

AERIAL ASSESSMENT LITTLE VERMILLION RIVER CHAMPAIGN AND VERMILLION COUNTIES

SEPTEMBER 2005 PREPARED BY WAYNE KINNEY FOR IL. DEPT. OF AGRICULTURE A public review draft stage three report on TMDL development for the Little Vermillion River by Tetra-Tech, Inc. was produced in August 2005. The key findings of this report identified two waterbodies as being impaired; Lake Georgetown (segment RBS) and the Little Vermilion River (segment BO07). Lake Georgetown is impaired by total phosphorus (TP) and the Little Vermillion River by fecal coliform, although the report states that there is insufficient data collection to confirm the fecal coliform impairment. Potential sources of Total Phosphorus to Georgetown Lake include sheet and rill erosion, lake shoreline erosion, stream channel erosion, fertilizers applied to both crops and lawns, livestock operations, storm water runoff, atmospheric deposition, and natural sources. A Forty-Six percent reductions in TP loading is indicated as being required to meet the 0.05 mg/L water quality standard.

This report will address only the potential TP contributions of stream channel erosion to the Little Vermillion Watershed.

Assessment Procedure

Low level geo-referenced video was taken of the Little 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 began at the Illinois-Indiana State Line. The mapping progressed upstream to just above the confluence of Goodall Branch above Road 420E in Vermilion Co. Aerial video of tributaries was not part of the project, regardless of the stream size or vegetation.



Fig. 1 Aerial Assessment Map of Sugar Creek

After videotaping the stream, the DVD tapes were processed by USGS to produce a georeferenced 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 Sugar 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.

CHAPTERS ON DVD AND ASSESSMENT REPORT Little Vermillion RiverVermilion Co.									
DVD		Beginning	Report	Cross					
Disc	DVD chapter	Time	Chapter	Sections					
1	2	5:00	1	6					
1	3	10:00	2	5					
1	4	15:00	3						
1	5	20:00	4	4					
1	6	25:00	5	3					
1	7	30:00	6	2					
1	8	35:00	7	1					

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".

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										
Little Vermilion River											
	ROCK		GEOTECH		BED	BREAK		STREAMBED			
CHAPTER	OUTCROP	LOGJAM	FAILURE	DEPOSITION	CONTROL	POINT	EROSION	STRUCTURE			
1	8	5	3	8	0	0	33	0			
2	12	3	3	5	0	6	23	0			
3	1	1	2	2	1	1	16	1			
4	1	7	4	0	0	0	22	3			
5	2	5	10	2	1	0	15	3			
6	0	0	4	6	0	1	6	0			
7	0	0	0	2	0	1	2	0			
TOTALS	24	21	26	25	2	9	117	7			

Table 1 Features by Chapter Identified with Aerial Assessment



Fig. 4 Chapter Division and Cross Section locations

Six cross sections were taken at selected locations on the Little 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. Aerial views of cross sections locations are shown in Figs. 17 thru 23. Exact locations as Eastings and Northings and more detail can be found in Appendix A.

	Cross Section Data – Little Vermilion River													
	Vermilion County, IL													
				Valley		Bank	Width	Mean			Bedload	1	CFS/	BKF Q/
X-sec	Easting	Northing	ADA	Slope	Q2	Full Q	Ft.	Depth	W/D	Vel.	Dia.	CEM	sq. mi.	Q2
			Sq. Mi.	ft/mi.	cfs	cfs		Ft.	Ratio	fps	Inches	Simon		
1	423427	4422494	33.22	2.3	492	298	42	3.71	11.3	1.9	1	2	8.97	0.61
2	431943	4418014	73.48	2.4	941	607	51	5.09	10	2.3	1	5	8.26	0.65
3	437449	4418486	91.54	2.5	1142	719	63	4.91	12.8	2.3	1	5	7.85	0.63
4	440932	4420789	120.5	2.5	1418	837	64	5.45	11.7	2.4	1	6	6.94	0.59
5	448746	4425136	171.2	2.8	1977	1537	87	5.43	16	3.3	3	5	8.98	0.78
6	452735	4421633	190.5	3	2223	1766	76	6.54	11.6	3.6	3	5	9.27	0.79

Table 2 Cross Section Summary

Figures 5 through 14 show a snapshot of Little Vermillion River from downstream to upstream highlighting typical stream features identified.



Fig. 5 Cross Section 6—Above Road 500N: Stable riffle site keeping channel well connected to floodplain



Fig. 6 Shale bed grade control in Chapter 2 has prevented downcutting



Fig. 8 Logjam resulting in split channel flow and mid channel island. Chapter 2



Fig. 9 Stable riffle at cross section 5 above Road 1800E; Chapter 3



Fig. 10 Dam at Georgetown Lake — Above Rte. 1; Chapter 4



Fig. 11 Channelized reach with no woody riparian area; notice meanders forming in channel that will tend to undercut stable banks.



Fig. 12 Split channel; likely the result of past logjam blocking channel; Chapter 6



Fig. 13 Slumped bank; geotech failure possible caused by improper bank shaping



Fig. 14 Eroding bank and deposition building on inside bend as opposite bank erodes; Chapter 7

Natur	al Op	en Channel Flow	
Project: Assisted by: Date: Channel Slope (S): Manning's n: Flow Depth:	Xsec2 W ayne Kinney 9/20/2005 0.000480 0.040 6.6	$Q \square \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$ ft/ft $assuming uniform, steady flow$ ft	
		Trial Depth 2 Trial Depth	3
Survey Data:	Distance (ft)	Selected Flow Depth: $6.6 \ tt$ 13.4	
		$\begin{array}{c c c c c c c c c c c c c c c c c c c $	
7.0	8.0	$\begin{array}{c} \text{Cross-Sectional Area} \left(\mathbf{A} \right) \\ \text{Cross-SectionArea} \left(\mathbf{A} \right) \\ Cro$	
9.3	12.0	Hydraulic Radius (\mathbf{R}): 4.6 $\#$ 8.2	
12.5	17.0		
13.8	19.0		
14.5	21.0	Distance (ft)	
14.8	31.0	0 0 20.0 40.0 60.0 80.0 100.0	
14.9	44.0	0.0	
15.5	53.0		
13.80	58		
9.10	62	5.0	
8.70	65		
7.80	71		3
4.70	77	10.0	-
1.90	82		
-3.8	90		
		- 20.0	

Fig. 15 Cross Section 2 showing "bankfull flow" depth at less than 50% of top bank depth.



Fig. 16 Cross section 4 showing "bankfull flow" at the top bank depth.

General Observations

- Channel degradation (downcutting) is not active in the Little Vermillion River Watershed. Cross sections 1 and 2 in the upper reaches of the aerial assessment are incised artificially by channelization for improved drainage, but show no signs of active downcutting and have relatively low bankfull velocities of around 2 ft/sec. (Fig. 15) Cross sections 3 through 6 show the channel to be well connected to the floodplain with little or no indication of any incision, past or present. (Fig. 16)
- 2. Lateral stream channel erosion is active, especially in Chapters 1 through 4 which include BO07 and Georgetown Lake, but less activity is found in the upper portions of the main channel.
- 3. Woody debris concentrated in logjams is a significant factor in the stream channel erosion in Chapters 1 thru 5. These chapters contain 21 logjams currently (March 2004) and often cause flow to bypass the logjam to one side creating a new channel (Fig. 8 and 12) and resulting in a split flow "mid-channel island" even after the logjam has been removed or naturally deteriorates.
- 4. Timely and appropriate management of logjams would reduce the stream channel erosion, however the presence of woody debris has positive effects also on both the channel stability and aquatic habitat; therefore wholesale removal of woody debris should be avoided.
- 5. Geotechnical erosion problems are of two types. In chapter 1 thru 5 they are generally the result of differing soil materials (loess over till, or stone/shale outcrops) that produce seepage areas and slipzones at the interface of the differing materials. In Chapters 6 and 7 they are often the result of oversteepened banks created by improper bank shaping during channel modifications or oversteepening due to undermining of the bank by lateral migration. (Fig. 13) In many instances either type can be corrected or diminished by providing "toe protection" and/or drainage, however each site requires analysis to determine the proper treatment.

Treatment Recommendations

The Little Vermillion River has no degradation problems. Although deeply incised the incision at X-sec 1 and 2 appears to be the result of channelization with no active downcutting. Therefore the entire Little Vermillion can be treated as a single segment. The recommendations are divided by chapter so a regional breakdown above and below Georgetown Lake is possible, although the chapter divisions do not coincide perfectly.

The general recommendation is to treat only the lateral bank migration with a combination of Stone Toe Protection, Stream Barbs or Bendway Weirs. The Width/depth ratio's of 10 to 16 lend themselves well to all three techniques and final design will have to take into account the radius of curvature, bedload size, presence or absence of any

geotechnical concerns, etc. at individual sites. All three techniques are estimated at approximately \$30.00 per lineal foot of bank protected and will require use of about 0.75 to 1.0 ton of quarry stone per lineal foot. There are no "large" logjams on the aerial assessment; therefore it is assumed that there will be lateral bank treatment at all sites with current logjams and the cost of removal is included in the estimated cost of bank treatment. Wholesale removal of woody debris is not recommended.

Rock Riffles could be installed in the Little Vermilion without increasing flooding or backwater conditions, but riffles would not be effective in meeting the TP reduction goals other than helping to reduce bank erosion and replacing a portion of the lateral bank treatment needs. Rock Riffles are therefore not included in the recommendations.

Table 3 shows the estimated treatment needs and cost for each chapter of aerial assessment for the Little Vermilion River. No costs are assigned for bank shaping or revegetation as experience has shown that natural regeneration will quickly provide the vegetative cover and soil stability needed. If shaping and vegetating is included in the projects a minimal additional cost of approximately \$5.00 to \$10.00 per lineal foot should be added to all estimates.

•	TREATMENTCHAPTERS 1 THRU 7											
Lateral Bank Protection												
Chapter	Erosion Sites	Average Length(ft)	Total Length	Average Cost/foot	Total Cost							
1	33	400	13200	\$30.00	\$396,000.00							
2	23	400	9200	\$30.00	\$276,000.00							
3	16	400	6400	\$30.00	\$192,000.00							
4	22	300	6600	\$30.00	\$198,000.00							
5	15	300	4500	\$30.00	\$135,000.00							
6	6	250	1500	\$30.00	\$45,000.00							
7	2	200	400	\$30.00	\$12,000.00							
Total	117		41800		\$1,254,000.00							

 Table 3 Treatment cost for lateral bank erosion in the Little Vermillion River using either Stone Toe Protection, Streambarbs or Bendway Weirs for stabilization.



Fig. 17 Chapter 1



Fig. 18 Chapter 2



Fig. 19 Chapter 3



Fig. 20 Chapter 4



Fig. 21 Chapter 5



Fig. 22 Chapter 6



Fig. 23 Chapter 7

APPENDIX A

CROSS SECTION DATA

Stream Sto	tream Stabilization I & E Form ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book								
County	Vermilion	•	т.	R.		Sec			
Date	9/19	/2005	Ву	Wayne Kinr	ney	l			
Stream Name Landowner Name	е	Little Vermillion R X-sec 1	River		UTM Coord.		E423427	N4422494	
Drainage Area		<u>33.22</u> sq. m	i.			Clear Cells			
Regional Curve I	Predictions.								
Bankfull dimension	ons	Width Depth	59 ft. 4.1 ft.	Cross Secti	onal Area	242	<mark>2</mark> sq. ft.		
Reference Stream	m Gage:								
Salt Fork poor Hom	or		-	Station No.	03338000	_	Gage Q ₂	3760 cfs	
				Drainage Area	344 sq.mi			4290 cfs	
Champaign Cour	ity,	IL			REFERENC	E STREAM DA			
USGS Flood-Pea	ak Discharg	e Predictions:							
Valley Slope:	2.3	ft./mi. (user-enter	red)			Reg	pression Q ₂	562 cfs	
		ft/mi (from works	heet) Rainfa	all 2.95 in	(2 yr, 24 hr)	A	djusted Q ₂	492 cfs	
	0.0004	ft./ft.	Regional Facto	or <u>1.057</u>		Typical Rai	nge for Ban	kfull Discharge:	
							190	to 400 cfs	
Local Stream Mo	orpholoav:								
Channel De	scription:						_		
Manning's "n"	0.04	(c) Clean, winding	, some pools and shoa	ls					
Marining o Ti	0.01		Stream Le	ength		ft.			
Basic Field Data:			Valley Ler	igth		ft.			
Bankfull Width		42 ft.	Contour Ir	nterval		feet 💌			
Mean Bankfull De	epth	3.71 ft.	Estimated	Sinuosity					
Width/Depth Rati	io	11.32							
		E 4 4	Channel Slo	pe:	£1. /£1	Bankfull Q from	:	-6-	
Wax. Bankfull De	eptn av daath	5.1 It.	Surveyed	d: 0.00048	11./11.	Cross-Section	291	cis	
width at twice m	ax. uepin (10.2 ft)	<u> </u>	Estimated	J	11./11.	Selected C	298	cfs	
Entrenchment Ra	atio	1.38	Radius of (Curvature (Rc)		ft.	200	010	
			Rc/I	Bankfull width:	0.00				
Bankfull Velocity	Check:	(typical Illinois sti	reams will have av	rerage bankful	ll velocity betw	veen 3 and 5 ft/s	ec.)		
Bedload:	D ₉₀	1 i n.	Velocity re	equirea to mov	е D ₉₀ :	2.1	ft./sec.		
	D ₅₀	in.	Velocity fr	om Cross-Sec	tion data:	1.86	ft./sec.		
GOAL: Develop	confidence	by matching	Velocity fr	om basic field	data:	1.96	ft./sec.		
Velocities	trom attrere	ent sources.	Velocity fr	om selected G	2:	1.9	It./Sec.		
Channel Evolutio	n Stage	II –	Stream 1	「ype (Rosgen)		<u> </u>			
Notes									
8.97 cfs/sa_mi									
2.0. 0.0/04.111.									

Natur	al Op	en Channel Flow	
Project: Assisted by: Date:	X-sec 1 Wayne Kinney 9/19/2005	$Q \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$	orm
Manning's <i>n</i> : Flow Depth:	0.000480 0.040 5.1	tt/ft assuming uniform, steady flow ft Trial Depth 2	Trial Depth 3
Survey Data: Rod (ft) 6.7 6.8	Distance (ft) 0.0 5.0	Selected Flow Depth: 5.1 ft 12.0 Channel Flow (Q): 290.6 cfs 1,367.3 Channel Velocity: 1.9 ft/sec 2.6 Cross-Sectional Area (A): 155.9 sq.ft. 528.7	
6.6 14.0 15.1 15.5 17.3 17.9 18.20 17.90 16.80 14.50 9.50 5.60 3.0	10.0 21.0 35.0 40.0 43.0 45.0 50.0 60 68 72 74 79 88 98	0.0 20.0 40.0 Distance (ft)	120.0 0.0 2.0 4.0 6.0 8.0 10.0 0 12.0 14.0 16.0 18.0 18.0 20.0
		COMMENTS:	

Stream Sto	tream Stabilization I & E Form ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book								
County	Vermilion	•	Т.	R		Sec			
Date	9/19	/2005	Ву	Wayne Kinr	ney				
Stream Name Landowner Name	е	Little Vermillion I Xsec2	River		UTM Coord.		E431943	N4418014	
Drainage Area		73.48 sq. m	ni.			Clear Cells			
Regional Curve I	Predictions.								
Bankfull dimension	ons	Width Depth	80 ft. 5.2 ft.	Cross Secti	onal Area	414	<mark>l</mark> sq. ft.		
Reference Stream	m Gage:								
Salt Fork poor Hom	or		-	Station No.	03338000	_	Gage Q ₂	3760 cfs	
			<u> </u>	Drainage Area	344 sq.mi			4290 cfs	
Champaign Cour	ity,	IL			REFERENC	E STREAM DAT			
USGS Flood-Pea	ak Discharg	e Predictions:							
Valley Slope:	2.4	ft./mi. (user-ente	red)			Reg	pression Q ₂	1074 cfs	
		ft/mi (from works	<i>heet)</i> Rainfa	all 2.95 in	(2 yr, 24 hr)	A	djusted Q ₂	941 cfs	
	0.0005	ft./ft.	Regional Facto	or <u>1.057</u>		Typical Rar	nge for Ban	kfull Discharge:	
							370	to 760 cfs	
Local Stream Mo	orpholoav:								
Channel De	scription:	() =					_		
Manning's "n"	0.04	(c) Clean, winding	I, some pools and shoa	ls					
ind in ing o	0.01	-	Stream Le	ength		ft.			
Basic Field Data:			Valley Ler	ngth		ft.			
Bankfull Width		51 ft.	Contour Ir	nterval		feet 🔻			
Mean Bankfull De	epth	5.09 ft.	Estimated	Sinuosity					
Width/Depth Rati	io	10.02							
		<u> </u>	Channel Slo	pe:	£1. /£1	Bankfull Q from	507	-6-	
Width at twice m	epin av dooth	0.0 <i>IL</i>	Surveyed	d. 0.00046	ft /ft	Basic field date	627	cis	
which at twice ma	(13.2 ft.)	00 11.	LStimated	u	11./11.	Selected C	607	cfs	
Entrenchment Ra	atio	1.57	Radius of (Curvature (Rc)		ft.			
			Rc/	Bankfull width:	0.00				
Bankfull Velocity	Check:	(typical Illinois st	reams will have av	verage bankfu	I velocity betw	veen 3 and 5 ft/s	ec.)		
Bedload:	D ₉₀	1 v in.	velocity re	equirea to mov	e D ₉₀ :	2.1	ft./sec.		
	D ₅₀	in.	Velocity fr	om Cross-Sec	tion data:	2.26	ft./sec.		
GOAL: Develop	confidence	by matching	Velocity fr	om basic field	data:	2.42	ft./sec.		
velocities	from amere	ent sources.	velocity fr	om selected G	2:	2.3	n./sec.		
Channel Evolutio	n Stage	v	Stream 7	Гуре (Rosgen)					
Notes									
8 26 cfs/sq. mi									

Natur	al Op	en Channel Flow
		back to I&E form
Project: Assisted by: Date:	Xsec2 Wayne Kinney 9/19/2005	$Q \equiv \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$ Clear Cells
Channel Slope (S): Manning's n : Elow Depth:	0.000480	ft/ft assuming uniform, steady flow
	0.0	Trial Depth 2 Trial Depth 3
Survey Data:		Selected Flow Depth: 6.6 ft 13.4
Rod (ft)	Distance (ft)	Channel Flow (Q): 586.5 cfs 2,423.5
2.1	0.0	Channel Velocity: 2.3 ft/sec 3.3
7.0	8.0	Cross-Sectional Area (\mathbf{A}): 259.8 sq.ft. 731.5 Hydraulic Radius (\mathbf{R}): 4.6 ft Regime R
9.5	12.0	
12.5	17.0	5.0
13.8	19.0	
14.0	21.0	
14.0	31.0	
14.9	44.0 52.0	
12.0	53.0	
0.10	50	
9.10	65	$1 \\ \\ \\ \\ \\ \\ \\ \\ \\ $
7.80	71	
1.00	77	
1 90	82	
-3.8	90	
-3.0	30	
		15.0
		•
		•
		4
		4
		4
		4
	1	1

Stream St	abilizat	ion I & E Fo	rm	ILLINC	IS NRCS - Vers	ion 2.05- modified 9/	(12/04 R.Book	
County	Vermilion		Т	R.		Sec		
Date	9/19	9/2005	By	Wayne Kinn	iey			
Stream Name		Little Vermillion	River		UTM Coord.		E437449	N4418486
Landowner Nan	ne	Xsec 3						
Drainage Area		91.54 sq. r	ni.			Clear Cells		
Regional Curve	Predictions						-	
Bankfull dimens	sions	Width Depth	87 ft. 5.5 ft.	Cross Section	onal Area	481	sq. ft.	
Reference Strea	am Gage:							
Salt Fork near Ho	mer		•	Station No.	03338000		Gage Q ₂	3760 cfs
Champaign Cou	unty,	IL		Drainage Area	REFERENC	E STREAM DAT	A ONLY	4290 Cfs
		Des l'alland						
Valley Slope:	ак Dischar 2.5	ge Predictions: ft./mi. (user-ente	ered)			Reg	ression Q ₂	1302 cfs
		ft/mi (from work	sheet) Rair	nfall 2.95 in	(2 yr, 24 hr)	A	djusted Q ₂	1142 cfs
	0.0005	ft./ft.	Regional Fac	ctor 1.057		Typical Rar	nge for Ban	full Discharge:
		_			-		450	to 920 cfs
Local Stream M	lorphology:							
Channel De Mapping's "p"	escription	(c) Clean, windin	g, some pools and sh	oals			•	
Marining S TI	0.04	_	Stream	Length		ft.		
Basic Field Data:			Valley L	ength		ft.		
Bankfull Width		63 ft.	Contour	Interval		feet 💌		
Mean Bankfull L Width/Depth Ra	Depth	4.91 <i>ft</i> .	Estimate	ed Sinuosity		_		
Widt#Doptil Re		12.00	Channel S	Slope:		Bankfull Q from	:	
Max. Bankfull D	epth	5.9 ft.	Survey	red: 0.00048	ft./ft.	Cross-Section	707	cfs
Width at twice n	nax. depth	800 ft.	Estimat	ted:	ft./ft.	Basic field data	730	cfs
	(11.8 ft.) Potio	12.70	Padius o	f Curveture (Pe)		Selected C	2 719	cfs
	(allo	12.70	Raulus U	c/Bankfull width:	0.00	11.		
					0.00			
Bankfull Velocit	y Check:	(typical Illinois s	treams will have	average bankful	l velocity betv	veen 3 and 5 ft/s	ec.)	
Bedload:	D ₉₀	1 🔻 in.	Velocity	required to mov	e D ₉₀ :	2.1	ft./sec.	
	D ₅₀	in.	Velocity	from Cross-Sec	tion data:	2.28	ft./sec.	
GOAL: Develop	confidence	by matching	Velocity	from basic field	data:	2.36	ft./sec.	
velocities	s from differ	ent sources.	Velocity	from selected Q	:	2.3	ft./sec.	
Channel Evoluti	on Stage	V	Stream	n Type (Rosgen)		L		
Notes								
7 85 cfe/ea mi								
1.00 013/34. III.								

Project: Xsec 3 Assisted by: Wayne Kinney Date: 9/19/2005 (Channel Slope (S): 0.000480 How Depth: back to I&E form Clear Cells Channel Slope (S): 0.000480 How Depth: channel Slope (S): 0.000480 How Depth: trial Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 3 Selected Flow Depth: 5.9 ft Toil Depth 3 Selected Flow CQ1: Colspan= 6 (ft) 14.1 53.0 144.3 35.0 144.3 35.0 144.3 35.0 7.740 66.0 6.0 6.0 7.30 Of 20.0 9 4.0 10.0 12.0 10.0 12.0 10.0 12.0 10.0 10	Natur	al Op	en Channel Flow	
Project: Xsec 3 Assisted by: Wayne Kinney Date: 9/19/2005 Clear Cells Channel Slope (S): 0.000480 Manning's r: 0.040 Clear Cells Selected Flow Depth: 5.9 ft Trial Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft S.9 ft S.9 ft S.9 ft S.9 ft S.9 ft Selected Flow Depth: 5.9 ft Trial Depth 3 Selected Flow Depth: Channel Flow (Q): Coss-Sectional Area (A): 309.6 sg.ft 309.6 sg.ft 309.6 sg.ft 100.0 14.2 16.0 14.3 25.0 14.3 35.0 14.1 53.0 14.1 53.0 100.0 0.0			back to I&E form	
Assisted by: Wayne Kinney 9/19/2005 Clear Cells Channel Slope (\$): 0.000480 h/h assuming uniform, steady flow Survey Data: Trial Depth 2 Trial Depth 3 Selected Flow Depth: 5.9 ft 5.9 ft Rod (ft) Distance (ft) Channel Flow (Q): 707.0 cts Attached Selected Flow Depth: 5.9 ft 5.9 ft Trial Depth 2 Trial Depth 3 Selected Flow Depth: 707.0 cts Channel Flow (Q): 707.0 cts Consolve Sectional Area (A): 309.6 sg.ft. 14.2 16.0 14.3 35.0 14.4 59.0 7.40 64 6.90 67 7.30 777	Project:	Xsec 3	-1.486 $10^{\frac{2}{3}}$ $10^{\frac{1}{3}}$	
Date: 9/19/2005 1/1 Channel Stope (S): 0.000480 t/tr Basuming uniform, steady flow n Survey Data: n Rod (ft) Distance (ft) 8.4 0.0 12.9 8.0 13.8 13.0 14.2 16.0 14.3 25.0 14.3 35.0 14.3 35.0 14.3 35.0 14.1 53.0 11.8 59.0 7.30 77	Assisted by:	Wayne Kinney	$Q \equiv A R^3 S^2$ Clear Cells	
Order Hol O(p) O(000000000000000000000000000000000000	Date: Channel Slone (S):	9/19/2005	tt/ft	
Flow Depth: t Survey Data: Selected Flow Depth: Trial Depth 2 Trial Depth 3 Sourcey Data: Selected Flow Depth: Trial Depth 2 Trial Depth 3 Selected Flow (Q) Total Channel Velocity: Classed (Q) Total Depth 3 12.9 8.0 Channel Velocity: Classed (Q) Total Depth 4 Trial Depth 3 14.2 16.0 Channel Velocity: Cross-Sectional Area (A): 309.6 sq.ft 309.6 14.3 35.0 14.3 35.0 11.8 59.0 100.0 2.0 14.1 53.0 0 0.0 0.0 0.0 2.0 4.7 4.7 11.8 59.0 7.30 77 0.0 0.0 2.0 4.0 6.0 8.0 0.0 100.0 2.0 10.0 7.30 77 0 6.0 8.0 0.0 10.0 2.0 10.0 6.0 6.0 6.0 6.0 8.0 0.0 10.0 10.0 14.2 4.0 6.0 6.0 6.0 6.0 8.0 0.0	Manning's n :	0.000480	assuming uniform, steady now	
Survey Data: Trial Depth 2 Trial Depth 3 Rod (ft) Distance (ft) Selected Flow Depth: 5.9 ft 5.9 12.9 8.0 Channel Flow (Q): 2.3 ft/sec 2.3 13.8 13.0 Hydraulic Radius (R): 4.7 ft 4.7 14.2 16.0 Hydraulic Radius (R): 4.7 ft 4.7 14.3 25.0 14.3 25.0 14.3 20.0 40.0 100.0 0.0 2.0 14.1 53.0 11.8 59.0.0 77.0 6.0 100.0 0.0 2.0 4.0 6.0 80.0 100.0 0.0 2.0 4.0 6.0 80.0 100.0 1	Flow Depth:	0.040	ft	
Survey Data: Selected Flow Depth: 5.9 ft 5.9 Rod (ft) Distance (ft) Channel Flow (Q): 707.0 cfs 309.6 cfs, dt. 4.7 tfs 4.7 tfs 4.7 tfs 4.7 tfs 4.7 tfs 4.7 tfs 4.0 tfs 6.0 tfs <td></td> <td></td> <td>Trial Depth 2 Trial Depth</td> <td>13</td>			Trial Depth 2 Trial Depth	13
Rod (ft) Distance (ft) 8.4 0.0 12.9 8.0 13.8 13.0 14.2 16.0 14.3 25.0 14.4 53.0 14.1 53.0 14.1 53.0 11.8 59.0 7.30 77 7.30 7.1 7.1 14.0	Survey Data:		Selected Flow Depth: 5.9 ft 5.9	
8.4 0.0 Channel Velocity: Cross-Sectional Area (A): 13.8 2.3 trisec 2.3 13.8 13.0 Hydraulic Radius (R): 309.6 309.6 14.2 16.0 Hydraulic Radius (R): 4.7 tr 4.7 14.3 25.0 Distance (ft) 0.0 0.0 14.3 35.0 Distance (ft) 0.0 0.0 14.1 53.0 Distance (ft) 4.7 tr 4.7 14.1 53.0 Distance (ft) 0.0 0.0 0.0 7.40 64 6.0 8.0 gr/str 8.0 gr/str 8.0 gr/str 7.30 77 0 77 10.0 12.0 10.0 12.0 0 0 0 0 0 0 12.0 14.0 16.0 0 0 0 0 0 0 14.0 16.0 14.0 10.0 0 0 0 0 0 0 14.0 16.0 0 0 0 0 0 0 0 14.0 16.0 0	Rod (ft)	Distance (ft)	Channel Flow (Q): 707.0 <i>cfs</i> 707.0	
12.9 8.0 Cross-Sectional Area (A): 309.6 sg.ft. 309.6 13.8 13.0 Hydraulic Radius (R): 4.7 fr. 4.7 14.2 16.0 0.0 0.0 0.0 0.0 14.3 25.0 14.3 35.0 0.0 0.0 0.0 14.1 53.0 0.0 0.0 0.0 0.0 0.0 11.8 59.0 7.40 64 6.90 67 7.30 77 0.0 0.0 0.0 0.0 0 0 0.0 0.0 0.0 0.0 0 0 0.0 0.0 0.0 0.0 14.2 45.0 0.0 0.0 0.0 0.0 7.40 64 6.90 67 0.0 0.0 0.0 7.30 77 0.0 0.0 0.0 0.0 0.0 0 0 0 0 0 0.0 0.0 0.0 0 0 0 0 0 0 0.0 0.0 11.8 59.0 0 0 0 0 0.0 0.0 0 0 0 0 0 0 0.0 <	8.4	0.0	Channel Velocity: 2.3 ft/sec 2.3	
13.8 13.0 Involution Readits (R) 4.7 ft 4.7 14.2 16.0 14.3 25.0 14.3 35.0 14.2 45.0 14.1 53.0 11.8 59.0 7.40 64 6.90 67 7.30 77	12.9	8.0	Cross-Sectional Area (A): 309.6 sq.ft. 309.6	
14.2 16.0 14.3 25.0 14.3 35.0 14.2 45.0 14.1 53.0 11.8 59.0 7.40 64 6.90 67 7.30 77	13.8	13.0	Hydraulic Radius (\mathbf{R}): 4.7 ft 4.7	
14.3 35.0 14.2 45.0 14.1 53.0 11.8 59.0 7.40 64 6.90 67 7.30 77	14.2	16.0	0.0 20.0 40.0 60.0 80.0 100.0	
14.2 45.0 14.1 53.0 11.8 59.0 7.40 64 6.90 67 7.30 77	14.3	25.0	Distance (ft)	
14.1 53.0 11.8 59.0 7.40 64 6.90 67 7.30 77	14.3	<u> </u>		
11.8 59.0 7.40 64 6.90 67 7.30 77	14.1	53.0	2.0	
7.40 64 6.90 67 7.30 77	11.8	59.0		
6.90 67 7.30 77	7.40	64	4.0	
7.30 77	6.90	67	6.0	
	7.30	77		2
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Image: Constraint of the second se				ĕ
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Stream St	abilizat	ion I & E For	m	ILLINOIS	S NRCS - Versi	on 2.05- modified 9/	12/04 R.Book	
County	Vermilion	•	Т.	R.		Sec.		
Date	9/19	9/2005	Ву	Wayne Kinne	у			
Stream Name		Little Vermillion R	liver	L L	JTM Coord.		E440932	N4420789
Landowner Nar	ne	Xsec 4						
Drainage Area		120.46 sq. m	i.			Clear Cells		
Regional Curve	Predictions							
Bankfull dimens	sions	Width Depth	96 ft. 6.0 ft.	Cross Section	hal Area	579	sq. ft.	
Reference Stre	am Gage:							
Salt Fork near Ho	mer		-	Station No.	03338000		Gage Q ₂	3760 cfs
Champaign Co	untv.	IL		Drainage Area	344 sq.mi REFERENCI	ہ E STREAM DAT	egression (4290 cfs
USGS Flood-Pe	eak Dischar 2.5	ge Predictions: ft./mi. (user-enter	red)			Reg	ression Q ₂	1618 cfs
<u></u>	2.0	ft/mi (from works)	heet) Rair	nfall 2.95 in <i>(</i> .	2 yr. 24 hr)	A	djusted Q ₂	1418 cfs
	0.0005	ft./ft.	Regional Fa	ctor 1.057		Typical Ran	ge for Bank	full Discharge:
							560	to 1140 cfs
Local Stream N	lorphology:							
Channel D	escription	(c) Clean, winding,	some pools and sh	noals			•	
wannings n	0.04	_	Stream	Length		ft.		
Basic Field Data:			Valley L	ength		ft.		
Bankfull Width		64 ft.	Contour	Interval		feet 💌		
Mean Bankfull I	Depth	5.45 ft.	Estimate	ed Sinuosity				
Width/Deptil Ka	10	11.74	Channel S	Slope:		Bankfull Q from:		
Max. Bankfull D	epth	7.4 ft.	Survey	/ed: 0.00048 ft	t./ft.	Cross-Section	792	cfs
Width at twice r	nax. depth	1000 ft.	Estimat	ted: fi	t./ft.	Basic field data	882	cfs
Entropolymont	(14.8 ft.)	15.62	Padius a	of Curriciture (Pa)		Selected Q	837	cfs
Entrenchinent	\all0	15.65	Raulus U	c/Bankfull width	0.00	11.		
					0.00			
Bankfull Velocit	y Check:	(typical Illinois str	reams will have	average bankfull v	elocity betw	een 3 and 5 ft/se	ес.)	
Bedload:	D ₉₀	1 v in.	Velocity	required to move	D ₉₀ :	2.1	ft./sec.	
	D ₅₀	In.	Velocity	from Cross-Section	on data:	2.27	IT./SEC.	
velocitie	s from differ	ent sources	Velocity	from selected Q	ala.	2.33	ft /sec	
Voiconio			volooity					
Channel Evolut	ion Stage	VI 💌	Stream	n Type (Rosgen)				
Notes								
6.04 cfc/cc. mi								
0.94 US/SY. MI.								

Natural Open Channel Flow							
		back to I&E form					
Project: Assisted by:	Xsec 4 Wayne Kinney	$Q \equiv \frac{1.486}{2} A R^{\frac{2}{3}} S^{\frac{1}{2}}$ Clear Cells					
Date: Channel Slope (S):	9/19/2005 0.000480	tt/ft assuming uniform, steady flow					
Manning's n :	0.040						
Flow Depth:	7.4	ft					
Survey Data:		Selected Flow Depth: 7.4 ft 7.4					
Rod (ft)	Distance (ft)	Channel Flow (Q): 791.7 cfs 791.7					
9.6	0.0	Channel Velocity: 2.3 ft/sec 2.3					
9.7	9.0	Cross-Sectional Area (A): 348.8 sq.ft. 348.8					
9.7	15.0	Hydraulic Radius (R): 4.7 ft 4.7					
9.7	25.0						
10.2	29.0	0.0 20.0 40.0 60.0 80.0 100.0 120.0 140.0 Distance (ft)					
14.6	36.0						
15.0	38.0	2.0					
16.4	44.0						
17.0	57.0	4.0					
17.30	67	6.0					
16.50	73						
16.10	75						
14.40	80						
14.40	87						
10.10	92						
9.9	98	14.0					
9.8	105						
9.8	118						
		18.0					
		COMMENTS:					
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		4					
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Stream St	abilizati	onI&EFa	orm	ILLING	OIS NRCS - Vers	sion 2.05- modified 9/	12/04 R.Book	
County	Vermilion	•	Т	R		Sec		
Date	9/19	/2005	Ву	Wayne Kinr	ney			
Stream Name		Little Vermillion	River		UTM Coord.		E448746	N4425136
Landowner Nam	e	Xsec 5						
Drainage Area		171.22 sq.	mi.			Clear Cells		
Regional Curve	Predictions	:						
Bankfull dimens	ions	Width Depth	111 ft. 6.6 ft.	Cross Secti	ional Area	735	sq. ft.	
Reference Strea	m Gage:							
Salt Fork poor Hop	nor		-	Station No.	03338000		Gage Q ₂	3760 cfs
Champaign Cou	ntv	Ш		Drainage Area	a 344 sq.mi		Cegression	4290 cfs
onampaign coa	<u>y</u> ,							
USGS Flood-Pe	<u>ak Dischar</u> 2 8	ge Predictions: ft /mi_(user-en	tered)			Red	ression Q ₂	2256 cfs
valley olope.	2.0	ft/mi (from wor	ksheet) R:	ainfall 2 95 in	(2 vr 24 hr)	A	diusted Q ₂	1977 cfs
	0.0005	ft./ft.	Regional F	Factor 1.057	(2), 2 ,)	Typical Rar	nge for Ban	full Discharge:
		-	- 3			51	790	to 1590 cfs
Local Stream M	orpholoav:							
Channel De	escription:	(c) Clean windi	ng some pools and	shoals			-	
Manning's "n"	0.04		ng, senie pools and	Shidalis		_		
			Stream	m Length		ft.		
Basic Field Data:		87 ft	Valley	/ Length		n.		
Mean Bankfull D	epth	5.43 ft.	Estima	ated Sinuosity				
Width/Depth Ra	tio	16.02		,		-		
			Channe	el Slope:	_	Bankfull Q from		
Max. Bankfull De	epth	7.2 ft.	Surv	veyed: 0.00081	ft./ft.	Cross-Section	1526	cfs
Width at twice m	ax. depth	400 ft.	Estim	nated:	ft./ft.	Basic field data	1548	cfs
Entrenchment R	(14.4 II.) atio	4 60	Radius	s of Curvature (Rc))	ft	1557	015
	ano			Rc/Bankfull width	. 0.00			
Bankfull Velocity	/ Check:	(typical Illinois	streams will hav	ve average bankfu	Il velocity betw	veen 3 and 5 ft/s	ec.)	
Bedload:	D ₉₀	3 v in.	Veloci	ity required to mov	/е D ₉₀ :	3.6	tt./sec.	
COAL	D ₅₀	In.	Veloci	ity from Cross-Sec	ction data:	3.23	IT./SEC.	
GOAL: Develop	from diffor	by matching	Veloci	ity from pasic field		3.28	ft /soc	
Velocities		ent sources.	Veloci		x.	3.3	11./SEC.	
Channel Evolution	on Stage	v 💌	Strea	am Type (Rosgen))			
Notes								
8.98 cfs/sq. mi.								

Project: Xsec 5 Assisted by: Wayne Kinney Date: 9/19/2005 back to l&E form Channel Slope (\$): 0.000810 Flow Depth: 7.2 back to l&E form Trial Depth 2 Trial Depth 3 Trial Depth 2 Trial Depth 3 Trial Depth 2 Trial Depth 3 Selected Flow Depth: 7.2 Trial Depth 3 Trial Depth 3 Selected Flow Depth: 7.2 Trial Depth 3 Trial Depth 3 Colspan="2">Trial Depth 3 Selected Flow Depth: 7.2 Trial Depth 3 Trial Depth 3 Selected Flow Q0; Channel Velocity: Cass-Sectional Area (A); Hydraulic Radius (R); 5.3 tr Sole def (t) Optimize To the tot of the tot of the tot of to	Natural Open Channel Flow							
Project: Xsec 5 Assisted by: Wayne Kinney Pate:			back to I&E form					
Channel Slope (S): 0.000810 Hanning's n: 0.040 r/r assuming uniform, steady flow Survey Data: Selected Flow Depth: 7.2 t 7.6 Trial Depth 2 Trial Depth 3 Rod (rt) Distance (rt) Channel Flow (Q): 1.525.8 cfs 1.634.4 Channel Flow (Q): Cross-Sectional Area (A): 472.7 sg.th 5.08.4 13.7 21.0 21.0 Hydraulic Radius (R): 5.3 t 5.3 13.6 36.0 10.0 10.0 12.00 40.0 Distance (ft) 0.0 2.0 13.6 36.0 100.0 120.0 10.0 120.0 0.0 2.0 14.1 62.0 13.6 36.0 100.0 120.0 0.0 2.0 9.50 86 7.00 92 5.60 100 10.0 12.0 10.0 10.0 10.0 12.0 10.0 12.0 10.0 10.0 9.50 86 7.00 92 5.60 10.0 10.0 10.0 10.0	Project: Assisted by: Date:	Xsec 5 Wayne Kinney 9/19/2005	$Q \Box \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$ Clear Cells					
Survey Data: Trial Depth 2 Trial Depth 3 Rod (ft) Distance (ft) Channel Flow (Q): 1,525.8 cfs 1,634.4 6.8 0.0 Channel Flow (Q): 3.2 trisec 3.2 7.3 7.0 Cross-Sectional Area (A): 472.7 sg.ft. 508.4 10.0 11.0 Hydraulic Radius (R): 5.3 tt 5.3 13.7 21.0 14.2 27.7.0 13.6 36.0 14.2 27.7.0 13.6 36.0 100.0 120.0 0.0 14.1 62.0 13.6 7.0 9.50 86 6.0 100 0.0 2.0 14.1 62.0 7.8 9.50 86 7.00 92 10.0	Channel Slope (S): Manning's n : Flow Depth:	0.000810 0.040 7.2	ft/ft assuming uniform, steady flow ft					
Rod (ft) Distance (ft) 6.8 0.0 7.3 7.0 10.0 11.0 13.7 21.0 14.2 27.0 13.6 36.0 14.3 42.0 14.4 50.0 14.1 62.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.0 105	Survey Data:		Trial Depth 2 Trial Depth Selected Flow Depth: 7.2 ft 7.6	13				
6.8 0.0 Channel Velocity: 3.2 ti/sec 3.2 7.3 7.0 100 11.0 11.0 472.7 sq.ft. 508.4 13.7 21.0 14.4 50.0 14.4 50.0 100.0 120.0 14.4 50.0 14.1 62.0 13.60 73 73 73 12.20 78 9.50 86 7.00 92 5.60 100 6.0 8.0 gr 8.0 gr 0.00 105 COMMENTS: COMMENTS: COMMENTS: COMMENTS:	Rod (ft)	Distance (ft)	Channel Flow (Q): 1.525.8 cfs 1.634.4					
7.3 7.0 Cross-Sectional Area (A): 472.7 sq.h. 508.4 10.0 11.0 Hydraulic Radius (R): 5.3 h 5.3 13.7 21.0 Hydraulic Radius (R): 5.3 h 5.3 13.6 36.0 14.3 42.0 Hydraulic Radius (R): 5.3 h 5.3 14.3 42.0 14.4 50.0 100.0 120.0 4.0 0.0 100.0 120.0 13.60 73 12.20 78 7.00 92 5.60 100 6.0 8.0 g 5.0 f 6.0 6.0 8.0 g 7.00 92 5.60 100 10.0 12.0 10.0 <td>6.8</td> <td>0.0</td> <td>Channel Velocity: 3.2 ft/sec 3.2</td> <td></td>	6.8	0.0	Channel Velocity: 3.2 ft/sec 3.2					
10.0 11.0 Hydraulic Radius (R): 5.3 th 5.3 13.7 21.0 14.2 27.0 13.6 36.0 14.3 42.0 14.4 50.0 100.0 120.0 14.4 50.0 14.1 62.0 0.0 0.0 2.0 13.60 73 12.20 78 0.0 6.0 8.0 0.0 9.50 86 7.00 92 5.60 100 10.0 12.0 0.00 105	7.3	7.0	Cross-Sectional Area (A): 472.7 sq.ft. 508.4					
13.7 21.0 14.2 27.0 13.6 36.0 14.3 42.0 14.4 50.0 14.4 50.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	10.0	11.0	Hydraulic Radius (R): 5.3 ft 5.3					
14.2 27.0 13.6 36.0 14.3 42.0 14.4 50.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	13.7	21.0						
13.6 36.0 14.3 42.0 14.4 50.0 14.1 62.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	14.2	27.0	0.0 20.0 40.0 60.0 80.0 100.0 120.0 Distance (ft)					
14.3 42.0 14.4 50.0 14.1 62.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	13.6	36.0						
14.4 50.0 14.1 62.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	14.3	42.0						
14.1 62.0 13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	14.4	50.0						
13.60 73 12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	14.1	62.0						
12.20 78 9.50 86 7.00 92 5.60 100 0.00 105	13.60	73						
9.50 86 7.00 92 5.60 100 0.00 105 	12.20	78	6.0					
7.00 92 5.60 100 0.00 105	9.50	86		<u>n</u>				
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Stream St	tabilizat	ion I & E For	'n	ILLINOI	IS NRCS - Vers	ion 2.05- modified 9/	12/04 R.Book	
County	Vermilion	•	Т	R.		Sec.		
Date	9/19	9/2005	Ву	Wayne Kinne	әу	<u> </u>		
Stream Name		Little Vermillion F	River		UTM Coord.		E452735	N4421384
Landowner Nar	ne	Xsec 6						
Drainage Area		<u>190.47</u> sq. m	i.			Clear Cells		
Regional Curve	Predictions	:					-	
Bankfull dimens	sions	Width Depth	115 ft. 6.9 ft.	Cross Sectio	nal Area	790	sq. ft.	
Reference Stre	am Gage:							
Salt Fork near Ho	mer		•	Station No.	03338000	D	Gage Q ₂	3760 cfs
Champaign Co	untv.	IL		Drainage Area	344 sq.mi REFERENC		A ONLY	4290 Cfs
Valley Slope:	eak Dischar 3.0	ge Predictions: ft./mi. (user-entei	red)			Reg	ression Q ₂	2537 cfs
		ft/mi (from works	heet) Rair	nfall 2.95 in	(2 yr, 24 hr)	A	djusted Q ₂	2223 cfs
	0.0006	ft./ft.	Regional Fac	ctor 1.057		Typical Rar	ige for Ban	full Discharge:
							880	to 1780 cfs
Local Stream N	lorphology:							
Channel D Manning's "n"		(c) Clean, winding	, some pools and sh	oals			•	
Marining 5 Tr	0.04	-	Stream	Length		ft.		
Basic Field Data:			Valley L	ength		ft.		
Bankfull Width	Denth	76 ft.	Contour	Interval		feet		
Width/Depth Ra	Deptn atio	6.54 <i>It.</i>	Estimate	ed Sinuosity				
			Channel S	Slope:		Bankfull Q from:		
Max. Bankfull D	Depth	7.6 ft.	Survey	ved: 0.00081	ft./ft.	Cross-Section	1688	cfs
Width at twice r	max. depth	1000 ft.	Estimat	ted:	ft./ft.	Basic field data	1844	cfs
	(15.2 π. ⊋atio	13.16	Radius o	f Curvature (Rc)		Selected Q	1766	CIS
Lindenchinent	Natio	13.10	R	c/Bankfull width	0.00	n.		
				o, Darman	0.00			
Bankfull Velocit	ty Check:	(typical Illinois sti	reams will have	average bankfull	velocity betw	veen 3 and 5 ft/se	ec.)	
Bedload:	D ₉₀	3 v in.	Velocity	required to move	9 D ₉₀ .	3.6	ft./sec.	
COAL: Douglas	D ₅₀	In.	Velocity	from basic field a	ion data:	3.39	IL/SEC.	
Velocitie	s from differ	ent sources	Velocity	from selected Q.	Jala.	3.6	ft /sec	
velocilie		om 600/000.	volocity	inem selected Q.		0.0	1./000.	
Channel Evolut	ion Stage	V 💌	Stream	n Type (Rosgen)		<u> </u>		
Notes								
0.27 of c/ca ===								
୬.∠/ UIS/SQ. MI.								

Natural Open Channel Flow							
		back to I&E form					
Project: Assisted by: Date:	Xsec 6 Wayne Kinney 9/19/2005	$\begin{bmatrix} -1.486 \\ n \end{bmatrix} A R^{\frac{2}{3}} S^{\frac{1}{2}} \begin{bmatrix} Clear Cells \end{bmatrix}$					
Channel Slope (S): Manning's n : Flow Depth:	0.000810 0.040 7.6	ft/ft assuming uniform, steady flow					
Purryey Deter	1.0	Trial Depth 2 Trial Depth	h 3				
Survey Data:	Distance (ft)	$\begin{array}{c c c c c c c c c c c c c c c c c c c $					
5 Q		$\begin{array}{c c c c c c c c c c c c c c c c c c c $					
6.2	102.0	Cross-Sectional Area (A): 497.3 sq ft 599.3					
14.2	93.0	Hydraulic Radius (\mathbf{R}): 5.8 ft 5.9					
14.7	70.0						
14.3	60.0	0.0 20.0 40.0 60.0 80.0 100.0 120.0					
14.5	45.0						
14.3	33.0						
7.1	25.0						
7.1	20.0						
5.70	15						
4.10	10	6.0					
4.40	0		G				
		8.0	с р				
			8				
		10.0					
		16.0					
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