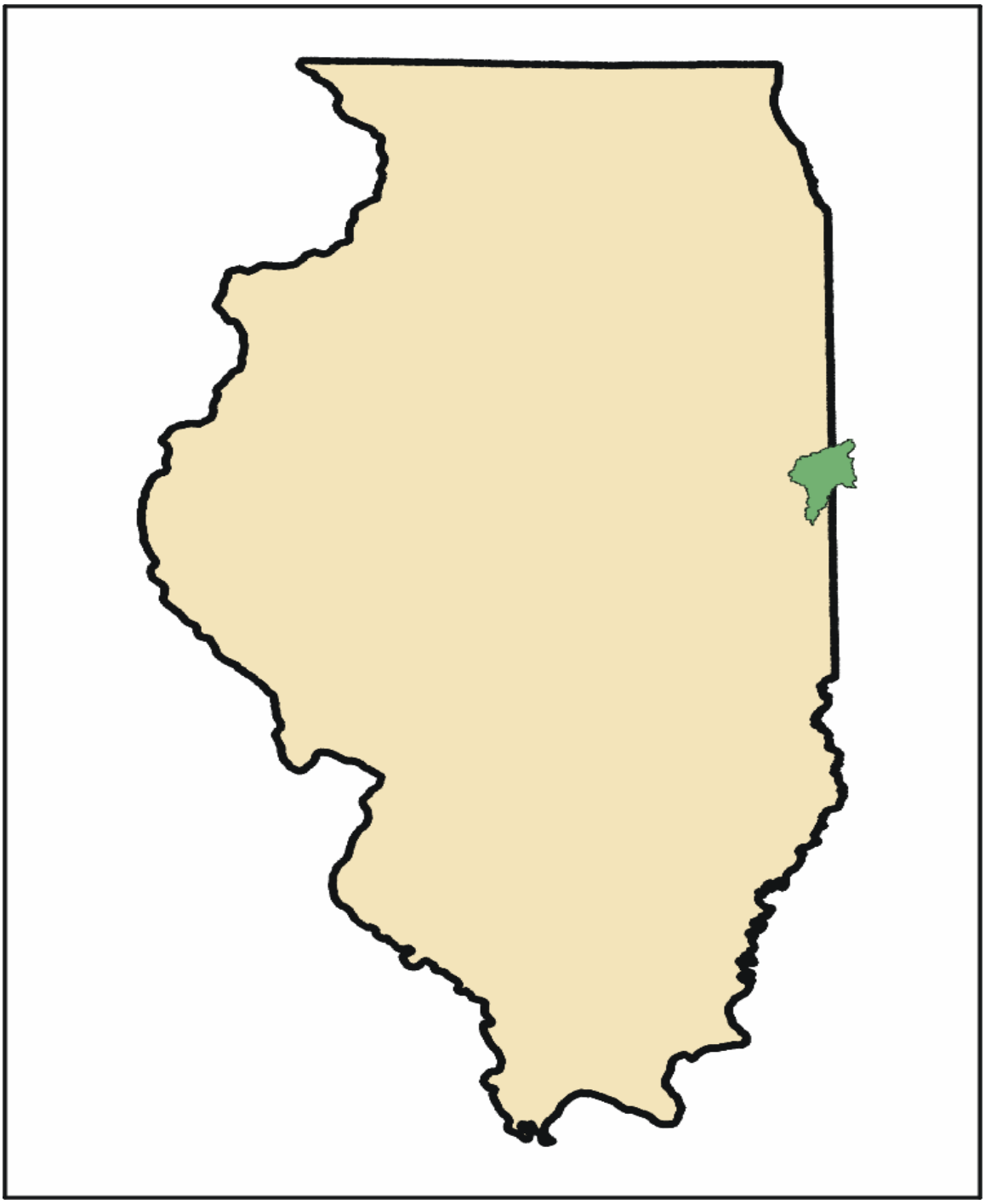


AERIAL ASSESSMENT REPORT FOR North Fork Vermilion River

VERMILION COUNTY

SEPTEMBER 2005

Prepared by Wayne Kinney for IL. Dept. of Agriculture

The TMDL study on the North Fork Vermilion River and Vermilion Lake began in October 2003. The 2004 303(d) list indicates Total Nitrogen, Nitrate, Siltation, DO, TSS and Algae as impairments in Vermilion Lake. Reach BPG 05 of the North Fork is listed for Nitrates and reach BPG 09 is listed for Pathogens in this watershed. The Hoopeston Branch is also listed for Total Nitrogen, DO and Phosphorus.
Only Nitrate, DO and Pathogens will be addressed by the TMDL study, however no additional information is available at this time through the IEPA website.

Assessment Procedure

Low level geo-referenced video was taken of the North Fork of the Vermilion River in March, 2004. Video taping was completed by Fostaire Helicopters, Sauget, IL, using a camera mounted beneath a helicopter to record data from just above tree top level in DVD format for further evaluation and assessment. Video mapping at the upper end of Lake Vermilion and preceded upstream to IL. Rte. 9 just East of Hoopeston, IL. Aerial video of tributaries was not part of the project, regardless of the stream size or vegetation.

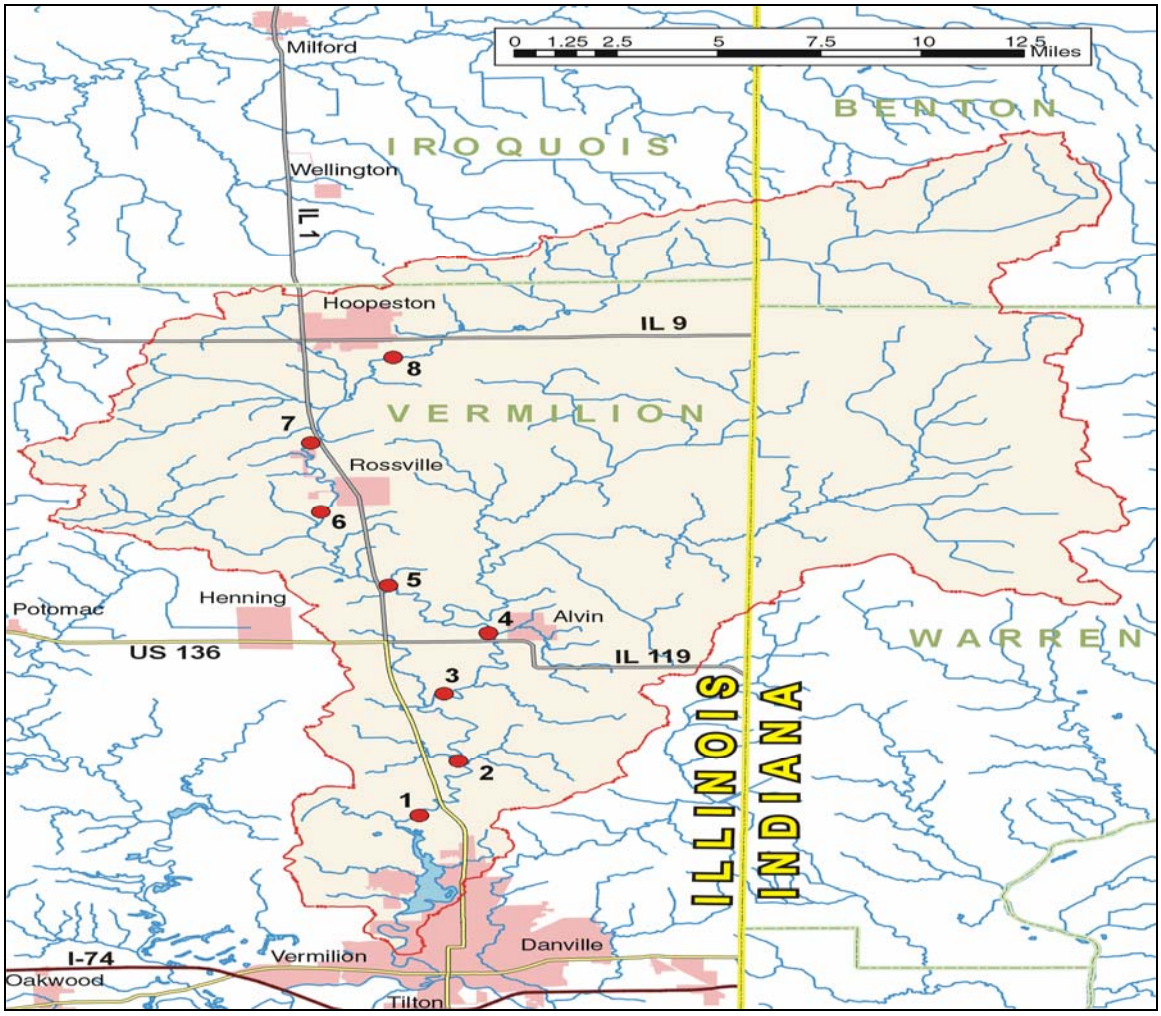


Fig. 1 Aerial Assessment Map of North Fork of the Vermilion River

After videotaping the stream, the DVD tapes were processed by USGS to produce a geo-referenced DVD showing flight data and location. Next, USGS identified features from the video and created shapefiles containing the GPS location, type of feature identified, and the time on the DVD to allow cross referencing. The shape-files along with the DVD were then used to identify and locate the points where ground investigations were needed to verify aerial assessment assumptions and gather additional data.

The ground investigations or "ground truthing" is intended to accomplish two primary functions. First, it provides those viewing videos the opportunity to verify the correct interpretation of the video. Second, the video allows the user to identify and gather field data at the most appropriate locations to more closely represent the entire study portion of the stream.

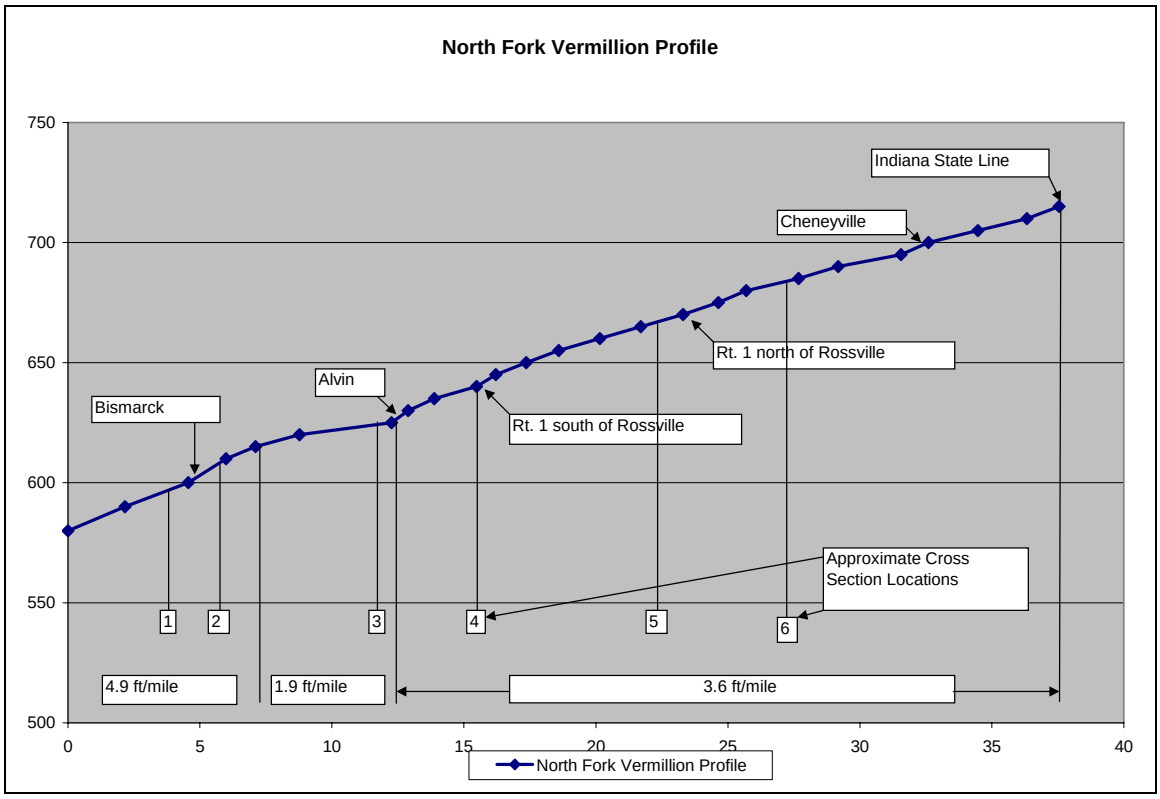


Fig. 2 Channel Profile North Fork Vermillion River

Detailed elevation data is not available; therefore the channel slope is calculated from USGS topo maps by measuring the channel length between contour lines. The report refers to this as "valley profile" although a true valley profile would use a straight line distance down the floodplain rather than channel length. However, this method is used because it incorporates sinuosity into the calculation and allows the channel slope to be assume equal to "valley slope" in order to estimate channel capacity, velocity, etc., although there are short segments where the channel slope may differ significantly near roads, logjams, knickpoints, etc.

CHAPTERS ON DVD AND ASSESSMENT REPORT North Fork Vermilion River				
DVD Disc	DVD chapter	Beginning Time	Report Chapter	Cross Sections
1	2	5:00	1	
1	3	10:00	2	1,2
1	4	15:00	3	
1	5	20:00	4	3
1	6	25:00:00	5	4
1	7	30:00:00	6	5
1	8	35:00:00	7	6
1	9	40:00:00	8	

Note: Flight path is from downstream to upstream

Fig. 3 DVD Chapters and Report Guide

The DVD has been divided into “chapters” of approximately five minutes of video (Fig. 3) to enhance the ability to navigate within the flight video and provide a simple way to identify and discuss different stream segments. Although the report will begin with a broader more general assessment of the entire study reach, it will also provide an assessment and treatment recommendations by chapter or group of chapters. The chapter divisions are clearly arbitrary and do not reflect “change points” in the stream characteristics or treatment recommendations. For clarity the conclusions and recommendations are presented for each stream “chapter”.

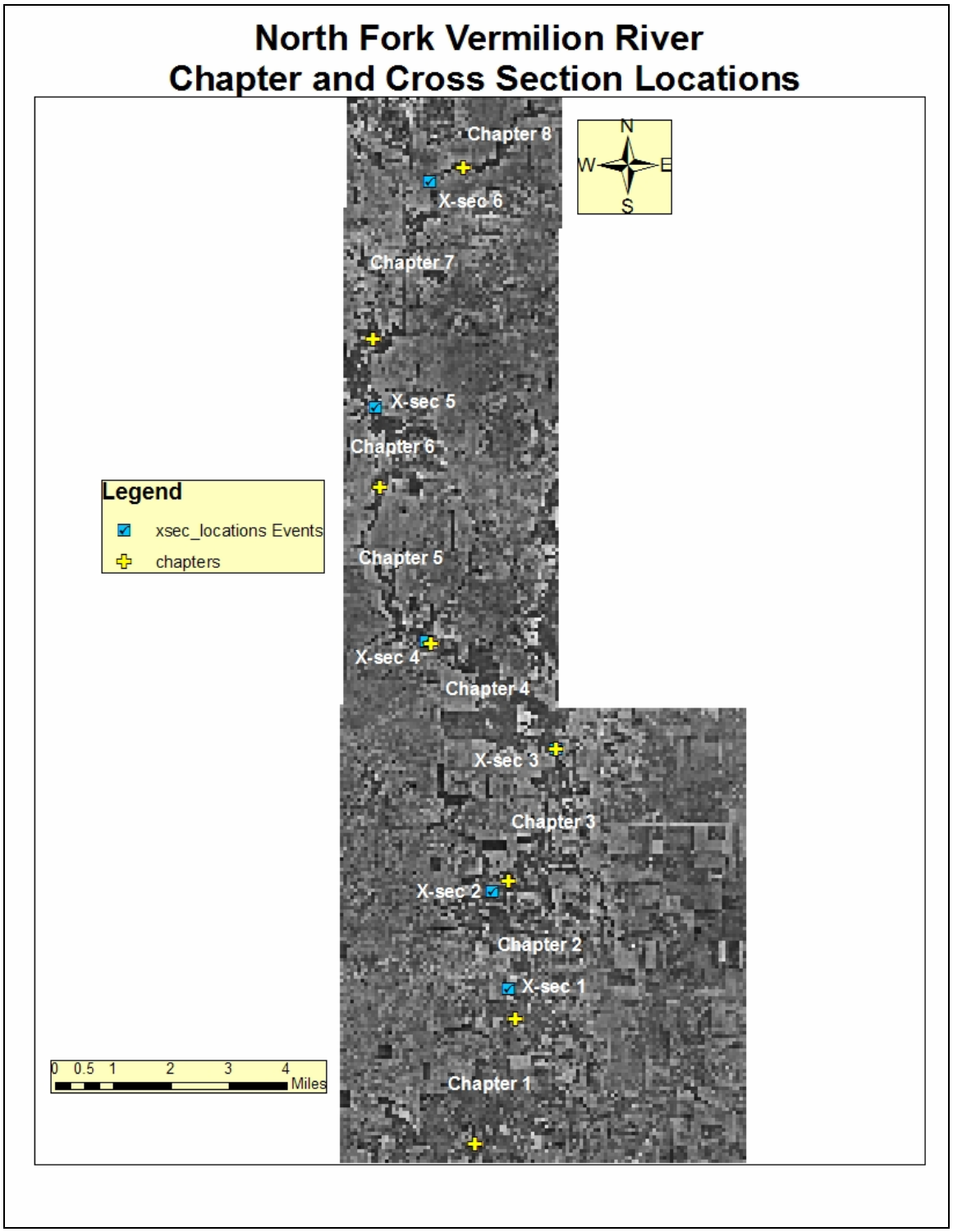


Fig. 4 Chapter Division and Cross Section locations

The major factors indicating channel conditions identified from the aerial assessment have been totaled by DVD chapter in Table 1 below. This tabulation allows a general comparison of the relative dominance of features found in each chapter and provides a

means of comparing stream characteristic between chapters. A discussion of the major differences will follow later in this report.

FEATURES IDENTIFIED BY CHAPTER								
North Fork Vermilion River								
REPORT CHAPTER	ROCK OUTCROP	LOGJAM	GEOTECH FAILURE	DEPOSITION	BED CONTROL	BREAK POINT	EROSION	BANK CONTROL
1	0	0	3	8	0	0	15	1
2	1	1	5	12	1	1	18	0
3	1	1	10	7	0	0	18	7
4	0	0	1	6	0	2	26	6
5	0	1	0	5	0	1	24	4
6	0	2	1	3	0	3	32	12
7	0	1	0	9	2	0	31	0
8	0	6	0	0	0	0	24	1
TOTALS	2	12	20	50	3	7	188	31

Table 1 Features by Chapter Identified with Aerial Assessment

Six cross sections were taken at selected locations on North Fork Vermilion River after viewing the DVD's. The cross sections are located at "riffle" locations to best represent the channel characteristics and to allow for comparison of width, depth, x-sec. area, etc. along the channel at similar geometric locations. The result of the hydraulic analysis at each site is presented in summary form in Table 2 and the approximate location of each cross section along the channel profile is found in Fig. 2. Exact locations as Eastings and Northings and more detail can be found in Appendix A.

Cross Section Data --North Fork Vermilion, Vermilion Co.														
X-sec	Easting	Northing	ADA Sq. Mi.	Valley Slope ft/mi.	Q2 cfs	Bank Full Q cfs	Width Ft.	Mean Depth Ft.	W/D Ratio	Vel. fps	Bedload Dia. Inches	CEM Simon	CFS/ sq. mi.	BKF Q/ Q2
1	445939	4455126	268.6	3.4	3098	2156	118	5.39	21.52	3.4	3	6	8.03	0.70
2	445475	4457826	265	3.4	3065	2102	120	5.2	23.08	3.4	2	6	7.93	0.69
3	447258	4461784	243.2	3.4	2864	1951	89	7.98	11.15	2.7	2	4	8.02	0.68
4	443642	4464787	118.1	3.2	1572	686	88	3.54	24.86	2.2	2	5	5.81	0.44
5	442237	4471277	95.75	3	1291	684	52	4.87	10.68	2.7	1	4	7.14	0.53
6	443744	4477558	63.05	2.5	850	527	50	4.41	11.34	2.4	1	5	8.35	0.62

Table 2 Cross Section Summary

Fig. 5 Lateral bank erosion near Cross Section 5

Fig. 6 Eroding escarpment near Cross Section 1 resulting from toe scour.

Fig. 7 Channel bed armored with heavy cobble near cross section 1 driving flow into base of escarpment.

Fig. 8 Stable CEM Class 6 channel near cross section 2.

General Observations

1. Flow Data is not available for North Fork Vermillion River. The nearest comparable stream of similar size and watershed characteristics with flow data was determined to be the Salt Fork Vermillion River. Two year discharge data from the Salt Fork has been used as a guide to selecting the two year discharge rates for the North Fork.
2. North Fork appears to be a stream driven by both flow and bedload with neither source dominating the channel evolution process.
3. Channel width/depth ratios were found to be either in the range of 10 to 12 where the bed was not armored with cobble or between 20 and 25 where heavy cobble had armored the bed.
4. There has not been extensive channelization on the lower end of North Fork, although some modifications have been made. However the upper reaches above Rte. 1 near Hoopeston are channelized.
5. The valley profile taken from USGS topographical maps shows almost a 50% drop in valley slope downstream of Alvin, IL for approximately 5 miles.
6. North Fork appears to be vertically stable with no knickzones or downcutting identified. Four of six cross sections proved to be CEM stage 5 or 6 channels with two cross sections in CEM stage 4 that may have some minor degradation.
7. The need for grade control structures was not found on the North Fork.
8. Recommendations will be for lateral bank migration only to protect eroding banks.

Recommendations Chapter 1-8

The North Fork has two distinct channel cross sections. One has a width depth ratio of 10 to 12 with no channel armoring of the bed. These sections are primarily in the upper half of the watershed and are CEM stage 4 or 5. The eroding banks in these reaches should be treated primarily with Stone Toe Protection due to the narrow W/D ratios. The other cross section identified has a width depth ration of 20 to 25 with an armored bed composed of heavy cobble eroded from the glacial till. These sections are very stable vertically but are moving laterally because the bank material is more mobile than the bed material. The eroding banks in these reaches can be treated with Stone Toe Protection and/or Stream Barbs and Bendway Weirs to protect the toe of the bank. Recommendations are therefore essentially the same for all chapters with the treatment required dependent on the width/depth ratio at each site.

`	TREATMENT --CHAPTERS 1 THRU 8				
	Lateral Bank Protection				
Chapter	Erosion Sites	Average Length(ft)	Total Length	Average Cost/foot	Total Cost
1	15	600	9000	$25.00	$225,000.00
2	18	600	10800	$25.00	$270,000.00
3	18	450	8100	$25.00	$202,500.00
4	26	450	11700	$25.00	$292,500.00
5	24	450	10800	$25.00	$270,000.00
6	32	300	9600	$25.00	$240,000.00
7	31	300	9300	$25.00	$232,500.00
8	24	300	7200	$25.00	$180,000.00
Total	188		76500		$1,912,500.00

Table 3 Recommended Treatment and Cost Estimate

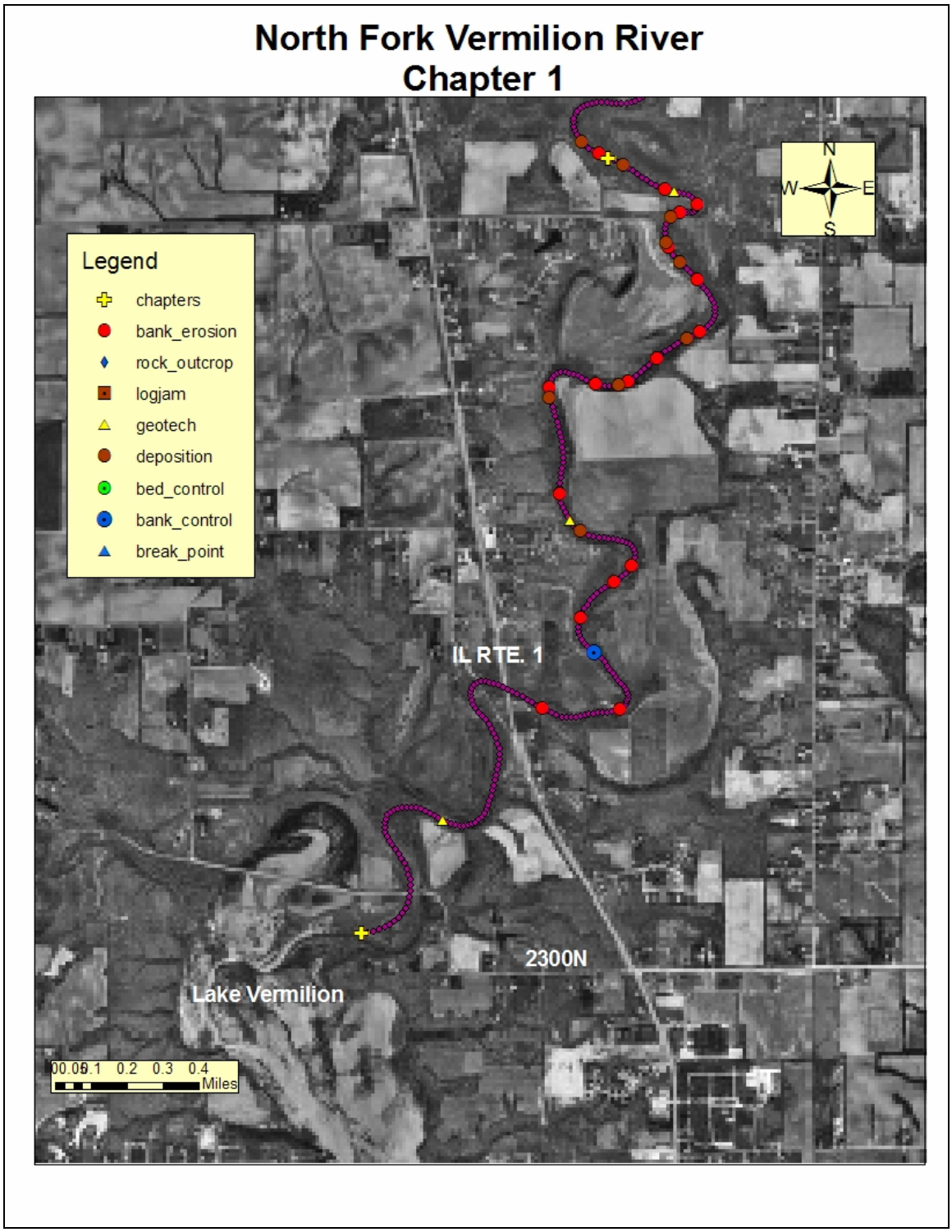


Fig. 9 Chapter 1

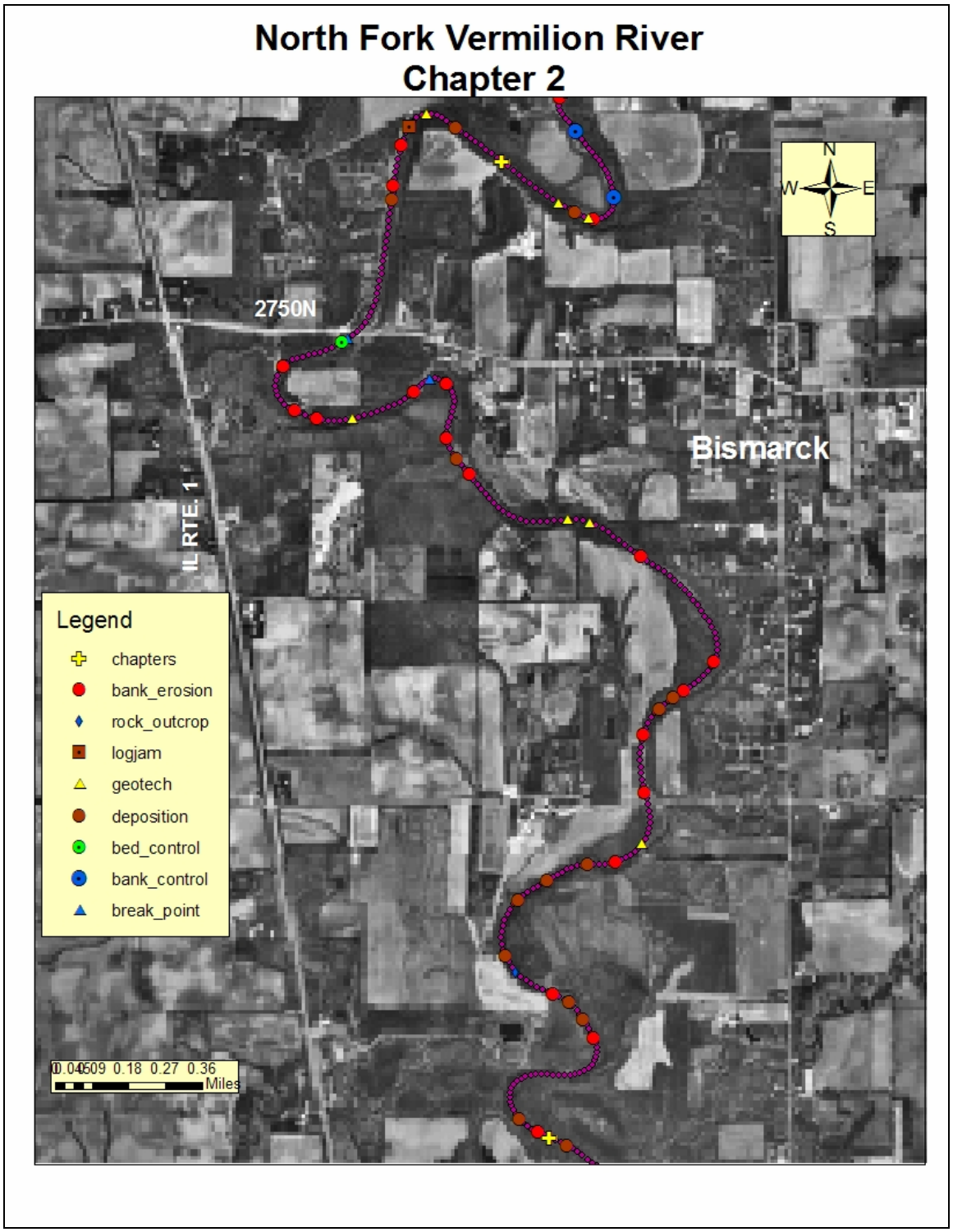


Fig. 10 Chapter 2

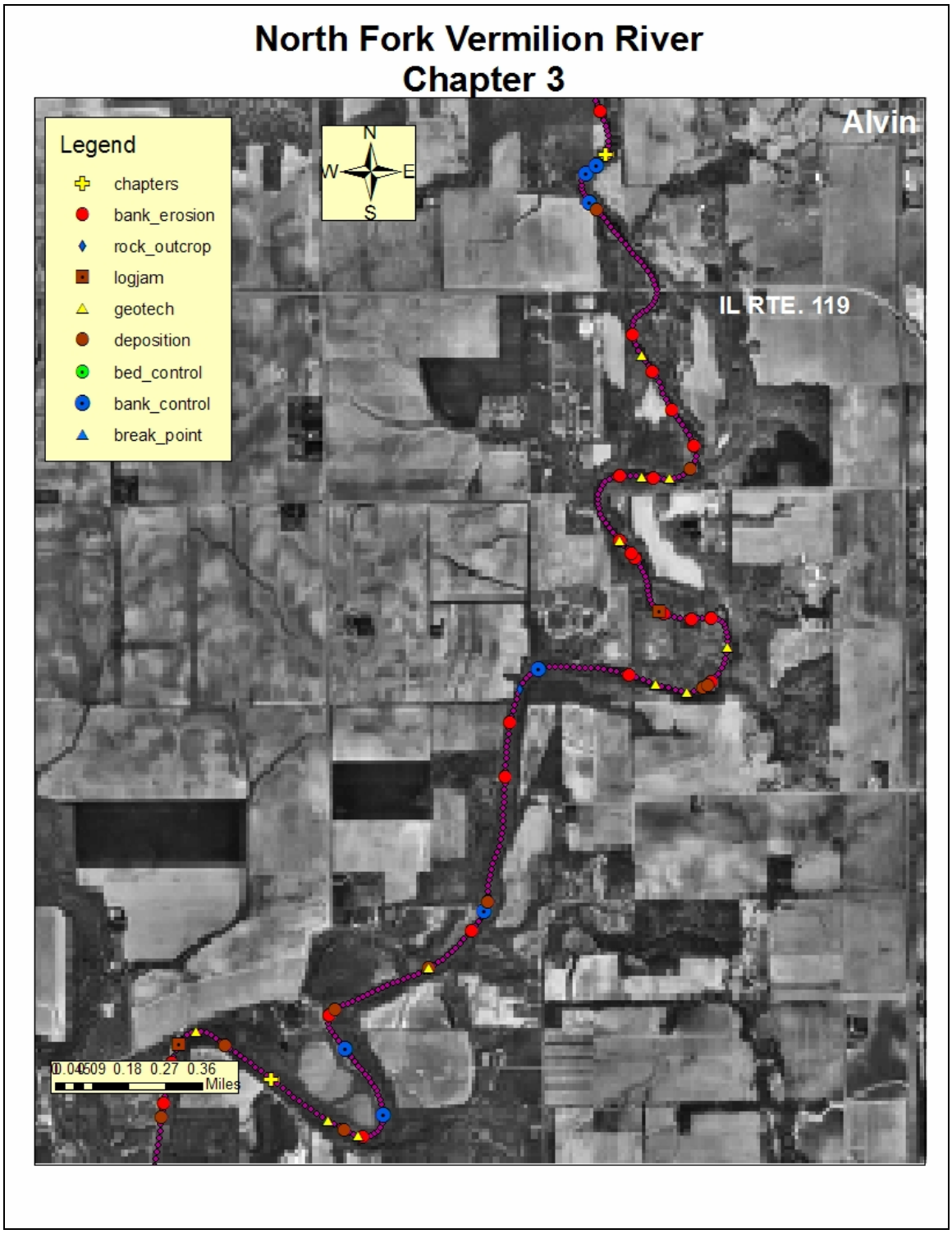


Fig. 11 Chapter 3

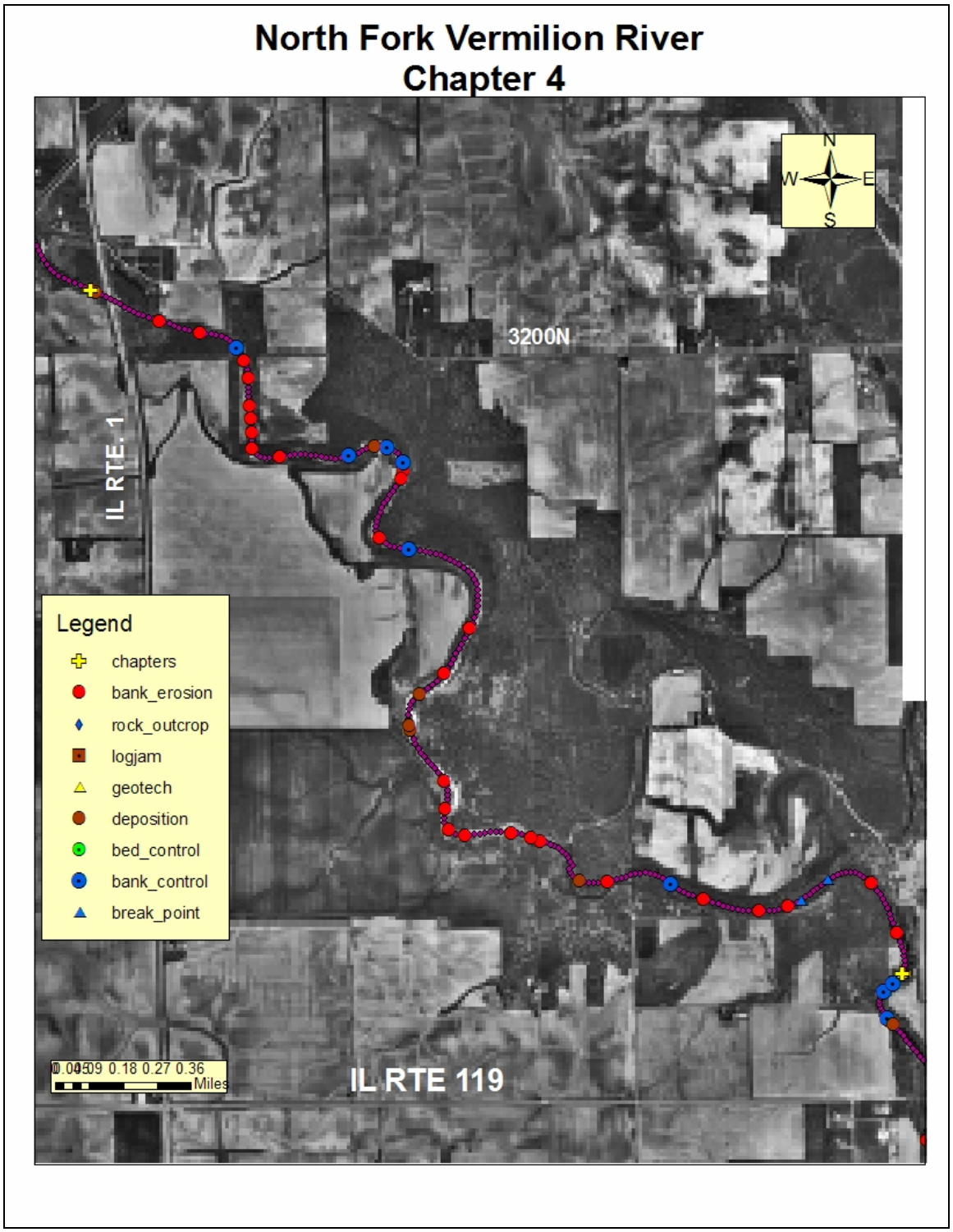


Fig. 12 Chapter 4

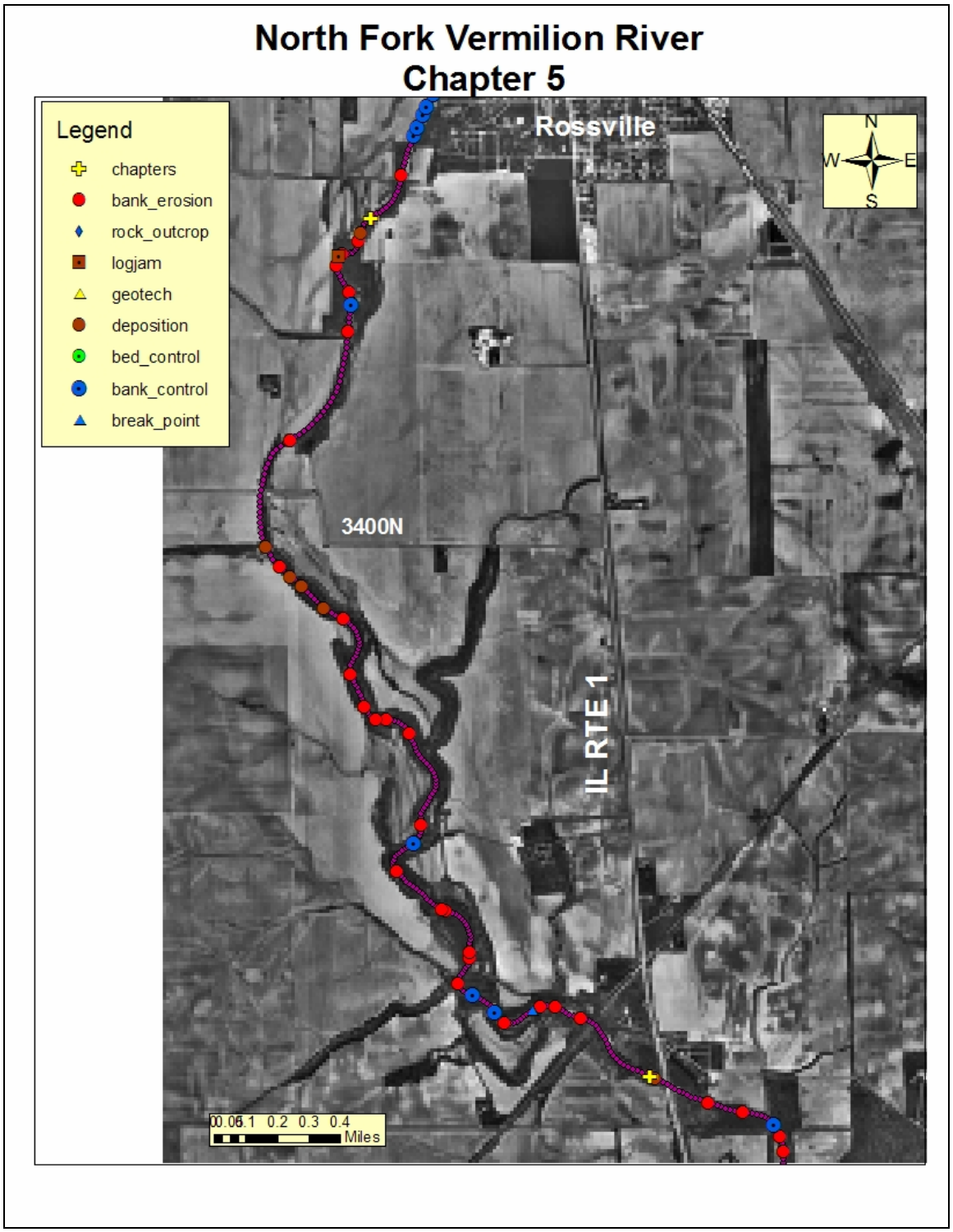


Fig. 13 Chapter 5

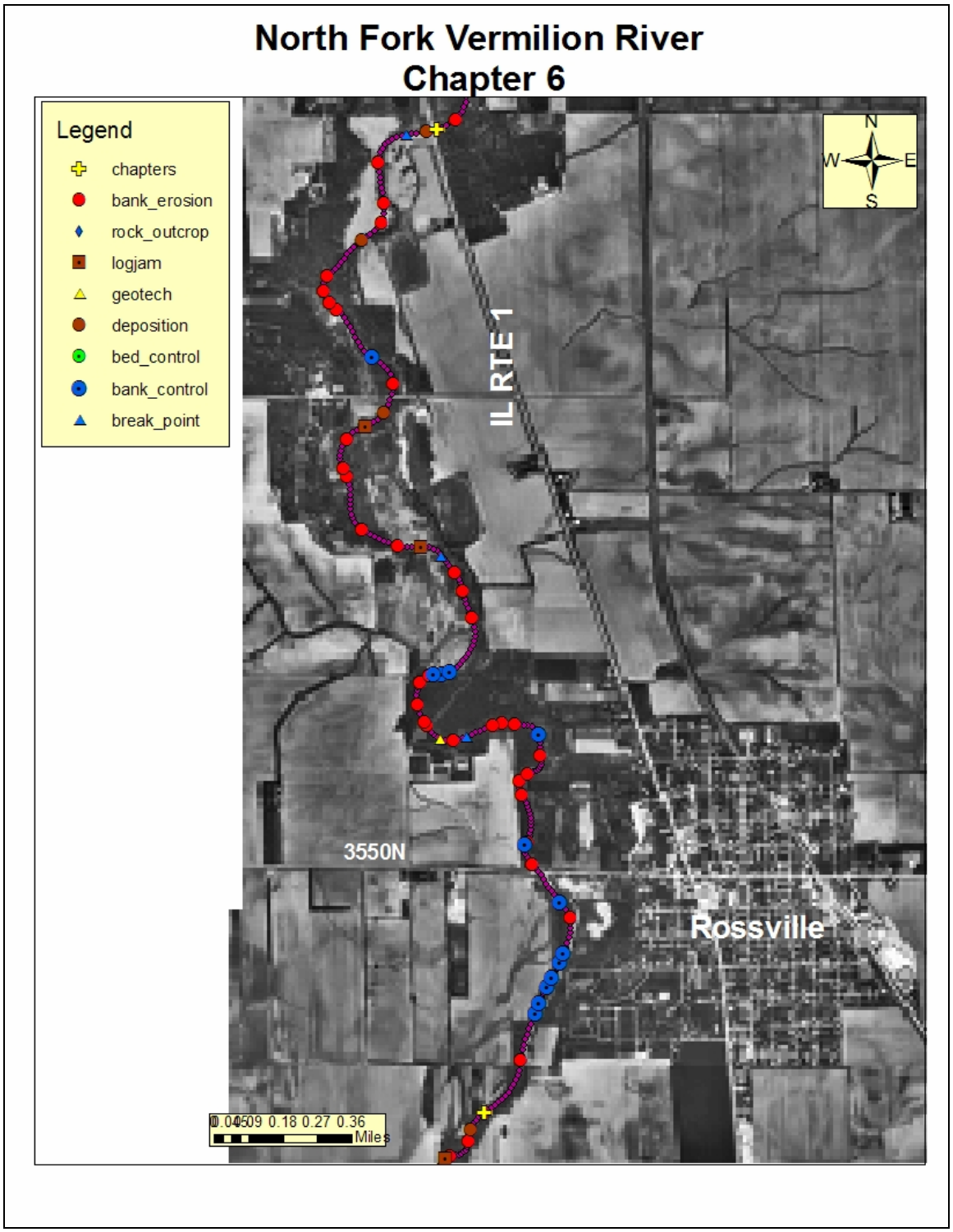


Fig. 14 Chapter 6

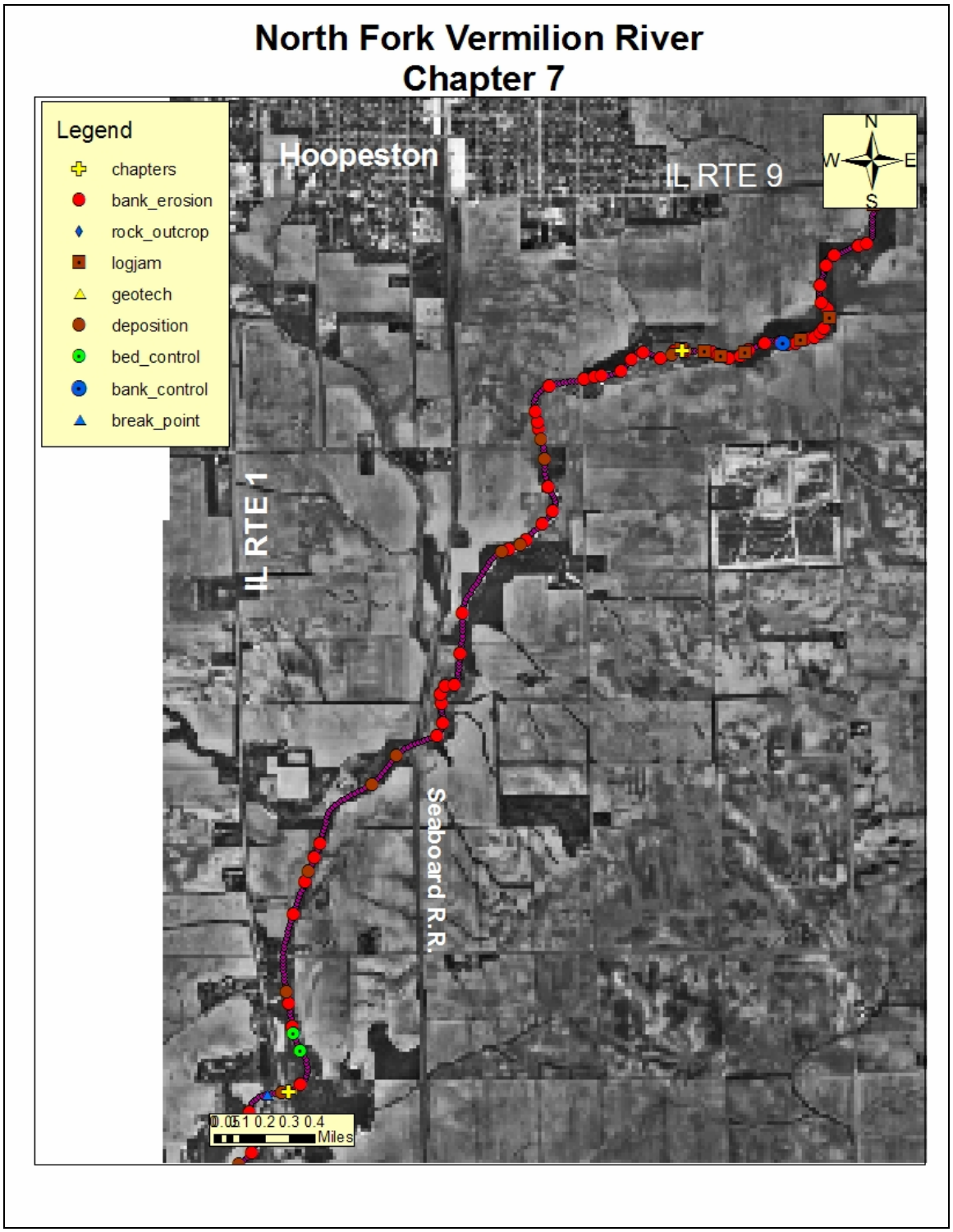


Fig. 15 Chapter 7

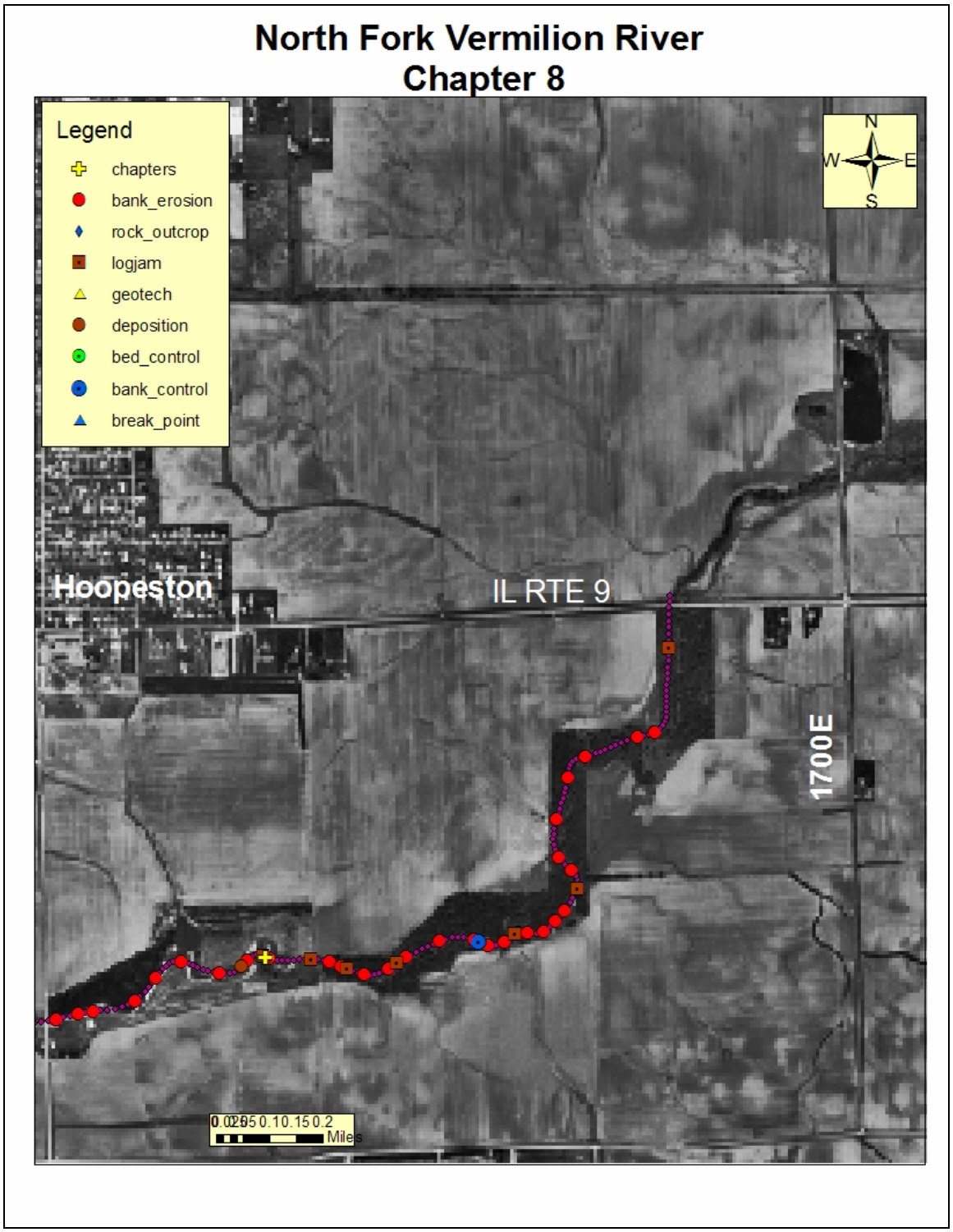


Fig. 16 Chapter 8

APPENDIX A

CROSS SECTION DATA

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 11/10/2005 By Wayne Kinney

Stream Name North Fork Vermillion UTM Coord. E445939 N4455126

Landowner Name X sec 1

Drainage Area 268.6 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions Width 132 ft. Cross Sectional Area 998 sq. ft.

Depth 7.6 ft.

Reference Stream Gage:

Salt Fork near Homer Station No. 03338000 Gage Q_2 3760 cfs

Drainage Area 344 sq.mi Regression (4290 cfs

Champaign County, IL **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.4 *ft./mi. (user-entered)* Regression Q_2 3534 cfs

ft/mi (from worksheet) Rainfall 2.95 in *(2 yr, 24 hr)* Adjusted Q_2 3098 cfs

0.0006 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

1230 to 2480 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Stream Length *ft.*

Basic Field Data: Valley Length *ft.*

Bankfull Width 116 *ft.* Contour Interval feet

Mean Bankfull Depth 5.39 *ft.* Estimated Sinuosity

Width/Depth Ratio 21.52

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 5.9 *ft.* Surveyed: 0.00093 *ft./ft.* Cross-Section 2128 *cfs*

Width at twice max. depth 240 *ft.* Estimated: *ft./ft.* Basic field data 2185 *cfs*

(11.8 ft.) Selected Q 2156 *cfs*

Entrenchment Ratio 2.07 Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90} 3 *in.* Velocity required to move D_{90}: 3.6 *ft./sec.*

D_{50} *in.* Velocity from Cross-Section data: 3.40 *ft./sec.*

GOAL: Develop confidence by matching Velocity from basic field data: 3.49 *ft./sec.*

velocities from different sources. Velocity from selected Q: 3.4 *ft./sec.*

Channel Evolution Stage VI Stream Type (Rosgen)

Notes

8.03 cfs/sq. mi.

Natural Open Channel Flow

Project:	X sec 1	
Assisted by:	Wayne Kinney	
Date:	11/10/2005	
Channel Slope (***S***):	0.000930	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	5.9	*ft*

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

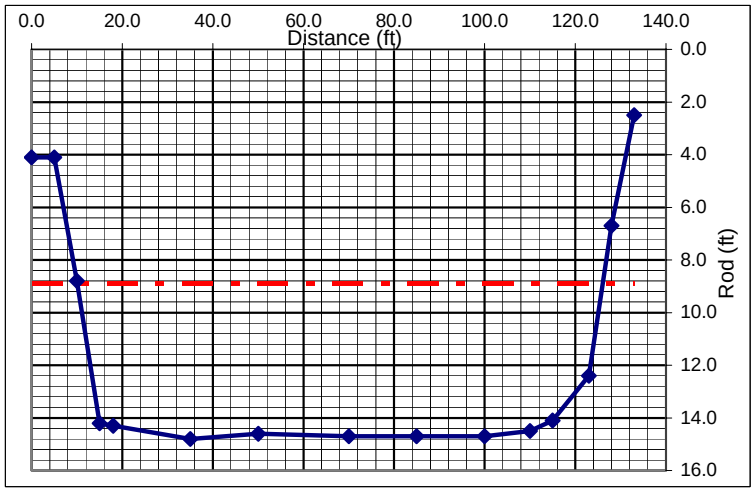
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	5.9 *ft*	10.7	
Channel Flow (***Q***):	2,128.1 *cfs*	5,762.2	
Channel Velocity:	3.4 *ft/sec*	4.8	
Cross-Sectional Area (***A***):	625.3 *sq.ft.*	1,205.3	
Hydraulic Radius (***R***):	5.2 *ft*	8.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
4.1	0.0
4.1	5.0
8.8	10.0
14.2	15.0
14.3	18.0
14.8	35.0
14.6	50.0
14.7	70.0
14.7	85.0
14.70	100
14.50	110
14.10	115
12.40	123
6.70	128
2.50	133



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 11/10/2005 By Wayne Kinney

Stream Name North Fork Vermillion UTM Coord. E445475 N4457826

Landowner Name Xsec 2

Drainage Area 265 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions Width 131 ft. Cross Sectional Area 989 sq. ft.

Depth 7.5 ft.

Reference Stream Gage:

Salt Fork near Homer Station No. 03338000 Gage Q_2 3760 cfs

Drainage Area 344 sq.mi Regression (4290 cfs

Champaign County, IL **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.4 *ft./mi. (user-entered)* Regression Q_2 3497 cfs

ft/mi (from worksheet) Rainfall 2.95 in *(2 yr, 24 hr)* Adjusted Q_2 3065 cfs

0.0006 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

1220 to 2460 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Stream Length *ft.*

Basic Field Data: Valley Length *ft.*

Bankfull Width 120 *ft.* Contour Interval feet

Mean Bankfull Depth 5.2 *ft.* Estimated Sinuosity

Width/Depth Ratio 23.08

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 6.3 *ft.* Surveyed: 0.00093 *ft./ft.* Cross-Section 2076 *cfs*

Width at twice max. depth 1000 *ft.* Estimated: *ft./ft.* Basic field data 2129 *cfs*

(12.6 ft.) Selected Q 2102 *cfs*

Entrenchment Ratio 8.33 Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90} 2 *in.* Velocity required to move D_{90}: 2.9 *ft./sec.*

D_{50} *in.* Velocity from Cross-Section data: 3.33 *ft./sec.*

GOAL: Develop confidence by matching Velocity from basic field data: 3.41 *ft./sec.*

velocities from different sources. Velocity from selected Q: 3.4 *ft./sec.*

Channel Evolution Stage VI Stream Type (Rosgen)

Notes

7.93 cfs/sq. mi.

Natural Open Channel Flow

Project:	Xsec 2	
Assisted by:	Wayne Kinney	
Date:	11/10/2005	
Channel Slope (***S***):	0.000930	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	6.3	*ft*

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

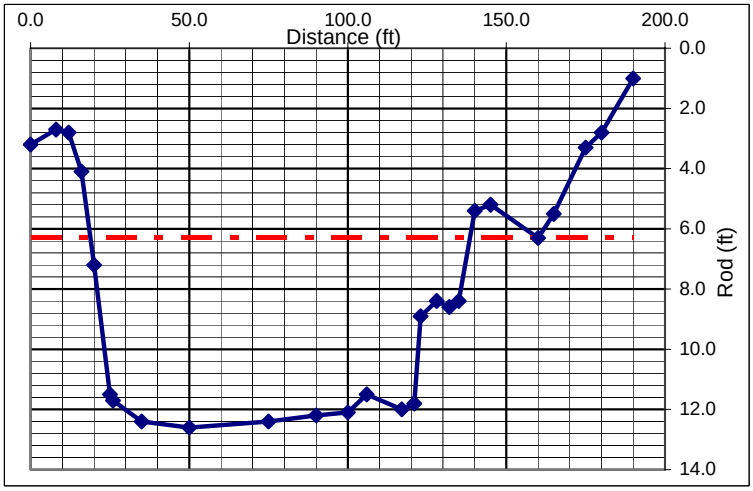
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.3 *ft*	9.9	
Channel Flow (***Q***):	2,076.0 *cfs*	4,479.4	
Channel Velocity:	3.3 *ft/sec*	3.8	
Cross-Sectional Area (***A***):	623.6 *sq.ft.*	1,164.9	
Hydraulic Radius (***R***):	5.0 *ft*	6.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.2	0.0
2.7	8.0
2.8	12.0
4.1	16.0
7.2	20.0
11.5	25.0
11.7	26.0
12.4	35.0
12.6	50.0
12.40	75
12.20	90
12.10	100
11.50	106
12.00	117
11.80	121
8.9	123
8.4	128
8.6	132
8.4	135
5.4	140
5.2	145
6.3	160
5.5	165
3.3	175
2.8	180
1.0	190



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 11/10/2005 By Wayne Kinney

Stream Name North Fork Vermillion UTM Coord. E447258 N4461784

Landowner Name X-sec3

Drainage Area 243.2 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	127 ft.	Cross Sectional Area	933	sq. ft.
	Depth	7.4 ft.			

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2	3760 cfs	
	Drainage Area	344 sq.mi	Regression (	4290 cfs	
Champaign County, IL	**REFERENCE STREAM DATA ONLY**				

USGS Flood-Peak Discharge Predictions:

Valley Slope:	3.4	*ft./mi. (user-entered)*			Regression Q_2	3268 cfs
		ft/mi (from worksheet)	Rainfall	2.95 in	*(2 yr, 24 hr)*	Adjusted Q_2 2864 cfs
	0.0006	*ft./ft.*	Regional Factor	1.057		Typical Range for Bankfull Discharge:
						1140 to 2300 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

			Stream Length		*ft.*
Basic Field Data:			Valley Length		*ft.*
Bankfull Width	89	*ft.*	Contour Interval		feet
Mean Bankfull Depth	7.98	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	11.15				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	9.6	*ft.*	Surveyed:	0.00036 *ft./ft.*	Cross-Section 1896 *cfs*
Width at twice max. depth	1000	*ft.*	Estimated:	*ft./ft.*	Basic field data 2006 *cfs*
(19.2 ft.)					Selected Q 1951 *cfs*
Entrenchment Ratio	11.24		Radius of Curvature (Rc)		ft.
			Rc/Bankfull width:	0.00	

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload:	D_{90}	2 *in.*	Velocity required to move D_{90}:	2.9	*ft./sec.*
	D_{50}	*in.*	Velocity from Cross-Section data:	2.67	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.82	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.7	*ft./sec.*

Channel Evolution Stage IV Stream Type (Rosgen)

Notes

8.02 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec3	
Assisted by:	Wayne Kinney	
Date:	11/10/2005	
Channel Slope (***S***):	0.000360	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	9.6	*ft*

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

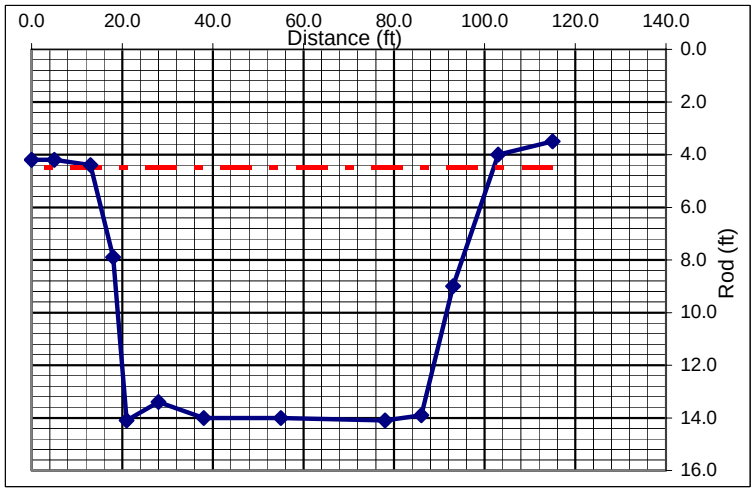
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	9.6 *ft*	9.9	
Channel Flow (***Q***):	1,895.9 *cfs*	1,847.4	
Channel Velocity:	2.7 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	710.6 *sq.ft.*	738.1	
Hydraulic Radius (***R***):	7.4 *ft*	6.7	

Survey Data:

Rod *(ft)*	Distance *(ft)*
3.5	115.0
4.0	103.0
9.0	93.0
13.9	86.0
14.1	78.0
14.0	55.0
14.0	38.0
13.4	28.0
14.1	21.0
7.90	18
4.40	13
4.20	5
4.20	0



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 11/10/2005 By Wayne Kinney

Stream Name North Fork Vermillion UTM Coord. E443642 N4464787

Landowner Name X-sec4

Drainage Area 118.12 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions Width 96 ft. Cross Sectional Area 572 sq. ft.

Depth 6.0 ft.

Reference Stream Gage:

Salt Fork near Homer Station No. 03338000 Gage Q_2 3760 cfs

Drainage Area 344 sq.mi Regression (4290 cfs

Champaign County, IL **REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope: 3.2 *ft./mi. (user-entered)* Regression Q_2 1794 cfs

ft/mi (from worksheet) Rainfall 2.95 in *(2 yr, 24 hr)* Adjusted Q_2 1572 cfs

0.0006 *ft./ft.* Regional Factor 1.057 Typical Range for Bankfull Discharge:

620 to 1260 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Stream Length *ft.*

Basic Field Data: Valley Length *ft.*

Bankfull Width 88 *ft.* Contour Interval feet

Mean Bankfull Depth 3.54 *ft.* Estimated Sinuosity

Width/Depth Ratio 24.86

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 5.5 *ft.* Surveyed: 0.00068 *ft./ft.* Cross-Section 668 *cfs*

Width at twice max. depth 1000 *ft.* Estimated: *ft./ft.* Basic field data 703 *cfs*

(11.0 ft.) Selected Q 686 *cfs*

Entrenchment Ratio 11.36 Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload: D_{90} 2 *in.* Velocity required to move D_{90}: 2.9 *ft./sec.*

D_{50} *in.* Velocity from Cross-Section data: 2.14 *ft./sec.*

GOAL: Develop confidence by matching Velocity from basic field data: 2.26 *ft./sec.*

velocities from different sources. Velocity from selected Q: 2.2 *ft./sec.*

Channel Evolution Stage V Stream Type (Rosgen)

Notes

5.81 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec4	
Assisted by:	Wayne Kinney	
Date:	11/10/2005	
Channel Slope (***S***):	0.000680	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	5.5	*ft*

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

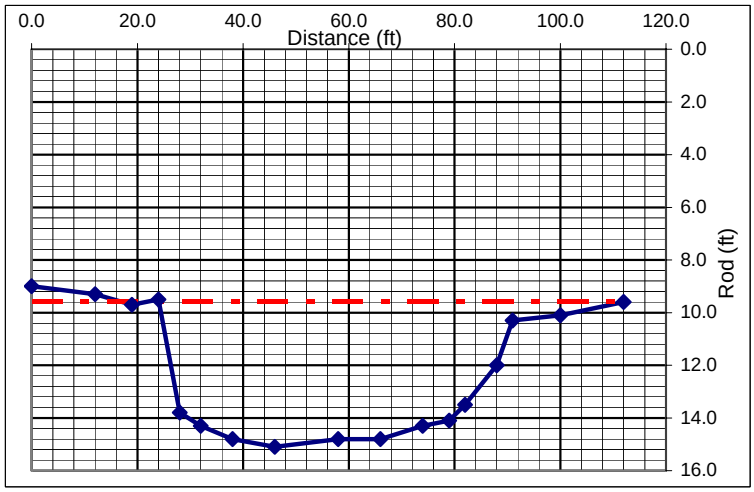
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	5.5 *ft*	5.5	
Channel Flow (***Q***):	667.7 *cfs*	667.7	
Channel Velocity:	2.1 *ft/sec*	2.1	
Cross-Sectional Area (***A***):	311.7 *sq.ft.*	311.7	
Hydraulic Radius (***R***):	3.3 *ft*	3.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
9.0	0.0
9.3	12.0
9.7	19.0
9.5	24.0
13.8	28.0
14.3	32.0
14.8	38.0
15.1	46.0
14.8	58.0
14.80	66
14.30	74
14.10	79
13.50	82
12.00	88
10.30	91
10.1	100
9.6	112



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 11/10/2005 By Wayne Kinney

Stream Name North Fork Vermillion UTM Coord. E442237 N4471277

Landowner Name X-sec5

Drainage Area 95.75 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	88 ft.	Cross Sectional Area	496 sq. ft.
	Depth	5.6 ft.		

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2 3760 cfs
	Drainage Area	344 sq.mi	Regression (4290 cfs
Champaign County, IL		**REFERENCE STREAM DATA ONLY**	

USGS Flood-Peak Discharge Predictions:

Valley Slope:	3.0	*ft./mi. (user-entered)*			Regression Q_2	1473 cfs
		ft/mi (from worksheet)	Rainfall	2.95 in *(2 yr, 24 hr)*	Adjusted Q_2	1291 cfs
	0.0006	*ft./ft.*	Regional Factor	1.057	Typical Range for Bankfull Discharge:	
					510 to 1040 cfs	

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

Basic Field Data:					
Bankfull Width	52	*ft.*	Stream Length		*ft.*
Mean Bankfull Depth	4.87	*ft.*	Valley Length		*ft.*
Width/Depth Ratio	10.68		Contour Interval		feet
			Estimated Sinuosity		

			Channel Slope:			Bankfull Q from:		
Max. Bankfull Depth	6	*ft.*	Surveyed:	0.00068	*ft./ft.*	Cross-Section	660	*cfs*
Width at twice max. depth	800	*ft.*	Estimated:		*ft./ft.*	Basic field data	707	*cfs*
(12.0 ft.)						Selected Q	684	*cfs*
Entrenchment Ratio	15.38		Radius of Curvature (Rc)		ft.			
			Rc/Bankfull width:	0.00				

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload:	D_{90}	1 *in.*	Velocity required to move D_{90}:	2.1 *ft./sec.*
	D_{50}	*in.*	Velocity from Cross-Section data:	2.61 *ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.79 *ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.7 *ft./sec.*

Channel Evolution Stage IV Stream Type (Rosgen)

Notes

7.14 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec5	
Assisted by:	Wayne Kinney	
Date:	11/10/2005	
Channel Slope (***S***):	0.000680	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	6.0	*ft*

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

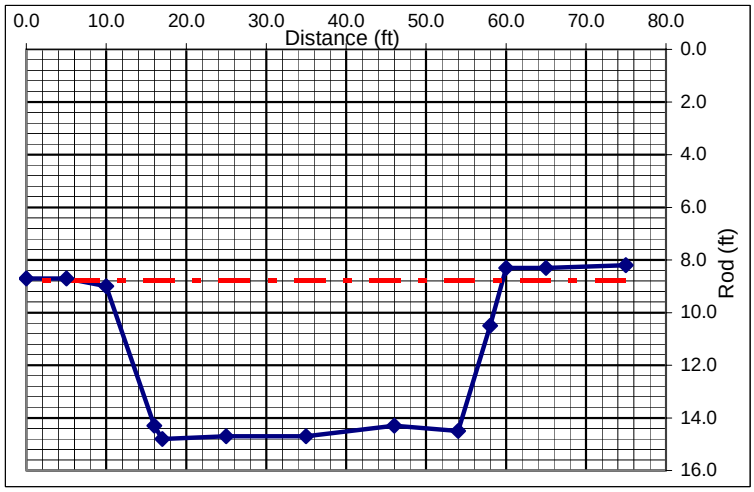
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	6.0 *ft*	6.1	
Channel Flow (***Q***):	660.4 *cfs*	634.7	
Channel Velocity:	2.6 *ft/sec*	2.5	
Cross-Sectional Area (***A***):	253.4 *sq.ft.*	258.8	
Hydraulic Radius (***R***):	4.4 *ft*	4.0	

Survey Data:

Rod *(ft)*	Distance *(ft)*
8.2	75.0
8.3	65.0
8.3	60.0
10.5	58.0
14.5	54.0
14.3	46.0
14.7	35.0
14.7	25.0
14.8	17.0
14.30	16
9.00	10
8.70	5
8.70	0



COMMENTS:

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County Vermilion T. R. Sec.

Date 11/10/2005 By Wayne Kinney

Stream Name North Fork Vermillion UTM Coord. E443744 N4477558

Landowner Name X-sec6

Drainage Area 63.05 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	75 ft.	Cross Sectional Area	374	sq. ft.
	Depth	5.0 ft.			

Reference Stream Gage:

Salt Fork near Homer	Station No.	03338000	Gage Q_2	3760 cfs	
	Drainage Area	344 sq.mi	Regression (	4290 cfs	
Champaign County, IL	**REFERENCE STREAM DATA ONLY**				

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.5	*ft./mi. (user-entered)*				Regression Q_2	970 cfs
		ft/mi (from worksheet)	Rainfall	2.95 in	*(2 yr, 24 hr)*	Adjusted Q_2	850 cfs
	0.0005	*ft./ft.*	Regional Factor	1.057		Typical Range for Bankfull Discharge:	
						340	to 690 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

			Stream Length		*ft.*
Basic Field Data:			Valley Length		*ft.*
Bankfull Width	50	*ft.*	Contour Interval		feet
Mean Bankfull Depth	4.41	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	11.34				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	5.8	*ft.*	Surveyed:	0.00068 *ft./ft.*	Cross-Section 478 *cfs*
Width at twice max. depth	1000	*ft.*	Estimated:	*ft./ft.*	Basic field data 576 *cfs*
(11.6 ft.)					Selected Q 527 *cfs*
Entrenchment Ratio	20.00		Radius of Curvature (Rc)		ft.
			Rc/Bankfull width:	0.00	

Bankfull Velocity Check: *(typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)*

Bedload:	D_{90}	1 *in.*	Velocity required to move D_{90}:	2.1	*ft./sec.*
	D_{50}	*in.*	Velocity from Cross-Section data:	2.17	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.61	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage V Stream Type (Rosgen)

Notes

8.35 cfs/sq. mi.

Natural Open Channel Flow

Project:	X-sec6	
Assisted by:	Wayne Kinney	
Date:	11/10/2005	
Channel Slope (***S***):	0.000680	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	5.8	*ft*

$$Q \equiv \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

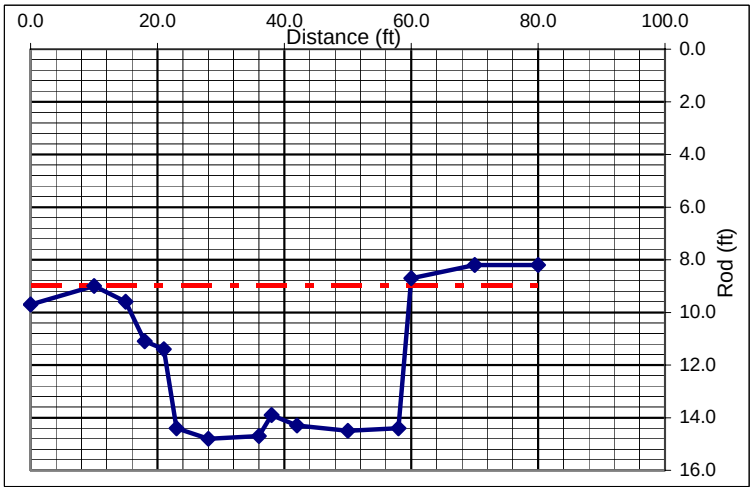
[back to I&E form](#)

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	5.8 *ft*	5.8	
Channel Flow (***Q***):	477.7 *cfs*	477.7	
Channel Velocity:	2.2 *ft/sec*	2.2	
Cross-Sectional Area (***A***):	220.5 *sq.ft.*	220.5	
Hydraulic Radius (***R***):	3.3 *ft*	3.3	

Survey Data:

Rod *(ft)*	Distance *(ft)*
9.7	0.0
9.0	10.0
9.6	15.0
11.1	18.0
11.4	21.0
14.4	23.0
14.8	28.0
14.7	36.0
13.9	38.0
14.30	42
14.50	50
14.40	58
8.70	60
8.20	70
8.20	80



COMMENTS: