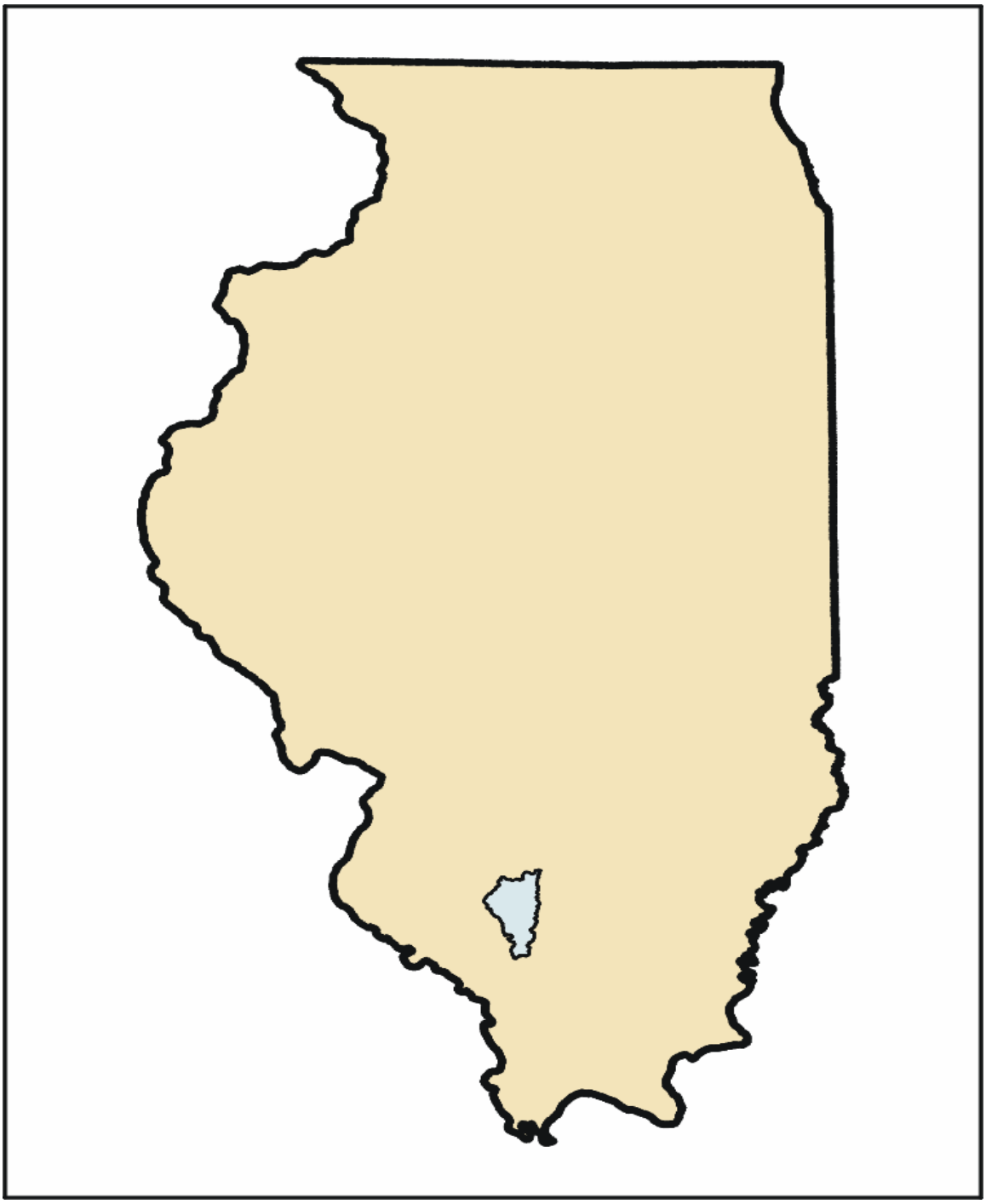


AERIAL ASSESSMENT REPORT FOR BEAUCOUP CREEK

JACKSON, PERRY AND WASHINGTON COUNTIES

SEPTEMBER 2005

PREPARED BY WAYNE KINNEY, FOR IL. DEPARTMENT OF AGRICULTURE

In May 2001, the Illinois EPA contracted with Camp Dresser & McKee to develop Total Maximum Daily Loads (TMDLs) for Beaucoup Creek. The impairments on Beaucoup Creek have been identified as manganese, sulfates, siltation, total dissolved solids (TDS), nitrogen, nitrates, phosphorus, low dissolved oxygen (DO), total suspended solids and other habitat alterations.

The final report of June 2004 lists Beaucoup segment NC10 as impaired by low DO and NC03 as impaired by sulfates and TDS. Segment NC10 begins at the confluence with White Walnut Creek and extends downstream for 10 miles. NC03 stretches from the confluence with Galum Creek and extends upstream for 8.5 miles.

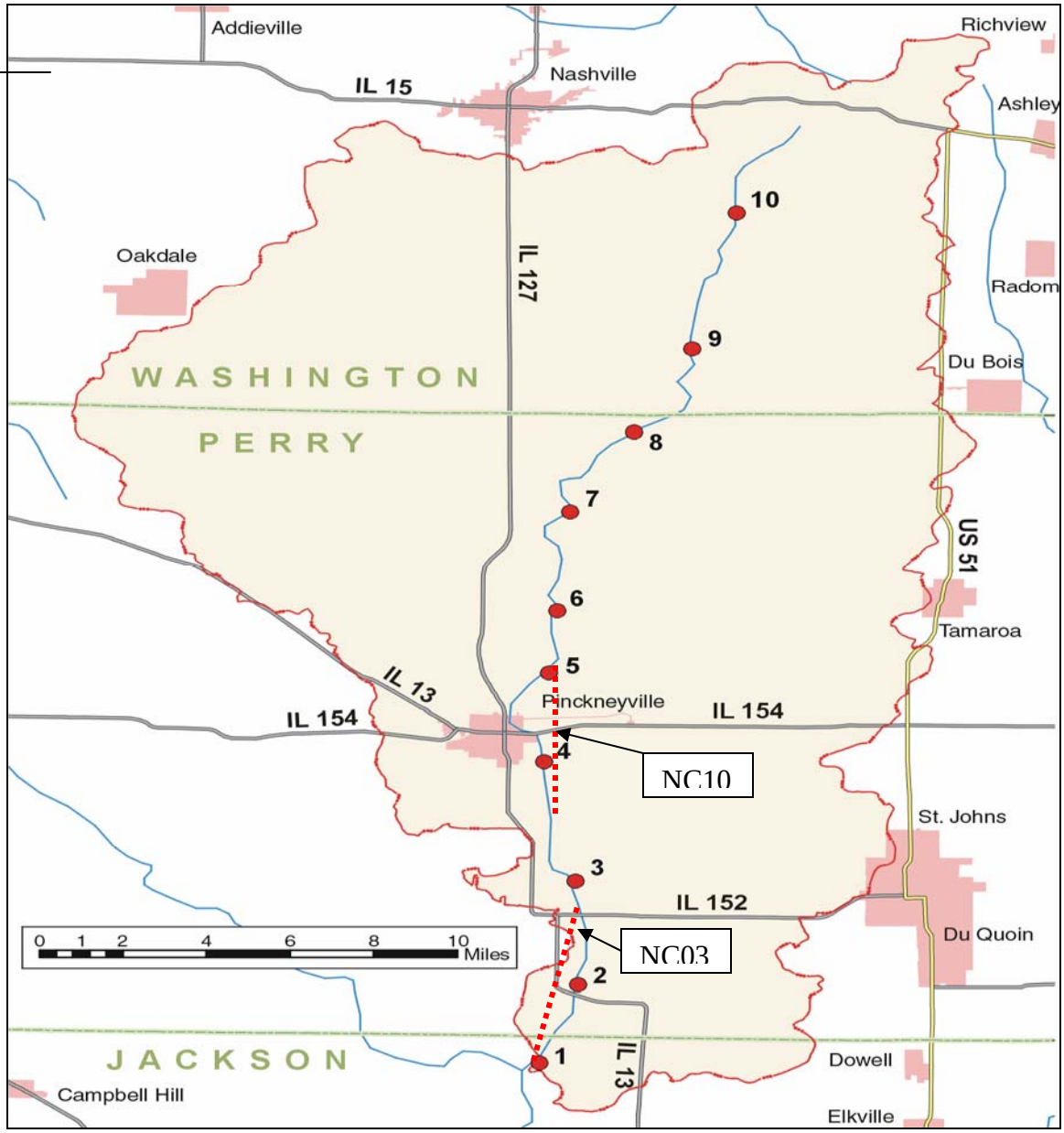


Fig. 1 Aerial Assessment Map of Beaucoup Creek Watershed and approximate impaired segment locations

Assessment Procedure

Low level geo-referenced video was taken of Beaucoup Creek 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 began at the Illinois Central RR Bridge (abandoned) over Beaucoup Creek just inside Jackson County. The mapping progressed upstream to approximately 3 miles south of IL. Rte. 15 near Beaucoup, Illinois. Aerial video of tributaries was not part of the project, regardless of the stream size or vegetation.

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.

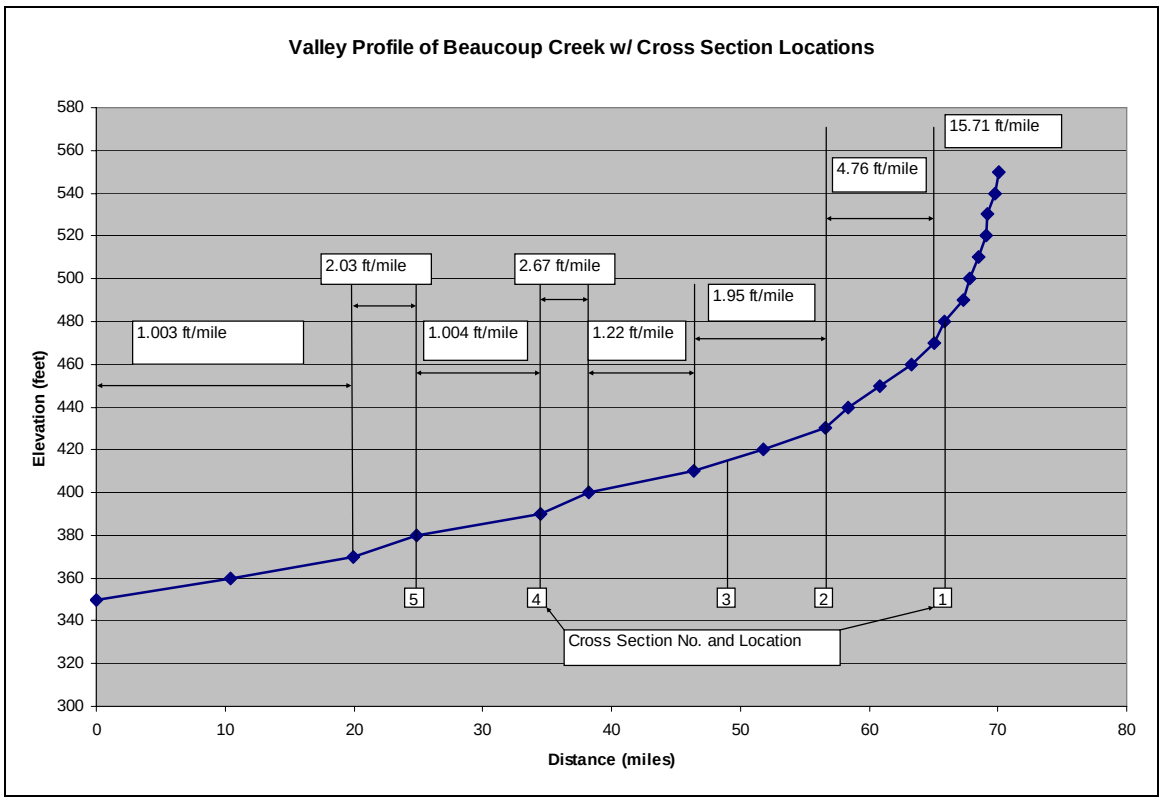


Figure 2 Channel Profile of Beaucoup Creek

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.

The DVD has been divided into “chapters” of approximately ten 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. 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”.

CHAPTERS ON DVD AND ASSESSMENT REPORT

DVD Disc	DVD chapter	Beginning Time	Report Chapter
1	2	10:00	1
1	3	20:00	2
1	4	30:00:00	3
1	5	40:00:00	4
2	2	10:00	5
2	3	20:00	6
2	4	30:00:00	7
2	5	40:00:00	8
2	6	50:00:00	9

Note: Flight path is from downstream to upstream

Fig. 3 DVD Chapters and Report Chapter Guide

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.

Five cross sections were taken at selected locations on Beaucoup Creek 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 Fig. 5 and the approximate location of each cross section along the channel profile is found in Fig. 2. Aerial views of cross sections locations are shown in Figs. 8,9,11,12 and 15 thru 19. Exact locations as Eastings and Northings and more detail can be found in Appendix A

FEATURES IDENTIFIED BY CHAPTER									
CHAPTER	ROCK OUTCROP	LOGJAM	GEOTECH FAILURE	DEPOSITION	BED CONTROL	BANK CONTROL	BREAK POINT	EROSION	SEVERE EROSION
1	0	0	0	0	0	0	0	4	0
2	1	6	8	0	1	1	0	23	0
3	6	4	3	0	0	1	1	19	0
4	12	3	17	0	1	1	3	24	0
5	0	3	2	0	1	1	0	32	3
6	2	10	2	0	1	0	1	41	0
7	2	6	17	2	0	0	3	52	0
8	1	8	15	0	1	0	1	44	1
9	0	10	13	3	2	0	6	53	0
TOTALS	24	50	77	5	7	4	15	292	4

Fig. 4 Features by Chapter identified with aerial assessment

BEAUCOUP CREEK CROSS SECTION SUMMARY																		
X-sec	Valley Slope ft/m	ADA sq. mi.	Q2 cfs	BKF Depth ft.	BKF Width ft.	BKF cfs	W/D	Max D feet	BKF CFS /sq. mile	Vel. FPS	BKF cfs/ Q2 cfs	BKF X- Area	Top Bk X- Area	Top Bk/ BKF area	Top Bk. Depth ft.	Top Bk. D/ Max D ft.	Top Bank cfs	TB/cfs/ sq. mi.
1	14.8	11	829	2.84	32	360	11.27	3.6	31.80	4	0.43	91	255	2.80	7.7	2.14	1196	105.65
2	6.7	45	1672	6.26	40	908	6.39	9.4	20.37	3.6	0.54	251	255	1.02	9.5	1.01	865	19.40
3	4.5	110	2817	7.9	64	1388	8.1	9.9	12.64	2.7	0.49	505	616	1.22	11.5	1.16	1580	14.39
4	2.6	225	3842	8.26	97	1940	11.74	13.8	8.61	2.4	0.50	801	801	1.00	13.8	1.00	1887	8.38
5	2.1	278	4058	9.06	100	2156	11.04	14.6	7.75	2.4	0.53	894	894	1.00	14.6	1.00	1914	6.88

Fig. 5 Cross Section Summary

A plot of the discharge probability curve from USGS Gage # 05599000 over the last 24 yrs. of continuous record (1959-1982) in Fig. 6 indicates the 2 yr. discharge (50% probability) at approx. 3400 cfs and the 1.5 yr. discharge (67% probability) at approx. 2700 cfs. The drainage area at Gage # 05599000 near Matthews, IL is 292 sq. miles; therefore the discharge per sq. mile is 11.64 and 9.25 cfs per sq. mile respectively for the 2 yr. and the 1.5 yr. R.I. discharge. The field determined “bankfull” discharge in the study area ranges from 7.75 to 31.8 cfs/sq. mile. Referring to Fig. 5 the data indicates the bankfull discharge at cross section 5 is 7.75 cfs per square mile. Cross section 5 has a drainage area of 278 sq. mi., therefore if the data is extrapolated to the former gage site the discharge would be 2263 cfs (7.75 x 292) and represents a Return Interval (R.I.) of approx. 1.2 yrs at cross section 5 near the gage site. It is expected that the cfs/sq. mile discharge would increase as the drainage area decreases and the valley slope increases. This is the case with Beaucoup Creek. It should be noted however that the field determined bankfull elevations at cross sections 2, 4 and 5 are actually at the top bank elevation and therefore indicate that Beaucoup Creek is well connected to its floodplain at these locations.

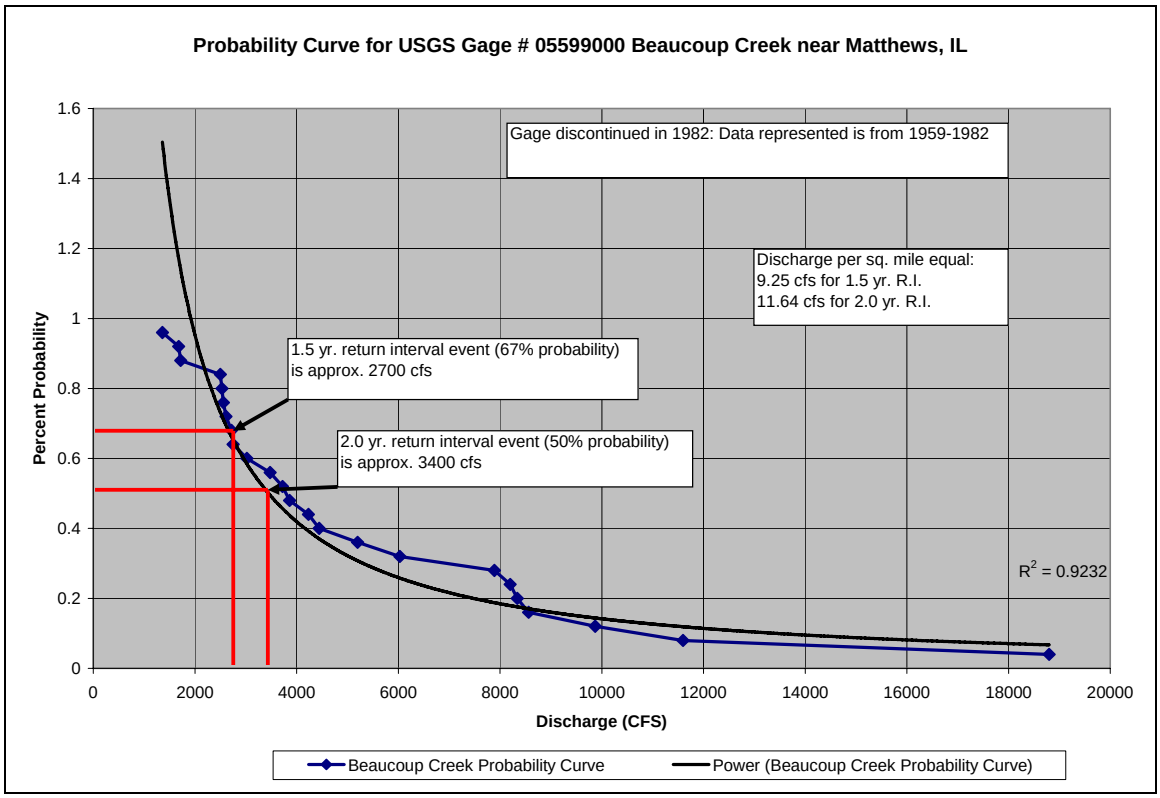


Fig. 6 Probability Curve –USGS Gage 05599000 for period 1959-1982

General Observations

1. Beaucoup Creek appears to be generally well connected to its floodplain with top bank elevations being at or near the field determined bankfull elevations with the exception of cross section 1 at the very upper end of the study area.
2. Cross section 1 is incised with top bank being more than twice the maximum bankfull depth.
3. Cross section 4 (near Pinckneyville) appears to be downcutting with a cemented layer having high manganese concentrations being eroded in channel bed at riffle locations. Although the bankfull discharge is at top bank, this could be an area of degrading channel bed.
4. There is an observed change in the frequency of erosion sites, geotech failures and logjams near Bowles Bottom Road in DVD Chapter 6. Respectively 65%, 61% and 68% of these observations are found in chapters 6 thru 9.
5. The source of the manganese in Beaucoup Creek has not been confirmed and data is limited according to the final report. Streambank and streambed erosion contributions should not be overlooked as natural high concentrations were found at some locations in the bank and bed of Beaucoup Creek.
6. Page 10-3 of the Beaucoup Creek TMDL Report recommends ..”passive treatment systems would be the best solution for controlling manganese from abandoned coal mines in the Beaucoup Creek Watershed”. Included in the list as the simplest passive treatment method is the use of “Open Limestone Channels” which can consist of “placing limestone fragments directly in a contaminated

stream". The use of this passive treatment would be well suited to stabilizing the eroding streambanks found in the study area.

7. The use of Rock Riffle Grade Control Structures (Newbury Riffles) should be considered in Beaucoup Creek to aid in increasing alkalinity and also aid in the low DO levels by providing additional aeration. Each riffle would require several hundred tons of limestone in addition to any other bank stabilization treatment utilizing limestone. Using Newbury Hydraulic's technique of calculating specific energy and applying to "critical flow depth" vs. "normal flow depth" allows for some manipulation of the bed without causing backwater effects. (Newbury Hydraulics Stream Design Manual) In the case of Beaucoup Creek initial calculations would allow riffle heights of 3 to 5 feet above the bed throughout the study reach.

Recommendations

Chapter 1 through 2

These chapters represent the lower end of the study reach, but they also represent the TMDL segment NC03 which is impaired by sulfates and total dissolved solids. There are a total of 11 geotechnical failures and 46 erosion sites in this reach.
This reach contains cross section 5, located downstream of IL. Rte. 152, which is well connected to the floodplain with an out-of-bank and a "geomorphic bankfull" return interval frequency of approx. 1.2 years. Therefore since neither DO nor manganese has been identified as an impairment in this reach and the width/depth is around eleven (11) the recommended treatment for the streambank erosion in this reach to use Stone Toe Protection at the rate of 1 ton per foot where bank erosion is to be controlled.

TREATMENT --CHAPTERS 1 THRU 2					
Chapter	Erosion Sites	Average Length	Total Length	Average Cost/foot	Total Cost
1	4	400	1600	$30.00	$48,000.00
2	23	400	9200	$30.00	$276,000.00
Total	27		10800		$324,000.00

Fig. 7 Treatment Cost Estimate Chapter 1 and 2

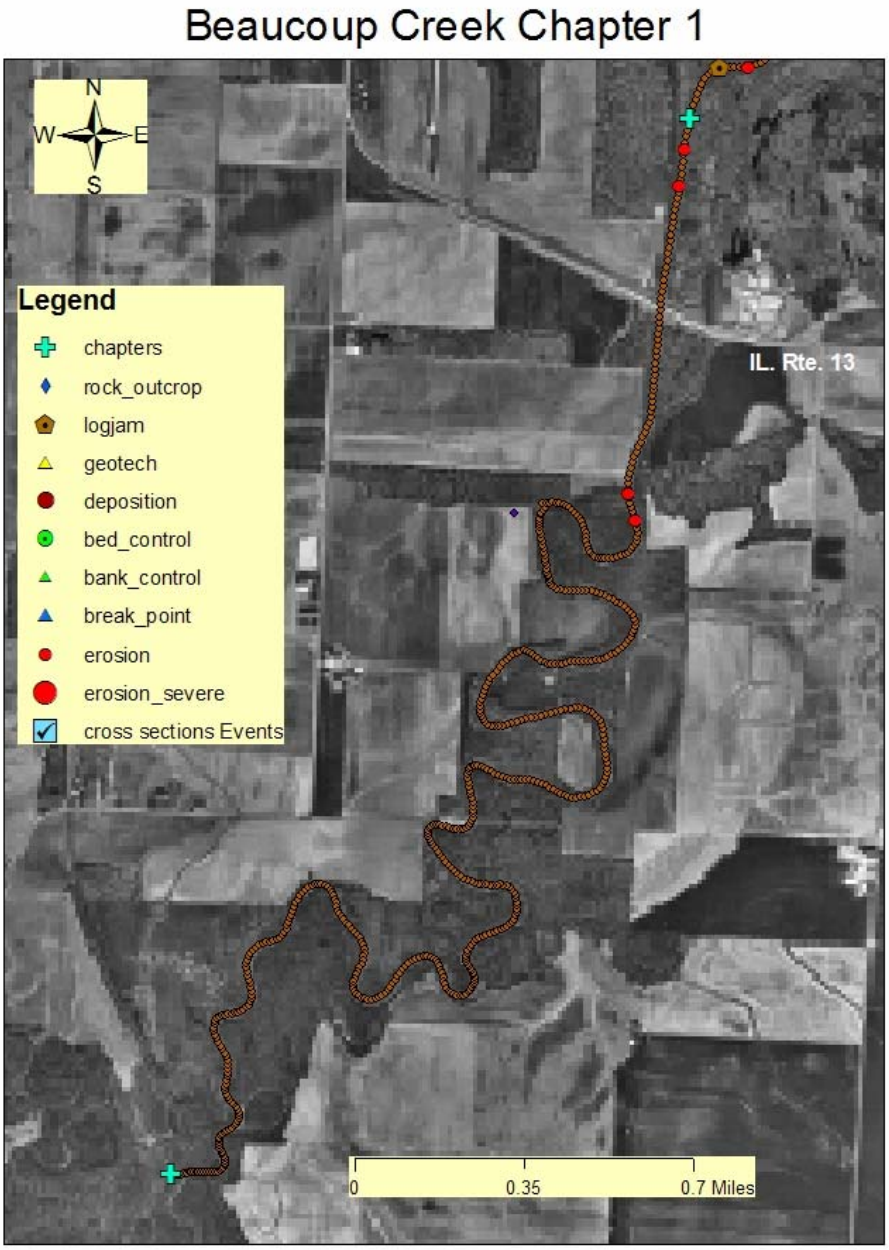


Fig. 8 DVD Chapter 1

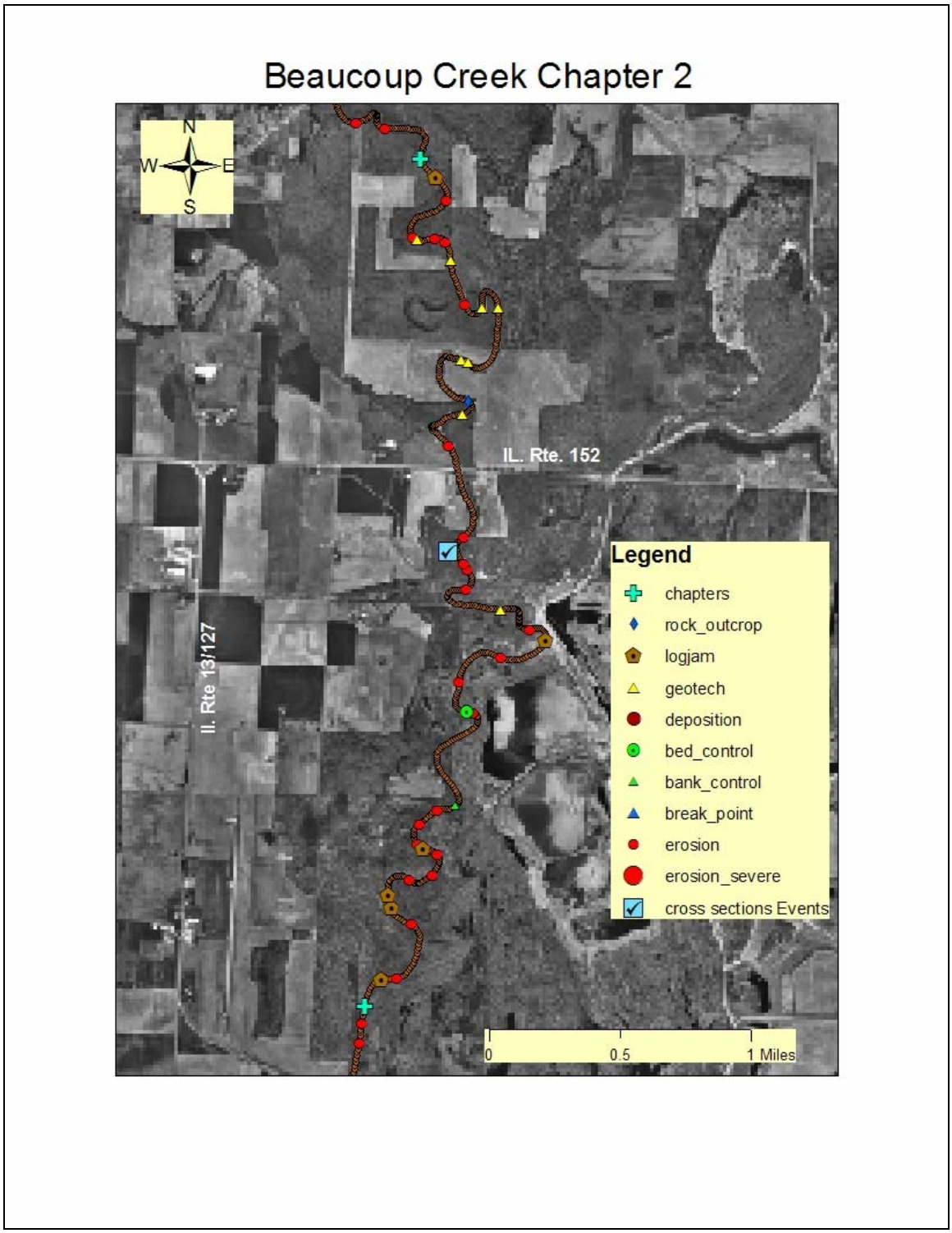


Fig. 9 DVD Chapter 2

Chapters 3 through 4

This segment closely corresponds with TMDL segment NC10 which is impaired by low Dissolved Oxygen levels. This segment also has exposed manganese concentrations exposed in the bank and bed at cross section 4 and appears to be a potentially degrading reach. The degradation may be the result of a channel cutoff of over 0.6 mile located downstream of Rte. 154 approximately one mile. Approximately 0.5 mile above Rte. 154 there is a large low head dam built across Beaucoup Creek that will halt any upward migration of a knickpoint.

There is however 4.25 miles of stream in this reach that is recommended to have Rock Riffle Grade Controls installed to increase aeration and halt downcutting. These structures will also have a positive effect on the alkalinity of Beaucoup Creek although this section is not listed for impairment by manganese.

In addition there are 43 erosion sites and 20 geotechnical failures in this reach. The geotechnical failures will be partially stabilized by the Rock Riffle Grade Controls where the base flow elevations are raised to create positive pore pressure to enhance stability. The erosion sites are recommended to be treated with Stone Toe Protection at 1 ton of quarried limestone per foot. Both the STP and the Rock Riffles will act as passive treatment for any manganese impairment that may exist.

TREATMENT --CHAPTERS 3 through 4					
Chapter	**Erosion Sites**	**Average Length**	**Total Length**	**Average Cost/foot**	**Total Cost**
3	19	400	7600	$30.00	$228,000.00
4	24	400	9600	$30.00	$288,000.00
Total	**43**		**17200**		**$516,000.00**
	Rock Riffles	**Average Tonnage**	**Ave. Cost Ton**	**Average Cost/Riffle**	
3	50	550	$30.00	$16,500.00	$825,000.00
4	20	550	$30.00	$16,500.00	$330,000.00
Total	**70**				**$1,155,000.00**

Fig. 10 Treatment Cost Estimate Chapter 3 and 4

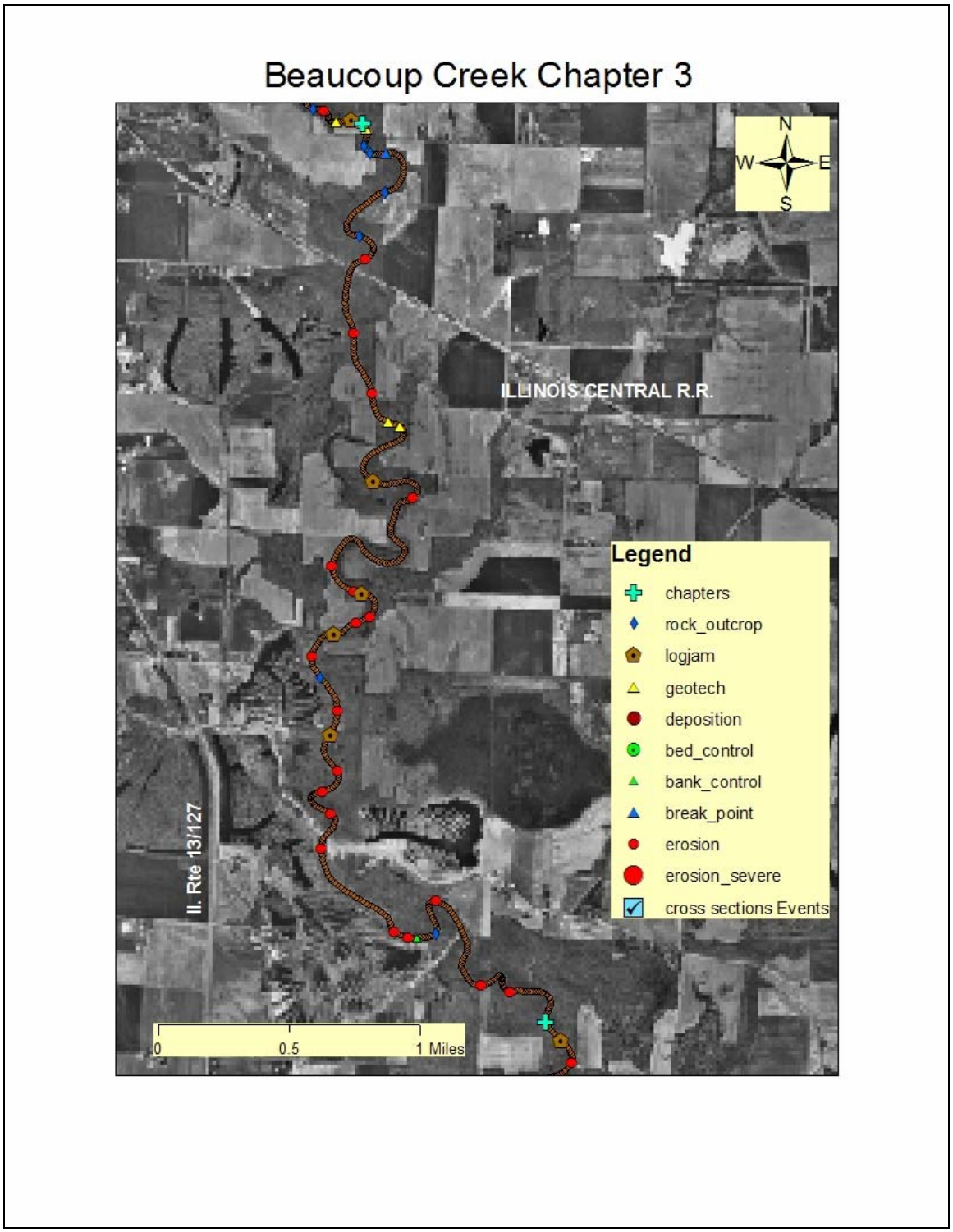


Fig. 11 DVD Chapter 3

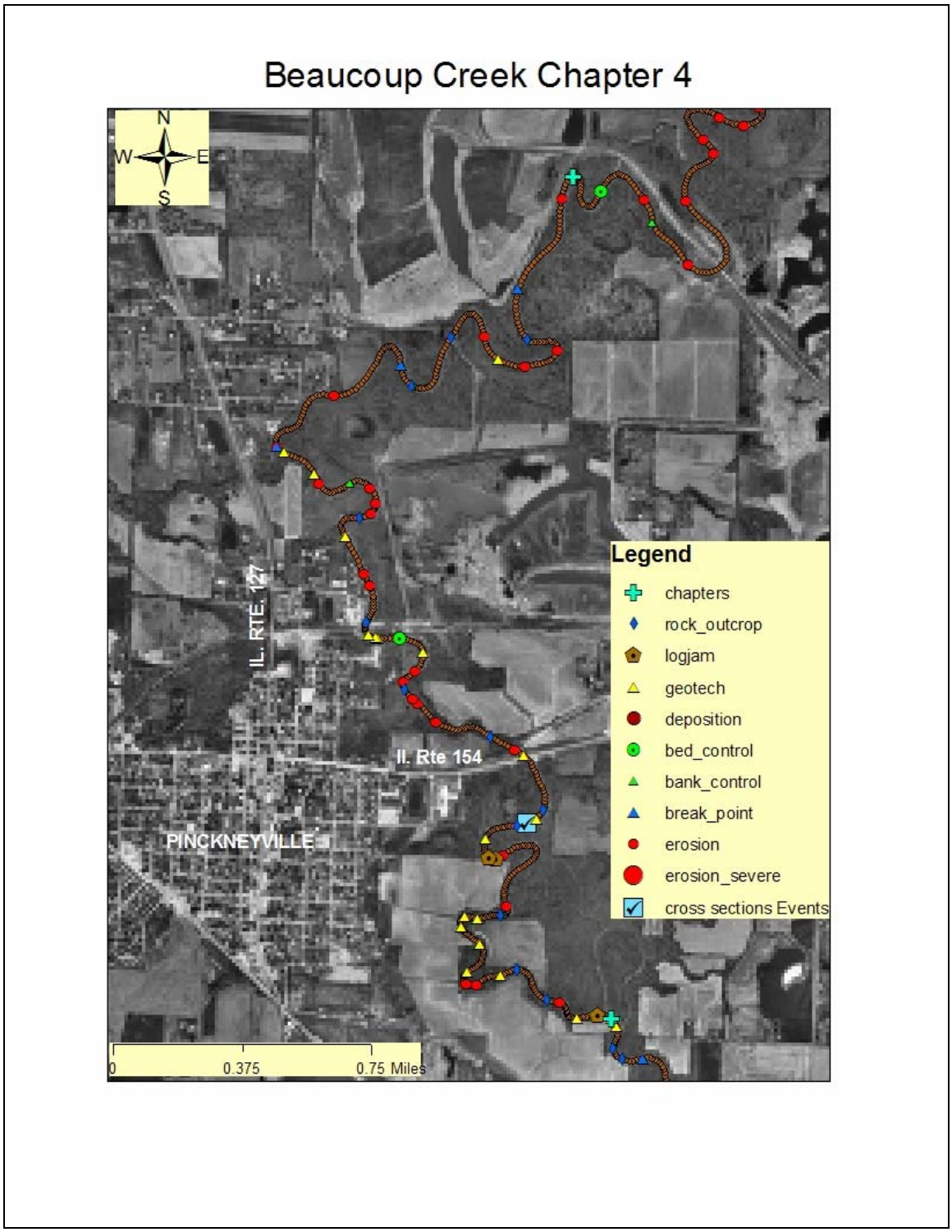


Fig. 12 DVD Chapter 4

Chapters 5 through 9

This reach is the main channel of Beaucoup Creek above segment NC10 and is not listed as impaired in the final report. This reach is also well connected to its floodplain until reaching the very upper end of the study reach and therefore the conclusion is that there has been little downcutting outside of Chapter 9. Therefore with width/depth ratios less than 12, the recommendation for this reach is to install Stone Toe Protection at the rate of 0.75 ton per foot on all eroding sites and in addition install Rock Riffle Grade Controls in Chapter 9.

As indicated earlier under the general observations, this reach has much more active erosion that the lower reaches. There are 49 geotechnical failures and 222 erosion sites in this reach. Geotechnical failure in this reach are generally not recommended for treatment, however field investigation of some sites may find economical solutions, however they are not included in this report.

TREATMENT --CHAPTERS 5 through 9 (STP)					
Chapter	Erosion Sites	Average Length	Total Length	Average Cost/foot	Total Cost
5	32	300	9600	$25.00	$240,000.00
6	41	300	12300	$25.00	$307,500.00
7	52	250	13000	$25.00	$325,000.00
8	44	250	11000	$25.00	$275,000.00
9	53	200	10600	$25.00	$265,000.00
Total	**222**		**56500**		**$1,412,500.00**

Fig. 13 Stone Toe Protection Treatment Cost for Chapters 5 through 9

TREATMENT --CHAPTERS 9 Riffles					
Chapter	Number Riffles	Average Tons Stone	Total Tons Stone	Average Cost/ton	Total Cost
9	140	175	24,500	$30.00	$735,000.00
Total	**140**		**24500**		**$735,000.00**

Fig. 14 Riffle Treatment Cost for Chapter 9

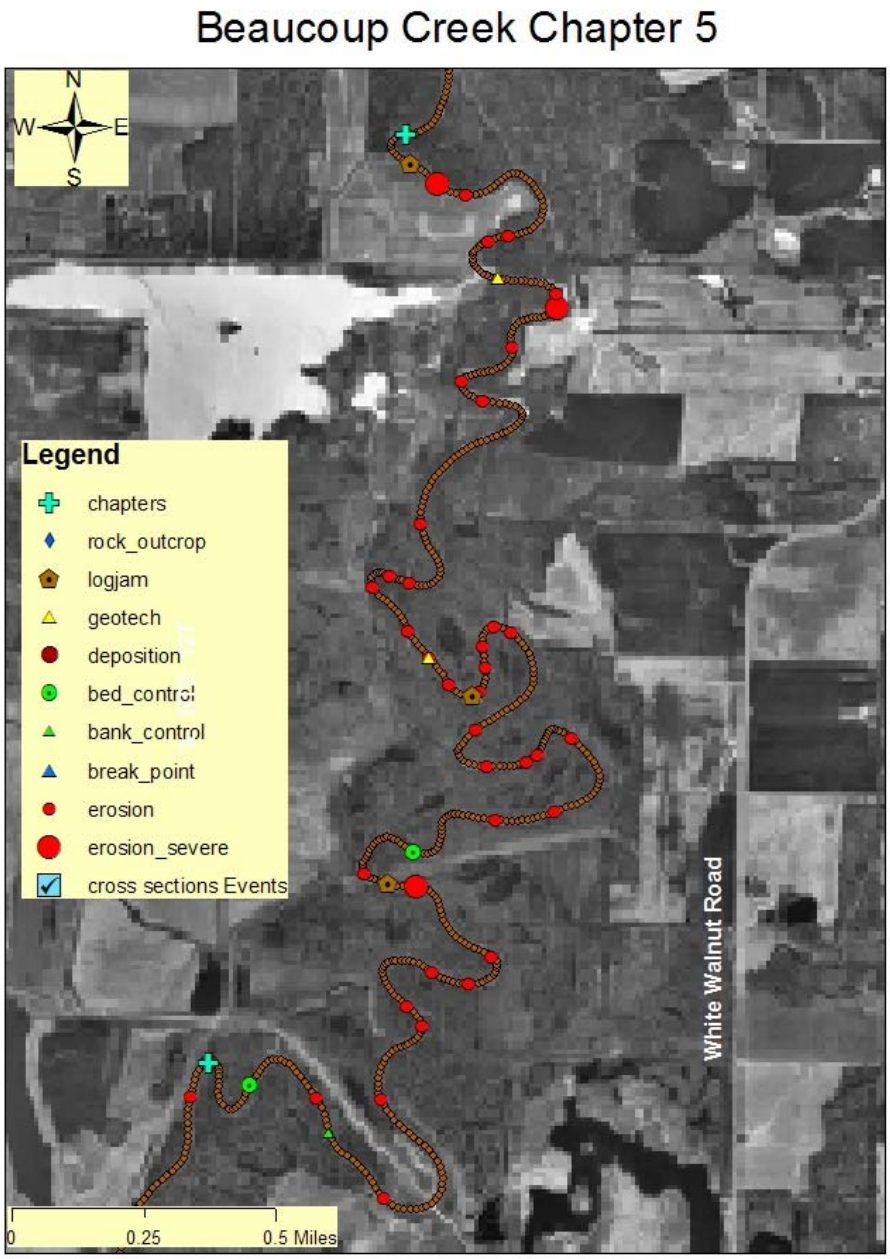


Fig. 15 DVD Chapter 5

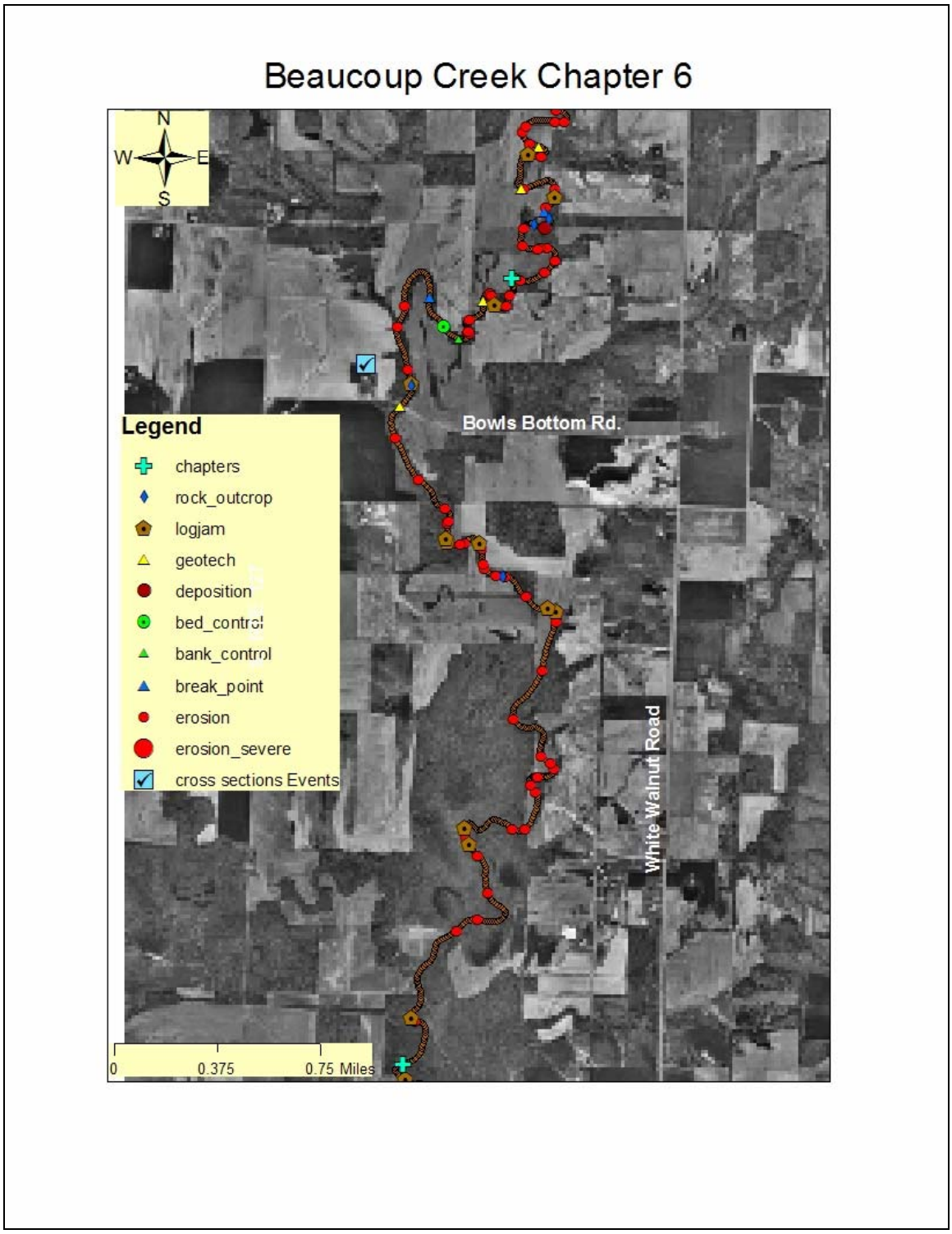


Fig. 16 DVD Chapter 6

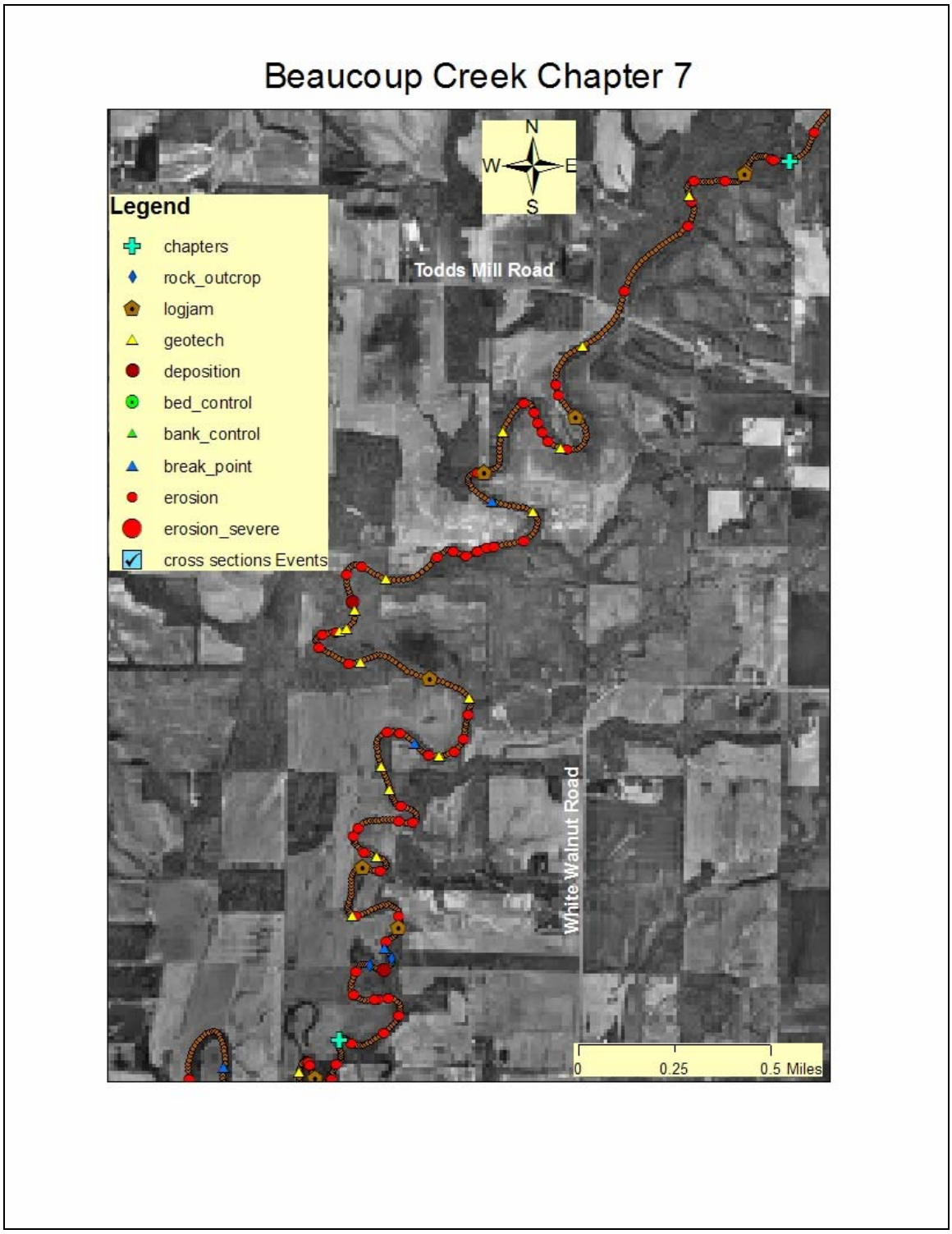


Fig. 17 DVD Chapter 7

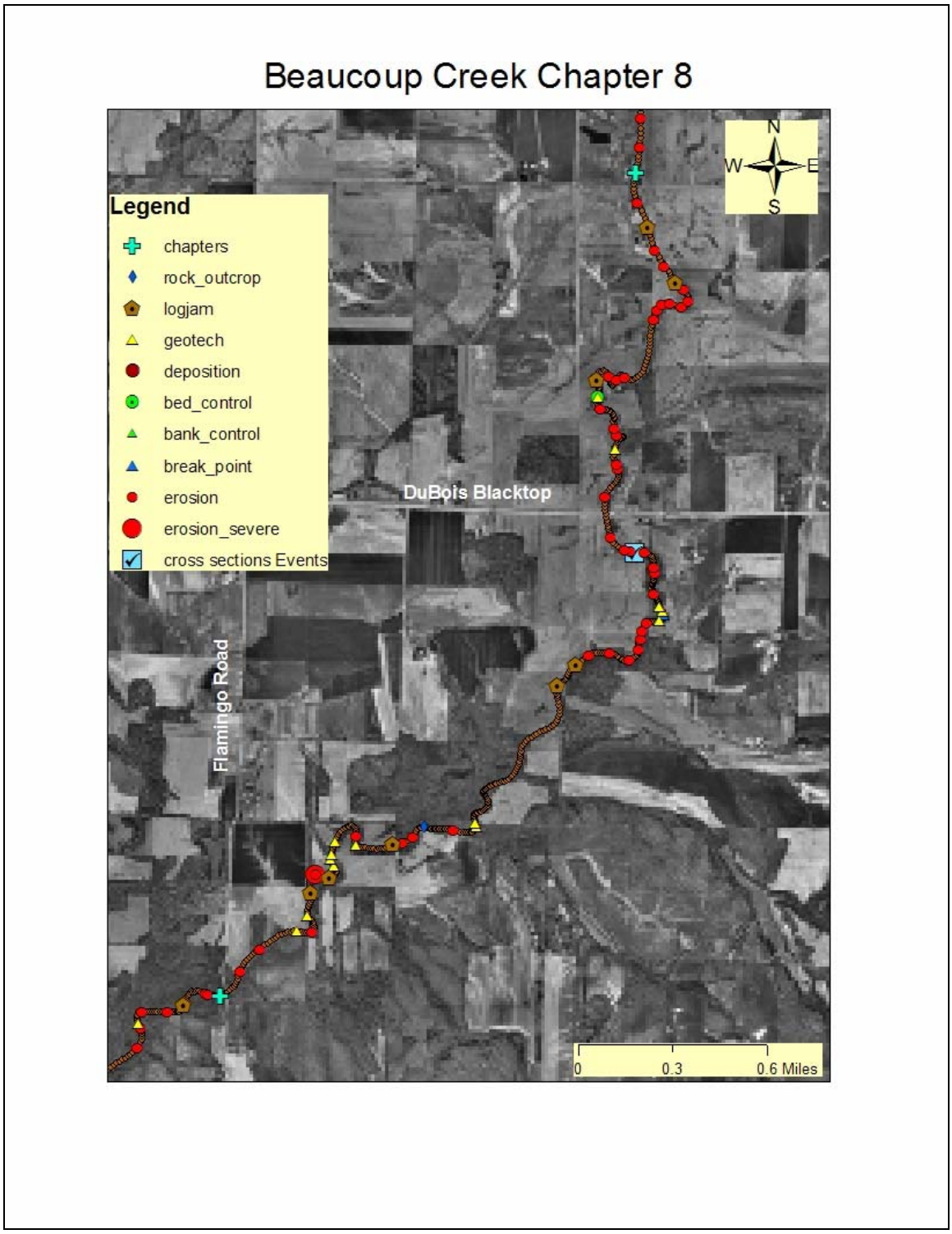


Fig. 18 DVD Chapter 8

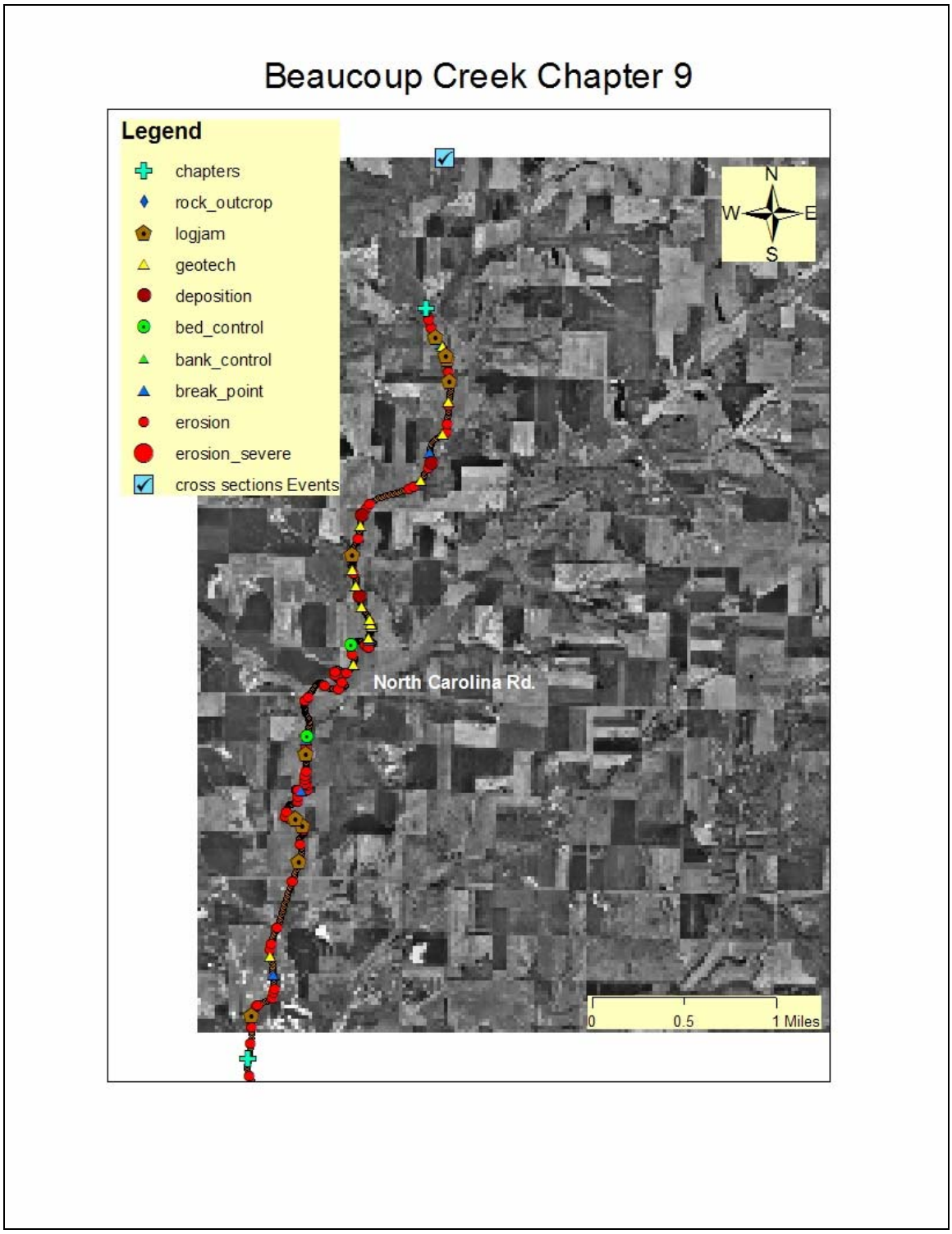


Fig. 19 DVD Chapter 9

APPENDIX A

CROSS SECTION DATA

Stream Stabilization I & E Form

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

County Perry T. R. Sec.

Date 9/8/2005 By Wayne Kinney

Stream Name Beaucoup Creek UTM Coord. E299520 N4243317

Landowner Name x-sec 1

Drainage Area 11.32 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions Width 39 ft. Cross Sectional Area 117 sq. ft.

Depth 3.0 ft.

Reference Stream Gage:

Beaucoup Creek near Matthews Station No. 05599000 Gage Q_2 4720 cfs

Drainage Area 292 sq.mi Regression (5300 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 14.8 *ft./mi. (user-entered)* Regression Q_2 931 cfs

ft/mi (from worksheet) Rainfall 3.50 in *(2 yr, 24 hr)* Adjusted Q_2 829 cfs

0.0028 *ft./ft.* Regional Factor 0.983 Typical Range for Bankfull Discharge:

330 to 670 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 32 *ft.* Contour Interval feet

Mean Bankfull Depth 2.84 *ft.* Estimated Sinuosity

Width/Depth Ratio 11.27

Channel Slope: Bankfull Q from:

Max. Bankfull Depth 3.6 *ft.* Surveyed: 0.00297 *ft./ft.* Cross-Section 350 *cfs*

Width at twice max. depth 43 *ft.* Estimated: *ft./ft.* Basic field data 370 *cfs*

(7.2 ft.) Selected Q 360 *cfs*

Entrenchment Ratio 1.34 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: 3.84 *ft./sec.*

GOAL: Develop confidence by matching Velocity from basic field data: 4.07 *ft./sec.*

velocities from different sources. Velocity from selected Q: 4.0 *ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

Natural Open Channel Flow

Project:	x-sec 1	
Assisted by:	Wayne Kinney	
Date:	9/8/2005	
Channel Slope (***S***):	0.002970	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	3.6	*ft*

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

assuming uniform, steady flow

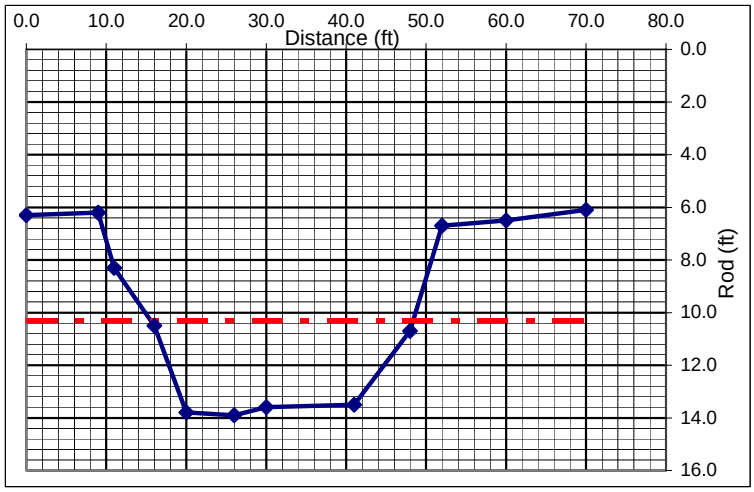
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	3.6 *ft*	7.7	
Channel Flow (***Q***):	349.5 *cfs*	1,196.0	
Channel Velocity:	3.8 *ft/sec*	4.7	
Cross-Sectional Area (***A***):	91.0 *sq.ft.*	254.9	
Hydraulic Radius (***R***):	2.6 *ft*	3.5	

Survey Data:

Rod *(ft)*	Distance *(ft)*
6.3	0.0
6.2	9.0
8.3	11.0
10.5	16.0
13.8	20.0
13.9	26.0
13.6	30.0
13.5	41.0
10.7	48.0
6.70	52
6.50	60
6.10	70



COMMENTS:

Stream Stabilization I & E Form

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

County Perry T. R. Sec.

Date 9/8/2005 By Wayne Kinney

Stream Name Beaucoup Creek UTM Coord. E297794 N4233470

Landowner Name x-sec 2

Drainage Area 44.58 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	66 ft.	Cross Sectional Area	295 sq. ft.
	Depth	4.5 ft.		

Reference Stream Gage:

Beaucoup Creek near Matthews — Station No. 05599000 — Gage Q_2 4720 cfs

Drainage Area 292 sq.mi — Regression (5300 cfs

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

USGS Flood-Peak Discharge Predictions:

Valley Slope: 6.7 *ft./mi. (user-entered)* — Regression Q_2 1878 cfs

ft/mi (from worksheet) — Rainfall 3.50 in *(2 yr, 24 hr)* — Adjusted Q_2 1672 cfs

0.0013 *ft./ft.* — Regional Factor 0.983 — Typical Range for Bankfull Discharge: 660 to 1340 cfs

Local Stream Morphology:

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

Manning's "n" 0.04

Basic Field Data:

Bankfull Width 40 *ft.*

Mean Bankfull Depth 6.26 *ft.*

Width/Depth Ratio 6.39

Max. Bankfull Depth 9.4 *ft.*

Width at twice max. depth 600 *ft.*

(18.8 ft.)

Entrenchment Ratio 15.00

Stream Length *ft.*

Valley Length *ft.*

Contour Interval feet

Estimated Sinuosity

Channel Slope:

Surveyed: 0.000902 *ft./ft.*

Estimated: *ft./ft.*

Radius of Curvature (Rc) ft.

Rc/Bankfull width: 0.00

Bankfull Q from:

Cross-Section 865 *cfs*

Basic field data 952 *cfs*

Selected Q 908 *cfs*

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: 3.45 *ft./sec.*

GOAL: Develop confidence by matching velocities from different sources.

Velocity from basic field data: 3.80 *ft./sec.*

Velocity from selected Q: 3.6 *ft./sec.*

Channel Evolution Stage II — Stream Type (Rosgen)

Notes

Natural Open Channel Flow

Project:	x-sec 2	
Assisted by:	Wayne Kinney	
Date:	9/8/2005	
Channel Slope (***S***):	0.000902	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	9.4	*ft*

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

assuming uniform, steady flow

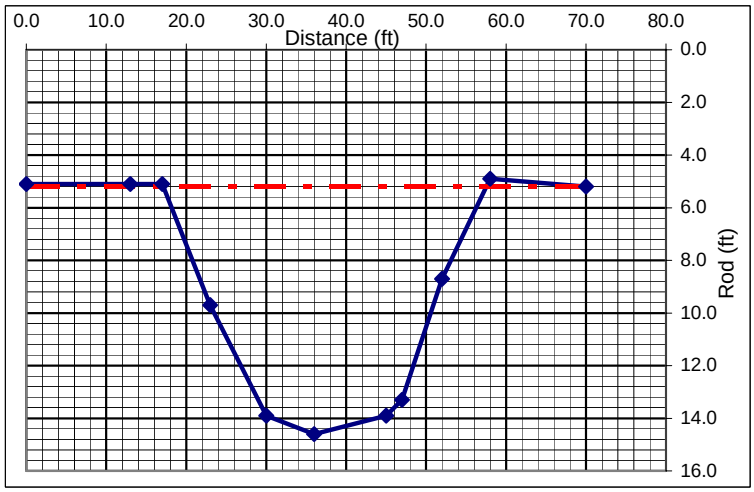
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	9.4 *ft*	9.5	
Channel Flow (***Q***):	865.2 *cfs*	690.2	
Channel Velocity:	3.5 *ft/sec*	2.7	
Cross-Sectional Area (***A***):	250.6 *sq.ft.*	254.9	
Hydraulic Radius (***R***):	5.4 *ft*	3.8	

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.2	70.0
4.9	58.0
8.7	52.0
13.3	47.0
13.9	45.0
14.6	36.0
13.9	30.0
9.7	23.0
5.1	17.0
5.10	13
5.10	0



COMMENTS:

Cross Section modified @ distance 12 to reflect truer WP

Natural Open Channel Flow

Project:	x-sec 2	
Assisted by:	Wayne Kinney	
Date:	9/8/2005	
Channel Slope (S):	0.000902	ft/ft
Manning's ***n***:	0.040	
Flow Depth:	9.4	ft

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

assuming uniform, steady flow

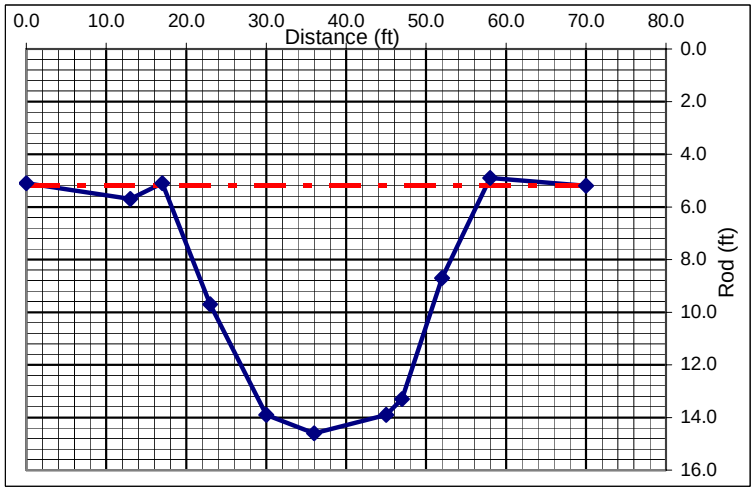
back to I&E form

Clear Cells

		Trial Depth 2	Trial Depth 3
Selected Flow Depth:	9.4 *ft*		
Channel Flow (***Q***):	740.3 *cfs*		
Channel Velocity:	2.9 *ft/sec*		
Cross-Sectional Area (***A***):	254.2 *sq.ft.*		
Hydraulic Radius (***R***):	4.2 *ft*		

Survey Data:

Rod *(ft)*	Distance *(ft)*
5.2	70.0
4.9	58.0
8.7	52.0
13.3	47.0
13.9	45.0
14.6	36.0
13.9	30.0
9.7	23.0
5.1	17.0
5.70	13
5.10	0



COMMENTS:

True Cross Section

Stream Stabilization I & E Form

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

County Perry T. R. Sec.

Date 9/8/2005 By Wayne Kinney

Stream Name Beaucoup Creek UTM Coord. E292932 N4227026

Landowner Name x-sec 3

Drainage Area 109.77 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	93 ft.	Cross Sectional Area	544 sq. ft.
	Depth	5.8 ft.		

Reference Stream Gage:

Beaucoup Creek near Matthews	Station No.	05599000	Gage Q_2 4720 cfs
	Drainage Area	292 sq.mi	Regression (5300 cfs
Perry County, IL		**REFERENCE STREAM DATA ONLY**	

USGS Flood-Peak Discharge Predictions:

Valley Slope:	4.5	*ft./mi. (user-entered)*			Regression Q_2 3163 cfs
		ft/mi (from worksheet)	Rainfall 3.50 in	*(2 yr, 24 hr)*	Adjusted Q_2 2817 cfs
	0.0009	*ft./ft.*	Regional Factor 0.983		Typical Range for Bankfull Discharge:
					1120 to 2260 cfs

Local Stream Morphology:

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

Manning's "n" 0.04

Basic Field Data:					
			Stream Length		*ft.*
			Valley Length		*ft.*
Bankfull Width	64	*ft.*	Contour Interval		feet
Mean Bankfull Depth	7.9	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	8.10				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	9.9	*ft.*	Surveyed:	0.000369 *ft./ft.*	Cross-Section 1339 *cfs*
Width at twice max. depth	2000	*ft.*	Estimated:	*ft./ft.*	Basic field data 1436 *cfs*
(19.8 ft.)					Selected Q 1388 *cfs*
Entrenchment Ratio	31.25		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:	2.65	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.84	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.7	*ft./sec.*

Channel Evolution Stage III Stream Type (Rosgen)

Notes

Natural Open Channel Flow

Project:	x-sec 3	
Assisted by:	Wayne Kinney	
Date:	9/8/2005	
Channel Slope (***S***):	0.000369	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	9.9	*ft*

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

assuming uniform, steady flow

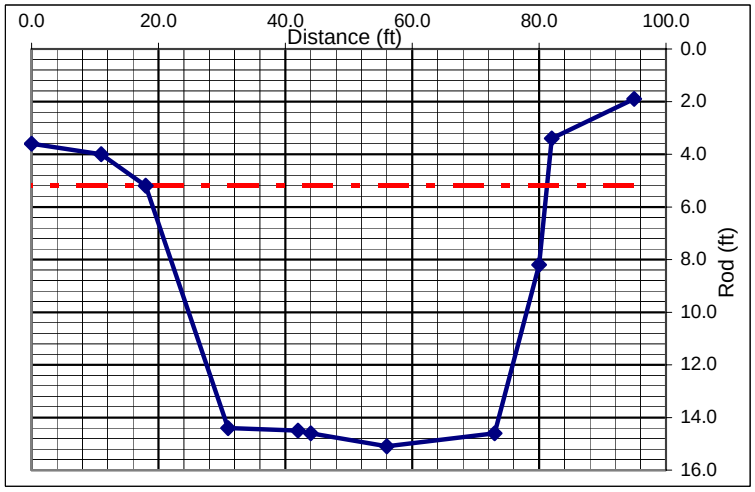
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	9.9 *ft*	11.5	
Channel Flow (***Q***):	1,338.5 *cfs*	1,579.9	
Channel Velocity:	2.6 *ft/sec*	2.6	
Cross-Sectional Area (***A***):	505.4 *sq.ft.*	616.3	
Hydraulic Radius (***R***):	7.2 *ft*	6.8	

Survey Data:

Rod *(ft)*	Distance *(ft)*
1.9	95.0
3.4	82.0
8.2	80.0
14.6	73.0
15.1	56.0
14.6	44.0
14.5	42.0
14.4	31.0
5.2	18.0
4.00	11
3.60	0



COMMENTS:

Stream Stabilization I & E Form

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

County Perry T. R. Sec.

Date 9/8/2005 By Wayne Kinney

Stream Name Beaucoup Creek UTM Coord. E292325 N4217075

Landowner Name x-sec 4

Drainage Area 225.27 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	123 ft.	Cross Sectional Area	886 sq. ft.
	Depth	7.2 ft.		

Reference Stream Gage:

Beaucoup Creek near Matthews	Station No.	05599000	Gage Q_2 4720 cfs
	Drainage Area	292 sq.mi	Regression (5300 cfs
Perry County, IL			**REFERENCE STREAM DATA ONLY**

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.6	*ft./mi. (user-entered)*			Regression Q_2 4314 cfs
		ft/mi (from worksheet)	Rainfall	3.50 in *(2 yr, 24 hr)*	Adjusted Q_2 3842 cfs
	0.0005	*ft./ft.*	Regional Factor	0.983	Typical Range for Bankfull Discharge:
					1530 to 3080 cfs

Local Stream Morphology:

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

Manning's "n" 0.04

Basic Field Data:					
			Stream Length		*ft.*
			Valley Length		*ft.*
Bankfull Width	97	*ft.*	Contour Interval		feet
Mean Bankfull Depth	8.26	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	11.74				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	13.8	*ft.*	Surveyed:	0.000267 *ft./ft.*	Cross-Section 1887 *cfs*
Width at twice max. depth	2000	*ft.*	Estimated:	*ft./ft.*	Basic field data 1994 *cfs*
(27.6 ft.)					Selected Q 1940 *cfs*
Entrenchment Ratio	20.62		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:	2.35	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.49	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage V Stream Type (Rosgen)

Notes

Natural Open Channel Flow

Project:	x-sec 4	
Assisted by:	Wayne Kinney	
Date:	9/8/2005	
Channel Slope (***S***):	0.000267	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	13.8	*ft*

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

assuming uniform, steady flow

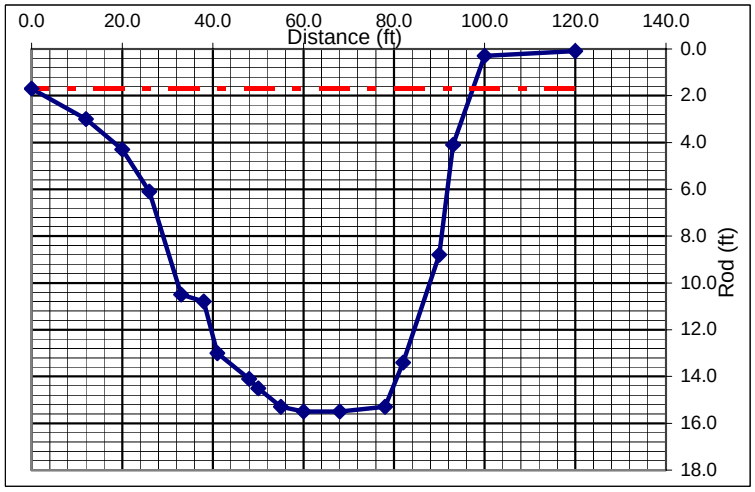
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	13.8 *ft*	13.8	
Channel Flow (***Q***):	1,886.9 *cfs*	1,886.9	
Channel Velocity:	2.4 *ft/sec*	2.4	
Cross-Sectional Area (***A***):	801.4 *sq.ft.*	801.4	
Hydraulic Radius (***R***):	7.6 *ft*	7.6	

Survey Data:

Rod *(ft)*	Distance *(ft)*
0.1	120.0
0.3	100.0
4.1	93.0
8.8	90.0
13.4	82.0
15.3	78.0
15.5	68.0
15.5	60.0
15.3	55.0
14.50	50
14.10	48
13.00	41
10.80	38
10.50	33
6.10	26
4.3	20
3.0	12
1.7	0



COMMENTS:

Stream Stabilization I & E Form

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

County Perry T. R. Sec.

Date 9/8/2005 By Wayne Kinney

Stream Name Beaucoup Creek UTM Coord. E294015 N4208223

Landowner Name x-sec 5

Drainage Area 278.27 sq. mi. Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	134 ft.	Cross Sectional Area	1022	sq. ft.
	Depth	7.7 ft.			

Reference Stream Gage:

Beaucoup Creek near Matthews	Station No.	05599000	Gage Q_2	4720 cfs
	Drainage Area	292 sq.mi	Regression (	5300 cfs
Perry County, IL		**REFERENCE STREAM DATA ONLY**		

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.1	*ft./mi. (user-entered)*			Regression Q_2	4556 cfs
		ft/mi (from worksheet)	Rainfall	3.50 in *(2 yr, 24 hr)*	Adjusted Q_2	4058 cfs
	0.0004	*ft./ft.*	Regional Factor	0.983	Typical Range for Bankfull Discharge:	
					1620	to 3250 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	100	*ft.*	Contour Interval		feet
Mean Bankfull Depth	9.06	*ft.*	Estimated Sinuosity		
Width/Depth Ratio	11.04				
			Channel Slope:		Bankfull Q from:
Max. Bankfull Depth	14.6	*ft.*	Surveyed:	0.000267 *ft./ft.*	Cross-Section 1914 *cfs*
Width at twice max. depth	2000	*ft.*	Estimated:	*ft./ft.*	Basic field data 2398 *cfs*
(29.2 ft.)					Selected Q 2156 *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:	2.14	*ft./sec.*
GOAL: Develop confidence by matching			Velocity from basic field data:	2.65	*ft./sec.*
velocities from different sources.			Velocity from selected Q:	2.4	*ft./sec.*

Channel Evolution Stage V Stream Type (Rosgen)

Notes

Natural Open Channel Flow

Project:	x-sec 5	
Assisted by:	Wayne Kinney	
Date:	9/8/2005	
Channel Slope (***S***):	0.000267	*ft/ft*
Manning's ***n***:	0.040	
Flow Depth:	14.6	*ft*

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

assuming uniform, steady flow

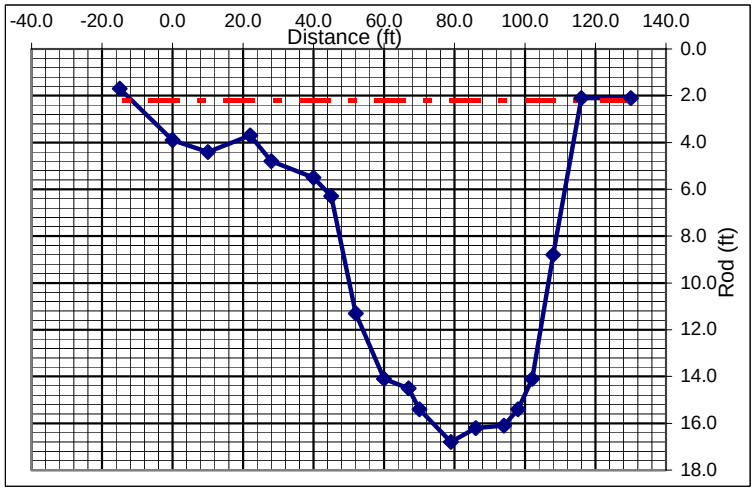
back to I&E form

Clear Cells

		Trial Depth 2	*Trial Depth 3*
Selected Flow Depth:	14.6 *ft*	14.7	
Channel Flow (***Q***):	1,913.9 *cfs*	1,827.9	
Channel Velocity:	2.1 *ft/sec*	2.0	
Cross-Sectional Area (***A***):	893.6 *sq.ft.*	906.4	
Hydraulic Radius (***R***):	6.6 *ft*	6.1	

Survey Data:

Rod *(ft)*	Distance *(ft)*
2.1	130.0
2.1	116.0
8.8	108.0
14.1	102.0
15.4	98.0
16.1	94.0
16.2	86.0
16.8	79.0
15.4	70.0
14.50	67
14.10	60
11.30	52
6.30	45
5.50	40
4.80	28
3.7	22
4.4	10
3.9	0
1.7	-15



COMMENTS: