DRAINAGE REPORT

FOR

QUIKTRIP 11TH ADDITION
Wichita, Kansas

OCTOBER 2010

Tab 0. Checklist

CITY OF WICHITA

Public Works, Engineering Division
Final Drainage Plan Submittal Checklist

Reviewer: City of Wichita Date: October 25, 2010

Subdivision Name: QuikTrip 11th Addition Location: Wichita, Kansas

Total Land Area Of Ownership: 2.2 Acres

Type: ☐ Residential ☑ Commercial ☐ Industrial ☐ Recreation ☐ Municipal ☐ Other

Applicant: QuikTrip Contact: Kevin Bledsoe Phone #: (918) 615-7141

Engineer: MKEC Engineering Consultants, Inc. Contact: Kara Anderson, P.E. Phone # (316) 684-9600

Please check the appropriate box: I = Included; NA = Non-Applicable; R= Required prior to development
(If "NA" is checked, an explanation must be entered)

	Applicant			Engr	
Tab 1. Project Narrative	**I**	**NA**	**Explanation / Location in Plan**	**I**	**NA**
A. Site Location Map, using USGS Map	✔		Appendix 1.1		
B. Discussion of development, existing conditions, and proposed impacts on stormwater, wetland, riparian, and flood plain	✔		Tab 1 Text		
C. Discussion of offsite conditions	✔		Tab 1 Text		
D. Summary of runoff calculations (pre/post development) No increase in peak discharge for all storm series	✔		Tab 1 Text		
E. Narrative description of the type and function of the permanent best management practices that are incorporated into the site design	✔		Tab 1 Text		
F. Copy of the plat	✔		Appendix 1.2		
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.)	✔		Appendix 1.4		
H. Professional Engineer seal, signature and date on cover of report	✔		Cover		
I. CD of drainage plan in PDF format (one file) and one paper copy bound with this checklist included behind the cover	✔		Cover & Tab 0.		

	Applicant			Engr	
Tab 2. Existing Conditions Runoff Calculations	**I**	**NA**	**Explanation / Location in Plan**	**I**	**NA**
A. Copy of applicable orthophoto showing proposed project boundaries (preferable in color)	✔		Appendix 2.1		
B. Runoff Method (Rational, Hydrograph Method, or other approved methods by Engineering)	✔		Tab 2 Text		
C. Existing topography (no greater than 2-foot contours, 1-foot recommend)	✔		Appendix 2.2		
D. Total Site Area and Total Impervious Area (acres)	✔		Tab 2 Text		
E. Benchmarks used for site control	✔		Appendix 2.2		
F. Streams, creeks, and waterway labeled	✔		Appendix 2.2		
G. Predominant soils from USDA soil surveys, and/or on site soil borings	✔		Tab 2 Text and Appendix 2.4		
H. Location and boundaries of natural features such as wetlands, lakes, and ponds with the normal water elevation noted	✔		Appendix 2.2		
I. Location of existing roads, buildings, parking lots and other impervious areas.	✔		Appendix 2.2		

Consulting Engineer Initials _____

J. Location of existing utilities (e.g., water, sewer, gas, electric) and easements	✔		Appendix 2.2		
K. Location of existing conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow	✔		Appendix 2.2		
L. Flow paths	✔		Appendix 2.2		
M. Location and dimensions of existing channels, bridges or culvert crossings	✔		Appendix 2.2		
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	✔		Tab 2 Text		
O. Assumed pre-developed runoff curve numbers	✔		Appendix 2.6		
P. Existing time of concentrations used in calculations	✔		Appendix 2.6		
Q. Evaluate immediate downstream drainage capacity, not to exceed more than 0.25 miles downstream of site	✔		Tab 2 Text		
R. Existing structural elevations (e.g., invert of pipes, manholes, etc.)	✔		Appendix 2.2		
S. Cross-section data for open channels	✔		Tab 2 Text		
T. Ground water elevations, if applicable	✔		Tab 2 Text		

	Applicant			Engr	
Tab 3. Post-Development Hydrologic Analysis	**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)	✔		Tab 3 Text and Appendix 2.5		
B. Proposed time of concentrations used in calculations	✔		Appendix 2.5		
C. Assumed post-developed runoff curve numbers	✔		Appendix 2.6		
D. Proposed contours for detention facilities (to equal area used in outlet rating curves)	✔		Appendix 3.1		
E. Preliminary sizing calculations for stormwater controls including contributing drainage area, storage, and outlet configuration	✔		Appendix 2.5		
F. Stage-storage-discharge or outlet rating curves and inflow and outflow hydrographs for storage facilities	✔		Appendix 2.5		
G. Final analysis of potential upstream/downstream impact/effects of project, where necessary	✔		Tab 3 Text		
H. Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.)	✔		Appendix 3.1		
I. Design water surface elevations and normal pool elevation for ponds.	✔		Appendix 3.1		
J. Typical detail for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc. To include height, width, elevation, and/or diameter.	✔		Appendix 3.1		
K. Proposed limits of clearing and grading	✔		Tab 3 Text		
L. Location of existing and proposed roads, buildings, parking lots and other impervious areas.	✔		Appendix 3.1		
M. Location of existing and proposed utilities (e.g., water, sewer) and easements	✔		Appendix 3.1		
N. Location of existing and proposed conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow	✔		Appendix 3.1		
O. Preliminary location and dimensions of proposed channel modifications, such as bridge or culvert crossings	✔		Appendix 3.1		

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P. Preliminary selection and location of stormwater controls	✔		Appendix 3.1		
Q. Emergency overflow structure's flow path	✔		Appendix 3.1		
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	✔		Appendix 3.1		
T. Lowest opening elevations table on the plat for structures located adjacent to channels or ponds	✔		Tab 3 Text		
U. Stormwater Management Facilities located within a Reserve		✔			
V. Maintenance responsibility of stormwater management facility shall be specified in the platters text. (e.g. HOA, Lot Owners Association, or lot)	✔		Tab 3 Text		
W. Off-site drainage easements or agreements required, where necessary	✔		Tab 3 Text		

	Applicant			Engr	
Tab 4. Floodplain Submittal	**I**	**NA**	**Explanation / Location in Plan**	**I**	**NA**
A. Provide source of flood profile		✔	No FEMA floodplain		
B. Nearest base flood elevations		✔	No FEMA floodplain		
C. Delineation of pre-developed regulatory floodplain/floodway limits		✔	No FEMA floodplain		
D. Delineation of post-developed regulatory floodplain and floodway limits		✔	No FEMA floodplain		
E. Floodplain boundary determination per elevation (project limits shown)		✔	No FEMA floodplain		
F. Provide source of floodway data table and discharges		✔	No FEMA floodplain		
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		✔	No FEMA floodplain		
H. Provide regulatory floodway and four natural profile models (10,50,100, and 500-yr) for existing and future watershed conditions		✔	No FEMA floodplain		
I. Location of floodplain/floodway limits and relationship of site to upstream/downstream properties (floodplain limits to be per elevation and scaled location)		✔	No FEMA floodplain		
J. Flood plains and floodways located within a Reserve, where necessary		✔	No FEMA floodplain		

	Applicant			Engr	
Tab 5. Federal, State and Local Permits (to be provided prior to construction unless otherwise specified)	**I/R**	**NA**	**Explanation / Location in Plan**	**I/R**	**NA**
A. US Army Corps of Engineers - Regulatory program permits (404 water quality certification)		✔	No wetlands or jurisdictional water ways		
B. Kansas Department of Agriculture - Division of Water Resources Permits (Stream Obstruction, Channel Change, Flood Plain Fill, Levee, Water Appropriations, Dam safety permit, etc.)		✔	No jurisdictional waterways		
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.		✔	No FEMA floodplain		
D. Kansas Department of Transportation		✔	No KDOT roads		
E. Sedgwick County Right-of-way Permit		✔	No county roads		

Consulting Engineer Initials _____

Tab 1. Project Narrative

Location

The subject property is in the City of Wichita, Sedgwick County, Kansas. The proposed development is south of Kellogg Avenue (US Highway 54) and west of Hillside Street. The site is bounded by Orme Street to the North and Lorraine Street to the west. The site lies in the northeast quarter of Section 27, Township 27 South, Range 1 East. The plat area is 2.2 acres. The site is shown on the USGS Map, Appendix 1.1.

Discussion of Development

The site is currently 14 residential lots approximately 1/8 acre in size. The residential houses will be removed and a convenience store is planned. The proposed site is shown on the plat, Appendix 1.2.

Drainage Summary

Pre-Development

The site is flat and the existing drainage patterns are not evident. The site ultimately drains to the adjacent streets and north to Orme Street into an existing 72" RCB storm water sewer (SWS) system. The SWS flows to the west and directly into the Wichita Drainage Canal. Pre-development flow rates are shown in Table 1.1.

Post-Development

The proposed development will provide detention along the east side of the property and a proprietary water quality system. Storm water runoff will continue to flow into the system along Orme which drains to the Wichita Drainage Canal. Post-project flow rates are shown in Table 1.1.

Table 1.1. Comparison of Pre and Post-Development Flow Rates

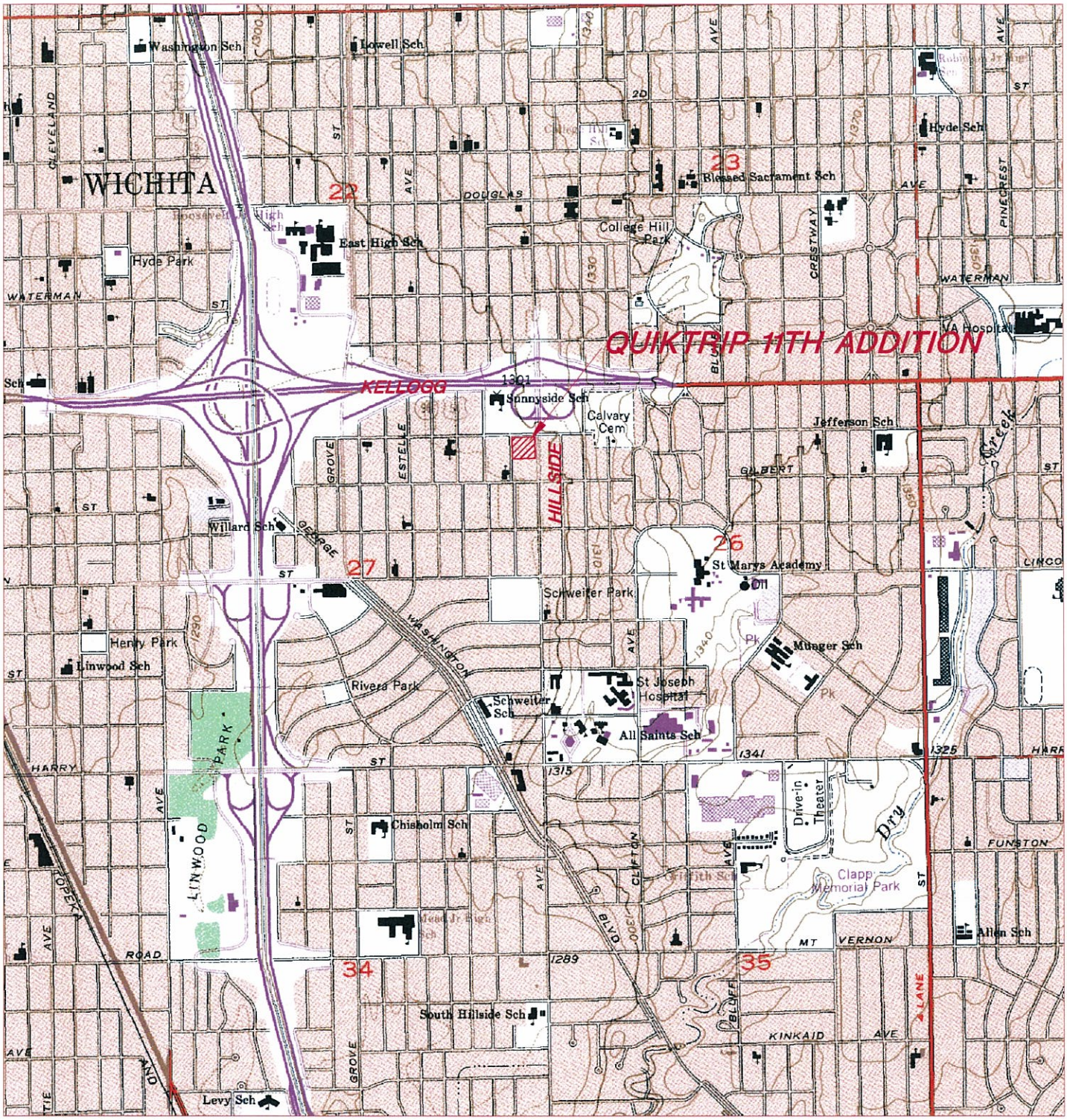
Description	Design Storm Flows (cfs)				
	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Pre-Project	4.5	6.1	7.1	8.6	11.2
Post-Project	7.6	9.9	14.0	17.5	22.7

Best Management Practices

The site will be seeded or sodded after completion of the construction of grading and utilities. During construction curb protection, inlet protection, a construction entrance, and other erosion protection devices will be used to prevent soil from leaving the site. A storm water pollution prevention plan will be implemented prior to any soil disturbing activities.

Appendix 1.1

USGS Quadrangle Map



SCALE: 1"=2000'

2000 0 2000 4000

N

SECTION 27
TOWNSHIP 27
RANGE 1E

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

QUIKTRIP 11TH ADDITION
PROJECT NAME

QUAD MAP
SHEET TITLE

KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:

OCTOBER 2010	10246	1 / 1
DATE	JOB NO.	SHEET/OF

J:\Civil\10246-Hillside\Dwg\DRNG\10246_QUAD.dwg

Appendix 1.2

Plat

FINAL PLAT

QUIKTRIP 11th ADDITION

AN ADDITION TO WICHITA, SEDGWICK COUNTY, KANSAS

CERTIFICATE OF SURVEY

I, Gregory J. Allison, a registered land surveyor in Kansas, do hereby certify that I have been in responsible charge of surveying and platting of "QUIKTRIP 11th ADDITION", an addition to Wichita, Sedgwick County, Kansas, into a Lot, and a Block, the same being accurately set forth in the accompanying plat and described herein:

Lots 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, and 72, Block 8, together with, the adjoining 16 foot platted alley, all in Sunny-Side Addition to the City of Wichita, Kansas, said tract being located in the Northeast Quarter of Section 27, Township 27 South, Range 1 East of the Sixth Principal Meridian, Wichita, Sedgwick County, Kansas, collectively being more particularly described as follows:

BEGINNING at the Northeast corner of said Lot 49, thence along the east line of said Block 8 on a Kansas coordinate system of 1983 south zone grid bearing of S01°04'18"E, a distance of 300.06 feet to the southeast corner of said Lot 71; thence S88°47'37"W along the south lines of said Lots 71 and 72, a distance of 318.01 feet to the southwest corner of said Lot 72; thence N01°03'56"W, along the west line of said Block 8, a distance of 299.91 feet to the northwest corner of said Lot 50; thence N88°46'03"E, along the north line of said Block 8, a distance of 317.98 feet to the POINT OF BEGINNING.

Said described tract contains 95,394 square feet or 2.19 acres, more or less.

All alleys, streets, easements, building setbacks, access controls, together with all other public dedications within the above described property are hereby vacated and replatted by virtue of K.S.A. 12-512(b).

I hereby certify that the details of this plat are correct to the best of my knowledge and belief this ___day of _____, 2010.

Gregory J. Allison, PE, LS #1257
MKEC Engineering Consultants, Inc.
411 North Webb Road
Wichita, Kansas 67206

OWNER'S CERTIFICATES

Know all men by these presents that we the undersigned property owners of the land above set forth in the Registered Land Surveyor's Certificate, have caused the same to be surveyed and platted into a Lot, and a Block, the same to be known as "QUIKTRIP 11th ADDITION," an addition to Wichita, Sedgwick County, Kansas.

Easements for the construction and maintenance of public utilities and drainage, as indicated on the accompanying plat are hereby granted to the public. That part of the former platted alley, now platted as a temporary easement utility easement, shall expire upon the cessation of usage and removal and/or abandonment of existing public and private utilities.

All abutters rights of access to or from Hillside Avenue over and across the east line of "QUIKTRIP 11th ADDITION," are hereby granted to the appropriate governing body, as indicated hereon.

A drainage plan has been developed for this plat. All drainage easements, right-of-way, or reserves shall remain at established grades or as modified with the approval of the applicable City or County Engineer, and unobstructed to allow for the conveyance of storm water.

Quiktrip Corporation

_____
Larry D. Dickerson, Director of Real Estate

STATE OF OKLAHOMA, TULSA COUNTY} ss:

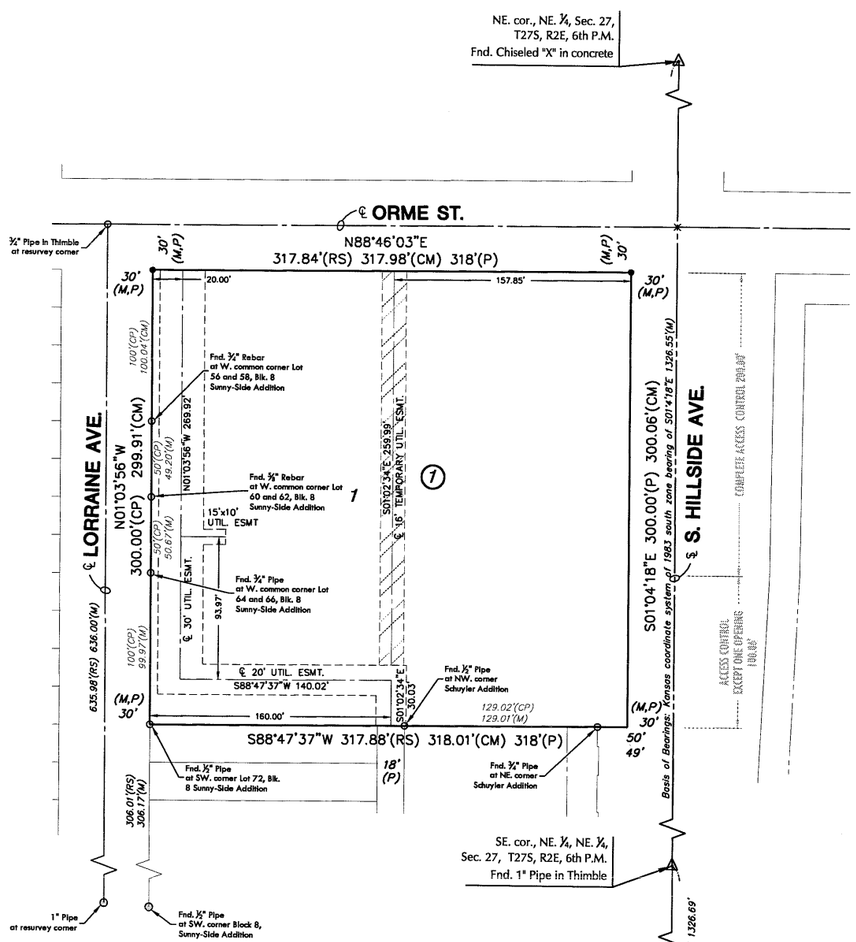
This instrument was acknowledged before me on ____ day of _____, 2010, by Larry D. Dickerson, Director of Real Estate, Quiktrip Corporation.

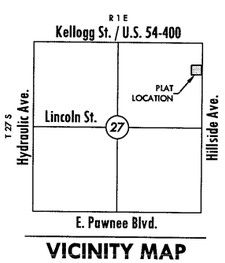
IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

SEAL

_____, Notary Public
Notary Public:

My Term Expires: _____.





VICINITY MAP

Basis of Bearing: Kansas coordinate system of 1983 south zone grid bearing of S01°04'18"E along the E. line of NE. ¼, Sec. 27, T27S, R1E, 6th P.M.

This plat is surveyed and platted on NAVD88 using Kansas state plane south zone coordinates, modified to the surface, having a combined adjustment scale factor of 1.000120014401728

LEGEND

Date of Survey: Sept., 2010

- △ = Section Corner Monument Found
- ○ = Found survey monument see annotation for type
- ● = Set ⅝" rebar w/ MKEC CLS 39 id. cap
- (M) = Measured
- (CM) = Calculated from measured
- (CP) = Calculated from Platted
- (P) = Platted
- (RS) = Record Survey

PLANNING COMMISSION CERTIFICATE

This plat of "QUIKTRIP 11th ADDITION" has been submitted to and approved by the Wichita-Sedgwick County Metropolitan Area Planning Commission, Wichita, Kansas.

Dated this ____ day of _____, 2010

WICHITA-SEDGWICK COUNTY METROPOLITAN AREA PLANNING COMMISSION

_____, Chair
Debra Miller Stevens, Chair

Attest:

_____, Secretary
John L. Schlegel, Secretary

Affix MAPC Seal

GOVERNING BODY CERTIFICATE

The dedications shown on this plat are hereby accepted and this plat is hereby approved by the governing body of the City of Wichita, Kansas.

Dated this ____ day of _____, 2010

At the direction of the City Council.

_____, Mayor
Carl Brewer, Mayor

Affix City Seal

Attest:

_____, City Clerk
Karen Sublett, City Clerk

TRANSFER RECORD

STATE OF KANSAS, SEDGWICK COUNTY} ss:

Entered on transfer record this ____ day of _____, 2010

_____, County Clerk
Don Brace, County Clerk

Affix County Clerk Seal

REGISTER OF DEEDS CERTIFICATE

STATE OF KANSAS, SEDGWICK COUNTY} ss:

This is to certify that this instrument was filed for record in the Register of Deeds office this ____ day of _____, 2010, at _____ o'clock _M; and is duly recorded.

_____, Register of Deeds
Bill Meek, Register of Deeds

Attest:

_____, Deputy
Tonya E. Buckingham, Deputy

Affix Register of Deeds Seal

COUNTY SURVEYOR

STATE OF KANSAS, SEDGWICK COUNTY} ss:

Reviewed in accordance with K.S.A. 58-2005 on this ____ day of _____, 2010.

_____, Deputy County Surveyor
Tricia L. Robello, LS #1246
Deputy County Surveyor
Sedgwick County, Kansas

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

J:\Civil\103246-Hillside\Survey\Prep\103246-dwg 10/11/2010 8:31:41 AM CDT

Tab 2. Existing Conditions

Description

The site is 2.2 acres of undeveloped ground. There are currently 14 residential houses approximately 1/4 acre in size. The site is shown on the aerial photograph, Appendix 2.1. The site is shown on the Existing Conditions Map in Appendix 2.2.

FEMA Floodplains

The platted area is located in Zone X, areas outside protected by the 100-year flood by levee, as shown on the Sedgwick County Kansas February 2, 2007 Map Number 20173C0366E, Appendix 2.3. The Wichita Drainage Canal is west of the site.

Soils

According to the NRCS (SCS) Sedgwick County Soil Survey, Appendix 2.4, soils on the site are:

- Urban land-Irwin complex, 1 to 3 percent slopes

Hydraulic Soil Group "D" was used for calculations for the basins.

Drainage Calculations

Runoff Method

The site was modeled using the SCS Hydrograph Method in Hydraflow Hydrographs, Appendix 2.5.

Rainfall

The rainfall information used is from the Kansas Department of Transportation Rainfall Depth Tables for Kansas Counties June 1997. The rainfall values used are shown in Table 2.1.

Table 2.1. 24-Hour Rainfall Depths.

	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Sedgwick	3.50	4.53	5.24	6.24	7.80

Time of Concentration

Time of concentration was calculated using the TR-55 method. Calculations are in the Hydraflow Hydrographs output, Appendix 2.5.

Curve Numbers

The curve number used for pre-developed conditions is a weighted average based on the land use. The pre-development curve number is 91.8. Calculations for the composite curve numbers are shown in Appendix 2.6.

Drainage Patterns

The site is flat and the existing drainage patterns are not evident. The site drains to the adjacent streets and ultimately flows into an existing storm water sewer (SWS) system in Orme that drains to the Wichita Drainage Canal. The SWS has a drainage area of approximately 350 acres. Runoff to the Wichita Drainage Canal is conveyed through the SWS and in the street. The SWS system and drainage basin are shown on the SWS Drainage Basin drawing, Appendix 2.7. The flow paths are shown on the Existing Drainage Patterns Drawing, Appendix 2.8.

Table 2.3. Pre-Development Flow Rates

Description	Area (ac.)	Tc (min.)	CN	Design Storm Flows (cfs)				
				2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Pre-Project	2.2	36.0	91.8	4.5	6.1	7.1	8.6	11.2

Utilities

Existing sanitary sewer crosses the site from south to north and ties into a system on the north side of Orme Street. An existing 12" water line runs along the east edge of the site in Hillside. An existing 72" RCB SWS flows from east to west along Orme Street.

Groundwater Elevations

Groundwater elevations will be determined through testing.

Appendix 2.1

Aerial Photograph

N

SCALE: 1"=1000'

1000 0 1000 2000

SECTION 27
TOWNSHIP 27
RANGE 1E

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

QUIKTRIP 11TH ADDITION
PROJECT NAME

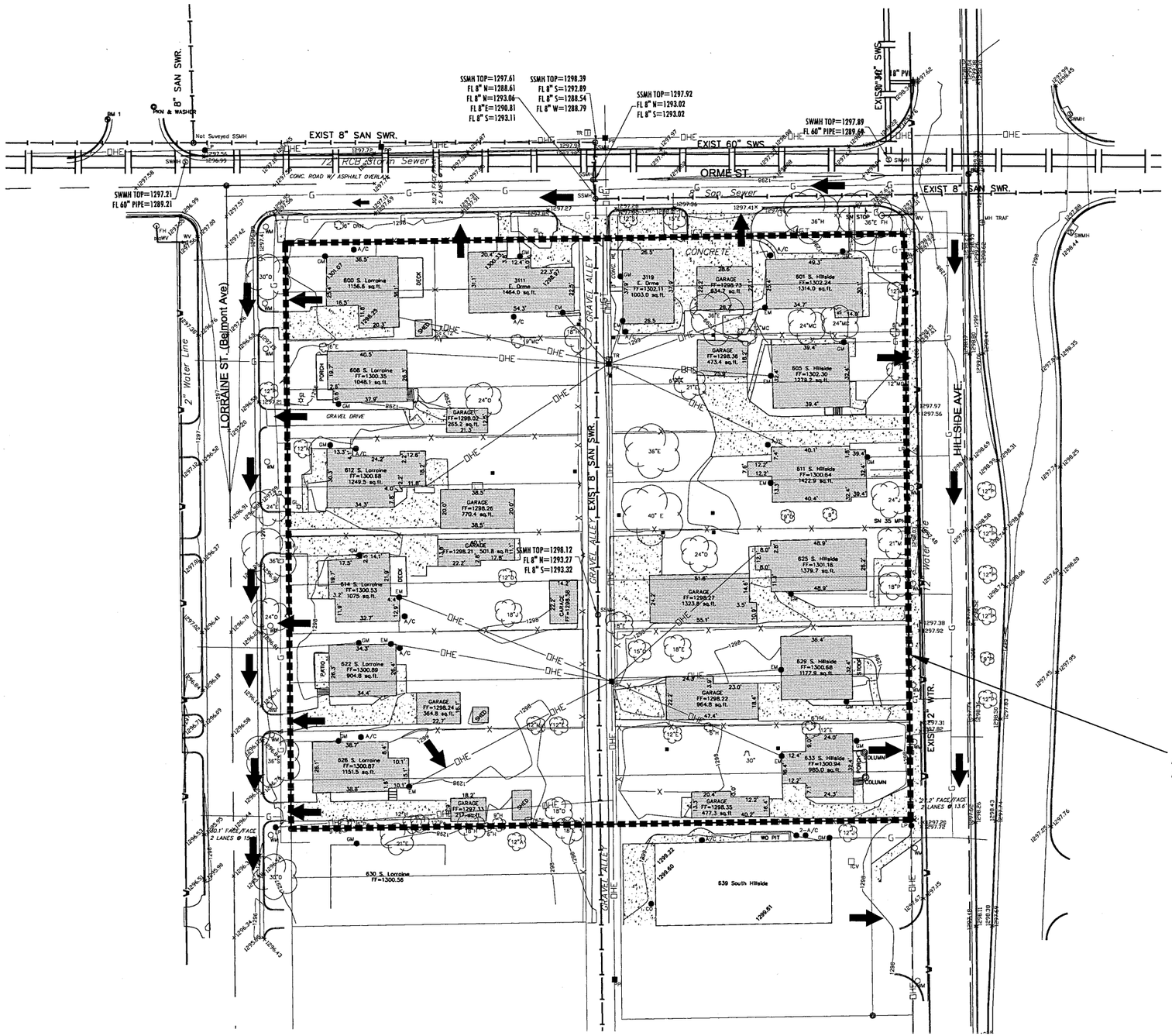
AERIAL MAP
SHEET TITLE

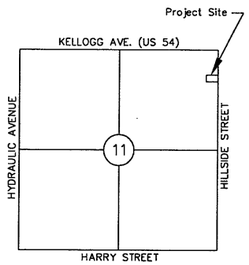
KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
OCTOBER 2010	10246	1 / 1
DATE	JOB NO.	SHEET/OF

J:\Civil\10246-Hillside\Dwg\DRNG\10246_AERIAL.dwg

Appendix 2.2

Existing Conditions Map

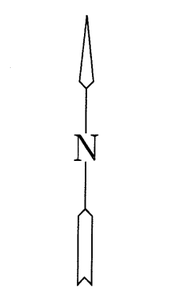




VICINITY MAP

LEGEND

- CIN - CONIFEROUS TREE
- DIN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SECTION CORNER
- BM - BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UGT - UNDERGROUND ELEC.
- OHE - OVERHEAD ELECTRIC
- FOC - FIBER OPTIC CABLE
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW
- A17 - AREA FOR SWS SIZING



MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

QUIKTRIP 11TH ADDITION

WICHITA, KANSAS

EXISTING CONDITIONS

DATE: October 10

REVISED

DESIGN BY: KLA

DRAWN BY: CMJ

CHECKED BY: GJA

SHEET NUMBER: 1

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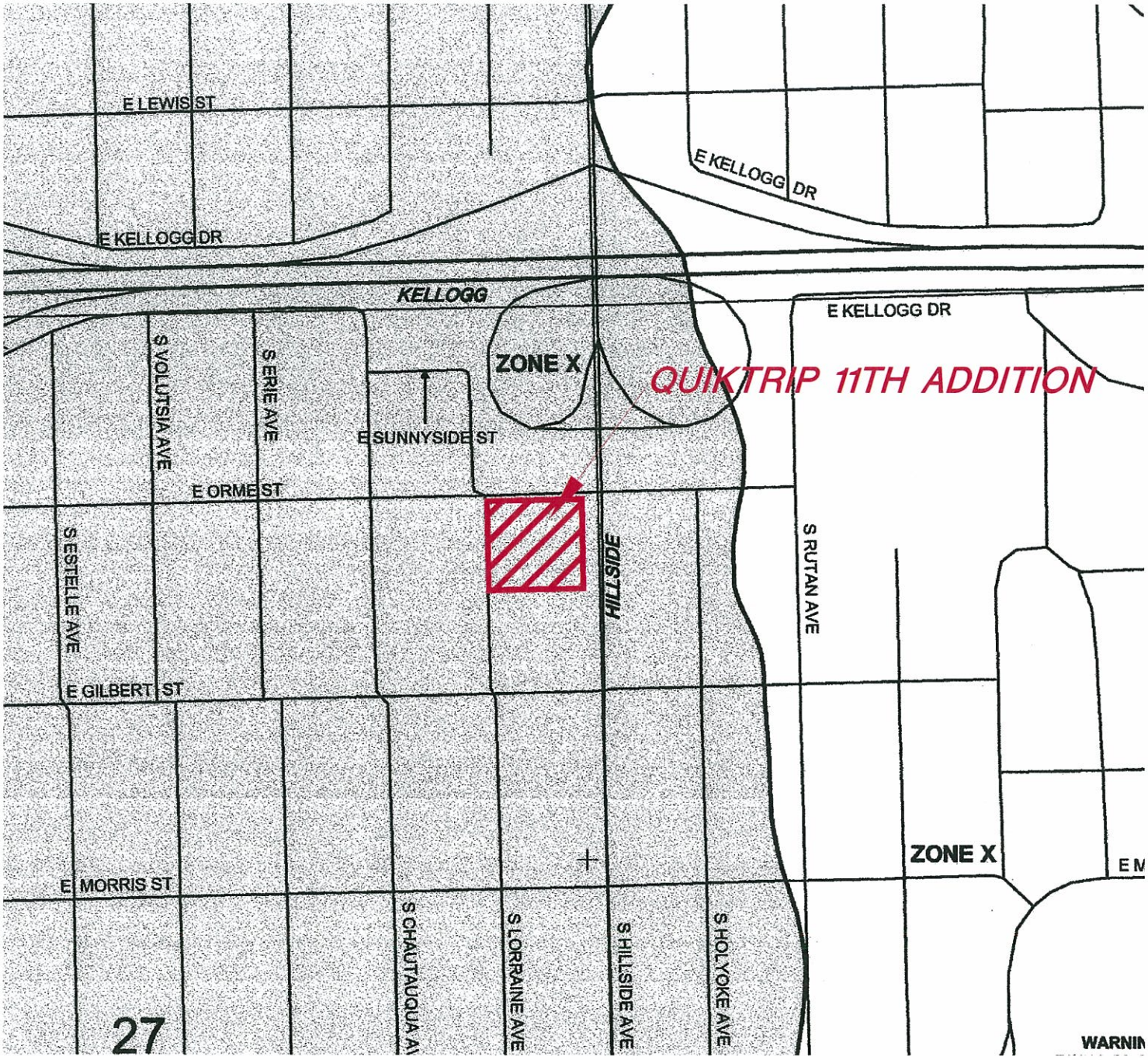
Appendix 2.3

Flood Insurance Rate Map (FIRM)



NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0366E

FIRM
FLOOD INSURANCE RATE MAP

SEDGWICK COUNTY, KANSAS
AND INCORPORATED AREAS

PANEL 366 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WICHITA, CITY OF	200328	0366	E

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
20173C0366E

EFFECTIVE DATE
FEBRUARY 2, 2007
Federal Emergency Management Agency

N

SCALE: 1"=500'

500 0 500 1000

SECTION 27
TOWNSHIP 27
RANGE 1E

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

QUIKTRIP 11TH ADDITION
PROJECT NAME

FIRM MAP
SHEET TITLE

KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:

OCTOBER 2010	*10246*	*1 / 1*
DATE	JOB NO.	SHEET/OF

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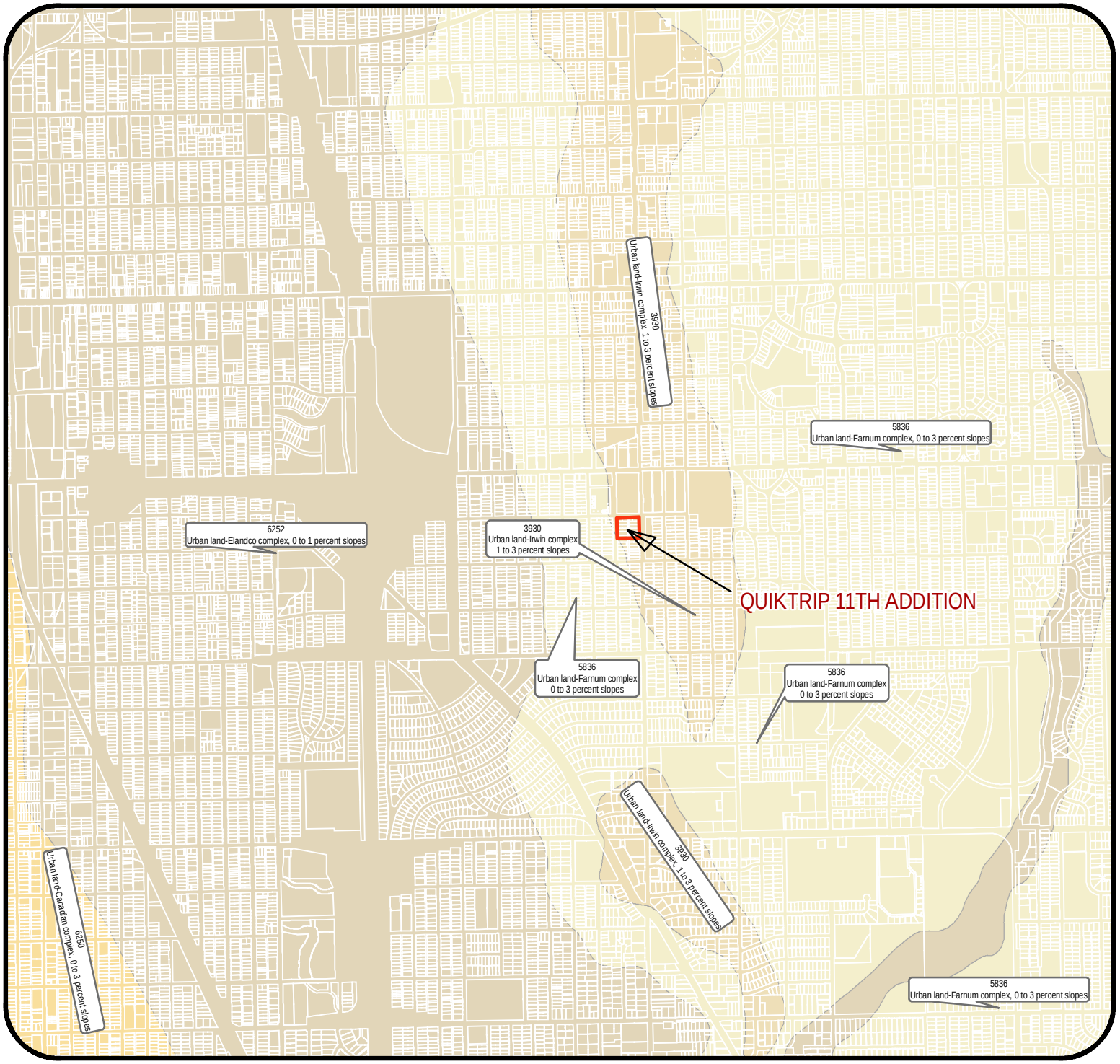
Appendix 2.4

Soil Survey



1 0.5 0 1 Miles

1,000 500 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 Feet

1 0.5 0 1 Kilometers

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QUIKTRIP 11TH ADDITION

Project Name:

Soil Survey - Sedgwick County, KS

Sheet Title:

MKEC ENGINEERING CONSULTANTS, INC.

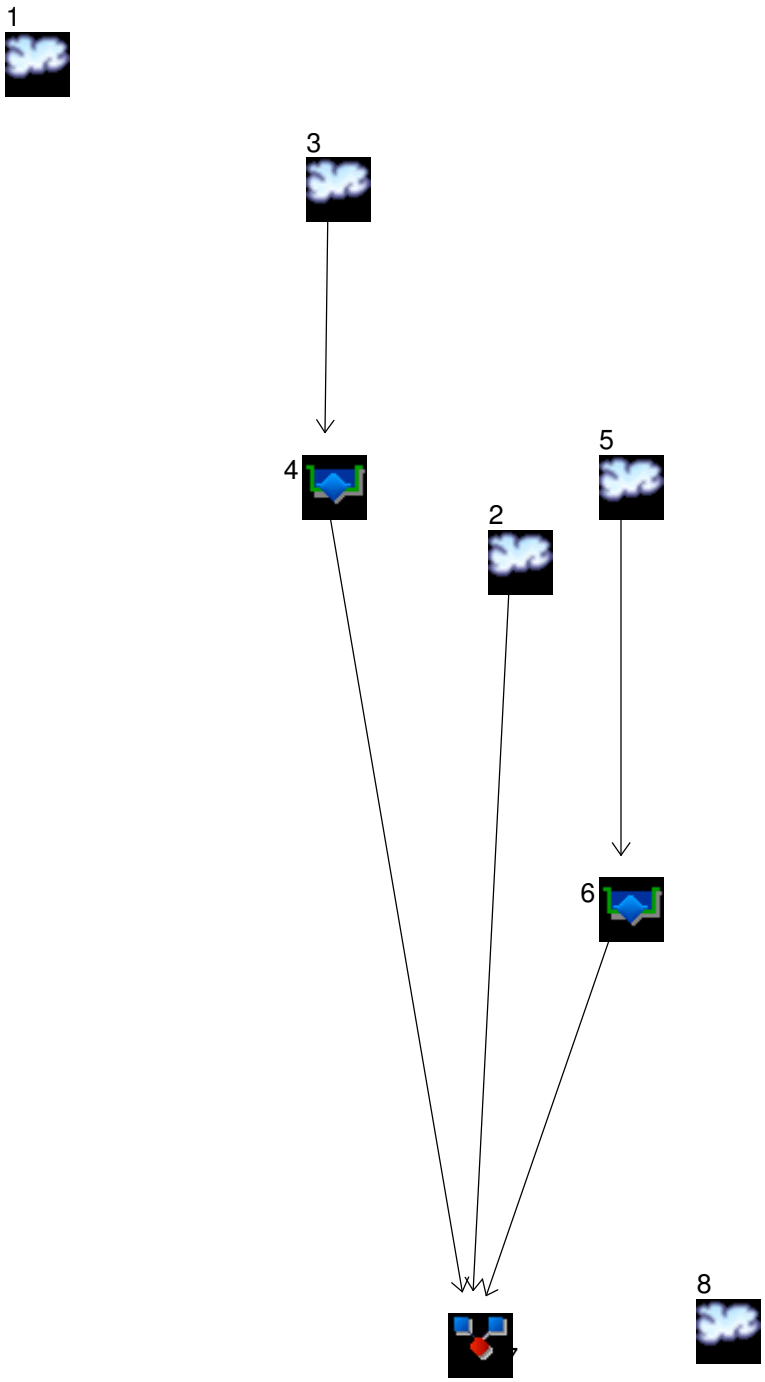
CMJ	OCT. 2010
Drawn By:	Date:
KLA	10246
Design / Review:	Job No.:

Appendix 2.5

Hydraflow Hydrographs Output

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Project
2	SCS Runoff	Post-Project To North Undetained
3	SCS Runoff	Post-Project To West Detention
4	Reservoir	West Detention
5	SCS Runoff	Post-Project To East Detention
6	Reservoir	East Detention
7	Combine	Post-Project
8	SCS Runoff	Entire Site no detention

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	------	-------	4.495	-------	6.073	7.172	8.578	9.822	11.21	Pre-Project
2	SCS Runoff	------	-------	1.857	-------	2.413	2.801	3.298	3.738	4.233	Post-Project To North Undetained
3	SCS Runoff	------	-------	4.178	-------	5.429	6.301	7.419	8.411	9.525	Post-Project To West Detention
4	Reservoir	3	-------	1.660	-------	3.906	5.336	7.171	8.200	9.314	West Detention
5	SCS Runoff	------	-------	4.178	-------	5.429	6.301	7.419	8.411	9.525	Post-Project To East Detention
6	Reservoir	5	-------	4.185	-------	5.375	6.267	7.380	8.378	9.488	East Detention
7	Combine	2, 4, 6	-------	7.569	-------	9.880	14.01	17.47	19.87	22.72	Post-Project
8	SCS Runoff	------	-------	10.21	-------	13.27	15.40	18.14	20.56	23.28	Entire Site no detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	4.495	2	734	0.474	------	------	------	Pre-Project
2	SCS Runoff	1.857	2	716	0.097	------	------	------	Post-Project To North Undetained
3	SCS Runoff	4.178	2	716	0.218	------	------	------	Post-Project To West Detention
4	Reservoir	1.660	2	722	0.218	3	1299.35	0.041	West Detention
5	SCS Runoff	4.178	2	716	0.218	------	------	------	Post-Project To East Detention
6	Reservoir	4.185	2	716	0.218	5	1297.69	0.005	East Detention
7	Combine	7.569	2	716	0.533	2, 4, 6	------	------	Post-Project
8	SCS Runoff	10.21	2	716	0.533	------	------	------	Entire Site no detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	6.073	2	734	0.649	------	------	------	Pre-Project
2	SCS Runoff	2.413	2	716	0.128	------	------	------	Post-Project To North Undetained
3	SCS Runoff	5.429	2	716	0.288	------	------	------	Post-Project To West Detention
4	Reservoir	3.906	2	720	0.288	3	1299.69	0.054	West Detention
5	SCS Runoff	5.429	2	716	0.288	------	------	------	Post-Project To East Detention
6	Reservoir	5.375	2	716	0.288	5	1297.76	0.005	East Detention
7	Combine	9.880	2	720	0.703	2, 4, 6	------	------	Post-Project
8	SCS Runoff	13.27	2	716	0.703	------	------	------	Entire Site no detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	7.172	2	734	0.773	------	------	------	Pre-Project
2	SCS Runoff	2.801	2	716	0.150	------	------	------	Post-Project To North Undetained
3	SCS Runoff	6.301	2	716	0.337	------	------	------	Post-Project To West Detention
4	Reservoir	5.336	2	720	0.337	3	1299.79	0.056	West Detention
5	SCS Runoff	6.301	2	716	0.337	------	------	------	Post-Project To East Detention
6	Reservoir	6.267	2	716	0.337	5	1297.80	0.005	East Detention
7	Combine	14.01	2	718	0.823	2, 4, 6	------	------	Post-Project
8	SCS Runoff	15.40	2	716	0.823	------	------	------	Entire Site no detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	8.578	2	734	0.933	------	------	------	Pre-Project
2	SCS Runoff	3.298	2	716	0.178	------	------	------	Post-Project To North Undetained
3	SCS Runoff	7.419	2	716	0.400	------	------	------	Post-Project To West Detention
4	Reservoir	7.171	2	718	0.400	3	1299.85	0.059	West Detention
5	SCS Runoff	7.419	2	716	0.400	------	------	------	Post-Project To East Detention
6	Reservoir	7.380	2	716	0.400	5	1297.85	0.005	East Detention
7	Combine	17.47	2	718	0.977	2, 4, 6	------	------	Post-Project
8	SCS Runoff	18.14	2	716	0.977	------	------	------	Entire Site no detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	9.822	2	734	1.075	------	------	------	Pre-Project
2	SCS Runoff	3.738	2	716	0.203	------	------	------	Post-Project To North Undetained
3	SCS Runoff	8.411	2	716	0.456	------	------	------	Post-Project To West Detention
4	Reservoir	8.200	2	718	0.456	3	1299.89	0.061	West Detention
5	SCS Runoff	8.411	2	716	0.456	------	------	------	Post-Project To East Detention
6	Reservoir	8.378	2	716	0.456	5	1297.89	0.006	East Detention
7	Combine	19.87	2	718	1.114	2, 4, 6	------	------	Post-Project
8	SCS Runoff	20.56	2	716	1.114	------	------	------	Entire Site no detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	11.21	2	734	1.236	------	------	------	Pre-Project
2	SCS Runoff	4.233	2	716	0.231	------	------	------	Post-Project To North Undetained
3	SCS Runoff	9.525	2	716	0.519	------	------	------	Post-Project To West Detention
4	Reservoir	9.314	2	718	0.519	3	1299.94	0.062	West Detention
5	SCS Runoff	9.525	2	716	0.519	------	------	------	Post-Project To East Detention
6	Reservoir	9.488	2	716	0.519	5	1297.93	0.006	East Detention
7	Combine	22.72	2	716	1.269	2, 4, 6	------	------	Post-Project
8	SCS Runoff	23.28	2	716	1.269	------	------	------	Entire Site no detention

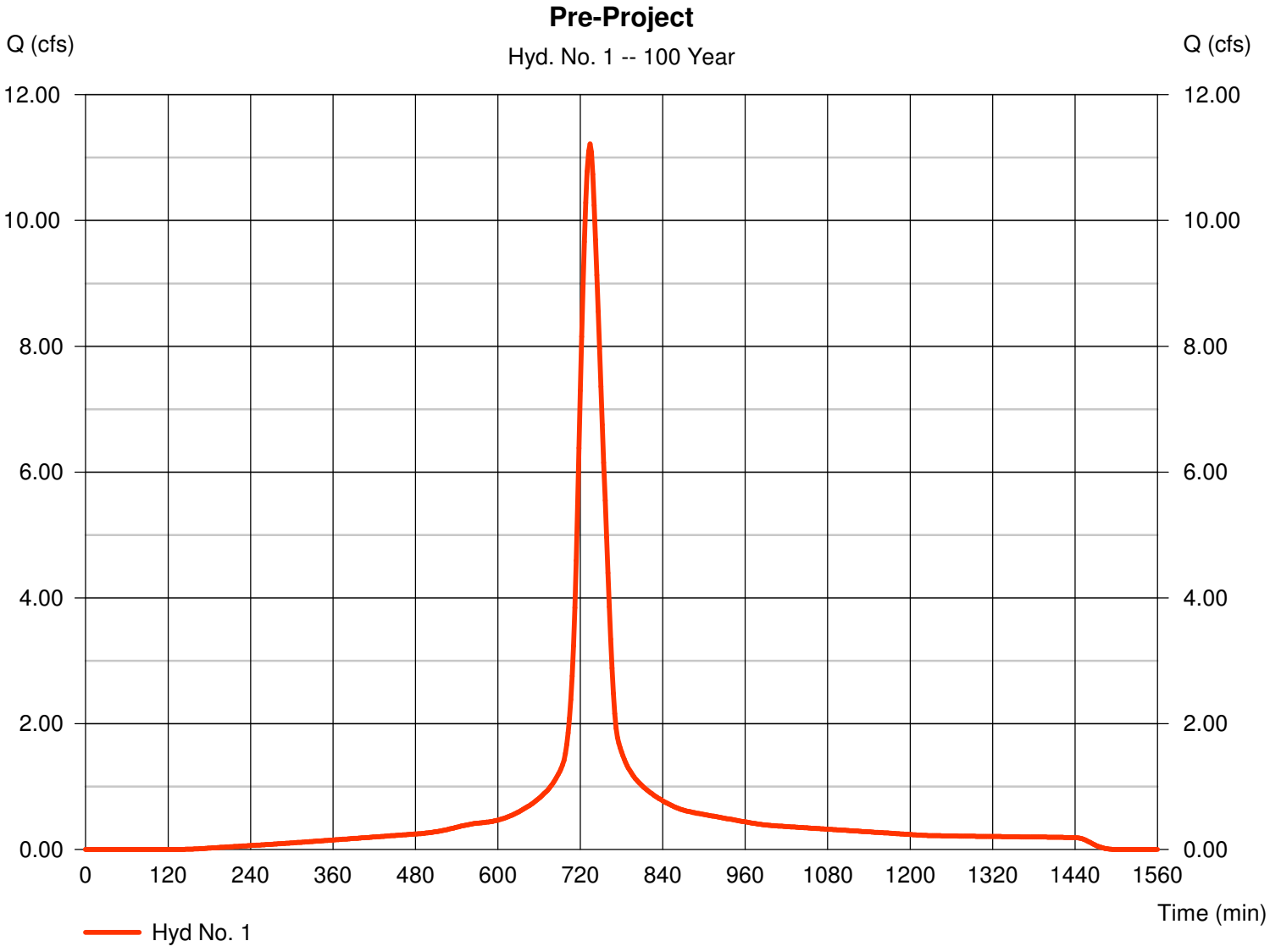
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Oct 22, 2010

Hyd. No. 1

Pre-Project

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.21 cfs
Storm frequency	=	100 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	1.236 acft
Drainage area	=	2.200 ac	Curve number	=	91.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	36.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

Pre-Project

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.48		0.00		0.00		
Land slope (%)	= 0.40		0.00		0.00		
Travel Time (min)	**= 36.03**	**+**	**0.00**	**+**	**0.00**	**=**	**36.03**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

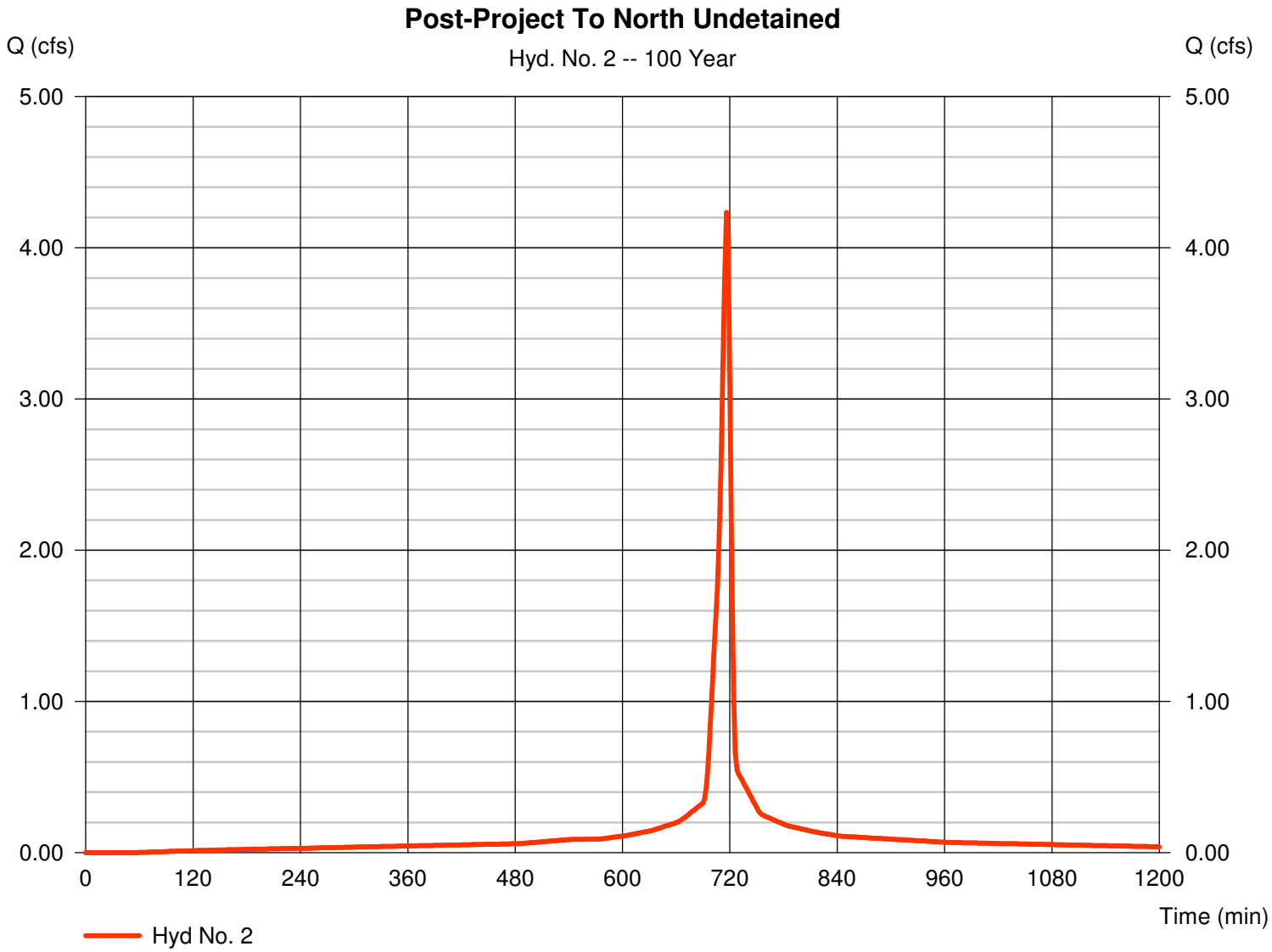
Total Travel Time, Tc ..... 36.00 min

Hydrograph Report

Hyd. No. 2

Post-Project To North Undetained

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.233 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	0.231 acft
Drainage area	=	0.400 ac	Curve number	=	96.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	3.10 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 2

Post-Project To North Undetained

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.013		0.011		0.011		
Flow length (ft)	=	200.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.48		0.00		0.00		
Land slope (%)	=	1.00		0.00		0.00		
Travel Time (min)	**=**	**3.05**	**+**	**0.00**	**+**	**0.00**	**=**	**3.05**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

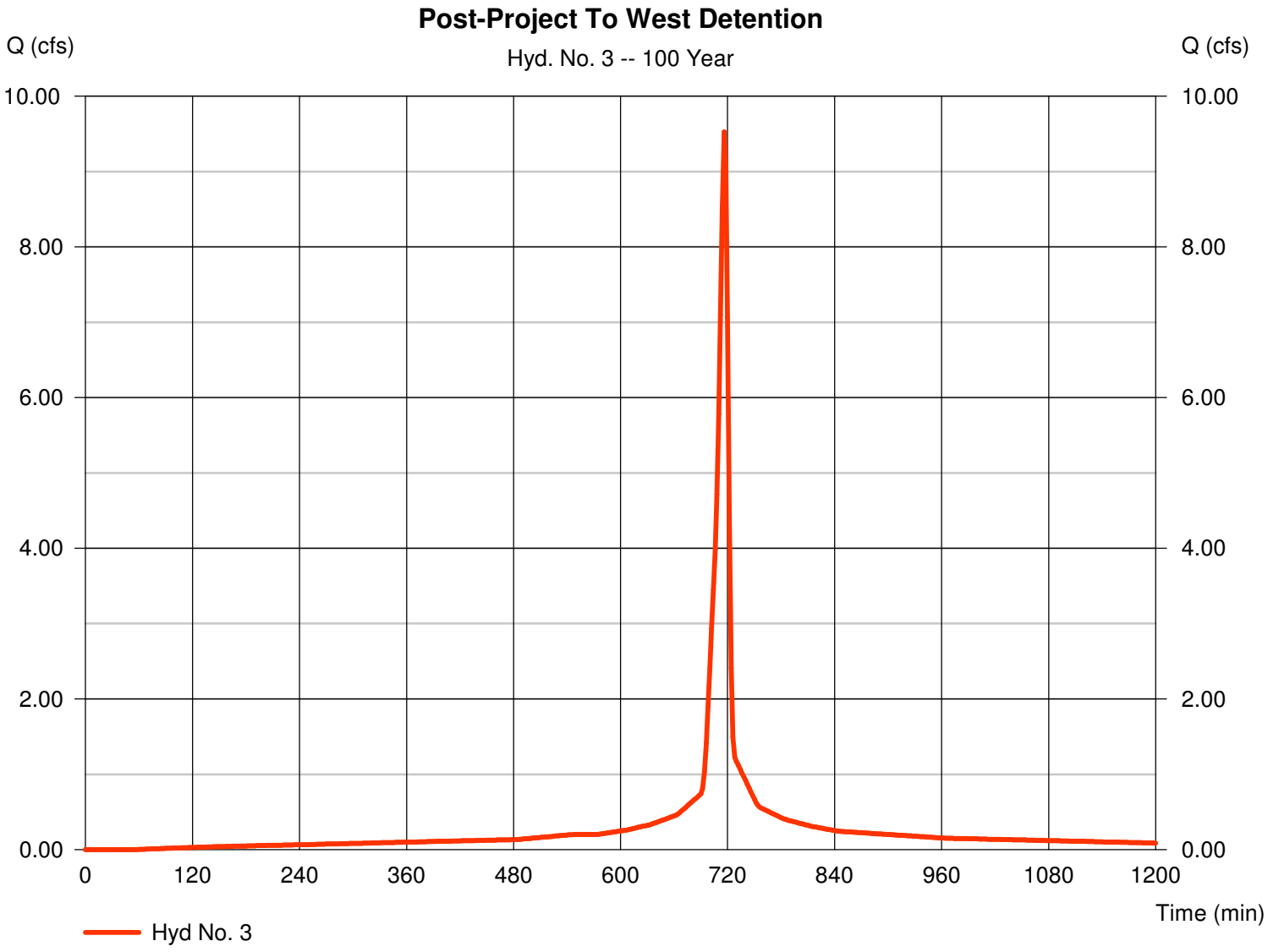
Total Travel Time, Tc ..... 3.10 min

Hydrograph Report

Hyd. No. 3

Post-Project To West Detention

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.525 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	0.519 acft
Drainage area	=	0.900 ac	Curve number	=	96.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	3.10 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 3

Post-Project To West Detention

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.013		0.011		0.011		
Flow length (ft)	=	200.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.48		0.00		0.00		
Land slope (%)	=	1.00		0.00		0.00		
Travel Time (min)	**=**	**3.05**	**+**	**0.00**	**+**	**0.00**	**=**	**3.05**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 3.10 min

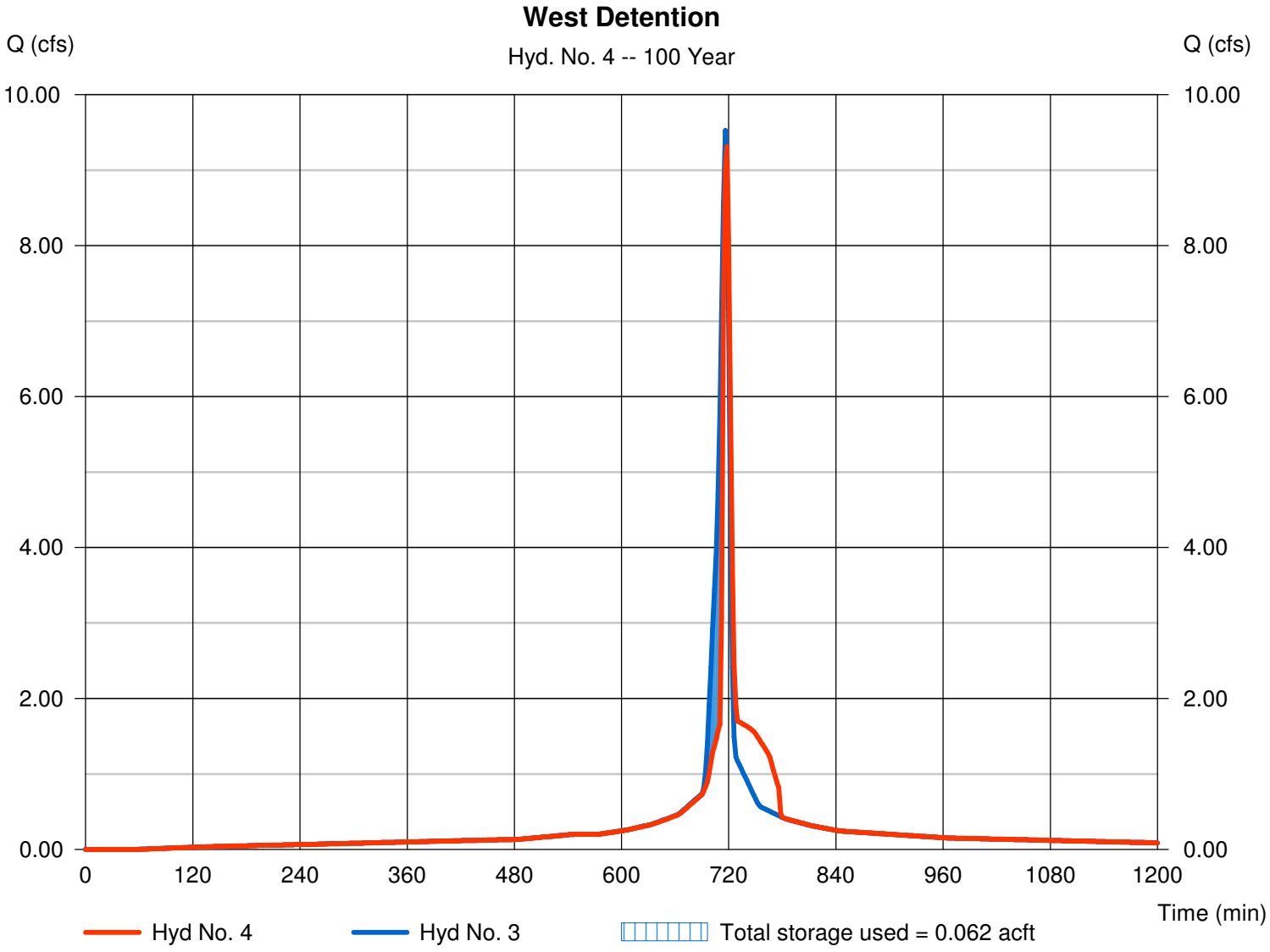
Hydrograph Report

Hyd. No. 4

West Detention

Hydrograph type	=	Reservoir	Peak discharge	=	9.314 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	0.519 acft
Inflow hyd. No.	=	3 - Post-Project To West Detention	Max. Elevation	=	1299.94 ft
Reservoir name	=	West Detention	Max. Storage	=	0.062 acft

Storage Indication method used.



Pond No. 4 - West Detention

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1296.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1296.00	00	0.000	0.000
1.00	1297.00	150	0.001	0.001
2.00	1298.00	600	0.008	0.009
3.00	1299.00	1,200	0.020	0.029
4.00	1300.00	1,900	0.035	0.065

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	6.00	0.00	0.00
Span (in)	= 18.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1292.00	1296.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.40	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 1299.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1296.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	0.000	1296.10	13.28 oc	0.03 ic	---	---	0.00	---	---	---	---	---	0.031
0.20	0.000	1296.20	13.28 oc	0.11 ic	---	---	0.00	---	---	---	---	---	0.114
0.30	0.000	1296.30	13.28 oc	0.23 ic	---	---	0.00	---	---	---	---	---	0.230
0.40	0.000	1296.40	13.28 oc	0.36 ic	---	---	0.00	---	---	---	---	---	0.363
0.50	0.001	1296.50	13.28 oc	0.47 ic	---	---	0.00	---	---	---	---	---	0.473
0.60	0.001	1296.60	13.28 oc	0.56 ic	---	---	0.00	---	---	---	---	---	0.559
0.70	0.001	1296.70	13.28 oc	0.63 ic	---	---	0.00	---	---	---	---	---	0.634
0.80	0.001	1296.80	13.28 oc	0.70 ic	---	---	0.00	---	---	---	---	---	0.701
0.90	0.001	1296.90	13.28 oc	0.76 ic	---	---	0.00	---	---	---	---	---	0.762
1.00	0.001	1297.00	13.28 oc	0.82 ic	---	---	0.00	---	---	---	---	---	0.819
1.10	0.002	1297.10	13.28 oc	0.87 ic	---	---	0.00	---	---	---	---	---	0.872
1.20	0.003	1297.20	13.28 oc	0.92 ic	---	---	0.00	---	---	---	---	---	0.921
1.30	0.004	1297.30	13.28 oc	0.97 ic	---	---	0.00	---	---	---	---	---	0.969
1.40	0.004	1297.40	13.28 oc	1.01 ic	---	---	0.00	---	---	---	---	---	1.014
1.50	0.005	1297.50	13.28 oc	1.06 ic	---	---	0.00	---	---	---	---	---	1.057
1.60	0.006	1297.60	13.28 oc	1.10 ic	---	---	0.00	---	---	---	---	---	1.098
1.70	0.007	1297.70	13.28 oc	1.14 ic	---	---	0.00	---	---	---	---	---	1.138
1.80	0.008	1297.80	13.28 oc	1.18 ic	---	---	0.00	---	---	---	---	---	1.177
1.90	0.008	1297.90	13.28 oc	1.21 ic	---	---	0.00	---	---	---	---	---	1.214
2.00	0.009	1298.00	13.28 oc	1.25 ic	---	---	0.00	---	---	---	---	---	1.251
2.10	0.011	1298.10	13.28 oc	1.29 ic	---	---	0.00	---	---	---	---	---	1.286
2.20	0.013	1298.20	13.28 oc	1.32 ic	---	---	0.00	---	---	---	---	---	1.320
2.30	0.015	1298.30	13.28 oc	1.35 ic	---	---	0.00	---	---	---	---	---	1.353
2.40	0.017	1298.40	13.28 oc	1.39 ic	---	---	0.00	---	---	---	---	---	1.386
2.50	0.019	1298.50	13.28 oc	1.42 ic	---	---	0.00	---	---	---	---	---	1.418
2.60	0.021	1298.60	13.28 oc	1.45 ic	---	---	0.00	---	---	---	---	---	1.449
2.70	0.023	1298.70	13.28 oc	1.48 ic	---	---	0.00	---	---	---	---	---	1.480
2.80	0.025	1298.80	13.28 oc	1.51 ic	---	---	0.00	---	---	---	---	---	1.510
2.90	0.027	1298.90	13.28 oc	1.54 ic	---	---	0.00	---	---	---	---	---	1.539
3.00	0.029	1299.00	13.28 oc	1.57 ic	---	---	0.00	---	---	---	---	---	1.568
3.10	0.033	1299.10	13.28 oc	1.60 ic	---	---	0.00	---	---	---	---	---	1.596
3.20	0.037	1299.20	13.28 oc	1.62 ic	---	---	0.00	---	---	---	---	---	1.624
3.30	0.040	1299.30	13.28 oc	1.65 ic	---	---	0.00	---	---	---	---	---	1.651
3.40	0.044	1299.40	13.28 oc	1.68 ic	---	---	0.00	---	---	---	---	---	1.678
3.50	0.047	1299.50	13.28 oc	1.70 ic	---	---	0.00	---	---	---	---	---	1.704
3.60	0.051	1299.60	13.28 oc	1.73 ic	---	---	0.84	---	---	---	---	---	2.572
3.70	0.054	1299.70	13.28 oc	1.76 ic	---	---	2.38	---	---	---	---	---	4.138
3.80	0.058	1299.80	13.28 oc	1.78 ic	---	---	4.38	---	---	---	---	---	6.160

Continues on next page...

West Detention

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.90	0.061	1299.90	13.28 oc	1.81 ic	---	---	6.74	---	---	---	---	---	8.546
4.00	0.065	1300.00	13.28 oc	1.83 ic	---	---	9.42	---	---	---	---	---	11.25

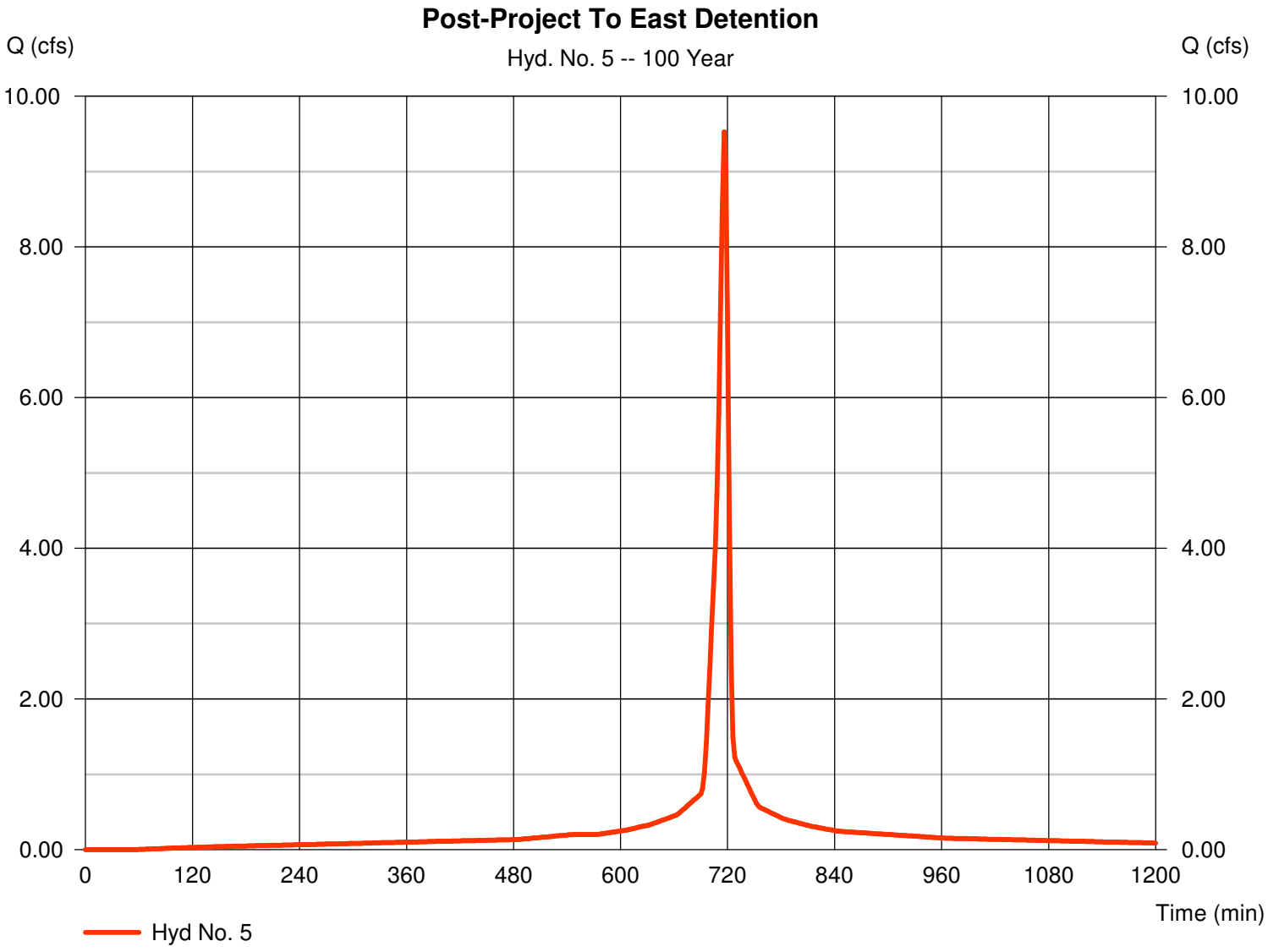
...End

Hydrograph Report

Hyd. No. 5

Post-Project To East Detention

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.525 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	0.519 acft
Drainage area	=	0.900 ac	Curve number	=	96.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	3.10 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 5

Post-Project To East Detention

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.013		0.011		0.011		
Flow length (ft)	=	200.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.48		0.00		0.00		
Land slope (%)	=	1.00		0.00		0.00		
Travel Time (min)	**=**	**3.05**	**+**	**0.00**	**+**	**0.00**	**=**	**3.05**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 3.10 min

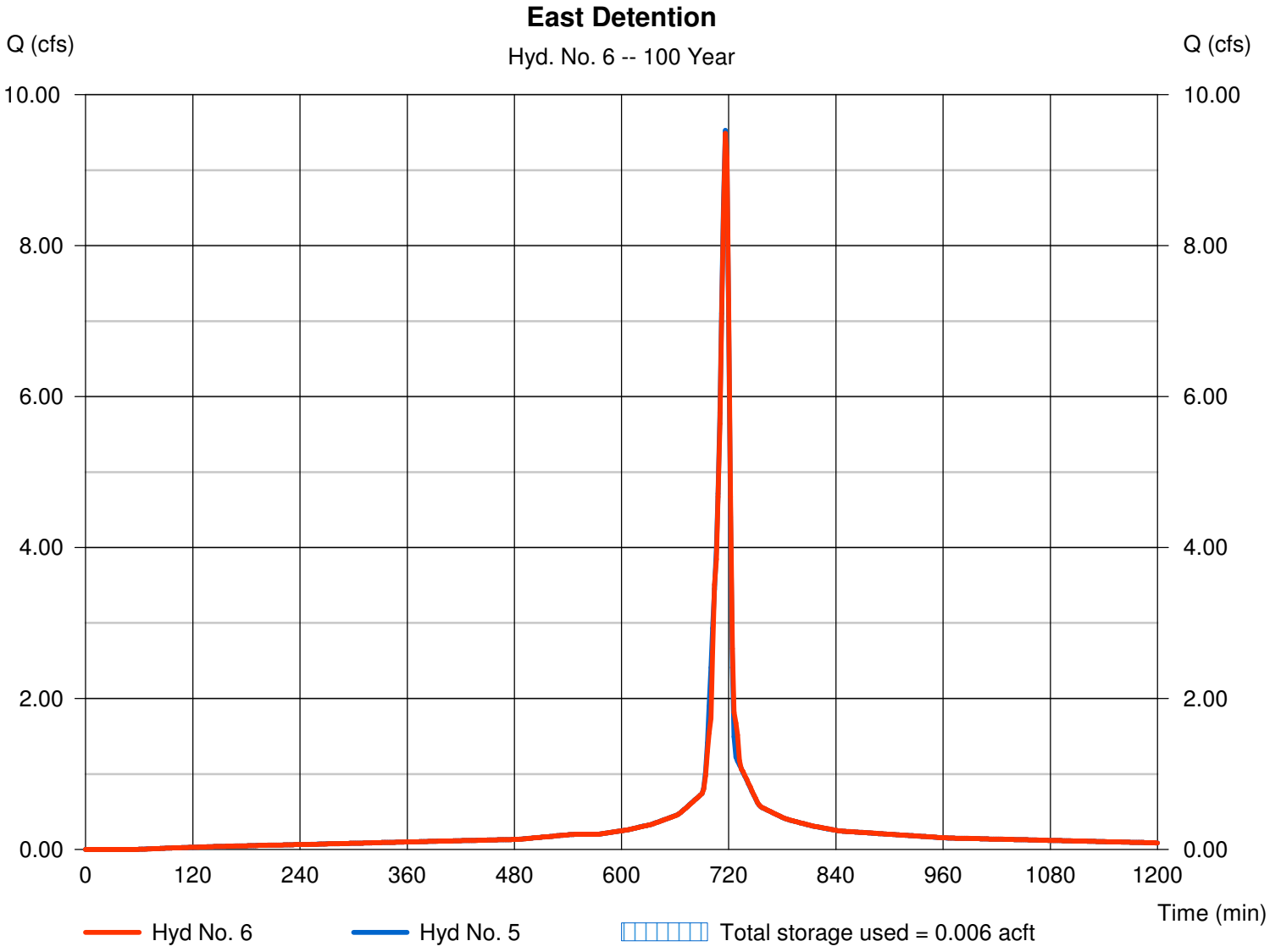
Hydrograph Report

Hyd. No. 6

East Detention

Hydrograph type	=	Reservoir	Peak discharge	=	9.488 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	0.519 acft
Inflow hyd. No.	=	5 - Post-Project To East Detention	Max. Elevation	=	1297.93 ft
Reservoir name	=	East Detention	Max. Storage	=	0.006 acft

Storage Indication method used.



Pond Report

Pond No. 3 - East Detention

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1296.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1296.00	00	0.000	0.000
1.00	1297.00	100	0.001	0.001
2.00	1298.00	425	0.006	0.006

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	4.00	0.00	0.00
Span (in)	= 18.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1292.00	1296.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.40	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 1297.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

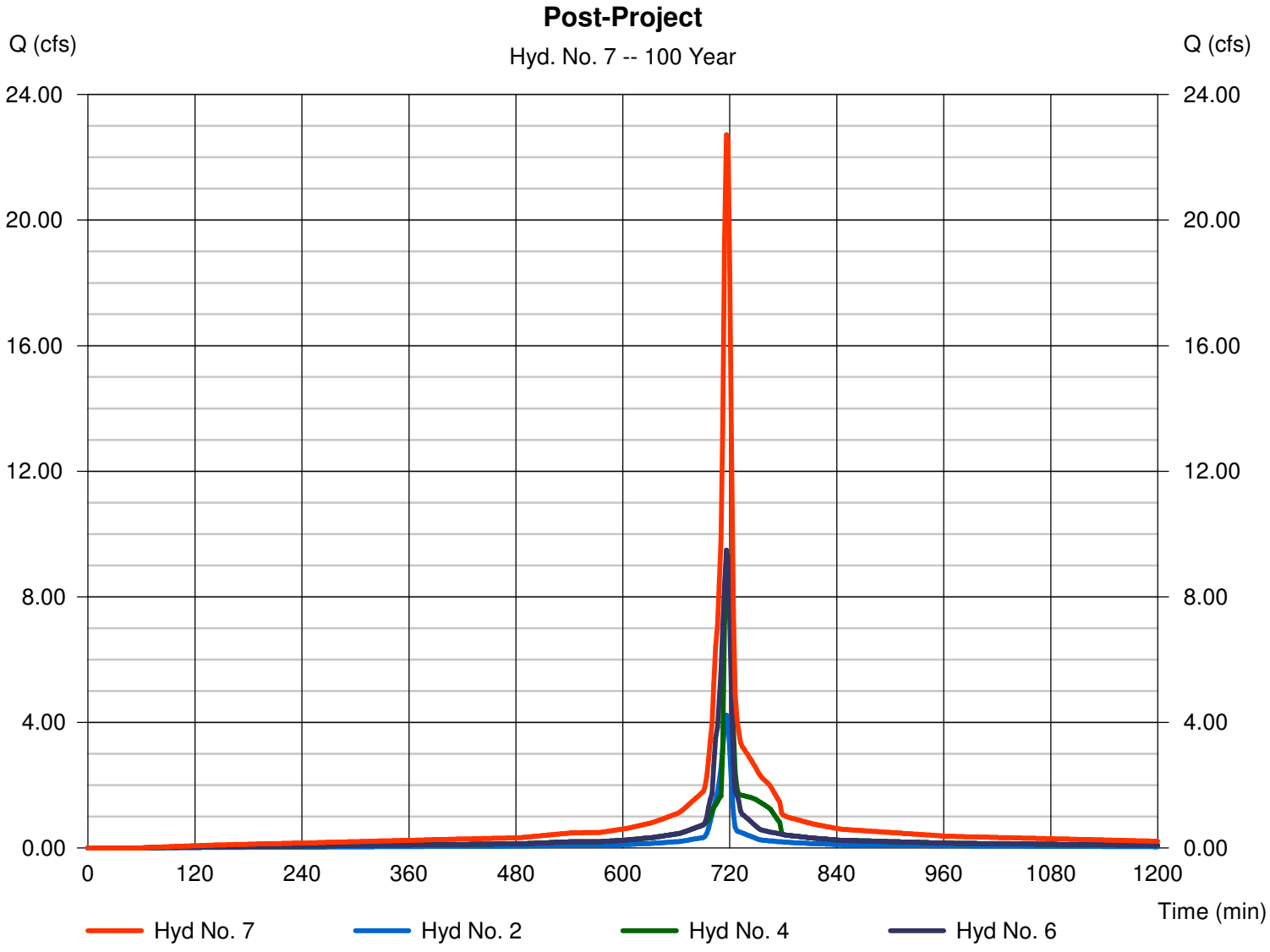
Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1296.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	0.000	1296.10	13.28 oc	0.11 ic	---	---	0.00	---	---	---	---	---	0.108
0.20	0.000	1296.20	13.28 oc	0.30 ic	---	---	0.00	---	---	---	---	---	0.304
0.30	0.000	1296.30	13.28 oc	0.56 ic	---	---	0.00	---	---	---	---	---	0.559
0.40	0.000	1296.40	13.28 oc	0.78 ic	---	---	0.00	---	---	---	---	---	0.775
0.50	0.000	1296.50	13.28 oc	0.93 ic	---	---	0.00	---	---	---	---	---	0.926
0.60	0.000	1296.60	13.28 oc	1.06 ic	---	---	0.00	---	---	---	---	---	1.056
0.70	0.001	1296.70	13.28 oc	1.17 ic	---	---	0.00	---	---	---	---	---	1.172
0.80	0.001	1296.80	13.28 oc	1.28 ic	---	---	0.00	---	---	---	---	---	1.277
0.90	0.001	1296.90	13.28 oc	1.37 ic	---	---	0.00	---	---	---	---	---	1.374
1.00	0.001	1297.00	13.28 oc	1.47 ic	---	---	0.00	---	---	---	---	---	1.465
1.10	0.001	1297.10	13.28 oc	1.55 ic	---	---	0.00	---	---	---	---	---	1.551
1.20	0.002	1297.20	13.28 oc	1.63 ic	---	---	0.00	---	---	---	---	---	1.631
1.30	0.002	1297.30	13.28 oc	1.71 ic	---	---	0.00	---	---	---	---	---	1.709
1.40	0.003	1297.40	13.28 oc	1.78 ic	---	---	0.00	---	---	---	---	---	1.782
1.50	0.004	1297.50	13.28 oc	1.85 ic	---	---	0.00	---	---	---	---	---	1.853
1.60	0.004	1297.60	13.28 oc	1.92 ic	---	---	0.84	---	---	---	---	---	2.762
1.70	0.005	1297.70	13.28 oc	1.99 ic	---	---	2.38	---	---	---	---	---	4.367
1.80	0.005	1297.80	13.28 oc	2.05 ic	---	---	4.37	---	---	---	---	---	6.424
1.90	0.006	1297.90	13.28 oc	2.11 ic	---	---	6.73	---	---	---	---	---	8.847
2.00	0.006	1298.00	13.28 oc	2.17 ic	---	---	9.42	---	---	---	---	---	11.59

Hydrograph Report

Hyd. No. 7

Post-Project

Hydrograph type	= Combine	Peak discharge	= 22.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1.269 acft
Inflow hyds.	= 2, 4, 6	Contrib. drain. area	= 0.400 ac

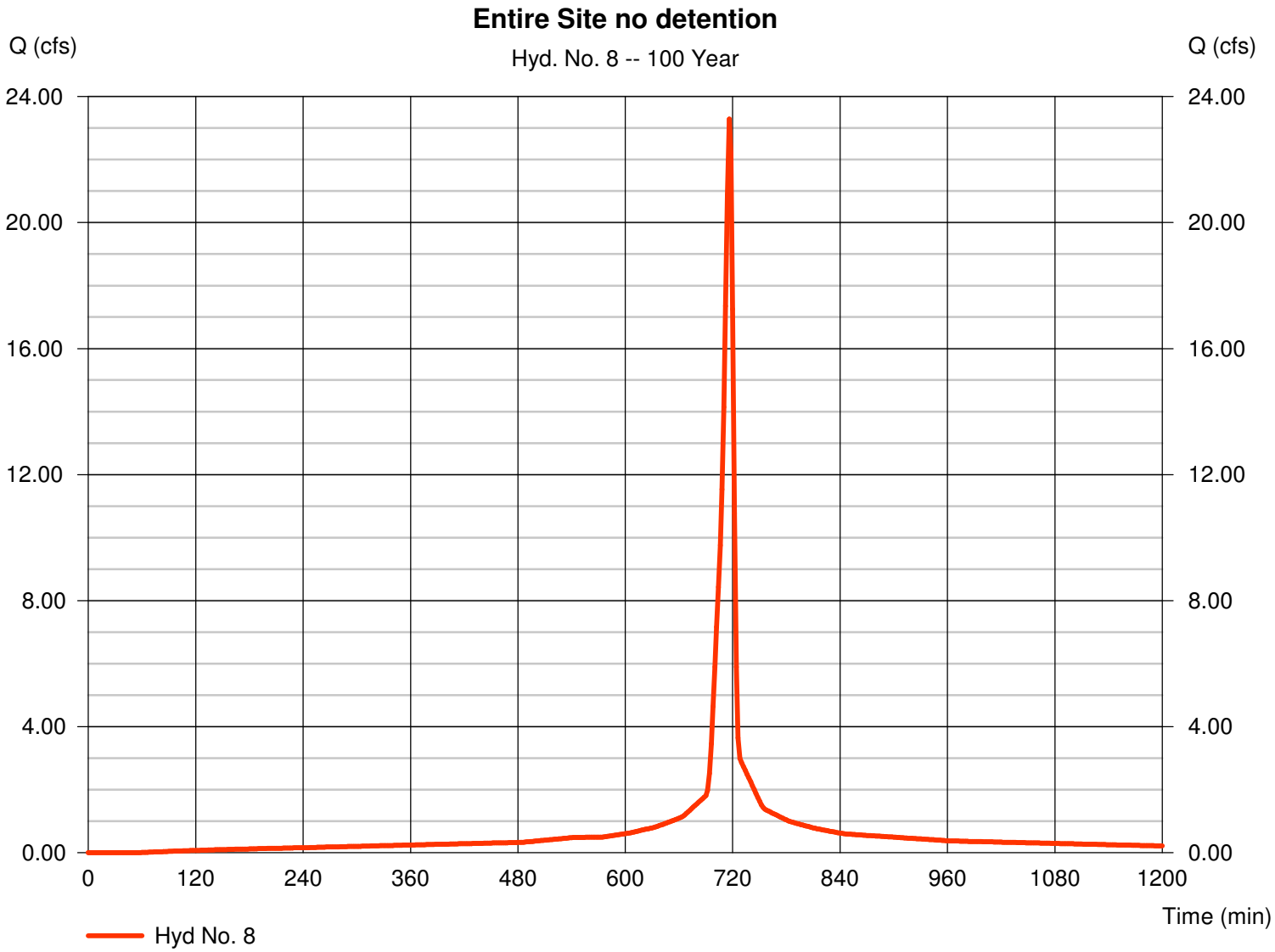


Hydrograph Report

Hyd. No. 8

Entire Site no detention

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.28 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	1.269 acft
Drainage area	=	2.200 ac	Curve number	=	96.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	3.10 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 8

Entire Site no detention

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.013		0.011		0.011		
Flow length (ft)	= 200.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.48		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 3.05**	**+**	**0.00**	**+**	**0.00**	**=**	**3.05**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 3.10 min

Appendix 2.6

Curve Number Calculations

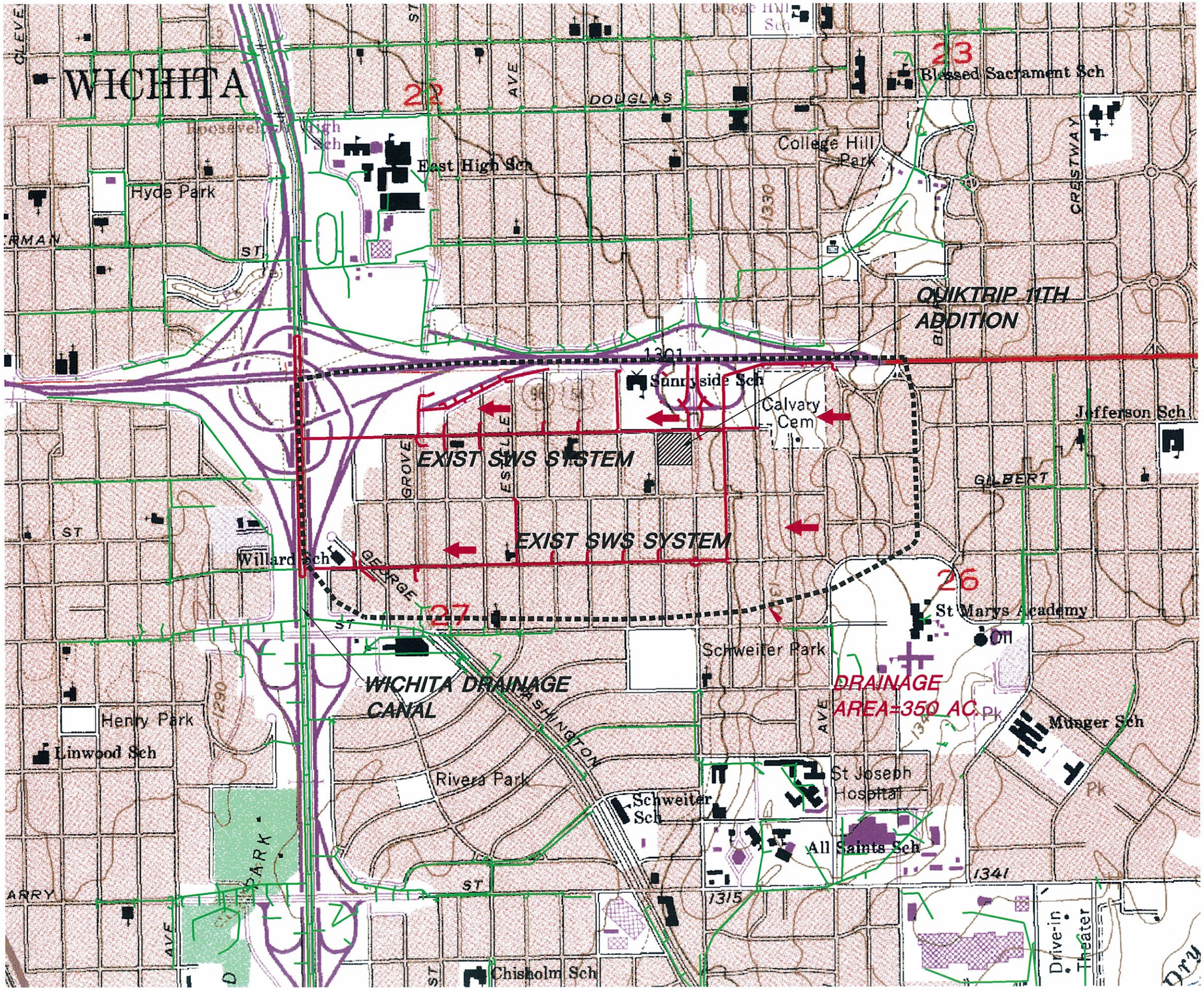
Curve Number Calculations

QuickTrip 11th Addition - Kellogg & Hillside

Basin	Total Area	HSG	Area of Impervious by Land Use												Undisturbed Pervious			Disturbed Pervious			Impervious			Water Surfaces			Composite CN
			Commercial		85%	Residential 1/4 acre		38%	Residential 1/2 acre		25%	Residential 1 acre		20%													
			Area	Perv.	Imp.	Area	Perv.	Imp.	Area	Perv.	Imp.	Area	Perv.	Imp.	Area	CN	Weighted CN	Area	CN	Weighted CN	Area	CN	Weighted CN	Area	CN	Weighted CN	
Pre-Project	2.2	D		0	0	2.2	1.364	0.836		0	0		0	0		84	0	1.4	88	54.6	0.8	98	37.2		100	0	91.8
Post-Project	2.2	D	2.2	0.33	1.87		0	0		0	0		0	0		84	0	0.3	88	13.2	1.9	98	83.3		101	0	96.5

Appendix 2.7

SWS Drainage Basin Drawing



MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

QUIKTRIP 11TH ADDITION

WICHITA, KANSAS

SWS DRAINAGE BASIN

DATE: October 10

REVISED

DESIGN BY: KLA

DRAWN BY: CMJ

CHECKED BY: GJA

SHEET NUMBER: 1

J:\Civil\10246-Hillside\Dwg\DRNG\10246_STORM.dwg

Tab 3. Post-Development Conditions

Description

The site is 2.2 acres that will develop for commercial usage. A convenience store is planned to be constructed on this site.

Drainage Calculations

Runoff Method

The site was modeled using Hydraflow Hydrographs by AutoCAD 2009, Appendix 2.5.

Rainfall

The rainfall information used is from the Kansas Department of Transportation Rainfall Depth Tables for Kansas Counties June 1997. The rainfall values used are shown in Table 3.1.

Table 3.1. 24-Hour Rainfall Depths.

	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Sedgwick	3.50	4.53	5.24	6.24	7.80

Time of Concentration

Time of concentration was calculated using theTR-55 method. Calculations are in Appendix 2.5.

Curve Numbers

Weighted curve numbers were calculated to represent the land usage of the basins. A curve number of 96.5 was used to represent the commercial development. The curve numbers are shown in Table 3.2.

Drainage Patterns

The site will drain to the north into the SWS along Orme. A detention facility will be constructed along the east side of the property. The detention area will drain into SWS that will flow to the north and into a proprietary water quality system before flowing into the existing SWS. Proposed contours are shown on the drainage and utility plan, Appendix 3.1.

Table 3.2. Post-Development Flow Rates.

Description	Area (ac.)	Tc (min.)	CN	Design Storm Flows (cfs)				
				2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Post-Project	2.2	3.1	96.5	7.6	9.9	14.0	17.5	22.7

Utilities

Storm Water Sewer

Proposed storm water sewer will convey runoff from the detention pond directly into a proprietary water quality system. The Storm Water Sewer connects into the existing 72" RCB SWS in Orme. The layout is shown on the Drainage and Utility Plan, Appendix 3.1. The proposed pipe system has been sized for a 5-year event.

Water

The proposed water system will tie into the existing system along Hillside.

Sanitary Sewer

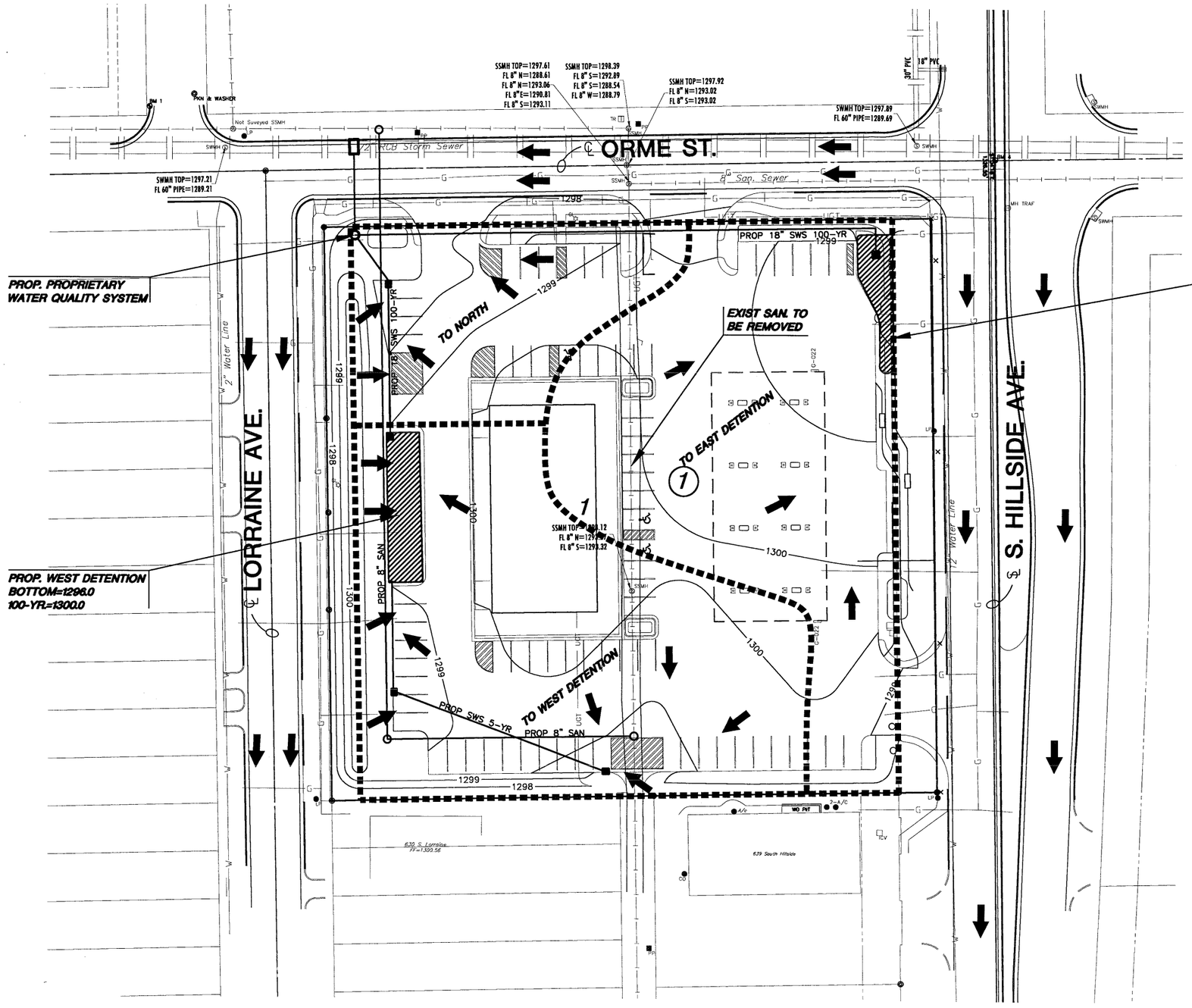
The existing sanitary sewer line through the center of the property will be abandoned. A new system will tie into the existing line and route it around the proposed building and tie into the existing system in Orme.

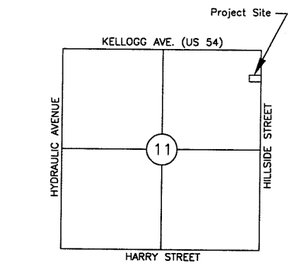
Minimum Lowest Opening

There are no minimum lowest openings for this plat.

Appendix 3.1

Drainage and Utility Plan





VICINITY MAP

LEGEND

- GIN - CONIFEROUS TREE
- DIN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SECTION CORNER
- BM - BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UGE - UNDERGROUND ELEC.
- OHE - OVERHEAD ELECTRIC
- FOC - FIBER OPTIC CABLE
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW
- A17 - AREA FOR SWS SIZING
- PROPOSED DETENTION

SCALE: 1"=30'

0 30 60

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

QUIKTRIP 11TH ADDITION

WICHITA, KANSAS

DRAINAGE & UTILITY PLAN

DATE: October 10

REVISED

DESIGN BY: KLA

DRAWN BY: CMJ

CHECKED BY: GJA

SHEET NUMBER: 1

J:\Civil\10246-Hillside\Dwg\DRNG\10246_DUP.dwg

Tab 4. Floodplain Submittal

There are no FEMA floodplains on this site.

Tab 5. Permits

US Army Corps of Engineers

There are blue lines on the USGS Quadrangle map on the site. Therefore no permit will be required.

Kansas Department of Agriculture

The site does not change any waterways or provide detention, therefore division of water resources permits.

Federal Emergency Agency (FEMA)

There are no FEMA floodplains on site, therefore no LOMC applications are required.

Kansas Department of Transportation

There are no state highways on site.

Sedgwick County Right-of-way Permit

Not applicable.