge Ave.

FIRM
FLOOD INSURANCE RATE MAP
SEDGWICK COUNTY,
KANSAS
AND INCORPORATED AREAS
PANEL 365 OF 700
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:		
<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL SUFFIX</u>
SEDGWICK COUNTY	200321	E 0365
WICHITA, CITY OF	200328	E 0365

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



MAP NUMBER
20173C0365E

EFFECTIVE DATE
FEBRUARY 2, 2007
Agency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov.

Soil Map—Sedgwick County, Kansas
(Braums 1st Addition)



MAP LEGEND

	Area of Interest (AOI)		Very Stony Spot
	Area of Interest (AOI)		Wet Spot
	Soils		Other
	Soil Map Units		Other
	Special Point Features		Special Line Features
	Blowout		Gully
	Borrow Pit		Short Steep Slope
	Clay Spot		Other
	Closed Depression		Political Features
	Gravel Pit		Cities
	Gravelly Spot		Water Features
	Landfill		Oceans
	Lava Flow		Streams and Canals
	Marsh or swamp		Transportation
	Mine or Quarry		Rails
	Miscellaneous Water		Interstate Highways
	Perennial Water		US Routes
	Rock Outcrop		Major Roads
	Saline Spot		Local Roads
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		
	Spoil Area		
	Stony Spot		

MAP INFORMATION

Map Scale: 1:1,500 if printed on A size (8.5" x 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000. Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 14N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Sedgwick County, Kansas
Survey Area Data: Version 5, Dec 3, 2008

Date(s) aerial images were photographed: 6/20/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Sedgwick County, Kansas (KS173)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6250	Urban land-Canadian complex, 0 to 3 percent slopes	1.4	100.0%
Totals for Area of Interest		1.4	100.0%

Report—Water Features

Water Features—Sedgwick County, Kansas									
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding		Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration
6250—Urban land-Canadian complex, 0 to 3 percent slopes				<i>Ft</i>	<i>Ft</i>	<i>Ft</i>			
Urban land	—	—	Jan-Dec	—	—	—	—	None	—
Canadian	B	Negligible	Jan-Dec	—	—	—	—	None	—

Data Source Information

Soil Survey Area: Sedgwick County, Kansas
 Survey Area Data: Version 5, Dec 3, 2008



Natural Resources
Conservation Service

Web Soil Survey 2.2
National Cooperative Soil Survey

5/26/2009
Page 3 of 3

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 face 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
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 face Characteristics	Percent Impervious	Frequency			
		<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 basins 320 acres or larger.

SOIL LEGEND

SYMBOL	HYDROLOGIC GROUP	NAME
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	Cline silty clay, 3 to 6 percent slopes
Ea ^{Cf-}	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
SEDGWICK COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

Time of conc.

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

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	1.66	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
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

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition

By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co.

Checked Date

Parcel Description: _____ Basin A

Existing X Developed

Sheet Flow

- | | | |
|---|--|----------------|
| 1 | Surface Description (Table 3-1): _____ Dense Grass | |
| 2 | Manning's Roughness Coefficient, n (Table 3-1) | 0.24 |
| 3 | Flow Length, $L \leq 300$ ft | 165 ft. |
| 4 | Two-yr 24-hr rainfall, P2 | 3.5 in |
| 5 | Land Slope, s | 0.0061 ft./ft. |
| 6 | $T = \frac{0.007 (nL)^{0.8}}{(P2^{0.5})(s^{0.4})}$ | 0.5473 hr |

Shallow Concentrated Flow

- | | | |
|----|--|---------|
| 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 | $T = L / 3600 V$ | hr |

Channel Flow

- | | | |
|----|-----------------------------------|-----------------|
| 12 | Cross sectional Flow Area, a | ft ² |
| 13 | Wetted Perimeter, P | ft. |
| 14 | Hydraulic Radius $r = a / P$ | ft. |
| 15 | Channel Slope, S | ft./ft. |
| 16 | Mannin's Roughness Coeff., n | |
| 17 | $V = 1.49 (r^{2/3})(s^{1/2}) / n$ | ft./s |
| 18 | Flow Length, L | ft. |
| 19 | $T = L / 3600 V$ | hr |
| 20 | $T = T + T + T$ | 0.55 hr |

33 minutes

Braums
Sec 19, T27S, R1E

Existing		A
Drainage Area =	0.30	Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentratio	33.00	Minutes
----------------------	-------	---------

C	Single Family (Soil Group B)				Total
2	0.33				0.33
5	0.35				0.35
10	0.40				0.40
25	0.44				0.44
100	0.51				0.51

I	
2	2.5
5	3.14
10	3.6
25	4.25
100	5.26

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.33	2.5	0.30		0.25
5	0.35	3.14	0.30		0.33
10	0.40	3.6	0.30		0.43
25	0.44	4.25	0.30		0.56
100	0.51	5.26	0.30		0.80

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition

By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co.

Checked Date

Parcel Description: _____ Basin B

Existing X Developed

Sheet Flow

- | | | |
|---|--|----------------|
| 1 | Surface Description (Table 3-1): _____ Dense Grass | |
| 2 | Manning's Roughness Coefficient, n (Table 3-1) | 0.24 |
| 3 | Flow Length, $L \leq 300$ ft | 202 ft. |
| 4 | Two-yr 24-hr rainfall, P2 | 3.5 in |
| 5 | Land Slope, s | 0.0069 ft./ft. |
| 6 | $T = \frac{0.007 (nL)^{0.8}}{(P2^{0.5})(s^{0.4})}$ | 0.6109 hr |

Shallow Concentrated Flow

- | | | |
|----|--|---------|
| 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 | $T = L / 3600 V$ | hr |

Channel Flow

- | | | |
|----|-----------------------------------|-----------------|
| 12 | Cross sectional Flow Area, a | ft ² |
| 13 | Wetted Perimeter, P | ft. |
| 14 | Hydraulic Radius $r = a / P$ | ft. |
| 15 | Channel Slope, S | ft./ft. |
| 16 | Mannin's Roughness Coeff., n | |
| 17 | $V = 1.49 (r^{2/3})(s^{1/2}) / n$ | ft./s |
| 18 | Flow Length, L | ft. |
| 19 | $T = L / 3600 V$ | hr |
| 20 | $T = T + T + T$ | 0.61 hr |

37 minutes

Braums
Sec 19, T27S, R1E

Existing		B
Drainage Area =	0.44	Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentratio	37.00	Minutes
----------------------	-------	---------

C	Single Family (Soil Group B)				Total
2	0.33				0.33
5	0.35				0.35
10	0.40				0.40
25	0.44				0.44
100	0.51				0.51

I	
2	2.33
5	2.94
10	3.38
25	3.99
100	4.95

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.33	2.33	0.44		0.34
5	0.35	2.94	0.44		0.45
10	0.40	3.38	0.44		0.59
25	0.44	3.99	0.44		0.77
100	0.51	4.95	0.44		1.11

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition

By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co.

Checked Date

Parcel Description: _____ Basin C

Existing X Developed

Sheet Flow

- | | | |
|---|--|----------------|
| 1 | Surface Description (Table 3-1): _____ Dense Grass | |
| 2 | Manning's Roughness Coefficient, n (Table 3-1) | 0.24 |
| 3 | Flow Length, $L \leq 300$ ft | 155 ft. |
| 4 | Two-yr 24-hr rainfall, P2 | 3.5 in |
| 5 | Land Slope, s | 0.0064 ft./ft. |
| 6 | $T = \frac{0.007 (nL)^{0.8}}{(P2^{0.5})(s^{0.4})}$ | 0.5094 hr |

Shallow Concentrated Flow

- | | | |
|----|--|---------|
| 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 | $T = L / 3600 V$ | hr |

Channel Flow

- | | | |
|----|-----------------------------------|---------|
| 12 | Cross sectional Flow Area, a | ft^2 |
| 13 | Wetted Perimeter, P | ft. |
| 14 | Hydraulic Radius $r = a / P$ | ft. |
| 15 | Channel Slope, S | ft./ft. |
| 16 | Mannin's Roughness Coeff., n | |
| 17 | $V = 1.49 (r^{2/3})(s^{1/2}) / n$ | ft./s |
| 18 | Flow Length, L | ft. |
| 19 | $T = L / 3600 V$ | hr |
| 20 | $T = T + T + T$ | 0.51 hr |

31 minutes

Braums
Sec 19, T27S, R1E

Existing		C
Drainage Area =	0.45	Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentratio	31.00	Minutes
----------------------	-------	---------

C	Single Family (Soil Group B)				Total
2	0.33				0.33
5	0.35				0.35
10	0.40				0.40
25	0.44				0.44
100	0.51				0.51

I	
2	2.59
5	3.26
10	3.72
25	4.39
100	5.43

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.33	2.59	0.45		0.38
5	0.35	3.26	0.45		0.51
10	0.40	3.72	0.45		0.67
25	0.44	4.39	0.45		0.87
100	0.51	5.43	0.45		1.25

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co. Checked Date

Parcel Description: _____ Basin D

Existing X Developed

Sheet Flow

- 1 Surface Description (Table 3-1): _____ Dense Grass
- 2 Manning's Roughness Coefficient, n (Table 3-1) 0.24
- 3 Flow Length, $L \leq 300$ ft 200 ft.
- 4 Two-yr 24-hr rainfall, P2 3.5 in
- 5 Land Slope, s 0.0085 ft./ft.
- 6 $T = \frac{0.007 (nL)^{0.8}}{(P2^{0.5})(s^{0.4})}$ 0.5576 hr

Shallow Concentrated Flow

- 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 $T = L / 3600 V$ hr

Channel Flow

- 12 Cross sectional Flow Area, a ft²
- 13 Wetted Perimeter, P ft.
- 14 Hydraulic Radius $r = a / P$ ft.
- 15 Channel Slope, S ft./ft.
- 16 Mannin's Roughness Coeff., n
- 17 $V = 1.49 (r^{2/3})(s^{1/2}) / n$ ft./s
- 18 Flow Length, L ft.
- 19 $T = L / 3600 V$ hr
- 20 $T = T + T + T$ 0.56 hr

33 minutes

Braums
Sec 19, T27S, R1E

Existing		D
Drainage Area =	0.25	Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentratio	33.00	Minutes
----------------------	-------	---------

C	Single Family (Soil Group B)				Total
2	0.33				0.33
5	0.35				0.35
10	0.40				0.40
25	0.44				0.44
100	0.51				0.51

I	
2	2.5
5	3.14
10	3.6
25	4.25
100	5.26

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.33	2.5	0.25		0.21
5	0.35	3.14	0.25		0.27
10	0.40	3.6	0.25		0.36
25	0.44	4.25	0.25		0.47
100	0.51	5.26	0.25		0.67

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co. Checked Date

Parcel Description: _____ Basin A

Existing Developed X

Sheet Flow

- 1 Surface Description (Table 3-1): _____ Asphalt
- 2 Manning's Roughness Coefficient, n (Table 3-1) 0.011
- 3 Flow Length, $L \leq 300$ ft 187 ft.
- 4 Two-yr 24-hr rainfall, P2 3.5 in
- 5 Land Slope, s 0.004 ft./ft.
- 6 $T = \frac{0.007 (nL)^{0.8}}{(P2^{0.5})(s^{0.4})}$ 0.0606 hr

Shallow Concentrated Flow

- 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 $T = L / 3600 V$ hr

Channel Flow

- 12 Cross sectional Flow Area, a ft²
- 13 Wetted Perimeter, P ft.
- 14 Hydraulic Radius $r = a / P$ ft.
- 15 Channel Slope, S ft./ft.
- 16 Mannin's Roughness Coeff., n
- 17 $V = 1.49 (r^{2/3})(s^{1/2}) / n$ ft./s
- 18 Flow Length, L ft.
- 19 $T = L / 3600 V$ hr
- 20 $T = T + T + T$ 0.06 hr

4 minutes

Braums
Sec 19, T27S, R1E

Proposed		A
Drainage Area =	0.30	Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentratio	15.00	Minutes
----------------------	-------	---------

C	Weighted				Total
	Soil	Pav-Roof			Average
	16%	84%			
2	0.16	0.87			0.39
5	0.18	0.87			0.39
10	0.24	0.88			0.41
25	0.33	0.89			0.43
100	0.37	0.89			0.43

I	
2	3.8
5	4.62
10	5.21
25	6.06
100	7.4

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.39	3.8	0.30		0.45
5	0.39	4.62	0.30		0.55
10	0.41	5.21	0.30		0.64
25	0.43	6.06	0.30		0.78
100	0.43	7.4	0.30		0.96

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition

By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co.

Checked Date

Parcel Description: _____ Basin B

Existing Developed X

Sheet Flow

- | | | |
|---|--|----------------|
| 1 | Surface Description (Table 3-1): _____ Asphalt | |
| 2 | Manning's Roughness Coefficient, n (Table 3-1) | 0.011 |
| 3 | Flow Length, $L \leq 300$ ft | 229 ft. |
| 4 | Two-yr 24-hr rainfall, P2 | 3.5 in |
| 5 | Land Slope, s | 0.0076 ft./ft. |
| 6 | $T = \frac{0.007 (nL)^{0.8}}{(P2^{0.5})(s^{0.4})}$ | 0.0551 hr |

Shallow Concentrated Flow

- | | | |
|----|--|---------|
| 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 | $T = L / 3600 V$ | hr |

Channel Flow

- | | | |
|----|-----------------------------------|-----------------|
| 12 | Cross sectional Flow Area, a | ft ² |
| 13 | Wetted Perimeter, P | ft. |
| 14 | Hydraulic Radius $r = a / P$ | ft. |
| 15 | Channel Slope, S | ft./ft. |
| 16 | Mannin's Roughness Coeff., n | |
| 17 | $V = 1.49 (r^{2/3})(s^{1/2}) / n$ | ft./s |
| 18 | Flow Length, L | ft. |
| 19 | $T = L / 3600 V$ | hr |
| 20 | $T = T + T + T$ | 0.06 hr |
| | | 3 minutes |

Braums
Sec 19, T27S, R1E

Proposed	B
Drainage Area =	0.44 Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentration	15.00 Minutes
-----------------------	---------------

C	Weighted				Total
	Soil	Pav-Roof			Average
	13%	87%			
2	0.16	0.87			0.40
5	0.18	0.87			0.40
10	0.24	0.88			0.41
25	0.33	0.89			0.43
100	0.37	0.89			0.44

I	
2	3.8
5	4.62
10	5.21
25	6.06
100	7.4

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.40	3.8	0.44		0.67
5	0.40	4.62	0.44		0.82
10	0.41	5.21	0.44		0.95
25	0.43	6.06	0.44		1.15
100	0.44	7.4	0.44		1.42

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition

By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co.

Checked Date

Parcel Description: _____ Basin C

Existing Developed X

Sheet Flow

- | | | |
|---|---|----------------|
| 1 | Surface Description (Table 3-1): _____ Asphalt | |
| 2 | Manning's Roughness Coefficient, n (Table 3-1) | 0.011 |
| 3 | Flow Length, L <= 300 ft | 130 ft. |
| 4 | Two-yr 24-hr rainfall, P2 | 3.5 in |
| 5 | Land Slope, s | 0.0096 ft./ft. |
| 6 | $T = \frac{0.007 (nL)^{0.8}}{(P^{0.5})(s^{0.4})}$ | 0.0319 hr |

Shallow Concentrated Flow

- | | | |
|----|--|---------|
| 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 | $T = L / 3600 V$ | hr |

Channel Flow

- | | | |
|----|-----------------------------------|---------|
| 12 | Cross sectional Flow Area, a | ft^2 |
| 13 | Wetted Perimeter, P | ft. |
| 14 | Hydraulic Radius $r = a / P$ | ft. |
| 15 | Channel Slope, S | ft./ft. |
| 16 | Mannin's Roughness Coeff., n | |
| 17 | $V = 1.49 (r^{2/3})(s^{1/2}) / n$ | ft./s |
| 18 | Flow Length, L | ft. |
| 19 | $T = L / 3600 V$ | hr |
| 20 | $T = T + T + T$ | 0.03 hr |

2 minutes

Braums
Sec 19, T27S, R1E

Proposed	C
Drainage Area =	0.45 Acres

Soil	Urban Land Canadian Complex
Type	B

Time of Concentration	15.00 Minutes
-----------------------	---------------

C	Weighted				Total
	Soil	Pav-Roof			Average
	13%	87%			
2	0.16	0.87			0.40
5	0.18	0.87			0.40
10	0.24	0.88			0.41
25	0.33	0.89			0.43
100	0.37	0.89			0.44

I	
2	3.8
5	4.62
10	5.21
25	6.06
100	7.4

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.40	3.8	0.45		0.68
5	0.40	4.62	0.45		0.84
10	0.41	5.21	0.45		0.97
25	0.43	6.06	0.45		1.17
100	0.44	7.4	0.45		1.45

WORKSHEET 3: TIME OF CONCENTRATION

Project: Braum 1st Addition

By CC Date 5/27/2009

Section: _____ Sec 19, T27S, R1E, Sedgwick Co.

Checked Date

Parcel Description: _____ Basin D

Existing Developed X

Sheet Flow

- | | | |
|---|---|----------------|
| 1 | Surface Description (Table 3-1): _____ Asphalt | |
| 2 | Manning's Roughness Coefficient, n (Table 3-1) | 0.011 |
| 3 | Flow Length, $L \leq 300$ ft | 252 ft. |
| 4 | Two-yr 24-hr rainfall, P2 | 3.5 in |
| 5 | Land Slope, s | 0.0044 ft./ft. |
| 6 | $T = \frac{0.007 (nL)^{0.8}}{(P^{0.5})(s^{0.4})}$ | 0.0738 hr |

Shallow Concentrated Flow

- | | | |
|----|--|---------|
| 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 | $T = L / 3600 V$ | hr |

Channel Flow

- | | | |
|----|-----------------------------------|-----------------|
| 12 | Cross sectional Flow Area, a | ft ² |
| 13 | Wetted Perimeter, P | ft. |
| 14 | Hydraulic Radius $r = a / P$ | ft. |
| 15 | Channel Slope, S | ft./ft. |
| 16 | Mannin's Roughness Coeff., n | |
| 17 | $V = 1.49 (r^{2/3})(s^{1/2}) / n$ | ft./s |
| 18 | Flow Length, L | ft. |
| 19 | $T = L / 3600 V$ | hr |
| 20 | $T = T + T + T$ | 0.07 hr |

4 minutes

Braums
Sec 19, T27S, R1E

Proposed		D
Drainage Area =	0.25	Acres

Soil	Urban Land Canadian Complex
Type	B

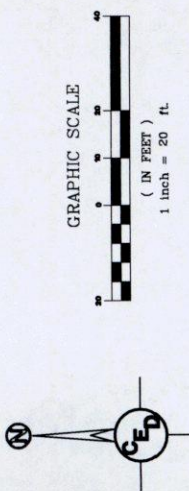
Time of Concentratio	15.00	Minutes
----------------------	-------	---------

C	Weighted				Total
	Soil	Pav-Roof			Average
	20%	80%			
2	0.16	0.87			0.38
5	0.18	0.87			0.38
10	0.24	0.88			0.40
25	0.33	0.89			0.42
100	0.37	0.89			0.43

I	
2	3.8
5	4.62
10	5.21
25	6.06
100	7.4

Peak Flow					
Year	C	I	A	=	Q
					cfs
2	0.38	3.8	0.25		0.36
5	0.38	4.62	0.25		0.44
10	0.40	5.21	0.25		0.52
25	0.42	6.06	0.25		0.64
100	0.43	7.4	0.25		0.80

DRAINAGE PLAN
BRAUM 1ST ADDITION
NE 1/4, SE 1/4, Sec 19, Township 27 South,
Range 1 East Wichita, Sedgwick County, Kansas



LEGAL DESCRIPTION:

Parcel 1:
Lot 1, Joe's Addition, Wichita, Sedgwick County, Kansas

Parcel 2:
Lots 21, 23, 25, 27 and 29 on Seneca Street, in Martinson's Addition to West Wichita, Sedgwick County, Kansas together with the East Half of Vacated Alley adjoining said Lots 21, 23, 25, 27 and 29 on the west and together with Vacated Pearl Street as platted in said Martinson's 2nd Addition, adjoining said Lot 21 and said East Half of vacated alley on the South.

Parcel 3:
Lots 22, 24, 26, 28 and 30, Dodge Avenue, Martinson's 2nd Addition to West Wichita, Sedgwick County, Kansas, together with the West Half of vacated alley adjoining said Lots 22, 24, 26, 28 and 30 on the East and together with Vacated Pearl Street as platted in said Martinson's 2nd Addition, adjoining said Lot 22 and said West Half of vacated alley on the South.

Parcel 4:
Lots 32, 34, 36 and 38 on Dodge Avenue, Martinson's Sixth Addition to Wichita, Sedgwick County, Kansas, together with the West Half of Vacated North-South Alley lying East of Lots 32, 34, 36 and 38.

BENCHMARK:
Square "a" cut top of curb, 14.9' North of the NW Corner, Lot 1, Block A, Brauns 1st Addition.
Elevation = 1301.83 NAVD 88

ZONING:
GC & LI

AREA:
62,583.04 sq ft ±, 1.44 Acres± (GROSS)
59,275.32 sq ft ±, 1.36 Acres± (NET)

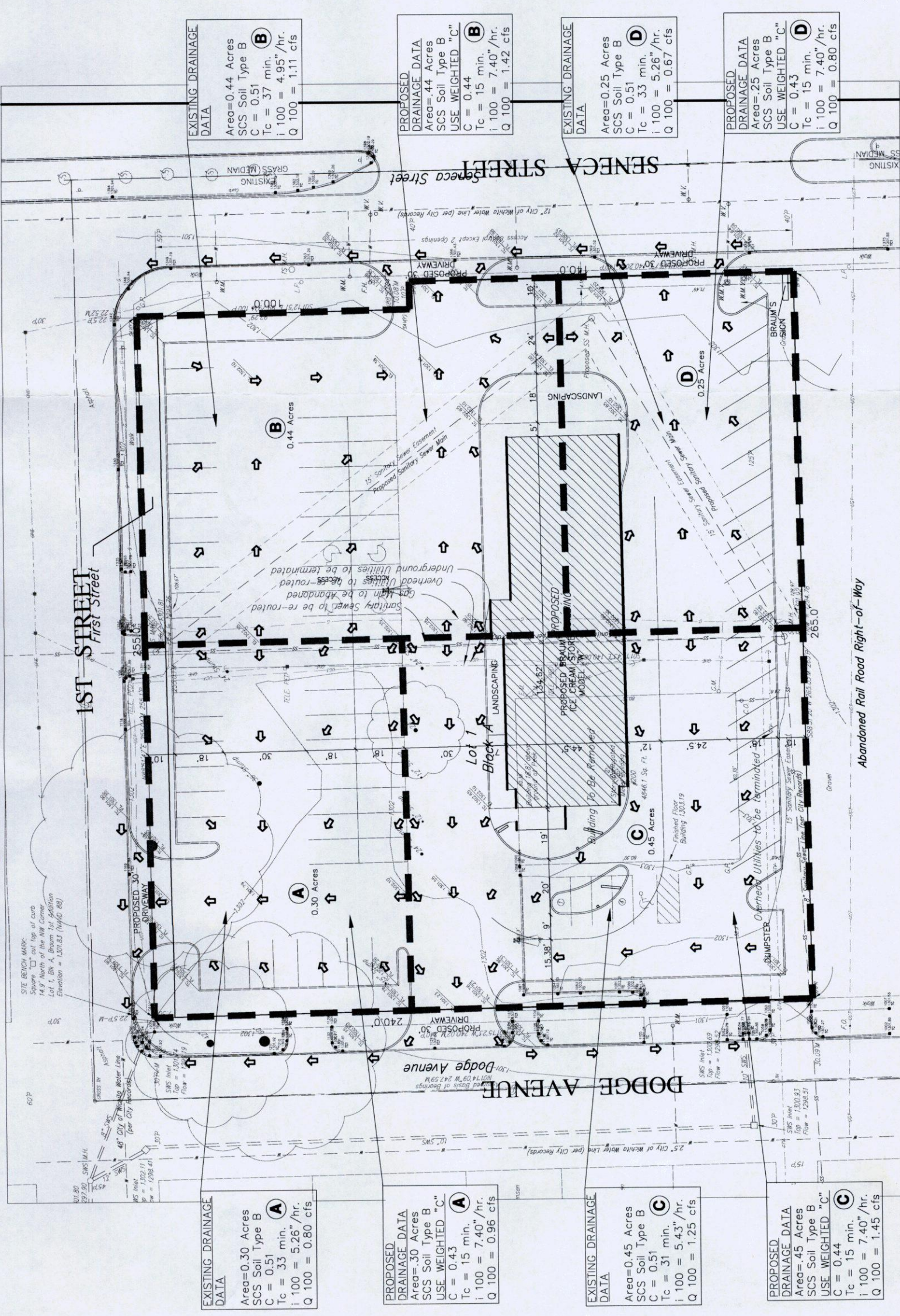
DATE SURVEYED:
May 15, 2009

SURVEYOR:
Sedgwick County, P.A.
Land Surveyors
433 S. Hydraulic
Wichita, KS 67211-1911
(316) 265-0005

ENGINEER:
Horton Foraker, P.E.
Certified Engineering Design, P.A.
810 W. Douglas, Suite C
Wichita, KS 67203
(316) 262-8808

OWNER:
Retail Buildings, Inc.
3000 NE 65th St.
Oklahoma City, OK 73121

CONTROL NOS.:
199783, 199784, 199789,
199790, 199791, 200111,
200112, 23092



EXISTING DRAINAGE DATA
Area=0.30 Acres
SCS Soil Type B
C = 0.51
Tc = 33 min.
I 100 = 5.26" /hr.
Q 100 = 0.80 cfs

PROPOSED DRAINAGE DATA
Area=30 Acres
SCS Soil Type B
USE WEIGHTED "C"
C = 0.43
Tc = 15 min.
I 100 = 7.40" /hr.
Q 100 = 0.96 cfs

EXISTING DRAINAGE DATA
Area=44 Acres
SCS Soil Type B
USE WEIGHTED "C"
C = 0.44
Tc = 33 min.
I 100 = 7.40" /hr.
Q 100 = 1.42 cfs

PROPOSED DRAINAGE DATA
Area=44 Acres
SCS Soil Type B
USE WEIGHTED "C"
C = 0.43
Tc = 15 min.
I 100 = 7.40" /hr.
Q 100 = 0.96 cfs

EXISTING DRAINAGE DATA
Area=0.25 Acres
SCS Soil Type B
C = 0.51
Tc = 33 min.
I 100 = 5.26" /hr.
Q 100 = 0.67 cfs

PROPOSED DRAINAGE DATA
Area=25 Acres
SCS Soil Type B
USE WEIGHTED "C"
C = 0.43
Tc = 15 min.
I 100 = 7.40" /hr.
Q 100 = 0.80 cfs

EXISTING DRAINAGE DATA
Area=0.44 Acres
SCS Soil Type B
C = 0.51
Tc = 33 min.
I 100 = 5.26" /hr.
Q 100 = 1.11 cfs

PROPOSED DRAINAGE DATA
Area=45 Acres
SCS Soil Type B
USE WEIGHTED "C"
C = 0.44
Tc = 15 min.
I 100 = 7.40" /hr.
Q 100 = 1.45 cfs

PROPOSED DRAINAGE DIRECTION

- 5/8" R
- 5/8" REBAR (FOUND)
- BRN
- 1/2" REBAR W/BAUGHMAN CAP (FOUND)
- MACON
- 1/2" REBAR W/MAACON CAP (FOUND)
- TH
- OTY OF WICHITA CONTROL (FOUND)
- SAV
- 1/2" REBAR W/SAVOY CAP (SET)
- SAV(F)
- 1/2" REBAR W/SAVOY CAP (FOUND)

LEGEND:

- P = Platted
- M = Measured
- C = Computed
- D = Descended

G = GAS MAIN
W = WATER MAIN
SCS = STORM WATER SEWER
UGF = UNDER GROUND ELECTRIC
UGT = UNDER GROUND TELEPHONE

TELE. PED. TELEPHONE PEDESTAL
E.E. ELECTRIC BOX
G.M. GAS METER
W.M. WATER METER
W.V. WATER VALVE
F.H. FIRE HYDRANT

MONITOR WELL
CLEAN OUT
LIGHT POLE
POWER POLE
HIGH LINE POLE
GUY ANCHOR

DRAINAGE PLAN
BRAUM 1ST ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS
PROJ. NO.: 20099999
CERTIFIED ENGINEERING DESIGN, P.A.
810 WEST DOUGLAS SUITE C
WICHITA, KANSAS 67203
PH (316) 262-8808 FAX (316) 262-1669
SEDGWICK ENGINEER HP
DRAWING: BRAUM CC
SCALE: SCALE 1"=20'
DATE: DATE May 2009
CHECKED: ENGINEER HPF
CSD FILE: BraumDRain
TOTAL 1