

DRAINAGE REPORT

FOR

**REUSSER ADDITION
SEDGWICK COUNTY, KANSAS**

SEPTEMBER 2008



Public Works, Engineering Division Final Drainage Plan Submittal Checklist

Reviewer: _____	Date: _____
Subdivision Name: _____	Location: _____
Total Land Area Of Ownership: _____ Acres	
Type: _____ Residential _____ Commercial _____ Industrial _____ Recreation _____ Municipal _____ Other	
Applicant: _____	Contact: _____ Phone #: _____
Engineer: _____	Contact: _____ Phone #: _____

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					
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					
I. Location of existing roads, buildings, parking lots and other impervious areas.					



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. 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			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Proposed (post-development) conditions hydrologic and hydraulic analysis for runoff rates, volumes, HGL, and velocities showing the methodologies used and supporting calculations for all applicable design storms (2, 5, 10, 25 & 100 year, 24-hour storm events)					
B. Proposed time of concentrations used in calculations					
C. Assumed post-developed runoff curve numbers					
D. Proposed contours for detention facilities (to equal area used in outlet rating curves)					
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 platters 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					
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					

Tab 1. Project Narrative

A. Location

The subject property is in Sedgwick County, Kansas. The proposed development is located in the northeast ¼ of the southeast ¼ of Section 34, Township 26 South, Range 2 East. The Reusser Addition consists of 37.9 acres of property west of 127th Street East, between 29th and 37th Street North. Four Oaks Addition is just north of the site. The site is shown on the USGS Map, Figure 1.1.

B. Discussion of Development

The entire site will be developed as single family residential lots, varying in size from, approximately, two to five acres. Water will be provided by Rural Water District Number 5 and a septic system will be constructed for each lot.

C. Discussion of Offsite

The site is bounded by 127th Street on the east, Four Oaks Addition to the North and undeveloped land to the west and south.

D. Summary of Runoff

The site drains in three directions; to the northeast, northwest and south. There is a ridge in the southern third of the property and elevations onsite range from 1405 feet in the southern third of the site to 1380 feet in the northeast. The amount of impervious area increases by approximately ten percent from pre to post-project conditions. In general, the existing drainage patterns will be maintained under post-project conditions; however, the proposed road will be graded to drain northeast. This grading extends the post-project Northeast basin flow path; thereby, increasing the time of concentration from pre to post-project. In addition, the proposed road will divert a small portion of the pre-project Northwest and South basin to the northeast. Because of the grading impacts described above, pre-project flowrates are maintained under post-project conditions. No detention is proposed. A summary of pre and post-project runoff rates is shown in the table below.

Comparison of Pre and Post-Development Flowrates

Description	Design Storm Flows (cfs)			
	2-Yr	5-Yr	10-Yr	100-Yr
<i>Pre-project</i>				
Northeast Basin	17.7	27.6	34.4	59.8
Northwest Basin	23.9	37.4	46.6	81.0
South Basin	11.9	18.7	23.2	40.2
<i>Post-Project</i>				
Northeast Basin	17.5	27.1	33.7	58.3
Northwest Basin	23.5	36.6	45.5	78.8
South Basin	12.0	18.7	23.2	40.0

E. Best Management Practices

The site will be seeded or sodded after construction of grading and utilities are complete.

F. Plat

The plat is included, Figure 1.2.

G. Preliminary Grading Plan

The preliminary lot grading plan is included, Figure 1.3.

H. Professional Engineer Seal

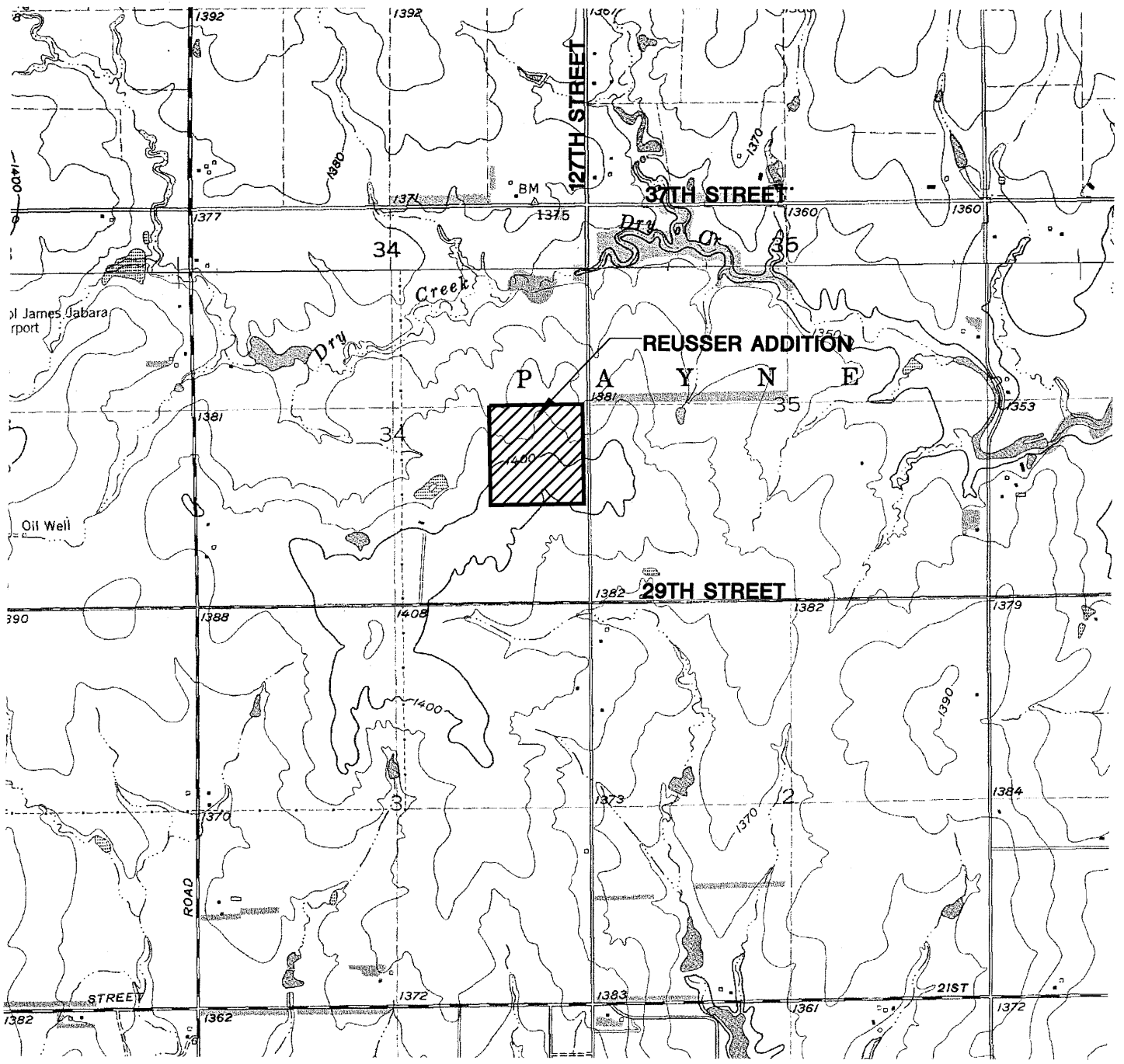
The cover of the report will be signed and dated.

I. CD

A CD of the drainage report in PDF format is attached to the inside front cover of the bound report.

Figure 1.1

USGS Quadrangle Map



SCALE: 1"=2000'



MKEC
ENGINEERING
CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS. 67206
316-684-9600

REUSSER ADDITION

PROJECT NAME

QUAD MAP

SHEET TITLE

TMH

DESIGN BY:

CMJ

DRAWN BY:

GJA

CHECKED BY:

SEPTEMBER 2008

DATE

07698

JOB NO.

1 / 1

SHEET/OF

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Figure 1.2

Plat



NOTES

1. LOT TOTAL - 12
2. ANNEXATION: To remain unincorporated
3. EXISTING/PROPOSED USES: Agriculture/Residential
4. ZONING: Existing - "RR"
5. PLAT AREA: Gross - 39.74 acres
6. SURVEY DATE: April 2008 (by MKEC)
7. ACCESS CONTROLS: As shown
8. FLOOD: According to FEMA FIRM Community Unit Panel 20173C 0377E, Effective Date February 7th, 2007, within flood zone "X".
9. DRAINAGE: A drainage report shall accompany this plat.
10. UTILITIES: Water is available from the east by Butler County Rural Water District No. 5. Individual alternative septic systems will be used.
11. STREETS: Gravel with ditches
12. PRIVATE STREET RESERVES: Reserve "A" is platted for private streets, public and private utilities, access and shall be owned and maintained by the Homeowners Association.












LEGAL DESCRIPTION

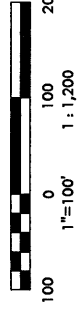
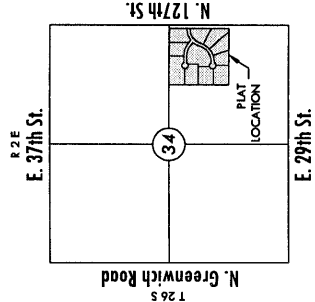
The NE 1/4 of the SE 1/4, Section 34, Township 26 South, Range 2 East of the 6th P.M., Sedgwick County, Kansas.

BENCH MARKS

- BM #1**  Brass disc in top of south curb of 26th Street North, 75' west of centerline Greenwidge Road. Elev. = 1379.43 (NAVD 88)
- BM #2**  Brass disc in top of south curb of 26th Street North, 938' west of centerline Greenwidge Road. Elev. = 1376.84 (NAVD 88)

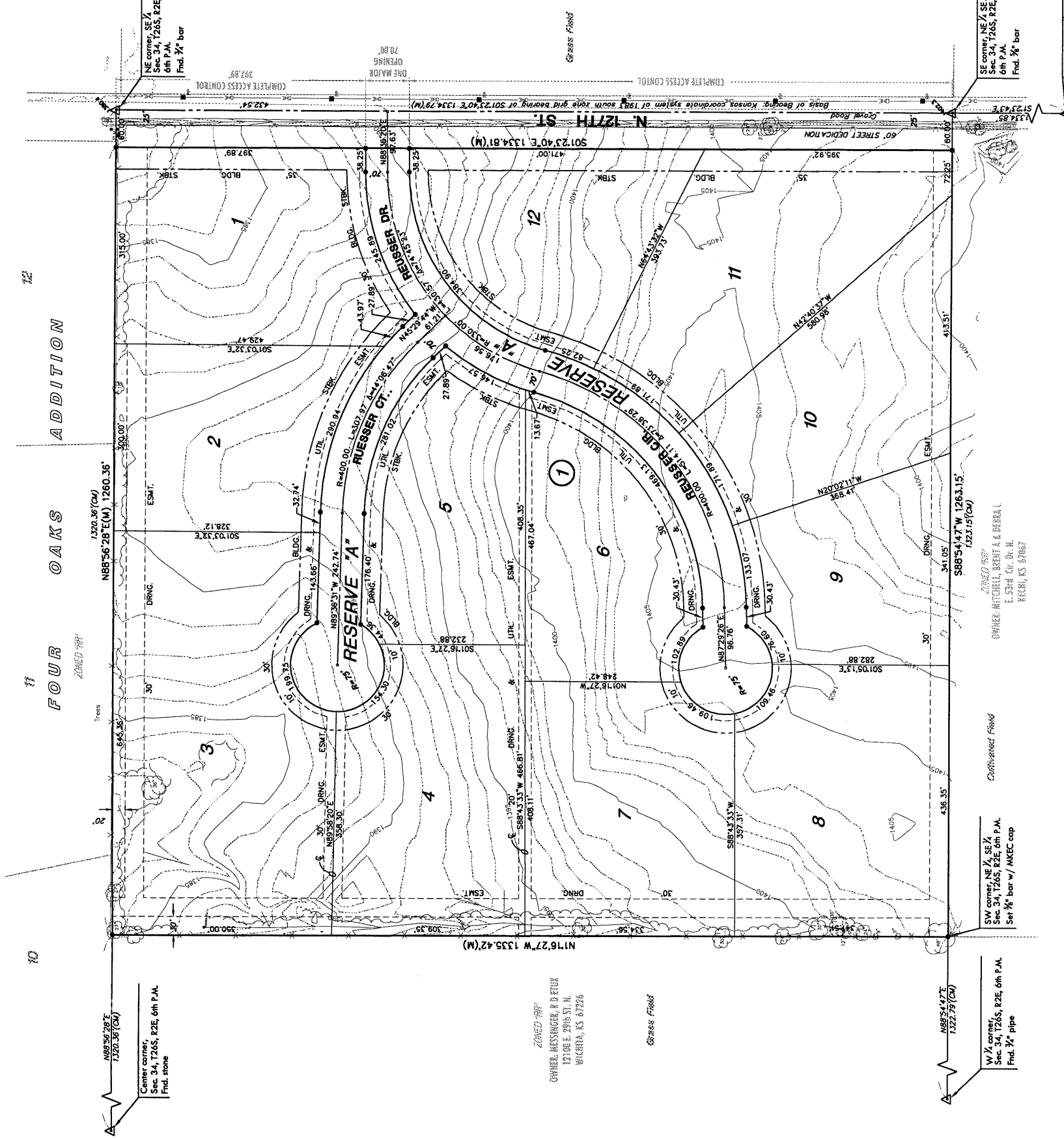
LEGEND

-  CONIFEROUS TREE
-  DECIDUOUS TREE
-  POWER POLE
-  WATER METER
-  SECTION CORNER
-  PIPELINE MARKER
-  EASEMENT
-  BUILDING SETBACK
-  FENCE
-  WATER LINE
-  OVERHEAD ELECTRIC



**PRELIMINARY PLAT
PREUSSER ADDITION**

OWNER / DEVELOPER: L & T Land, LLC 14101 Sport Of Kings, Wichita, KS 67230 (316) 265-1308



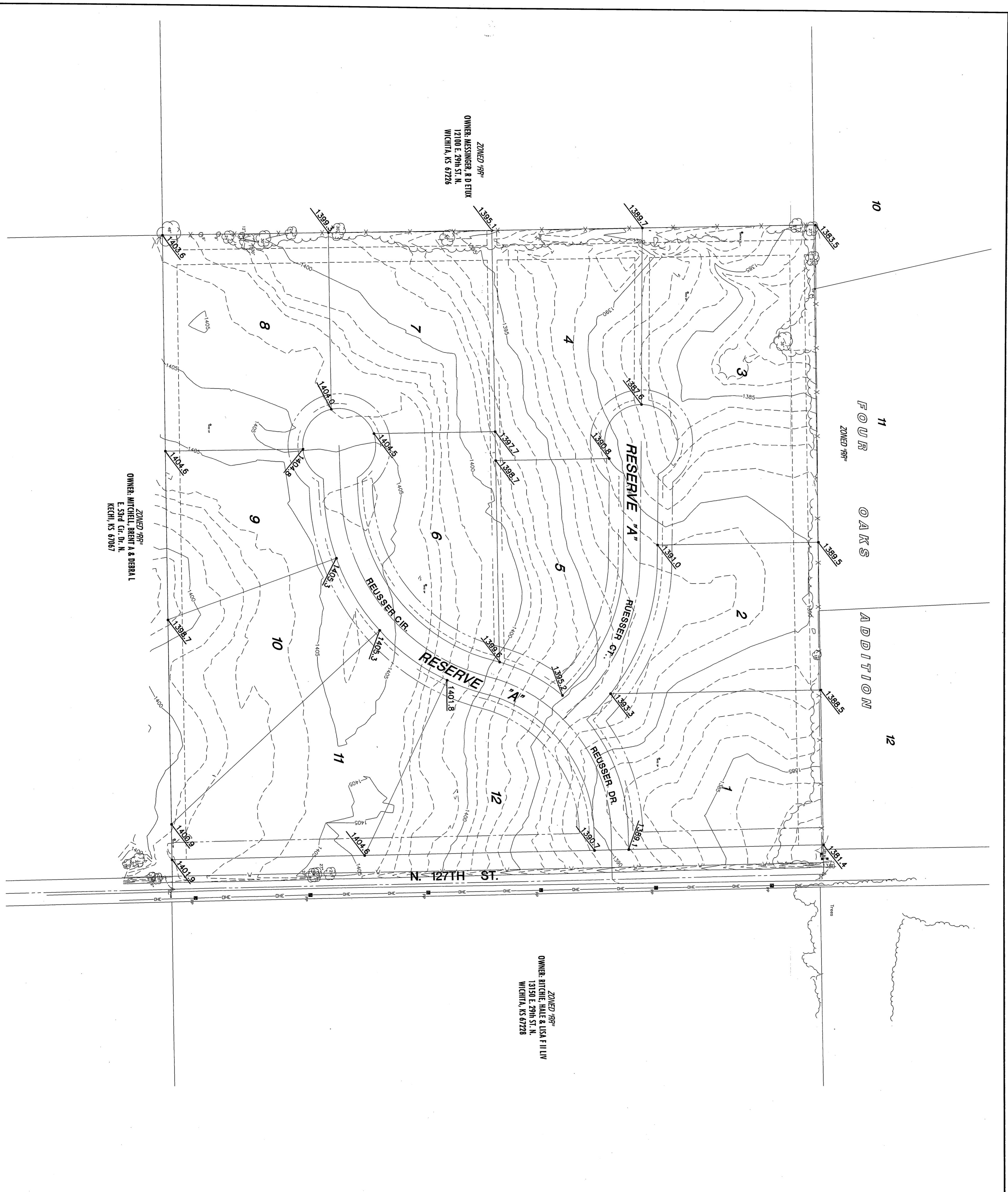
MKEC
ENGINEERING
CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS 67206
316-684-9600

Planning Commission Hearing: September 25th, 2008
Subdivision Hearing: September 18th, 2008
Submitted: August 29th, 2008

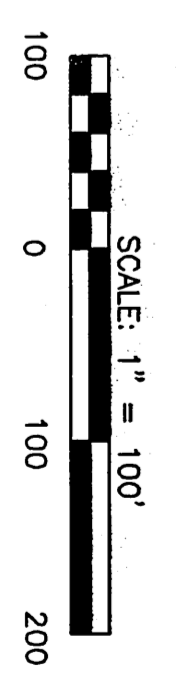
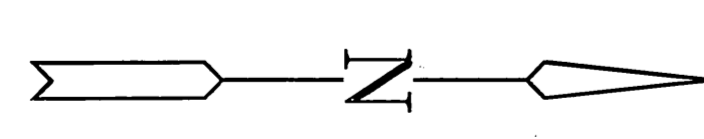
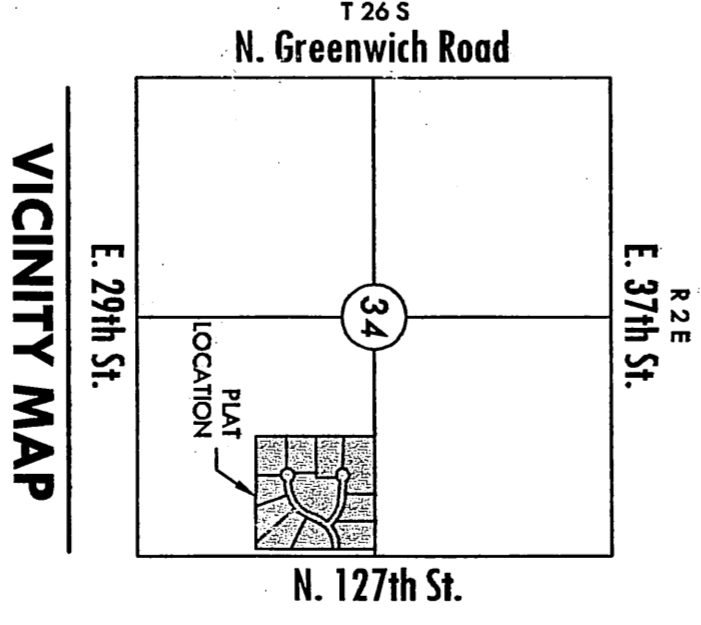
Figure 1.3

Preliminary Grading Plan



LEGEND

- ✱ - CONIFEROUS TREE
- - DECIDUOUS TREE
- - SIGN
- ⊙ - POWER POLE
- ⊙ - ELECTRIC BOX
- ⊙ - LIGHT POLE
- ⊙ - FIRE HYDRANT
- ⊙ - WATER VALVE
- ⊙ - WATER METER
- ⊙ - SECTION CORNER
- ⊙ - BENCHMARK
- ⊙ - EASEMENT
- ⊙ - BUILDING SETBACK
- ⊙ - FENCE
- ⊙ - STORM SEWER PIPE
- ⊙ - WATER LINE
- ⊙ - SANITARY SEWER LINE
- ⊙ - GAS LINE
- ⊙ - GAS PRELINE
- ⊙ - TELEPHONE LINE
- ⊙ - UNDERGROUND ELEC.
- ⊙ - OVERHEAD ELECTRIC
- ⊙ - FIBER OPTIC CABLE
- ⊙ - SPOT ELEVATION



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DATE	SEPTEMBER 2008
REVISION	
DESIGN BY	TMH
DRAWN BY	CMJ
CHECKED BY	GJA
SHEET NUMBER	1

REUSSER ADDITION
 REUSSER'S ADDITION
 WICHITA, KANSAS
PRELIMINARY LOT GRADING PLAN

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

Tab 2. Existing Conditions Runoff Calculations

A. Orthophotograph

The aerial photograph is included, Figure 2.1.

B. Runoff Method

The SCS method in Hydraflow Hydrographs 2007 was used to determine pre and post-project runoff rates.

C. Existing Topography

Elevations on the site range from 1405 feet in the south to 1380 feet, in the northeast. The existing topography is shown on the Existing Conditions Drawing, Figure 2.2.

D. Site Areas

The site is undeveloped, agricultural pasture land.

E. Benchmarks

Benchmark 1: Center, Sec 34, T26S, R2E, 6th P.M., Fnd Stone; Elevation = 1320.36' (NGVD29)

Benchmark 2: SE corner, SE ¼ Sec 34, T26S, R2E, 6th P.M. Fnd. ½" pipe; Elevation = 1334.85 (NGVD29)

Both benchmarks are shown on Figure 1.2. NGVD 29 datum is used in this report.

F. Streams, Creeks, and Waterways

No portion of the site is included in a regulatory floodplain. The site is in Zone X, areas outside the 0.2% annual chance event, as shown on FIRM Panel 0377E of 700, Sedgwick County, Kansas February 2, 2007 in Figure 2.3. The closest floodplain is approximately 1,500 feet north of the site.

G. Soils

According to the NRCS (SCS) Sedgwick County Soil Survey, Figure 2.4, soils on the site are Goessel silty clay 1 to 3 percent slopes, (Ga – HSG “D”) and Irwin silty clay loam 1 to 3 percent slopes, (Ia, - HSG “D), Clime silty clay 3 to 7 percent slopes (Ce – HSG “C”) and Rosehill silty clay 1 to 3 percent slopes (Rd – HSG “D”). The Hydraulic Soil Group used to select runoff coefficients and curve numbers is “D”.

H. Natural Features

There are no natural ponds or channels onsite.

I. Location of Existing Impervious Areas

There is no impervious area onsite.

J. Location of Existing Utilities

There is an existing 4-inch waterline on the west side of 127th Street.

K. Location of Existing Conveyance Systems

There are no existing man-made conveyance systems onsite.

L. Flow Paths

Flow paths are shown on the Existing Conditions Drawing, Figure 2.2.

M. Location and Sizes of Existing Structures

There are no existing drainage structures on site.

N. Existing Conditions Hydrologic Analysis

Hydraflow Hydrographs 2007 was used to calculate pre-project runoff rates. The SCS method was used to determine runoff rates. There are three drainage basins onsite, the Northeast, Northwest and South basins. These basins drain as they are named. The pre-project drainage basins are shown on the Existing Conditions drawing, Figure 2.2. The pre-development runoff rates are shown in the table below, calculations are in Figure 2.5.

Pre-Development Flowrates

Description	Design Storm Flows (cfs)			
	2-Yr	5-Yr	10-Yr	100-Yr
Northeast Basin	17.7	27.6	34.4	59.8
Northwest Basin	23.9	37.4	46.6	81.0
South Basin	11.9	18.7	23.2	40.2

O. Pre-Developed Runoff Curve Numbers

The entire site is agricultural pasture area; a curve number of 80 was used to represent existing conditions.

P. Existing Time of Concentration

The FAA method was used to calculate the time of concentration. The times of concentration and rational coefficients for pre-development conditions are shown in the following table. Time of concentration calculations are in Figure 2.6.

Existing Time of Concentration and Rational Coefficient

Basin	T _c	Rational Coefficient
	minutes	
Northeast	29.2	0.47
Northwest	39.8	0.47
South	21.3	0.47

Q. Downstream Drainage Capacity

The current downstream drainage capacity will be unaffected by the proposed development.

R. Existing Structural Elevations

There are no existing structures onsite.

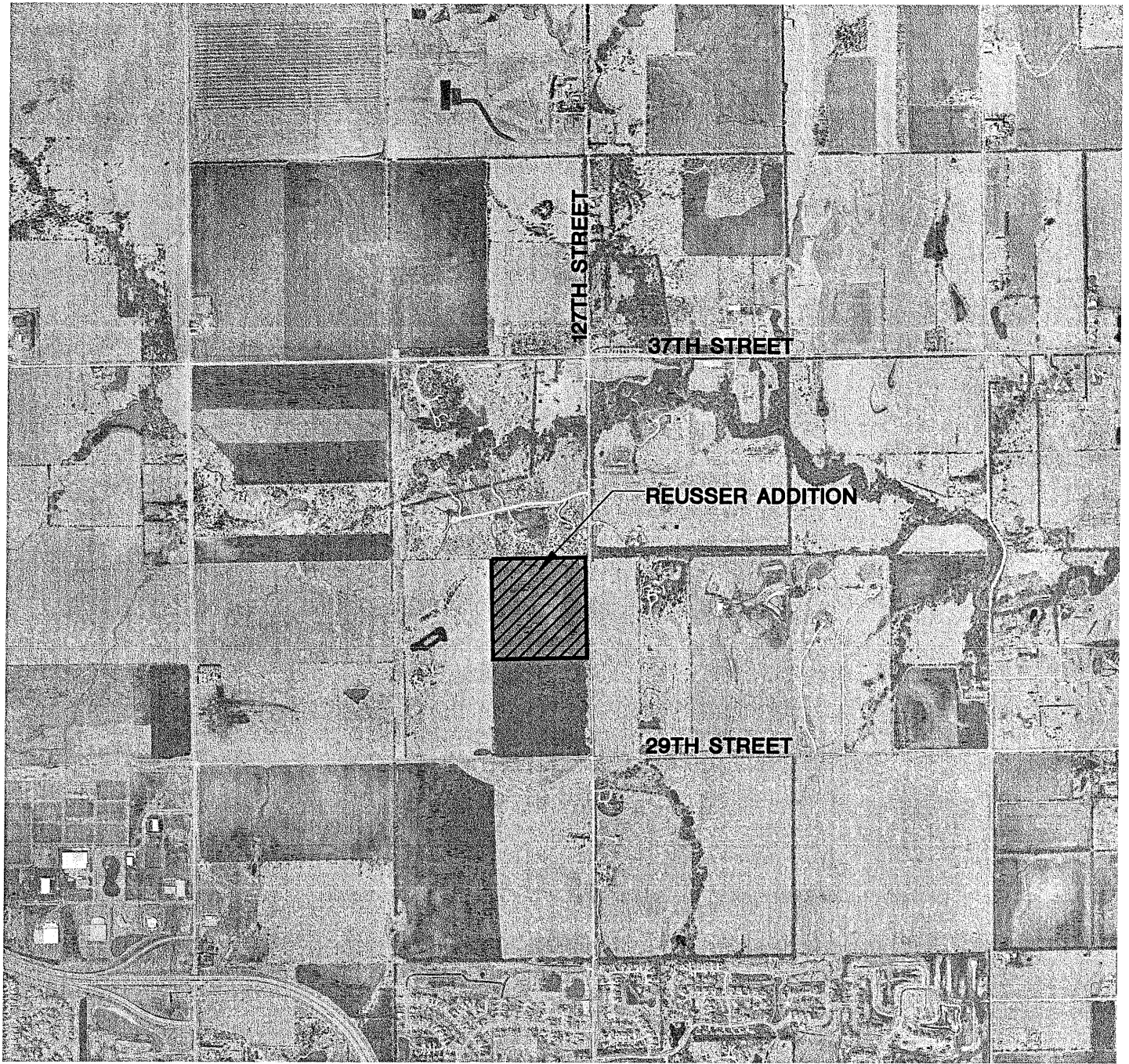
S. Open Channels

There are no open channels onsite.

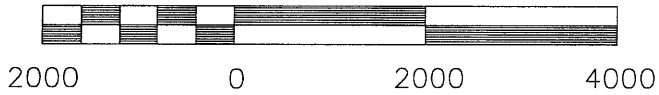
T. Groundwater Elevations

Groundwater elevations are not applicable for this project.

Figure 2.1
Orthophotograph



SCALE: 1"=2000'



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MKEC
ENGINEERING
CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

REUSSER ADDITION
PROJECT NAME

AERIAL MAP
SHEET TITLE

TMH
DESIGN BY:

CMJ
DRAWN BY:

GJA
CHECKED BY:

SEPTEMBER 2008
DATE

07698
JOB NO.

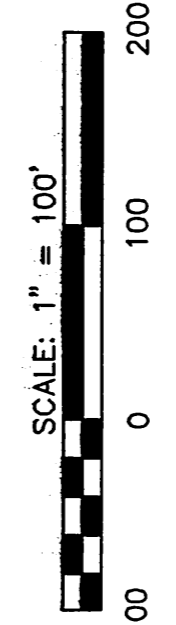
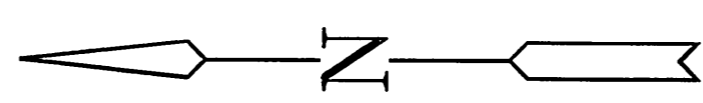
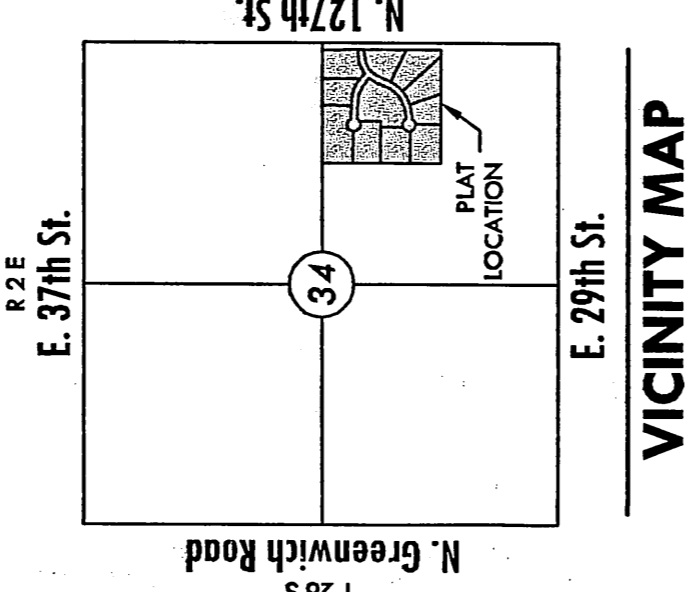
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SHEET/OF

Figure 2.2

Existing Conditions Drawing

LEGEND

- CONIFEROUS TREE
- DECIDUOUS TREE
- POWER POLE
- ELECTRIC BOX
- LIGHT POLE
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- SECTION CORNER
- BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS PIPELINE
- TELEPHONE LINE
- UNDERGROUND ELEC
- OVERHEAD ELECTRIC
- FIBER OPTIC CABLE
- DRAINAGE BASIN
- FLOW ARROW



BENCHMARKS
Date of Survey: April, 2008
= Section corner Monument Found
= Found 3/4" rebar w/ MIKEC
= CLS 39' Id. cap unless otherwise annotated
= Set 3/4" Rebar w/ MIKEC
= CLS 39' Id. cap
= Measured
= Calculated from measured

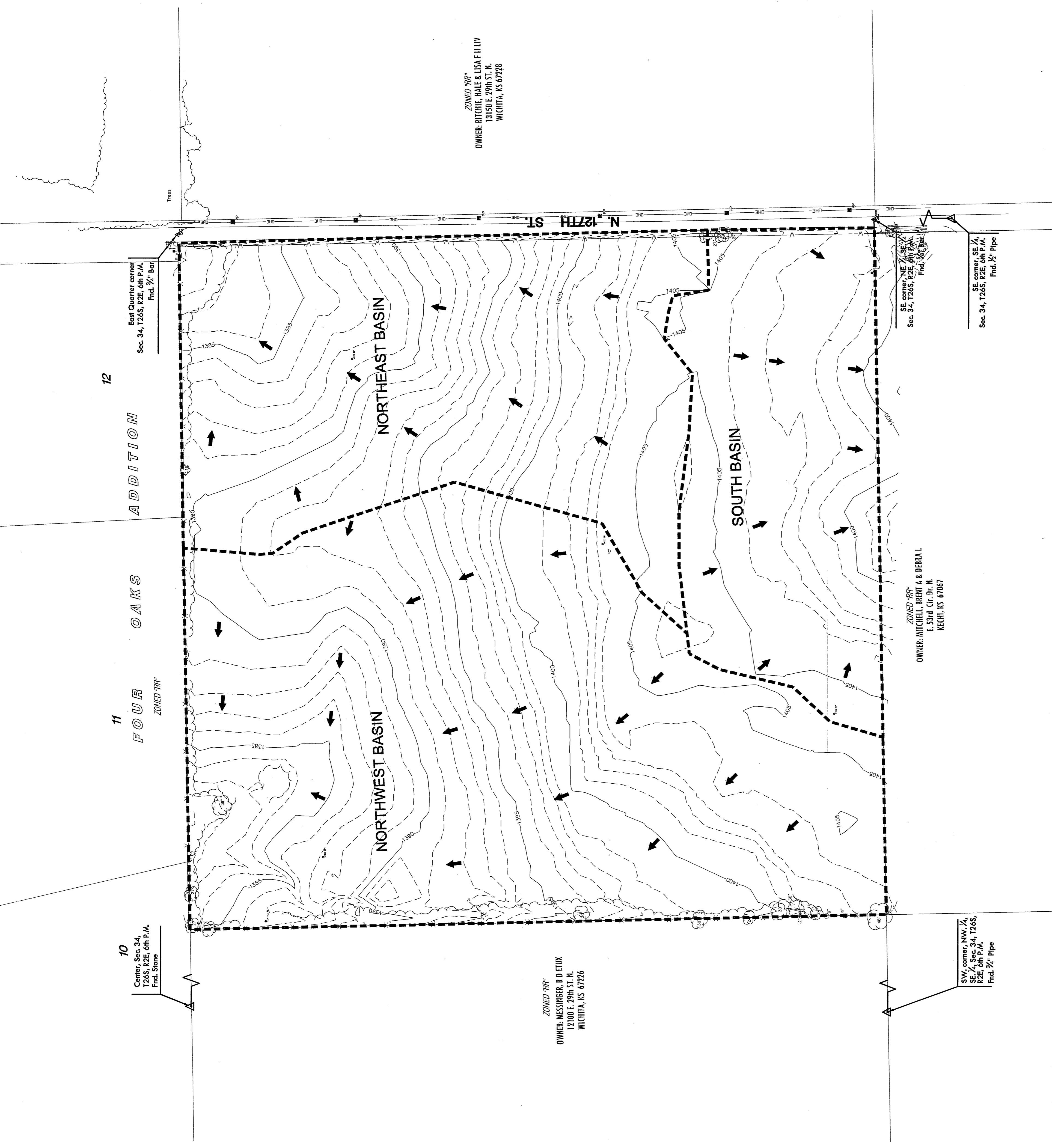
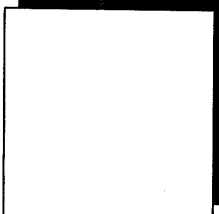


Figure 2.3

FIRM



DATE	SEPTEMBER 2008
REVISED	

DESIGN BY	TMH
DRAWN BY	CMJ
CHECKED BY	GJA

SHEET NUMBER	1
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NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0377E

FIRM
FLOOD INSURANCE RATE MAP
SEDGWICK COUNTY,
KANSAS
AND INCORPORATED AREAS

PANEL 377 OF 700
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	NUMBER	PANEL	SUFFIX
COMMUNITY	200321	0377	E
SEDGWICK COUNTY	200328	0377	E
WICHITA, CITY OF			

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
20173C0377E

EFFECTIVE DATE
FEBRUARY 2, 2007

Federal Emergency Management Agency

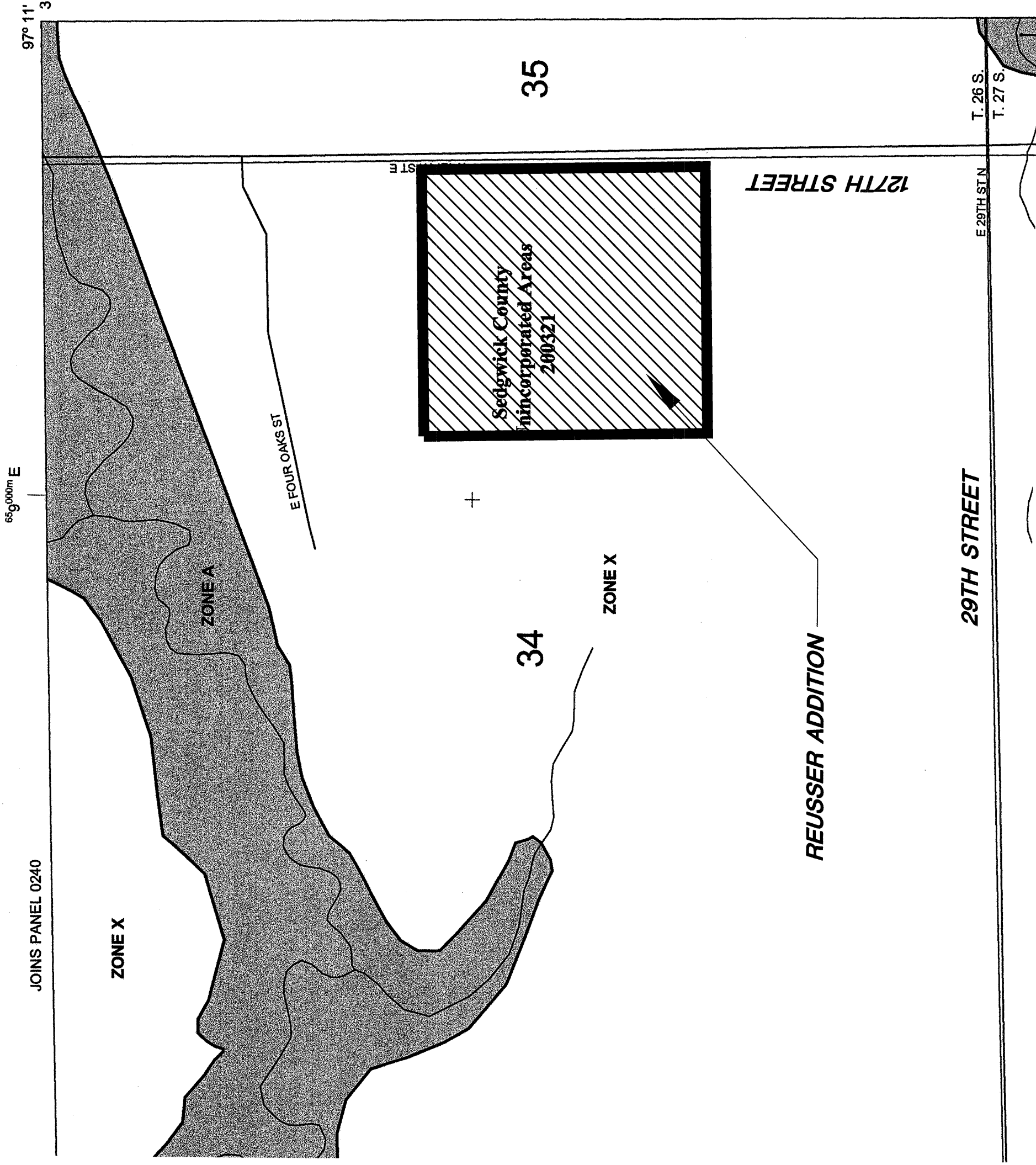
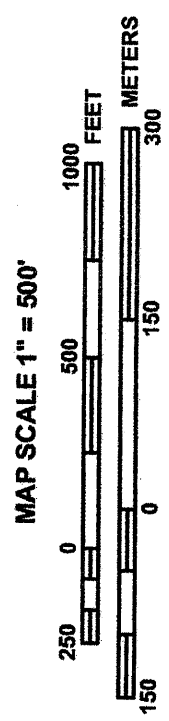
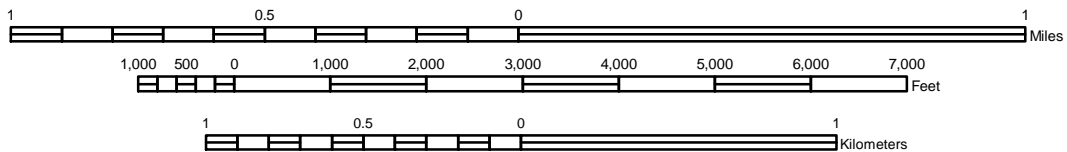
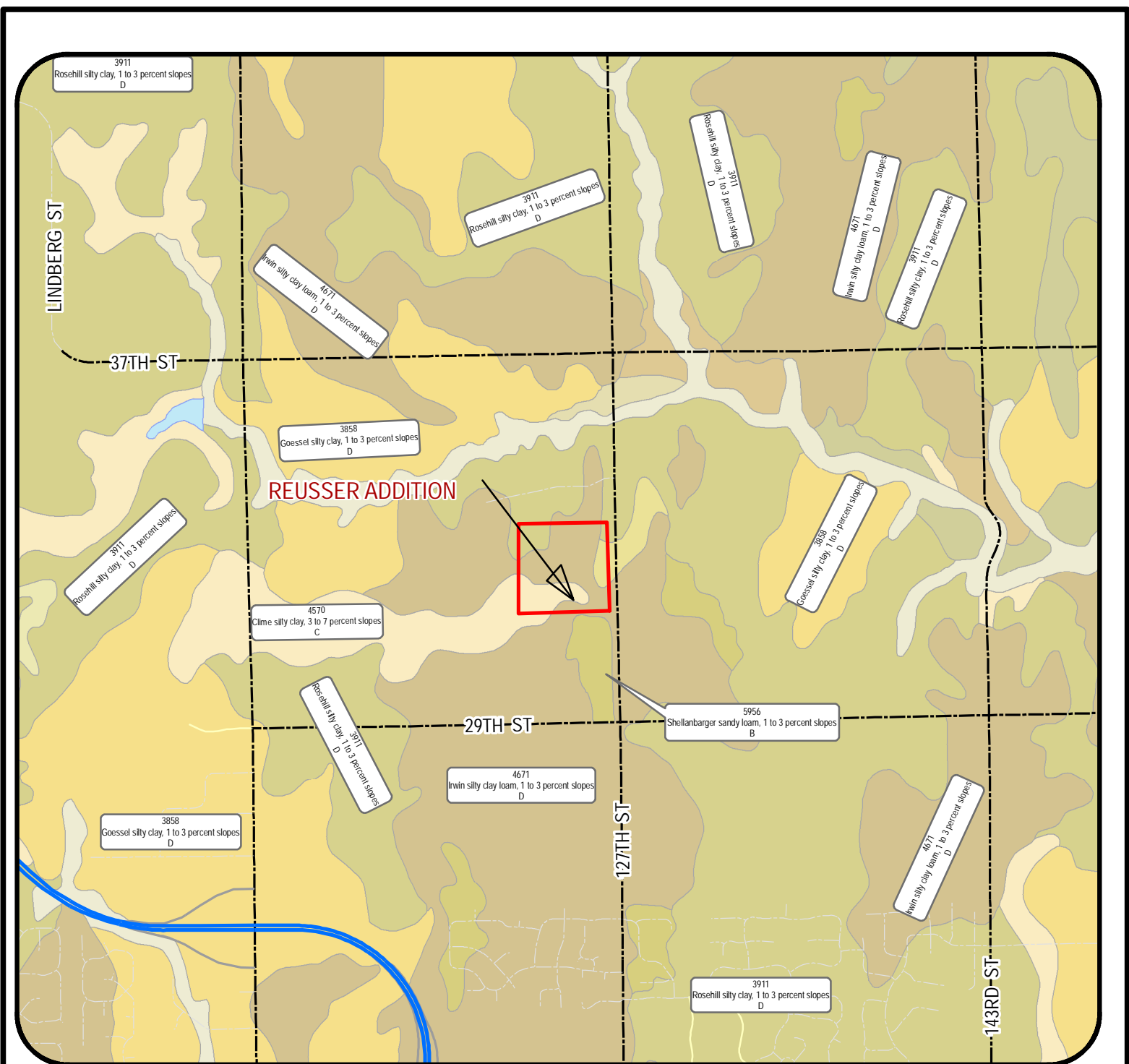


Figure 2.4
Soil Survey



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REUSSER ADDITION

Project Name: _____
 Soil Survey - Sedgwick County, KS
 Sheet Title: _____



CMJ	Sept. 2008
Drawn By:	Date:
TMH / KLA	07698
Design / Review:	Job No.:

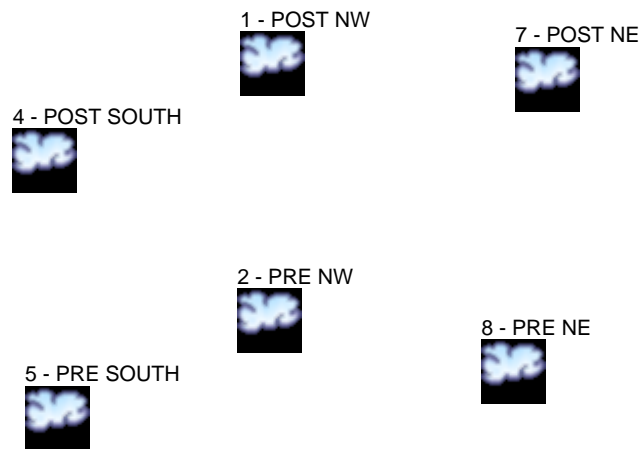
Figure 2.5

Hydraflow Hydrographs

Watershed Model Schematic	1
Hydrograph Return Period Recap	2
100 - Year	
Summary Report	3
Hydrograph Reports	4
Hydrograph No. 1, SCS Runoff, POST NW	4
Hydrograph No. 2, SCS Runoff, PRE NW	5
Hydrograph No. 4, SCS Runoff, POST SOUTH	6
Hydrograph No. 5, SCS Runoff, PRE SOUTH	7
Hydrograph No. 7, SCS Runoff, POST NE	8
Hydrograph No. 8, SCS Runoff, PRE NE	9
IDF Report	10

Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.22



Legend

Hyd.	Origin	Description
1	SCS Runoff	POST NW
2	SCS Runoff	PRE NW
4	SCS Runoff	POST SOUTH
5	SCS Runoff	PRE SOUTH
7	SCS Runoff	POST NE
8	SCS Runoff	PRE NE

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.22

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	-----	-----	23.54	-----	36.59	45.50	59.11	69.58	78.79	POST NW
2	SCS Runoff	-----	-----	23.93	-----	37.36	46.57	60.64	71.47	81.00	PRE NW
4	SCS Runoff	-----	-----	12.01	-----	18.67	23.18	30.05	35.33	39.97	POST SOUTH
5	SCS Runoff	-----	-----	11.94	-----	18.66	23.22	30.17	35.52	40.22	PRE SOUTH
7	SCS Runoff	-----	-----	17.45	-----	27.09	33.69	43.76	51.52	58.32	POST NE
8	SCS Runoff	-----	-----	17.67	-----	27.64	34.42	44.78	52.76	59.76	PRE NE

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

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	78.79	3	735	8.727	----	-----	-----	POST NW
2	SCS Runoff	81.00	3	735	8.966	----	-----	-----	PRE NW
4	SCS Runoff	39.97	3	726	3.253	----	-----	-----	POST SOUTH
5	SCS Runoff	40.22	3	726	3.269	----	-----	-----	PRE SOUTH
7	SCS Runoff	58.32	3	732	6.047	----	-----	-----	POST NE
8	SCS Runoff	59.76	3	729	5.528	----	-----	-----	PRE NE
07698_Detention.gpw					Return Period: 100 Year			Thursday, Sep 4, 2008	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

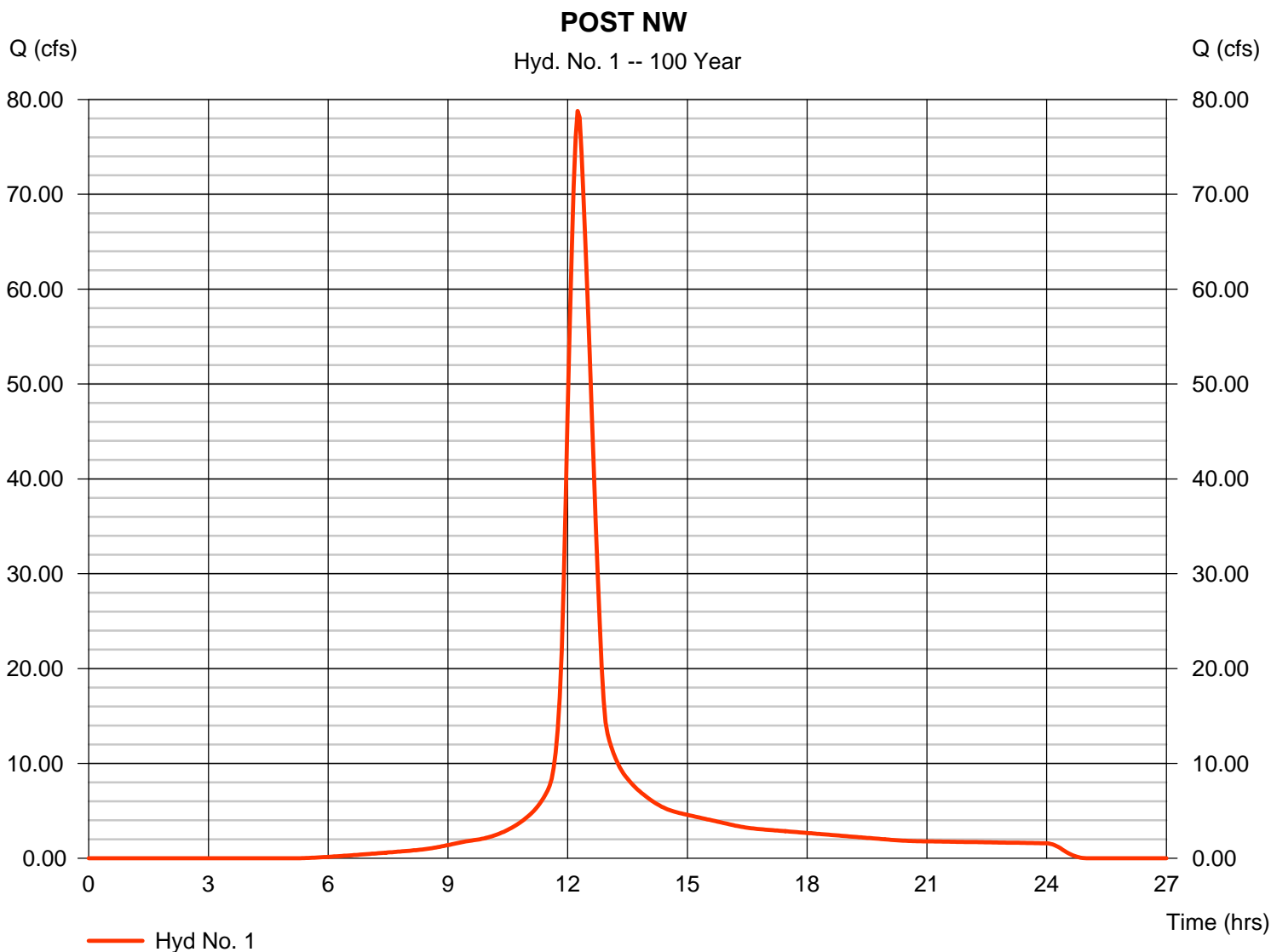
Thursday, Sep 4, 2008

Hyd. No. 1

POST NW

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 3 min
 Drainage area = 19.400 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 78.79 cfs
 Time to peak = 12.25 hrs
 Hyd. volume = 8.727 acft
 Curve number = 80.4
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 39.40 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

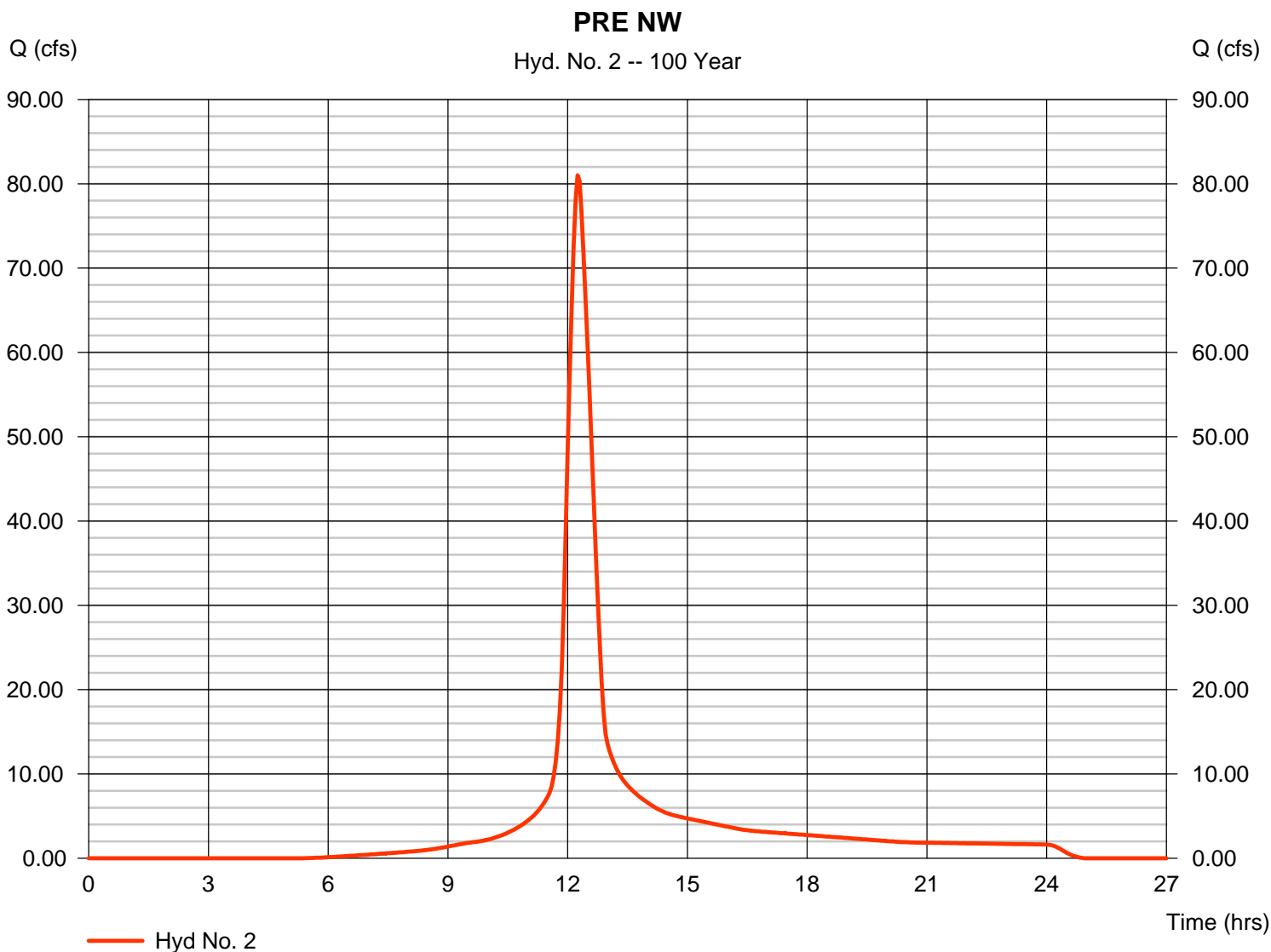
Thursday, Sep 4, 2008

Hyd. No. 2

PRE NW

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 3 min
 Drainage area = 20.100 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 81.00 cfs
 Time to peak = 12.25 hrs
 Hyd. volume = 8.966 acft
 Curve number = 80
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 39.80 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

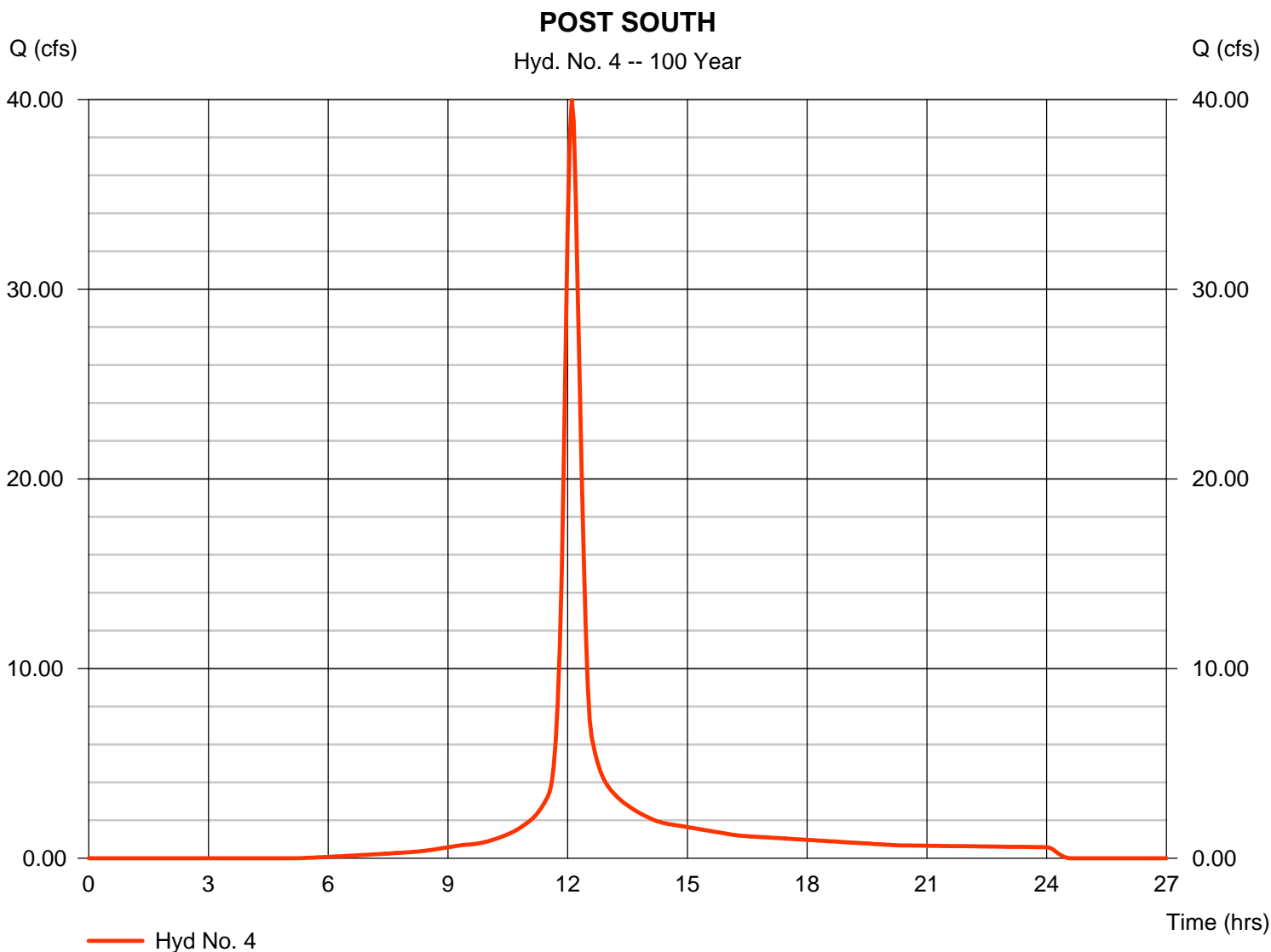
Thursday, Sep 4, 2008

Hyd. No. 4

POST SOUTH

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 3 min
 Drainage area = 7.300 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 39.97 cfs
 Time to peak = 12.10 hrs
 Hyd. volume = 3.253 acft
 Curve number = 80.4
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 21.10 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

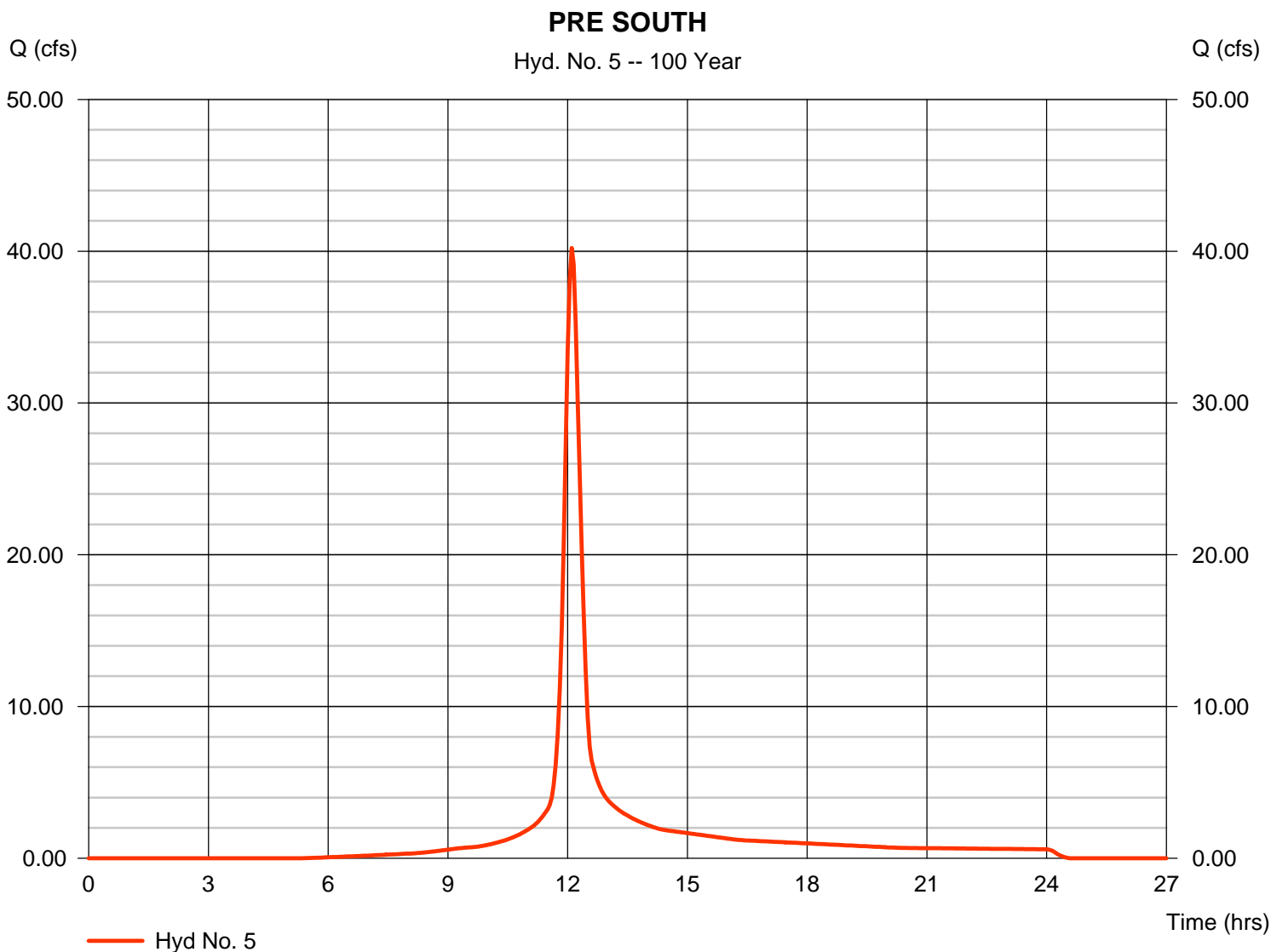
Thursday, Sep 4, 2008

Hyd. No. 5

PRE SOUTH

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 3 min
 Drainage area = 7.400 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 40.22 cfs
 Time to peak = 12.10 hrs
 Hyd. volume = 3.269 acft
 Curve number = 80
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 21.30 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

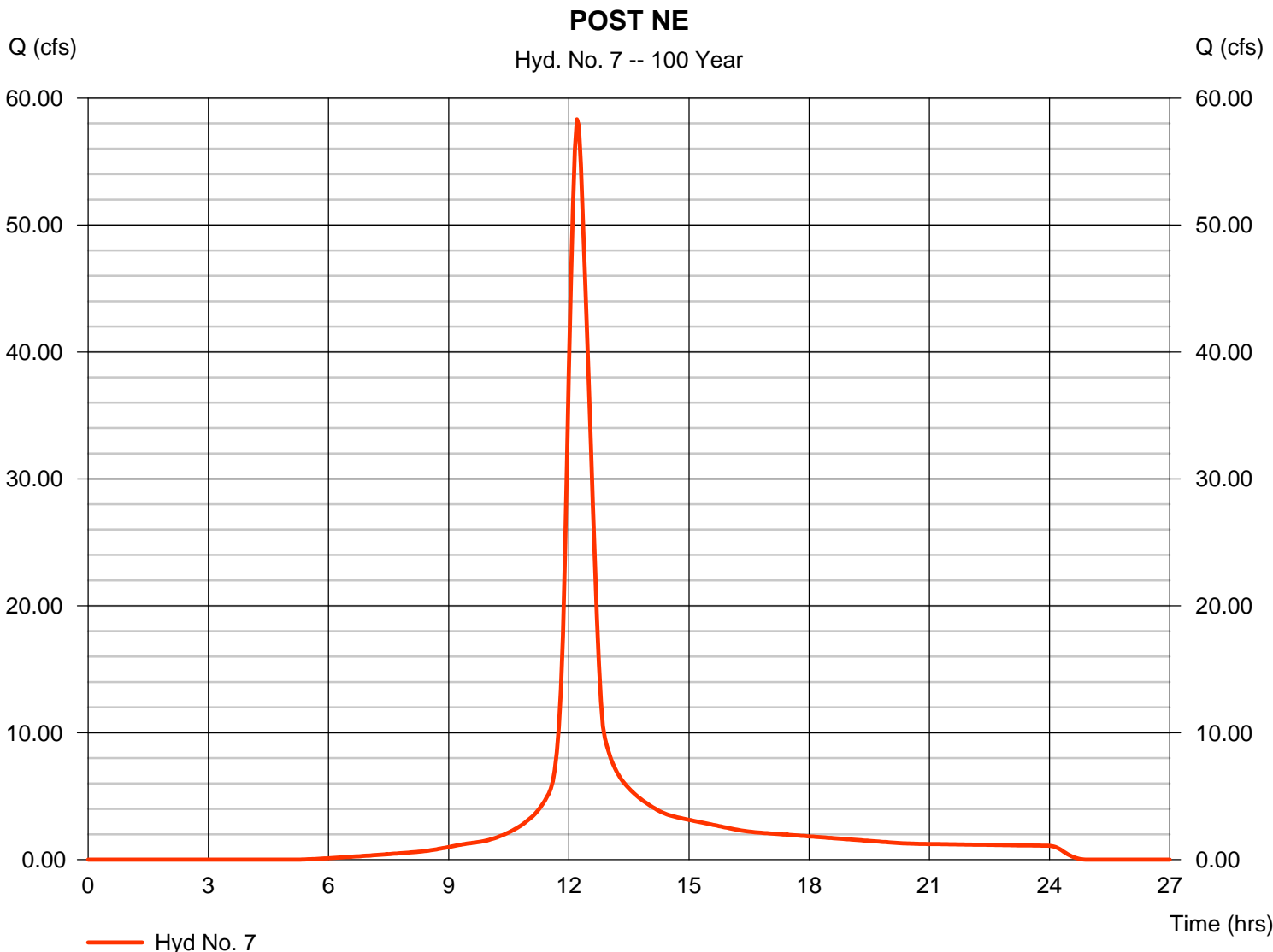
Thursday, Sep 4, 2008

Hyd. No. 7

POST NE

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 3 min
Drainage area = 13.000 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 7.80 in
Storm duration = 24 hrs

Peak discharge = 58.32 cfs
Time to peak = 12.20 hrs
Hyd. volume = 6.047 acft
Curve number = 80.4
Hydraulic length = 0 ft
Time of conc. (Tc) = 30.30 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

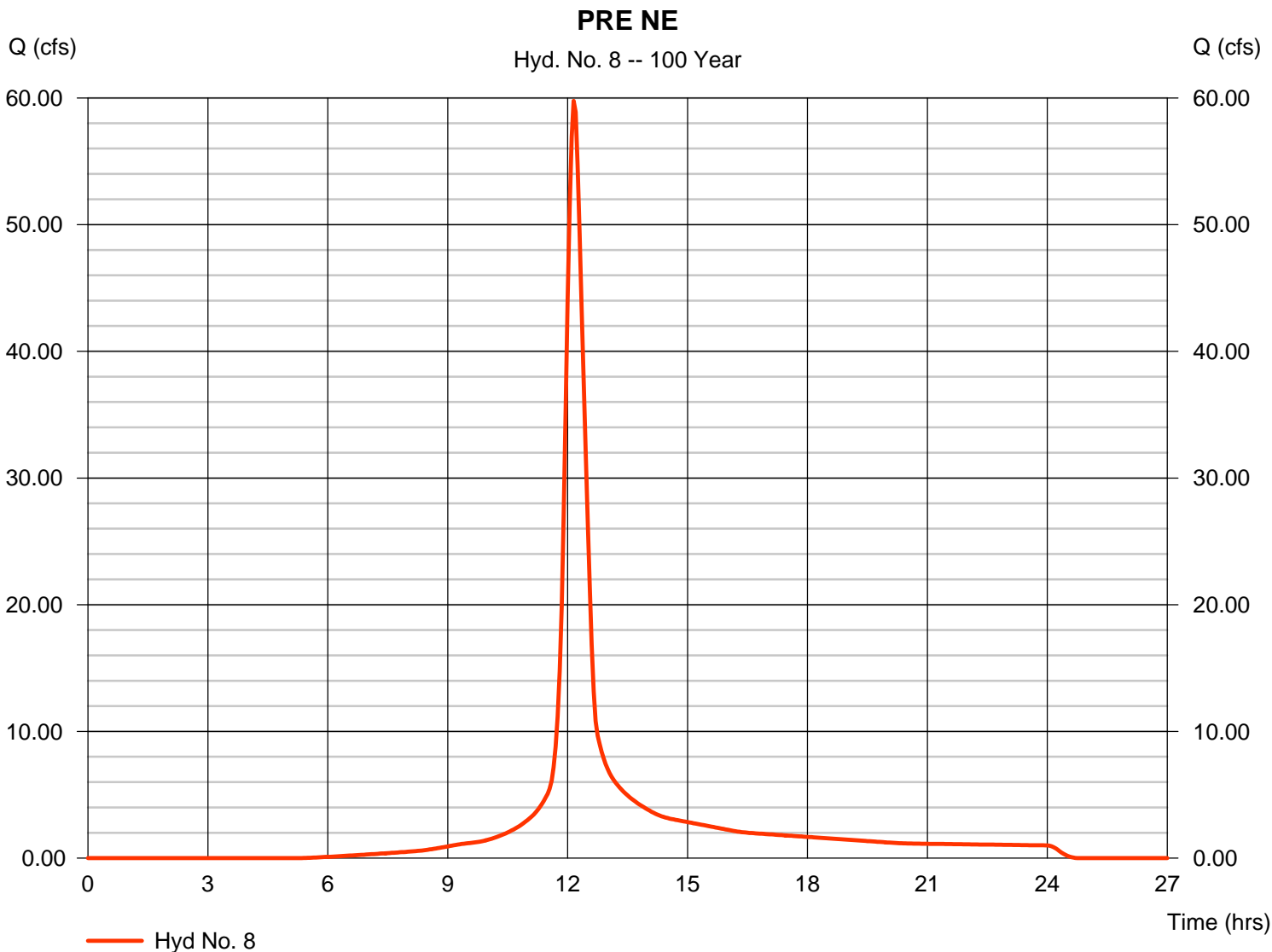
Thursday, Sep 4, 2008

Hyd. No. 8

PRE NE

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 3 min
 Drainage area = 12.200 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 59.76 cfs
 Time to peak = 12.15 hrs
 Hyd. volume = 5.528 acft
 Curve number = 80
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 29.20 min
 Distribution = Type II
 Shape factor = 484



Hydraflow Rainfall Report

Hydraflow Hydrographs by Intelisolve v9.22

Thursday, Sep 4, 2008

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	-----
2	76.3137	14.3000	0.8844	-----
3	0.0000	0.0000	0.0000	-----
5	52.6224	11.2000	0.7497	-----
10	55.1841	11.1000	0.7229	-----
25	60.7012	11.1000	0.7068	-----
50	66.9222	11.3000	0.7004	-----
100	62.2794	10.1000	0.6624	-----

File name: SedgwickCoKS.IDF

$$\text{Intensity} = B / (T_c + D)^E$$

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.57	4.54	3.85	3.35	2.97	2.67	2.43	2.23	2.06	1.92	1.80	1.69
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.52	5.33	4.55	3.99	3.57	3.24	2.97	2.75	2.57	2.41	2.27	2.15
10	7.40	6.09	5.22	4.60	4.13	3.76	3.46	3.21	3.00	2.82	2.67	2.53
25	8.51	7.03	6.05	5.35	4.81	4.39	4.05	3.76	3.52	3.32	3.14	2.98
50	9.47	7.86	6.78	6.00	5.41	4.94	4.56	4.24	3.98	3.75	3.55	3.37
100	10.31	8.53	7.37	6.53	5.90	5.40	5.00	4.66	4.37	4.13	3.92	3.73

T_c = time in minutes. Values may exceed 60.

Precip. file name: SedgwickCoKS.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.48	0.00	4.55	5.25	6.30	7.10	7.80
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Custom	0.00	2.50	0.00	0.00	0.00	4.60	5.20	5.90

Figure 2.6

Time of Concentration Calculations

Time of Concentration Calculations by the FAA method
Reusser Addition

Project Number 07698

$$T_c = \frac{(1.1 - CL)^{1/2}}{100 S^{1/3}}$$

Area Name	Land Use	Soil Group	Maximum Elevation	Minimum Elevation	Flow Length (L)	Rational Runoff Coefficient, C				Time of Concentration (min), T _c				Time of Concentration (hr), T _c				Area Acres	
						2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year		CN
Pre-project																			
Northeast	Agricultural - Pasture - Slopes 1-4%	D	1405.0	1380.0	1128	0.32	0.37	0.47	0.67	36.2	33.8	29.2	19.9	0.6028	0.5642	0.4869	0.3323	80.0	12.2
Northwest	Agricultural - Pasture - Slopes 1-4%	D	1405.0	1382.0	1583	0.32	0.37	0.47	0.67	49.3	46.2	39.8	27.2	0.8220	0.7693	0.6639	0.4532	80.0	20.1
South	Agricultural - Pasture - Slopes 1-4%	D	1405.0	1399.0	437	0.32	0.37	0.47	0.67	26.4	24.7	21.3	15.0	0.4401	0.4119	0.3555	0.2500	80.0	7.4
Post-project*																			
	Residential - 1 Acre	D				0.41	0.45	0.54	0.71										
	Agricultural - Pasture - Slopes 1-4%	D				0.32	0.37	0.47	0.67										
Northeast			1405.0	1380.0	1195	0.33	0.38	0.48	0.67	37.5	35.1	30.3	20.7	0.6252	0.5855	0.5052	0.3454	80.4	13.0
Northwest			1405.0	1382.0	1583	0.33	0.38	0.48	0.67	48.8	45.7	39.4	27.0	0.8135	0.7617	0.6573	0.4494	80.4	19.4
South			1405.0	1399.0	437	0.33	0.38	0.48	0.67	26.1	24.5	21.1	15.0	0.4355	0.4078	0.3519	0.2500	80.4	7.3

*The post-project site will be approximately 10% impervious, therefore a weighted coefficient and curve number was utilized

SCS Runoff Curve Number Calculations

9/4/2008 10:50 AM

Project Name: Reusser Property
 Project Number: 07698
 Basin: Pre-project

Total Area = 39.7 Acres
Total Area = 0.0620 sq. mi.
Composite Curve Number = 80.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

9/4/2008 10:50 AM

Project Name: Reusser Property
 Project Number: 07698
 Basin: Post-project

Total Area = 39.7 Acres
Total Area = 0.0620 sq. mi.
Composite Curve Number = 80.40

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

Tab 3. Post-Development Hydrologic Analysis

A. Proposed Conditions Hydrologic and Hydraulic Analysis

The post-project drainage boundaries are shown on the Drainage and Utility plan Figure 3.1 The SCS method in Hydraflow Hydrographs 2007 was used to determine the post-development flowrates. These flows are shown below; calculations are in Figure 2.5.

Post-Development Flowrates

Basin	Design Storm Flows (cfs)			
	2-Yr	5-Yr	10-Yr	100-Yr
Northeast	17.5	27.1	33.7	58.3
Northwest	23.5	36.6	45.5	78.8
South	12.0	18.7	23.2	40.0

B. Proposed Time of Concentration

The FAA method was used to calculate post-project times of concentration. The Northeast basin time of concentration increases from pre to post-project because the proposed grading extends the flowpath for this basin. The times of concentration and rational coefficients for post-development conditions are shown in the following table. Calculations are in Figure 2.6.

Proposed Time of Concentration and Rational Coefficient

Basin	T _c	Rational Coefficient
	minutes	
Northeast	30.3	0.48
Northwest	39.4	0.48
South	21.1	0.48

C. Assumed Post-Developed Curve Numbers

A curve number of 80.4 was used to represent post-project conditions.

D. Proposed Contours for Detention

Because the existing drainage patterns have been generally maintained and the amount of impervious area onsite will increase by only ten percent; detention is not needed to maintain existing runoff flowrates under post-project conditions.

E. Preliminary SWS Sizing Calculations

Because of the rural nature of this site, stormsewer is not proposed onsite. Drainage will be conveyed via overland flow and ditches. An 18" culvert is proposed under the entrance drive to maintain current flow patterns in the ditch west of 127th Street.

F. Stage-Storage-Discharge

Because detention is not proposed for this site, stage-storage-discharge information is not applicable.

G. Analysis of upstream/downstream impact

Runoff flow for all design storms remains relatively the same or decreases from pre to post-development; therefore, upstream/downstream impacts are unchanged from current conditions.

H. Existing and Proposed Structural Elevations

Minimum pads for the proposed structures will be set according to natural grade, while creating drainage patterns that extend away from the residential structures.

I. Pond Design Elevations

Because detention is not proposed for this site, pond design information is not applicable.

J. Structure Details

There are no existing or proposed drainage structures onsite.

K. Limits of Clearing and Grading

Portions of the site will be cleared and graded in order to accommodate building and road construction; a majority of the site will be left in its natural state or allowed to return to its existing condition.

L. Location of Impervious Areas

Gravel roads will be located as shown on the Drainage and Utility Plan, Figure 3.1.

M. Location of Utilities

Proposed utilities are shown on the Drainage and Utility Plan, Figure 3.1. Septic systems are proposed for each lot.

N. Location of Conveyance Systems

Natural drainage patterns will be closely maintained; proposed grading and ditches will direct runoff from the site as shown on the Drainage and Utility Plan, Figure 3.1. An 18" culvert is proposed under the entrance drive.

O. Location of Channel Modifications

Channel modifications are not applicable to the Reusser Addition.

P. Selection and Location of Stormwater Controls

Stormwater controls consist of grading, overland flow and ditches to convey the drainage away from the proposed structures.

Q. Emergency Overflow

Because the existing drainage patterns on site, generally, will be maintained under post-project conditions, the emergency overflow will remain similar to what is currently experienced. Overflow will drain to the northwest, northeast and south.

R. Freeboard

Because detention is not proposed for this site, freeboard is not applicable.

S. 100-Year High Water Line

Because detention is not proposed for this site and there are no channels onsite, the 100-year high water line is not applicable.

T. Lowest Openings

Lowest openings for the houses will be constructed in order to follow existing grade when feasible.

U. Stormwater Management Facilities

Drainage easements are proposed to convey runoff from the lots to the existing flow paths.

V. Maintenance Responsibility

The maintenance of the reserves will be the responsibility of the owner.

W. Offsite-Drainage Easements

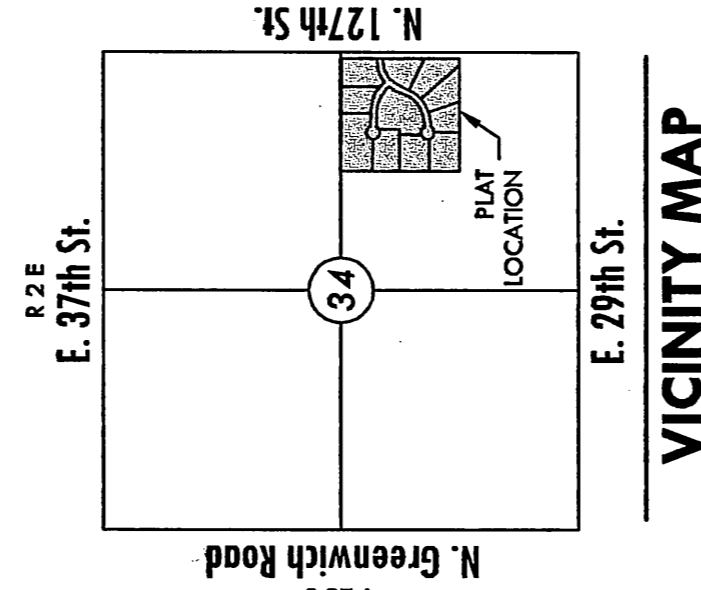
Not applicable to Reusser Addition.

Figure 3.1

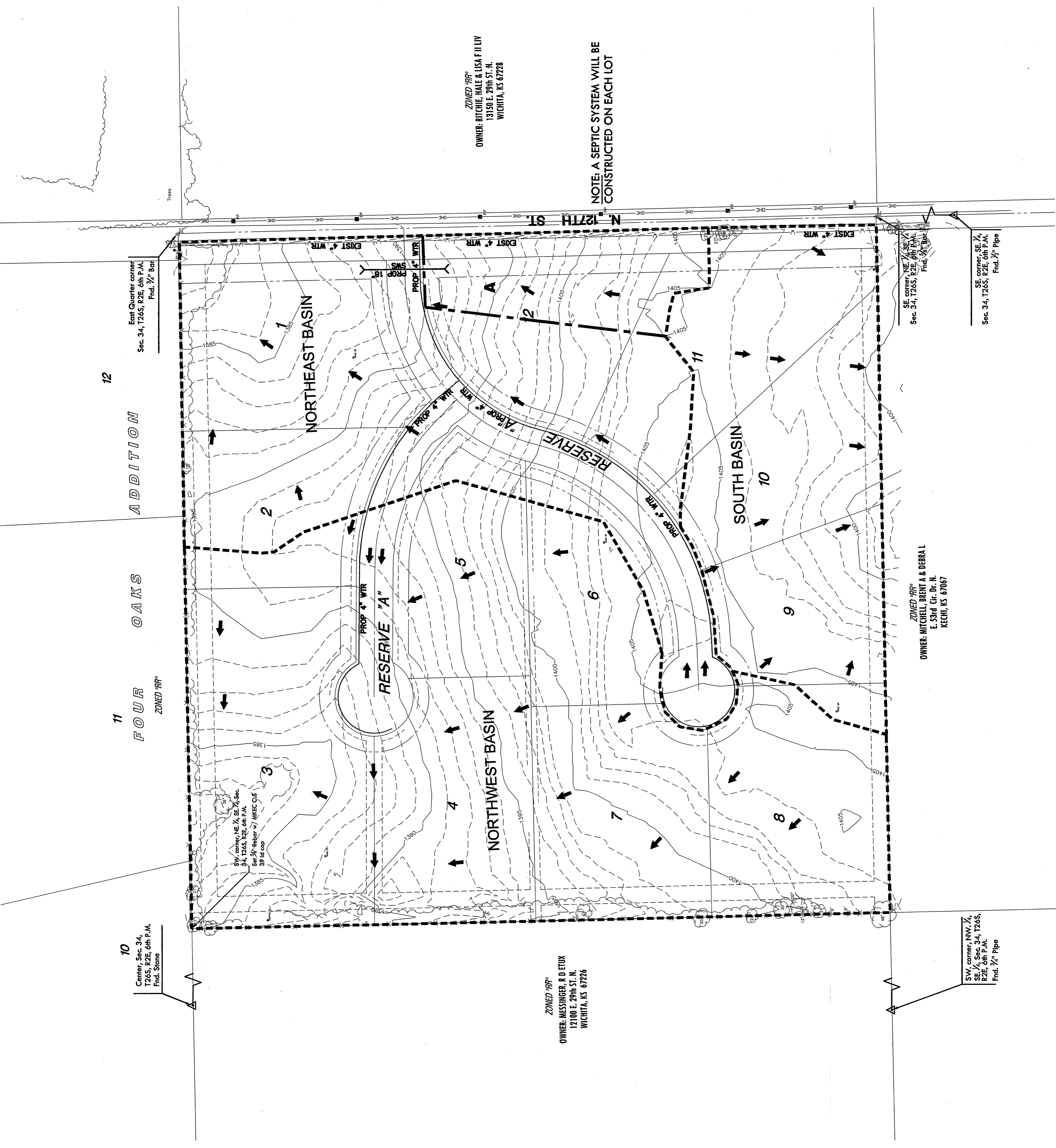
Drainage and Utility Plan

DATE	SEPTEMBER 2008
DESIGNED BY	TMH
DRAWN BY	CMJ
CHECKED BY	GJA
SHEET NUMBER	1

- LEGEND**
- CONIFEROUS TREE
 - DECIDUOUS TREE
 - SIGN
 - POWER POLE
 - ELECTRIC BOX
 - LIGHT POLE
 - FIRE HYDRANT
 - WATER VALVE
 - WATER METER
 - SECTION CORNER
 - BENCHMARK
 - EASEMENT
 - BUILDING SETBACK
 - FENCE
 - STORM SEWER PIPE
 - WATER LINE
 - SANITARY SEWER LINE
 - GAS LINE
 - GAS PIPELINE
 - TELEPHONE LINE
 - UNDERGROUND ELEC.
 - OVERHEAD ELECTRIC
 - FIBER OPTIC CABLE
 - DRAINAGE BASIN
 - SWS DRAINAGE AREA
 - FLOW ARROW
 - A17 - AREA FOR SWS SIZING



- BENCHMARKS**
Date of Survey April, 2008
- △ = Section corner Monument Found
 - = Found 3/4" rebar w/ MIKEC
 - = Set 3/4" Rebar w/ MIKEC
 - = Set 3/4" Rebar w/ MIKEC
 - (M) = Measured
 - (CM) = Calculated from measured



J:\Civil\07698-Reusser's\Drawings\07698-dwp.dwg

Figure 3.2

Hydraflow Stormsewers

Hydraflow Storm Sewers Plan



Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	148	2.00	2.00	0.48	0.96	0.96	15.0	15.0	7.4	7.07	5.99	4.76	18	0.33	1388.75	1389.23	1389.77	1390.85	0.00	1392.00	
Project File: 07698SWS.stm														Number of lines: 1				Run Date: 09-05-2008				

NOTES: Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; c = cir e = ellip b = box

Tab 4. Floodplain Submittal

Not applicable to Reusser Addition.

Tab 5. Permits

A. *US Army Corps of Engineers*

Not applicable to Reusser Addition.

B. *Kansas Department of Agriculture*

Not applicable to Reusser Addition.

C. *Federal Emergency Agency (FEMA)*

Not applicable to Reusser Addition.

D. *Kansas Department of Transportation*

Not applicable to Reusser Addition.

E. *Sedgwick County Right-of-way Permit*

Not applicable to Reusser Addition.