100-YEAR FLOODPLAIN STUDY
for an
UNNAMED TRIBUTARY OF THE
"MIDDLE RUN"
in the
"WILOMT MANOR – SECTION 8"
SUBDIVISION

Carroll County File #P-05-014

INDEX OF SHEETS

SUBMITTAL DATES

Description	Date
Origination Date	4/06
Initial Submittal	4/06
2nd Submittal	6/06

CONSULTANT:

BPR, Inc.
150 Airport Drive, Unit #4
Westminster, Md. 21157

Randall A. Petkus, P.E.

6/12/06

FLOODPLAIN STUDY NARRATIVE
FOR
WILMOT MANOR
SECTION 8

C.C. File No. P-05-014

I BACKGROUND

PURPOSE

In accordance with Section 114-8A, B, "Delineations", of the Carroll County Floodplain Management Code, this study provides the computations to determine the Ultimate Condition 100-Yr. Flood Plain width for two Tributary's of Middle Run. It employs the "Simplified Method" as described in the Floodplain Management Manual to compute the hydraulic characteristics in representative stream channel sections obtained from topographic mapping and supplemental field measurements. The objective is to accurately compute the Flood Plain limits for the tributary as shown on the FIRM Panel, for the portion of the tributary that runs through Wilmot Manor Section 8. This is to document adherence to the applicable items of Section 114-7, "General Regulations" of the code. An approximate tributary location is shown on the FIRM on Panel #240015 0100 B, and designated as a "Zone C, Areas of minimal flooding" in the vicinity of the property.

EXISTING CONDITION

The property is located on the West side along Don Avenue, directly across from the intersection with East Court, in the 4th Election District, Carroll County, Md. It contains a total of 38.67 acres, and lies entirely within the "R-40" Zone. It is currently un-developed with one existing Barn and an out-building. Existing access to Don Avenue is provided by a stone driveway, coming off of a existing paved access at the intersection of Don avenue and Wilmot Ridge Road, located in the northern portion of the property. Groundcover is typical agricultural uses, being, crop fields bounded by small woods, tree rows and thick grass pastures.

The property location appears on FIRM Panel #240015 0100 B, and the portion of the tributary runs through the south portion of our property, with the discharge point at a culvert crossing under Don Avenue. The tributary runs east to west beginning at property line North 18 Degrees 00 Minutes 25 Seconds West 457.85 ft. and continuing easterly for approximately 1,250 ft., ending at the invert of a 36 inch RCP.

PROPOSED CONDITION

The project is proposing an 8 Lot Major Subdivision, and the total acreage is divided into typically 1.50 ac. lots, and one lot containing the remaining acreage of the total 38.67 ac. Subdivision. All proposed building areas lie within the Northern portion of the property, and will be developed with new single family residences. All residences will have access to Don Avenue provided by a proposed Cul-Da-Sac "South Bend Court", at the north end of the property. This proposed Cul-Da-Sac shall be conveyed to the County through a 44 ft. wide right-of-way and a 50 ft. wide right-of-way around the Cul-Da-Sac.

II METHODOLOGY

Hydrology

The 100-Yr. Stream Flow(Q) used to compute the 100-yr. floodplain Water Surface Elevation(WSE) was computed using the TR-55 method. The Drainage Area is comprised of several Aerial topography maps plotted at 5ft intervals as stated on the "DRAINAGE AREA MAP" enclosed and verified against USGS Map Westminster. The DA Map is overlaid with Carroll County Zoning Maps and Soils Conservation District Soils Maps, using CADD techniques and are listed on the DA Map. A Study Point location is chosen where the tributary discharges off the property through a 36in. RCP at the south easterly portion of he property, and is used as the downstream point to delineate the maximum contributory Drainage Area(DA), DA "A" = 155.2 ac., to any point along the tributary within the subdivision.

The Ultimate Condition Weighted Runoff Curve Number(CN) =56 and 100-Yr. runoff depth Q =2.28 in., is computed on the "TR-55 WORKSHEET 2, RUNOFF CURVE NUMBER AND RUNOFF" spreadsheet. To compute the weighted CN, the applicable composite RCN Cover Type is assigned to each Residential and Commercial Zoning Districts from the TR-55 manual, and the HGS areas are measured and tabulated separately on the spreadsheet. For the R-40 Zoning District, the RCN is derived by assigning the "1 ac. Lot" cover type to the maximum area of lot yield(1 lot/40000 Sq.ft.) permitted by zoning requirements. The resulting cover type breakdown is tabulated on part 1 of the spreadsheet.

Time of Concentration(Tc) is computed by standard TR55 methods on the "TR-55 WORKSHEET 3, TIME OF CONCENTRATION OR TRAVEL TIME" spreadsheet. The Tc path is shown and identified on the Drainage Area Map. Segment A-B is the 100 ft. maximum sheet flow length and occurs in the yards within the upstream properties of the residential zone. Segment B-C, C-D, and D-E is the limits of shallow concentrated flow throughout the Residential Zone. The remaining downstream segments E-F are defined channel lengths at different longitudinal slopes.

The ultimate condition 100-Yr. Storm flow =320.68 CFS is computed on the "TR-55 WORKSHEET 4, GRAPHICAL PEAK DISCHARGE METHOD" spreadsheet using the contributory area and hydrologic RCN and Tc data discussed above as input. The 2-Yr. storm flow is also computed as a guide to estimate bankfull flow and confirm the defined channel velocities for the Tc spreadsheet.

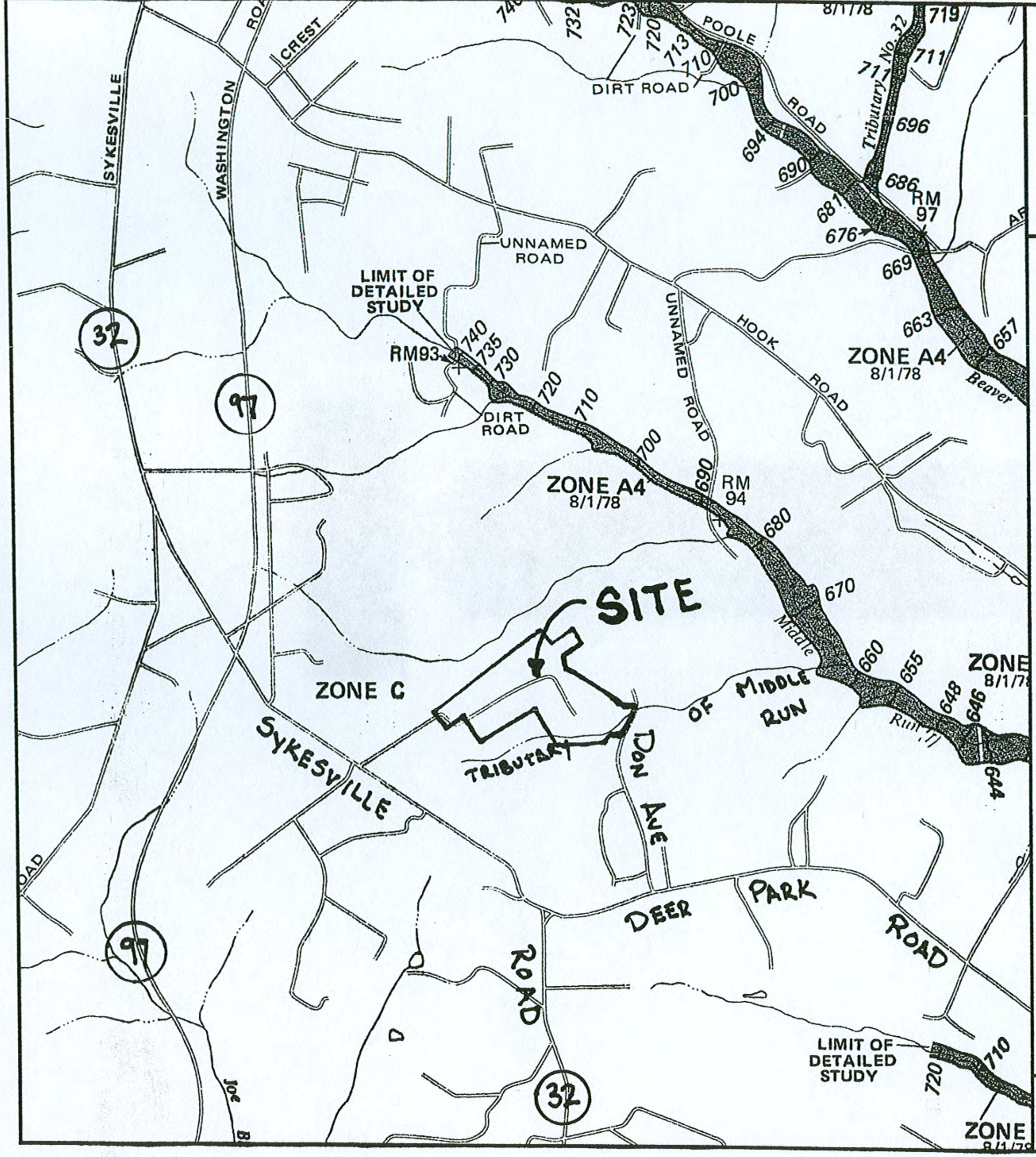
Hydraulics

Hydraulic Computations to determine the 100-Yr. Water Surface Elevations(W.S.E.) at 10 Cross-sections(XS) are completed using the "FLOWMASTER 2005" computer program. The cross-sections are specifically located to model abrupt changes in floodplain cross-section, horizontal & vertical alignments, and/or hydraulic structure interference. At a minimum, cross-sections are placed at each end of the study limits, and one in the middle. All XS channel geometry and other input used in the computations is printed as tabular form output and contained in this report. The maximum 100-Yr. flow computed at the downstream property line is used at all XS. A "N-FACTOR DELINEATION PLAN" using an Orthometric view of the existing site to show the different groundcover N-factor limits input for the left and right over-banks is provided in the report.

Hydraulics (Continued)

Headwater and Tailwater elevations for Don Avenue culvert crossing is computed using the HY-8 Culvert Analysis computer program. The elevations are plotted at the culvert inlet and tailwater cross-section locations on the Water Surface Profile. The same 100 yr. flow(Q=320.68 cfs) determined for the study point is used for the culvert flow input for simplicity. A constant elevation of 713.50 was used to define the tail water. All roadway configuration and culvert alignment input data used in the analysis is shown on the "HY-8 Program Output" sheets contained in the report. The Headwater for the culvert overtops the roadway, and is conveyed downstream by weir flow. The WSE over Don Avenue =720.60 ft.

The results of the Water Surface Elevations computed by the methods above are plotted on Attachment 2 -"100 YR FLOODPLAIN CROSS-SECTIONS" sheet contained in this report.



N

APPROXIMATE SCALE

2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CARROLL COUNTY, MARYLAND

UNINCORPORATED AREAS

PANEL 100 OF 150

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER

240015 0100 B

MAP REVISED:

AUGUST 7, 1981

federal emergency management agency
federal insurance administration

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TR-55 WORKSHEET 2
Runoff Curve Number and Runoff

DATE: 3/23/06 **DESIGN BY:** Randall A. Petkus

LOCATION: Don Avenue @ East Court, 4th E.D.
Carroll County, MD.
CONDITION: Ultimate Condition
SUBAREA: "A"

* COMPUTED OUTPUT IN BOLD TYPE

1. RUNOFF CURVE NUMBER (CN)

SOIL NAME/ HYDRO GRP (appendix)	*COVER DESCRIPTION* (Cover Type, Treatment, & Hydrologic Cond.)	CN Tab 2-2	Fig 2-3	Fig 2-4	*AREA* (x)ac	( )mi	PRODUCT CN x AREA
A	Business Local Zone	89			1.05		**93.45**
B	Business Local Zone	92			2.01		**184.92**
A	R-40000 Zone: 1 ac Lots	51			120.72		**6156.72**
D	R-40000 Zone: 1 ac Lots	68			19.22		**1306.96**
C	R-40000 Zone: 1 ac Lots	79			12.23		**966.17**
							0.00
							0.00
							0.00
							0.00
							0.00
	TOTALS				**155.2**		**8708.22**
	WHEIGHTED CN = product/area =	**56.1**			**USE CN=**		**56**

2. RUNOFF

S= **7.86**

		STORM #1	STORM #2
FREQUENCY	Yr.	2	100
RAINFALL, P(24 hour)	In.	3.1	7.1
RUNOFF, Q	In.	**0.25**	**2.28**

NOTES:

1. For Goundcover delineations & map source information, see DRAINAGE AREA MAP.

TR-55 WORKSHEET 3:
Time of Concentration(Tc) or Travel Time(Tt)

ORIGIN. DATE: 3/22/2006 **CHECK BY:** R.A. Petkus, P.E.

LOCATION: Don Avenue @ East Court
4th E.D. Carroll County, MD.
CONDITION: Ultimate
SUBAREA: "A"

* COMPUTED OUTPUT IN BOLD TYPE

Sheet Flow

				Subtotals
	Segment ID		A-B	
1	Surface Description		Residental yard Grasses	
2	Mannings Coeff, n		0.24	
3	Flow Length, L	ft	100.0	
4	2yr-24hr Rainfall, P2	in	3.1	
5	Land Slope, S	'/ft	0.06	
6	Travel Time, Tt	hr	**0.156**	**0.16**

Shallow Concentrated Flow

	Segment ID		B-C	C-D	D-E	
7	Surface Description		unpaved	unpaved	unpaved	
8	Flow Length, L	ft	293.0	722.0	566.0	
9	Watercourse Slope, S	'/ft	0.09	0.07	0.05	
10	Average Velocity, V	ft/s	**4.8**	**4.3**	**3.6**	
11	Travel Time, Tt	hr	**0.017**	**0.047**	**0.044**	**0.11**

Channel Flow

	Segment ID		E-F	
	Assumptions:			
12	X-Sec Flow Area, a	sf		
13	Wetted Perimeter, Pw	ft		
14	Hydraulic Radius, =a/Pw	ft		
15	Channel Slope, S	'/ft	0.02	
16	Mannings Coeff, n		0.04	
17	V (Manning formula)	ft/s	5.0	
18	Flow Length	ft	2287.7	
19	Travel Time Tt	hr	**0.127**	**0.13**

20 Watershed or Subarea Tc or Tt..... hr **0.39**

NOTES:
1.

TR-55 WORKSHEET 4
Graphical Peak Discharge Method

ORIGIN. DATE: 3/20/06 **CHECK BY:**

LOCATION: Don Avenue @ East Court
4th E.D. Carroll County, MD.
PRES/DEVEL: Developed
SUBAREA: "A"

1. DATA:

Drainage Area ..... Am= **0.24250** mi^2 *155.2* ac
Runoff Curve Number ..... CN= *56* (from worksheet 2)
Time of Concentration ..... Tc= *0.36* hr. (from worksheet 3)
Rainfall Distribution Type ..... = *II* (I, IA, II, III)
Pond & Swamp Area(s) ..... = *1.00* % of Am(0 ac or mi^2 cov'rd)

		Storm #1	Storm #2	Storm #3	Storm #4
2. FREQUNCY	Yr	*2*	*100*		
3. RAINFALL, P(24-hour)	in	*3.1*	*7.1*		
4. INITIAL ABSTRACTION, Ia ..... (Ia =200/CN-2)	in	**1.571**	**1.571**		
5. COMPUTE Ia/P		**0.51**	**0.22**		
6. UNIT PEAK DISCHARGE, qu ..... (Use Tc and Ia/P with Exhibit 4-II)	csm /in	*270.0*	*580.0*		
7. RUNOFF, Q (from worksheet 2)	in	*0.25*	*2.28*		
FACTOR (use % pond/swamp area w/ table 4-2)	Fp	*1.00*	*1.00*		
9. PEAK DISCHARGE, qp ..... where qp = qu x Am x Q x Fp)	**cfs**	**16.37**	**320.68**		

CURRENT DATE: 04-10-2006
CURRENT TIME: 18:45:49

FILE DATE: 04-10-2006
FILE NAME: FSWMANOR

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	713.50	710.50	105.04	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: FSWMANOR DATE: 04-10-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
713.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
716.14	32.1	32.1	0.0	0.0	0.0	0.0	0.0	0.00	1
718.13	64.1	64.1	0.0	0.0	0.0	0.0	0.0	0.00	1
719.84	96.2	82.3	0.0	0.0	0.0	0.0	0.0	13.20	8
719.87	100.0	82.7	0.0	0.0	0.0	0.0	0.0	16.60	6
720.18	160.4	85.5	0.0	0.0	0.0	0.0	0.0	74.25	6
720.28	192.4	86.4	0.0	0.0	0.0	0.0	0.0	104.39	4
720.37	224.5	87.2	0.0	0.0	0.0	0.0	0.0	135.80	4
720.45	256.6	87.9	0.0	0.0	0.0	0.0	0.0	167.35	4
720.53	288.6	88.6	0.0	0.0	0.0	0.0	0.0	198.89	4
720.60	320.7	89.2	0.0	0.0	0.0	0.0	0.0	230.46	4
719.47	78.8	78.8	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: FSWMANOR DATE: 04-10-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
713.50	0.000	0.00	0.00	0.00
716.14	0.000	32.07	0.00	0.00
718.13	0.000	64.14	0.00	0.00
719.84	-0.004	96.21	0.68	0.71
719.87	-0.003	100.00	0.74	0.74
720.18	-0.004	160.35	0.63	0.39
720.28	-0.009	192.42	1.67	0.87
720.37	-0.008	224.49	1.52	0.68
720.45	-0.007	256.56	1.30	0.51
720.53	-0.006	288.63	1.16	0.40
720.60	-0.005	320.70	1.03	0.32

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

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CURRENT TIME: 18:45:49 FILE NAME: FSWMANOR

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	713.50	0.00	0.00	0-NF	0.00	0.00	0.00	3.00	0.00	0.00
32.07	716.14	2.64	2.64	1-S1f	1.04	1.83	2.00	3.00	6.41	0.00
64.14	718.13	4.63	4.63	1-S1f	1.54	2.55	2.70	3.00	9.57	0.00
82.33	719.83	6.33	3.88	4-FFt	1.80	2.84	1.80	3.00	18.58	0.00
82.66	719.87	6.37	3.91	4-FFt	1.81	2.85	1.81	3.00	18.59	0.00
85.47	720.18	6.68	4.18	4-FFt	1.85	2.89	1.85	3.00	18.70	0.00
86.36	720.27	6.77	4.27	4-FFt	1.86	2.91	1.86	3.00	18.77	0.00
87.18	720.37	6.87	4.35	4-FFt	1.87	2.92	1.87	3.00	18.80	0.00
87.91	720.45	6.95	4.42	4-FFt	1.88	2.93	1.88	3.00	18.84	0.00
88.59	720.53	7.03	4.49	4-FFt	1.89	2.94	1.89	3.00	18.87	0.00
89.21	720.60	7.10	4.56	4-FFt	1.90	2.95	1.90	3.00	18.89	0.00

El. inlet face invert 713.50 ft El. outlet invert 710.50 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	1000.00 ft
INLET ELEVATION	713.50 ft
OUTLET STATION	895.00 ft
OUTLET ELEVATION	710.50 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0286
CULVERT LENGTH ALONG SLOPE	105.04 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END PROJECTION
INLET DEPRESSION	NONE

CURRENT DATE: 04-10-2006 FILE DATE: 04-10-2006
CURRENT TIME: 18:45:49 FILE NAME: FSWMANOR

TAILWATER

CONSTANT WATER SURFACE ELEVATION
713.50

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED

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EMBANKMENT TOP WIDTH 60.00 ft

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X ft	Y ft
1	0.00	721.23
2	43.08	720.15
3	93.79	719.47
4	142.70	720.07
5	191.80	722.74
6	236.75	726.04

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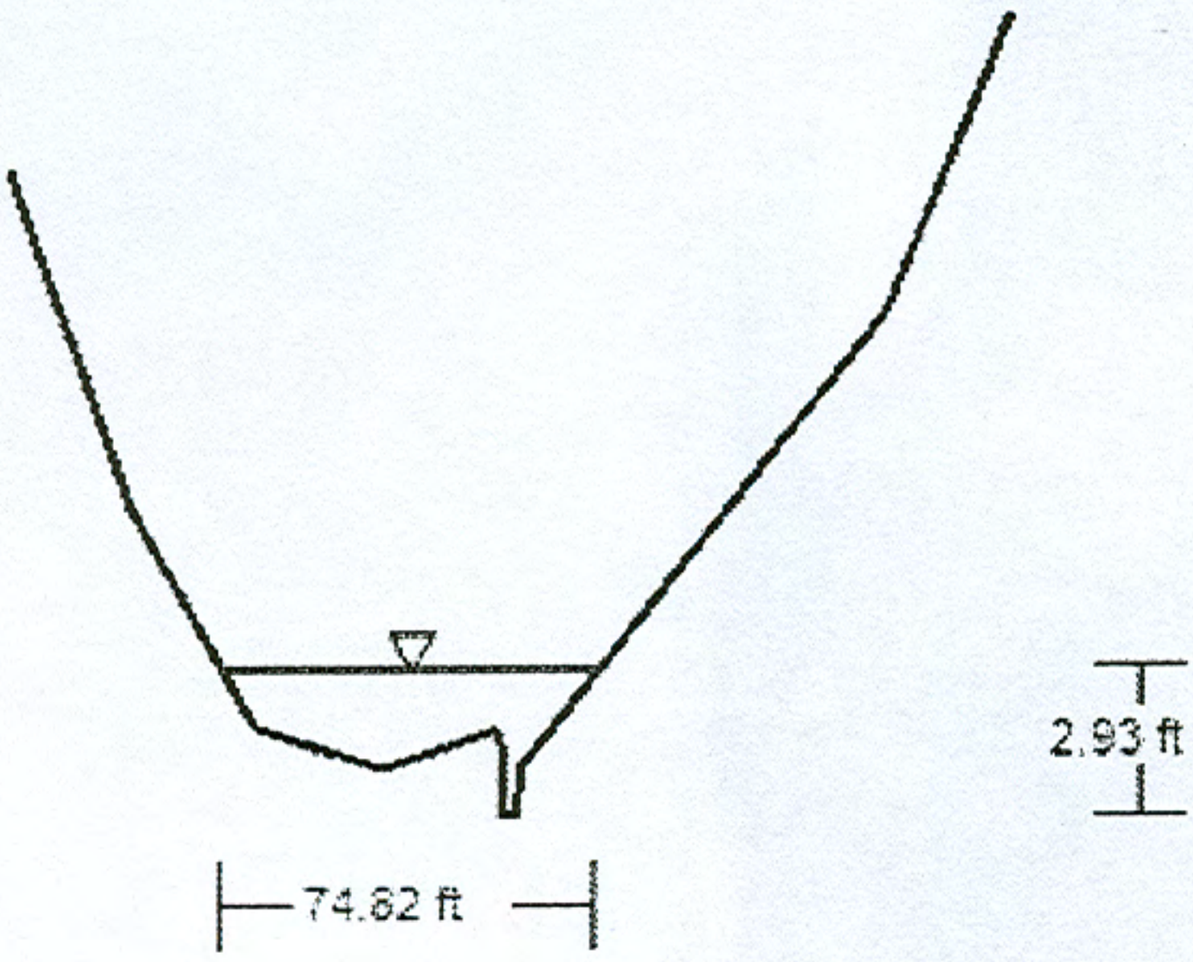
XS No.10 @ RS 105+50

Cross Section for Tributary No.2 - XS No.10 @ RS 105+50

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.087	
Channel Slope:	0.02081	ft/ft
Normal Depth:	2.93	ft
Elevation Range:	735.62 to 751.60 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.2 - XS No.10 @ RS 105+50

Project Description

Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data

Channel Slope:	0.02081	ft/ft
Discharge:	320.68	ft^3/s

Options

Current Roughness Weighted Metho	ImprovedLotters
Open Channel Weighted Roughnes:	ImprovedLotters
Closed Channel Weighted Roughne	Hortons

Results

Roughness Coefficient:	0.087	
Water Surface Elevation:	738.55	ft
Elevation Range:	735.62 to 751.60 ft	
Flow Area:	105.43	ft^2
Wetted Perimeter:	76.67	ft
Top Width:	74.82	ft
Normal Depth:	2.93	ft
Critical Depth:	2.28	ft
Critical Slope:	0.11852	ft/ft
Velocity:	3.04	ft/s
Velocity Head:	0.14	ft
Specific Energy:	3.08	ft
Froude Number:	0.45	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 748.50)	(0+98.40, 737.37)	0.100
(0+98.40, 737.37)	(1+02.51, 736.62)	0.050
(1+02.51, 736.62)	(2+00.00, 751.60)	0.100

Section Geometry

Worksheet for Tributary No.2 - XS No.10 @ RS 105+50

Station	Elevation
0+00.00	748.50
0+25.00	741.70
0+50.00	737.40
0+75.00	736.60
0+98.40	737.37
0+99.20	735.62
1+01.70	735.62
1+02.51	736.62
1+75.00	745.60
2+00.00	751.60

XS No.9 @ RS 103+00

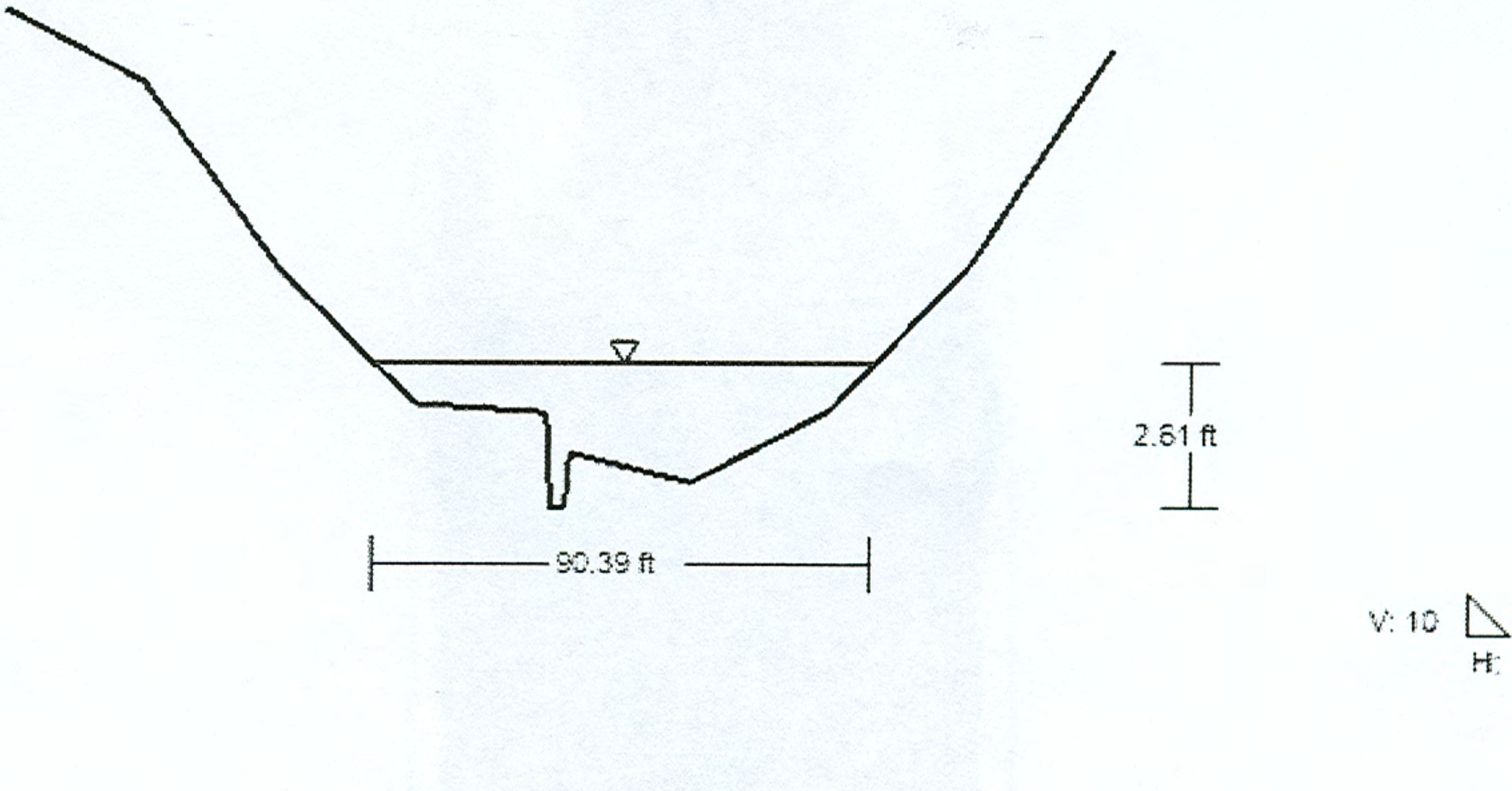
Cross Section for Tributary No.2 - XS No.9 @ RS 103+00

Project Description

Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data

Roughness Coefficient:	0.086	
Channel Slope:	0.02081	ft/ft
Normal Depth:	2.61	ft
Elevation Range:	730.41 to 739.40 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.2 - XS No.9 @ RS 103+00

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.02081	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Metho	ImprovedLotters	
Open Channel Weighted Roughnes:	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.086	
Water Surface Elevation:	733.02	ft
Elevation Range:	730.41 to 739.40 ft	
Flow Area:	112.41	ft^2
Wetted Perimeter:	92.09	ft
Top Width:	90.39	ft
Normal Depth:	2.61	ft
Critical Depth:	2.03	ft
Critical Slope:	0.11872	ft/ft
Velocity:	2.85	ft/s
Velocity Head:	0.13	ft
Specific Energy:	2.74	ft
Froude Number:	0.45	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 739.40)	(0+98.77, 732.15)	0.100
(0+98.77, 732.15)	(1+02.96, 731.42)	0.050
(1+02.96, 731.42)	(2+00.00, 738.70)	0.100

Section Geometry

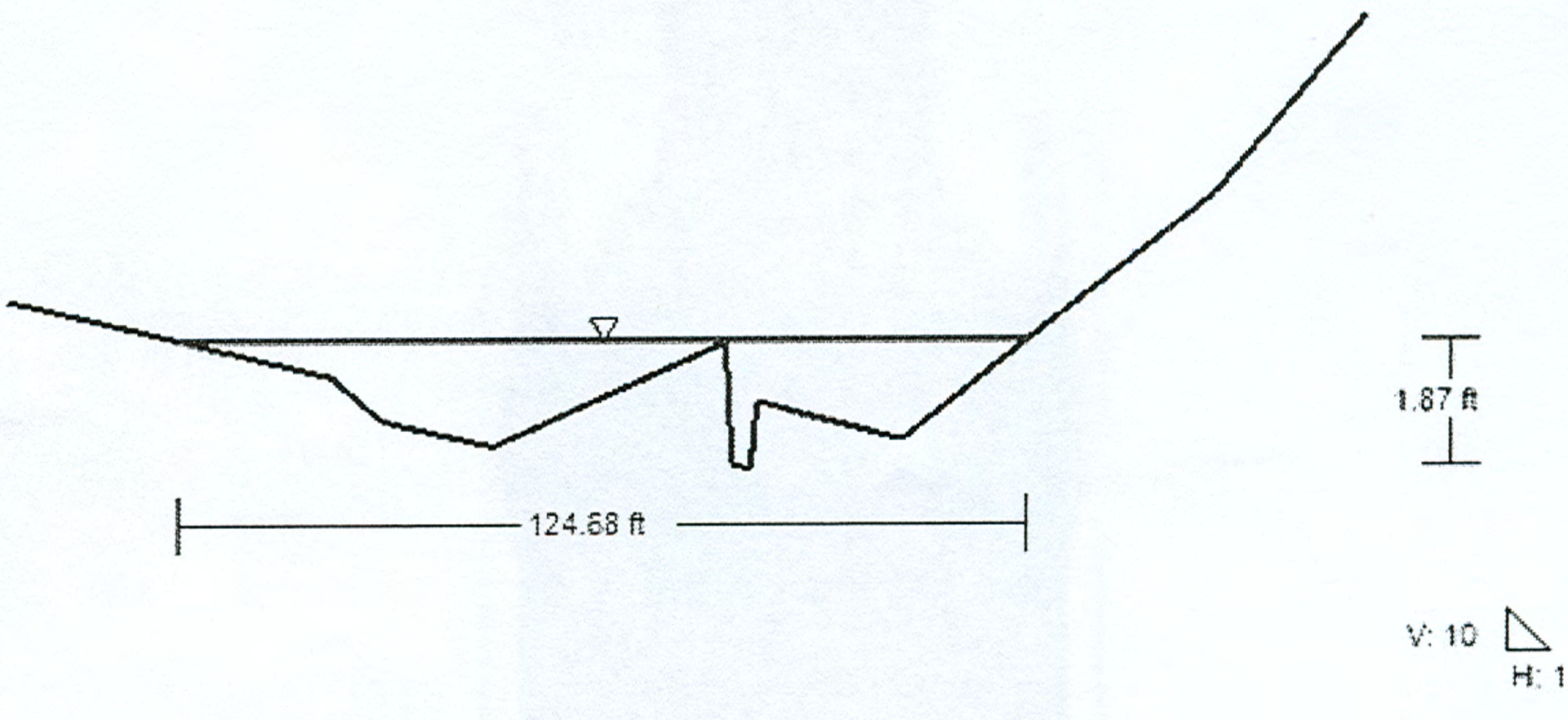
Worksheet for Tributary No.2 - XS No.9 @ RS 103+00

Station	Elevation
0+00.00	739.40
0+25.00	738.10
0+50.00	734.70
0+75.00	732.30
0+98.77	732.15
0+99.58	730.41
1+02.14	730.42
1+02.96	731.42
1+25.00	730.90
1+50.00	732.20
1+75.00	734.80
2+00.00	738.70

XS No.8 @ RS 102+00

Cross Section for Tributary No.2 - XS No.8 @ RS 102+00

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.091	
Channel Slope:	0.04337	ft/ft
Normal Depth:	1.87	ft
Elevation Range:	726.29 to 732.94 ft	
Discharge:	320.68	ft^3/s



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Worksheet for Tributary No.2 - XS No.8 @ RS 102+00

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.04337	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Methc	ImprovedLotters	
Open Channel Weighted Roughnes:	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.091	
Water Surface Elevation:	728.16	ft
Elevation Range:	726.29 to 732.94 ft	
Flow Area:	106.16	ft^2
Wetted Perimeter:	126.33	ft
Top Width:	124.68	ft
Normal Depth:	1.87	ft
Critical Depth:	1.53	ft
Critical Slope:	0.13998	ft/ft
Velocity:	3.02	ft/s
Velocity Head:	0.14	ft
Specific Energy:	2.01	ft
Froude Number:	0.58	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 728.77)	(1+06.03, 728.13)	0.100
(1+06.03, 728.13)	(1+10.63, 727.27)	0.050
(1+10.63, 727.27)	(2+00.00, 732.94)	0.100

Section Geometry

Pg 19/46

Worksheet for Tributary No.2 - XS No.8 @ RS 102+00

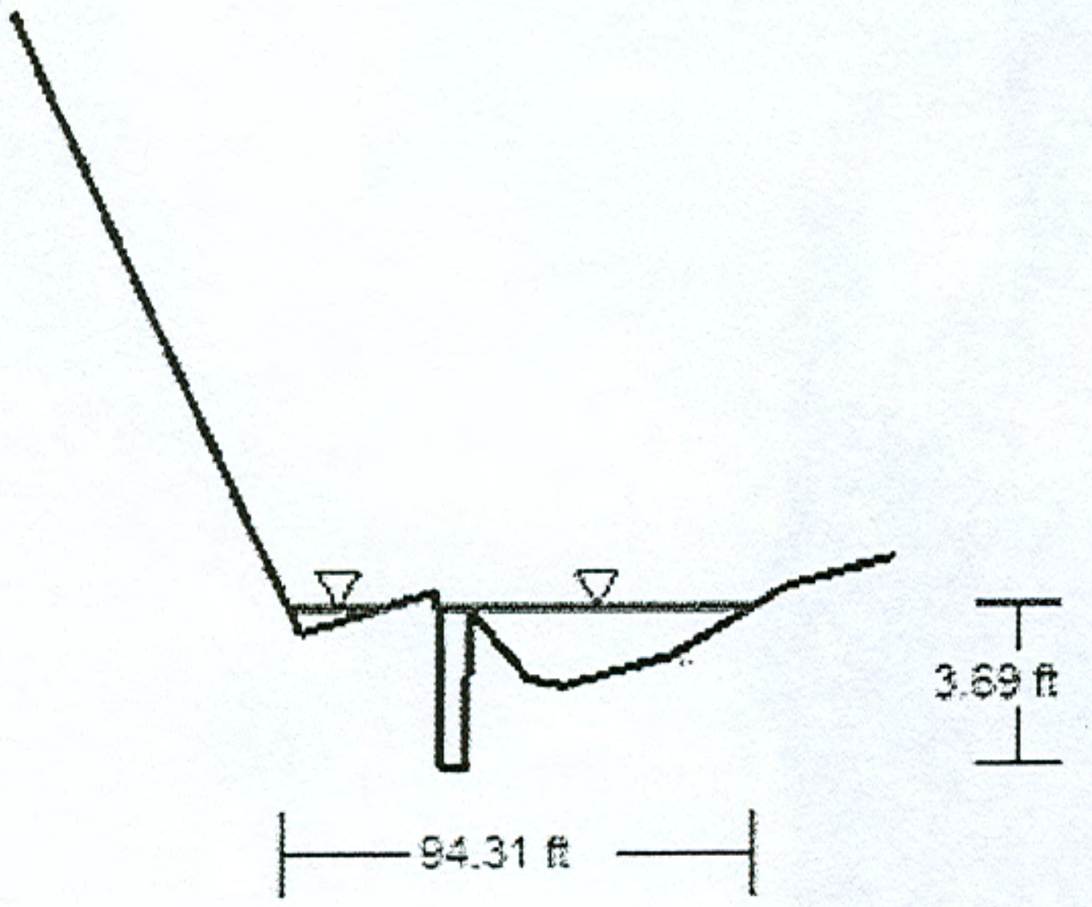
Station	Elevation
0+00.00	728.77
0+47.89	727.64
0+55.17	727.01
0+71.71	726.63
1+06.03	728.13
1+06.93	726.36
1+09.73	726.29
1+10.63	727.27
1+32.14	726.73
1+77.76	730.29
2+00.00	732.94

Rq 20/46

XS No.7 @ RS 26+50

Cross Section for Tributary No.1 - XS No.7 @ RS 26+50

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.069	
Channel Slope:	0.02173	ft/ft
Normal Depth:	3.69	ft
Elevation Range:	746.81 to 763.90 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.7 @ RS 26+50

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.02173	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Metho	ImprovedLotters	
Open Channel Weighted Roughnes:	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.069	
Water Surface Elevation:	750.50	ft
Elevation Range:	746.81 to 763.90 ft	
Flow Area:	100.85	ft^2
Wetted Perimeter:	100.10	ft
Top Width:	94.31	ft
Normal Depth:	3.69	ft
Critical Depth:	3.13	ft
Critical Slope:	0.07834	ft/ft
Velocity:	3.18	ft/s
Velocity Head:	0.16	ft
Specific Energy:	3.85	ft
Froude Number:	0.54	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 763.90)	(0+96.67, 750.83)	0.100
(0+96.67, 750.83)	(1+03.90, 750.41)	0.050
(1+03.90, 750.41)	(2+00.00, 751.60)	0.100

Section Geometry

Worksheet for Tributary No.1 - XS No.7 @ RS 26+50

Station	Elevation
0+00.00	763.90
0+65.73	749.91
0+96.67	750.83
0+97.68	746.83
1+02.89	746.81
1+03.90	750.41
1+17.39	748.85
1+25.00	748.70
1+50.00	749.40
1+75.00	750.90
2+00.00	751.60

XS No.6 @ RS 22+75

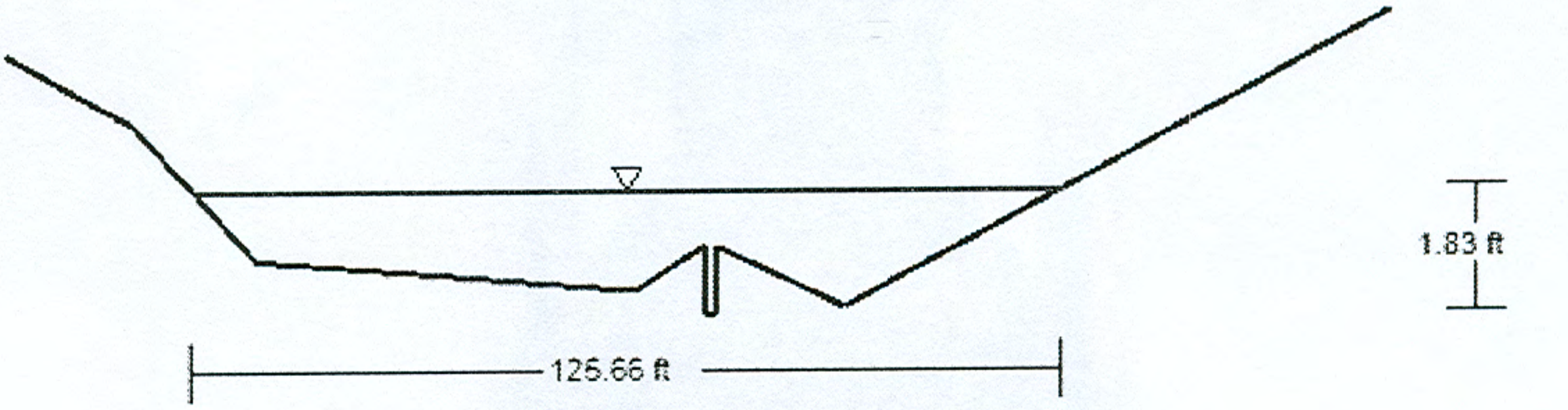
Cross Section for Tributary No.1 - XS No.6 @ RS 22+75

Project Description

Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data

Roughness Coefficient:	0.098	
Channel Slope:	0.02173	ft/ft
Normal Depth:	1.83	ft
Elevation Range:	738.71 to 743.08 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.6 @ RS 22+75

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.02173	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Metho	ImprovedLotters	
Open Channel Weighted Roughnes:	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.098	
Water Surface Elevation:	740.54	ft
Elevation Range:	738.71 to 743.08 ft	
Flow Area:	136.72	ft^2
Wetted Perimeter:	127.56	ft
Top Width:	125.66	ft
Normal Depth:	1.83	ft
Critical Depth:	1.27	ft
Critical Slope:	0.16526	ft/ft
Velocity:	2.35	ft/s
Velocity Head:	0.09	ft
Specific Energy:	1.91	ft
Froude Number:	0.40	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 742.52)	(1+01.51, 739.74)	0.100
(1+01.51, 739.74)	(1+03.32, 739.71)	0.050
(1+03.32, 739.71)	(2+00.00, 743.08)	0.100

Section Geometry

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Worksheet for Tributary No.1 - XS No.6 @ RS 22+75

Station	Elevation
0+00.00	742.52
0+18.55	741.50
0+36.56	739.52
0+91.31	739.08
1+01.51	739.74
1+01.64	738.74
1+03.19	738.71
1+03.32	739.71
1+21.61	738.84
2+00.00	743.08

XS No.5 @ RS 19+50

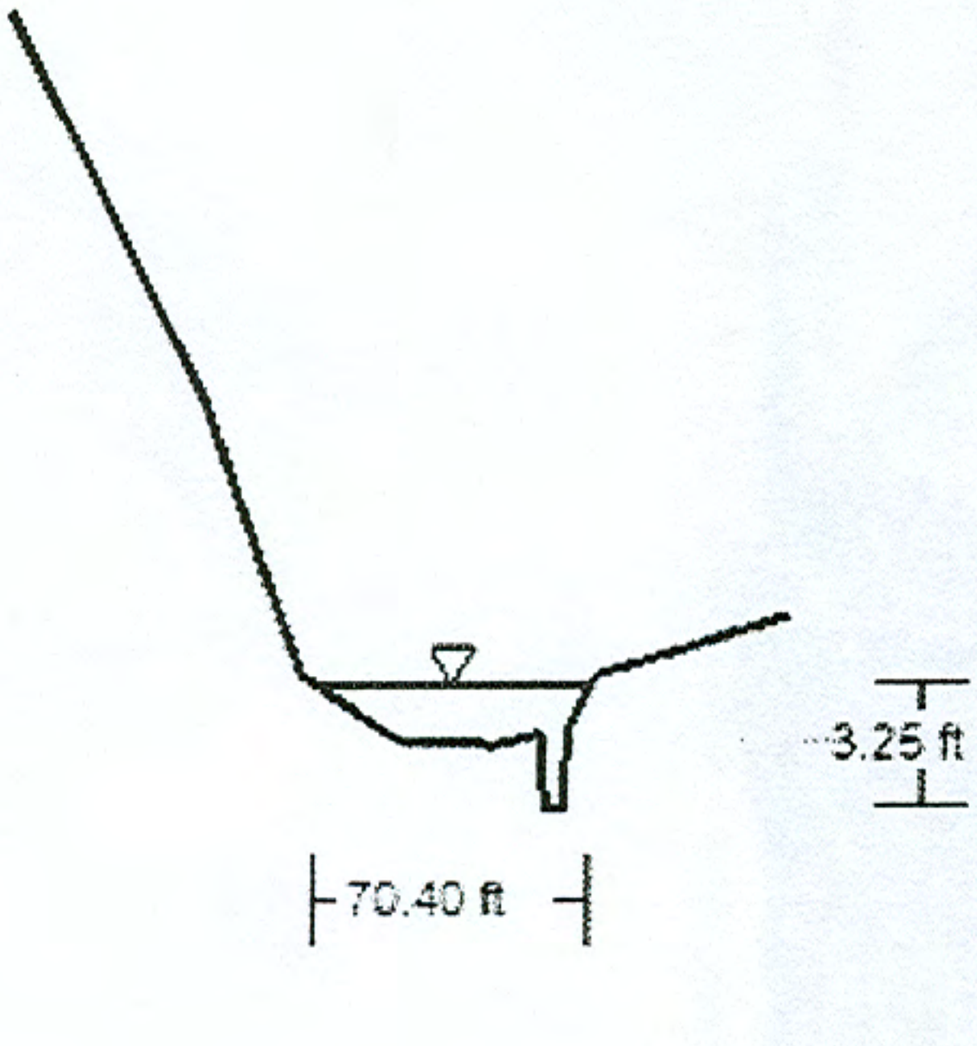
Cross Section for Tributary No.1 - XS No.5 @ RS 19+50

Project Description

Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data

Roughness Coefficient:	0.075	
Channel Slope:	0.02173	ft/ft
Normal Depth:	3.25	ft
Elevation Range:	731.61 to 752.00 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.5 @ RS 19+50

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.02173	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Meth	ImprovedLotters	
Open Channel Weighted Roughnes	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.075	
Water Surface Elevation:	734.86	ft
Elevation Range:	731.61 to 752.00 ft	
Flow Area:	93.10	ft^2
Wetted Perimeter:	73.36	ft
Top Width:	70.40	ft
Normal Depth:	3.25	ft
Critical Depth:	2.71	ft
Critical Slope:	0.08730	ft/ft
Velocity:	3.44	ft/s
Velocity Head:	0.18	ft
Specific Energy:	3.44	ft
Froude Number:	0.53	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 752.00)	(1+36.47, 733.61)	0.100
(1+36.47, 733.61)	(1+42.98, 733.61)	0.050
(1+42.98, 733.61)	(2+00.00, 736.60)	0.100

Section Geometry

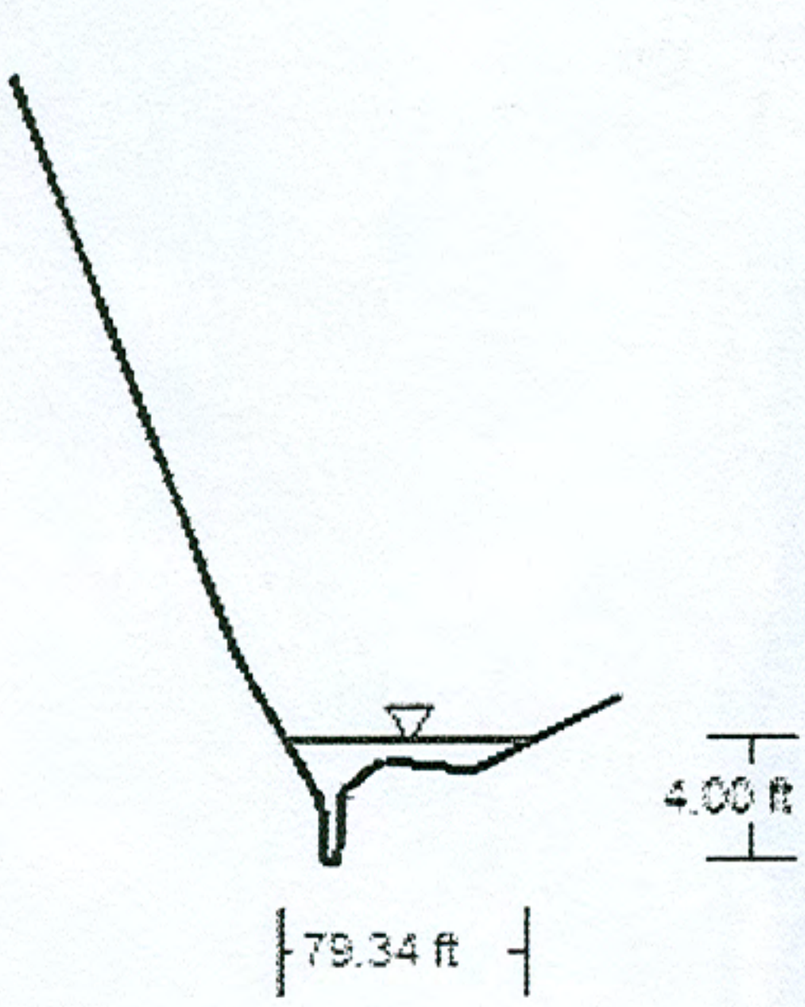
Worksheet for Tributary No.1 - XS No.5 @ RS 19+50

Station	Elevation
0+00.00	752.00
0+50.00	742.10
0+75.00	735.10
1+00.00	733.40
1+25.00	733.30
1+36.47	733.61
1+37.22	731.61
1+42.23	731.61
1+42.98	733.61
1+50.00	735.10
2+00.00	736.60

XS No.4 @ RS 17+75

Cross Section for Tributary No.1 - XS No.4 @ RS 17+75

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.056	
Channel Slope:	0.02173	ft/ft
Normal Depth:	4.00	ft
Elevation Range:	727.73 to 753.40 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.4 @ RS 17+75

Project Description

Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data

Channel Slope:	0.02173	ft/ft
Discharge:	320.68	ft^3/s

Options

Current Roughness Weighted Metho	ImprovedLotters
Open Channel Weighted Roughnes:	ImprovedLotters
Closed Channel Weighted Roughne	Hortons

Results

Roughness Coefficient:	0.056	
Water Surface Elevation:	731.73	ft
Elevation Range:	727.73 to 753.40 ft	
Flow Area:	82.50	ft^2
Wetted Perimeter:	82.24	ft
Top Width:	79.34	ft
Normal Depth:	4.00	ft
Critical Depth:	3.72	ft
Critical Slope:	0.05166	ft/ft
Velocity:	3.89	ft/s
Velocity Head:	0.23	ft
Specific Energy:	4.23	ft
Froude Number:	0.67	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 753.40)	(1+02.57, 729.77)	0.100
(1+02.57, 729.77)	(1+09.74, 730.15)	0.050
(1+09.74, 730.15)	(2+00.00, 733.20)	0.100

Section Geometry

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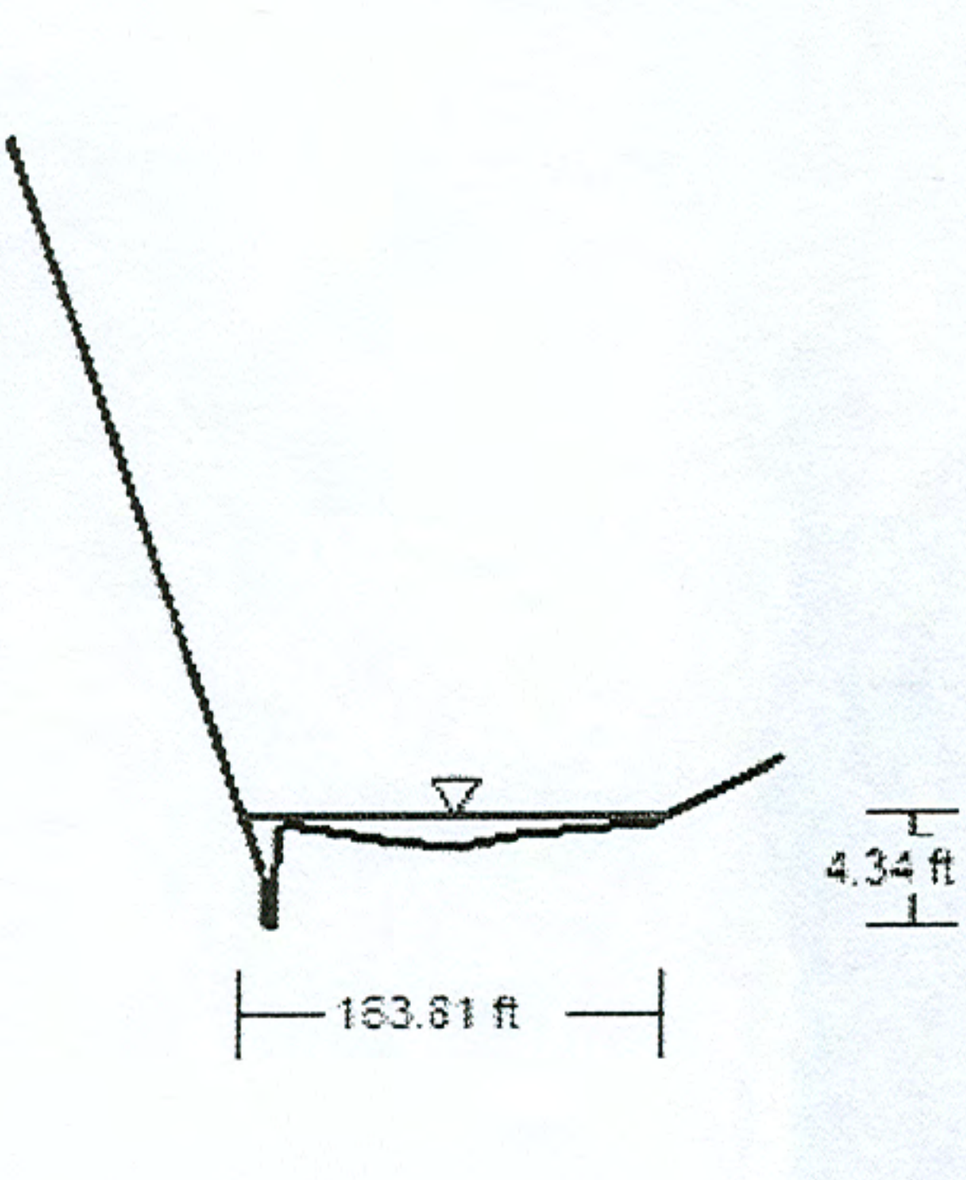
Worksheet for Tributary No.1 - XS No.4 @ RS 17+75

Station	Elevation
0+00.00	753.40
0+75.00	734.50
1+02.57	729.77
1+03.27	727.76
1+08.00	727.73
1+09.74	730.15
1+22.64	731.13
1+51.28	730.77
2+00.00	733.20

XS No.3 @ RS 16+25

Cross Section for Tributary No.1 - XS No.3 @ RS 16+25

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.080	
Channel Slope:	0.02173	ft/ft
Normal Depth:	4.34	ft
Elevation Range:	724.49 to 754.90 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.3 @ RS 16+25

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.02173	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Methc	ImprovedLotters	
Open Channel Weighted Roughnes:	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.080	
Water Surface Elevation:	728.83	ft
Elevation Range:	724.49 to 754.90 ft	
Flow Area:	135.72	ft^2
Wetted Perimeter:	167.95	ft
Top Width:	163.81	ft
Normal Depth:	4.34	ft
Critical Depth:	3.97	ft
Critical Slope:	0.12044	ft/ft
Velocity:	2.36	ft/s
Velocity Head:	0.09	ft
Specific Energy:	4.42	ft
Froude Number:	0.46	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 754.90)	(1+00.20, 726.51)	0.100
(1+00.20, 726.51)	(1+03.26, 725.69)	0.050
(1+03.26, 725.69)	(3+00.00, 731.08)	0.100

Section Geometry

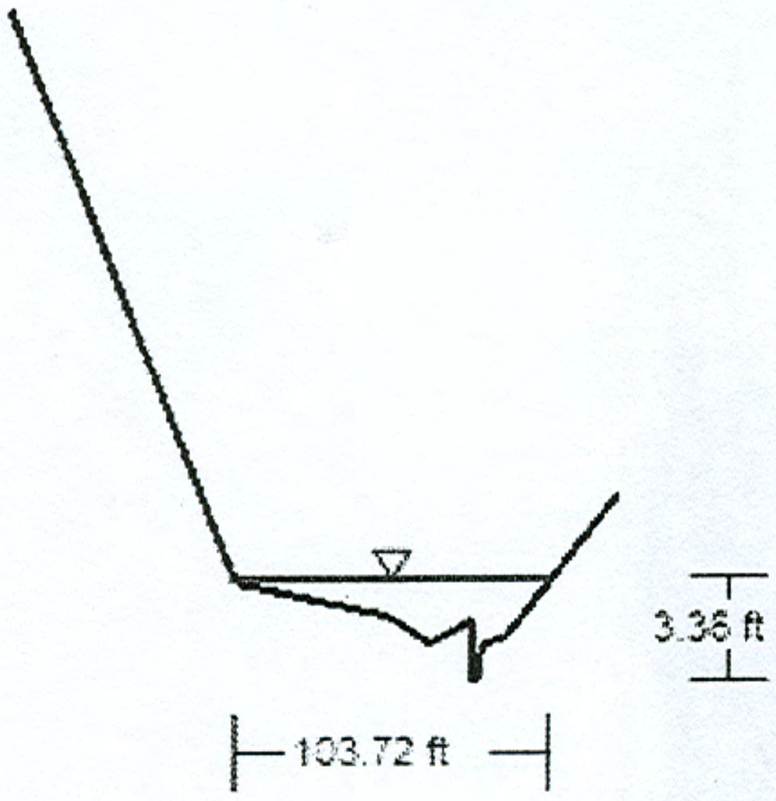
Worksheet for Tributary No.1 - XS No.3 @ RS 16+25

Station	Elevation
0+00.00	754.90
0+75.00	733.60
1+00.20	726.51
1+00.46	724.51
1+03.01	724.49
1+03.26	725.69
1+06.51	728.52
1+50.00	727.80
1+75.00	727.60
2+00.00	728.10
2+50.00	728.53
3+00.00	731.08

XS No.2 @ RS 13+75

Cross Section for Tributary No.1 - XS No.2 @ RS 13+75

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.089	
Channel Slope:	0.02173	ft/ft
Normal Depth:	3.36	ft
Elevation Range:	719.07 to 741.10 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.2 @ RS 13+75

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Channel Slope:	0.02173	ft/ft
Discharge:	320.68	ft^3/s
Options		
Current Roughness Weighted Meth	ImprovedLotters	
Open Channel Weighted Roughnes	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	
Results		
Roughness Coefficient:	0.089	
Water Surface Elevation:	722.43	ft
Elevation Range:	719.07 to 741.10 ft	
Flow Area:	120.36	ft^2
Wetted Perimeter:	106.65	ft
Top Width:	103.72	ft
Normal Depth:	3.36	ft
Critical Depth:	2.72	ft
Critical Slope:	0.12961	ft/ft
Velocity:	2.66	ft/s
Velocity Head:	0.11	ft
Specific Energy:	3.47	ft
Froude Number:	0.44	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 741.10)	(1+52.37, 721.07)	0.100
(1+52.37, 721.07)	(1+55.45, 720.28)	0.050
(1+55.45, 720.28)	(2+00.00, 725.20)	0.100

Section Geometry

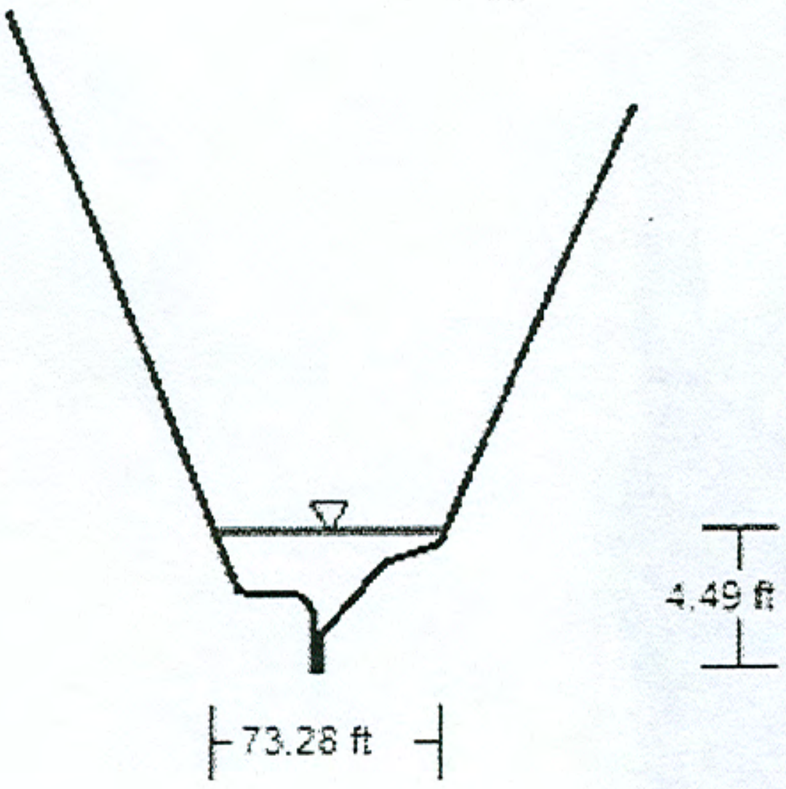
Worksheet for Tributary No.1 - XS No.2 @ RS 13+75

Station	Elevation
0+00.00	741.10
0+75.00	722.30
1+25.00	721.20
1+38.54	720.32
1+52.37	721.07
1+52.63	719.07
1+55.19	719.08
1+55.45	720.28
1+63.52	720.56
2+00.00	725.20

XS No.1 @ RS 12+50

Cross Section for Tributary No.1 - XS No.1 @ RS 12+50

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Section Data		
Roughness Coefficient:	0.088	
Channel Slope:	0.01325	ft/ft
Normal Depth:	4.49	ft
Elevation Range:	716.90 to 738.00 ft	
Discharge:	320.68	ft^3/s



Worksheet for Tributary No.1 - XS No.1 @ RS 12+50

Project Description

Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data

Channel Slope:	0.01325	ft/ft
Discharge:	320.68	ft^3/s

Options

Current Roughness Weighted Metho	ImprovedLotters
Open Channel Weighted Roughnes:	ImprovedLotters
Closed Channel Weighted Roughne	Hortons

Results

Roughness Coefficient:	0.088	
Water Surface Elevation:	721.39	ft
Elevation Range:	716.90 to 738.00 ft	
Flow Area:	121.58	ft^2
Wetted Perimeter:	76.52	ft
Top Width:	73.28	ft
Normal Depth:	4.49	ft
Critical Depth:	3.43	ft
Critical Slope:	0.11924	ft/ft
Velocity:	2.64	ft/s
Velocity Head:	0.11	ft
Specific Energy:	4.60	ft
Froude Number:	0.36	
Flow Type:	Subcritical	

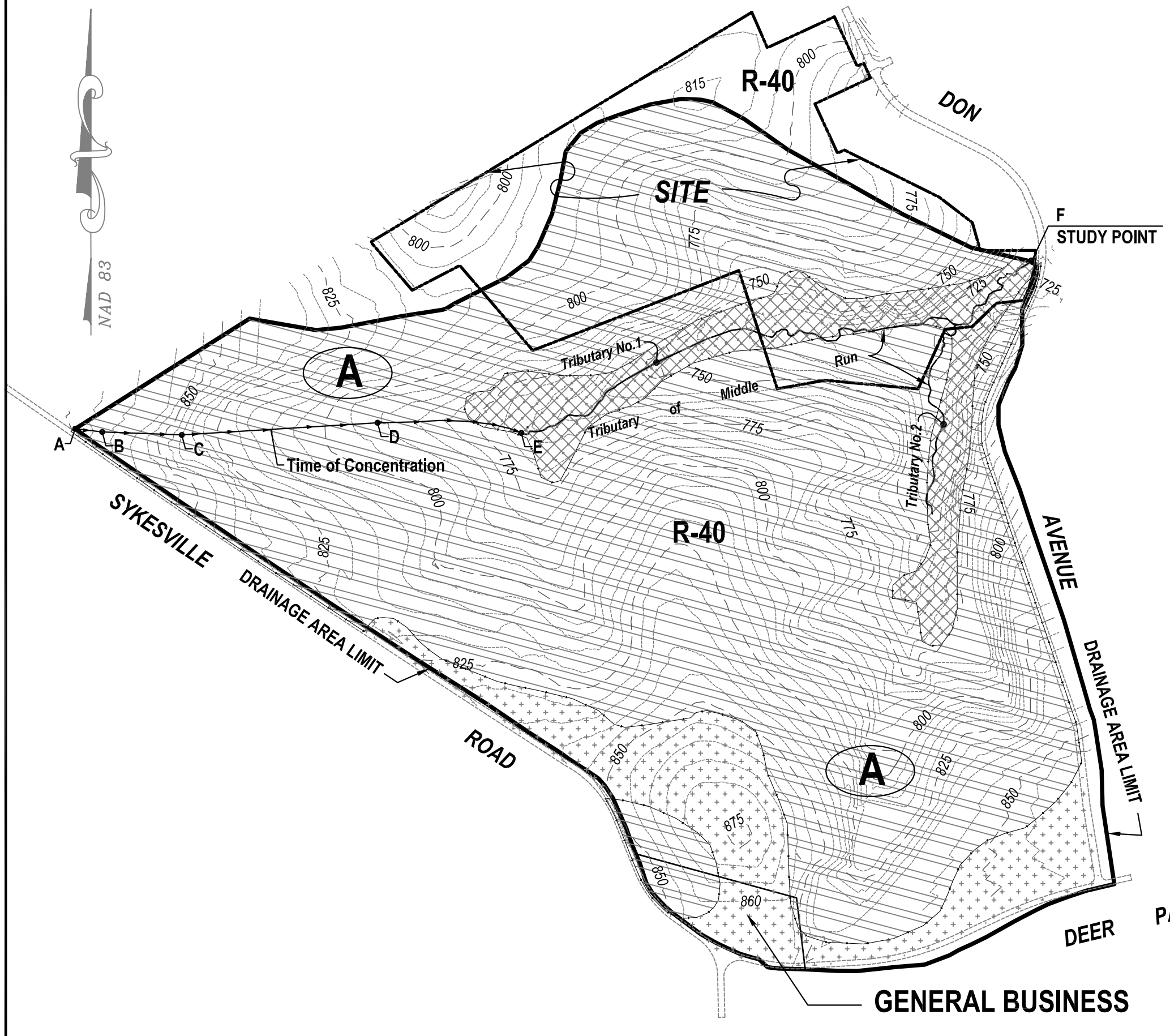
Segment Roughness

Start Station	End Station	Roughness Coefficient
(0+00.00, 738.00)	(0+98.62, 718.90)	0.100
(0+98.62, 718.90)	(1+01.37, 718.10)	0.050
(1+01.37, 718.10)	(2+00.00, 734.90)	0.100

Section Geometry

Worksheet for Tributary No.1 - XS No.1 @ RS 12+50

Station	Elevation
0+00.00	738.00
0+75.00	719.50
0+95.67	719.36
0+98.62	718.90
0+98.85	716.90
1+01.15	716.90
1+01.37	718.10
1+21.51	720.43
1+38.87	721.00
2+00.00	734.90



"A" SOILS

"B" SOILS

"C" SOILS

MAPPING SOURCES:

1. TOPOGRAPHY MAPPING: 5' Contour Interval
   - A. Field run survey by BPR, Inc. for WILMONT MANOR Section 8 - CC File No. P-05-014
   - B. Aerial topography, Flown for VICTORIA FARMS - CC File No. P-02-011
   - C. Aerial topography, Flown for FORSTER PROPERTY - BPR Job No. 04-160-000
   - D. USGS Quad Map - Westminster

2. C.C. ZONNING MAP - GENERALIZED ZONNING MAP OF CARROLL COUNTY

3. SDC SOILS MAP - MAP No.36

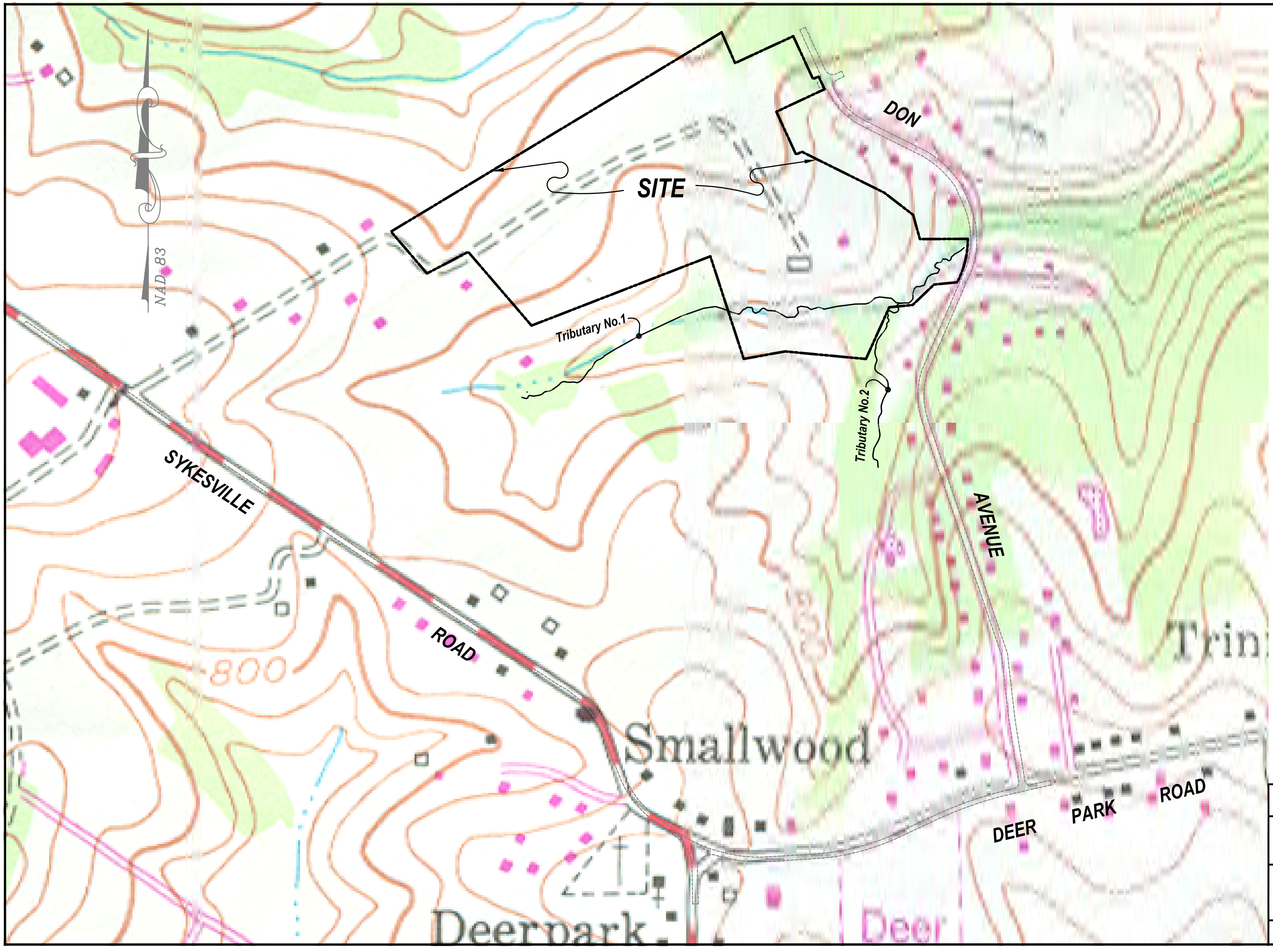
DRAINAGE AREA:

DA 'A' = 155.2 Acres

DRAINAGE AREA MAP

SECTION 8
WILMONT MANOR

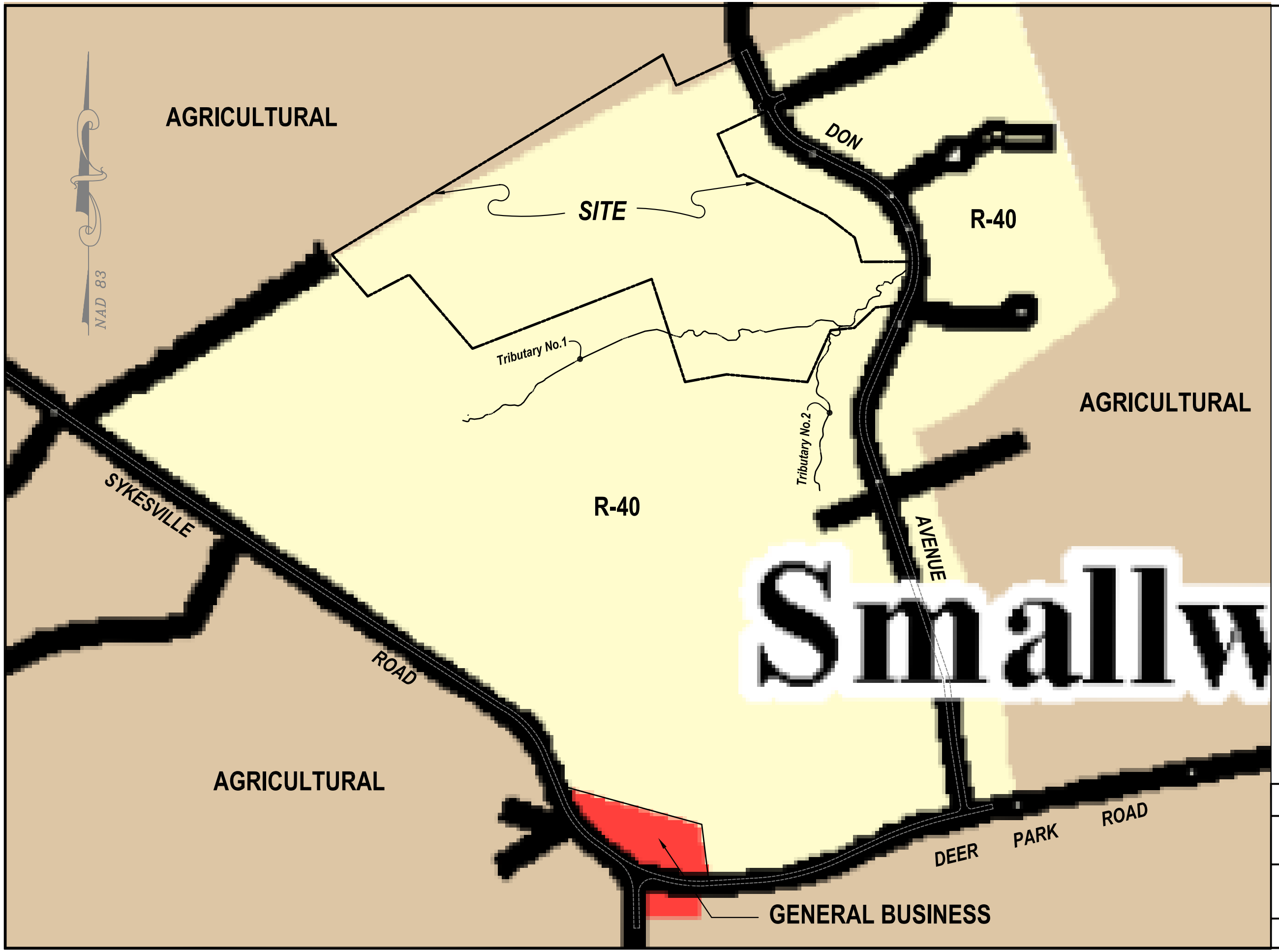
C.C. File No. P-05-014
SCALE: 1" = 400'
March. 2006 BPR JOB # 02-123-000



USGS MAP

SECTION 8
WILMONT MANOR

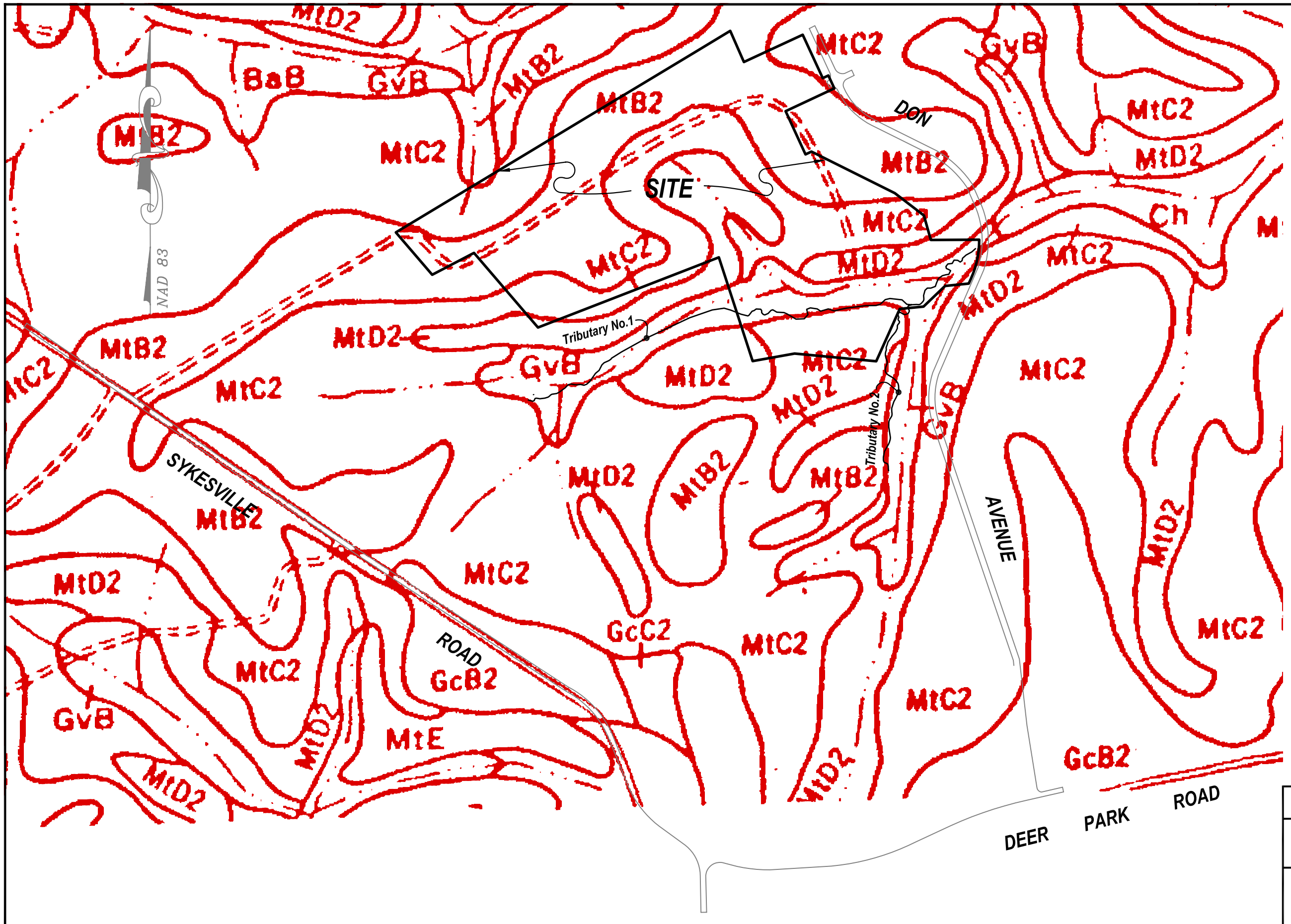
C.C. File No. P-05-014
SCALE: 1" = 400'
March. 2006 BPR JOB # 02-123-000



ZONNING MAP

SECTION 8
WILMONT MANOR

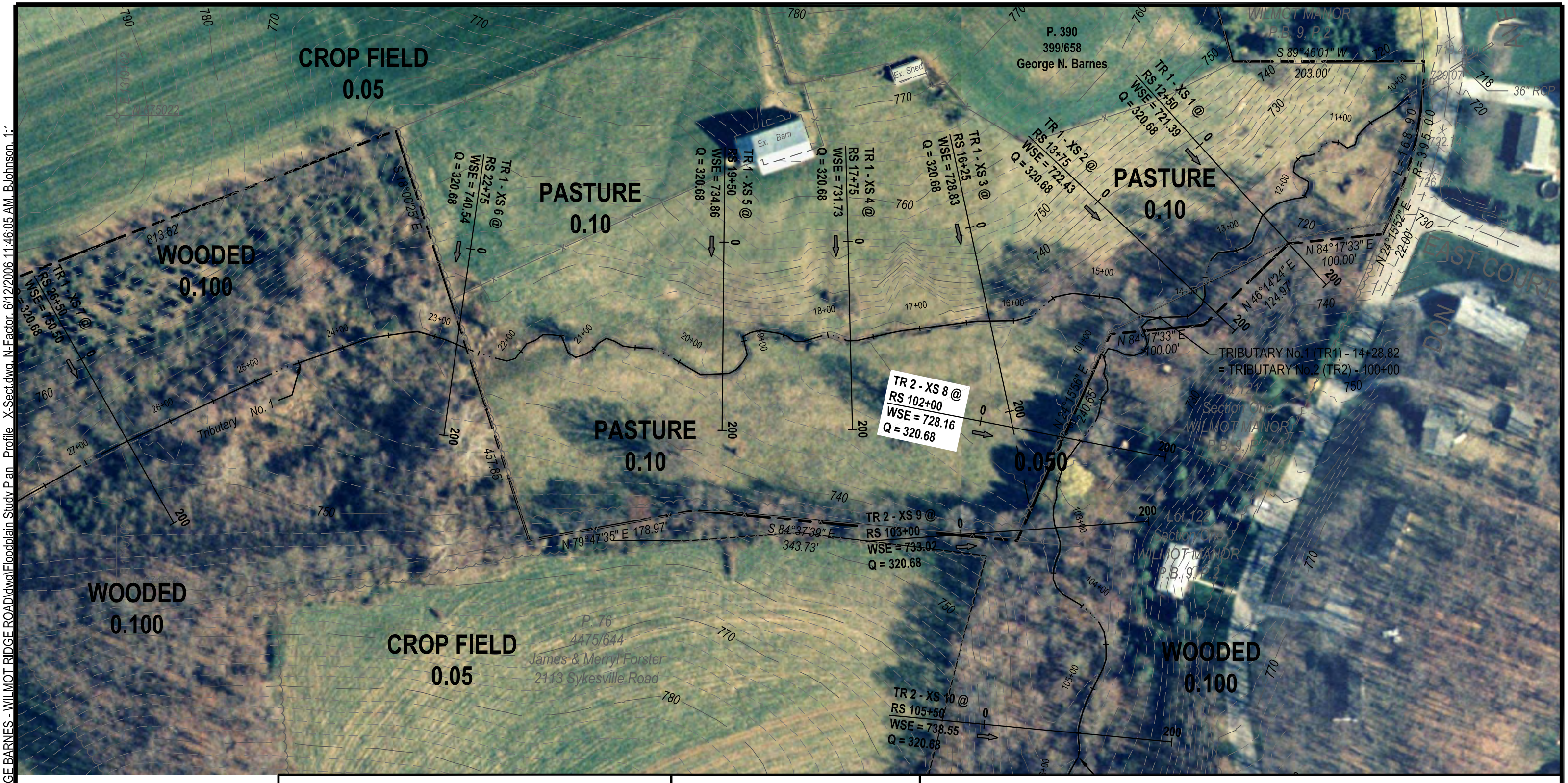
C.C. File No. P-05-014
SCALE: 1" = 400'
March. 2006 BPR JOB # 02-123-000



SOILS MAP

SECTION 8
WILMONT MANOR

C.C. File No. P-05-014
SCALE: 1" = 400'
March. 2006 BPR JOB # 02-123-000



NOTE:
1. N-Factor for main channel: 0.05

OWNER / DEVELOPER

Wilomt, LLC.
c/o Mark Bollinger, Managing Partner
P.O. Box 569
Westminster, Maryland 21158

BPR, Inc. Job No. 02-123-000

Date: April 12, 2006

Scale: 1" = 200'

BPR INC.
SURVEYORS - LAND PLANNERS
150 Airport Drive
Suite 4
Westminster, Maryland 21157
Phone: (410)-857-9030
or (410)-876-0333
Fax: (410)-876-1532

N-FACTOR DELINEATION PLAN

FOR

AN UNNAMED TRIBUTARY OF THE MIDDLE RUN

WILMOT MANOR - SECTION 8

TAX MAP - 52 GRID - 21 PARCEL - 390

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