Illinois

Lake Pittsfield
Section 319
National Monitoring Program Project

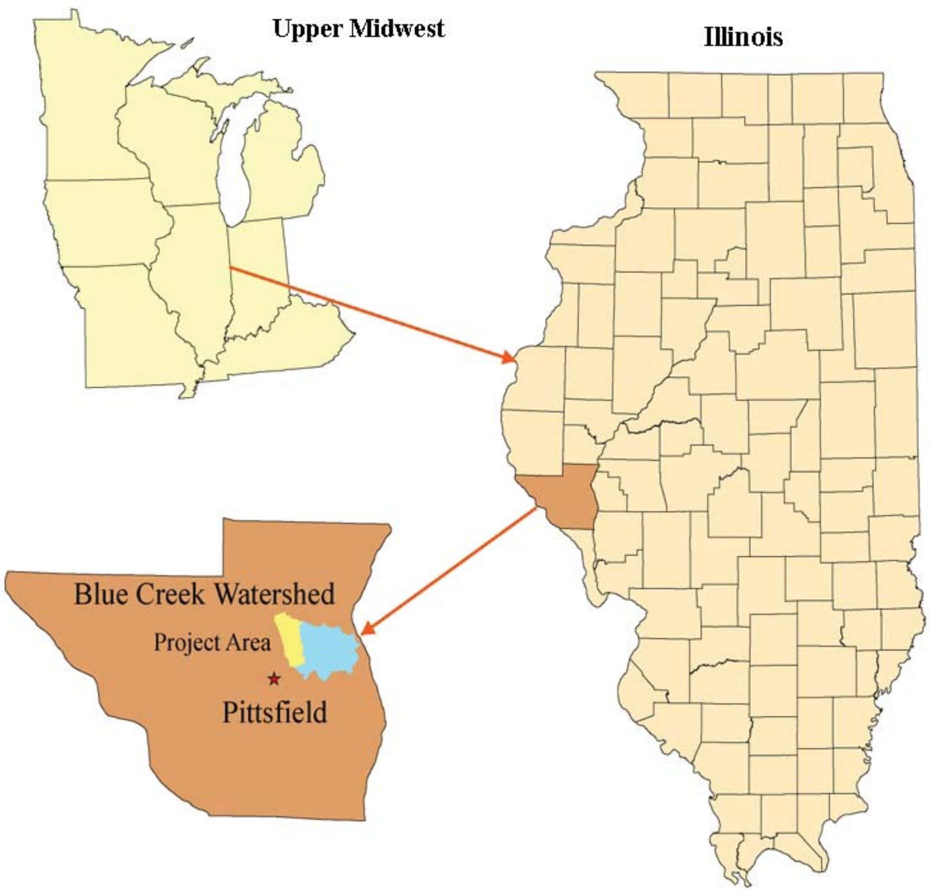

Figure 11: Location of the Lake Pittsfield Project in the Blue Creek Watershed of Pike County, Illinois

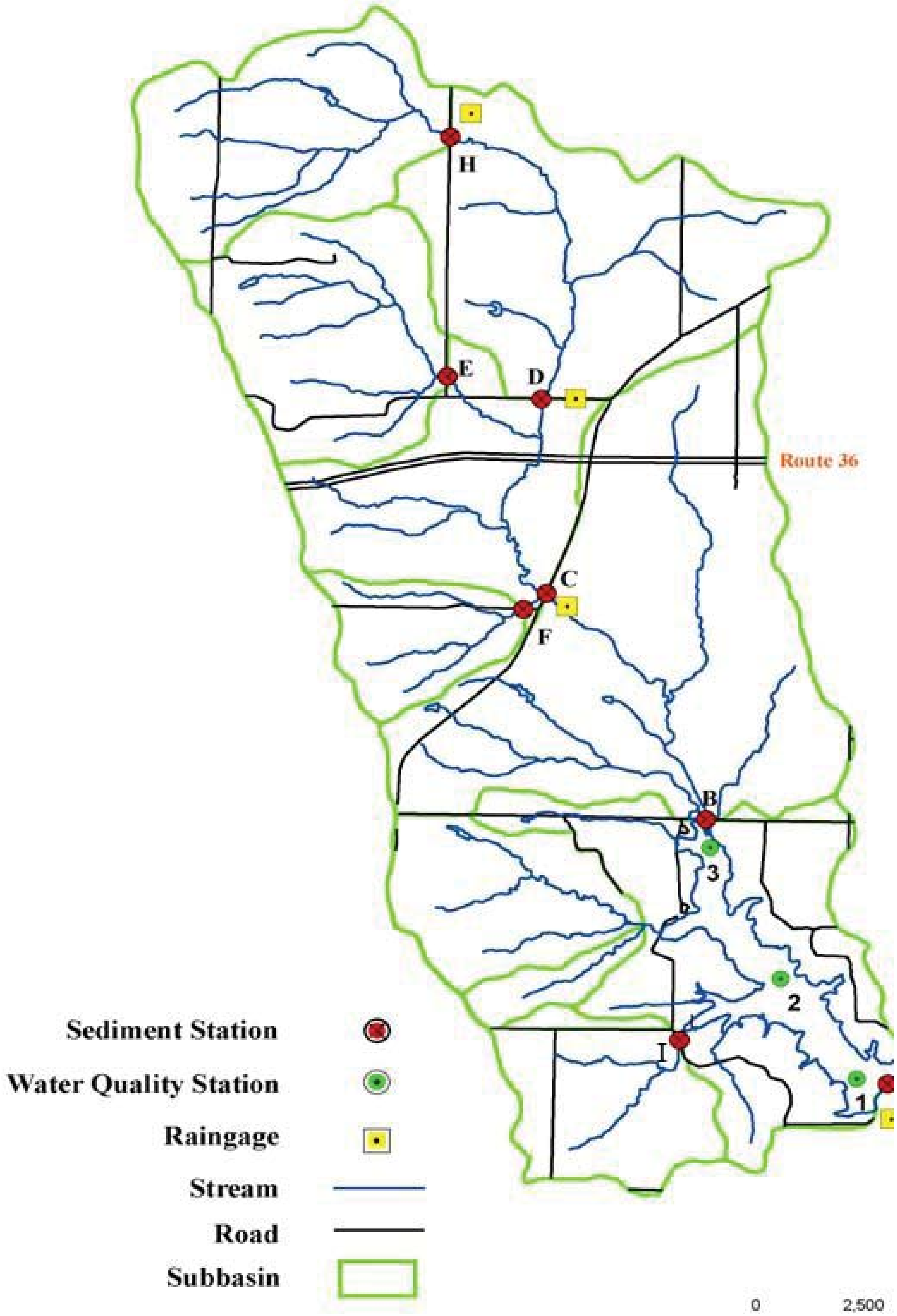

Figure 12: Monitoring Network in the Blue Creek Watershed above Lake Pittsfield

PROJECT OVERVIEW

Lake Pittsfield was constructed in 1961 to serve as both a flood control structure and a public water supply for the city of Pittsfield, a western Illinois community of approximately 4,000 people. The project area consists of 6,956 acres of the Blue Creek watershed that directly drains into Lake Pittsfield. Agricultural production consists primarily of row crops (corn and soybeans), and small livestock operations: hog production, generally on open lots, and some cattle on pasture.

Sedimentation is the major water quality problem in Lake Pittsfield. Sediment from farming operations, gullies, and shoreline erosion has decreased the surface area of Lake Pittsfield from 262 acres to 219.6 acres in the last 33 years. Other water quality problems are excessive nutrients and atrazine contamination. The lake is classified as hypereutrophic, a condition caused by excess nutrients.

The major land treatment strategy is to reduce sediment transport into Lake Pittsfield by constructing settling basins throughout the watershed, including a large basin at the upper end of Lake Pittsfield. Water Quality Incentive Project (WQIP) money, provided through the United States Department of Agriculture (USDA) Farm Service Agency (FSA), was used to fund conservation tillage, integrated crop management, livestock exclusion, filter strips, and wildlife habitat management. An information and education program on the implementation of best management practices (BMPs) used to control sediment, fertilizer, and pesticides were conducted by the Pike County Soil and Water Conservation District (SWCD).

The Illinois State Water Survey (ISWS) conducted the Lake Pittsfield Section 319 National Monitoring Program project in order to evaluate the effectiveness of the settling basins. Water quality monitoring consists of storm event tributary sampling, lake water quality monitoring, and lake sedimentation rate monitoring.

Land-based data was used by the ISWS to develop watershed maps of sediment sources using a geographic information system (GIS). The data for the different GIS layers consist of streams, land uses, soils, roads, subwatersheds, topography, and border line of the lake.

Monitoring ended in August 2004. Results are included in the 2009 Final Report and highlights are summarized in NWQEP NOTES #129 (September 2008) at http/ncsu.edu/waterquality.

PROJECT BACKGROUND

Project Area

The 6,956-acre Blue Creek watershed that drains into Lake Pittsfield is located in western Illinois (Figure 11). The terrain is rolling with many narrow forested draws in the lower portion of the watershed. The topography of the upper portion of the watershed is mild and the draws are generally grassed.

Relevant Hydrologic, Geologic, and Meteorologic Factors

The area surrounding Lake Pittsfield receives approximately 39.5 inches of rainfall per year, most of which falls in the spring, summer, and early fall. Soils are primarily loess derived. Soils in the upper portion of the watershed developed under prairie vegetation, while those in the middle and lower portions of the watershed were developed under forest vegetation.

Land Use

Some sediment-reducing BMPs are currently being used by area farmers as a result of a program (Special Water Quality Project) that was started in 1979. Pike County SWCD personnel encouraged the use of terraces, no-till cultivation, contour plowing, and water control structures. Many terraces were constructed and most farmers adopted contour plowing. Table 1 shows that agriculture is the dominate land use in the Blue Creek watershed above Lake Pittsfield.

Table 1: Land Use of the Blue Creek watershed above Lake Pittsfield

Land Use	Acres	%
Agricultural	3350.5	48
Forest/Shrub	1505.1	21
Pasture/Rangeland	1374.9	20
Residential	132.4	2
Reservoir/Farm Ponds	258.7	4
Roads/Construction	137.1	2
Park	197.5	3
TOTAL	6956.2	100

Source: Illinois Environmental Protection Agency. 1993. Springfield, IL.

Water Resource Type and Size

Lake Pittsfield is a 219.6-acre lake located near the city of Pittsfield in Pike County (western Illinois) (Figure 11).

Water Uses and Impairments

Lake Pittsfield serves as the primary drinking water source for the city of Pittsfield. Secondarily, the lake is used for recreational purposes (fishing and boating). Sedimentation, which has decreased storage capacity in Lake Pittsfield, is the primary water quality impairment. Lake eutrophication and occasional concentrations of atrazine above the 3 ppb Maximum Contaminant Level (MCL) also impair lake uses.

Pollutant Sources

Cropland, pasture, shoreline, and streambanks

Pre-Project Water Quality

Lake sedimentation studies have been conducted four times (1974, 1979, 1985, and 1992). Almost 15% of Lake Pittsfield's volume was lost in its first 13 years (Table 2). An additional 10% of the lake's volume was lost in the next 18 years (1974 to 1992), suggesting that the rate of sedimentation has slowed. The majority of the lake volume that has been lost is at the Blue Creek inlet into the lake, which is in the northern portion of the lake.

Table 2: Lake Pittsfield Sedimentation Studies

Year of Survey	Lake Age (Years)	Lake Volume		Sediment Volume		Original Volume
		ac-ft	MG	ac-ft	MG	Lose (%)
1961		3563	1161			
1974	13.5	3069	1000	494	161	13.9
1979	18.3	2865	933	697	227	19.6
1985	24.3	2760	899	803	262	22.5
1992	31.5	2679	873	884	288	24.8
2004	43.5	2839	926	748	244	21.0

Source: Illinois Environmental Protection Agency, 1993; Illinois State Water Survey, 2005

Long-term water quality monitoring data demonstrated that the lake has been, and continues to be, hypereutrophic. In 1993, Lake Pittsfield's water quality was found to exceed the Illinois Pollution Control Board's general use water quality standards for total phosphorus (0.05 mg/l). Total phosphorus standards of 0.05 mg/l were exceeded in 70% of the samples taken. The 0.3 mg/l standard for inorganic nitrogen was exceeded in 60% of the water samples. Water quality samples collected in 1979 had similar concentrations in terms of phosphorus and nitrogen.

In 2004, a partial sedimentation survey was conducted to define the baseline condition for post-dredge lake volume. An estimate of the volume of dredged material from the lake was based on the observed extent of the dredging, 2004 average depth of water, the dredged area, and the 1992 depth determined by survey transects within the dredged area. The estimated area of dredging was 16.6 acres. The estimated volume of the removed sediment was 136 ac-ft and the average depth of sediment removal was 8.2 feet. Dredging restored the lake volume loss from 24.8% to 21% which is just under the volume loss of the 1985 sedimentation survey (Table 2).

Water Quality Objectives

The objectives of the project are to

- reduce sediment loads into Lake Pittsfield
- evaluate the effectiveness of sediment retention basins.

Project Time Frame

Initial water quality funding began in 1992 as a 319 Watershed Project. In 1994, the project was approved for the Section 319 National Monitoring Program and continued up through the 2004 seasonal sampling events. This allowed monitoring for a period of nine years after the installation of sediment retention basins.

March 1, 1993 to September 30, 1995 (Watershed)

September 1, 1992 to 1994 (Monitoring Strategy)

PROJECT DESIGN

Nonpoint Source Control Strategy

The nonpoint source control strategy is based on reducing off-site sediment movement and limiting the transport of sediment into the water resource of Lake Pittsfield.

In 1995 Section 319(h) funds were used to build 29 small (approximately two acres each) sediment retention basins. These basins are used to limit the transport of sediment into Lake Pittsfield. In addition, a large sediment retention basin (SRB) capable of trapping over 90% of the sediment entering Lake Pittsfield at the upper end was built above station B in 1996 by utilizing Section 319(h) funds.

Funds from the Water Quality Incentive Program were used to encourage the adoption of BMPs that reduce the off-site movement of sediment, fertilizer, and pesticides. These BMPs include conservation tillage, integrated crop management, livestock exclusion, filter strips, and wildlife habitat management.

Section 314 Clean Lakes Program funds were used to build shoreline stabilization BMPs in order to reduce shoreline erosion. Areas where rip rap existed were reinforced and new rip rap was installed along the eroded shoreline.

In 1998, a series of 12 rock grade controls (Newbury weirs) were constructed above sampling station D on Blue Creek to stabilize the streambed and recreate pool and riffle sequences. The rock grade controls helped slow erosion occurring from streambanks and a large mass wasting upstream of station D. Re-vegetation (tree planting and seeding) was also conducted on the streambanks and the mass wasting in conjunction with the installation of rock grade controls. Table 3 outlines the pre and post BMP monitoring dates covering the basins and the rock grade controls.

A Phase II Section 314 Clean Lakes Program was conducted for the Illinois EPA utilizing Section 314 funding in 1999-2000 which evaluated the effectiveness of the restoration measures implemented within Lake Pittsfield and its watershed from 1989-1999. The restoration measures implemented were recommended under a Phase I Diagnostic - Feasibility Study of Lake Pittsfield, completed in 1989 through Section 314 funding, and included but was not limited to watershed treatments, upland watershed best management practices, shoreline stabilization practices, thermal destratification, algal treatment and dredging (sediment removal). An additional 3,000 linear feet of shoreline stabilization practices were implemented in 2002 on Lake Pittsfield utilizing Section 319 funding to address eroded shoreline.

Table 3: Project Schedule

Site	Pre-BMP Monitoring	BMP Installation	Post-BMP Monitoring
Subwatershed D	11/92-12/94	1995	1996-1998
Subwatershed C	11/92-12/94	1995	1996-2004
Subwatershed B	11/92-06/96	Fall 96	2/97-12/04
Subwatershed D	12/92-12/97	1998	1998-2004

Water Quality Monitoring

Storm sampling was conducted at four stations on the main channel of Blue Creek which feeds into Lake Pittsfield. Three storm monitoring stations on tributaries of Blue Creek and a station located at the outflow of Lake Pittsfield were monitored up to 1995. Monthly ambient lake monitoring was conducted at three water quality stations within Lake Pittsfield. Trend monitoring was also done at the three lake stations. The variables used at these monitoring stations are listed in table 4. Lake sedimentation studies were conducted before dredging and a post-dredge baseline condition has been established.

Variables Measured

Table 4: List of Variables Measured within Lake Pittsf eld and its Watershed

Chemical and other (Lake)	Chemical and other (Stream)	Biological	Covariates
Total phosphorus (TP)	Total suspended solids (TSS)	None	Rainfall
Dissolved phosphorus (DP)			
Total Kjeldahl nitrogen (TKN)			
Nitrate + nitrite (NO3 + NO2)			
Ammonia nitrogen (NH3+ NH4+)			
Total suspended solids (TSS)			
Volatile suspended solids (VSS)			
pH			
Total alkalinity			
Phenolphthalein alkalinity			
Specific conductivity			
Water temperature			
Dissolved oxygen (DO)			
Atrazine (started in 1999)			

Sampling Scheme

Storm sampling has been conducted at four stations located at stations B, C, D, and H on Blue Creek (Figure 2). These stations were equipped with ISCO automatic samplers and manual DH-59 depth-integrated samplers. A pressure transducer triggers sampling as the stream rises. The samplers measure stream height. In addition, the streams were checked manually with a gauge during flood events to determine the stage of the stream. During these flood events, the stream was rated to determine flow in cubic feet per second. Stream stage was then correlated with flow in order to construct a stream discharge curve. Water samples were analyzed to determine sediment loads. From 1992 to 1995 three stations located on tributaries to Blue Creek (stations E, F, and I) were sampled with manual DH-59 depth-integrated samplers and grab samples while taking flow measurements with a Marsh-McBirney Flowmate 2000 flowmeter. Grab Samples were taken at station A at the outflow of the dam. Rain gauges have been placed near sampling sites A, C, D, and H (Figure 12).

Three lake sampling stations had been established in the shallowest portion of the lake, the middle of the lake, and the deepest part of the lake (Figure 2). Water quality grab samples were taken monthly from April through October starting in October of 1992 through August of 1995. In-situ observations were done at 2-foot intervals at these stations for Secchi disk transparency, temperature and dissolved oxygen profiles. In addition, water chemistry samples were taken from the surface of all three lake stations, as well as the lowest depth at the deepest station, and were analyzed for the chemical constituents listed in table 5.

Table 5: Monitoring Scheme for the Lake Pittsfield Section 319 National Monitoring Program Project

Design	Sites or Activities	Primary Parameters	Covariates	Frequency	Duration
Before/After	Stations B, C	TSS	Rainfall	During storms	11 yrs
pre-BMP	D & H				2 yr
post-BMP					9 yrs
Single	Lake stations	Secchi disk transparency	Rainfall	Monthly,	2 yrs
pre-BMP	Stations 1, 2, & 3	DO		April	1 yr
		OP		through October	
		TP			
		Ammonia nitrogen ($NH_3 + NH_4^+$)			
		TKN			
		$NO_3 + NO_2$			
		TSS			
		VSS			
		pH			
		Total alkalinity			
		Phenolphthalein alkalinity			
		Specific conductivity			
		Water temperature			
		Air temperature			
		DO			
		Atrazine			
Lake Sedimentation Study		Lake depth		Prior to dredging	
Shoreline erosion Severity Survey				Once	

Land Treatment Monitoring

Table 6 shows the extent and installation dates of the Water and Sediment Control Basins (WASCOBs). Excluded from the table is the large Sediment Retention Basin (SRB) built 300 feet above station B in 1996. The watershed above the SRB includes the subwatersheds of stations B, C, and D totaling 4984 acres which is 71.7% of the entire watershed above Lake Pittsfield.

Table 6: Summary of Water and Sediment Control Basin Installation

Subwatershed	Subwatershed acres	Watershed above WASCOBs, %	No. of WASCOBS	Installation Dates
A	1551	34	7	8/25/94 to 9/08/95
B	1661	13.4	4	8/13/94 to 9/23/95
I	421	69	4	7/29/94 to 9/26/95
C	1567	41	7	8/17/94 to 9/30/95
D	1756	45	7	7/27/94 to 9/06/95

Modifications During Project

The contract for building sediment basins was extended to August 20, 1996, due to design modification and the permit process for the large sediment basin.

Nonpoint source national monitoring during the spring season was included at monitoring sites B and C, which includes 2 years of pre-BMP data, 1 year during BMP implementation, and 8 years of sampling after BMP implementation.

Progress to Date

A total of 29 sediment basins and the large SRB have been completed. It is estimated that the basins in the C and D subwatersheds are reducing sediment delivery by 68-61% respectively. The large SRB is estimated to be reducing sediment delivery entering directly into Lake Pittsfield from the entire watershed by 91%. A series of rock grade controls (Newbury weirs) have been installed throughout 3,000 feet of stream channel upstream of station D. All WQIP projects have been implemented.

A Phase II Section 314 Clean Lakes Program was conducted for the Illinois EPA utilizing Section 314 funding in 1999-2000 to evaluate the effectiveness of the restoration measures implemented at Lake Pittsfield from 1989 to1999. Addition 3,000 linear feet of shoreline stabilization practices on Lake Pittsfield utilizing Section 319 funding to address eroded shoreline were installed in 2002 to help reduce the amount of in-lake sedimentation sources and to provide enhanced wildlife habitat, while also providing NPS education to the local community.

DATA MANAGEMENT AND ANALYSIS

Data Management and Storage

The water quality monitoring data are entered into a database and then loaded into the USEPA (U.S. Environmental Protection Agency) water quality data base, STORET. Data are also stored and analyzed with the USEPA Nonpoint Source Management System (NPSMS) software. Table 7 contains sediment yield data for the larger subwatersheds in the project.

NPSMS Data Summary

Table 7: Summary of Data Collected from Subwatersheds B and C

PERIOD: Spring Season, 1994
STATION TYPE: Upstream Station — **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	
-25-STREAM, INSTANTANEOUS, CFS	S	cfs	8.4	3.9	2.4
INSTANTANEOUS YIELD	S	lbs/sec	.017	.004	.002
PRECIPITATION, TOTAL	S	in/day	.2	0	0
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	49	24	10

STATION TYPE: Downstream Station — **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	9.5 4	.5	2.4
INSTANTANEOUS YIELD	S	lbs/sec	.024	.022	.007
PRECIPITATION, TOTAL	S	in/day	0	0	0
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	133	69	40

Table 7: Continued

PERIOD: Spring Season, 1995

STATION TYPE: Upstream Station **PRIMARY CODE:** Station C

<u>CHEMICAL PARAMETERS</u>

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	6.3	3.6	2.8
INSTANTANEOUS YIELD	S	lbs/sec	0.025	0.005	0.002
PRECIPITATION, TOTAL	S	in/day	0.05	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	60	27	14

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	8.9	5.0	3.0
INSTANTANEOUS YIELD	S	lbs/sec	0.081	0.023	0.008
PRECIPITATION, TOTAL	S	in/day	0.08	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	112	64	44

PERIOD: Spring Season, 1997

STATION TYPE: Upstream Station **PRIMARY CODE:** Station C

<u>CHEMICAL PARAMETERS</u>

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	2.5	1.9	1.5
INSTANTANEOUS YIELD	S	lbs/sec	0.03	0.002	0.001
PRECIPITATION, TOTAL	S	in/day	0.00	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	22	17	13

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50--25-FLOW,	
STREAM, INSTANTANEOUS, CFS	S	cfs	4.9	4.4	3.6
INSTANTANEOUS YIELD	S	lbs/sec	0.007	0.005	0.003
PRECIPITATION, TOTAL	S		in/day		0.00
0.00	0.00				
SEDIMENT, PARTICLE SIZE FRACT.	S		mg/L		27
19	12	< .0625 MM % dry wgt.			

PERIOD: Spring Season, 1998

STATION TYPE: Upstream Station **PRIMARY CODE:** Station C

<u>CHEMICAL PARAMETERS</u>

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	6.4	4.2	2.4
INSTANTANEOUS YIELD	S	lbs/sec	0.012	0.004	0.002
PRECIPITATION, TOTAL	S	in/day	0.05	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	40	20	13

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	18.4	9.1	6.7
INSTANTANEOUS YIELD	S		lbs/sec	0.035	0.015
0.010					
PRECIPITATION, TOTAL	S		in/day		0.00
0.00	0.00				
SEDIMENT, PARTICLE SIZE FRACT.	S		mg/L		52
30	18	< .0625 MM % dry wgt.			

PERIOD: Spring Season, 1999
STATION TYPE: Upstream Station **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	5.2	3.0	2.2
INSTANTANEOUS YIELD	S	lbs/sec	0.007	0.003	0.002
PRECIPITATION, TOTAL	S	in/day	0.09	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	36	17	10

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	14.3	6.0	3.7
INSTANTANEOUS YIELD	S	lbs/sec	0.039	0.010	0.004
PRECIPITATION, TOTAL	S	in/day	0.38	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 MM % dry wgt.	S	mg/L	41	30	19

PERIOD: Spring Season, 2000
STATION TYPE: Upstream Station **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	0.4	0.1	0.1
INSTANTANEOUS YIELD	S	lbs/sec	0.003	0.000	0.000
PRECIPITATION, TOTAL	S	in/day	0.310.00	0.00	
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	120	59	18

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	4.5	0.1	0.0
INSTANTANEOUS YIELD	S		lbs/sec	0.008	0.010
0.000					
PRECIPITATION, TOTAL	S	in/day	0.41	0.000.00	
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	110	30	19

PERIOD: Spring Season, 2001
STATION TYPE: Upstream Station **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	3.5	2.1	0.9
INSTANTANEOUS YIELD	S	lbs/sec	0.006	0.002	0.001
PRECIPITATION, TOTAL	S	in/day	0.070.00	0.00	
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	29	16	10

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	10.5	4.6	1.6
INSTANTANEOUS YIELD	S		lbs/sec	0.020	0.009
0.001					
PRECIPITATION, TOTAL	S	in/day	0.07	0.000.00	
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	56	25	19

Table 7: Continued

PERIOD: Spring Season, 2002
STATION TYPE: Upstream Station **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	5.9	2.5	1.8
INSTANTANEOUS YIELD	S	lbs/sec	0.020	0.002	0.001
PRECIPITATION, TOTAL	S	in/day	0.140.00	0.00	
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	56	15	10

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	19.2	6.9	3.0
INSTANTANEOUS YIELD	S		lbs/sec	0.025	0.009
0.002					
PRECIPITATION, TOTAL	S	in/day	0.07	0.000.00	
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	32	16	10

PERIOD: Spring Season, 2003
STATION TYPE: Upstream Station **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	5.6	3.4	1.5
INSTANTANEOUS YIELD	S	lbs/sec	0.013	0.004	0.002
PRECIPITATION, TOTAL	S	in/day	0.01	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT.	S	mg/L	50	30	
18					
< .0625 mm, % dry wgt.					

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	16.3	10.6	7.2
INSTANTANEOUS YIELD	S	lbs/sec	0.020	0.009	0.005
PRECIPITATION, TOTAL	S	in/day	0.00	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	26	13	10

PERIOD: Spring Season, 2004
STATION TYPE: Upstream Station **PRIMARY CODE:** Station C
CHEMICAL PARAMETERS

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	3.3	2.4	1.3
INSTANTANEOUS YIELD	S	lbs/sec	0.002	0.002	0.001
PRECIPITATION, TOTAL	S	in/day	0.03	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT.	S	mg/L	26	14	
6					
< .0625 mm, % dry wgt.					

STATION TYPE: Downstream Station **PRIMARY CODE:** Station B

Parameter Name	Parm Type	Reporting Units	QUARTILE VALUES -75-	-50-	-25-
FLOW, STREAM, INSTANTANEOUS, CFS	S	cfs	20.7	14.5	10.9
INSTANTANEOUS YIELD	S	lbs/sec	0.012	0.007	0.005
PRECIPITATION, TOTAL	S	in/day	0.04	0.00	0.00
SEDIMENT, PARTICLE SIZE FRACT. < .0625 mm, % dry wgt.	S	mg/L	12	8	5

Final Results

The non-glaciated C watershed with limited rowcrop agriculture had the highest sediment yields, which decreased after basin construction. Subwatershed D, which is glaciated and has greater row crop agriculture, had higher sediment yields after basin construction. Streambank erosion sites were evident and resulted from streambank incision. Tabulations of mass wasting at specific bank erosion sites indicate the increased sediment concentrations resulted from channel erosion upstream of sampling station D. Upstream of station B a large sediment basin was constructed in 1996. Results of the installation of the basin showed that sediment yields dropped from 4.35 tons per acre-ft of stream flow to 0.26 tons/ac-ft of stream flow. This represents a decrease in concentration from 3,197 mg/L to 189 mg/L entering into Lake Pittsfield. Figure (3) illustrates all events sampled at station B and shows the reduction of tons of sediment entering Lake Pittsfield.

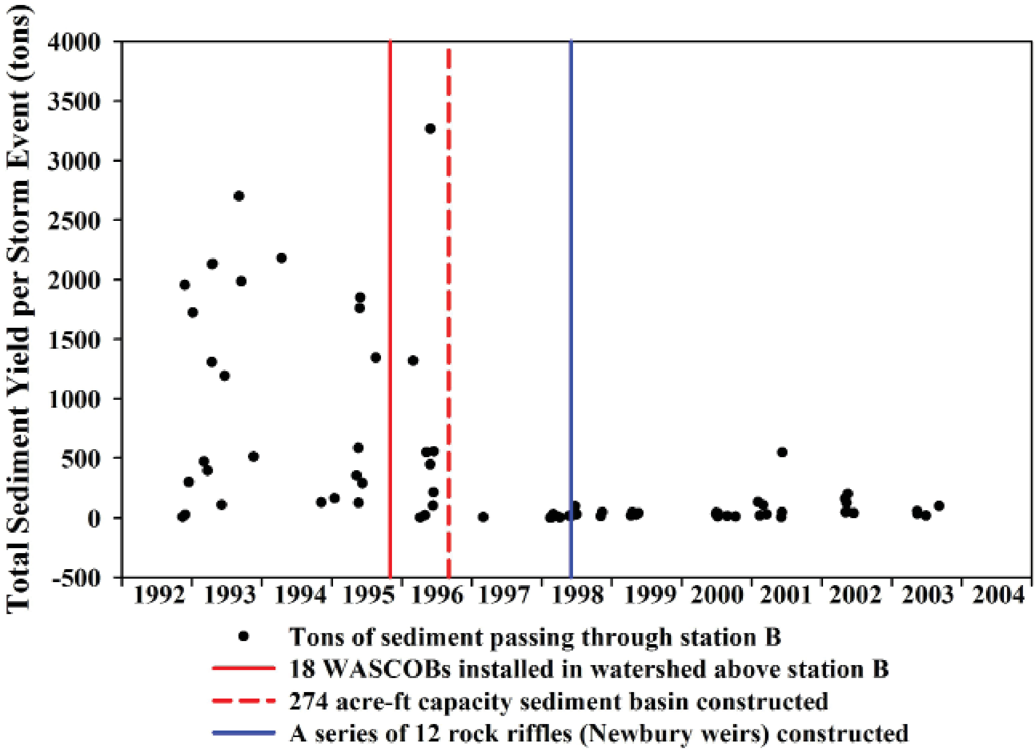

Figure 13: Total sediment yield, monitoring station B, 1992-2003. The number of WASCOBs cited represents the cumulative number constructed above the monitoring station

Project data were also statistically analyzed in two stages. Preliminary data (1992-1998) were analyzed by Grabow (1999), while ISWS project staff conducted subsequent analysis on complete project data (1992 to 2003). Grabow (1999) first evaluated discrete changes in sediment yield, then gradual changes and lastly year-by-year changes. To analyze discrete changes in sediment yield, Grabow (1999) conducted multiple regression analysis on data from 1992-1998 using the variables ‘period’, ‘season’ and ‘discharge’. The variable ‘period’ defined data from 1992 to 1996 as being pre-BMP, while data from 1997-1998 was defined as post-BMP. Sediment yield per storm event was the dependent variable. Storm water discharge, period and season (winter/spring and summer/fall) were explanatory variables. Grabow (1999) used the nonparametric Kendall’s tau-b (Kendall, 1938) to corroborate findings from the test for gradual change in sediment yield from storm events from 1992 to 1998. Analysis of Covariance (ANCOVA) was used to detect differences in sediment yield between specific years. The data were log transformed due to the skewness of the data.

Multiple regression analysis was also used to analyze updated data covering 1992 to 2003 consistent with Grabow's (1999) methodology. As before, the variables 'season,' 'discharge,' and 'period' where used as explanatory variables, with the 'period' variable redefined as pre-BMP (1992–1996) and post-BMP (1997-2003). Storm event sediment yield was the dependent variable. Storm water discharge, period and season (winter/spring and summer/fall) were explanatory variables. Statistical tests and results are summarized in Table 8. Kendall tau b and ANCOVA results for gradual and yearly change in sediment yield from storm events from 1992 to 2003 will be published elsewhere. All statistical analyses were done using appropriate SAS procedures (SAS Institute 2001). The impact of potential differences in the intensity of individual storm events was not examined in this study and could affect conclusions presented here regarding trends in erosion and sediment yield. The authors are in the process of investigating this issue.

Table 8. Summary of Findings by Station

Station		**Analysis Method**[3]		
	Period covered	**Pre/Post Ye**	**arly**	**Gradual**
B	1992-1998	90% reduction	1997 and 1998 lower than all previous years	Significant trend, reduction from 330 to 70 kg at avg flow (79% reduction)
	1992-2003	91% reduction	--	--
C	1992-1998	45% reduction	1998 lower than 1993, 1994 and 1996	No significant trend over period covered
	1992-2003	67.8% reduction	--	--
D[2]	1992-1998	48% reduction	1998 lower than 1993 and 1996, higher than 1992. 1996 higher than all other years	No significant trend over period covered
	1992-2003	61% reduction	--	--

[1] Sediment yield and reductions based on average flow
[2] No data collected in 1997
[3] All statistical results presented are significant at α=0.05

INFORMATION, EDUCATION, AND PUBLICITY

Information and education activities were conducted by a private organization (Farm Bureau) and the Pike County S&WCD. Two public meetings were held to inform producers about the goals of the project. Articles pertaining to the project have appeared in the local newspapers.

The Illinois State Water Survey will produce two educational/informational productions at the end of the Lake Pittsfield National Monitoring Strategy. These two productions will include a final videotape production and a final project report documenting the entire aspects of the Lake Pittsfield National Monitoring Strategy. The final videotape was produced and the final project report is being created and should be complete on or before January of 2009.

TOTAL PROJECT BUDGET

The estimated budget for the Lake Pittsfield Section 319 National Monitoring Program project for the period of FY 92-04 is summarized in table 9.

Table 9: Summary of the Lake Pittsfield Section 319 National Monitoring Program Project

Project Element	**Funding Source ($)**			
	Federal	**State**	**Local**	**Sum**
Proj Mgt	NA	NA	NA	NA
I&E	NA	NA	NA	NA
LT [319(h)]	689,000	459,333	NA	1,148,333
WQ Monit	617,934	NA	223,332	841,266
Cultural Practices (WQIP)	32,000	NA	NA	32,000
Dredge/Shoreline/ Aeration (314 Clean Lakes)	132,110	NA	132,110	264,220
TOTALS	1,471,044	459,333	355,442	2,285,819

Source: State of Illinois, 1993; State of Illinois, 1992; Gary Eicken (Personal Communication), 2000, Scott Tomkins (Personal Communication), 2001; Scott Tomkins (Personal Communication), 2002; Scott Tomkins (Personal Communication), 2003; Scott Tomkins (Personal Communication); 2004; Scott Tomkins (Personal Communication); 2005; Scott Tomkins (Personal Communication)

IMPACT OF OTHER FEDERAL AND STATE PROGRAMS

In 1979, the Pike County SWCD began a Special Water Quality Project that encouraged the implementation of terraces, no-till cultivation, contour plowing, and water control structures. This project was instrumental, along with drier weather conditions, in reducing soil erosion from an average of 5.8 tons per acre to 3.3 tons per acre (a 45% decrease) from 1979 to 1994.

In the fall of 1997, funding was designated from the Illinois EPA and the Illinois Department of Agriculture for the construction of a series of rock grade controls (Newbury weirs) located on Blue Creek upstream of station D. The construction of these rock grade controls was completed in May of 1998. The construction of the weirs has helped to reduce channel erosion and sedimentation by slowing the incision process occurring upstream of station D.

Section 314 funds have been used to install sediment-reducing shoreline BMPs and one destratifier (aerator) in Lake Pittsfield to increase oxygen concentrations throughout the lake, thereby increasing fish habitat. The lake was dredged in April of 1999 in an effort to reclaim the original capacity of the lake.

OTHER PERTINENT INFORMATION

Many organizations have combined resources and personnel in order to protect Lake Pittsfield from agricultural nonpoint source pollution. These organizations are listed below:

- USDA FSA
- City of Pittsfield
- Farm Bureau
- U.S. Environmental Protection Agency

- Illinois Environmental Protection Agency
- Illinois State Water Survey
- Landowners
- Pike County Soil and Water Conservation District
- Illinois Department of Agriculture

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