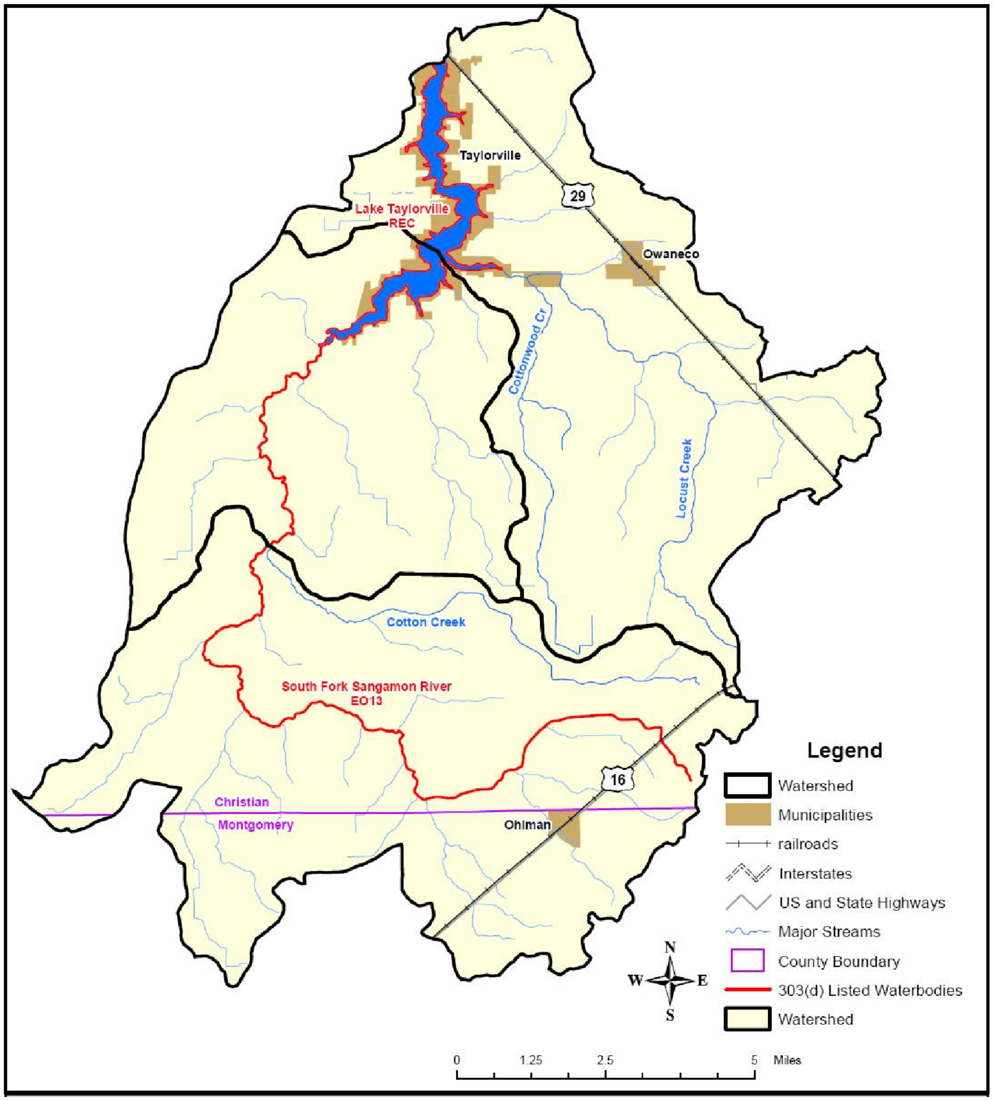
Illinois
Environmental
Protection Agency

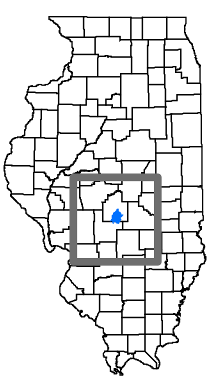
Bureau of Water
P.O. Box 19276
Springfield, IL 62794-9276

December 2007

IEPA/BOW/07-027

SOUTH FORK SANGAMON RIVER/LAKE TAYLORVILLE WATERSHED TMDL REPORT





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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

DEC 13 2007

REPLY TO THE ATTENTION OF:
WW-16J

Marcia Willhite, Chief
Bureau of Water
Illinois Environmental Protection Agency
P.O. Box 19276
Springfield, IL 62794-9276

Dear Ms. Willhite:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the final Total Maximum Daily Loads (TMDL) from the Illinois Environmental Protection Agency (IEPA) for the South Fork Sangamon River (EO13), and Lake Taylorville (REC) in Illinois. The TMDLs are for phosphorus and manganese, and address several impairments in these waterbodies.

Based on this review, U.S. EPA has determined that Illinois' TMDLs for phosphorus and manganese meet the requirements of Section 303(d) of the Clean Water Act and U.S. EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, U.S. EPA hereby approves two TMDLs for six impairments for the South Fork Sangamon River (EO13), and Lake Taylorville (REC) in Illinois. The statutory and regulatory requirements, and U.S. EPA's review of Illinois' compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Illinois' effort in submitting this TMDL and look forward to future TMDL submissions by the State of Illinois. If you have any questions, please contact Mr. Kevin Pierard, Chief of the Watersheds and Wetlands Branch at 312-886-4448.

Sincerely yours,

Tinka G. Hyde
Acting Director, Water Division

Enclosure

cc: Trevor Sample, IEPA

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Tables

Section 1
Goals and Objectives for South Fork Sangamon River/Lake Taylorville Watershed (0713000702)

1.1 Total Maximum Daily Load (TMDL) Overview

A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs are a requirement of Section 303(d) of the Clean Water Act (CWA). To meet this requirement, the Illinois Environmental Protection Agency (Illinois EPA) must identify water bodies not meeting water quality standards and then establish TMDLs for restoration of water quality. Illinois EPA lists water bodies not meeting water quality standards every two years. This list is called the 303(d) list and water bodies on the list are then targeted for TMDL development.

In general, a TMDL is a quantitative assessment of water quality problems, contributing sources, and pollution reductions needed to attain water quality standards. The TMDL specifies the amount of pollution or other stressor that needs to be reduced to meet water quality standards, allocates pollution control or management responsibilities among sources in a watershed, and provides a scientific and policy basis for taking actions needed to restore a water body.

Water quality standards are laws or regulations that states authorize to enhance water quality and protect public health and welfare. Water quality standards provide the foundation for accomplishing two of the principal goals of the CWA. These goals are:

- Restore and maintain the chemical, physical, and biological integrity of the nation's waters
- Where attainable, to achieve water quality that promotes protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water

Water quality standards consist of three elements:

- The designated beneficial use or uses of a water body or segment of a water body
- The water quality criteria necessary to protect the use or uses of that particular water body
- An antidegradation policy

Examples of designated uses are recreation and protection of aquatic life. Water quality criteria describe the quality of water that will support a designated use. Water quality criteria can be expressed as numeric limits or as a narrative statement.

Antidegradation policies are adopted so that water quality improvements are conserved, maintained, and protected.

1.2 TMDL Goals and Objectives for South Fork Sangamon River/Lake Taylorville Watershed

The Illinois EPA has a three-stage approach to TMDL development. The stages are:

- Stage 1 – Watershed Characterization, Data Analysis, Methodology Selection
- Stage 2 – Data Collection (optional)
- Stage 3 – Model Calibration, TMDL Scenarios, Implementation Plan

This report addresses all stages of TMDL development for the South Fork Sangamon River/Lake Taylorville watershed. Stage 2 was conducted in the fall of 2006 and the separate Stage 2 data report is available in Appendix F.

The TMDL goals and objectives for the South Fork Sangamon River/Lake Taylorville watershed were to develop TMDLs for all impaired water bodies within the watershed, describe all of the necessary elements of the TMDL, develop an implementation plan for each TMDL, and gain public acceptance of the process. Following are the impaired water body segments in the South Fork Sangamon River/Lake Taylorville watershed for which a TMDL will be developed:

- South Fork Sangamon River (EO 13)
- Lake Taylorville (REC)

These impaired water body segments are shown on Figure 1-1. There are two impaired segments within the South Fork Sangamon River/Lake Taylorville watershed. Table 1-1 lists the water body segment, water body size, and potential causes of impairment for the water body.

Table 1-1 Impaired Water Bodies in South Fork Sangamon River/Lake Taylorville Watershed

Water Body Segment ID	Water Body Name	Size	Causes of Impairment with Numeric Water Quality Standards	Causes of Impairment with Assessment Guidelines
EO 13	South Fork Sangamon River	20.03 miles	Boron[(1)], manganese, dissolved oxygen (DO)	Chlordane
REC	Lake Taylorville	1,148 acres	Manganese, total phosphorus, DO	Excess algal growth, chlordane, total suspended solids (TSS)

(1) Data collected during Stage 2 indicated that boron was no longer a potential cause of impairment to the South Fork Sangamon River. Therefore, no TMDL was developed for boron.

Illinois EPA is currently developing TMDLs for parameters that have numeric water quality standards, and therefore the remaining sections of this report will focus on the boron, manganese, DO, and total phosphorus (numeric standard) impairments in the South Fork Sangamon River/Lake Taylorville watershed. For potential causes that do not have numeric water quality standards as noted in Table 1-1, TMDLs will not be developed at this time. However, in the implementation plans presented in Section 9, many of these potential causes may be addressed by implementation of controls for the pollutants with water quality standards.

The TMDL for the segments listed above will specify the following elements:

- Loading Capacity (LC) or the maximum amount of pollutant loading a water body can receive without violating water quality standards
- Waste Load Allocation (WLA) or the portion of the TMDL allocated to existing or future point sources
- Load Allocation (LA) or the portion of the TMDL allocated to existing or future nonpoint sources and natural background
- Margin of Safety (MOS) or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality

These elements are combined into the following equation:

$$\mathbf{TMDL = LC = \Sigma WLA + \Sigma LA + MOS}$$

The TMDLs take into account the seasonal variability of pollutant loads so that water quality standards are met during all seasons of the year. Also, reasonable assurance that the TMDL will be achieved is described in the implementation plan. The implementation plan for the South Fork Sangamon River/Lake Taylorville watershed describes how water quality standards will be attained. The implementation plan includes recommendations for implementing best management practices (BMPs), cost estimates, institutional needs to implement BMPs and controls throughout the watershed, and a timeframe for completion of implementation activities.

1.3 Report Overview

The remaining sections of this report contain:

- **Section 2 South Fork Sangamon River/Lake Taylorville Watershed Characteristics** provides a description of the watershed's location, topography, geology, land use, soils, population, and hydrology.
- **Section 3 Public Participation and Involvement** discusses public participation activities that occurred throughout the TMDL development.

- **Section 4 South Fork Sangamon River/Lake Taylorville Watershed Water Quality Standards** defines the water quality standards for the impaired water body.
- **Section 5 South Fork Sangamon River/Lake Taylorville Watershed Characterization** presents the available water quality data needed to develop TMDLs, discusses the characteristics of the impaired reservoirs in the watershed, and also describes the point and non-point sources with potential to contribute to the watershed load.
- **Section 6 Approach to Developing TMDL and Identification of Data Needs** makes recommendations for the models and analysis that will be needed for TMDL development and also suggests segments for Stage 2 data collection.
- **Section 7 Model Development for the South Fork Sangamon River/Lake Taylorville Watershed** provides an explanation of modeling tools used to develop TMDLs for impaired segments and potential causes of impairments within the watershed.
- **Section 8 Total Maximum Daily Loads for the South Fork Sangamon River/Lake Taylorville Watershed** discusses the calculated allowable loadings to water bodies in order to meet water quality standards and the reductions in existing loadings needed to meet the determined allowable loads.
- **Section 9 Implementation Plan** includes recommendations for implementing BMPs and continued monitoring throughout the watershed
- **Section 10 References**

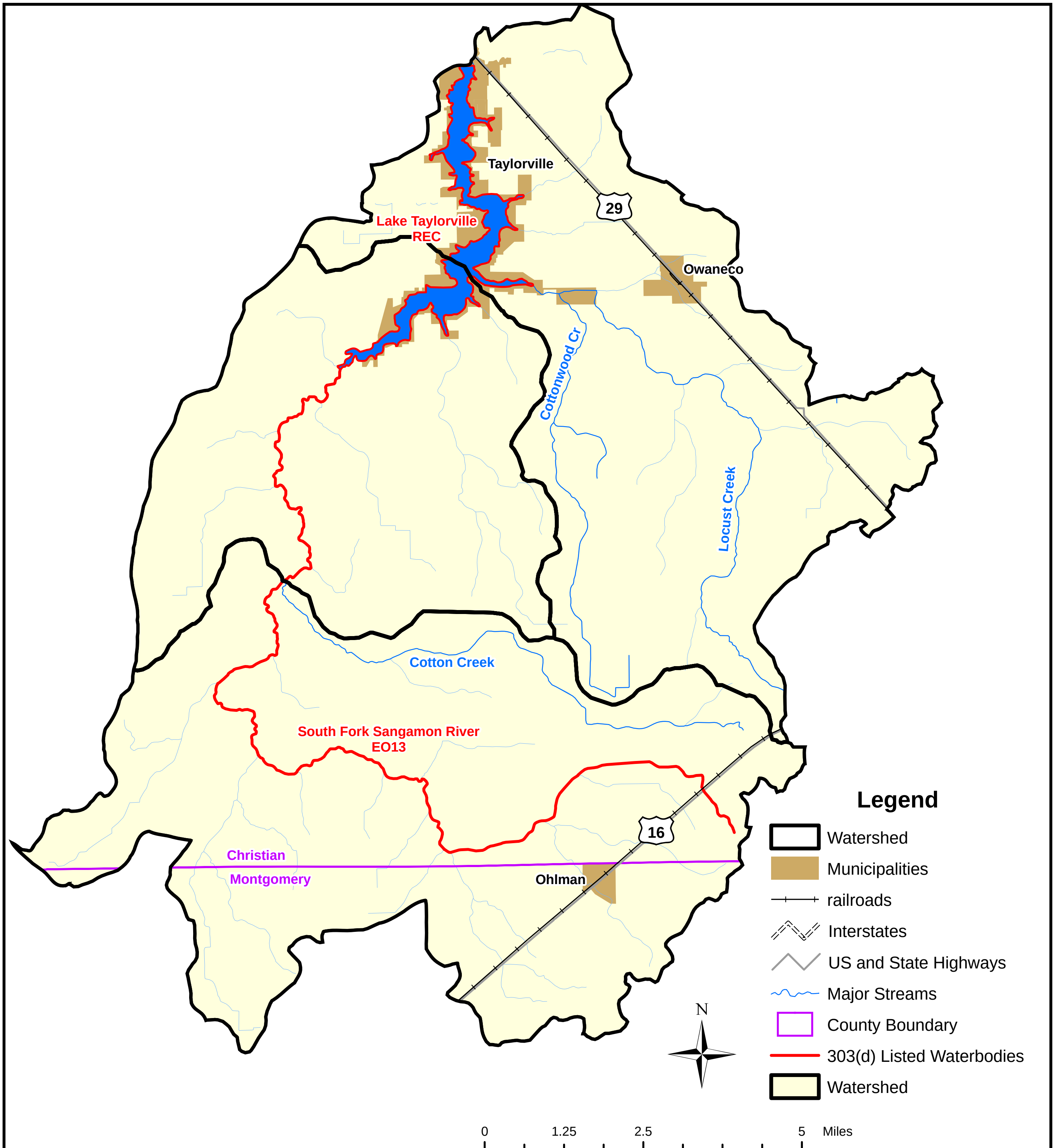

Figure 1-1
Sangamon River - Lake Taylorville Watershed

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Section 2
South Fork Sangamon River/Lake Taylorville Watershed Description

2.1 South Fork Sangamon River/Lake Taylorville Watershed Location

The South Fork Sangamon River/Lake Taylorville watershed (Figure 1-1) is located in central Illinois, flows in a northerly direction, and drains approximately 83,000 acres within the state of Illinois. The watershed covers land within Christian and Montgomery Counties.

2.2 Topography

Topography is an important factor in watershed management because stream types, precipitation, and soil types can vary dramatically by elevation. National Elevation Dataset (NED) coverages containing 30-meter grid resolution elevation data are available from the U.S. Geological Survey (USGS) for each 1:24,000-topographic quadrangle in the United States. Elevation data for the South Fork Sangamon River/Lake Taylorville watershed was obtained by overlaying the NED grid onto the geographic information system (GIS)-delineated watershed. Figure 2-1 shows the elevations found within the watershed.

Elevation in the South Fork Sangamon River/Lake Taylorville watershed ranges from 777 feet above sea level in the headwaters of South Fork Sangamon River to 567 feet at its most downstream point at Lake Taylorville in the northern end of the watershed. The absolute elevation change is 151 feet over the approximately 20-mile stream length of South Fork Sangamon River, which yields a stream gradient of approximately 7.5 feet per mile.

2.3 Land Use

Land use data for the South Fork Sangamon River/Lake Taylorville watershed were extracted from the Illinois Gap Analysis Project (IL-GAP) Land Cover data layer. IL-GAP was started at the Illinois Natural History Survey (INHS) in 1996, and the land cover layer was the first component of the project. The IL-GAP Land Cover data layer is a product of the Illinois Interagency Landscape Classification Project (IILCP), an initiative to produce statewide land cover information on a recurring basis cooperatively managed by the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), the Illinois Department of Agriculture (IDA), and the Illinois Department of Natural Resources (IDNR). The land cover data were generated using 30-meter grid resolution satellite imagery taken during 1999 and 2000. The IL-GAP Land Cover data layer contains 23 land cover categories, including detailed classification in the vegetated areas of Illinois. Appendix A contains a complete listing of land cover categories. (Source: IDNR, INHS, IDA, USDA NASS's

1:100,000 Scale Land Cover of Illinois 1999-2000, Raster Digital Data, Version 2.0, September 2003.)

The land use of the South Fork Sangamon River/Lake Taylorville watershed was determined by overlaying the IL-GAP Land Cover data layer onto the GIS-delineated watershed. Table 2-1 contains the land uses contributing to the South Fork Sangamon River/Lake Taylorville watershed, based on the IL-GAP land cover categories and also includes the area of each land cover category and percentage of the watershed area. Figure 2-2 illustrates the land uses of the watershed.

The land cover data reveal that approximately 76,635 acres, representing nearly 92 percent of the total watershed area, are devoted to agricultural activities. Corn and soybean farming account for about 45 percent and 41 percent of the watershed area, respectively; rural grassland accounts for nearly 4 percent. Other land cover categories represent 2 percent or less of the watershed area.

Table 2-1 Land Use in South Fork Sangamon River/Lake Taylorville Watershed

Land Cover Category	Area (Acres)	Percentage
Corn	37,759	45.4%
Soybeans	33,955	40.8%
Winter Wheat	531	0.6%
Other Small Grains and Hay	447	0.5%
Winter Wheat/Soybeans	723	0.9%
Other Agriculture	274	0.4%
Rural Grassland	2,947	3.5%
Upland	1,588	1.9%
Forested Areas	324	0.4%
High Density	689	0.8%
Low/Medium Density	561	0.7%
Urban Open Space	303	0.4%
Wetlands	1,944	2.3%
Surface Water	1,027	1.2%
Barren and Exposed Land	70	0.2%
Total	**83,142**	**100%**

1. Forested areas include partial canopy/savannah upland.
2. Wetlands include shallow marsh/wet meadow, deep marsh, seasonally/ temporally flooded, floodplain forest, and shallow water.

2.4 Soils

Two types of soil data are available for use within the state of Illinois through the National Resource Conservation Service (NRCS). General soils data and map unit delineations for the entire state are provided as part of the State Soil Geographic (STATSGO) database. Soil maps for the database are produced by generalizing detailed soil survey data. The mapping scale for STATSGO is 1:250,000. More detailed soils data and spatial coverages are available through the Soil Survey Geographic (SSURGO) database for a limited number of counties. For SSURGO data, field mapping methods using national standards are used to construct the soil maps. Mapping scales generally range from 1:12,000 to 1:63,360 making SSURGO the most detailed level of soil mapping done by the NRCS.

The South Fork Sangamon River/Lake Taylorville watershed falls within Christian and Montgomery counties. At this time, SSURGO data are only available for Christian County. STATSGO data have been used in lieu of SSURGO data for the portion of the watershed that lies within Montgomery County. Figure 2-3 displays the STATSGO soil map units as well as the SSURGO soil series in the South Fork Sangamon River/Lake Taylorville watershed. Attributes of the spatial coverage can be linked to the STATSGO and SSURGO databases, which provide information on various chemical and physical soil characteristics for each map unit and soil series. Of particular interest for TMDL development are the hydrologic soil groups as well as the K-factor of the Universal Soil Loss Equation. The following sections describe and summarize the specified soil characteristics for the South Fork Sangamon River/Lake Taylorville watershed.

2.4.1 South Fork Sangamon River/Lake Taylorville Watershed Soil Characteristics

Appendix B contains the STATSGO Map Unit IDs (MUIDs) for the South Fork Sangamon River/Lake Taylorville watershed as well as the SSURGO soil series. The table also contains the area, dominant hydrologic soil group, and K-factor range. Each of these characteristics is described in more detail in the following paragraphs. The predominant soil type in the watershed is Herrick silt loam on 0 to 2 percent slope.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms. Hydrologic soil groups B, C, and D are found within the South Fork Sangamon River/ Lake Taylorville watershed with the majority of the watershed falling into category B. Category B soils are defined as "soils having a moderate infiltration rate when thoroughly wet." C soils consist "chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture." These soils have a moderate rate of water transmission (NRCS 2005).

A commonly used soil attribute is the K-factor. The K-factor:

> *Indicates the susceptibility of a soil to sheet and rill erosion by water.* (The K-factor) *is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water (NRCS 2005).*

The distribution of K-factor values in the South Fork Sangamon River/Lake Taylorville watershed range from 0.15 to 0.55.

2.5 Population

Population data were retrieved from Census 2000 TIGER/Line Data from the U.S. Bureau of the Census. Geographic shape files of census blocks were downloaded for every county containing any portion of the watersheds. The block files were clipped to each watershed so that only block populations associated with the watershed would be counted. The census block demographic text file (PL94) containing population data were downloaded and linked to each watershed and summed. City populations were taken from the U.S. Bureau of the Census. For municipalities that are located across watershed borders, the population was estimated based on the percentage of area of municipality within the watershed boundary.

Approximately 3,900 people reside in the watershed. The municipalities in the Sangamon River/Lake Taylorville watershed are shown in Figure 1-1. The city of Taylorville is the largest population center in the watershed and contributes an estimated 3,400 people to total watershed population.

2.6 Climate and Streamflow

2.6.1 Climate

Central Illinois has a temperate climate with hot summers and cold, snowy winters. There is a weather station in Taylorville; however, it has a data gap from 1972 to 2001 and does not have temperature data. Therefore, monthly precipitation and temperature data from the Morrisonville 4 SE (station id. 5846) in Christian County were extracted from the NCDC database for the years of 1901 through 2004. The Morrisonville, Illinois station was chosen to be representative of meteorological conditions throughout the Sangamon River/Lake Taylorville watershed. Morrisonville is located approximately 10 miles west of the watershed.

Table 2-2 contains the average monthly precipitation along with average high and low temperatures for the period of record. The average annual precipitation is approximately 36 inches.

Table 2-2 Average Monthly Climate Data for the Sangamon River/Lake Taylorville Watershed

Month	Total Precipitation (inches)	Maximum Temperature (degrees F)	Minimum Temperature (degrees F)
January	2.0	37	19
February	1.9	40	22
March	2.9	51	31
April	3.6	64	42
May	4.0	74	52
June	4.2	83	61
July	3.4	88	65
August	3.4	86	63
September	3.2	80	55
October	2.7	68	44
November	2.7	53	33
December	2.2	40	23
Total	**36.2**		

2.6.2 Streamflow

Analysis of the South Fork Sangamon River/Lake Taylorville watershed requires an understanding of flow throughout the drainage area. Unfortunately, there are no USGS gages within the watershed that have current, or even recent, streamflow data. Spot streamflow values were collected on the South Fork Sangamon River during Stage 2 data collection and addition values were estimated through the drainage area ratio method, which assumes that the flow per unit area is equivalent in watersheds with similar characteristics. Further discussion of the area ration method is described in Section 7.

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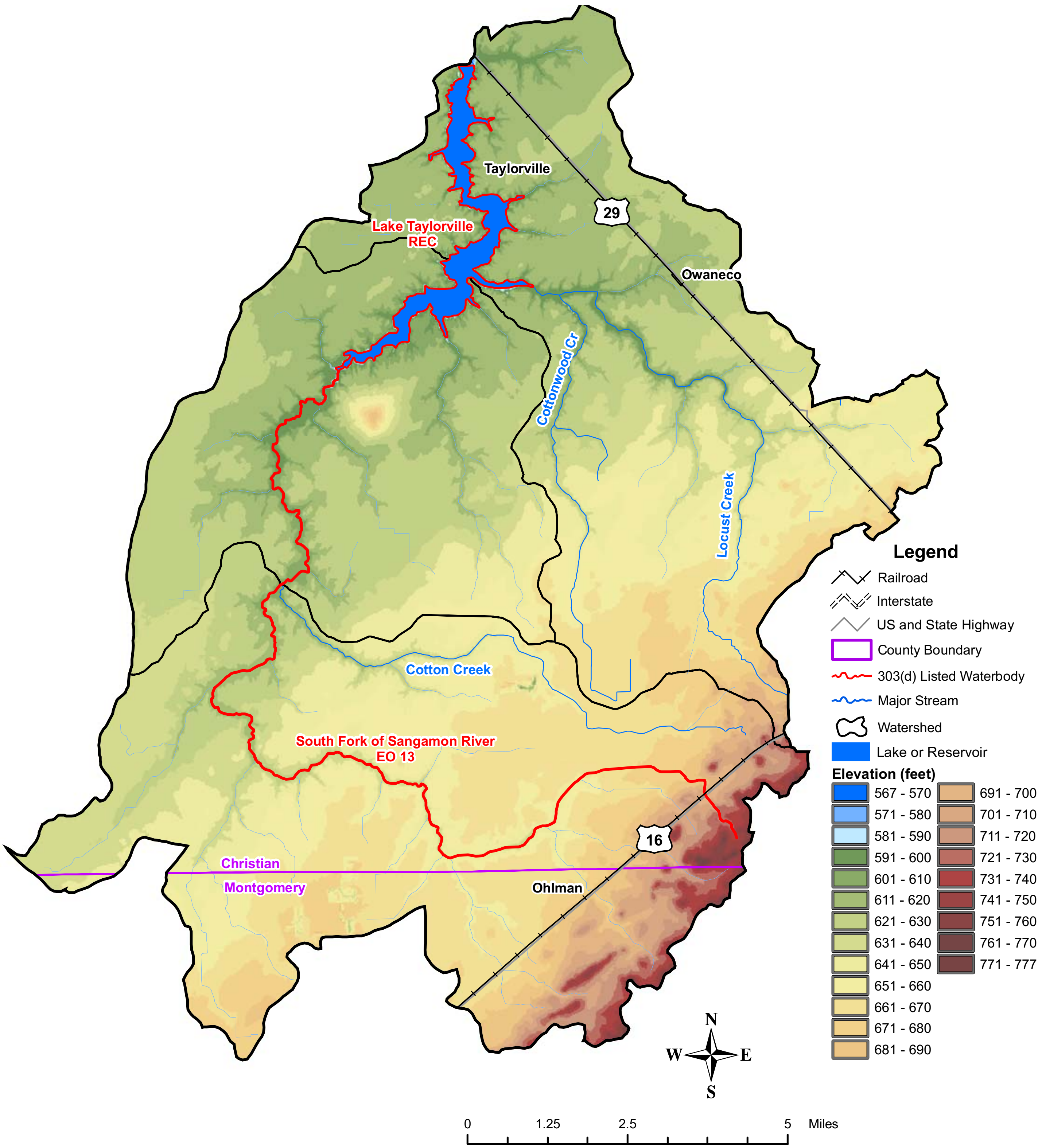

Figure 2-1
Sangamon River - Lake Taylorville Watershed
Elevation

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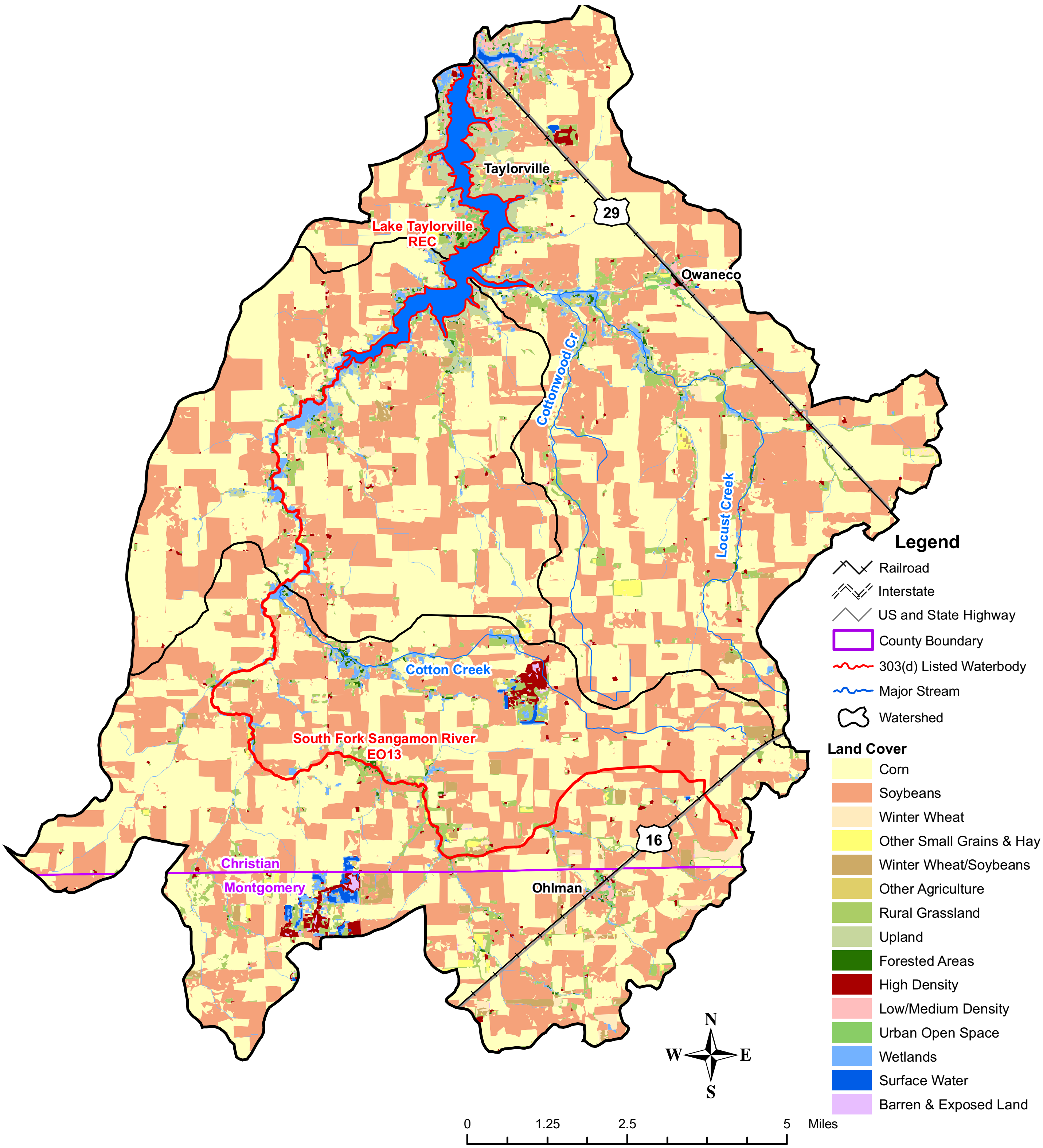

Figure 2-2
Sangamon River - Lake Taylorville Watershed
Land Use

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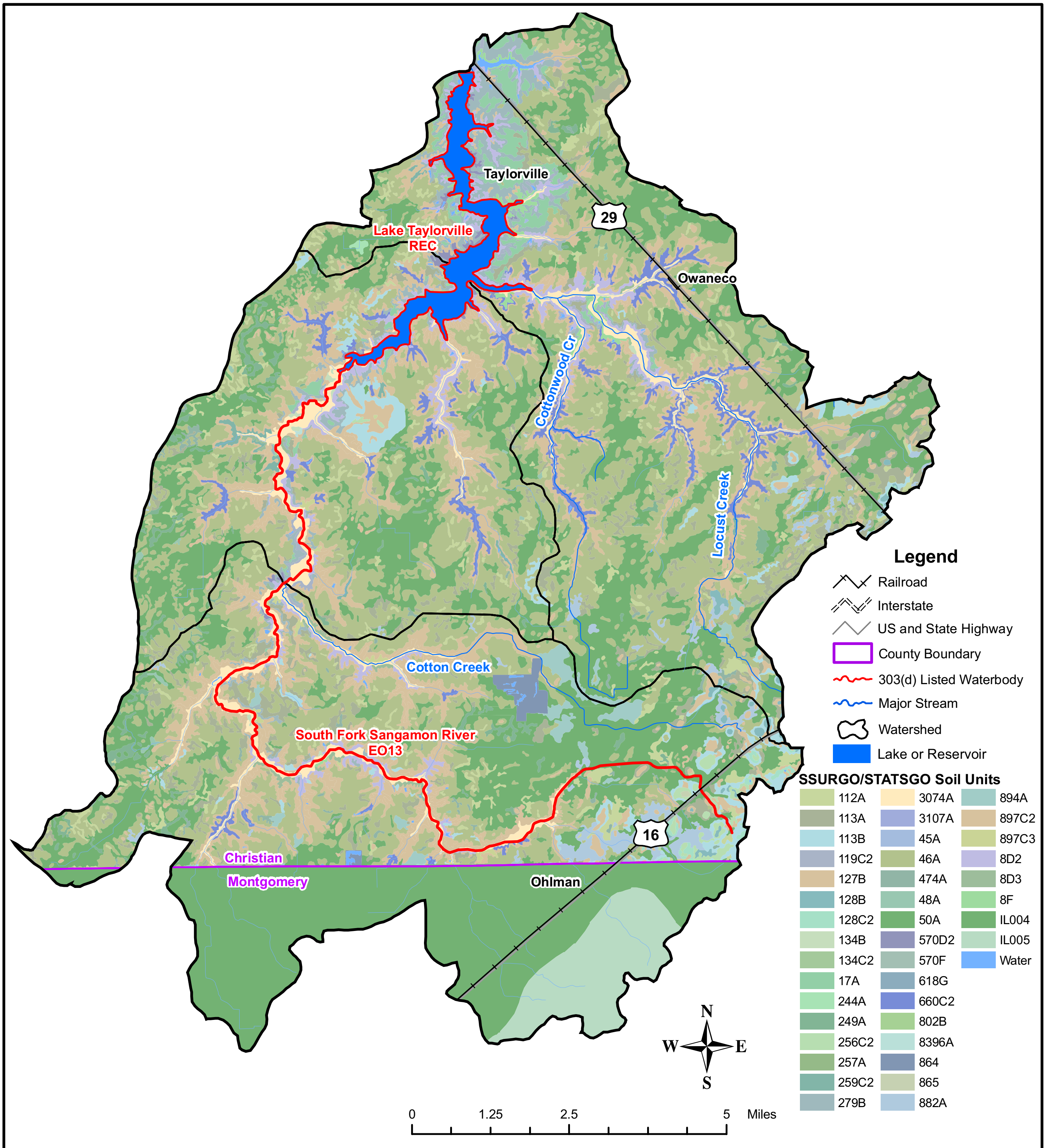

Figure 2-3
Sangamon River - Lake Taylorville Watershed
Soils

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Section 3
Public Participation and Involvement

3.1 South Fork Sangamon River/Lake Taylorville Watershed Public Participation and Involvement

Public knowledge, acceptance, and follow through are necessary to implement a plan to meet recommended TMDLs. It is important to involve the public as early in the process as possible to achieve maximum cooperation and counter concerns as to the purpose of the process and the regulatory authority to implement any recommendations.

Illinois EPA conducted a preliminary meeting with local watershed officials on October 11, 2005. Local officials were given the opportunity to review the draft Stage 1 TMDL report and to provide input.

A public meeting for the Stage 1 report was held at the University of Illinois Extension Building in Taylorville, Illinois on July 12, 2006 from 6 to 9 p.m. There were 15 citizens in attendance.

An additional public meeting to present the Stage 3 report was also held at the University of Illinois Extension Building in Taylorville, Illinois on August 16, 2007 from 6 to 9 p.m. There was 1 citizen in attendance.

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Section 4
South Fork Sangamon River/Lake Taylorville Watershed Water Quality Standards

4.1 Illinois Water Quality Standards

Water quality standards are developed and enforced by the state to protect the "designated uses" of the state's waterways. In the state of Illinois, setting the water quality standards is the responsibility of the Illinois Pollution Control Board (IPCB). Illinois is required to update water quality standards every three years in accordance with the CWA. The standards requiring modifications are identified and prioritized by Illinois EPA, in conjunction with USEPA. New standards are then developed or revised during the three-year period.

Illinois EPA is also responsible for developing scientifically based water quality criteria and proposing them to the IPCB for adoption into state rules and regulations. The Illinois water quality standards are established in the Illinois Administrative Rules Title 35, Environmental Protection; Subtitle C, Water Pollution; Chapter I, Pollution Control Board; Part 302, Water Quality Standards.

4.2 Designated Uses

The waters of Illinois are classified by designated uses, which include: General Use, Public and Food Processing Water Supplies, Lake Michigan, and Secondary Contact and Indigenous Aquatic Life Use (Illinois EPA 2005). The designated uses applicable to the South Fork Sangamon River/Lake Taylorville watershed are the General Use and Public and Food Processing Water Supplies Use.

4.2.1 General Use

The General Use classification is defined by IPCB as: The General Use standards will protect the state's water for aquatic life, wildlife, agricultural use, secondary contact use and most industrial uses and ensure the aesthetic quality of the state's aquatic environment. Primary contact uses are protected for all General Use waters whose physical configuration permits such use.

4.2.2 Public and Food Processing Water Supplies

The Public and Food Processing Water Supplies Use is defined by IPCB as: These are cumulative with the general use standards of Subpart B and must be met in all waters designated in Part 303 at any point at which water is withdrawn for treatment and distribution as a potable supply or for food processing.

4.3 Illinois Water Quality Standards

To make 303(d) listing determinations for aquatic life uses, Illinois EPA first collects biological data and if this data suggests that impairment to aquatic life is occurring, then a comparison of available water quality data with water quality standards occurs.

For public and food processing water supply waters, Illinois EPA compares available data with water quality standards to make impairment determinations. Tables 4-1 and 4-2 present the water quality standards of the potential causes of impairment for both lakes and streams within the South Fork Sangamon River/Lake Taylorville watershed. Only constituents with numeric water quality standards will have TMDLs developed at this time.

Table 4-1 Summary of Water Quality Standards for Potential South Fork Sangamon River/Lake Taylorville Watershed Lake Impairments

Parameter	Units	General Use Water Quality Standard	Public and Food Processing Water Supplies	Regulatory Citation 35 Ill Adm Code
Chlordane - Statistical Guideline	NA	No numeric standard	No numeric standard	
Excess Algal Growth	NA	No numeric standard	No numeric standard	
Manganese	µg/L	1000	150	302.208g 302.304
Oxygen, Dissolved	mg/L	5.0 instantaneous minimum; 6.0 minimum during at least 16 hours of any 24 hour period	No numeric standard	302.206
Total Phosphorus	mg/L	0.05[1]	No numeric standard	302.205
Total Suspended Solids	NA	No numeric standard	No numeric standard	

µg/L = micrograms per liter mg/L = milligrams per liter NA = Not Applicable
(1) Standard applies in particular inland lakes and reservoirs (greater than 20 acres) and in any stream at the point where it enters any such lake or reservoir.

Table 4-2 Summary of Water Quality Standards for Potential South Fork Sangamon River/Lake Taylorville Watershed Stream Impairments

Parameter	Units	General Use Water Quality Standard	Public and Food Processing Water Supplies	Regulatory Citation 35 Ill Adm Code
Chlordane - Statistical Guideline	NA	No numeric standard	No numeric standard	
Manganese	µg/L	1000	150	302.208g 302.304
Oxygen, Dissolved	mg/L	5.0 instantaneous minimum; 6.0 minimum during at least 16 hours of any 24 hour period	No numeric standard	302.206

µg/L = micrograms per liter mg/L = milligrams per liter NA = Not Applicable

4.4 Potential Pollutant Sources

In order to properly address the conditions within the South Fork Sangamon River/ Lake Taylorville watershed, potential pollution sources must be investigated for the pollutants where TMDLs will be developed. The following is a summary of the potential sources associated with the listed causes for the 303(d) listed segments in this watershed. They are summarized in Table 4-3.

Table 4-3 Summary of Potential Sources for South Fork Sangamon River/Lake Taylorville Watershed

Segment ID	Segment Name	Potential Causes	Potential Sources
EO 13	South Fork Sangamon River	Manganese, DO, chlordane	Agriculture, hydromodification, source unknown
REC	Lake Taylorville	Manganese, total phosphorus, DO, total suspended solids, excess algal growth, chlordane	Agriculture, crop-related sources, nonirrigated crop production, hydromodification, flow regulation/modification, recreation and tourism activities (other than boating), forest/grassland/parkland, source unknown

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Section 5
South Fork Sangamon River/Lake Taylorville Watershed Characterization

Data were collected and reviewed from many sources in order to further characterize the South Fork Sangamon River/Lake Taylorville watershed. Data have been collected for water quality, reservoirs, and both point and nonpoint sources. This information is presented and discussed in further detail in the remainder of this section.

5.1 Water Quality Data

There are four historic water quality stations within the South Fork Sangamon River/ Lake Taylorville watershed that were used for this report. Figure 5-1 shows the water quality data stations within the watershed that contain data relevant to the impaired segments.

The impaired water body segments in the South Fork Sangamon River/Lake Taylorville watershed were presented in Section 1. Refer to Table 1-1 for impairment information specific to each segment. The following sections address both stream and lake impairments. Data are summarized by impairment and discussed in relation to the relevant Illinois numeric water quality standard. The information presented is a combination of USEPA Storage and Retrieval (STORET) database and Illinois EPA database data. STORET data are available for stations sampled prior to January 1, 1999 while Illinois EPA data (electronic and hard copy) are available for stations sampled after that date. The following sections will first discuss South Fork Sangamon River/Lake Taylorville watershed stream data followed by South Fork Sangamon River/Lake Taylorville watershed lake/reservoir data.

5.1.1 Stream Water Quality Data

The South Fork Sangamon River/Lake Taylorville watershed has one impaired stream within its drainage area. Segment EO13 of the South Fork Sangamon River is listed as impaired for boron, manganese, and DO. The state indicated that the 2004 assessment was made based on the 1989 Intensive Basin Survey of the Sangamon River and its tributaries. The report stated that field measurements indicated low DO levels (2.1 mg/L) and violations in the state general use water quality standards occurred for DO, total boron, and manganese. Only one sample is available for each parameter. Table 5-1 contains this information.

Table 5-1 Samples Indicating Impairment on Segment EO13

Station ID	Sample Date	Parameter	Result	Standard
EO 13	26-Oct-89	Dissolved Oxygen (mg/L)	2.1	5.0 instantaneous minimum
EO 13	26-Oct-89	Total Boron (µg/L)	18960	1000
EO 13	26-Oct-89	Total Manganese (µg/L)	2623	1000 General Use

5.1.2 Lake and Reservoir Water Quality Data

The South Fork Sangamon River/Lake Taylorville watershed has one impaired lake within its drainage area. There are three active water quality stations on Lake Taylorville (see Figure 5-1). No recent tributary data are available. The data summarized in this section include water quality data for impaired constituents as well as parameters that could be useful in future modeling and analysis efforts. All historic data are available in Appendix C.

5.1.2.1 Lake Taylorville

Lake Taylorville is impaired for manganese, total phosphorus, and DO. An inventory of all available manganese, phosphorus, and DO data at all depths is presented in Table 5-2.

Table 5-2 Lake Taylorville Data Inventory for Impairments

Lake Taylorville Segment REC; Sample Locations REC-1, REC-2, and REC-3		
REC-1	**Period of Record**	**Number of Samples**
Total Phosphorus	1990-2002	56
Dissolved Phosphorus	1991-1997	30
Total Phosphorus in Bottom Deposits	1991-1997	3
Total Manganese	2000	4
Manganese in Bottom Deposits	1991-2000	4
Dissolved Oxygen	1991-2000	202
REC-2		
Total Phosphorus	1990-2000	26
Dissolved Phosphorus	1991-1997	15
Dissolved Oxygen	1991-2000	111
REC-3		
Total Phosphorus	1990-2000	26
Dissolved Phosphorus	1991-1997	15
Total Phosphorus in Bottom Deposits	1991-1997	3
Manganese in Bottom Deposits	1991-2000	4
Dissolved Oxygen	1991-2000	111

Table 5-3 contains information on data availability for other parameters that may be useful in data needs analysis and modeling efforts for total phosphorus, manganese, and DO. Other nutrient data as well as chlorophyll "a" data have been collected where available.

Table 5-3 Lake Taylorville Data Availability for Data Needs Analysis and Future Modeling Efforts

Lake Taylorville Segment REC; Sample Locations REC-1, REC-2, and REC-3		
REC-1	**Period of Record**	**Number of Samples**
Chlorophyll-A Corrected	1991-2000	23
Chlorophyll-A Uncorrected	1991-2000	23
Ammonia, Unionized (Calc Fr Temp-pH-NH4) (mg/L)	1991-1997	28
Ammonia, Unionzed (mg/L as N)	1991-1997	28
COD, .025N K2DR2O7 (mg/L)	1991	10
Nitrite plus Nitrate, Total 1 Det. (mg/L as N)	1991-1997	41
Nitrogen Kjeldahl Total Bottom Dep Dry Wt (mg/kg)	1991-1997	3
Nitrogen, Ammonia, Total (mg/L as N)	1990-2000	56
Nitrogen, Kjeldahl, Total, (mg/L as N)	1990-2000	45

Table 5-3 Lake Taylorville Data Availability for Data Needs Analysis and Future Modeling Efforts (continued)		
Lake Taylorville Segment REC; Sample Locations REC-1, REC-2, and REC-3		
REC-2		
Chlorophyll-a Corrected	1991-2000	18
Chlorophyll-a Uncorrected	1991-2000	18
Ammonia, Unionized (Calc Fr Temp-pH-NH4) (mg/L)	1991-1997	15
Ammonia, Unionzed (mg/L as N)	1991-1997	15
COD, .025N K2CR2O7 (mg/L)	1991	5
Nitrite plus Nitrate, Total 1 Det. (mg/L as N)	1990-1997	21
Nitrogen, Ammonia, Total (mg/L as N)	1990-2000	26
Nitrogen, Kjeldahl, Total, (mg/L as N)	1990-2000	20
REC-3		
Chlorophyll-a Corrected	1991-2000	18
Chlorophyll-a Uncorrected	1991-2000	18
Ammonia, Unionized (Calc Fr Temp-pH-NH4) (mg/L)	1991-1997	15
Ammonia, Unionzed (mg/L as N)	1991-1997	15
COD, .025N K2CR2O7 (mg/L)	1991	5
Nitrite plus Nitrate, Total 1 Det. (mg/L as N)	1990-1997	21
Nitrogen Kjeldahl Total Bottom Dep Dry Wt (mg/kg)	1991-1997	3
Nitrogen, Ammonia, Total (mg/L as N)	1990-2000	26
Nitrogen, Kjeldahl, Total, (mg/L as N)	1991-2000	20

5.1.2.1.1 Total Phosphorus

Compliance with the total phosphorus standard is based on samples collected at a one-foot depth from the lake surface. The average total phosphorus concentrations at a one-foot depth for each year of available data at each monitoring site in Lake Taylorville are presented in Table 5-4. The water quality standard for total phosphorus is a maximum concentration of 0.05 mg/L.

Table 5-4 Average Total Phosphorus Concentrations (mg/L) in Lake Taylorville at one-foot depth

	REC-1		**REC-2**		**REC-3**		**Lake Average**	
Year	**Data Count; Number of Violations**	**Average**	**Data Count; Number of Violations**	**Average**	**Data Count; Number of Violations**	**Average**	**Data Count; Number of Violations**	**Average**
1990	5;5	0.18	5;5	0.31	5;5	0.37	15;15	0.29
1991	5;5	0.14	5;5	0.17	5;5	0.22	15;15	0.17
1994	5;5	0.33	5;5	0.28	5;5	0.32	15;15	0.31
1995	1;1	0.13	1;1	0.14	1;1	0.19	3;3	0.16
1997	10;10	0.19	5;5	0.27	5;5	0.28	20;20	0.25
2000	5;4	0.16	5;4	0.26	5;4	0.28	15;12	0.23

The annual averages for total phosphorus at all three sites, as well as the lake average, are greater than the 0.05 mg/L standard. Samples at all sites have been above 0.05 mg/L except for three samples collected during 2000. The non-violating samples were all collected on April 26, 2000, one sample at each station. Figure 5-2 shows the average values by year.

5.1.2.1.2 Manganese

The applicable water quality standard for manganese is 1,000 µg/L for general use and 150 µg/L for public water supplies.

Table 5-5 Total Manganese Data collected on Lake Taylorville; Sample Location REC-1

Sample Date	Sample Depth (ft)	Result (µg/L)
4/26/2000	7	120
6/7/2000	7	**180**
7/7/2000	7	150
8/17/2000	7	**230**

Table 5-5 summarizes available manganese data for Lake Taylorville. Recent total manganese data are only available at lake site REC-1. Total manganese samples have not been collected at the other lake stations since 1979. Two of the four samples taken at REC-1 in 2000 violated the public water supply standard and are shown in bold type. The average total manganese concentration at sampling site REC-1 is 170 µg/L.

5.1.2.1.3 Dissolved Oxygen

The average DO concentrations at a one-foot depth for each year of available data at each monitoring site on Lake Taylorville are presented in Table 5-6. The water quality standard for DO is a 5.0 mg/L instantaneous minimum. Compliance is determined at a one-foot depth from the lake surface.

Table 5-6 Average Dissolved Oxygen Concentrations (mg/L) in Lake Taylorville at one-foot depth

	REC-1		REC-2		REC-3		Lake Taylorville	
Year	Data Count; Number of Violations	Average	Data Count; Number of Violations	Average	Data Count; Number of Violations	Average	Data Count; Number of Violations	Average
1991	5; 3	6.2	5; 1	7.0	5; 0	8.0	15; 4	7.1
1994	5; 1	7.1	5; 0	7.2	5; 0	6.4	15; 1	6.9
1997	5; 1	8.3	5; 1	9.9	5; 0	10.7	15; 2	9.6
2000	5; 1	6.5	5; 1	7.4	5; 1	8.5	15; 3	7.5

The annual averages for DO at all three sites as well as the lake average are not in violation of the DO standard at one-foot depth during any sampling year. Figure 5-3 shows DO sampling results at one-foot depth over time. In 1997 and 2000, DO violations occurred during the month of August.

5.2 Reservoir Characteristic

There is one impaired reservoir in the South Fork Sangamon River/Lake Taylorville watershed. Reservoir information that can be used for future modeling efforts was collected from GIS analysis, U.S. Army Corp of Engineers (USACE), the Illinois EPA, and USEPA water quality data. The following sections will discuss the available characteristics data for the reservoir.

5.2.1 Lake Taylorville

Table 5-7 Lake Taylorville Dam Information (U.S. Army Corps of Engineers)

Dam Length	1,400 feet
Dam Height	27 feet
Maximum Discharge	58,840 cfs
Maximum Storage	28,500 acre-feet
Normal Storage	10,394 acre-feet
Spillway Width	300 feet
Outlet Gate Type	U

Lake Taylorville is located in Christian County and has a surface area of 1,148 acres. In 1960, Lake Taylorville was created by damming and flooding the South Fork of the Sangamon River. Water from the lake is used as drinking water by the Taylorville community water supply at two million gallons per day (Source Water Assessment Program, Illinois EPA, 2001). Local officials suggested that usage can be between three and four million gallons per day during summer months when peak demand occurs. Table 5-7 contains USACE dam data.

Table 5-8 contains depth information for each sampling location on the lake. The average maximum depth in Lake Taylorville is 14.7 feet.

Table 5-8 Average Depths (ft) for Lake Taylorville Segment REC (Illinois EPA 2002 and USEPA 2002a)

Year	REC-1	REC-2	REC-3
1990	14.5	8.4	4.8
1991	16.1	8.2	4.4
1992	14.0	8.3	4.5
1993	14.6	8.5	5.3
1994	15.3	7.9	3.9
1995	14.8	8.3	5.0
1996	13.9	8.4	4.6
1997	15.7	8.2	4.1
1998	13.1	7.3	4.5
2000	15.2	7.3	4.0
Average	**14.7**	**8.1**	**4.5**

5.3 Point Sources

Point sources for the South Fork Sangamon River/Lake Taylorville watershed have been separated into municipal/industrial sources and mining discharges. Available data have been summarized and are presented in the following sections.

5.3.1 Municipal and Industrial Point Sources

Permitted facilities must provide Discharge Monitoring Reports (DMRs) to Illinois EPA as part of their NPDES permit compliance. DMRs contain effluent discharge sampling results that are then maintained in a database by the state. There are three permitted point sources located within the South Fork Sangamon Rive /Lake Taylorville watershed, as shown in Figure 5-4. In order to assess point source contributions to the watershed, the data have been examined by the receiving water and by the downstream segments that have the potential to receive the discharge. Receiving waters were determined through information contained in the USEPA Permit Compliance System (PCS) database. Maps were used to determine downstream impaired receiving water information when PCS data were not available. The impairments for each segment or downstream segment were considered when reviewing DMR data. Data have been summarized for any sampled parameter that is associated with a downstream impairment (i.e., all available nutrient and carbonaceous biochemical oxygen demand [CBOD] data were reviewed for segments that are impaired for DO). These data will help guide future model selection as well as source assessment and load allocation. Available permit requirements and limits are contained in Appendix D for review.

5.3.1.1 South Fork Sangamon River Segment EO13

There are three point sources with the potential to contribute discharge to South Fork Sangamon River Segment EO13. Segment EO13 is listed as impaired for boron, manganese, and DO. Table 5-9 contains a summary of available and pertinent DMR data for these point sources.

Table 5-9 Effluent Data from Point Sources Discharging to or Above South Fork Sangamon River Segment EO13 (Illinois EPA 2005)

Facility Name Period of Record Permit Number	Receiving Water/ Downstream Impaired Waterbody	Constituent	Average Value	Average Loading (lb/d)
Ohlman STP 2001-2006 IL 0032671	NA/South Fork Sangamon River Segment EO13	Average Daily Flow	0.02 mgd	NA
		CBOD-5	8.6 mg/L	0.16
Nokomis Quarry Co-Nokomis Qry 1994-2004 ILG840055	South Fork Creek/South Fork Sangamon River Segment EO13	Average Daily Flow	2.97 mgd	NA
Christian County Limestone 1998-2004 ILG840105	Cotton Creek/South Fork Sangamon River Segment EO13	Average Daily Flow	0.15 mgd	NA

5.3.1.2 Other

There are no permitted facilities that discharge directly to Lake Taylorville.

5.3.2 Mining Discharges

There are no permitted mine sites or recently abandoned mines within the South Fork Sangamon River/Lake Taylorville watershed. If additional information becomes available, it will be reviewed and considered during Stage 3 of TMDL development.

5.4 Nonpoint Sources

There are many potential nonpoint sources of pollutant loading to the impaired segments in the South Fork Sangamon River/Lake Taylorville watershed. This section will discuss site-specific cropping practices, animal operations, and area septic systems as potential nonpoint sources of pollution in this watershed. Data were collected through communication with local NRCS, Soil and Water Conservation District (SWCD), Public Health Department, and County Tax Department officials.

5.4.1 Crop Information

The majority of the land found within the South Fork Sangamon River/Lake Taylorville watershed is devoted to crops. Corn and soybean farming account for approximately 45 percent and 41 percent of the watershed, respectively. Tillage practices can be categorized as conventional till, reduced till, mulch-till, and no-till. The percentage of each tillage practice for corn, soybeans, and small grains by county are generated by the IDA from County Transect Surveys. The most recent survey was conducted in 2004. Data specific to the South Fork Sangamon River/Lake Taylorville watershed were not available; however, the Christian and Montgomery County practices were available and are shown in Tables 5-10 and 5-11 respectively. Local officials indicated that the tillage information presented for the county is representative of watershed practices.

Table 5-10 Tillage Practices in Christian County

Tillage System	Corn	Soybean	Small Grain
Conventional	87%	27%	80%
Reduced - Till	11%	43%	0%
Mulch - Till	0%	6%	0%
No - Till	2%	24%	20%

Table 5-11 Tillage Practices in Montgomery County

Tillage System	Corn	Soybean	Small Grain
Conventional	76%	6%	0%
Reduced - Till	9%	23%	0%
Mulch - Till	8%	38%	0%
No - Till	7%	33%	100%

Specific information regarding field tiling was not available; however, local officials noted that almost all land that is farmed in the watershed has some field tiling. SSURGO soils data, which is available for the majority of the watershed, can also be reviewed for information on hydrologic soil group in order to provide a basis for further tile drain estimates.

5.4.2 Animal Operations

Watershed specific animal numbers were not available for Christian County. The Montgomery County NRCS office provided an estimate of animal operations located within the South Fork Sangamon River/Lake Taylorville watershed. They believe that there are approximately four operations in existence but did not provide information on location. The NRCS has worked with owners in the watershed to develop comprehensive nutrient plans. The estimated numbers for Christian and Montgomery County from the 2002 Census of Agriculture are provided below for countywide reference.

Table 5-12 Christian County Animal Population (2002 Census of Agriculture)

	1997	2002	Percent Change
Cattle and Calves	5,931	6,884	16%
Beef	2,783	2,852	2%
Dairy	6	11	83%
Hogs and Pigs	37,145	27,742	-25%
Poultry	644	241	-63%
Sheep and Lambs	761	665	-13%
Horses and Ponies	NA	484	NA

Table 5-13 Montgomery County Animal Population (2002 Census of Agriculture)

	1997	2002	Percent Change
Cattle and Calves	13,301	11,053	-17%
Beef	4,395	4,212	-4%
Dairy	1,082	889	-18%
Hogs and Pigs	67,031	58,861	-12%
Poultry	2,165	485	-78%
Sheep and Lambs	475	388	-18%
Horses and Ponies	NA	625	NA

5.4.3 Septic Systems

Many households in rural areas of Illinois that are not connected to municipal sewers make use of onsite sewage disposal systems, or septic systems. There are many types of septic systems, but the most common septic system is composed of a septic tank draining to a septic field, where nutrient removal occurs. However, the degree of nutrient removal is limited by soils and system upkeep and maintenance.

A summary of the available information on septic systems for the two counties within the Sangamon River/Lake Taylorville watershed is shown in Table 5-14. Information on sewered and septic municipalities was requested from the county health departments. Christian and Montgomery County health departments were unable to estimate the number of septic systems that exist in the counties within the watershed.

Table 5-14 Estimated Septic Systems in South Fork Sangamon River/Lake Taylorville Watershed

County	Estimated No. of Septic Systems	Sources Contacted for Septic Areas/ No. of Septic Systems
Christian	864	Health Department
Montgomery	177	Health Department/Tax Assessor
Total	**1041**	

In Montgomery County, the tax assessor was able to provide estimates on the number of existing residences located in areas known to be served by septic systems (Table 5-14). The Montgomery County tax assessor estimated that there are 177 septic systems within the watershed in the county. The staff at the Christian County Tax Assessor's office used the watershed boundary to identify residential parcels located in that portion of the county. It is estimated that 864 septic systems exist in the Christian County portion of the watershed. Local officials also noted that there is not much development around the shores of the lake. It is thought that less than 50 houses surround the lake area, although some future development is planned.

5.5 Watershed Studies and Other Watershed Information

Previous planning efforts have been conducted within the South Fork Sangamon River/Lake Taylorville watershed. A Watershed Plan for Lake Taylorville was completed in the mid-90s. At that time, 106 acres were enrolled in the Conservation Reserve Program. In 2004, a $50,000 grant from a portion of an environmental enforcement case settlement by Illinois EPA was awarded to the Lake Taylorville Resource Planning Committee. The group is using the grant for the Lake Taylorville Water Quality and Quality Planning Project, which will look at a variety of issues including land use and zoning, lake development planning and infrastructure, and community and economic development in the lake's watershed.

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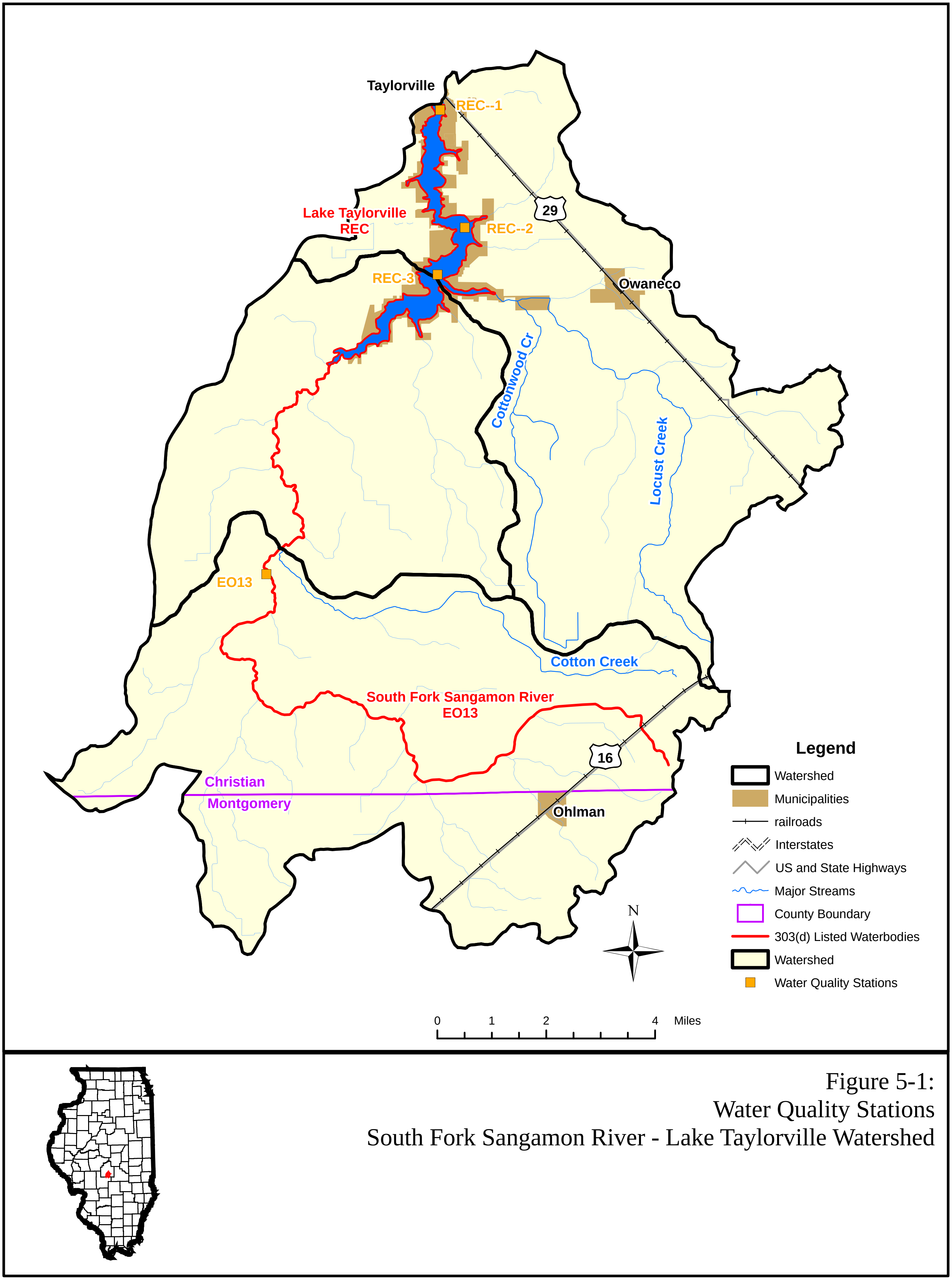

Figure 5-1:
Water Quality Stations
South Fork Sangamon River - Lake Taylorville Watershed

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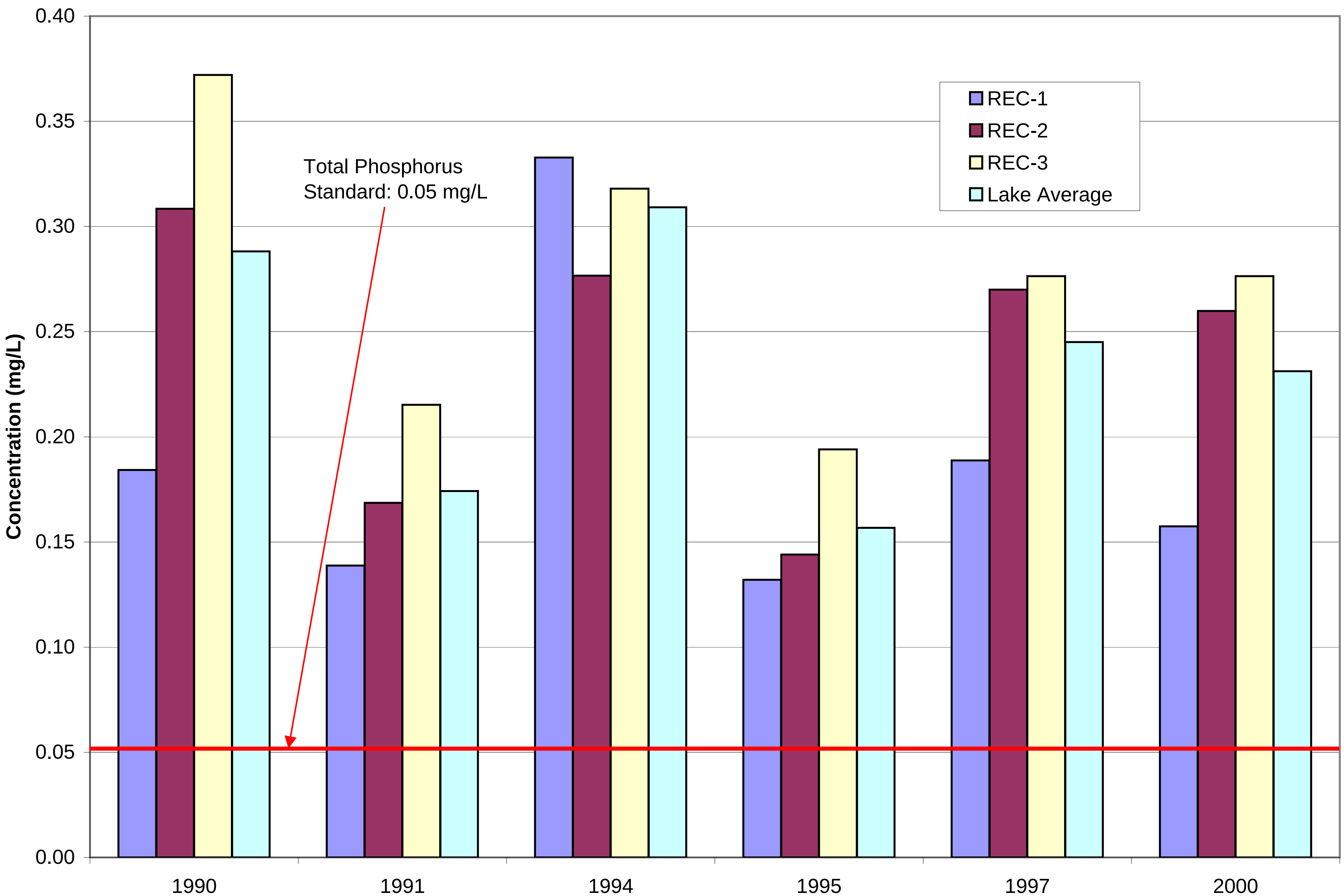

CDM

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Figure 5-2:
Lake Taylorville
Average Annual Total Phosphorus Concentrations

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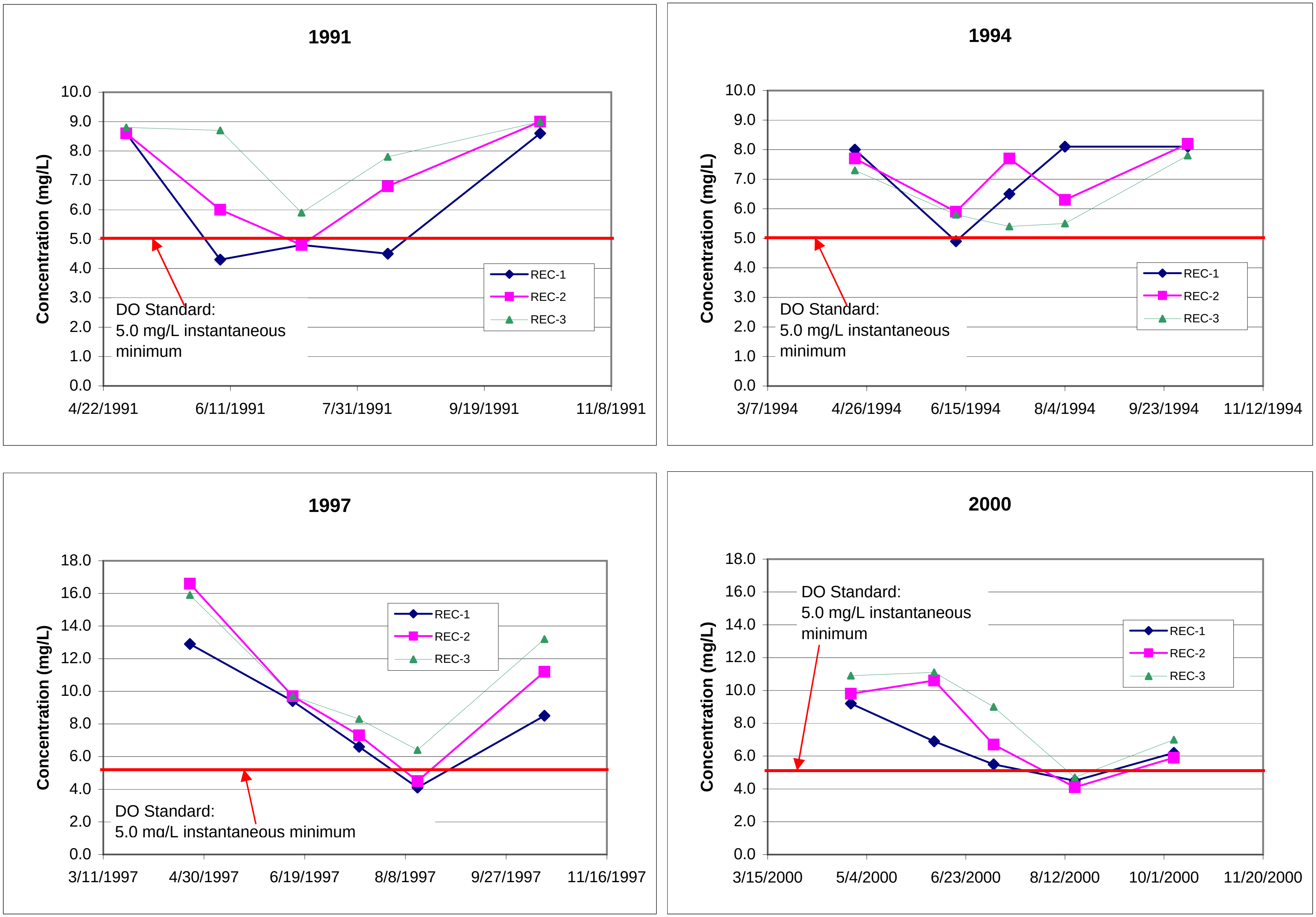

CDM

Figure 5-3:
Lake Taylorville
DO Concentrations

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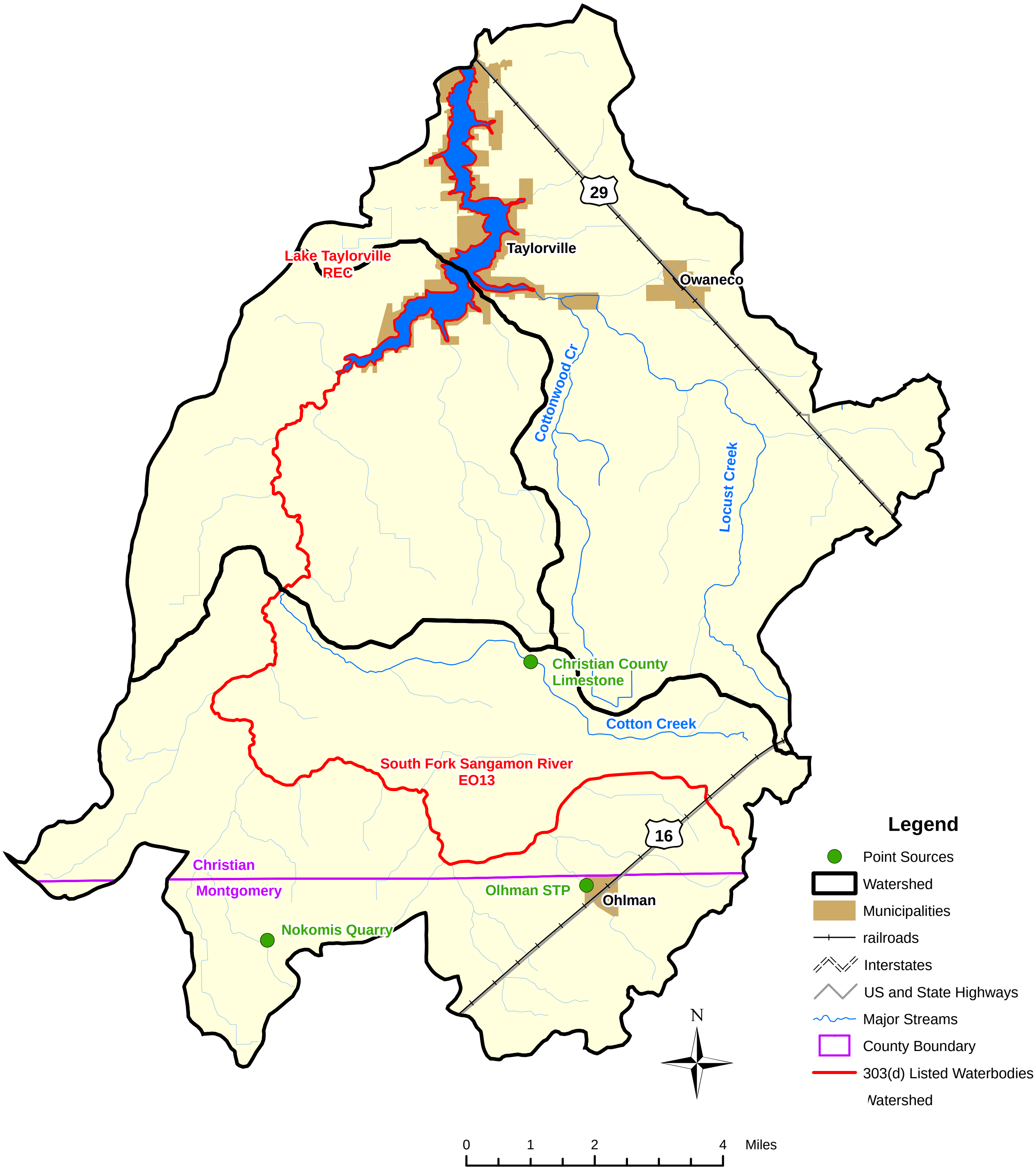

Figure 5-4:
NPDES Permits
South Fork Sangamon River/Lake Taylorville Watershed

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Section 6
Approach to Developing TMDL and Identification of Data Needs

Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards. Refer to Table 1-1 for a list of all pollutants potentially causing impairment within the watershed. Of the pollutants impairing stream segments in the South Fork Sangamon/Lake Taylorville watershed, manganese and DO are the only parameters with numeric water quality standards. For lakes, total phosphorus, manganese, and DO are the only parameters with numeric water quality standards. Illinois EPA believes that addressing these impairments should lead to an overall improvement in water quality due to the interrelated nature of the other listed pollutants. Recommended technical approaches for developing TMDLs for streams and lakes are presented in this section. Additional data needs are also discussed.

6.1 Simple and Detailed Approaches for Developing TMDLs

The range of analyses used for developing TMDLs varies from simple to complex. Examples of a simple approach include mass-balance, load-duration, and simple watershed and receiving water models. Detailed approaches incorporate the use of complex watershed and receiving water models. Simple approaches typically require less data than detailed approaches and therefore, due to limited data availability, are the analyses recommended for the South Fork Sangamon River/Lake Taylorville watershed. Establishing a link between pollutant loads and resulting water quality is one of the most important steps in developing a TMDL. As discussed above, this link can be established through a variety of techniques. The objective of the remainder of this section is to recommend approaches for establishing these links for the constituents of concern in the South Fork Sangamon River/Lake Taylorville watershed.

6.2 Approaches for Developing TMDLs for Stream Segments in the South Fork Sangamon/Lake Taylorville Watershed

Stream segment EO13 of the South Fork Sangamon River does not have any major point sources discharging directly to it. Approaches for developing TMDLs for areas without major point sources are described below.

6.2.1 Recommended Approach for DO TMDLs for Stream Segments without Major Point Sources

As discussed above, Segment EO13 does not have major point sources discharging to it. Permitted facilities do discharge within the watershed, but all facilities are located significantly upstream on non-impaired tributaries. The data for these segments are limited to samples collected over a decade ago. This available data does suggest an impairment of the DO standard, although it was determined based on a single sample. It is recommended that more sampling be conducted on the segment to confirm that a DO impairment exists. If more data becomes available, a simplified approach that involves simulating pollutant oxidation and stream reaeration only within a spreadsheet model is recommended for DO TMDL development.

This model simulates steady state stream DO as a function of carbonaceous and nitrogenous pollutant oxidation and atmospheric reaeration. The model allows for non-uniform stream hydraulics, hydrology, and pollutant loadings at any level of segmentation. It is also free of numerical dispersion as it relies on well-known analytical solutions rather than numerical approximations of the fundamental equations. The model assumes plug flow (i.e., the pollutant does not disperse through the system due to velocity shear or turbulent diffusion), which is likely an acceptable assumption for most small to medium sized streams. The model also does not incorporate the impacts of stream plant life, which generally require site-specific data for meaningful parameterization. A watershed model will not be used for this segment. Using the spreadsheet model iteratively, the BOD loads estimated to cause the DO impairments and to maintain a DO of 5.0 mg/L will be calculated. These calculated loads will become the basis for recommending TMDL reductions if necessary.

6.2.2 Recommended Approach for Manganese and Boron TMDLs

Segment EO13 of the South Fork Sangamon River is impaired for manganese and boron. Data have not been collected since 1989. One sample of each constituent suggests that the segment was impaired in 1989. It is again recommended that more data be collected to confirm the impairments on this segment. No apparent sources of manganese or boron have been identified to date and therefore, an empirical loading and spreadsheet analysis will be utilized to calculate these TMDLs if more data become available.

6.3 Approaches for Developing TMDLs for Lake Taylorville

Recommended TMDL approaches for Lake Taylorville will be discussed in this section. It is assumed that enough data exists to develop a simple model for use in TMDL development.

6.3.1 Recommended Approach for Total Phosphorus and Dissolved Oxygen TMDLs

Lake Taylorville is impaired for total phosphorus and DO. The BATHTUB model is recommended for lake phosphorus and DO assessments. The BATHTUB model performs steady-state water and nutrient balance calculations in a spatially segmented hydraulic network that accounts for advective and diffusive transport and nutrient sedimentation. The model relies on empirical relationships to predict lake trophic conditions and subsequent DO conditions as functions of total phosphorus and nitrogen loads, residence time, and mean depth (USEPA 1997). Oxygen conditions in the model are simulated as meta- and hypolimnetic depletion rates, rather than explicit concentrations.

Watershed loadings to the lake will be based on empirical data or tributary data available in the watershed. Tributary data within the watershed are very limited.

6.3.2 Recommended Approach for Manganese TMDLs

The applicable water quality standard for manganese is 150 µg/L. It is assumed that the only controllable sources of manganese to the lake are those which enter from lake sediments during periods of low dissolved oxygen. It is thought that the manganese in the lake sediments can be (partially) controlled by reducing phosphorus loads and increasing hypolimnetic DO concentrations. Eight sediment samples of manganese have been collected in the lake since 1990. The results of these samples can be used as a screening tool to determine if the assumptions made about manganese sources are plausible. If this is determined to be the case, it is assumed that development of the phosphorus TMDL described above will, in turn, control the manganese concentrations. Therefore, the manganese target is maintenance of hypolimnetic DO concentrations above zero which would prevent manganese bound in the sediment from entering the water column. The lack of DO in lake bottom waters is presumed to be due to the effects of nutrient enrichment, as there are no significant sources of oxygen demanding materials to the lake. For this reason, attainment of the total phosphorus standard is expected to result in oxygen concentrations that will reduce sediment manganese flux to natural background levels. The TMDL target for manganese is set as a total phosphorus concentration of 0.050 mg-P/l. The recommended approach for the lake phosphorus TMDL was discussed above.

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Section 7
Methodology Development for the South Fork Sangamon River/Lake Taylorville Watershed

Because insufficient data were available for Stage 3 TMDL development for the South Fork Sangamon River segment EO13, additional data were collected in the fall of 2006. The data collected during Stage 2 confirmed impairments of the aquatic life use in the South Fork Sangamon River caused by manganese and dissolved oxygen concentrations. However, the data also showed that the boron concentrations were no longer causing impairment. For this reason, a TMDL for boron will not be developed. The following sections summarize the TMDLs developed for total phosphorus, DO, and manganese in Lake Taylorville and dissolved oxygen and manganese in the South Fork Sangamon River. In addition, Section 9 presents implementation actions available within the watershed.

7.1 Methodology Overview

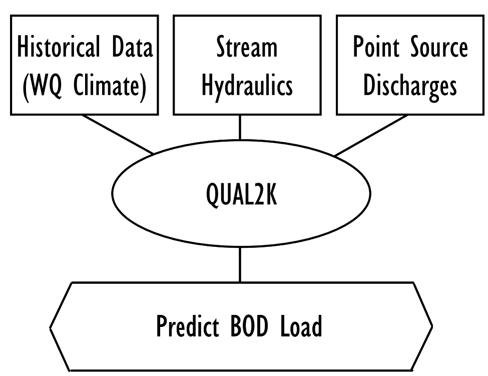
Table 7-1 contains information on the methodologies selected and used to develop TMDLs for impaired segments within the South Fork Sangamon River/Lake Taylorville watershed.

Table 7-1 Methodologies Used to Develop TMDLs in the South Fork Sangamon River/Lake Taylorville Watershed

Segment Name/ID	Cause of Impairment	Methodology
South Fork Sangamon River/EO13	Dissolved Oxygen	QUAL2K
South Fork Sangamon River/EO13	Manganese	Spreadsheet Analysis
Lake Taylorville/ REC	Total Phosphorus	BATHTUB

7.1.1 QUAL2K Overview

The QUAL2K model was used to develop the DO TMDL for segment EO13 of South Fork Sangamon River. QUAL2K is a stream water quality model that is one-dimensional and applicable to well-mixed streams. The model assumes steady state hydraulics and allows for point source inputs, diffuse loading and tributary flows. Historic water quality data, observed hydraulic information, and point source discharge data were coupled with model defaults to predict the external oxygen-demanding load to the system.

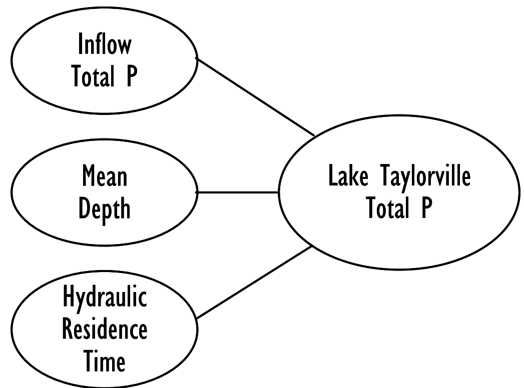


Schematic 1

7.1.2 Empirical Analysis of Manganese Overview

An empirical analysis of manganese was performed for South Fork Sangamon River. Due to limited data availability, the analysis included a spreadsheet evaluation of recently collected data and one historic sample in relation to the water quality standard.

7.1.3 BATHTUB Overview



Schematic 2
BATHTUB Model Schematic

Lake Taylorville is listed for impairments caused by dissolved oxygen, manganese, and total phosphorus. It is assumed that the only controllable sources of manganese to the lake are those which enter from lake sediments during periods of low dissolved oxygen. It is thought that the manganese in the lake sediments can be (partially) controlled by reducing phosphorus loads and increasing hypolimnetic DO concentrations. For this reason, attainment of the total phosphorus standard is expected to result in oxygen concentrations that will reduce sediment manganese flux to natural background levels.

To develop the total phosphorus TMDL for Lake Taylorville, a model called BATHTUB was utilized. Model selection was discussed in the Stage One report.

Schematic 1 shows that by using total phosphorus concentrations, the resulting in-lake total phosphorus concentrations can be predicted. The BATHTUB model uses empirical relationships between mean reservoir depth, total phosphorus inflow into the lake, and the hydraulic residence time to determine in-reservoir concentrations.

7.2 Methodology Development

The following sections further discuss and describe the methodologies utilized to examine DO, manganese and total phosphorus levels in the impaired waterbodies in the South Fork Sangamon River/Lake Taylorville watershed.

7.2.1 QUAL2K Model

QUAL2K (Q2K) is a river and stream water quality model that is intended to represent a modernized version of the QUAL2E (Q2E) model (Brown and Barnwell 1987). The original Q2E model is well-known and USEPA-supported. The modernized version has been updated to use Microsoft Excel as the user interface and has expanded the options for stream segmentation as well as a number of other model inputs. Q2K simulates DO dynamics as a function of nitrogenous and carbonaceous oxygen demand, atmospheric reaeration, SOD, and plant photosynthesis and respiration. The model also simulates the fate and transport of nutrients and BOD and the growth and abundance of floating (phytoplankton) and attached (periphyton) algae (as chlorophyll-a). Stream hydrodynamics and temperature are important controlling parameters in the model. Headwater, point source, and non-point source loadings and flows are explicitly input by the user. The model simulates steady-state diurnal cycles. Model parameter default values are provided in the model based on past studies and are recommended in the absence of site-specific information.

7.2.1.1 QUAL2K Inputs

Table 7-2 contains the categories of data required for the Q2K model along with the sources of data used to analyze segment EO13 of the South Fork Sangamon River.

Table 7-2 Q2K Data Inputs

Input Category	Data Source
Stream Segmentation	GIS data
Hydraulic characteristics	CDM field survey
Headwater conditions	CDM field survey
Meteorologic conditions	National Climatic Data Center; Taylorville station
Point Source contributions	Illinois EPA and USEPA PCS

7.2.1.1.1 Stream Segmentation

The Q2K model represents a river as a series of reaches. Each reach shares constant channel geometry and hydraulic characteristics. Figure 7-1 shows the stream segmentation used for the Q2K model. The South Fork Sangamon River was broken into three reaches for analysis. The three reaches were represented by sample locations EO13B, EO13 and EO13C (see Figure 7-1).

7.2.1.1.2 Hydraulic Characteristics

Stream hydraulics were specified in the model based on a CDM field survey conducted in August 2006 under low-flow conditions. A wetted cross-section was surveyed by measuring depths, velocities, and widths at sampling location EO13. Three other target locations (EO13A, B and C) did not have adequate water (EO13A and B) or, were not wadeable (EO13 C) and therefore were not gaged. GIS data along with visual and photograph characterization were used to guide model hydraulic inputs for the non-gaged areas. The Stage 2 report contains field sheets and photographs from the August 2006 survey. The Stage 2 report is available as Appendix F.

7.2.1.1.3 Headwater Conditions

The headwater flow and concentrations are user-specified in the model and represent the system's upstream boundary condition. The model was developed using the most complete data set available which was collected on August 30, 2006. Water quality data collected at site EO13B were used to characterize headwater quality conditions.

As discussed in the Stage One report, there are no USGS stream gages within the watersheds that have current, or even recent, streamflow data. Therefore, the drainage area ratio method, represented by the following equation, was used to estimate flows.

$$Q_{gaged}\left(\frac{Area_{ungaged}}{Area_{gaged}}\right) = Q_{ungaged}$$

where Q_{gaged} = Streamflow of the gaged basin
$Q_{ungaged}$ = Streamflow of the ungaged basin
$Area_{gaged}$ = Area of the gaged basin
$Area_{ungaged}$ = Area of the ungaged basin

The assumption behind the equation is that the flow per unit area is equivalent in watersheds with similar characteristics. Therefore, the flow per unit area in the gaged watershed multiplied by the area of the ungaged watershed estimates the flow for the ungaged watershed.

USGS gage 05593900 (East Fork Shoal Creek near Coffeen, Illinois) was chosen as an appropriate gage from which to estimate flows in the Lake Taylorville watershed. The East Fork Shoal Creek watershed is approximately 24 miles south of Taylorville Lake. The gage drains an area that contains similar land uses and receives comparable precipitation throughout the year. Gage 05593900 captures flow from a drainage area of 56 square miles while the South Fork Sangamon River/Lake Taylorville watershed drains approximately 130 square miles at the Lake Taylorville dam.

There are two point sources located upstream of the surrogate gage on East Fork Shoal Creek. In order to account for these point source contributions to flow, the average daily discharge rate from August 2006 was subtracted from the gaged data. Discharge monitoring report data showed that the Nokomis STP discharged 0.15 mgd while Witt STP discharged 0.14 mgd. Together, these point sources contributed 0.48 cfs to the East Fork Shoal Creek at the upper reaches of the watershed. The flow value at gage 05593900 for August 30, 2006 was 0.18 cfs. This indicates that there is significant stream loss between the point source discharges and the gage location during low flow periods.

Because of this scenario, field estimates and the area ratio method were applied to stream flow data collected at sampling location EO13 on August 29, 2006. The Stage 2 field survey determined flows at EO13 to be 1.6 cfs. Using the area ratio method as described above, the estimated flow at sampling location EO13B on August 30, 2006 was determined to be approximately 1.4 cfs. Field notes indicate that the river at site EO13B was significantly shallower and less wide than at EO13. Based on this information and the area ratio method estimates, the flow at EO13B was estimated to be 0.8 cfs. This value is considered representative of low-flow, critical conditions.

7.2.1.1.4 Climate

Q2K requires inputs for climate. Hourly temperature, dew point temperature and wind speed data for August 30, 2006 from Taylorville, IL were used for the model.

7.2.1.1.5 Point Sources

Three point sources discharge within the South Fork Sangamon River watershed. Q2K allows user input of point source locations, flow and water quality data. DMR records were reviewed and recent data available through the USEPA PCS database were reviewed for each facility. Table 7-3 contains information for each facility while

Figure 7-1 shows the locations of each facility. Flow information was available for each discharger; however, effluent quality data are available only for parameters that are sampled per permit requirements. According to USEPA PCS, none of the facilities discharged effluent to South Fork Sangamon River tributaries during August of 2006, therefore, for purposes of this model, the system was set up with no point source contributions.

Table 7-3 Point Source Discharges within the South Fork Sangamon River Watershed

Facility Name	Permit Number	Permitted Average Flows
Ohlman STP	IL0032671	.025 mgd
Nokomis Quarry	ILG840055	0.72 mgd
Christian County Limestone	ILG840105	0.15 mgd

7.2.1.2 QUAL2K Calibration

The QUAL2K model for the South Fork Sangamon River was set up and run as discussed in the preceding sections. Data collected during Stage 2 at sample locations EO13 and EO13C were used for model calibration. Initially, "truth checking" was performed on key model calculated parameters, such as reaeration rates, SOD fluxes, temperature, and phytoplankton concentrations using literature values and best professional judgment. Hydraulics were adjusted to represent slower and deeper flow conditions at sites where data were not available from Stage 2 field surveys and diffuse loadings were increased for $CBOD_5$ and nutrients to represent nonpoint source contribution from the surrounding watershed. Figure 7-2 shows the calibration outcome. Appendix G contains the model input worksheets.

7.2.2 Empirical Analysis of Manganese

Load duration curves are generally used to gain understanding of the range of loads allowable throughout the flow regime of a stream. Insufficient data were available to develop a complete load-duration curve for segment EO13. A simplified spreadsheet analysis was used to calculate reduction values while a load duration curve was calculated to determine the loading capacity of the stream. Only five sample results were available between the four sampling locations on the segment. The load reduction needed to meet the water quality target was determined by averaging the samples that exceeded the target, and calculating the reductions needed to bring the average exceedence value down to the water quality standard. Figure 7-3 shows the total manganese target (1,000 µg/L) plotted as a line against the empirical data available for the segment. The average exceedence value is 3,100 µg/L and needs to be reduced by 68 percent in order to meet the instream water quality standard.

Again, flow rates were estimated using the area ratio method discussed in Section 7.2.1.1.3. Flows were then ranked to develop a percent exceedance value and multiplied by the standard to develop a load duration curve to determine the loading capacity for segment EO13. The loading capacity of the segment is further discussed in Section 8. The load duration curve developed for this segment is available in Appendix H.

7.3 BATHTUB Model Development and Input

BATHTUB has three primary input interfaces: global, reservoir segment(s), and watershed inputs. The individual inputs for each of these interfaces are described in the following sections.

7.3.1 Global Inputs

Global inputs represent atmospheric contributions of precipitation, evaporation, and atmospheric phosphorus. Based on precipitation and evaporation rates discussed in the previous sections, the average annual precipitation input to the model was 36.2 inches, and the average annual evaporation input to the model was 33.2 inches. The default atmospheric phosphorus deposition rate suggested in the BATHTUB model was used in absence of site-specific data, which is a value of 30 kg/km^2-yr (USACE 1999).

7.3.2 Reservoir Segment Inputs

Reservoir segment inputs in BATHTUB are used for physical characterization of the reservoir. Lake Taylorville was modeled with three segments (REC-1, REC-2, and REC-3) in BATHTUB. The segment boundaries are shown on Figure 7-4. Segmentation was established based on available water quality and lake morphologic data.

Segment inputs to the model include average depth, surface area, and segment length. The lake depth was represented by the averaged data from the water quality stations discussed in Section 5. These data are shown below (Table 7-4) for reference. Segment lengths and surface areas were determined in GIS.

Table7-4 Average Depths (ft) for Lake Taylorville Segment REC (Illinois EPA 2002 and USEPA 2002a)

Year	REC-1	REC-2	REC-3
1990	14.5	8.4	4.8
1991	16.1	8.2	4.4
1992	14.0	8.3	4.5
1993	14.6	8.5	5.3
1994	15.3	7.9	3.9
1995	14.8	8.3	5.0
1996	13.9	8.4	4.6
1997	15.7	8.2	4.1
1998	13.1	7.3	4.5
2000	15.2	7.3	4.0
Average	**14.7**	**8.1**	**4.5**

7.3.3 Tributary Inputs

Tributary inputs to BATHTUB include drainage area, flow, and total phosphorus (dissolved and solid-phase) loading. The drainage area of each tributary is equivalent to the basin or subbasin it represents, which was determined with GIS analyses. See Figure 7-4 for subbasin boundaries. The watershed was broken up into five tributaries for purposes of the model. There are two tributaries that flow into the upstream lake segment (South Fork Sangamon River and Locust Creek). The remaining tributary areas are those contributing direct overland flow to each lake segment. The tributary areas are shown in Table 7-5. In addition to the contributing tributary areas, a water outtake was included in the model to account for lake withdrawals for the public water supply. Pumping rates for the summer months were averaged out for the remainder of the year to estimate an annual withdrawal value for the model.

Table 7-5 Lake Taylorville Tributary Subbasin Information

Tributary Name	Lake Segment Receiving Drainage	Subbasin Area (acres)	Estimated Subbasin flow (cfs)	Percent Contribution to Total External Load
South Fork Sangamon River	REC-3	43436.8	52.7	54.4
Locust Creek	REC-3	20054.4	24.4	25.2
Direct Runoff : REC-3	REC-3	10657.9	12.9	13.3
Direct Runoff : REC-2	REC-2	2417.9	2.9	3.1
Direct Runoff : REC-1	REC-1	3249.9	3.9	4.0
	Total	79816.9	96.8	100.0

The storage volume for Lake Taylorville was available through the national dam inventory. Normal storage volume for the lake is 10,394 acre-feet. Based on this storage volume and the inflow of 95.24 cfs, the lake residence time is approximately 55 days.

Stage Two data showed that average phosphorus concentrations on the South Fork Sangamon River were 0.61 mg/L. This information was coupled with flow data estimated using the area ratio method and provided in Table 7-5, and was used to estimate loadings from each tributary subbasin. Table 7-6 contains the estimated total phosphorus loads entering the lake from each subbasin.

Table 7-6 Estimated Tributary Loads of Total Phosphorous (lbs/day)

Tributary	Estimated Load
South Fork Sangamon	10.39
Locust	4.80
Direct Flow to Segment REC-3	2.55
Direct Flow to Segment REC-2	0.58
Direct Flow to Segment REC-1	0.78
TOTAL	19.10

7.4 BATHTUB Confirmatory Analysis

Available lake and tributary water quality data are summarized in the reports for Stages One and Two. These data were used to help confirm model calculations. The following setup was used in the BATHTUB Model for the total phosphorus assessment:

- Conservative Substance Balance: Not computed
- Phosphorus Balance: 2nd Order, Available Phosphorus
- Nitrogen Balance: Not computed
- Chlorophyll-*a*: Not computed
- Secchi Depth: Not computed
- Longitudinal Dispersion: Fischer-Numeric

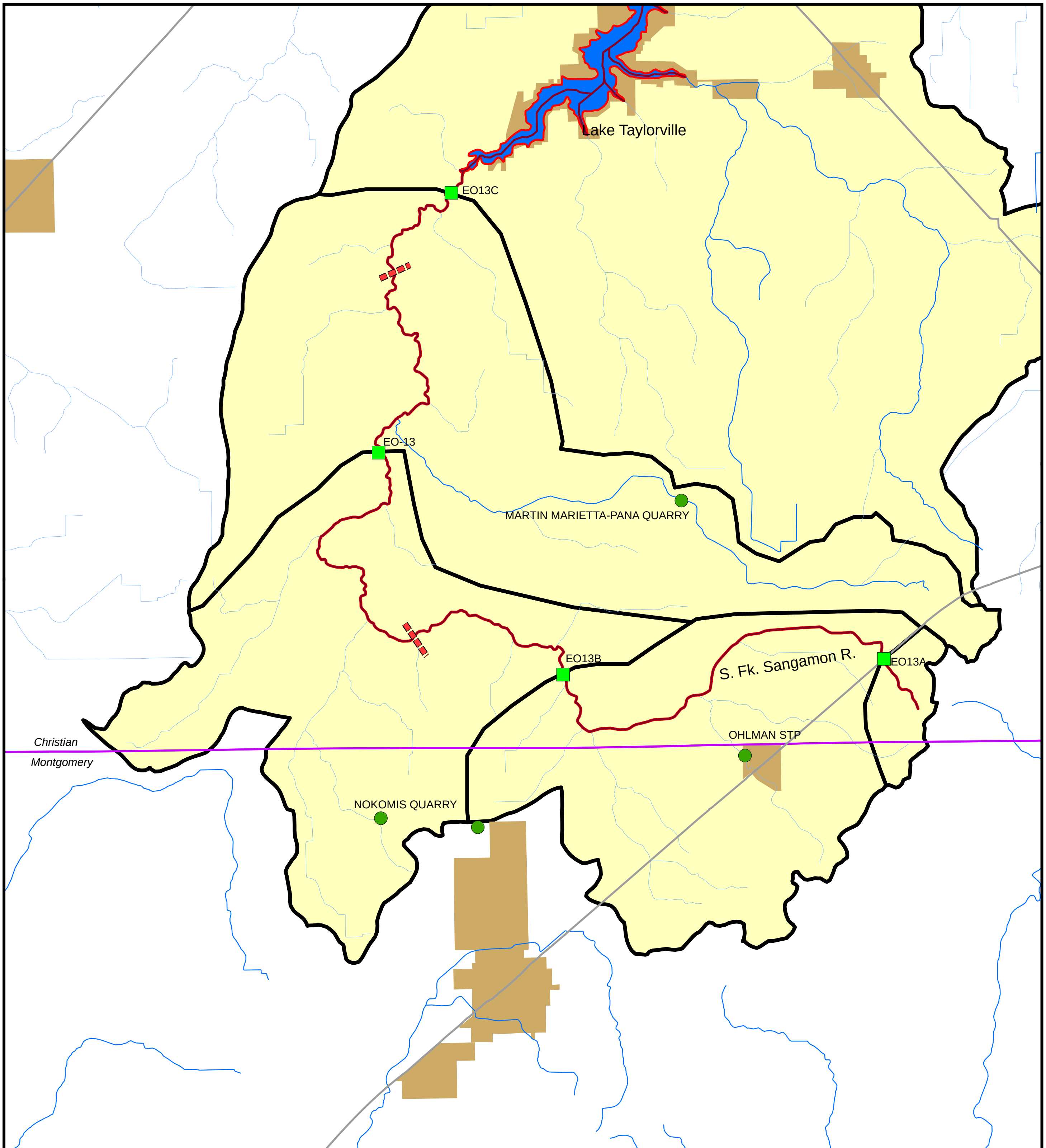
- Error Analysis: Not computed
- Phosphorus Calibration: None
- Nitrogen Calibration: None
- Application of Nutrient Availability Factors: Ignore
- Calculation of Mass Balances: Use estimated concentration

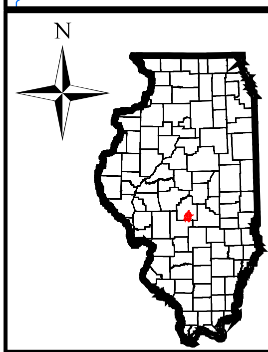
The annual average loadings described above were entered into the BATHTUB model and compared with available water quality data for the lake. When using these loadings, the BATHTUB model under-predicted the concentrations when compared to actual water quality data. To achieve a better match with actual water quality data, internal loading rates were adjusted. Internal loading rates reflect nutrient recycling from bottom sediments. Based on the confirmatory analysis internal cycling is occurring throughout the lake where oxygen levels could be depleted at lower levels, which indicates favorable conditions for internal cycling. Table 7-7 shows the results of this analysis.

Table 7-7 Summary of Model Confirmatory Analysis: Lake Total Phosphorus (µg/L)

Lake Segment	Predicted Concentration	Observed Concentration	Internal Loading Rate (mg/m^2-day)
REC-3	187.6	188.3	15
REC-2	229.1	238.3	15
REC-1	286.8	276.7	15
Lake Average	243.0	240.5	15

Again, it is believed that controlling nutrient loads to the lake will in turn improve dissolved oxygen concentrations throughout the water column which will reduce the influx of manganese from the sediments. Because the model indicates that internal loading is occurring throughout the lake, a review of DO levels was performed to lend confidence to this theory. Because the lake is listed on the 303(d) list for impairment caused by low DO, it is already confirmed that concentrations at 1-foot depth (where assessments are made) have not met the standard in the past. Figure 5-3 in the Stage 1 report shows DO concentrations at one-foot depth. Data from 2000 also indicate that during the summer, DO concentrations were recorded as low as 1.2 mg/L (at site REC-1 on July 7, 2000). In addition, the highest manganese concentration sampled during 2000 (230 µg/L) was recorded on August 17, 2000 closely following the time period that the lake experienced the lowest DO values in the bottom waters.





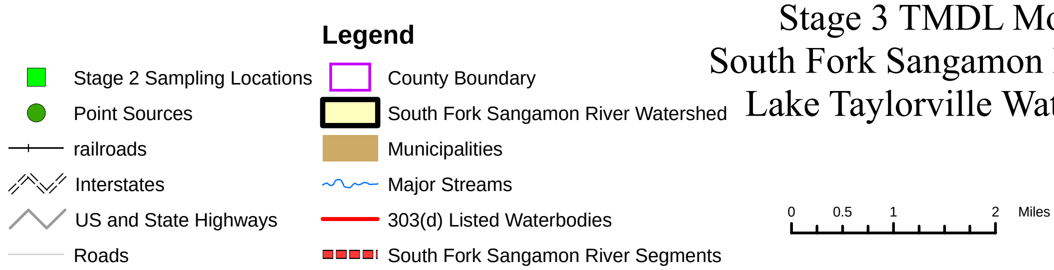


Figure 7-1:
Stage 3 TMDL Modeling
South Fork Sangamon River -
Lake Taylorville Watershed

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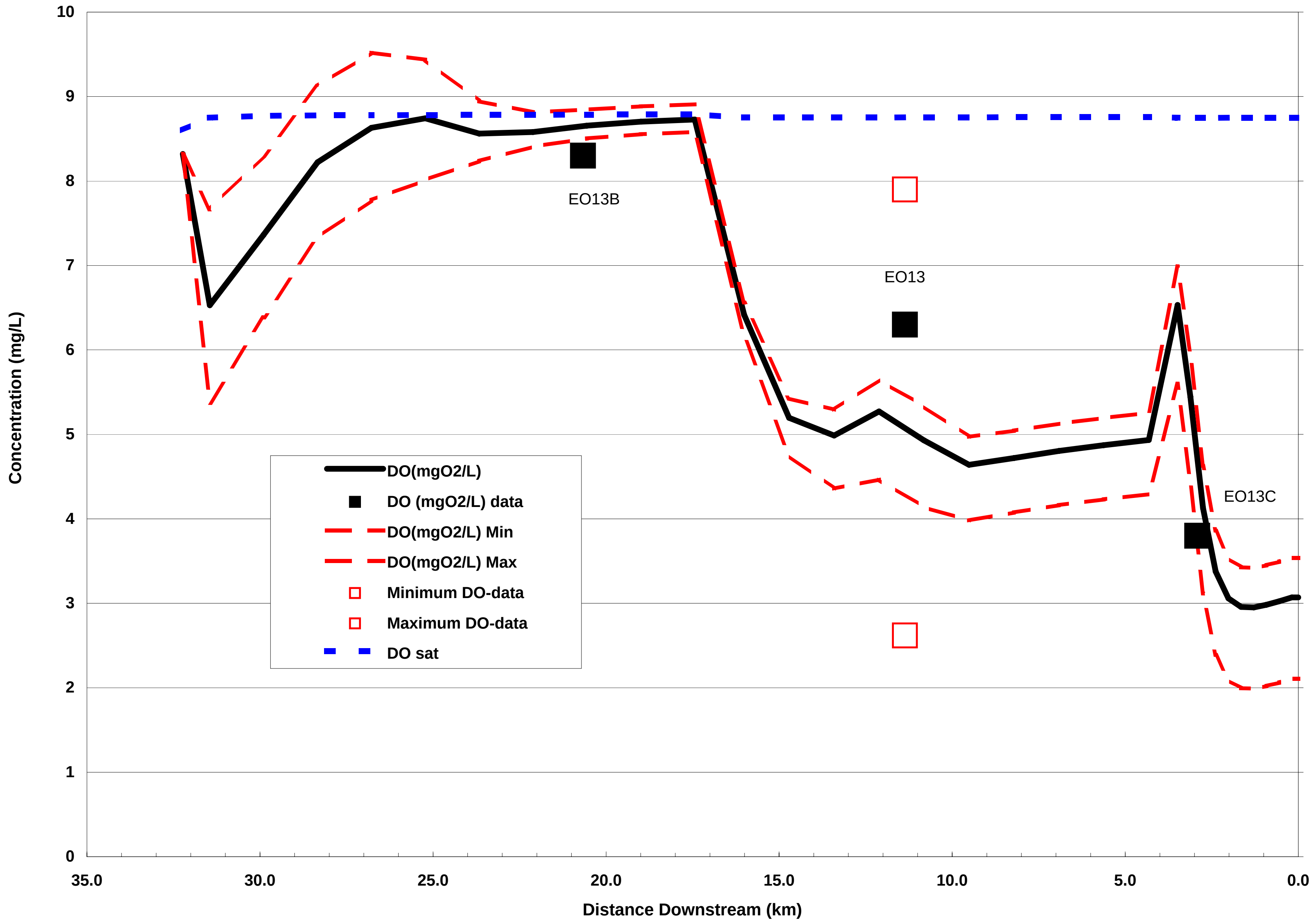

CDM

Figure 7-2: South Fork Sangamon River Modeled and Observed DO Concentrations August 30, 2006

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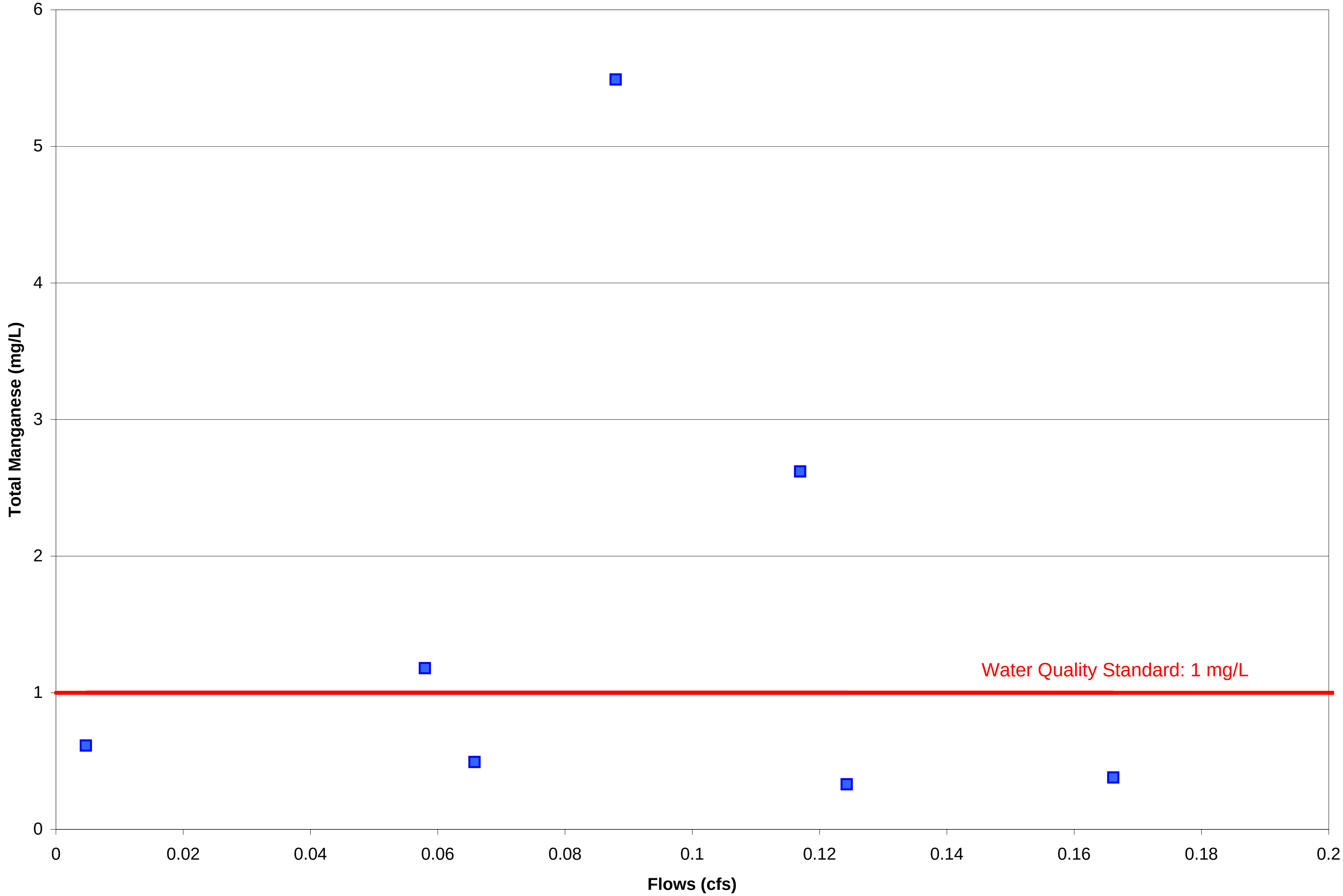

Figure 7-3:
Total Manganese Concentrations
South Fork Sangamon River

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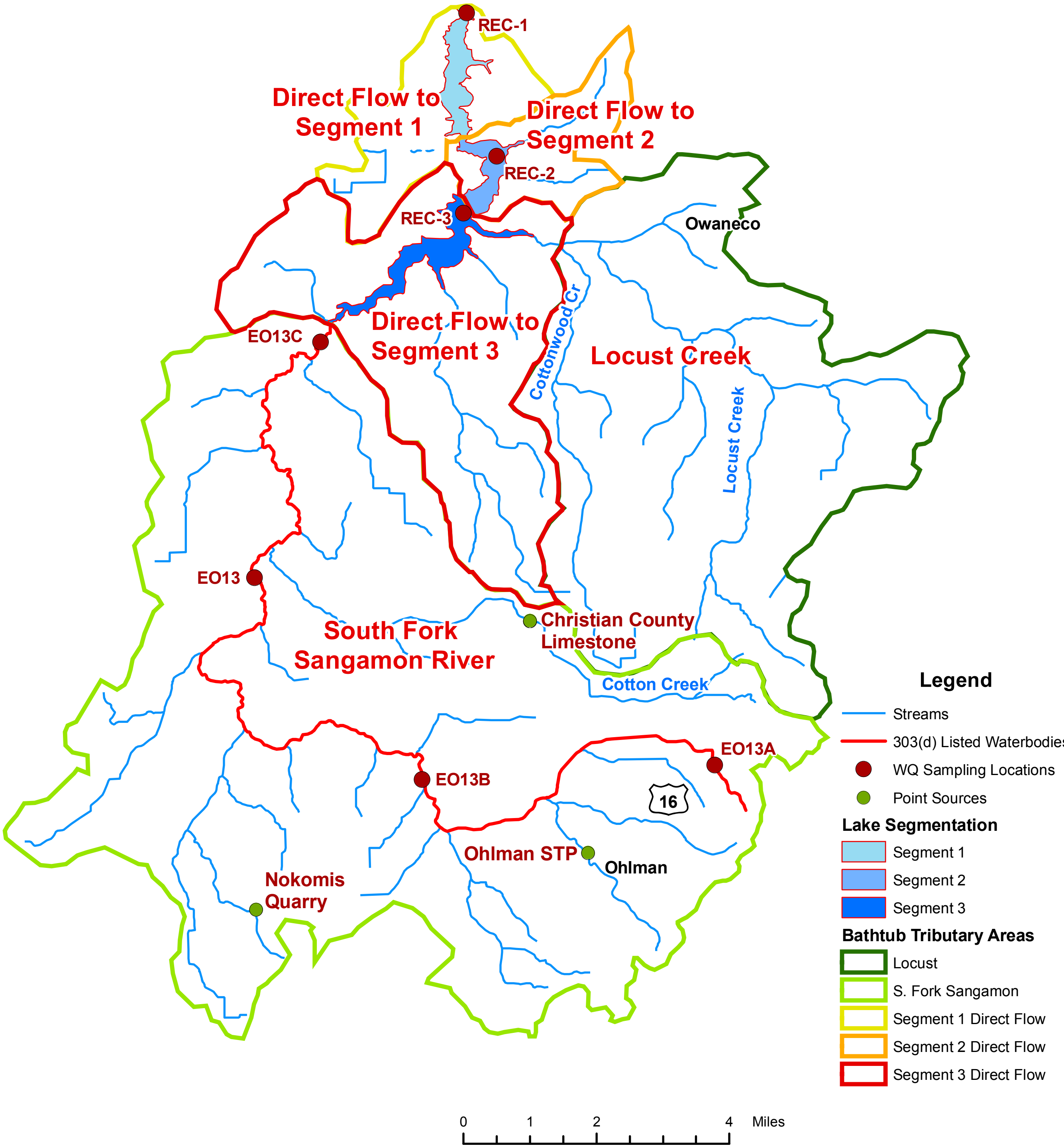

Figure 7-4:
BATHTUB Segmentation
Lake Taylorville Watershed

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Section 8
Total Maximum Daily Loads for the South Fork Sangamon River/Lake Taylorville Watershed

8.1 TMDL Endpoints

The TMDL endpoints for DO, manganese, and total phosphorus for the impaired segments in the South Fork Sangamon River/Lake Taylorville watershed are summarized in Table 8-1. All concentrations must be below the TMDL endpoints except for DO concentrations which need to be above 6.0 mg/L during 16 hours of any 24 hour period and must never go below 5.0 mg/L. The endpoints are based on the protection of aquatic life in the South Fork Sangamon River and Lake Taylorville. Some of the average concentrations, which are based on data sets discussed in Section 5 and data collected during Stage 2, meet the desired endpoints. However, each data set has maximum or minimum values that do not meet the desired endpoints and this was the basis for TMDL analysis. Further monitoring as outlined in the monitoring plan presented in Section 3, will help further define when impairments are occurring in the watershed and support the TMDL allocations outlined in the remainder of this section.

Table 8-1 TMDL Endpoints and Average Observed Concentrations for Impaired Segments in the South Fork Sangamon River/Lake Taylorville Watershed

Impaired Segment	Constituent	TMDL Endpoint	Average Observed Value on Impaired Segment
Lake Taylorville	Phosphorus	0.05 mg/L	0.23 mg/L
South Fork Sangamon River	Manganese	1 mg/L	1.4 mg/L
South Fork Sangamon River	DO	6.0 mg/L (16 hours of any 24-hour period), 5.0 mg/L instantaneous minimum	4.02 mg/L

8.2 Pollutant Source and Linkage

Potential pollutant sources for the impaired waterbodies in the South Fork Sangamon River/Lake Taylorville watershed were identified through the existing data review described in Sections 1 through 5 and the TMDL methodologies discussed and presented in Section 7 of this document. The source of manganese in the South Fork Sangamon River is most likely natural sources. The likely source of oxygen demanding materials in South Fork Sangamon River is nonpoint source runoff and slow-moving waters with increased water temperatures that promote algal growth. Additionally, during low flow conditions the river experiences very low reaeration and is subject to sediment oxygen demands. Nutrient sources to Lake Taylorville include both internal and external nonpoint sources.

8.3 Allocation

As explained in Section 1, the TMDLs for the impaired segments in the South Fork Sangamon River/Lake Taylorville watershed will address the following equation:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

where: LC = Maximum amount of pollutant loading a water body can receive without violating water quality standards

WLA = The portion of the TMDL allocated to existing or future point sources

LA = Portion of the TMDL allocated to existing or future nonpoint sources and natural background

MOS = An accounting of uncertainty about the relationship between pollutant loads and receiving water quality

Each of these elements will be discussed in this section as well as consideration of seasonal variation in the TMDL calculation.

8.3.1 South Fork Sangamon River Manganese TMDL

8.3.1.1 Loading Capacity

The LC is the maximum amount of manganese that the South Fork Sangamon River can receive and still maintain compliance with the water quality standards. The average exceedence value recorded on the segment was 3,100 µg/L and needs to be reduced by 68 percent in order to meet the instream water quality standard.

In order to determine the loading capacity at various flow conditions for the South Fork Sangamon River, a load duration curve was developed by multiplying the range of flows by the water quality standard. Table 8-2 contains the loading capacity for manganese in the South Fork Sangamon River segment EO13.

8.3.1.2 Seasonal Variation

Consideration to seasonality is inherent in the load duration analysis described above. The standard is not seasonal and the full range of expected flows is represented in the loading capacity table (Table 8-2). Therefore, the loading capacity represents conditions throughout the year. Similarly, by considering and addressing all flow scenarios, the critical conditions when the stream segment is most vulnerable to water quality exceedences were addressed.

8.3.1.3 Margin of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The TMDL developed for the South Fork Sangamon River contains an explicit MOS of 10 percent. Ten percent is considered adequate to compensate for any uncertainty in the TMDL.

8.3.1.4 Waste Load Allocation

There are three point sources that discharge within the South Fork Sangamon River watershed. Table 8-2 contains permit information for each facility.

Table 8-2 Point Source Information for Dischargers in the Segment EO13 Watershed

Facility Name	Permit Number	Average Daily Flow (mgd)
Ohlman STP	IL0032671	0.02
Nokomis Quarry	ILG840055	0.72
Christian County Limestone	ILG840105	0.15

As shown in Table 8-2, one facility is a sanitary treatment plant while the other two are related to quarries. None of the facilities are required to sample their discharge for manganese and the facilities are not believed to contribute significantly to manganese concentrations in South Fork Sangamon River. Manganese loading to the creek most likely originates from natural sources such as groundwater and soils. Because of this, a WLA was not calculated.

8.3.1.5 Load Allocation and TMDL Summary

Because there is no WLA in this TMDL, the manganese load has been allocated between the LA (nonpoint sources) and the MOS. As discussed in Section 8.3.1.1, a spreadsheet analysis determined that a 68 percent reduction in manganese loading is needed to meet the water quality standard of 1,000 µg/L. Table 8-3 shows the summary of the manganese TMDL for the South Fork Sangamon River.

Table 8-3 TMDL Summary for Manganese in the South Fork Sangamon River

Estimated Mean Daily Flow (cfs)	LC (lb/d)	WLA (lb/d)	LA (lb/d)	MOS (lb/d)
5	27	0	24	3
10	54	0	49	5
25	135	0	122	14
50	270	0	243	27
100	540	0	486	54
500	2,698	0	2,428	270
1,000	5,395	0	4,856	540
2,000	10,791	0	9,712	1,079

8.3.2 South Fork Sangamon River DO TMDL

8.3.2.1 Loading Capacity

The LC is the maximum amount of oxygen-demanding material that the South Fork Sangamon River can receive and still maintain compliance with the water quality standards. The Q2K model showed that diffuse loads of oxygen-demanding materials coupled with low flow conditions cause dissolved oxygen violations in the river. It is assumed that low flows, low stream reaeration and high temperatures are driving the dissolved oxygen levels below the standard on the South Fork Sangamon River. This theory is also supported by available data for the segment.

There are three point sources located within the watershed and none were determined to contribute significantly to low dissolved oxygen levels in the stream, as low dissolved oxygen concentrations were recorded when zero point source effluent was being discharged to the stream. The three point sources that discharge to this segment, the Ohlman STP, the Nokomis Quarry and the Christian County Limestone facility are small facilities that discharge to tributaries of South Fork Sangamon River that likely have little to no flow during low flow periods. Because of their negligible contribution to low dissolved oxygen levels, it was determined that permit limit reductions are not needed. Because a TMDL can not be developed for flow rates or reaeration rates, no TMDL will be developed at this time. Implementation activities to lessen diffuse loading during periods of runoff and measures to increase reaeration in the river are presented in Section 9.

8.3.3 Total Phosphorus TMDL for Lake Taylorville

8.3.3.1 Loading Capacity

The LC of Lake Taylorville is the pounds of total phosphorus that can be allowed as input to the lake per day and still meet the water quality standard of 0.05 mg/L total phosphorus. The allowable phosphorus loads that can be generated in the watershed and still maintain water quality standards were determined with the model that was set up and confirmed as discussed in Section 7. To accomplish this, the loads calculated using average values from the historic data were reduced by a percentage and entered into the BATHTUB model until the water quality standard of 0.05 mg/L total phosphorus was met in Lake Taylorville. The allowable annual phosphorus load determined by reducing modeled inputs to Lake Taylorville through BATHTUB was determined to be 43 lbs/day. This analysis is included as Appendix I.

8.3.3.2 Seasonal Variation

A season is represented by changes in weather; for example, a season can be classified as warm or cold as well as wet or dry. Seasonal variation is represented in the Lake Taylorville TMDL as conditions were modeled on an annual basis. Modeling on an annual basis takes into account the seasonal effects the lake will undergo during a given year. Since the pollutant source can be expected to contribute loadings in different quantities during different time periods (e.g., various portions of the agricultural season resulting in different runoff characteristics), the loadings for this TMDL will focus on average annual loadings converted to daily loads rather than specifying different loadings by season. The Lake Taylorville Watershed would most likely experience critical conditions annually based on the growing season. Because an average annual basis was used for TMDL development, it is assumed that the critical condition is accounted for within the analysis.

8.3.3.3 Margin of Safety

The MOS can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The MOS for the Lake Taylorville TMDL is implicit. The analysis completed for Lake Taylorville is conservative because of the following:

- In the absence of site-specific data, an atmospheric loading rate of 30 kg/km^2-yr total phosphorus (USACE 1999) was taken from literature values and assumed in the BATHTUB model.

- Default values were used in the BATHTUB model, which in absence of site-specific information are assumed conservative. Default model values, such as the phosphorus assimilation rate, are based on scientific data accumulated from a large survey of lakes. Because no site-specific data are available, it is assumed that default values are adequate and applicable for this model.

- Because site-specific data were not available on internal cycling rates, estimates were used based on modeling and available in-lake concentration data. This analysis resulted in the model achieving a close estimate of in-lake concentration data for average-loading conditions and an overprediction of in-lake concentrations for high-loading conditions.

8.3.3.4 Waste Load Allocation

Again there are three point sources within the Lake Taylorville watershed. It is assumed that the quarries are not contributing nutrients to the system. In addition, the Ohlman STP is a two cell lagoon facility with rock filters that discharges intermittently. Currently, there are no phosphorus limits for this facility and because the facility is located significantly upstream from the lake and does not discharge regularly, it is assumed that the contributions to lake nutrients are negligible. For this reason, the WLA is set to zero for this TMDL.

8.3.3.5 Load Allocation and TMDL Summary

Table 8-4 shows a summary of the TMDL for Lake Taylorville. On average, a total reduction of 91 percent of total phosphorus loads to Lake Taylorville would result in compliance with the water quality standard of 0.05 mg/L total phosphorus. The 91 percent reduction would need to come from both internal and external sources. These values were determined using average values from the historic data set. Table 8-4 shows where resulting load reductions could be achieved from either internal cycling or from external watershed loadings.

Table 8-4 TMDL Summary for Lake Taylorville

Load Source	LC (lb/day)	WLA (lb/day)	LA (lb/day)	MOS (lb/day)	Current Load (lb/day)	Reduction Needed (lb/day)	Reduction Needed (percent)
Total	43	0	43	0	488.8	445.8	91%
Internal	23.9	0	23.9	0	170.4	146.5	86%
External	19.1	0	19.1	0	318.4	299.3	94%

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Section 9
Implementation Plan for the South Fork Sangamon River/Lake Lake Taylorville Watershed

9.1 Adaptive Management

An adaptive management or phased approach is recommended for the TMDLs developed for the South Fork Sangamon River/Lake Taylorville watershed. Adaptive management is a systematic process for continually improving management policies and practices through learning from the outcomes of operational programs. Some of the differentiating characteristics of adaptive management are:

- Acknowledgement of uncertainty about what policy or practice is "best" for the particular management issue
- Thoughtful selection of the policies or practices to be applied (the assessment and design stages of the cycle)
- Careful implementation of a plan of action designed to reveal the critical knowledge that is currently lacking
- Monitoring of key response indicators
- Analysis of the management outcomes in consideration of the original objectives and incorporation of the results into future decisions (British Columbia Ministry of Forests 2000)

Implementation actions, point source controls, management measures, or BMPs are used to control the generation or distribution of pollutants. BMPs are either structural, such as wetlands, sediment basins, fencing, or filter strips; or managerial, such as conservation tillage, nutrient management plans, or crop rotation. Both types require good management to be effective in reducing pollutant loading to water resources (Osmond et al. 1995).

It is generally more effective to install a combination of point source controls and BMPs or a BMP system. A BMP system is a combination of two or more individual BMPs that are used to control a pollutant from the same critical source. In other words, if the watershed has more than one identified pollutant, but the transport mechanism is the same, then a BMP system that establishes controls for the transport mechanism can be employed (Osmond et al. 1995).

To assist in adaptive management, implementation actions, management measures, available assistance programs, and recommended continued monitoring are all discussed throughout the remainder of this section.

9.2 Implementation Actions and Management Measures for DO in the South Fork Sangamon River

DO impairments are generally addressed by focusing on organic loads that consume oxygen through decomposition and nutrient loads that can cause algal growth, which can also deplete DO. Analysis discussed in Section 8 established a relationship between low flows, oxygen-demanding materials (BOD_5, ammonia-nitrogen, and organic nitrogen), and DO concentrations in the South Fork Sangamon River segment EO13; therefore, management measures for segment EO13 will focus on increasing reaeration and decreasing loads of oxygen-demanding materials to increase DO concentrations.

DO impairments in the South Fork Sangamon River segment EO13 are mostly attributed to low-flow or stagnant conditions within the river. Runoff from nonpoint sources also contributes loading of oxygen-demanding materials in the segment. An additional contributor to low DO is increased water temperatures. Therefore, management measures for the segment EO13 watershed will focus on reducing nonpoint source loading through sediment and surface runoff controls, reducing stream temperatures, and reducing stagnant conditions through reaeration.

9.2.1 Point Sources of Oxygen-Demanding Materials

This section discusses the point sources within the watershed and their potential to contribute oxygen-demanding materials to the impaired segment.

9.2.1.1 Municipal/Industrial Sources

One small STP discharges oxygen-demanding materials within the South Fork Sangamon River/Lake Taylorville watershed. In addition, two quarries are permitted to discharge to tributaries of the South Fork Sangamon River. All of these facilities are located tributaries of the impaired segment. Table 9-1 contains permit information on each of these facilities.

Table 9-1 Point Source Discharges to South Fork Sangamon River Segment EO13

Facility Name	Permit Number	Permitted Flow (mgd)	Permit Expiration
Ohlman STP	IL0032671	0.025	07/31/2010
Nokomis Quarry Co-Nokomis Qry	ILG840055	0.72	11/30/2011
Christian County Limestone	ILG840105	0.15	11/30/2011

Illinois EPA will evaluate the need for point source controls through the NPDES permitting program as each permit is due for renewal. Each facility is located at the upstream end of a tributary, which flows into segment EO13 and does not contribute significant flow to the system. The facilities are not believed to be a significant source of oxygen-demanding materials to the South Fork Sangamon River. Only the Ohlman STP permit has limits for DO and $CBOD_5$. The facility is required to discharge effluent with DO concentrations higher than 6.0 mg/L and $CBOD_5$ concentrations that average less than 25 mg/L. A review of DO and $CBOD_5$ data from recent discharge monitoring reports for the Ohlman STP shows that the facility has not had any violations of its permit limits. These permit limits are thought to be adequately protective of aquatic life uses within the South Fork Sangamon River. During the next permit cycle for Ohlman's NPDES permit, the state should evaluate the need for ammonia permit limits for this facility and should consider monitoring requirements to confirm its contribution. Also, at the time of permit renewal, Illinois EPA will determine if the lagoon exemption is still appropriate for this facility under IPCB regulations and whether or not ammonia limits should be applied to this facility.

9.2.2 Nonpoint Sources of Oxygen-Demanding Materials

In addition to point sources of oxygen-demanding materials within the watershed, there are a number or potential nonpoint sources. The potential sources of nonpoint pollution to the South Fork Sangamon River include over fertilization, streambank erosion, low flows, and high temperatures. BMPs evaluated for treatment of these nonpoint sources are:

- Filter strips
- Grassed waterways
- Riparian buffers
- Reaeration/Erosion Control/Streambank Stabilization

In addition, there are a number of BMPs available to treat nutrients from nonpoint sources that also may contribute to low DO levels in the river. These BMPs are discussed in detail in Section 9.4.

9.2.2.1 Filter Strips

Filter strips can be used as a control to reduce pollutant loads, including nutrients and sediment, to the South Fork Sangamon River. Filter strips implemented along stream segments slow and filter nutrients and sediment out of runoff and provide bank stabilization decreasing erosion and deposition. The following paragraphs focus on the implementation of filter strips in the South Fork Sangamon River/Lake Taylorville watershed. Finally, design criteria and size selection of filter strips are detailed.

Organic debris in topsoil contributes to the BOD_5 load to water bodies (USEPA 1997). Increasing the length of stream bordered by grass and riparian buffer strips will decrease the amount of BOD_5 and nutrient load associated with sediment loads to the South Fork Sangamon River. Nutrient criteria, currently being developed and expected to be adopted in the near future by the Illinois EPA, will assess the instream nutrient concentrations required for the watershed. Excess nutrients in streams can cause excessive algal growth, which can deplete DO in streams. Adoption of nutrient criteria will potentially affect this DO TMDL and help control exceedences of DO water quality criteria in the South Fork Sangamon River.

Filter strips will help control BOD_5 levels by removing organic loads associated with sediment from runoff; however, no studies were identified as providing an estimate of removal efficiency. Grass filter strips can remove as much as 75 percent of sediment and 45 percent of total phosphorus from runoff, so it is assumed that the removal of

BOD_5 falls within this range (NCSU 2000). Riparian buffer strips also help reduce water temperatures which can in turn increase the water body DO saturation level.

Riparian vegetation, specifically shade, plays a significant role in controlling stream temperature change. The shade provided will reduce solar radiation loading to the stream. Furthermore, riparian vegetation provides bank stability that reduces sediment loading to the stream and the stream width-to-depth ratio. Research in California (Ledwith 1996), Washington (Dong et al. 1998), and Maine (Hagan and Whitman 2000) has shown that riparian buffers effect microclimate factors such as air temperature and relative humidity proximal to the stream. Ledwith (1996) found that a 500-foot buffer had an air temperature decrease of 12°F at the stream over a zero-foot buffer. The greatest change occurred in the first 100 feet of the 500-foot buffer where the temperature decreased 2°F per 30 feet from the stream bank. A decrease in the air temperature proximal to the stream would result in a smaller convective flux to the stream during the day.

Filter strip widths for the South Fork Sangamon River TMDL were estimated based on the land slope. According to the NRCS Planning and Design Manual, the majority of sediment is removed in the first 25 percent of the width (NRCS 1994). Table 9-2 outlines the guidance for filter strip flow length by slope (NRCS 1999).

Table 9-2 Filter Strip Flow Lengths Based on Land Slope

Percent Slope	0.5%	1.0%	2.0%	3.0%	4.0%	5.0% or greater
Minimum	36	54	72	90	108	117
Maximum	72	108	144	180	216	234

GIS land use data described in Section 5 were used in conjunction with soil slope data to provide an estimate of acreage where filter strips could be installed. As discussed in Section 2.4.1, the most predominant soil type in the watershed is Herrick silt loam ranging from silts to clays on 0 to 2 percent slopes. Based on these slope values, filter strip widths of 72 to 144 feet could be incorporated into agricultural lands adjacent to the canal and its tributaries. Mapping software was then used to buffer stream segments to determine the total area found within 144 feet of tributaries in the watershed. There are approximately 2,553 total acres within this buffer distance. The land use data were then clipped to the buffer area to determine the amount of this land that is agricultural. There are an estimated 1,849 acres of agricultural land surrounding tributaries of the South Fork Sangamon River where filter strips and riparian buffers could potentially be installed. Landowners should evaluate their land near the South Fork Sangamon River and its tributaries and install or extend filter strips according to the NRCS guidance provided in Table 9-2. Programs available to help fund the construction of these buffer strips are discussed in Section 9.5.

9.2.2.2 Grassed Waterways

Grassed waterways are stormwater conveyances lined with grass that prevent erosion of the transport channel. In addition, the grassed channel reduces runoff velocities, allows for some infiltration, and filters out some particulate pollutants. Phosphorus reductions for grassed waterways are reported at 30 percent (Winer 2000).

9.2.2.3 Riparian Buffers

Riparian corridors, including both the stream channel and adjacent land areas, are important components of watershed ecology. The streamside forest slowly releases nutrients as twigs and leaves decompose. These nutrients are valuable to the fungi, bacteria, and invertebrates that form the basis of a stream's food chain. Tree canopies of riparian forests also cool the water in streams, which can affect the composition of the fish species in the stream as well as the rate of biological reactions. Channelization or widening of streams moves the canopy farther apart, decreasing the amount of shaded water surface and increasing water temperature, which can increase DO problems.

Preserving natural vegetation along stream corridors can effectively reduce water quality degradation associated with development. The root structure of the vegetation in a buffer enhances infiltration of runoff and subsequent trapping of nonpoint source pollutants. However, the buffers are only effective in this manner when the runoff enters the buffer as a slow moving, shallow "sheet"; concentrated flow in a ditch or gully will quickly pass through the buffer offering minimal opportunity for retention and uptake of pollutants.

Even more important than the filtering capacity of the buffers is the protection they provide to streambanks. The rooting systems of the vegetation serve as reinforcements in streambank soils, which help to hold streambank material in place and minimize erosion. Due to the increase in stormwater runoff volume and peak rates of runoff associated with agriculture and development, stream channels are subject to greater erosional forces during stormflow events. Thus, preserving natural vegetation along stream channels minimizes the potential for water quality and habitat degradation due to streambank erosion and enhances the pollutant removal of sheet flow runoff from developed areas that passes through the buffer.

Converting land adjacent to streams for the creation of riparian buffers will provide stream bank stabilization, stream shading, and nutrient uptake and trapping from adjacent areas. Minimum buffer widths of 25 feet are required for water quality benefits. Higher removal rates are provided with greater buffer widths. NCSU (2002) reports phosphorus removal rates of approximately 25 to 30 percent for 30-foot wide buffers and 70 to 80 percent for 60- to 90-foot wide buffers.

Riparian corridors typically treat a maximum of 300 feet of adjacent land before runoff forms small channels that short circuit treatment. In addition to the treated area, the land converted from agricultural land to buffer will generate 90 percent less phosphorus based on data presented in Haith et al. (1992).

9.2.2.4 Reaeration/Streambank Stabilization

The purpose of reaeration is to increase DO concentrations in streams. Physical measures that will assist in increasing reaeration of a stream include bank stabilization, channel modifications, and the addition of riprap or pool and riffle sequences. Bank stabilization reduces erosion by planting vegetation along the bank or modification of the channel to decrease the slope of the bank. Riprap or pool and riffle sequences would increase reaeration by increasing turbulence. Turbulence creates an increase in the interaction between air and water, which draws air into the river increasing aeration. Expanding monitoring to several locations along the impaired segments could help identify reaches that would benefit the most from an increase of turbulence.

9.3 Implementation Actions and Management Measures for Manganese in Sangamon River

Only three violations of the manganese standard have been recorded on the South Fork Sangamon River in the last 10 years. The only known potential sources of manganese to the river are natural sources including overland runoff, soil erosion, and groundwater.

9.3.1 Point Sources of Manganese

Again, one small STP and two quarries are permitted to discharge to tributaries of the South Fork Sangamon River. All of these facilities are located tributaries of the impaired segment. Table 9-3 contains permit information on each of these facilities.

Table 9-3 Point Source Discharges to South Fork Sangamon River Segment EO13

Facility Name	Permit Number	Permitted Flow (mgd)	Permit Expiration
Ohlman STP	IL0032671	0.025	07/31/2010
Nokomis Quarry Co-Nokomis Qry	ILG840055	0.72	NA
Christian County Limestone	ILG840105	0.15	NA

Illinois EPA will evaluate the need for point source controls through the NPDES permitting program as each permit is due for renewal. Each facility is located at the upstream end of a tributary, which flows into segment EO13 and does not contribute significant flow to the system. The facilities are not believed to be a significant source of manganese to the South Fork Sangamon River. During the next permit cycle for the quarries, the state should evaluate the need for manganese permit limits for these facilities and should consider monitoring requirements to confirm their contributions.

9.3.2 Nonpoint Sources of Manganese

It is likely that the main contributors to elevated manganese in the South Fork Sangamon River are natural background levels. As such, nonpoint source controls that are designed to reduce erosion are expected to provide a secondary benefit of reducing manganese that may be attached to the soil.

Following are examples of potentially applicable erosion control measures:

- Filter Strips
- Sediment Control Basins
- Streambank Stabilization/Erosion Control

The remainder of this section discusses these management options.

9.3.2.1 Filter Strips

Filter strips were discussed in Section 9.2.2.1. The same technique for evaluating available land was applied to the South Fork Sangamon River. There are 2,553 acres of land within 144 feet of the South Fork Sangamon River; of this area, 1,849 acres are categorized as agricultural and could potentially be converted into filter strips.

9.3.2.2 Sediment Control Basins

Sediment control basins are designed to trap sediments (and the pollutants bound to the sediment) prior to reaching a receiving water. Sediment control basins are typically earthen embankments that act similarly to a terrace. The basin traps water and sediment running off cropland upslope from the structure, and reduces gully erosion by controlling flow within the drainage area. The basin then releases water slowly, which also helps to decrease streambank erosion in the receiving water.

Sediment control basins are usually designed to drain an area of 30 acres or less and should be large enough to control runoff from a 10-year, 24-hour storm. Locations are determined based on slopes, tillage and crop management, and local NRCS can often provide information and advice for design and installation. Maintenance includes maintaining shoreline vegetation and periodic repairs or excess sediment removal if necessary.

9.3.2.3 Streambank Stabilization/Erosion Control

Soil erosion is the process of moving soil particles or sediment by flowing water or wind. Eroding soil transports pollutants, such as manganese, that can potentially degrade water quality.

Following are three available approaches to stabilizing eroding banks that could, in turn, decrease nonpoint source manganese loads:

- Stone Toe Protection (STP)
- Rock Riffle Grade Control (RR)
- Floodplain Excavation

STP uses nonerodible materials to protect the eroding banks. Meandering bends found in the South Fork Sangamon River watershed could possibly be stabilized by placing the hard armor only on the toe of the bank. STP is most commonly implemented "using stone quarry stone that is sized to resist movement and is placed on the lower one third of the bank in a windrow fashion" (STREAMS 2005).

Naturally stable stream systems typically have an alternating riffle-pool sequence that helps to dissipate stream energy. RR places loose rock grade control structures at locations where natural riffles would occur to create and enhance the riffle-pool flow sequence of stable streams. By installing RR in an incised channel, the riffles will raise the water surface elevation resulting in lower effective bank heights, which increases the bank stability by reducing the tractive force on the banks (STREAMS 2005).

Rather than raising the water level, Floodplain Excavation lowers the floodplain to create a more stable stream. Floodplain Excavation uses mechanical means to restore the floodplain by excavating and utilizing the soil that would eventually be eroded away and deposited in the lake (STREAMS 2005).

Streambank erosion in the South Fork Sangamon River watershed is thought to be significant. Specific studies have not been performed for the river; however, a number of studies have been conducted on the sedimentation of Lake Taylorville. One study estimated that since Lake Taylorville's construction in the 1960s, the lake has lost 21 percent of its volume due to sedimentation (Dawson 2003). Erosion control measures discussed above will have beneficial effects on all impairments in the watershed.

9.4 Implementation Actions and Management Measures for Phosphorus in Lake Taylorville

Phosphorus loads in the South Fork Sangamon River/Lake Taylorville watershed originate from both external and internal sources. As discussed in previous sections, possible sources of total phosphorus in the Lake Taylorville watershed include runoff from agricultural areas and internal cycling. To achieve a reduction of total phosphorus for this lake, management measures must address loading through sediment and surface runoff controls, and internal nutrient cycling through in-lake management.

9.4.1 Point Sources of Phosphorus

As discussed in Section 8.3.3.4, no WLA was applied to the Lake Taylorville phosphorus TMDL.

9.4.2 Nonpoint Sources of Phosphorus

The 303(d) list identified nonpoint source runoff as the source of total phosphorus for Lake Taylorville. Nonpoint sources within the Lake Taylorville watershed are considered to contribute significant nutrient loading to the lake. Potential sources of nonpoint source phosphorus pollution to Lake Taylorville may include septic systems and agricultural sources.

BMPs available that could be utilized to treat these nonpoint sources within the Lake Taylorville watershed are:

- Conservation tillage practices
- Filter strips

- Wetlands
- Nutrient management
- Septic system maintenance or sanitary system

Total phosphorus originating from cropland is most efficiently treated with a combination of no-till or conservation tillage practices and grass filter strips. Wetlands located upstream of the reservoir could provide further reductions in total and dissolved phosphorus in runoff from croplands in the watershed. Nutrient management focuses on source control of nonpoint source contributions to the lake.

9.4.2.1 Conservation Tillage Practices

For the Lake Taylorville watershed, where 86 percent of the watershed consists of agricultural land uses, conservation tillage practices could help reduce nutrient loads in the lake. The lake potentially receives nonpoint source runoff from approximately 34,347 acres of row crops and small grain agriculture. Total phosphorus loading from cropland is controlled through management BMPs, such as conservation tillage. Conservation tillage maintains at least 30 percent of the soil surface covered by residue after planting. Crop residuals or living vegetation cover on the soil surface protect against soil detachment from water and wind erosion. Conservation tillage practices can remove up to 45 percent of the dissolved and total phosphorus from runoff and approximately 75 percent of the sediment. Additionally, studies have found around 93 percent less erosion occurred from no-till acreage compared to acreage subject to moldboard plowing (USEPA 2003); however, filter strips are less effective at removing dissolved phosphorus only. The 2006 IDA's Soil Transect Survey estimated that conventional till currently accounts for 68 percent of corn, 22 percent of soybean, and 0 percent of small grain tillage practices in Christian County, and these percentages were assumed to apply to the Lake Taylorville watershed as well. To achieve TMDL load allocations, tillage practices already in place should be continued, and practices may be assessed and improved upon for all 34,347 agricultural acres in the Lake Taylorville watershed.

9.4.2.2 Filter Strips

Filter strips were discussed in Section 9.2.2.1. The same technique for evaluating available land was applied to the lake watershed. In the Lake Taylorville watershed there are 2,085 acres of land within 180 feet of the lake tributaries; of this area, 1,260 acres are categorized as agricultural and could potentially be converted into filter strips.

9.4.2.3 Wetlands

The use of wetlands as a structural control is applicable to nutrient reduction from agricultural lands in the Lake Taylorville watershed. To treat loads from agricultural runoff, a wetland could be constructed on the upstream end of the reservoir. Wetlands are an effective BMP for sediment and phosphorus control because they:

- Prevent floods by temporarily storing water, allowing the water to evaporate or percolate into the ground

- Improve water quality through natural pollution control such as plant nutrient uptake
- Filter sediment
- Slow overland flow of water thereby reducing soil erosion (USDA 1996)

A properly designed and functioning wetland can provide very efficient treatment of pollutants, such as phosphorus. Design of wetland systems is very important and should consider soils in the proposed location, hydraulic retention time, and space requirements. Constructed wetlands, which comprise the second or third stage of nonpoint source treatment, can be effective at improving water quality. Studies have shown that artificial wetlands designed and constructed specifically to remove pollutants from surface water runoff have removal rates for suspended solids of greater than 90 percent, 0 to 90 percent for total phosphorus, 20 to 80 percent of orthophosphate, and 10 to 75 percent for nitrogen species (Johnson, Evans, and Bass 1996; Moore 1993; USEPA 1993; Kovosic et al. 2000). Although the removal rate for phosphorus is low in long-term studies, the rate can be improved if sheet flow is maintained to the wetland and vegetation and substrate are monitored to ensure the wetland is operating optimally. Sediment or vegetation removal may be necessary if the wetland removal efficiency is lessened over time (USEPA 1993; NCSU 2000).

Guidelines for wetland design suggest a wetland to watershed ratio of 0.6 percent for nutrient and sediment removal from agricultural runoff. Table 9-4 outlines estimated wetland areas for each subbasin in the Lake Taylorville watershed based on these recommendations. A wetland system to treat agricultural runoff from the tributary subbasins could be approximately 380.9 acres (Denison and Tilton 1993).

Table 9-4 Acres of Wetland for Lake Taylorville Watershed

Subbasin	Area (acres)	Recommended Wetlands (acre)
South Fork Sangamon River	43,437	260.6
Locust/Cottonwood Creek	20,054	120.3
Total	**79,909**	**380.9**

9.4.2.4 Nutrient Management

Nutrient management could result in reduced nutrient loads to Lake Taylorville. A nutrient management plan should address fertilizer application rates, methods, and timing. Initial soil phosphorus concentrations are determined by onsite soil testing, which is available from local vendors. Losses through plant uptake are subtracted, and gains from organic sources such as manure application or industrial/municipal wastewater are added. The resulting phosphorus content is then compared to local guidelines to determine if fertilizer should be added to support crop growth and maintain current phosphorus levels. In some cases, the soil phosphorus content is too high, and no fertilizer should be added until stores are reduced by crop uptake to target levels.

The Illinois Agronomy Handbook (IAH) lists guidelines for fertilizer application rates based on the inherent properties of the soil (typical regional soil phosphorus concentrations, root penetration, pH, etc.), the starting soil test phosphorus concentration for the field, and the crop type and expected yield.

The overall goal of phosphorus reduction from agriculture should increase the efficiency of phosphorus use by balancing phosphorus inputs in feed and fertilizer with outputs in crops and animal produce as well as managing the level of phosphorus in the soil. Reducing phosphorus loss in agricultural runoff may be brought about by source and transport control measures, such as filter strips or grassed waterways. The Nutrient Management Plans account for all inputs and outputs of phosphorus to determine reductions. Nutrient Management Plans include:

- Review of aerial photography and soil maps
- Regular soil testing (IAH recommends soil testing every four years)
- Review of current and/or planned crop rotation practices
- Yield goals and associated nutrient application rates
- Nutrient budgets with planned rates, methods, timing, and form of application
- Identification of sensitive areas and restrictions on application when land is snow covered, frozen, or saturated

Band placement could occur prior to or during corn planting, depending on the type of field equipment available. Fertilizer should be applied when the chance of a large precipitation event is low. Researchers in Iowa found that runoff concentrations of phosphorus were 60 percent lower when the next precipitation event occurred 10 days after fertilizer application, as opposed to 24 hours after application. Application to frozen ground or snow cover is strongly discouraged. Researchers studying loads from agricultural fields in east-central Illinois found that fertilizer application to frozen ground or snow followed by a rain event could transport 40 percent of the total annual phosphorus load (Gentry et al. 2007).

Recent technological developments in field equipment allow for fertilizer to be applied at varying rates across a field. Crop yield and net profits are optimized with this variable rate technology (IAH 2002). Precision farming typically divides fields into one- to three-acre plots that are specifically managed for seed, chemical, and water requirements. Operating costs are reduced and crop yields typically increase, though upfront equipment costs may be high.

The effectiveness of nutrient management plans (application rates, methods, and timing) in reducing phosphorus loading from agricultural land will be site specific.

In Illinois, Nutrient Management Plans have successfully reduced phosphorus application to agricultural lands by 36-lb/acre. National reductions range from 11 to 106-lb/acre, with an average reduction of 35-lb/acre (USEPA 2003).

9.4.2.5 Drainage Control Structures for Tile Drain Outlets

As discussed in the Stage One report, the Lake Taylorville watershed is underlain by drain tile designed to remove standing water from the soil surface. Subsurface drainage is designed to remove excess water from the soil profile. The water table level is controlled through a series of drainage pipes (tiles or tubing) that are installed below the soil surface, usually just below the root zone. In Illinois, subsurface drainage pipes are typically installed at a depth of three to four feet and at spacing of 80 to 120 feet. The subsurface drainage network generally outlets to an open ditch or stream.

A conventional tile drain system collects infiltrated water below the root zone and transports the water quickly to a down-gradient surface outlet. Placement of a water-level control structure at the outlet allows for storage of the collected water to a predefined elevation. The stored water becomes a source of moisture for plants during dry conditions and undergoes biological, chemical, and physical processes that result in lower nutrient concentrations in the final effluent. Use of control structures on conventional tile drain systems in the coastal plains has resulted in reductions of total phosphorus loading of 35 percent (Gilliam et al. 1997). Researchers at the University of Illinois also report reductions in phosphorus loading with tile drainage control structures. Concentrations of phosphate were reduced by 82 percent, although total phosphorus reductions were not quantified in this study (Cooke 2005). Going from a surface draining system to a tile drain system with outlet control reduces phosphorus loading by 65 percent (Gilliam et al. 1997).

9.4.2.6 Septic System Maintenance and Sanitary System

Septic systems are a potential source of nonpoint source phosphorus loading. During stage 1 investigations, it was estimated that over 1,000 septic systems exist within the watershed. The exact locations and spatial distribution of the septic systems are unknown.

To reduce the excessive amounts of contaminants from a faulty septic system, a maintenance plan that includes regular pumping and maintenance of the septic system should be followed. The majority of failures originate from excessive suspended solids, nutrients, and BOD loading to the septic system. Reduction of solids to the tank can be achieved via limiting garbage disposals use and water conservation.

Septic system management activities can extend the life and maintain the efficiency of a septic system. Water conservation practices, such as limiting daily water use or using low flow toilets and faucets, are the most effective methods to maintain a properly functioning septic system. Additionally, the system should not be used for the disposal of solids, such as cigarette butts, cat litter, cotton swabs, coffee grinds, disposable diapers, etc. Finally, physical damage to the drainfield can be prevented by:

- Maintaining a vegetative cover over the drainfield to prevent erosion
- Avoiding construction over the system
- Protecting the area down slope of the system from excavation
- Landscape the area to divert surface flow away from the drainfield (Johnson 1998)

9.4.2.7 Unsewered Communities

The town of Owaneco is an unsewered community in the South Fork Sangamon River/Lake Taylorville watershed. Illinois has investigated multiple complaints in the last few years related to raw sewage discharges and odor observed downstream in Locust Creek. Investigations determined that failing and/or improperly installed septic systems exist in the area and that some may potentially be linked into tile drains. Specifically, pipes located near the intersection of Cochran and Masonic Streets were observed to be discharging what appeared to be water contaminated with sewage. In addition, water upstream of these four pipes also appeared to be contaminated with sewage although a source could not be identified at the time.

Illinois EPA has proposed a permitting program for individual private sewage disposal systems. The draft general permit is intended to minimize discharges to the ground surface and receiving waters, and includes requirements designed to protect surface waters. Illinois EPA held three public hearings throughout the state to solicit questions and comments about the proposed permit.

9.4.3 In-Lake Phosphorus

The Lake Taylorville phosphorus TMDL determined that approximately 35 percent of the current phosphorus load to Lake Taylorville comes from internal cycling. Reduction of phosphorus from in-lake cycling through management strategies is necessary for attainment of the TMDL load allocation. Internal phosphorus loading occurs when the water above the sediments become anoxic causing the release of phosphorus from the sediment in a form that is available for plant uptake. The addition of bioavailable phosphorus in the water column stimulates more plant growth and die-off, which perpetuates the anoxic conditions and enhances the subsequent release of phosphorus into the water.

A number of sedimentation studies have been conducted on Lake Taylorville. The studies have shown that historically, significant sedimentation was taking place in Lake Taylorville. More recent studies have shown that the combination of conservation practices in the watershed and the sediment retention structure in the lake have decreased the rate of sedimentation observed in the lake. Sedimentation from watershed runoff introduces nutrient rich sediments to the lake which further fuel internal loading.

For lakes experiencing high rates of phosphorus inputs from bottom sediments, several management measures are available to control internal loading. Three BMP options for the control of internal loading include the installation of an aerator, the addition of aluminum, and dredging.

9.4.3.1 Aeration

Hypolimnetic (bottom water) aeration involves an aerator air-release that can be positioned at a selected depth or at multiple depths to increase oxygen transfer efficiencies in the water column and reduce internal loading by establishing aerobic conditions at the sediment-water interface. Hypolimnetic aeration effectiveness in reducing phosphorus concentration depends in part on the presence of sufficient iron to bind phosphorus in the oxygenated waters. A mean hypolimnetic iron:phosphorus ratio greater than 3.0 is optimal to promote iron phosphate precipitation (Stauffer 1981). The iron:phosphorus ratio in the sediments should be greater than 15 to bind phosphorus (Welch 1992).

9.4.3.2 Alum

Phosphorus inactivation by aluminum addition (specifically aluminum sulfate or alum) to lakes has been the most widely-used technique to control internal phosphorus loading. Alum forms a polymer that binds phosphorus and organic matter. The aluminum hydroxide-phosphate complex (commonly called alum floc) is insoluble and settles to the bottom, carrying suspended and colloidal particles with it. Once on the sediment surface, alum floc retards phosphate diffusion from the sediment to the water (Cooke et al.1993).

9.4.3.3 Dredging

Phosphorus release from the sediment is greatest from recently deposited layers. Dredging about one meter of recently deposited phosphorus-rich sediment can remove approximately 80 to 90 percent of the internally loaded phosphorus without the addition of potentially toxic compounds to the reservoir. However, dredging is more costly than other management options (NRCS 1992).

A sedimentation survey conducted in 1977 showed significant sedimentation throughout Lake Taylorville. The 2006 Comprehensive Plan for Lake Taylorville and City of Taylorville Illinois details past sedimentation surveys conducted on the lake that both concluded that 50 percent of the lake capacity will be lost within five to 10 years. The city plan suggests that dredging operations should be started by March 2010.

9.5 Reasonable Assurance

Reasonable assurance means that a demonstration is given that nonpoint source reductions in this watershed will be implemented. It should be noted that all programs discussed in this section are voluntary and some may be in practice to some degree within the watershed. The discussion in the preceding sections provided information on available BMPs for loads from nonpoint sources. The remainder of this section discusses an estimate of costs to the watershed for implementing these practices and programs available to assist with funding.

9.5.1 Available Cost-Share Programs

Approximately 86 percent of the Lake Taylorville watershed is classified as agricultural row crop and small grains land. There are several voluntary conservation programs established through the 2002 U.S. Farm Bill (the 2007 Farm Bill is currently being developed), which encourage landowners to implement resource-conserving practices for water quality and erosion control purposes. These programs would apply to crop fields and rural grasslands that are presently used as pasture land. Each program is discussed separately in the following paragraphs.

9.5.1.1 Illinois Department of Agriculture and Illinois EPA Nutrient Management Plan Project

The IDA and Illinois EPA are presently co-sponsoring a cropland Nutrient Management Plan project in watersheds that have or are developing a TMDL. This voluntary project supplies incentive payments to producers to have Nutrient Management Plans developed and implemented. Additionally, watersheds that have sediments or phosphorus identified as a cause for impairment (as is the case in this watershed), are eligible for cost-share assistance in implementing traditional erosion control practices through the Nutrient Management Plan project.

9.5.1.2 Conservation Reserve Program (CRP)

This voluntary program encourages landowners to plant long-term resource-conserving cover to improve soils, water, and wildlife resources. CRP is the USDA's single largest environmental improvement program and one of its most productive and cost-efficient. It is administered through the Farm Service Agency (FSA) by USDA's Commodity Credit Corporation (CCC). The program was initially established in the Food & Security Act of 1985. The duration of the contracts under CRP range from 10 to 15 years.

Eligible land must be one of the following:

1. Cropland that is planted or considered planted to an agricultural commodity two of the five most recent crop years (including field margins) and must be physically and legally capable of being planted in a normal manner to an agricultural commodity.

2. Certain marginal pastureland enrolled in the Water Bank Program.

The CCC bases rental rates on the relative productivity of soils within each county and the average of the past three years of local dry land cash rent or cash-rent equivalent. The maximum rental rate is calculated in advance of enrollment. Producers may offer land at the maximum rate or at a lower rental rate to increase likelihood of offer acceptance. In addition, the CCC provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices (USDA 2006).

Finally, CCC offers additional financial incentives of up to 20 percent of the annual payment for certain continuous sign-up practices (USDA 2006). Continuous sign-up provides management flexibility to farmers and ranchers to implement certain high-priority conservation practices on eligible land. The land must be determined by NRCS to be eligible and suitable for any of the following practices:

- Riparian buffers
- Filter strips

- Grass waterways
- Shelter belts
- Field windbreaks
- Living snow fences
- Contour grass strips
- Salt tolerant vegetation
- Shallow water areas for wildlife
- Eligible acreage within an EPA-designated wellhead protection area (FSA 1997)

9.5.1.3 Clean Water Act Section 319 Grants

Section 319 was added to the CWA to establish a national program to address nonpoint sources of water pollution. Through this program, each state is allocated Section 319 funds on an annual basis according to a national allocation formula based on the total annual appropriation for the Section 319 grant program. The total award consists of two categories of funding: incremental funds and base funds. A state is eligible to receive EPA 319(b) grants upon USEPA's approval of the state's Nonpoint Source Assessment Report and Nonpoint Source Management Program. States may reallocate funds through subawards (e.g., contracts, subgrants) to both public and private entities, including local governments, tribal authorities, cities, counties, regional development centers, local school systems, colleges and universities, local nonprofit organizations, state agencies, federal agencies, watershed groups, for-profit groups, and individuals.

USEPA designates incremental funds, a $100-million award, for the restoration of impaired water through the development and implementation of watershed-based plans and TMDLs for impaired waters. Base funds, funds other than incremental funds, are used to provide staffing and support to manage and implement the state Nonpoint Source Management Program. Section 319 funding can be used to implement activities which improve water quality, such as filter strips, streambank stabilization, etc. (USEPA 2003).

Illinois EPA receives federal funds through Section 319(h) of the CWA to help implement Illinois' Nonpoint Source (NPS) Pollution Management Program. The purpose of the program is to work cooperatively with local units of government and other organizations toward the mutual goal of protecting the quality of water in Illinois by controlling NPS pollution. The program emphasizes funding for implementing cost-effective corrective and preventative BMPs on a watershed scale; funding is also available for BMPs on a non-watershed scale and the development of information/ education NPS pollution control programs.

The Maximum Federal funding available is 60 percent, with the remaining 40 percent coming from local match. The program period is two years unless otherwise approved. This is a reimbursement program.

Section 319(h) funds are awarded for the purpose of implementing approved NPS management projects. The funding will be directed toward activities that result in the implementation of appropriate BMPs for the control of NPS pollution or to enhance the public's awareness of NPS pollution. Applications are accepted June 1 through August 1.

9.5.1.4 Wetlands Reserve Program (WRP)

The WRP is a voluntary program that provides technical and financial assistance to eligible landowners to restore, enhance, and protect wetlands. The goal of WRP is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. At least 70 percent of each project area will be restored to the original natural condition, to the extent practicable. The remaining 30 percent of each area may be restored to other than natural conditions. Landowners have the option of enrolling eligible lands through permanent easements, 30-year easements, or 10-year restoration cost-share agreements. The program is offered on a continuous sign-up basis and is available nationwide. WRP offers landowners an opportunity to establish, at minimal cost, long-term conservation and wildlife habitat enhancement practices and protection. It is administered through the NRCS (2002b).

Eligible participants must have owned the land for at least one year and be able to provide clear title. Restoration agreement participants must show evidence of ownership. Owners may be an individual, partnership, association, corporation, estate, trust, business, or other legal entity; a state (when applicable); a political subdivision of a state; or any agency thereof owning private land. Land eligibility is dependent on length of ownership, whether the site has been degraded as a result of agriculture, and the land's ability to be restored.

The 2002 Farm Bill reauthorized the program through 2007. The reauthorization increased the acreage enrollment cap to 2,275,000 acres with an annual enrollment of 250,000 acres per calendar year. The program is limited by the acreage cap and not by program funding. Since the program began in 1985, the average cost per acre is $1,400 in restorative costs and the average project size is 177 acres. The costs for each enrollment options follow in Table 9-5 (USDA 2006).

Table 9-5 Costs for Enrollment Options of WRP Program

Option	Permanent Easement	30-year Easement	Restoration Agreement
Payment for Easement	100% Agricultural Value	75% Agricultural Value	NA
Payment Options	Lump Sum	Lump Sum	NA
Restoration Payments	100% Restoration Cost Reimbursements	75% Restoration Cost Reimbursements	75% Restoration Cost Reimbursements

9.5.1.5 Environmental Quality Incentive Program (EQIP)

The EQIP is a voluntary USDA conservation program for farmers and private landowners engaged in livestock or agricultural production who are faced with serious threats to soil, water, and related natural resources. It provides technical, financial, and educational assistance primarily in designated "priority areas." National priorities include the reduction of non-point source pollution, such as nutrients, sediment, pesticides, or excess salinity in impaired watersheds, consistent with TMDLs where available, and the reduction in soil erosion and sedimentation from unacceptable levels on agricultural land. The program goal is to maximize environmental benefits per dollar expended and provides "(1) flexible technical and financial assistance to farmers and ranchers that face the most serious natural resource problems; (2) assistance to farmers and ranchers in complying with federal, state, and tribal environmental laws, and encourage environmental enhancement; (3) assistance to farmers and ranchers in making beneficial, cost-effective changes to measures needed to conserve and improve natural resources; and (4) for the consolidation and simplification of the conservation planning process (NRCS 2002)."

Landowners, with the assistance of a local NRCS or other service provider, are responsible for the development of an EQIP plan that includes a specific conservation and environmental objective, one or more conservation practices in the conservation management system to be implemented to achieve the conservation and environmental objectives, and the schedule for implementing the conservation practices. This plan becomes the basis of the cost-share agreement between NRCS and the participant. NRCS provides cost-share payments to landowners under these agreements that can be up to 10 years in duration.

Cost-share assistance may pay landowners up to 75 percent of the costs of conservation practices, such as grassed waterways, filter strips, manure management, capping abandoned wells, and other practices important to improving and maintaining the health of natural resources in the area. EQIP cost-share rates for limited resource producers and beginning farmers may be up to 90 percent. Total incentive and cost-share payments are limited to an aggregate of $450,000 (NRCS 2006).

9.5.1.6 Wildlife Habitat Incentives Program (WHIP)

The WHIP is voluntary program that encourages the creation of high quality wildlife habitat of national, state, tribal, or local significance. WHIP is administered through NRCS, which provides technical and financial assistance to landowners for development of upland, riparian, and aquatic habitat areas on their property. NRCS works with the participant to develop a wildlife habitat development plan that becomes the basis of the cost-share agreement between NRCS and the participant. Most contracts are 5 to 10 years in duration, depending upon the practices to be installed. However, longer term contracts of 15 years or greater may also funded. In addition, if the landowner agrees, cooperating state wildlife agencies and nonprofit or private organizations may provide expertise or additional funding to help complete a project.

9.5.1.7 Streambank Stabilization and Restoration Practice (SSRP)

Erosion from lake tributaries is thought to be a significant contributor of nutrients to the lake. The SSRP was established by the IDA to address problems associated with streambank erosion, such as loss or damage to valuable farmland, wildlife habitat, roads; stream capacity reduction through sediment deposition; and degraded water quality, fish, and wildlife habitat. The primary goals of the SSRP are to develop and demonstrate vegetative, stone structure and other low cost bio-engineering techniques for stabilizing streambanks and to encourage the adoption of low-cost streambank stabilization practices by making available financial incentives, technical assistance, and educational information to landowners with critically eroding streambanks. A cost share of 75 percent is available for approved project components; such as willow post installation, bendway weirs, rock riffles, stream barbs/rock, vanes, lunker structures, gabion baskets, and stone toe protection techniques. There is no limit on the total program payment for cost-share projects that a landowner can receive in a fiscal year. However, maximum cost per foot of bank treated is used to cap the payment assistance on a per foot basis and maintain the program's objectives of funding low-cost techniques (IDA 2000).

9.5.1.8 Conservation Practices Cost-Share Program

The Conservation Practices Program (CPP) is a 10-year program. The practices consist of waterways, water, and sediment control basins (WASCOBs), pasture/hayland establishment, critical area, terrace system, no-till system, diversions, and grade stabilization structures. The CPP is state-funded through the IDA. There is a project cap of $5,000 per landowner and costs per acre vary significantly from project to project.

9.5.1.9 Illinois Conservation and Climate Initiative (ICCI)

The ICCI is a joint project of the state of Illinois and the Delta Institute that allows farmers and landowners to earn revenue through the sale of greenhouse gas emissions credits when they use conservation practices such as no-till, grass plantings, reforestation, or manure digesters.

The Chicago Climate Exchange (CCX®) quantifies, credits, and sells greenhouse gas credits from conservation practices. The credits are aggregated, or pooled, from farmers and landowners in order to sell them to CCX® members that have made voluntary commitments to reduce their greenhouse gas contributions.

ICCI provides an additional financial incentive for farmers and landowners to use conservation practices that also benefit the environment by creating wildlife habitat and limiting soil and nutrient run-off to streams and lakes.

Many farmers and landowners are already using conservation practices eligible for carbon credits on the CCX® such as no-till farming, strip-till farming, grass plantings, afforestation/reforestation, and the use of methane digesters. To be eligible, the producer or landowner must make a contractual commitment to maintain the eligible practice through 2010. CREP and CRP land is eligible for enrollment in the ICCI as long as it meets CCX® eligibility requirements for the practice (www.illinoisclimate.org).

9.5.1.10 Local Program Information

The Farm Service Agency (FSA) administers the CRP. NRCS administers the EQIP, WRP, and WHIP. Local NRCS contact information in Christian and Montgomery Counties are listed in the Table 9-6 below.

Table 9-6 Christian and Montgomery County USDA Service Center Contact Information

Contact	Address	Phone
Christian County	951-2 W. Spresser Street Taylorville, IL 62568	217.824.2123 ext. 3
Montgomery County	1621 Vandalia Road, Suite D Hillsboro, IL 62049	217.532.3610 ext. 3

9.5.2 Cost Estimates of BMPs

Cost estimates for different BMPs and individual practice prices such as filter strip installation are detailed in the following sections. Table 9-7 outlines the estimated cost of implementation measures in the Lake Taylorville watershed.

9.5.2.1 Wetlands

The price to establish a wetland is very site-specific. There are many different costs that could be incurred depending on wetland construction. Examples of costs associated with constructed wetlands include excavation costs. NRCS estimates excavation cost at $2/cubic foot. Establishment of vegetation in critical areas including seeding and fertilizing is estimated at $230/acre. It should be noted that the larger the wetland acreage to be established, the more cost-effective the project.

9.5.2.2 Filter Strips and Riparian Buffers

Filter strips can either be seeded with grass or sodded for immediate function. The seeded filter strips cost approximately $0.30/square-foot to construct, and sodded filter strips cost approximately $0.70/square-foot to construct. Generally, it is assumed that the required filter strip area is 2 percent of the area drained. This means that 870 square feet of filter strip are required for each acre of agricultural land treated. The construction cost to treat one acre of land is therefore $261/acre for a seeded filter strip and $609/acre for a sodded strip. At an assumed system life of 20 years (Weiss et al. 2007), the annualized construction costs are $13/acre/year for seeded and $30.50/acre/year for sodded strips. Annual maintenance of filter strips is estimated at $0.01/square-foot (USEPA 2002b) for an additional cost of $8.70/acre/year of agricultural land treated. In addition, the area converted from agricultural production to filter strip will result in a net annual income loss of $3.50.

Restoration of riparian areas costs approximately $100/acre to construct and $475/acre to maintain over the life of the buffer (Wossink and Osmond 2001; NCEEP 2004). Maintenance of a riparian buffer should be minimal, but may include items such as period inspection of the buffer, minor grading to prevent short circuiting, and replanting/reseeding dead vegetation following premature death or heavy storms.

Assuming a buffer width of 90 feet on either side of the stream channel and an adjacent treated width of 300 feet of agricultural land, one acre of buffer will treat approximately 3.3 acres of adjacent agricultural land. The cost per treated area is thus $30/acre to construct and $142.50/acre to maintain over the life of the buffer. Assuming a system life of 30 years results in an annualized cost of $59.25/year for each acre of agricultural land treated.

9.5.2.3 Nutrient Management Plan - NRCS

A significant portion of the agricultural land in the Lake Taylorville watershed is comprised of cropland. The service for developing a nutrient management plan averages $6 to $18/acre. This includes soil testing, manure analysis, scaled maps, and site specific recommendations for fertilizer management.

9.5.2.4 Nutrient Management Plan - IDA and Illinois EPA

The costs associated with development of Nutrient Management Plans co-sponsored by the IDA and the Illinois EPA is estimated as $10/acre paid to the producer and $3/acre for a third party vendor who develops the plans. There is a 200 acre cap per producer. The total plan development cost is estimated at $13/acre.

9.5.2.5 Conservation Tillage

Conservation tillage practices generally require fewer trips to the field, saving on labor, fuel, and equipment repair costs, though increased weed production may result in higher pesticide costs relative to conventional till (USDA 1999). In general, conservation tillage results in increased profits relative to conventional tillage (Olson and Senjem 2002; Buman et al. 2004; Czapar 2006). The HRWCI (2005) lists the cost for conservation tillage at $0/acre.

Hydrologic inputs are often the limiting factor for crop yields and farm profits. Conservation practices reduce evaporative losses by covering the soil surface. USDA (1999) reports a 30 percent reduction in evaporative losses when 30 percent ground cover is maintained. Harman et al. (2003) and the Southwest Farm Press (2001) report substantial yield increases during dry years on farms managed with conservation or no-till systems compared to conventional till systems.

Depending on the type of equipment currently used, replacing conventional till equipment with no-till equipment can either result in a net savings or slight cost to the producer. Al-Kaisi et al. (2000) estimate that converting conventional equipment to no-till equipment costs approximately $1.25 to $2.25/acre/year, but that is for new equipment.

Other researchers report a net gain when conventional equipment is sold to purchase no-till equipment (Harman et al. 2003).

9.5.2.6 Septic System Maintenance

Septic tanks are designed to accumulate sludge in the bottom portion of the tank while allowing water to pass into the drain field. If the tank is not pumped out regularly, the sludge can accumulate and eventually become deep enough to enter the drain field. Pumping the tank every three to five years prolongs the life of the system by protecting the drain field from solid material that may cause clogs and system back-ups. In addition, septic systems should not be connected to field tile lines.

The cost to pump a septic tank ranges from $250 to $350 depending on how many gallons are pumped out and the disposal fee for the area. If a system is pumped once every three to five years, this expense averages out to less than $100 per year. Septic tanks that are not maintained will likely require replacement, which may cost between $2,000 and $10,000.

The cost of developing and maintaining a watershed-wide database of the onsite wastewater treatment systems in the Lake Taylorville watershed depends on the number of systems that need to be inspected. A recent inspection program in South Carolina found that inspections cost approximately $160 per system (Hajjar 2000).

Education of home and business owners that use onsite wastewater treatment systems should occur periodically. Public meetings; mass mailings; and radio, newspaper, and TV announcements can all be used to remind and inform owners of their responsibility to maintain their systems.

The costs associated with education and inspection programs will vary depending on the level of effort required to communicate the importance of proper maintenance and the number of systems in the area.

9.5.2.7 Internal Cycling

Internal cycling was identified as a source of nutrients to Lake Taylorville. Controls of internal phosphorus cycling in lakes are costly. The in-lake controls have been converted to year 2004 dollars assuming an average annual inflation rate of 3 percent. The number and size of hypolimnetic aerators used in a waterbody depend on lake morphology, bathymetry, and hypolimnetic oxygen demand. Total cost for successful systems has ranged from $170,000 to $1.7 million (Tetra Tech 2002). USEPA (1993) reports initial costs ranging from $340,000 to $830,000 plus annual operating costs of $60,000. System life is assumed to be 20 years.

The City of Taylorville installed a new solar destratifier system near the dam in June of 2007. It is likely that this will help the low DO concentrations recorded during summer months in the lake. Because the system was recently installed, the extent of the effects of this partial aeration in the lake are not yet known.

Alum treatments are effective on average for approximately eight years per application and can reduce internal loading by 80 percent. Treatment cost ranges from $290/acre to $720/acre (WIDNR 2003). The surface area of Lake Taylorville is approximately 1,290 acres, so total application costs for the lake would likely range from $374,100 to $928,800 (Green & Bradford 2006).

Dredging is typically the most expensive management practice averaging $8,000/acre. Although cost is high, the practice is 80 to 90 percent effective at nutrient removal and will last for at least 50 years (Cortell 2002; Geney 2002). The dredging plans laid out in the 2006 Comprehensive Plan for Lake Taylorville and City of Taylorville Illinois (see discussion in Section 9.4.3.3) estimated dredging costs for Lake Taylorville at $28,520,000.

9.5.2.8 Planning Level Cost Estimates for Implementation Measures

Cost estimates for different implementation measures are presented in Table 9-7. Cost estimates shown in Table 9-7 are the total estimated cost per acre and many costs could be reduced through cost share opportunities discussed in Section 9.5.1. The column labeled Program or Sponsor lists the financial assistance program or sponsor available for various BMPs. The programs and sponsors represented in the table are the SSRP, WRP, the CRP, NRCS, CPP, Illinois EPA, and IDA. It should be noted that Illinois EPA 319 Grants are applicable to all of these practices.

Table 9-7 Cost Estimate of Various BMP Measures

Source	Program	Sponsor	BMP	Installation Mean $/acre
Nonpoint	CRP/CPP	NRCS and IDA	Seeded filter strip	$25
	CRP/CPP	NRCS and IDA	Sodded filter strip	$43
	CRP/CPP	NRCS and IDA	Riparian Buffer	$60
	WRP	NRCS	Wetland	varies
		NRCS	Nutrient Management Plan	$6-18
		IDA and Illinois EPA	Nutrient Management Plan	$13
	CRP/CPP/ICCI	NRCS, IDA, CCX	Conservation Tillage	varies
Internal Cycling			Dredging	$8,000
			Aerator	varies
			Alum	$290-$720

Total watershed costs will depend on the combination of BMPs selected to target non-point sources within the watershed. Regular monitoring will support adaptive management of implementation activities to most efficiently reach the TMDL goals.

9.6 Monitoring Plan

The purpose of the monitoring plan for the South Fork Sangamon River/Lake Taylorville watershed is to assess the overall implementation of management actions outlined in this section. This can be accomplished by conducting the following monitoring programs:

- Track implementation of management measures in the watershed
- Estimate effectiveness of management measures
- Further monitoring of point source discharges in the watershed
- Continued ambient monitoring of all TMDL segments
- Investigation of tile line flow and associated water quality from agricultural land
- Continued documentation of tributary erosion
- Further information gathering on area septic systems including locations and failure rates
- Storm-based monitoring of high flow events
- Tributary monitoring

Tracking the implementation of management measures can be used to address the following goals:

- Determine the extent to which management measures and practices have been implemented compared to action needed to meet TMDL endpoints
- Establish a baseline from which decisions can be made regarding the need for additional incentives for implementation efforts
- Measure the extent of voluntary implementation efforts
- Further clarify the contributions from point sources
- Support work-load and costing analysis for assistance or regulatory programs
- Determine the extent to which management measures are properly maintained and operated

Estimating the effectiveness of the BMPs implemented in the watershed could be completed by monitoring before and after the BMP is incorporated into the watershed. Additional monitoring could be conducted on specific structural systems such as a constructed wetland. Inflow and outflow measurements could be conducted to determine site-specific removal efficiency. In addition, sampling should be performed before and after management operations employed within both lakes to determine their effects on lake nutrient levels.

Illinois EPA monitors lakes every three years and conducts Intensive Basin Surveys every five years. The lake was monitored in 2006 and a data audit is currently under way to determine the data validity. Once the audit is complete, Illinois EPA will determine if the data is useable for future assessment purposes.

Although Lake Taylorville is sampled every three years, there are no ambient sites on lake tributaries. This means that the lake tributaries and the impaired segment of the South Fork Sangamon River are not regularly sampled by Illinois EPA as part of the rotating basin ambient monitoring program. Illinois does administer the Volunteer Lake Monitoring Program (VLMP). The VLMP has a three tiered approach. The three tiers are described below:

- Tier 1 – In this tier, volunteers perform Secchi disk transparency monitoring and field observations only. Monitoring is conducted twice per month from May through October typically at three in-lake sites.
- Tier 2 – In addition to the tasks of Tier 1, Tier 2 volunteers collect water samples for nutrient and suspended solid analysis at the representative lake site: Site 1. Water quality samples are taken only once per month, May through August, and October in conjunction with one Secchi transparency monitoring trip.
- Tier 3 – This is the most intensive tier. In addition to the tasks of Tier 1, Tier 3 volunteers collect water samples at up to three sites on their lake (depending on lake size and shape). Their samples are analyzed for nutrients and suspended solids. They

also collect and filter their own chlorophyll samples. This component may also include DO and temperature profiles as equipment is available. As in Tier 2, water quality samples are taken only once per month, May through August, and October in conjunction with one Secchi transparency monitoring trip.

Data collected in either Tier 1 or Tier 2 is considered educational. It is used to make general water quality assessments while data collected in Tier 3 is used in the Integrated Report and is subject to the impaired waters listing. A volunteer monitoring team could be enacted in the South Fork Sangamon River/Lake Taylorville watershed in order to regularly monitor lake and stream water quality and assess progress over time. Stakeholders interested in participating in the VLMP can contact Sandy Nickel of the Illinois EPA Surface Water Monitoring Section at (217) 782-3362.

Regular and more extensive monitoring of point sources in the watershed would confirm their collective contributions and provide additional information regarding oxygen-demanding materials to the South Fork Sangamon River and total phosphorus to Lake Taylorville. As permits come up for renewal, Illinois EPA NPDES program should review the permits and decide if further management measures are required.

Continued tributary monitoring is needed to further confirm the contribution of internal loading to Lake Taylorville. By having more knowledge on actual contributions from external loads, a more precise estimate of internal loads could occur. Data on the different forms of phosphorus (dissolved, total, or orthophosphate) would also be beneficial to better assess reservoir responses to phosphorus loading.

Significant work has already been completed within the watershed. As mentioned throughout this document, multiple sediment surveys have been conducted to assess sedimentation rates in Lake Taylorville. A sediment basin has been installed in the lake, and in 2006 the Comprehensive City Plan for Lake Taylorville and City of Taylorville Illinois provided detailed information for future of the lake. Active community involvement will have continued beneficial effects throughout the watershed.

9.7 Implementation Time Line

Implementing the actions outlined in this section for the South Fork Sangamon River/Lake Taylorville watershed should occur in phases and assessing effectiveness of the management actions as improvements are made. It is assumed that it may take up to five years to secure funding for actions needed in the watershed and five to seven years after funding to implement the measures. Once improvements are implemented, it may take impaired segments 10 years or more to reach their water quality standard targets. In summary, it may take up to 20 years for impaired segments to meet the applicable water quality standards.

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Section 10
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Appendix A
Land Use Categories

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File names and descriptions:

Values and class names found in the Land Cover of Illinois 1999-2000 Arc/Info GRID coverage.

Value	Class Names
0	Background
	AGRICULTURAL LAND
11	Corn
12	Soybeans
13	Winter Wheat
14	Other Small Grains & Hay
15	Winter Wheat/Soybeans
16	Other Agriculture
17	Rural Grassland
	FORESTED LAND
21	Upland
25	Partial Canopy/Savannah Upland
26	Coniferous
	URBAN & BUILT-UP LAND
31	High Density
32	Low/Medium Density
35	Urban Open Space
	WETLAND
41	Shallow Marsh/Wet Meadow
42	Deep Marsh
43	Seasonally/Temporally Flooded
44	Floodplain Forest
48	Swamp
49	Shallow Water
	OTHER
51	Surface Water
52	Barren & Exposed Land
53	Clouds
54	Cloud Shadows

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Appendix B
Soil Characteristics

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Appendix B
South Fork Sangamon River/Lake Taylorville Watershed Soil Series Characteristics

STATSGO Map Unit ID and SSURGO Soil Series Code	STATSGO Map Unit ID and SSURGO Soil Series Code Definition	Acres	Percent of Watershed	Dominant Hydrologic Soil Group	Minimum K-factor	Maximum K-factor
W	WATER	1306.70	1.57%	-		
IL005	STATSGO	2150.56	2.59%	B	0.28	0.43
IL004	STATSGO	8102.60	9.75%	B	0.28	0.43
8F	Hickory silt loam, 18 to 35 percent slopes	247.85	0.30%	C	0.24	0.37
8D3	Hickory clay loam, 10 to 18 percent slopes, severely eroded	150.73	0.18%	B	0.24	0.49
8D2	Hickory loam, 10 to 18 percent slopes, eroded	1589.63	1.91%	C	0.24	0.43
897C3	Bunkum-Atlas silty clay loams, 5 to 10 percent slopes, severely eroded	96.45	0.12%	C	0.28	0.37
897C2	Bunkum-Atlas silt loams, 5 to 10 percent slopes, eroded	1851.56	2.23%	C	0.28	0.43
894A	Herrick-Biddle-Piasa silt loams, 0 to 2 percent slopes	619.99	0.75%	B	0.28	0.49
882A	Oconee-Darmstadt-Coulterville silt loams, 0 to 2 percent slopes	897.49	1.08%	D	0.37	0.55
8396A	Vesser silt loam, 0 to 2 percent slopes, occasionally flooded	5.79	0.01%	C/D	0.32	0.37
802B	Orthents, loamy, undulating	24.63	0.03%	B	0.24	0.49
660C2	Coatsburg silt loam, 5 to 10 percent slopes, eroded	1563.44	1.88%	D	0.28	0.28
618G	Senachwine loam, 35 to 60 percent slopes	4.82	0.01%	B	0.28	0.43
570F	Martinsville loam, 18 to 35 percent slopes	10.08	0.01%	B	0.28	0.37
570D2	Martinsville sandy loam, 10 to 18 percent slopes, eroded	176.19	0.21%	B	0.20	0.37
50A	Virden silty clay loam, 0 to 2 percent slopes	16845.20	20.26%	B/D	0.24	0.49
48A	Ebbert silt loam, 0 to 2 percent slopes	76.90	0.09%	C/D	0.28	0.49
474A	Piasa silt loam, 0 to 2 percent slopes	238.26	0.29%	D	0.24	0.49
46A	Herrick silt loam, 0 to 2 percent slopes	24564.78	29.55%	B	0.24	0.49
45A	Denny silt loam, 0 to 2 percent slopes	1.86	0.00%	D	0.24	0.49
3107A	Sawmill silty clay loam, 0 to 2 percent slopes, frequently flooded	9.77	0.01%	B/D	0.15	0.49
3074A	Radford silt loam, 0 to 2 percent slopes, frequently flooded	2371.72	2.85%	B	0.28	0.49
279B	Rozetta silt loam, 2 to 5 percent slopes	1813.26	2.18%	B	0.24	0.49
259C2	Assumption silt loam, 5 to 10 percent slopes, eroded	148.39	0.18%	B	0.24	0.49
257A	Clarksdale silt loam, 0 to 2 percent slopes	28.22	0.03%	C	0.24	0.49
256C2	Pana silt loam, 5 to 10 percent slopes, eroded	219.01	0.26%	B	0.24	0.32
249A	Edinburg silty clay loam, 0 to 2 percent slopes	862.40	1.04%	C/D	0.24	0.49
244A	Hartsburg silty clay loam, 0 to 2 percent slopes	24.02	0.03%	B/D	0.24	0.49
17A	Keomah silt loam, 0 to 2 percent slopes	903.17	1.09%	C	0.24	0.55
134C2	Camden silt loam, 5 to 10 percent slopes, eroded	3.69	0.00%	B	0.28	0.43
134B	Camden silt loam, 2 to 5 percent slopes	41.54	0.05%	B	0.24	0.55
128C2	Douglas silt loam, 5 to 10 percent slopes, eroded	128.10	0.15%	B	0.37	0.37
128B	Douglas silt loam, 2 to 5 percent slopes	187.06	0.22%	B	0.28	0.43
127B	Harrison silt loam, 2 to 5 percent slopes	8868.63	10.67%	B	0.24	0.49
119C2	Elco silt loam, 5 to 10 percent slopes, eroded	214.09	0.26%	B	0.28	0.43
113B	Oconee silt loam, 2 to 5 percent slopes	1465.34	1.76%	C	0.32	0.49
113A	Oconee silt loam, 0 to 2 percent slopes	3101.18	3.73%	C	0.32	0.49
112A	Cowden silt loam, 0 to 2 percent slopes	1940.52	2.33%	D	0.37	0.49
865	Pits, gravel	7.66	0.01%	NA	NA	NA
864	Pits, quarries	276.51	0.33%	NA	0.17	0.49
	TOTAL	**83139.79**				

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Appendix C
Water Quality Data

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Appendix C:
Water Quality Data
South Fork Sangamon River and Lake Taylorville

Station ID	Sample Date	Sample Depth	Parameter	Result
EO 13	10/26/1989	NA	NITROGEN KJELDAHL TOTAL BOTTOM DEP DRY WT MG/KG	1450
EO 13	10/26/1989	NA	PHOSPHORUS,TOTAL,BOTTOM DEPOSIT (MG/KG-P DRY WGT)	571
EO 13	10/26/1989	NA	MANGANESE IN BOTTOM DEPOSITS (MG/KG AS MN DRY WGT)	460
EO 13	10/28/1989	NA	OXYGEN ,DISSOLVED, ANALYSIS BY PROBE MG/L	2
EO 13	10/28/1989	NA	BOD, 5 DAY, 20 DEG C MG/L	4
EO 13	10/28/1989	NA	NITROGEN, AMMONIA, TOTAL (MG/L AS N)	0
EO 13	10/28/1989	NA	AMMONIA, UNIONZED (MG/L AS N)	0
EO 13	10/28/1989	NA	AMMONIA, UNIONIZED (CALC FR TEMP-PH-NH4) (MG/L)	0
EO 13	10/28/1989	NA	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	0
EO 13	10/28/1989	NA	PHOSPHORUS, TOTAL (MG/L AS P)	0
EO 13	10/28/1989	NA	PHOSPHORUS, DISSOLVED (MG/L AS P)	0
EO 13	10/28/1989	NA	BORON, TOTAL (UG/L AS B)	18960
EO 13	10/28/1989	NA	MANGANESE, TOTAL (UG/L AS MN)	2623
REC-1	5/1/1991	1	Dissolved Oxygen mg/L	8.60
REC-1	6/7/1991	1	Dissolved Oxygen mg/L	4.30
REC-1	7/9/1991	1	Dissolved Oxygen mg/L	4.80
REC-1	8/12/1991	1	Dissolved Oxygen mg/L	4.50
REC-1	10/11/1991	1	Dissolved Oxygen mg/L	8.60
REC-1	4/20/1994	1	Dissolved Oxygen mg/L	8.00
REC-1	6/10/1994	1	Dissolved Oxygen mg/L	4.90
REC-1	7/7/1994	1	Dissolved Oxygen mg/L	6.50
REC-1	8/4/1994	1	Dissolved Oxygen mg/L	8.10
REC-1	10/5/1994	1	Dissolved Oxygen mg/L	8.10
REC-1	4/23/1997	1	Dissolved Oxygen mg/L	12.90
REC-1	6/13/1997	1	Dissolved Oxygen mg/L	9.40
REC-1	7/16/1997	1	Dissolved Oxygen mg/L	6.60
REC-1	8/14/1997	1	Dissolved Oxygen mg/L	4.10
REC-1	10/16/1997	1	Dissolved Oxygen mg/L	8.50
REC-1	4/26/2000	1	Dissolved Oxygen mg/L	9.20
REC-1	6/7/2000	1	Dissolved Oxygen mg/L	6.90
REC-1	7/7/2000	1	Dissolved Oxygen mg/L	5.50
REC-1	8/17/2000	1	Dissolved Oxygen mg/L	4.50
REC-1	10/6/2000	1	Dissolved Oxygen mg/L	6.20
REC-2	5/1/1991	1	Dissolved Oxygen mg/L	8.60
REC-2	6/7/1991	1	Dissolved Oxygen mg/L	6.00
REC-2	7/9/1991	1	Dissolved Oxygen mg/L	4.80
REC-2	8/12/1991	1	Dissolved Oxygen mg/L	6.80
REC-2	10/11/1991	1	Dissolved Oxygen mg/L	9.00
REC-2	4/20/1994	1	Dissolved Oxygen mg/L	7.70
REC-2	6/10/1994	1	Dissolved Oxygen mg/L	5.90
REC-2	7/7/1994	1	Dissolved Oxygen mg/L	7.70
REC-2	8/4/1994	1	Dissolved Oxygen mg/L	6.30
REC-2	10/5/1994	1	Dissolved Oxygen mg/L	8.20
REC-2	4/23/1997	1	Dissolved Oxygen mg/L	16.60
REC-2	6/13/1997	1	Dissolved Oxygen mg/L	9.70
REC-2	7/16/1997	1	Dissolved Oxygen mg/L	7.30
REC-2	8/14/1997	1	Dissolved Oxygen mg/L	4.50
REC-2	10/16/1997	1	Dissolved Oxygen mg/L	11.20
REC-2	4/26/2000	1	Dissolved Oxygen mg/L	9.80
REC-2	6/7/2000	1	Dissolved Oxygen mg/L	10.60
REC-2	7/7/2000	1	Dissolved Oxygen mg/L	6.70
REC-2	8/17/2000	1	Dissolved Oxygen mg/L	4.10
REC-2	10/6/2000	1	Dissolved Oxygen mg/L	5.90
REC-3	5/1/1991	1	Dissolved Oxygen mg/L	8.80
REC-3	6/7/1991	1	Dissolved Oxygen mg/L	8.70
REC-3	7/9/1991	1	Dissolved Oxygen mg/L	5.90
REC-3	8/12/1991	1	Dissolved Oxygen mg/L	7.80
REC-3	10/11/1991	1	Dissolved Oxygen mg/L	9.00
REC-3	4/20/1994	1	Dissolved Oxygen mg/L	7.30
REC-3	6/10/1994	1	Dissolved Oxygen mg/L	5.80
REC-3	7/7/1994	1	Dissolved Oxygen mg/L	5.40
REC-3	8/4/1994	1	Dissolved Oxygen mg/L	5.50

Appendix C:
Water Quality Data
South Fork Sangamon River and Lake Taylorville

Station ID	Sample Date	Sample Depth	Parameter	Result
REC-3	10/5/1994	1	Dissolved Oxygen mg/L	7.80
REC-3	4/23/1997	1	Dissolved Oxygen mg/L	15.90
REC-3	6/13/1997	1	Dissolved Oxygen mg/L	9.70
REC-3	7/16/1997	1	Dissolved Oxygen mg/L	8.30
REC-3	8/14/1997	1	Dissolved Oxygen mg/L	6.40
REC-3	10/16/1997	1	Dissolved Oxygen mg/L	13.20
REC-3	4/26/2000	1	Dissolved Oxygen mg/L	10.90
REC-3	6/7/2000	1	Dissolved Oxygen mg/L	11.10
REC-3	7/7/2000	1	Dissolved Oxygen mg/L	9.00
REC-3	8/17/2000	1	Dissolved Oxygen mg/L	4.70
REC-3	10/6/2000	1	Dissolved Oxygen mg/L	7.00
REC-1	4/26/2000	7	Total Manganese ug/L	120
REC-1	6/7/2000	7	Total Manganese ug/L	180
REC-1	7/7/2000	7	Total Manganese ug/L	150
REC-1	8/17/2000	7	Total Manganese ug/L	230
REC-1	5/15/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.13
REC-1	6/25/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.39
REC-1	8/13/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.10
REC-1	9/11/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.12
REC-1	10/15/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.17
REC-1	5/1/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-1	6/7/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.13
REC-1	7/9/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.12
REC-1	8/12/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.13
REC-1	10/11/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.13
REC-1	4/20/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.72
REC-1	6/10/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.19
REC-1	7/7/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.28
REC-1	8/4/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.12
REC-1	10/5/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.36
REC-1	10/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.13
REC-1	4/23/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.13
REC-1	5/28/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.14
REC-1	6/13/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-1	6/17/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.14
REC-1	7/16/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.21
REC-1	7/30/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.27
REC-1	8/14/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.25
REC-1	8/29/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.21
REC-1	9/30/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.17
REC-1	10/16/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.16
REC-1	4/26/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.09
REC-1	6/7/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.01
REC-1	7/7/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.11
REC-1	8/17/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.14
REC-1	10/6/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.44
REC-2	5/15/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.69
REC-2	6/25/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.46
REC-2	8/13/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.15
REC-2	9/11/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.08
REC-2	10/15/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.17
REC-2	5/1/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-2	6/7/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.17
REC-2	7/9/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.14
REC-2	8/12/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.16
REC-2	10/11/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.17
REC-2	4/20/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.42
REC-2	6/10/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.40
REC-2	7/7/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-2	8/4/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.21
REC-2	10/5/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.15
REC-2	10/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.14

Appendix C:
Water Quality Data
South Fork Sangamon River and Lake Taylorville

Station ID	Sample Date	Sample Depth	Parameter	Result
REC-2	4/23/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.16
REC-2	6/13/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.27
REC-2	7/16/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.35
REC-2	8/14/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.39
REC-2	10/16/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.18
REC-2	4/26/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.01
REC-2	6/7/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.14
REC-2	7/7/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.15
REC-2	8/17/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.18
REC-2	10/6/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.82
REC-3	5/15/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.79
REC-3	6/25/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.51
REC-3	8/13/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.16
REC-3	9/11/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.16
REC-3	10/15/1990	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.25
REC-3	5/1/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.21
REC-3	6/7/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.26
REC-3	7/9/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.23
REC-3	8/12/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-3	10/11/1991	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.18
REC-3	4/20/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.30
REC-3	6/10/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.49
REC-3	7/7/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.23
REC-3	8/4/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.28
REC-3	10/5/1994	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.29
REC-3	10/10/1995	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.19
REC-3	4/23/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-3	6/13/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.25
REC-3	7/16/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.38
REC-3	8/14/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.34
REC-3	10/16/1997	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.21
REC-3	4/26/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.01
REC-3	6/7/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.17
REC-3	7/7/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.15
REC-3	8/17/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.20
REC-3	10/6/2000	1	PHOSPHORUS, TOTAL (MG/L AS P)	0.89

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Appendix D
NPDES Permit Information

APPENDIX D: NPDES INFORMATION

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APPENDIX D: NPDES INFORMATION

FACILITY NAME:	NOKOMIS QUARRY CO	NPDES:	ILG840055
STREET 1:	23311 TAYLORVILLE ROAD		
CITY:	NOKOMIS	PERMIT ISSUED DATE:	AUG-01-1997
STATE:	IL	PERMIT EXPIRED DATE:	MAY-31-2002
ZIP CODE:	62075		
COUNTY NAME:	MONTGOMERY	SIC CODE:	1422 CRUSHED AND BROKEN LIMESTONE
REGION:	5	MAPPING INFO:	MAP
MAILING NAME:	NOKOMIS QUARRY CO-NOKOMIS QRY		

List of Permitted Discharges

PIPE NUMBER	REPORT DESIGNATOR	PIPE SET QUALIFIER	PIPE DESCRIPTION	PARAMETER CODE	PARAMETER DESCRIPTION
001	0	9	PIT PUMPAGE; SW	00400	PH
002	0	9	PIT PUMPAGE; SW	00400	PH
001	0	9	PIT PUMPAGE; SW	00530	SOLIDS, TOTAL SUSPENDED
002	0	9	PIT PUMPAGE; SW	00530	SOLIDS, TOTAL SUSPENDED
001	0	9	PIT PUMPAGE; SW	50050	FLOW, IN CONDUIT OR THRU TREATMENT PLANT
002	0	9	PIT PUMPAGE; SW	50050	FLOW, IN CONDUIT OR THRU TREATMENT PLANT

APPENDIX D: NPDES INFORMATION

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Appendix D: NPDES Information

Facility Information

FACILITY NAME:	OHLMAN STP	NPDES:	IL0032671
STREET 1:	PO BOX 43		
CITY:	OHLMAN	PERMIT ISSUED DATE:	JUN-10-2005
STATE:	IL	PERMIT EXPIRED DATE:	JUL-31-2010
ZIP CODE:	620760043		
COUNTY NAME:	MONTGOMERY	SIC CODE:	4952 SEWERAGE SYSTEMS
REGION:	5	MAPPING INFO:	MAP
MAILING NAME:	OHLMAN STP, VILLAGE OF		

List of Permitted Discharges

PIPE NUMBER	REPORT DESIGNATOR	PIPE SET QUALIFIER	PIPE DESCRIPTION	PARAMETER CODE	PARAMETER DESCRIPTION
001	0	9	STP OUTFALL	00300	OXYGEN, DISSOLVED (DO)
001	0	9	STP OUTFALL	00400	PH
001	0	9	STP OUTFALL	00530	SOLIDS, TOTAL SUSPENDED
001	0	9	STP OUTFALL	50050	FLOW, IN CONDUIT OR THRU TREATMENT PLANT
001	0	9	STP OUTFALL	50060	CHLORINE, TOTAL RESIDUAL
001	0	9	STP OUTFALL	80082	BOD, CARBONACEOUS 05 DAY, 20C
INF	L	9	INFLUENT MONITORING	00310	BOD, 5-DAY (20 DEG. C)
INF	L	9	INFLUENT MONITORING	00530	SOLIDS, TOTAL SUSPENDED
INF	L	9	INFLUENT MONITORING	50050	FLOW, IN CONDUIT OR THRU TREATMENT PLANT

APPENDIX D: NPDES INFORMATION

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Appendix E
Watershed Photographs

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Locust Creek: Looking north from 1600 East Road

Locust Creek: Looking south from 1600 East Road

South Fork Sangamon River: Looking downstream from sampling location EO13

South Fork Sangamon River: Looking upstream from sampling location EO13

Lake Taylorville: Near the beach

Lake Taylorville: Looking north from 1400 East Road

Lake Taylorville: Looking south from 1400 East Road

Lake Taylorville: Looking north from 900 North Road

Lake Taylorville: Sediment Retention Structure

Lake Taylorville: Spillway

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Appendix F
Stage Two Report

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CDM

Illinois Environmental
Protection Agency

Stage 2 Data Report

March 2007

Final Report

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Contents

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Figures

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Tables

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Section 1
Introduction

The Illinois Environmental Protection Agency (Illinois EPA) has a three-stage approach to total maximum daily load (TMDL) development. The stages are:

Stage 1 – Watershed Characterization, Data Analysis, Methodology Selection

Stage 2 – Data Collection (optional)

Stage 3 – Model Calibration, TMDL Scenarios, Implementation Plan

This report addresses data collection associated with Stage 2 TMDL development for the following watersheds:

- Bay Creek
- Cahokia Creek/Holiday Shores Lake
- Cedar Creek/Cedar Lake
- Crab Orchard Creek/Crab Orchard Lake
- Crooked Creek
- Little Wabash River
- Mary's River/North Fork Cox Creek
- Sangamon River/Lake Decatur
- Shoal Creek
- South Fork Saline River/Lake of Egypt
- South Fork Sangamon River/Lake Taylorville

Sampling has been completed based on the recommendations presented in Section 6 of each watershed's Stage 1 TMDL report and the sampling plan described within the quality assurance project plan (QAPP). The Stage 2 data will supplement existing data collected and assessed as part of Stage 1 of TMDL development and will support the development of TMDLs under Stage 3 of the process. Where adequate supporting data exist, data collected during Stage 2 activities may also be used to support the delisting of certain parameters from the state 303(d) list.

The remaining sections of this report contain:

- **Section 2 Field Activities** includes information on sampling locations as well as field parameter, grab sample and continuous monitoring data
- **Section 3 Quality Assurance Review** discusses changes in the sampling plan from the original QAPP, data verification and validity, and conformance to the data quality objectives
- **Section 4 Conclusions** summarizes the Stage 2 work and makes recommendations for moving forward

Section 2
Field Activities

TMDL streams were sampled by CDM twice during the fall of 2006 to collect data needed to support water quality modeling and TMDL development. The first round of Stage 2 data collection took place between August 28 and September 29, 2006. The second round of Stage 2 data collection took place between October 16 and November 17, 2006. In addition, three segments within the Little Wabash River watershed were sampled by Illinois EPA between April and August of 2006. Over the course the sampling project, 32 streams (out of a possible 33) and one lake were sampled within the eleven Stage 2 watersheds. Table 2-1 contains data collection dates for each watershed.

Table 2-1: Stage 2 Data Collection Field Dates

Watershed	First Round Dates (2006)	Second Round Dates (2006)
Bay Creek	9/25-9/29	10/30-11/6
Cahokia Creek/Holiday Shores Lake	8/28-9/6	10/16-10/20
Cedar Lake	9/5-9/14	10/30-11/6
Crab Orchard Lake	9/5-9/14	10/30-11/6
Crooked Creek	9/5-9/14	10/16-10/20
South Fork Saline River/Lake of Egypt	9/25-9/29	10/30-11/6
Little Wabash River - CDM	9/5-9/14	10/30-11/16
Little Wabash River – Illinois EPA	4/18-8/8	
Mary's River	9/5-9/14	10/16-10/20
Sangamon River/Lake Decatur	8/28-9/6	10/30-11/3
Shoal	8/28-9/6	10/16-10/20
South Fork Sangamon River/Lake Taylorville	8/28-9/6	10/30-11/3

Sampling was conducted in accordance with the QAPP by CDM personnel at stream and lake locations with sufficient water and access. When time permitted, alternate locations were investigated if water and/or access were limited at original locations. Figures 2-1 through 2-11 show sampling locations used for Stage 2 data collection for each watershed. Refer to section 3.1 for further information related to sampling location changes from the original QAPP. Appendix A contains pictures of each sampling location. The sampling and analysis activities conducted at each sampling location included:

- In-stream field parameterization
- Grab samples for laboratory analysis
- Continuous monitoring
- Stream gaging

2.1 Instream field parameters

Water quality measurements for pH, temperature, dissolved oxygen (DO), conductivity, and turbidity were taken at each accessible sampling location where water was present using an In-Situ 9500 Profiler water quality meter. In-Situ 9500 Profilers were calibrated each morning of field activity. Water quality readings were taken at each accessible site with adequate water at the center of flow and values were recorded in field books. These values are presented in Table 2-2. Table 2-2 also contains sample location latitude and longitude as well as explanatory information as to why a limited number of sites were not sampled.

At each site with adequate and safely wadeable streamflow, flow measurements were recorded using a Marsh McBirney 2000 flow meter. Appendix B contains flow meter data and stream discharge analysis for these sites.

2.2 Grab Samples

Grab samples were collected based on the causes of impairment identified in the 303(d) list as well as data needed to support TMDL development under Stage 3. Samples collected on Owl Creek and South Fork Sangamon River were analyzed by Prairie Analytical Laboratories in Springfield, IL and all other samples collected by CDM were analyzed by ARDL, Inc in Mt. Vernon, IL. Samples were delivered in person to the laboratory or exchanged with laboratory personnel in the field. Select segments in the Little Wabash watershed (Elm River segment CD01, and Little Wabash River segments C09 and C33) were sampled by Illinois EPA and analyzed by the Illinois EPA Laboratory in Champaign, IL.

Table 2-3 contains data collected at each location associated with impairment status. Values shown in bold face with gray background violated the applicable water quality standard. All data analyzed by the laboratories are contained in Appendix C. This appendix includes the data shown in Table 2-3 as well as all other parameters that were sampled in order to support Stage 3 TMDL development. In addition, Appendix C shows data qualifiers as well as detection limits for all samples.

2.3 Continuous Monitoring

In-Situ 9500 Professional XP multi-parameter data-logging sondes were used for continuous data measurements on streams impaired by low DO and/or pH. The sondes were calibrated prior to deployment then deployed for at least 3 days at select locations with adequate water and access. DO, pH, conductivity and temperature data were recorded at 15 minute intervals during sonde deployment, after which the sonde was removed and data were downloaded to a laptop computer. The continuous data associated with impairment causes are presented in Appendix D. Because sondes were not field checked at the time of retrieval, there is a possibility that some experienced times of drying or build-up of sedimentation during deployment. A column was added to the data presented in Appendix D to estimate acceptable or “suspect” data. Data were deemed suspect when low conductivity or high temperature values indicate that the meter was likely out of the water or also at times when field log books indicated that the sonde had not yet been deployed or had been pulled from the stream. The data that were deemed acceptable were plotted on Figures D-1 through D-26. The charts are grouped by watershed and show data collected during the first and second round of sampling at each location.

Violations of the instantaneous DO standard (5.0 mg/L minimum) were not recorded during either monitoring period on the following segments that are currently listed for impairment caused by low DO:

- Cedar Creek AJF16 (Figure D-1)
- Big Muddy River N99 (Figure D-4)
- Shoal Creek OI05 (Figures D-22 and D-23)
- South Fork Saline River ATH08 (Figure D-24)

According to Table B-2 of the Illinois Integrated Water Quality Report (2006), the aquatic life use may also be impaired if DO concentrations are below 6.0 mg/L for more than 16 hours of any 24 hour period. Appendix D also contains this analysis for the segments that did not violate the instantaneous minimum standard. The number of values recorded below 6.0 mg/L during any 24 hour period were counted and if any count was above 64 (64 values equates to 16 hours worth of data), the stream was considered to be potentially impaired by low DO. The following segments did not experience a violation of either the 5.0 mg/L instantaneous standard or the 6.0 mg/L standard as described above:

- Cedar Creek AJF16 (Figure D-1)
- Shoal Creek OI05 (Figures D-22 and D-23)
- South Fork Saline River ATH08 (Figure D-24)

Violations of the pH standard (6.5 minimum, 9.0 maximum) were not recorded during either monitoring period on the following segments that are currently listed for impairment caused by pH:

- Crab Orchard Creek ND12 (Figure D-5)
- Briers Creek ATHS01 (Figure D-25)

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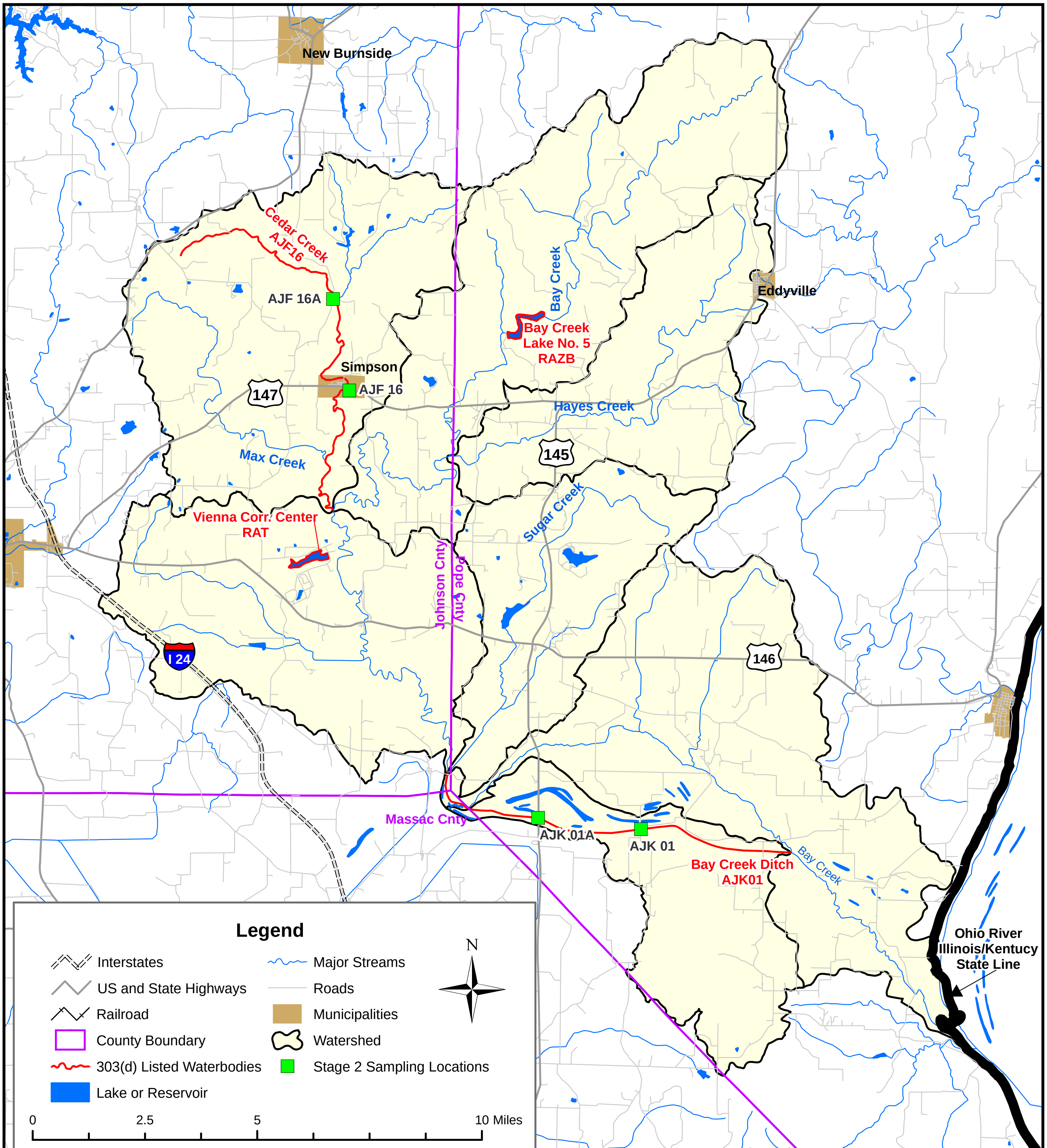

Figure 2-1
Stage 2 Sampling Locations
Bay Creek Watershed

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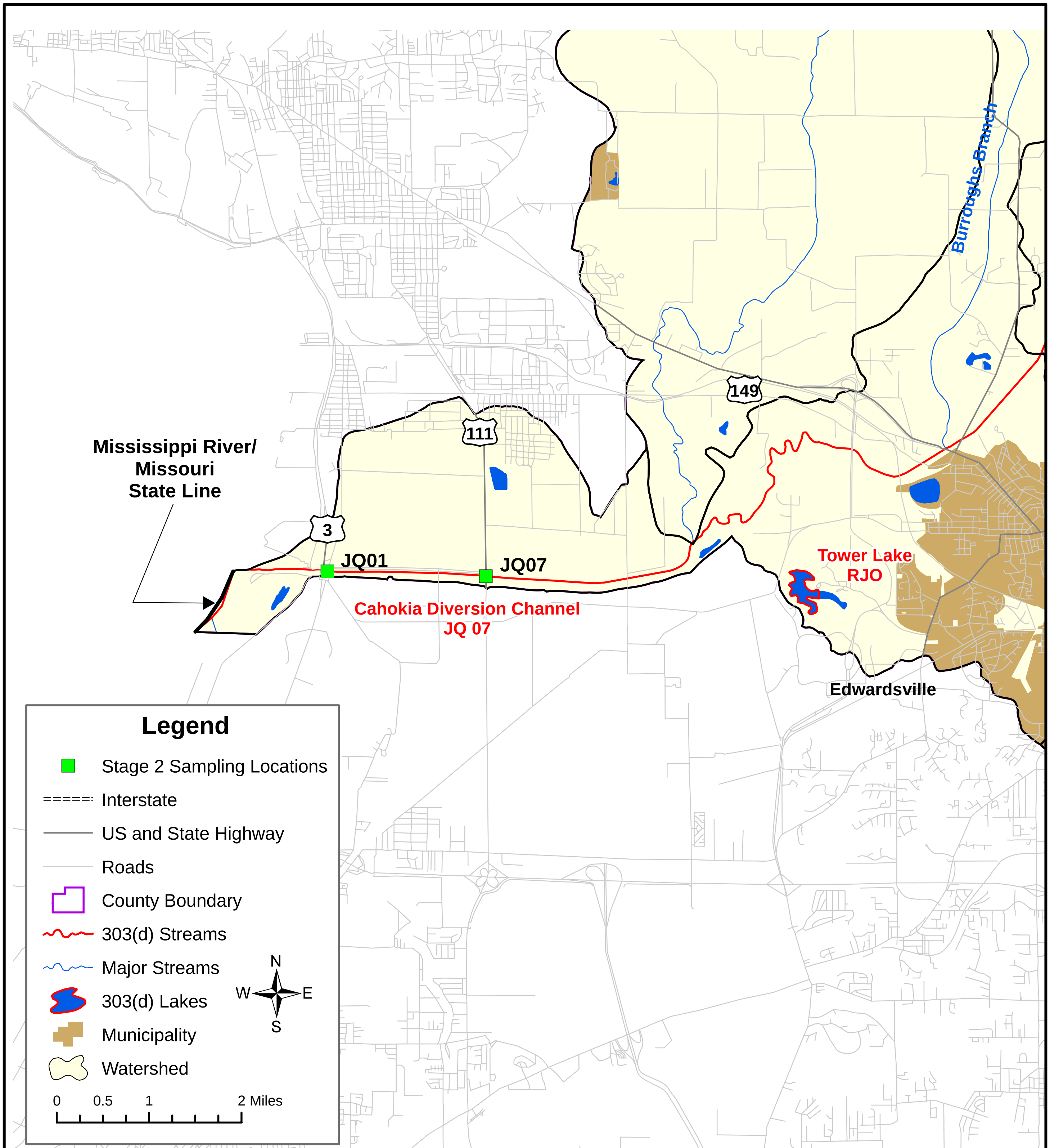

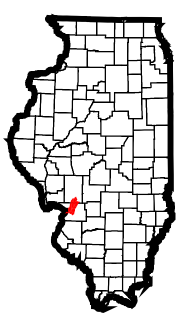

Figure 2-2:
Stage 2 Sampling Locations
Cahokia Creek/Holiday Shores Lake Watershed

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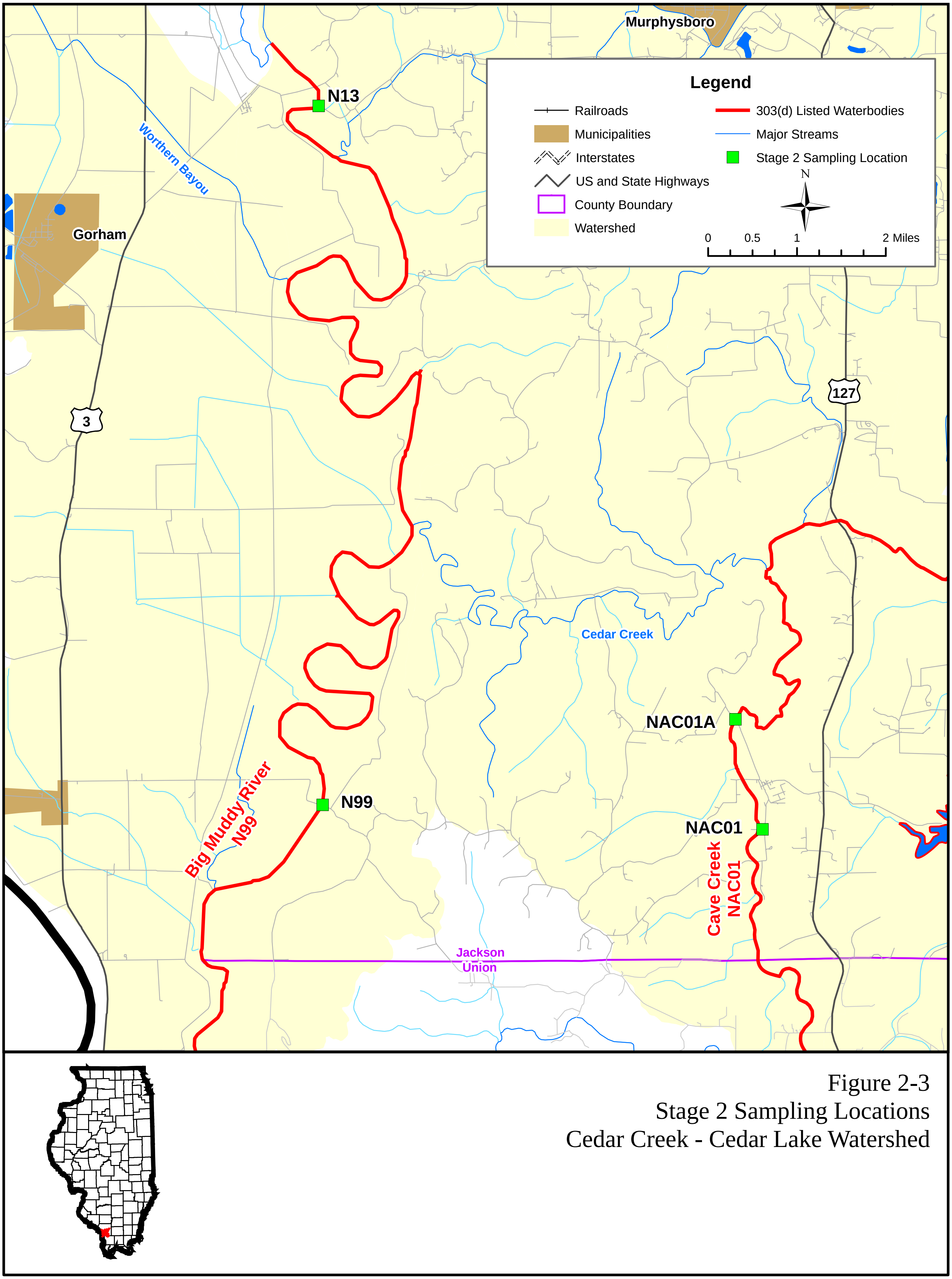

Figure 2-3
Stage 2 Sampling Locations
Cedar Creek - Cedar Lake Watershed

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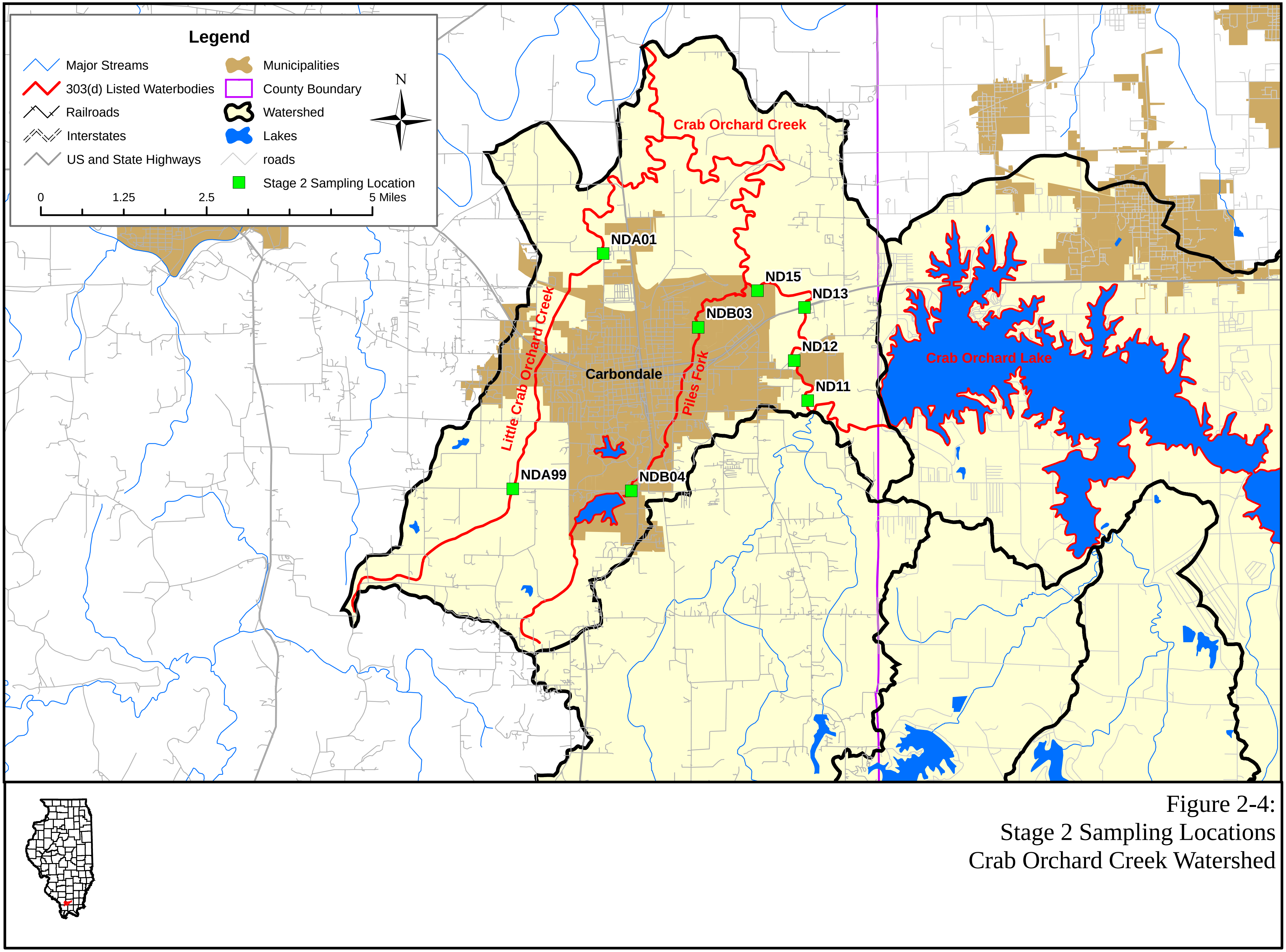

Figure 2-4:
Stage 2 Sampling Locations
Crab Orchard Creek Watershed

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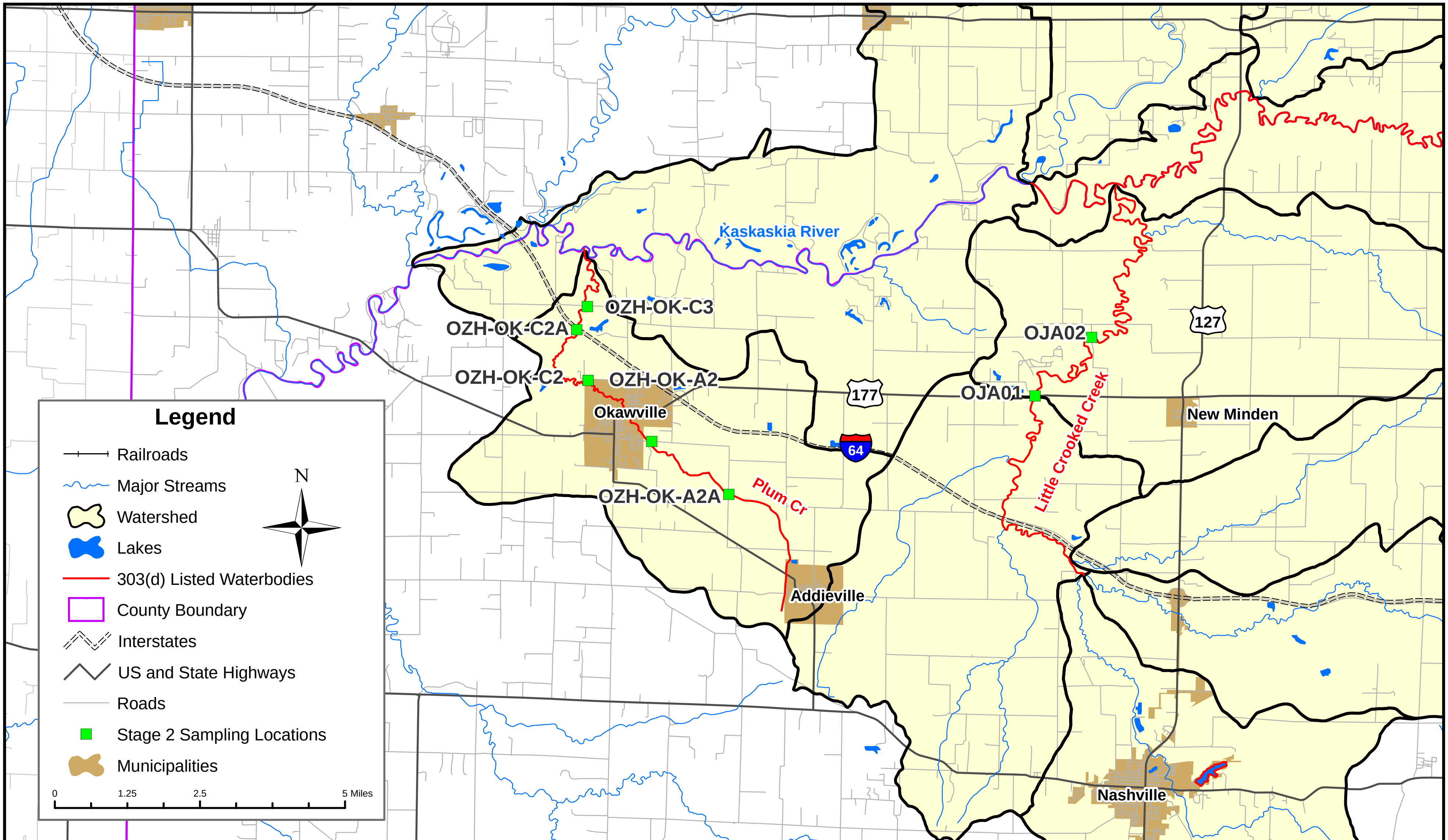

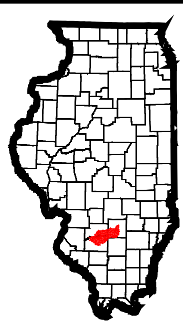

Figure 2-5
Stage 2 Sampling Locations
Crooked Creek Watershed

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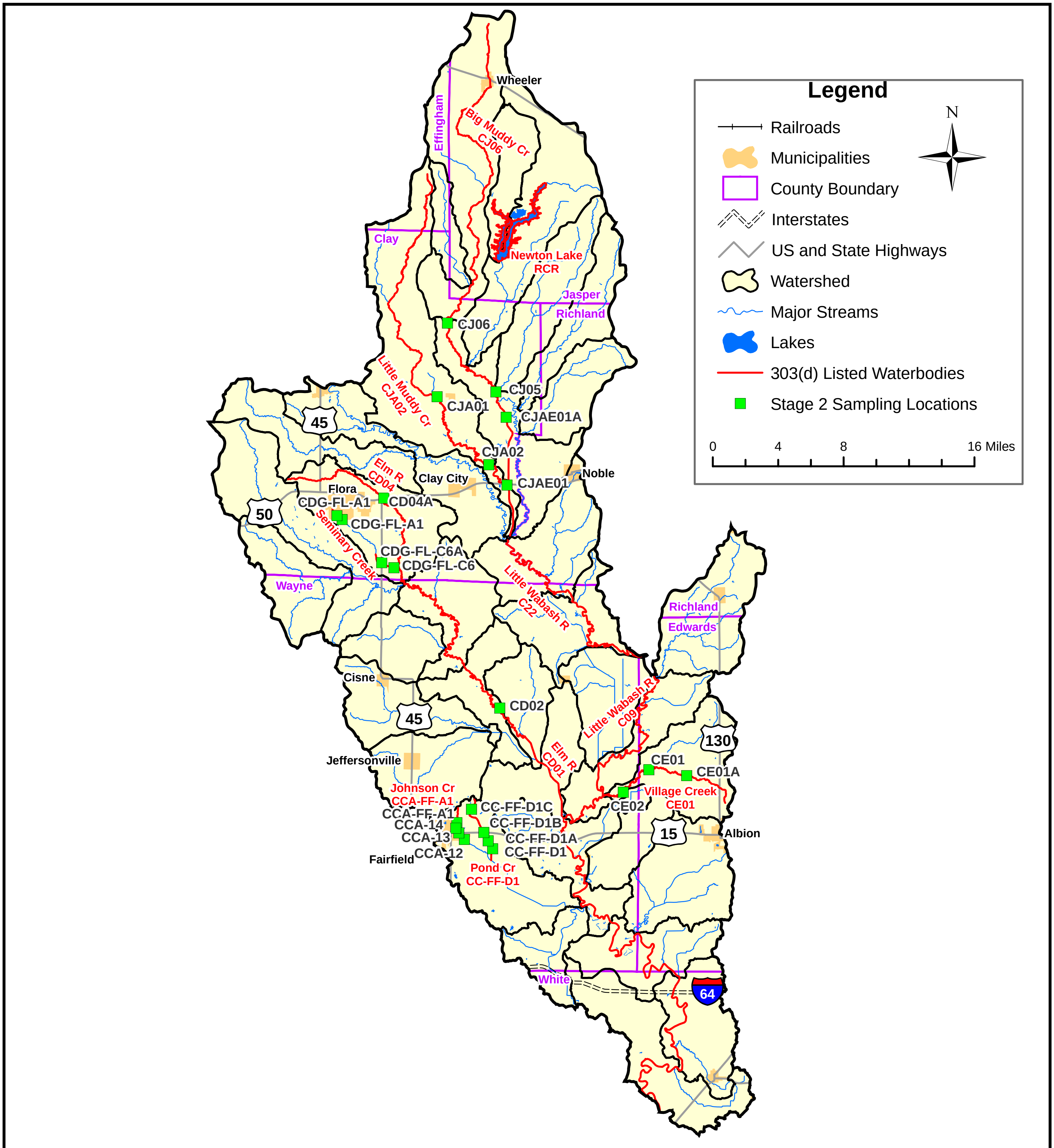

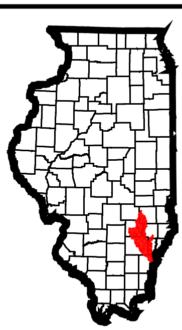

Figure 2-6:
Stage 2 Sampling Locations
Little Wabsash River Watershed

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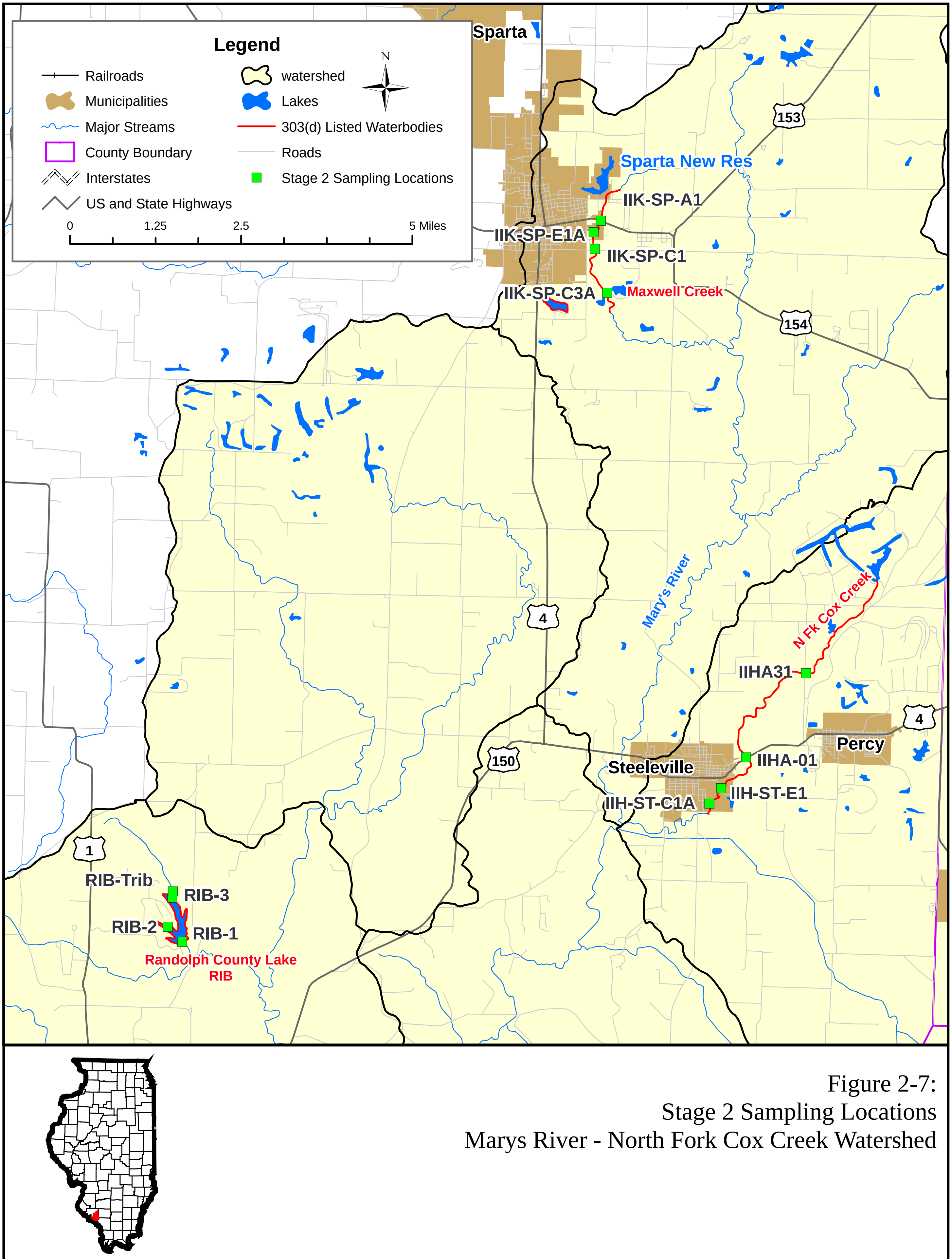

Figure 2-7:
Stage 2 Sampling Locations
Marys River - North Fork Cox Creek Watershed

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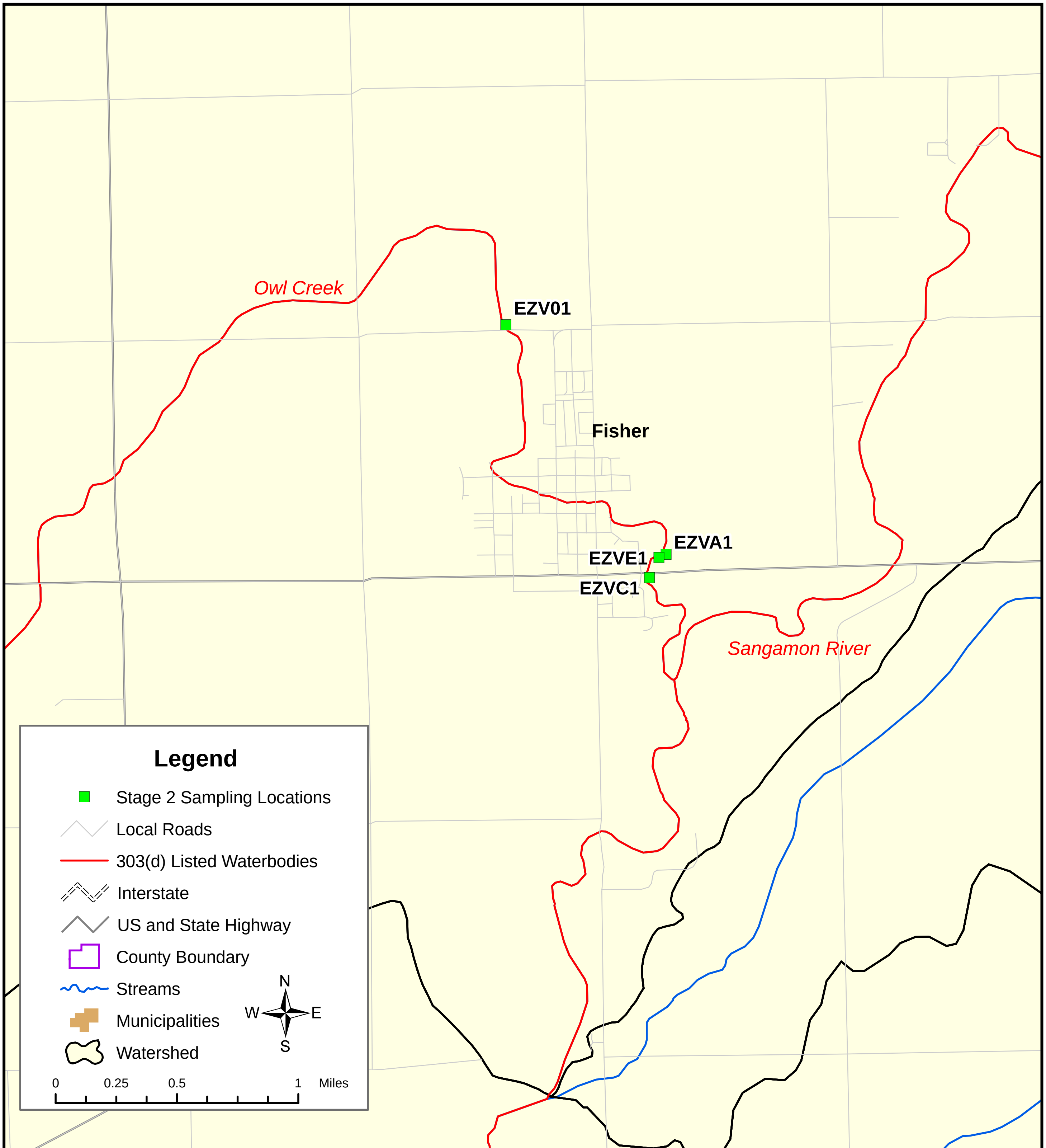

Figure 2-8:
Stage 2 Sampling Locations
Sangamon River - Lake Decatur Watershed

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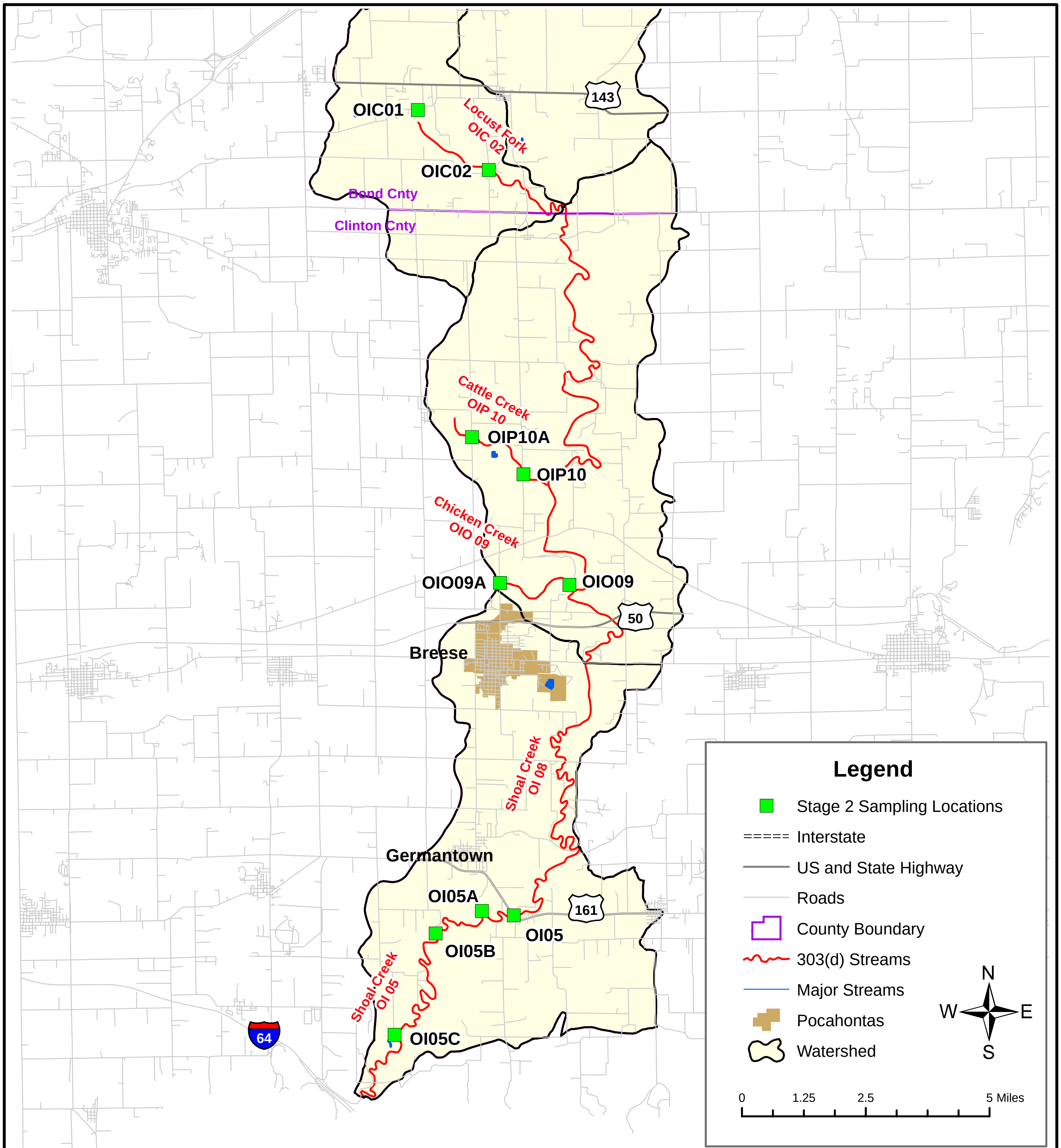

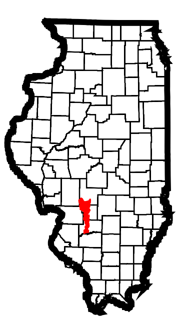

Figure 2-9:
Stage 2 Sampling Locations
Shoal Creek Watershed

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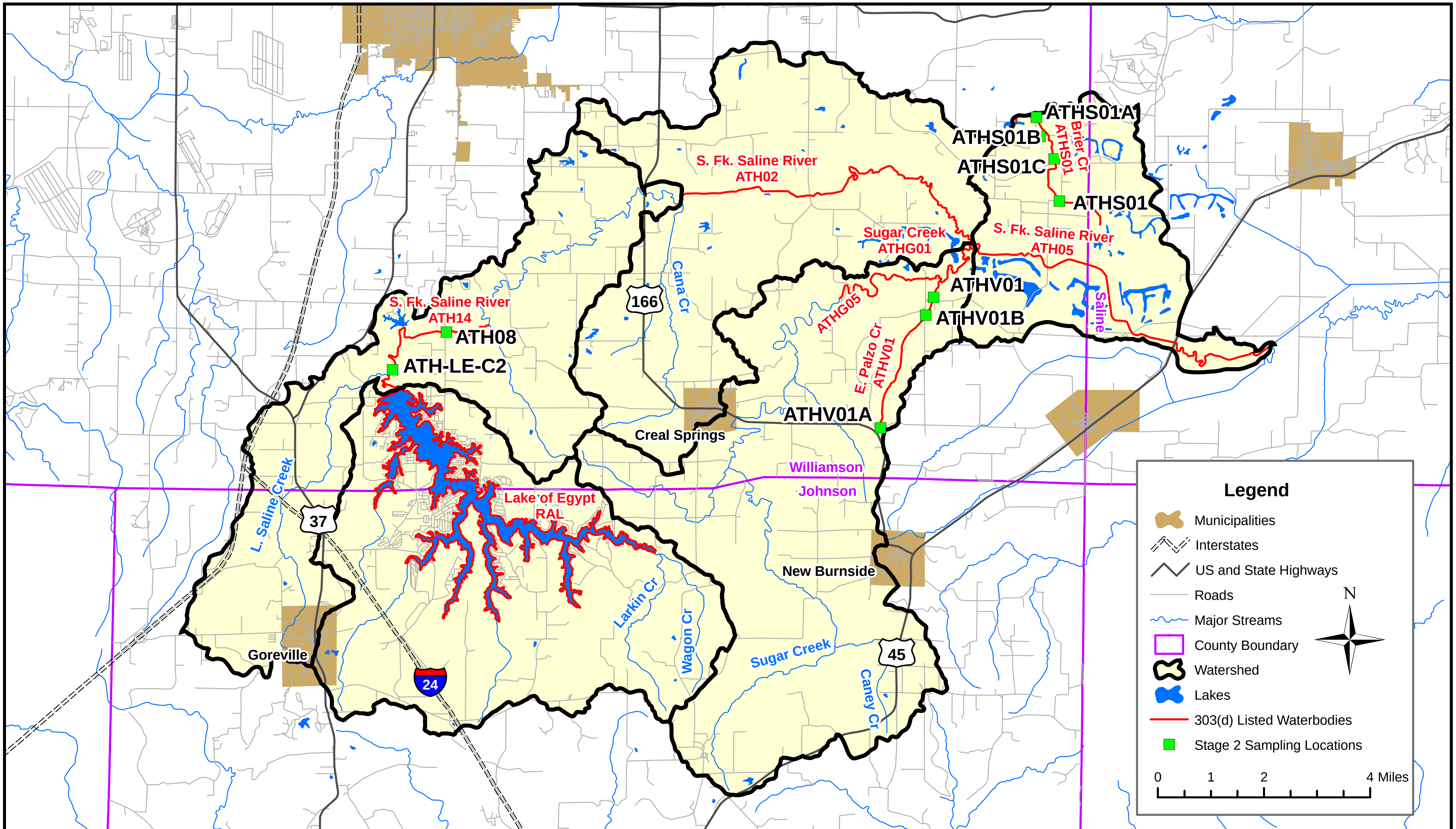

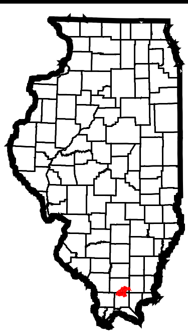

Figure 2-10
Stage 2 Sampling Locations
South Fork Saline River - Lake of Egypt Watershed

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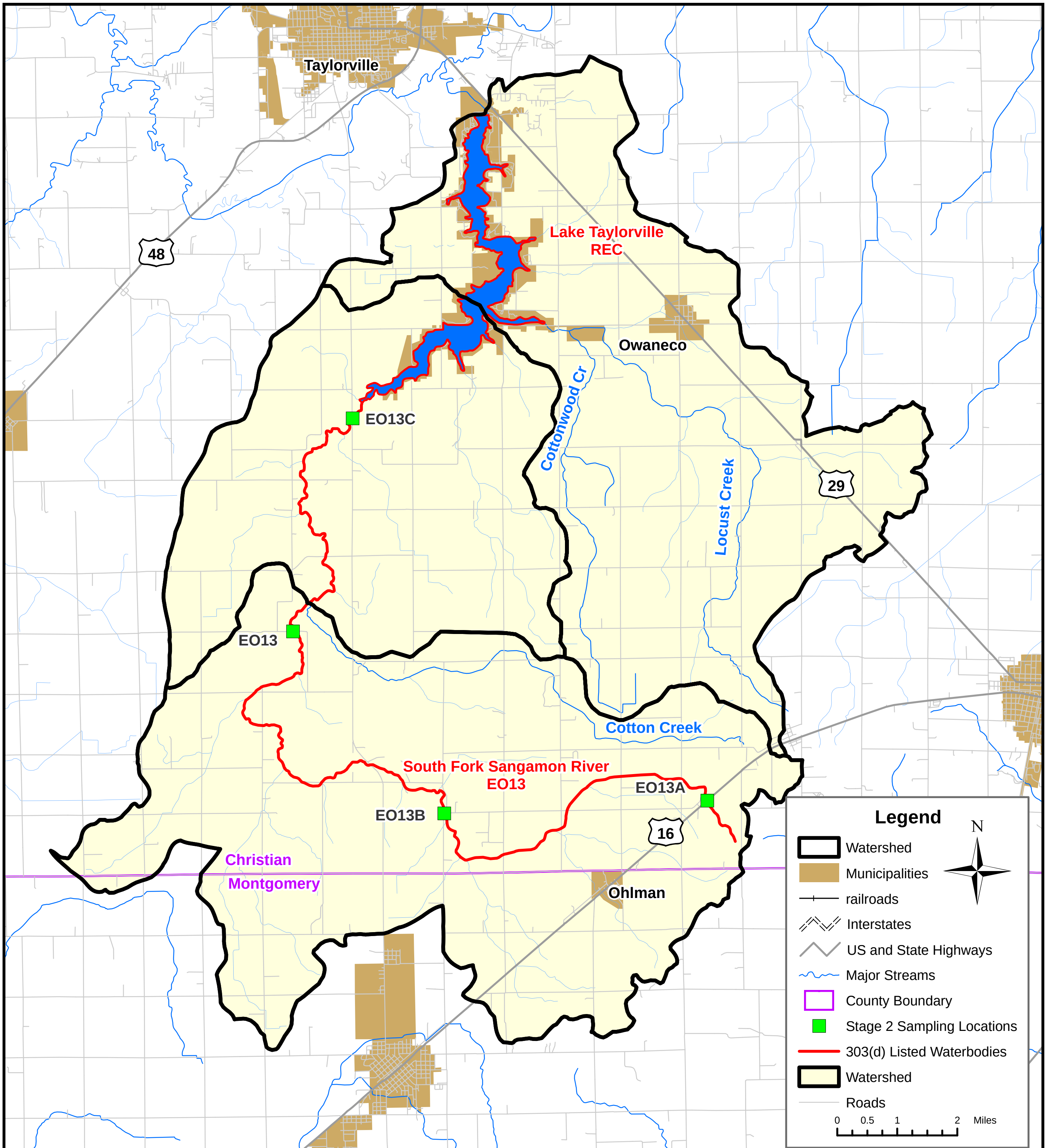

Figure 2-11:
Stage 2 Sampling Locations
South Fork Sangamon River - Lake Taylorville Watershed

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Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
Bay Creek	Cedar Creek	AJF16	37.4661	88.7508	9/25/2006	18:00	6.5	117.0	7.8	8.9	63.9	NA
	Cedar Creek	AJF16	37.4661	88.7508	11/3/2006	11:05	7.2	164.5	8.6	11.0	7.0	NA
	Cedar Creek	AJF16A	37.4954	88.7592	9/25/2006	18:15	6.6	81.0	15.6	9.4	64.0	NA
	Cedar Creek	AJF16A	37.4954	88.7592	11/2/2006	13:30	7.3	101.8	5.4	11.6	9.2	NA
	Bay Creek Ditch	AJK01	37.3245	88.6337	9/25/2006	15:58	6.3	74.0	17.2	5.6	66.6	NA
	Bay Creek Ditch	AJK01	37.3245	88.6337	10/31/2006	8:15	7.2	91.6	20.4	8.2	12.8	NA
	Bay Creek Ditch	AJK01A	37.3282	88.6747	9/25/2006	NOT SAMPLED *Site flooded over banks into surrounding fields with no access/alternate site not located*						NA
	Bay Creek Ditch	AJK01A	37.3282	88.6747	10/31/2006	8:45	7.1	91.1	44.5	6.1	13.2	NA
Cahokia Creek/Holiday Shores Lake	Cahokia Diversion Ditch	JQ01	38.8054	90.1023	8/31/2006	13:40	7.4	606.7	62.3	3.4	23.9	NA
	Cahokia Diversion Ditch	JQ01	38.8054	90.1023	10/17/2006	14:45	8.3	459.8	92.9	9.6	12.6	NA
	Cahokia Diversion Ditch	JQ07	38.8050	90.0673	8/31/2006	14:45	7.4	498.6	68.0	5.3	23.0	NA
	Cahokia Diversion Ditch	JQ07	38.8050	90.0673	10/17/2006	14:15	8.3	427.0	115.8	9.4	12.8	NA
Cedar Creek	Big Muddy River	N13	37.7392	89.4284	9/7/2006	11:15	7.6	646.1	45.5	8.1	29.9	NA
	Big Muddy River	N13	37.7392	89.4284	11/1/2006	10:45	7.1	319.1	258.5	8.2	11.2	NA
	Big Muddy River	N99	37.6252	89.4284	9/7/2006	12:15	7.7	749.5	40.2	10.1	23.6	NA
	Big Muddy River	N99	37.6252	89.4284	11/1/2006	9:45	7.4	333.4	188.4	7.8	11.5	NA
	Cave Creek	NAC01	37.6154	89.3395	9/11/2006	11:45	7.8	288.4	N/A	7.6	20.4	NA
	Cave Creek	NAC01	37.6154	89.3395	11/1/2006	11:45	7.8	213.2	24.0	10.6	9.8	NA
	Cave Creek	NAC01A	37.6380	89.5660	9/11/2006	11:15	7.5	330.3	N/A	4.9	20.5	NA
	Cave Creek	NAC01A	37.6380	89.5660	11/1/2006	12:15	7.7	227.7	20.6	10.1	10.2	NA
Crab Orchard Creek	Crab Orchard Creek	ND11	37.7198	89.1717	9/6/2006	12:15	7.3	385.9	N/A	5.2	20.1	NA
	Crab Orchard Creek	ND11	37.7198	89.1717	11/1/2006	14:00	7.7	229.6	26.7	10.1	11.7	NA
	Crab Orchard Creek	ND12	37.7286	89.1753	9/6/2006	13:15	7.3	502.7	N/A	6.4	24.2	NA
	Crab Orchard Creek	ND12	37.7286	89.1753	11/1/2006	15:00	7.7	233.4	52.2	10.4	11.7	NA
	Crab Orchard Creek	ND13	37.7402	89.1723	9/6/2006	15:00	7.4	494.1	N/A	6.0	22.2	NA
	Crab Orchard Creek	ND13	37.7402	89.1723	11/1/2006	15:45	7.3	234.7	19.0	11.1	11.8	NA
	Crab Orchard Creek	ND15	37.7440	89.1852	9/6/2006	16:30	7.0	470.0	N/A	6.8	22.4	NA
	Crab Orchard Creek	ND15	37.7440	89.1852	11/1/2006	NOT SAMPLED *Site located behind Walmart parking lot and not accessible due to large chain link fence/no available alternate sites*						NA
	Little Crab Orchard Creek	NDA01	37.7525	89.2276	9/6/2006	18:00	7.3	242.5	N/A	2.1	19.2	NA
	Little Crab Orchard Creek	NDA01	37.7525	89.2276	11/2/2006	8:30	7.0	225.5	30.4	8.2	6.3	NA
	Little Crab Orchard Creek	NDA99	37.7011	89.2531	9/9/2006	NOT SAMPLED *Site dry and road crossings in the vacinity of site were also dry*						NA
	Little Crab Orchard Creek	NDA99	37.7011	89.2531	11/2/2006	10:30	8.7	190.5	17.0	12.3	5.5	NA
	Piles Fork	NDB03	37.7361	89.2016	9/7/2006	10:00	7.3	404.0	7.4	1.6	18.5	NA
	Piles Fork	NDB03	37.7361	89.2016	11/2/2006	9:15	7.7	240.7	25.5	10.3	7.3	NA
	Piles Fork	NDB04	37.7004	89.2205	9/9/2006	7:40	7.7	753.7	7.8	3.6	17.6	NA
	Piles Fork	NDB04	37.7004	89.2205	11/2/2006	11:00	8.1	154.9	56.5	11.5	10.2	NA
Crooked Creek	Little Crooked Creek	OJA-01	38.4416	89.4170	9/7/2006	17:45	7.0	274.0	22.5	3.7	20.3	NA
	Little Crooked Creek	OJA-01	38.4416	89.4170	10/19/2006	14:05	7.5	335.4	84.1	4.7	12.0	NA
	Little Crooked Creek	OJA-02	38.4564	89.3992	9/8/2006	11:15	7.0	284.8	20.2	3.1	19.7	NA
	Little Crooked Creek	OJA-02	38.4564	89.3992	10/19/2006	14:35	7.3	332.5	48.1	3.8	12.4	NA
	Plum Creek	OZH-OK-A2	38.4290	89.5387	9/8/2006	14:00	7.9	663.3	10.4	6.8	23.9	NA
	Plum Creek	OZH-OK-A2	38.4290	89.5387	10/19/2006	10:50	7.6	390.6	51.8	5.3	11.2	NA
	Plum Creek	OZH-OK-A2A	38.4160	89.5140	9/8/2006	16:45	7.8	503.2	56.9	8.5	22.3	NA
	Plum Creek	OZH-OK-A2A	38.4160	89.5140	10/19/2006	11:20	7.8	341.6	74.7	9.0	9.8	NA
	Plum Creek	OZH-OK-C2	38.4441	89.5592	9/8/2006	12:45	7.3	367.1	11.2	1.1	18.8	NA
	Plum Creek	OZH-OK-C2	38.4441	89.5592	10/19/2006	10:15	7.4	361.7	66.4	2.5	12.0	NA
	Plum Creek	OZH-OK-C2A	38.4568	89.5630	9/8/2006	17:30	7.8	977.9	13.4	4.6	20.7	NA
	Plum Creek	OZH-OK-C2A	38.4568	89.5630	10/19/2006	13:40	7.7	433.1	48.8	3.2	11.5	NA
	Plum Creek	OZH-OK-C3	38.4626	89.5598	9/8/2006	15:00	7.7	983.2	38.5	4.1	21.2	NA
	Plum Creek	OZH-OK-C3	38.4626	89.5598	10/19/2006	9:35	7.5	384.1	556.5	5.2	11.7	NA

Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
Little Wabash	Little Wabash River	C09	38.4407	88.2581	1/25/2005	14:00	7.3	415	42	12.1	1.1	NA
	Little Wabash River	C09	38.4407	88.2581	3/17/2005	8:00	8.3	700	23	14.9	7	NA
	Little Wabash River	C09	38.4407	88.2581	4/19/2005	14:30	7.8	535	50	7.3	18.8	NA
	Little Wabash River	C09	38.4407	88.2581	5/9/2005	10:30	7.3	738	60	6.7	19.7	NA
	Little Wabash River	C09	38.4407	88.2581	6/23/2005	7:30	7.7	690	47	5.1	26	NA
	Little Wabash River	C09	38.4407	88.2581	8/23/2005	13:00	7.2	290	70	4.2	27.1	NA
	Little Wabash River	C09	38.4407	88.2581	9/27/2005	16:00	7.8	533	25	7.5	24.6	NA
	Little Wabash River	C09	38.4407	88.2581	10/27/2005	14:00	7.8	550	11	8.7	11.7	NA
	Little Wabash River	C09	38.4407	88.2581	12/6/2005	13:00	7.6	375	70	11.8	1.6	NA
	Little Wabash River	C09	38.4407	88.2581	2/1/2006	13:00	7.6	390	200	9.3	6.8	NA
	Little Wabash River	C09	38.4407	88.2581	3/15/2006	10:00	6.6	150	130	6.2	12.4	NA
	Little Wabash River	C09	38.4407	88.2581	4/18/2006	16:00	7.9	572	40	8.1	20.1	NA
	Little Wabash River	C09	38.4407	88.2581	4/26/2006	10:00	7.8	580	59	7.2	17.7	NA
	Little Wabash River	C09	38.4407	88.2581	5/1/2006	9:45	7.5	543	75	6.4	16.2	NA
	Little Wabash River	C09	38.4407	88.2581	5/10/2006	10:00	7.4	475		6.2	18.5	NA
	Little Wabash River	C09	38.4407	88.2581	5/17/2006	11:00	7.4	421	70	7.4	14.7	NA
	Little Wabash River	C09	38.4407	88.2581	5/24/2006	9:45	7.5	473		6.6	18.9	NA
	Little Wabash River	C09	38.4407	88.2581	5/31/2006	10:20	7.2	352		4	25.3	NA
	Little Wabash River	C09	38.4407	88.2581	6/7/2006	10:15	7.2	345		4.3	23.3	NA
	Little Wabash River	C09	38.4407	88.2581	6/15/2006	8:50	7.4	536	55	5.2	23.9	NA
	Little Wabash River	C09	38.4407	88.2581	6/22/2006	10:05	7.5	608	65	4.4	28.4	NA
	Little Wabash River	C09	38.4407	88.2581	6/27/2006	10:40	7.44	462	64	4.9	24.17	NA
	Little Wabash River	C09	38.4407	88.2581	7/5/2006	10:30	7.2	321		4.4	27.5	NA
	Little Wabash River	C09	38.4407	88.2581	7/12/2006	10:30	7.3	456		3.8	25.3	NA
	Little Wabash River	C09	38.4407	88.2581	7/20/2006	10:00	7.4	372		4.8	29.4	NA
	Little Wabash River	C09	38.4407	88.2581	7/27/2006	10:00	7.2	239		4.8	26.4	NA
	Little Wabash River	C09	38.4407	88.2581	8/1/2006	8:30	7.3	306	65	4.5	30.3	NA
	Little Wabash River	C09	38.4407	88.2581	8/8/2006	11:05	7.3	392	55	4.75	28.4	NA
	Little Wabash River	C33	38.2699	88.1377	4/18/2006	11:00	7.1	418	35	4.4	19.8	NA
	Little Wabash River	C33	38.2699	88.1377	4/26/2006	12:15	7.7	607	56	6	19	NA
	Little Wabash River	C33	38.2699	88.1377	5/1/2006	11:45	7.7	597	58	6.8	16.8	NA
	Little Wabash River	C33	38.2699	88.1377	5/10/2006	12:20	7.3	409		5.3	18.7	NA
	Little Wabash River	C33	38.2699	88.1377	5/17/2006	14:00	7.4	462	90	7.2	15.5	NA
	Little Wabash River	C33	38.2699	88.1377	5/24/2006	12:15	7.4	494		6.4	19.9	NA
	Little Wabash River	C33	38.2699	88.1377	5/31/2006	12:40	7.2	449		3.9	25.4	NA
	Little Wabash River	C33	38.2699	88.1377	6/7/2006	12:30	6.8	286		3	23.01	NA
	Little Wabash River	C33	38.2699	88.1377	6/15/2006	11:05	7.5	511	45	8.1	25.1	NA
	Little Wabash River	C33	38.2699	88.1377	6/22/2006	12:00	7.2	546	38	3	29.8	NA
	Little Wabash River	C33	38.2699	88.1377	6/27/2006	11:50	7.4	548	61	4.8	26.17	NA
	Little Wabash River	C33	38.2699	88.1377	7/5/2006	13:00	7.3	334		5.8	29	NA
	Little Wabash River	C33	38.2699	88.1377	7/12/2006	12:30	7.1	326		3.4	25.3	NA
	Little Wabash River	C33	38.2699	88.1377	7/20/2006	12:20	6.9	247		3.4	29.9	NA
	Little Wabash River	C33	38.2699	88.1377	7/27/2006	12:10	7.5	308		6.4	27.4	NA
	Little Wabash River	C33	38.2699	88.1377	8/1/2006	10:30	7.3	296	40	4.7	30.8	NA
	Little Wabash River	C33	38.2699	88.1377	8/8/2006	13:30	7.3	361	40	4.9	29.8	NA
	Johnson Creek	CCA12	38.3732	88.3449	9/9/2006	13:05	8.2	1402.0	13.4	14.2	28.4	NA
	Johnson Creek	CCA12	38.3732	88.3449	11/14/2006	9:45	7.5	651.4	645.5	7.7	7.0	NA
	Johnson Creek	CCA13	38.3789	88.3511	9/9/2006	14:30	8.6	1517.0	3.1	14.9	25.4	NA
	Johnson Creek	CCA13	38.3789	88.3511	11/14/2006	10:15	7.7	649.4	19.0	12.8	8.1	NA
	Johnson Creek	CCA14A	38.3830	88.3546	9/9/2006	15:25	7.6	836.0	3.6	5.7	21.6	NA

Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
Little Wabash (cont.)	Johnson Creek	CCA14A	38.3830	88.3546	11/14/2006	10:25	7.7	694.2	2.4	12.5	8.0	NA
	Johnson Creek	CCAFFA1A	38.3881	88.3535	9/10/2006	10:50	7.4	788.0	5.9	3.8	19.8	NA
	Johnson Creek	CCAFFA1A	38.3881	88.3535	11/14/2006	10:45	7.4	789.8	4.3	12.3	7.5	NA
	Pond Creek	CCFFD1	38.3648	88.3130	9/9/2006	10:30	7.7	576.0	8.6	7.1	19.5	NA
	Pond Creek	CCFFD1	38.3648	88.3130	10/31/2006	10:10	7.6	8719.7	29.2	8.2	3.8	NA
	Pond Creek	CCFFD1A	38.3720	88.3181	9/9/2006	NOT SAMPLED *Site Dry/no available alternate sites*						NA
	Pond Creek	CCFFD1A	38.3720	88.3181	11/9/2006	12:15	7.3	742.5	9.1	11.2	13.6	NA
	Pond Creek	CCFFD1B	38.3793	88.3230	9/9/2006	11:45	7.5	784.0	10.0	8.6	22.9	NA
	Pond Creek	CCFFD1B	38.3793	88.3230	11/9/2006	11:35	7.3	827.9	4.1	12.1	12.7	NA
	Pond Creek	CCFFD1C	38.3999	88.3370	9/10/2006	12:10	8.0	3941.0	17.8	11.9	19.3	NA
	Pond Creek	CCFFD1C	38.3999	88.3370	10/31/2006	11:20	8.8	1394.0		14.4	4.4	NA
	Elm River	CD01	38.5184	88.1320	1/26/2005	13:00	7.1	388	36	9.1	1.4	NA
	Elm River	CD01	38.5184	88.1320	3/15/2005	11:30	8.4	950	7.2	14.6	6.2	NA
	Elm River	CD01	38.5184	88.1320	4/20/2005	11:30	7.4	670	60	6.7	20.1	NA
	Elm River	CD01	38.5184	88.1320	5/5/2005	13:00	7.5	625	27	7.6	13.8	NA
	Elm River	CD01	38.5184	88.1320	6/23/2005	10:00	7.5	1050	22	5.2	24.7	NA
	Elm River	CD01	38.5184	88.1320	8/18/2005	11:00	7.6	730	34	3.6	24.6	NA
	Elm River	CD01	38.5184	88.1320	9/29/2005	11:30	7.6	700	17	3.6	18.5	NA
	Elm River	CD01	38.5184	88.1320	10/18/2005	11:30	7.5	680	8.2	5.9	15	NA
	Elm River	CD01	38.5184	88.1320	12/8/2005	10:30	7.4	321	65	9.6	0.3	NA
	Elm River	CD01	38.5184	88.1320	2/1/2006	15:00	7.5	430	80	9.1	7	NA
	Elm River	CD01	38.5184	88.1320	3/1/2006	13:30	7.4	840	42	10.2	9.1	NA
	Elm River	CD01	38.5184	88.1320	4/6/2006	11:00	7.3	440	90	8.6	13.5	NA
	Elm River	CD01	38.5184	88.1320	4/18/2006	14:30	7.3	670	40	5.6	20.9	NA
	Elm River	CD01	38.5184	88.1320	4/26/2006	11:15	7.5	860		6.2	15.9	NA
	Elm River	CD01	38.5184	88.1320	5/1/2006	11:00	7.4	958		5.9	15.2	NA
	Elm River	CD01	38.5184	88.1320	5/10/2006	11:10	7.2	489		5	18.2	NA
	Elm River	CD01	38.5184	88.1320	5/17/2006	9:30	7.1	484	35	7	13.8	NA
	Elm River	CD01	38.5184	88.1320	5/24/2006	11:20	7.2	594		5.7	18.5	NA
	Elm River	CD01	38.5184	88.1320	5/31/2006	11:30	7.2	605		3.8	25.7	NA
	Elm River	CD01	38.5184	88.1320	6/7/2006	11:25	7	346		4.5	23.4	NA
	Elm River	CD01	38.5184	88.1320	6/15/2006	9:50	7.1	622		4.6	22.5	NA
	Elm River	CD01	38.5184	88.1320	6/22/2006	11:15	7.1	443		4.6	27.9	NA
	Elm River	CD01	38.5184	88.1320	6/27/2006	9:15	6.77	229	91	5	21.95	NA
	Elm River	CD01	38.5184	88.1320	7/5/2006	11:50	7.2	588		3.6	26.6	NA
	Elm River	CD01	38.5184	88.1320	7/12/2006	11:30	7.2	569		4.2	23.9	NA
	Elm River	CD01	38.5184	88.1320	7/20/2006	11:15	7	285		2.8	28.2	NA
	Elm River	CD01	38.5184	88.1320	7/27/2006	11:05	7.1	346		3.5	25.8	NA
	Elm River	CD01	38.5184	88.1320	8/1/2006	9:20	7.3	382		4	27.8	NA
	Elm River	CD01	38.5184	88.1320	8/8/2006	12:20	7.1	425		4.1	26.3	NA
	Elm River	CD02	38.6751	88.4362	9/8/2006	17:45	7.5	344.0	15.9	8.1	23.2	NA
	Elm River	CD02	38.6751	88.4362	11/8/2006	NOT SAMPLED *Miscommunication between field crews caused error in sampling*						NA
	Elm River	CD02A	38.4894	88.3051	9/12/2006	12:51	7.2	404.0	15.7	3.8	22.0	NA
	Elm River	CD02A	38.4894	88.3051	11/8/2006	NOT SAMPLED *Miscommunication between field crews caused error in sampling*						NA
	Seminary Creek	CDFGLC6	38.6180	88.4384	9/8/2006	12:25	7.7	708.0	4.2	6.6	19.5	NA
	Seminary Creek	CDFGLC6	38.6180	88.4384	11/8/2006	17:00	7.5	527.6	17.5	10.5	12.4	NA
	Seminary Creek	CDFGLC6A	38.6135	88.4245	9/8/2006	11:10	7.7	720.0	201.2	7.0	20.1	NA
	Seminary Creek	CDFGLC6A	38.6135	88.4245	11/8/2006	16:45	7.3	561.7	15.1	12.0	13.5	NA
	Seminary Creek	CDGFLA1	38.6561	88.4832	9/8/2006	15:40	7.9	558.0	7.0	10.0	22.0	NA
	Seminary Creek	CDGFLA1	38.6561	88.4832	11/8/2006	14:45	7.3	385.0	12.5	14.3	12.7	NA

Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
Little Wabash (cont.)	Seminary Creek	CDGFLA1A	38.6595	88.4890	9/8/2006	13:45	7.4	362.0	22.7	2.6	19.0	NA
	Seminary Creek	CDGFLA1A	38.6595	88.4890	11/8/2006	15:50	7.2	429.8	16.8	15.1	12.7	NA
	Village Creek	CE01	38.4348	88.1369	9/6/2006	17:30	8.1	610.0	11.4	9.9	24.9	NA
	Village Creek	CE01	38.4348	88.1369	11/14/2006	8:45	7.5	697.9	8.0	10.6	6.8	NA
	Village Creek	CE01A	38.4294	88.0943	9/12/2006	17:05	7.2	327.0	145.2	5.8	22.6	NA
	Village Creek	CE01A	38.4294	88.0943	11/9/2006	13:45	7.2	607.2	8.7	11.2	14.2	NA
	Village Creek	CE02	38.4150	88.1659	9/6/2006	15:20	7.8	568.0	15.7	7.9	25.0	NA
	Village Creek	CE02	38.4150	88.1659	11/9/2006	12:55	7.5	587.4	14.1	10.7	13.1	NA
	Big Muddy Creek	CJ05	38.7693	88.3093	9/7/2006	16:45	8.2	63.1	11.4	10.5	23.6	NA
	Big Muddy Creek	CJ05	38.7693	88.3093	11/8/2006	11:30	7.4	457.0	32.5	12.4	8.3	NA
	Big Muddy Creek	CJ06	38.8298	88.3642	9/7/2006	18:10	7.5	588.0	34.6	4.9	21.8	NA
	Big Muddy Creek	CJ06	38.8298	88.3642	11/8/2006	11:00	7.3	455.1	15.8	11.6	10.6	NA
	Little Muddy Creek	CJA01	38.7647	88.3760	9/12/2006	10:20	7.0	321.0	9.5	3.4	20.9	NA
	Little Muddy Creek	CJA01	38.7647	88.3760	11/13/2006	12:00	7.0	267.9	113.2	10.1	7.4	NA
	Little Muddy Creek	CJA02	38.7047	88.3174	9/7/2006	14:20	6.8	554.0	45.9	2.8	20.4	NA
	Little Muddy Creek	CJA02	38.7047	88.3174	11/8/2006	12:30	7.0	497.0	35.8	9.3	10.4	NA
	Big Muddy Diversion Ditch	CJAE01	38.6865	88.2967	9/7/2006	12:10	7.1	1946.0	26.9	9.1	22.2	NA
	Big Muddy Diversion Ditch	CJAE01	38.6865	88.2967	11/8/2006	13:05	7.3	478.2	30.8	10.8	11.7	NA
	Big Muddy Diversion Ditch	CJAE01A	38.7467	88.2977	9/7/2006	15:45	8.1	908.0	6.5	10.3	24.3	NA
	Big Muddy Diversion Ditch	CJAE01A	38.7467	88.2977	11/13/2006	12:30	7.6	452.9	37.8	9.8	8.2	NA
Mary's River/North Fork Cox Creek	North Fork Cox Creek	IIHA01	38.0114	89.6460	9/9/2006	17:40	7.9	2073.0	N/A	10.0	22.0	NA
	North Fork Cox Creek	IIHA01	38.0114	89.6460	10/18/2006	14:25	8.3	2995.0	13.5	8.1	15.4	NA
	North Fork Cox Creek	IIHA31	38.0293	89.6303	9/9/2006	17:10	8.2	3491.0	N/A	9.6	23.9	NA
	North Fork Cox Creek	IIHA31	38.0293	89.6303	10/18/2006	14:45	8.4	3215.0	8.5	8.6	15.5	NA
	North Fork Cox Creek	IIHA-STC1	38.0015	89.6557	9/9/2006	16:15	7.8	3019.0	N/A	7.1	21.9	NA
	North Fork Cox Creek	IIHA-STC1	38.0015	89.6557	10/18/2006	14:00	8.1	1990.0	20.0	7.0	14.9	NA
	North Fork Cox Creek	IIHA-STE1	38.0048	89.6526	9/9/2006	15:45	7.8	3422.0	N/A	6.9	20.7	NA
	North Fork Cox Creek	IIHA-STE1	38.0048	89.6526	10/18/2006	13:40	8.0	2505.0	16.3	6.0	14.7	NA
	Maxwell Creek	IIKSPA1	38.1242	89.6870	9/7/2006	NOT SAMPLED						NA
	Maxwell Creek	IIKSPA1	38.1242	89.6870	10/17/2006	*Site dry during both visits/available alternate locations also dry*						NA
	Maxwell Creek	IIKSPC1	38.1182	89.6885	9/7/2006	15:30	7.3	968.1	4.8	2.0	24.3	NA
	Maxwell Creek	IIKSPC1	38.1182	89.6885	10/17/2006	8:20	7.1	561.5	22.3	20.2	18.4	NA
	Maxwell Creek	IIKSPC3A	38.1090	89.6850	9/7/2006	15:00	7.5	997.0	4.4	2.6	21.6	NA
	Maxwell Creek	IIKSPC3A	38.1090	89.6850	10/17/2006	8:45	7.5	457.8	19.2	6.5	15.4	NA
	Maxwell Creek	IIKSPE1A	38.1218	89.6889	9/7/2006	NOT SAMPLED						NA
	Maxwell Creek	IIKSPE1A	38.1218	89.6889	10/17/2006	*Site dry during both visits/available alternate locations also dry*						NA
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:00	9.1	279.7	N/A	13.9	25.6	1
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:02	9.1	279.5	N/A	13.9	24.9	2
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:04	9.1	279.2	N/A	13.8	24.7	3
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:06	9.1	278.8	N/A	13.9	24.6	4
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:08	9.0	279.3	N/A	13.2	24.4	5
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:10	9.0	279.7	N/A	12.6	24.3	6
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:12	8.9	280.4	N/A	11.8	24.2	7
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:14	8.2	286.0	N/A	6.2	23.9	8
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:16	7.8	287.4	N/A	4.4	23.7	9
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:18	7.6	288.9	N/A	2.5	23.5	10
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:20	7.3	290.3	N/A	0.3	23.1	11
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:22	7.3	296.0	N/A	0.1	22.7	12
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:24	7.1	317.6	N/A	0.0	21.2	13
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:26	7.1	332.7	N/A	0.0	18.5	14
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:28	7.1	330.3	N/A	0.0	17.1	15

Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
Mary's River/North Fork Cox Creek (cont.)	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:30	7.1	329.6	N/A	0.0	16.1	16
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:32	7.1	329.9	N/A	0.0	14.7	17
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:34	7.1	330.0	N/A	0.0	13.6	18
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:36	7.1	332.4	N/A	0.0	12.4	19
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:38	7.1	335.4	N/A	0.0	11.8	20
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:40	7.1	341.7	N/A	0.0	11.3	21
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:42	7.1	347.9	N/A	0.0	10.9	22
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:44	7.1	350.1	N/A	0.0	10.8	23
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:46	7.1	352.6	N/A	0.0	10.6	24
	Randolph County Lake	RIB-1	37.9707	89.7962	9/9/2006	12:48	7.0	363.8	N/A	0.0	10.2	25
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	8.0	306.1	5.6	7.1	15.8	0
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.8	305.0	6.7	5.4	15.7	3.28
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.8	304.9	5.9	5.4	15.7	6.56
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.8	303.6	6.6	5.3	15.6	9.84
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.7	303.5	7.1	5.3	15.6	13.12
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.6	304.0	11.9	4.5	13.3	16.4
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.5	371.4	9.8	0.6	12.7	19.68
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.6	392.9	8.3	0.5	10.9	22.96
	Randolph County Lake	RIB-1	37.9707	89.7962	10/18/2006	10:25	7.5	435.0	63.4	0.3	10.1	26.24
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:00	9.0	286.4	N/A	13.3	27.0	1
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:02	9.0	282.2	N/A	13.8	26.8	2
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:04	9.1	279.7	N/A	14.7	25.0	3
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:06	9.0	280.2	N/A	14.3	24.7	4
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:08	8.9	282.2	N/A	12.5	24.4	5
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:10	8.6	286.3	N/A	9.0	24.1	6
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:12	8.1	290.2	N/A	6.0	24.0	7
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:14	7.8	292.2	N/A	4.0	23.9	8
	Randolph County Lake	RIB-2	37.9738	89.8000	9/9/2006	14:16	7.7	292.7	N/A	3.1	23.8	9
	Randolph County Lake	RIB-2	37.9738	89.8000	10/18/2006	12:05	8.0	304.9	10.3	7.1	16.0	0
	Randolph County Lake	RIB-2	37.9738	89.8000	10/18/2006	12:05	7.9	304.5	7.0	6.7	15.9	3.28
	Randolph County Lake	RIB-2	37.9738	89.8000	10/18/2006	12:05	7.8	304.5	6.6	6.4	15.9	6.56
	Randolph County Lake	RIB-2	37.9738	89.8000	10/18/2006	12:05	7.8	304.5	6.3	6.3	15.8	9.84
	Randolph County Lake	RIB-3	37.9800	89.7990	9/9/2006	13:00	9.0	283.0	N/A	13.2	26.4	1
	Randolph County Lake	RIB-3	37.9800	89.7990	9/9/2006	13:02	9.0	283.3	N/A	12.9	26.5	2
	Randolph County Lake	RIB-3	37.9800	89.7990	9/9/2006	13:04	9.0	281.0	N/A	12.8	25.8	3
	Randolph County Lake	RIB-3	37.9800	89.7990	9/9/2006	13:06	9.0	280.4	N/A	12.9	25.0	4
	Randolph County Lake	RIB-3	37.9800	89.7990	9/9/2006	13:08	9.0	279.7	N/A	12.9	24.6	5
	Randolph County Lake	RIB-3	37.9800	89.7990	9/9/2006	13:10	9.0	279.7	N/A	12.6	24.5	6
	Randolph County Lake	RIB-3	37.9800	89.7990	10/18/2006	11:15	8.0	305.0	8.8	7.9	16.0	0
	Randolph County Lake	RIB-3	37.9800	89.7990	10/18/2006	11:15	7.9	304.7	8.7	7.1	16.0	3.28
	Randolph County Lake	RIB-3	37.9800	89.7990	10/18/2006	11:15	7.8	304.7	10.4	6.7	16.0	6.56
	Randolph County Lake Tributary	RIB-Trib	37.9813	89.7988	9/9/2006	13:20	9.0	284.0	N/A	12.9	28.4	NA
	Randolph County Lake Tributary	RIB-Trib	37.9813	89.7988	10/18/2006	11:45	8.1	341.7	46.3	8.3	16.2	NA
Sangamon River/Lake Decatur	Owl Creek	EZV01	40.3254	88.3531	8/30/2006	12:50	7.4	669.0	50.8	8.5	21.2	NA
	Owl Creek	EZV01	40.3254	88.3531	11/2/2006	9:25	8.2	856.7		12.2	5.1	NA
	Owl Creek	EZVA1	40.3115	88.3409	8/30/2006	11:05	7.7	606.9	52.3	6.5	19.0	NA
	Owl Creek	EZVA1	40.3115	88.3409	11/2/2006	10:33	8.2	856.3		11.8	4.7	NA
	Owl Creek	EZVC1	40.3101	88.3423	8/30/2006	10:25	7.3	1450.0	25.6	5.0	21.0	NA
	Owl Creek	EZVC1	40.3101	88.3423	11/2/2006	12:20	8.1	990.7		11.7	6.0	NA
	Owl Creek	EZVE1	40.3113	88.3415	8/30/2006	10:45	7.5	1497.0	20.3	11.1	21.5	NA
	Owl Creek	EZVE1	40.3113	88.3415	11/2/2006	12:59	8.3	859.8		12.5	6.1	NA

Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
Shoal Creek	Shoal Creek	OI05	38.5361	89.5213	9/1/2006	12:35	7.5	563.4	38.7	9.1	22.9	NA
	Shoal Creek	OI05	38.5361	89.5213	10/17/2006	11:30	7.9	604.4	39.7	8.5	12.0	NA
	Shoal Creek	OI05A	38.5370	89.5330	9/1/2006	NOT SAMPLED *Site located at end of private road with chained fence/alternate location not located*						NA
	Shoal Creek	OI05A	38.5370	89.5330	10/17/2006							NA
	Shoal Creek	OI05B	38.5333	89.5496	9/1/2006	14:20	7.8	542.2	43.0	10.8	26.2	NA
	Shoal Creek	OI05B	38.5333	89.5496	10/17/2006	11:15	7.9	542.4	72.7	8.7	12.3	NA
	Shoal Creek	OI05C	38.5020	89.5661	9/1/2006	15:40	7.8	535.3	43.5	10.2	23.5	NA
	Shoal Creek	OI05C	38.5020	89.5661	10/16/2006	10:30	8.0	578.9	46.0	9.4	12.1	NA
	Locust Fork	OIC01	38.7715	89.5556	8/31/2006	NOT SAMPLED *Site dry/no other road crossings on segment*						NA
	Locust Fork	OIC01	38.7715	89.5556	10/19/2006	12:20	7.8	401.1	24.3	3.8	10.0	NA
	Locust Fork	OIC02	38.7536	89.5288	8/31/2006	17:50	8.0	499.6	23.2	9.4	24.2	NA
	Locust Fork	OIC02	38.7536	89.5288	10/17/2006	13:00	7.7	422.2	26.9	5.2	14.2	NA
	Chicken Creek	OIO09	38.6407	89.5025	9/1/2006	NOT SAMPLED *Sites dry during both visits/sites located at only two road crossings on segment*						NA
	Chicken Creek	OIO09	38.6407	89.5025	10/17/2006							NA
	Chicken Creek	OIO09A	38.6373	89.5260	9/1/2006							NA
	Chicken Creek	OIO09A	38.6373	89.5260	10/17/2006							NA
	Cattle Creek	OIP10	38.6649	89.5170	8/31/2006	NOT SAMPLED *Site dry/no other road crossings on segment*						NA
	Cattle Creek	OIP10	38.6649	89.5170	10/17/2006	12:05	7.9	928.0	105.6	2.0	14.2	NA
	Cattle Creek	OIP10A	38.6744	89.5359	8/31/2006	NOT SAMPLED *Site dry/no other road crossings on segment*						NA
	Cattle Creek	OIP10A	38.6744	89.5359	10/17/2006							NA
South Fork Saline River/Lake of Egypt	South Fork Saline River	ATH08	37.6399	88.9281	9/26/2006	10:20	7.1	165.0	0.6	8.7	23.6	NA
	South Fork Saline River	ATH08	37.6399	88.9281	10/31/2006	11:15	6.6	213.1	10.0	8.8	19.0	NA
	South Fork Saline River	ATH14	NA	NA	9/26/2006	NOT SAMPLED *Sites located on private property and/or not accessible by roads* *No other road crossings available on segment*						NA
	South Fork Saline River	ATH14	NA	NA	10/31/2006							NA
	South Fork Saline River	ATHLEC1	NA	NA	9/26/2006							NA
	South Fork Saline River	ATHLEC1	NA	NA	10/31/2006							NA
	South Fork Saline River	ATHLEC2	37.6295	88.9465	9/26/2006	9:45	6.6	81.0	15.6	9.4	18.1	NA
	South Fork Saline River	ATHLEC2	37.6295	88.9465	10/31/2006	12:00	6.8	137.7	11.6	9.6	17.1	NA
	Briers Creek	ATHS01	37.6766	88.7178	9/11/2006	11:30	7.6	1997.0	2.0	9.1	21.3	NA
	Briers Creek	ATHS01	37.6766	88.7178	9/27/2006	9:00	7.3	1392.0	3.4	10.2	15.5	NA
	Briers Creek	ATHS01	37.6766	88.7178	10/30/2006	16:30	7.1	1281.0	19.6	9.4	13.7	NA
	Briers Creek	ATHS01	37.6766	88.7178	11/15/2006	10:25	7.0	700.1	185.3	4.6	9.4	NA
	Briers Creek	ATHS01A	37.6995	88.7257	9/11/2006	10:00	7.1	765.0	5.6	9.7	17.9	NA
	Briers Creek	ATHS01A	37.6995	88.7257	9/27/2006	11:30	7.5	817.0	1.9	9.7	17.0	NA
	Briers Creek	ATHS01A	37.6995	88.7257	11/2/2006	12:00	8.0	862.8	3.0	8.5	9.5	NA
	Briers Creek	ATHS01A	37.6995	88.7257	11/15/2006	11:10	6.8	226.1	36.3	5.4	10.2	NA
	Briers Creek	ATHS01B	37.6943	88.7245	9/11/2006	10:25	7.2	507.0	6.2	9.5	17.8	NA
	Briers Creek	ATHS01B	37.6943	88.7245	9/27/2006	10:35	6.7	500.0	0.5	9.7	17.3	NA
	Briers Creek	ATHS01B	37.6943	88.7245	11/2/2006	12:20	7.4	726.7	2.9	9.9	9.5	NA
	Briers Creek	ATHS01B	37.6943	89.7640	11/15/2006	11:30	6.8	198.9	69.1	4.0	10.0	NA
	Briers Creek	ATHS01C	37.6882	88.7195	9/11/2006	12:55	6.8	2071.0	21.5	6.3	19.0	NA
	Briers Creek	ATHS01C	37.6882	88.7195	9/27/2006	9:30	7.0	1571.0	2.2	9.8	15.1	NA
	Briers Creek	ATHS01C	37.6882	88.7195	10/31/2006	14:30	7.4	1296.0	4.5	9.4	12.0	NA
	Briers Creek	ATHS01C	37.6882	88.7195	11/15/2006	10:45	7.0	848.6	90.7	8.8	9.5	NA
	East Palzo Creek	ATHV01	37.6502	88.7608	9/11/2006	10:40	6.9	375.0	16.4	6.7	22.7	NA
	East Palzo Creek	ATHV01	37.6502	88.7608	9/27/2006	NOT SAMPLED *Site flooded over road with no safe access/no other road crossings on segment*						NA
	East Palzo Creek	ATHV01	37.6502	88.7608	10/31/2006	13:40	6.5	490.6	14.2	7.6	12.4	NA
	East Palzo Creek	ATHV01	37.6502	88.7608	11/15/2006	10:00	6.3	554.5	200.0	5.1	9.4	NA
	East Palzo Creek	ATHV01A	37.6143	88.7788	9/11/2006	8:25	7.2	1878.0	1.7	6.6	18.8	
	East Palzo Creek	ATHV01A	37.6143	88.7788	9/27/2006	NOT SAMPLED *Site dry/no other road crossings on segment*						NA
	East Palzo Creek	ATHV01A	37.6143	88.7788	10/31/2006							NA
	East Palzo Creek	ATHV01A	37.6143	88.7788	11/15/2006	9:05	6.8	158.9	81.9	9.0	9.4	NA
	East Palzo Creek	ATHV01B	37.6452	88.7635	9/11/2006	8:55	6.9	481.0	28.8	6.0	19.1	NA
	East Palzo Creek	ATHV01B	37.6452	88.7635	9/26/2006	12:30	6.2	405.0	4.6	10.9	17.4	NA
	East Palzo Creek	ATHV01B	37.6452	88.7635	10/31/2006	13:00	6.4	498.2	23.8	8.7	12.4	NA
	East Palzo Creek	ATHV01B	37.6452	88.7635	11/15/2006	9:35	6.1	435.0	243.8	5.6	9.4	NA

Table 2-2: Field Measurements

Watershed	Water body	Sample Site	Latitude	Longitude	Date	Time	pH (s.u.)	Conductivity (uS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. °C	Depth (ft)
South Fork Sangamon River/ Lake Taylorville	South Fork Sangamon River	EO13	39.4072	89.3164	8/30/2006	18:10	7.3	719.3	7.2	6.3	20.4	NA
	South Fork Sangamon River	EO13	39.4072	89.3164	11/2/2006	16:50	7.7	528.5		6.5	6.1	NA
	South Fork Sangamon River	EO13A	39.2700	89.1880	8/30/2006	19:55	7.3	754.7	7.6	9.7	21.6	NA
	South Fork Sangamon River	EO13A	39.2700	89.1880	11/2/2006	NOT SAMPLED *Miscommunication between field crews caused error in sampling*						NA
	South Fork Sangamon River	EO13B	39.3630	89.2700	8/30/2006	19:25	7.6	1112.0	60.1	8.3	21.6	NA
	South Fork Sangamon River	EO13B	39.3630	89.2700	11/2/2006	NOT SAMPLED *Miscommunication between field crews caused error in sampling*						NA
	South Fork Sangamon River	EO13C	39.4590	89.2970	8/30/2006	18:55	7.0	56.9	96.0	3.8	21.1	NA
	South Fork Sangamon River	EO13C	39.4590	89.2970	11/2/2006	16:25	8.2	954.1		5.8	6.4	NA

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Table 2-3: Data Associated with Impairment Status

Watershed	Water body	Sample Site	Date	Time	Causes of Impairment												
					pH [1]	DO [1]	Total Mn	Sulfates	TDS	Total Boron	Dissolved Zinc [6]	Dissolved Iron	Total Silver	Dissolved Copper [6]	TP	Atrazine [5]	Ammonia
					s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
Bay Creek	Cedar Creek	AJF16	9/25/2006	18:00		8.9	0.25										
			11/3/2006	11:05		11.0	0.12										
		AJF16A	9/25/2006	18:15		9.4	0.23										
			11/2/2006	13:30		11.6	0.08										
	Bay Creek Ditch	AJK01	9/25/2006	15:58		5.6	0.16										
			10/31/2006	8:15		8.2	0.05										
		AJK01A	10/31/2006	8:45		6.1	0.06										
Cahokia Creek/Holiday Shores Lake	Cahokia Diversion Ditch	JQ07	10/4/2006	16:35		5.3								ND			
			10/17/2006	14:15		9.4								ND			
		JQ01	10/4/2006	16:20		**3.4**								ND			
			10/17/2006	14:45		9.6								ND			
Cedar Creek	Big Muddy River	N99	9/7/2006	12:15		10.1		186									
			11/1/2006	9:45		7.8		75									
		N13	9/7/2006	11:15		8.1		144									
			11/1/2006	10:45		8.2		68									
	Cave Creek	NAC01	9/11/2006	11:45		7.6											
			11/1/2006	11:45		10.6											
		NAC01A	9/11/2006	11:15		**4.9**											
			11/1/2006	12:15		10.1											
Crab Orchard Lake	Crab Orchard Creek	ND11	9/6/2006	12:15	7.3	5.2	1.00										
			11/1/2006	14:00	7.7	10.1	0.26										
		ND12	9/6/2006	13:15	7.3		0.17										
			11/1/2006	15:00	7.7		ND										
		ND13	9/6/2006	15:00		6.0											
			11/1/2006	15:45		11.1											
		ND15	9/6/2006	16:30		6.8											
	Little Crab Orchard Creek	NDA01	9/6/2006	18:00		**2.1**	**2.00**										
			11/2/2006	8:30		8.2	0.20										
		NDA99	11/2/2006	10:30		12.3	0.03										
	Piles Fork	NDB03	9/7/2006	10:00		**1.6**											
			11/2/2006	9:15		10.3											
		NDB04	9/9/2006	7:40		**3.6**											
			11/2/2006	11:00		11.5											
Crooked Creek	Plum Creek	OZH-OK-A2	9/8/2006	14:00		6.8	0.65										
			10/19/2006	10:50		5.3	0.33										
		OZH-OK-A2A	9/8/2006	16:25		8.5	0.20										
			10/19/2006	11:20		9.0	0.22										
		OZH-OK-C2	9/8/2006	12:45		**1.1**											
			10/19/2006	10:15		**2.5**											
		OZH-OK-C2A	9/8/2006	17:30		**4.6**											
			10/19/2006	13:40		**3.2**											
		OZH-OK-C3	9/9/2006	15:00		**4.1**	0.30										
			10/19/2006	9:35		5.2	0.77										
	Little Crooked Creek	OJA-01	9/7/2006	17:45		**3.7**	0.14										
			10/19/2006	14:05		**4.7**	0.17										
		OJA-02	9/8/2006	11:15		**3.1**	0.14										
			10/19/2006	14:35		**3.8**	0.17										

Table 2-3: Data Associated with Impairment Status

Watershed	Water body	Sample Site	Date	Time	Causes of Impairment												
					pH[1]	DO[1]	Total Mn	Sulfates	TDS	Total Boron	Dissolved Zinc [6]	Dissolved Iron	Total Silver	Dissolved Copper [6]	TP	Atrazine [5]	Ammonia
					s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
Little Wabash	Village Creek	CE01	9/6/2006	17:30		9.9	0.17										
			11/14/2006	8:45		10.6	0.10										
		CE02	9/6/2006	15:20		7.9	0.80										
			11/9/2006	12:55		10.7	0.11										
		CE01A	9/12/2006	17:05		5.8	0.41										
			11/9/2006	13:45		11.2	0.08										
	Johnson Creek	CCAFFA1A	9/10/2006	10:50		**3.8**											
			11/14/2006	10:45		12.3											
		CCA12	9/9/2006	13:05		14.2											
			11/14/2006	9:45		7.7											
		CCA13	9/9/2006	14:30		14.9											
			11/14/2006	10:15		12.8											
		CCA14A	9/9/2006	15:25		5.7											
			11/14/2006	10:25		12.5											
	Pond Creek	CCFFD1	9/9/2006	10:30		7.1											
			10/31/2006	10:10		8.2											
		CCFFD1A	11/9/2006	12:15		11.2											
		CCFFD1B	9/9/2006	11:45		8.6											
			11/9/2006	11:35		12.1											
		CCFFD1C	9/10/2006	12:10		11.9											
			10/31/2006	11:20		14.4											
	Seminary Creek	CDGFLA1	9/8/2006	15:40		10.0											
			11/8/2006	14:45		14.3											
		CDGFLA1A	9/8/2006	13:45		**2.6**											
			11/8/2006	15:50		15.1											
		CDFGLC6	9/8/2006	12:25		6.6											
			11/8/2006	17:00		10.5											
		CDFGLC6A	9/8/2006	11:10		7.0											
			11/8/2006	16:45		12.0											
	Big Muddy Creek	CJ06	9/7/2006	18:10		**4.9**	0.54										
			11/8/2006	11:00		11.6	0.39										
		CJ05	9/7/2006	16:45		10.5	0.04										
			11/8/2006	11:30		12.4	0.07										
	Little Muddy Creek	CJA02	9/7/2006	4:20		**2.8**	**1.30**										
			11/8/2006	12:30		9.3	0.39										
		CJA01	9/12/2006	10:20		**3.4**	**1.30**										
			11/13/2006	12:00		10.1	0.17										
	Big Muddy Diversion Ditch	CJAE01	9/7/2006	12:10		9.1											
			11/8/2006	13:05		10.8											
		CJAE01A	9/7/2006	15:45		10.3											
			11/13/2006	12:30		9.8											

Table 2-3: Data Associated with Impairment Status

Watershed	Water body	Sample Site	Date	Time	Causes of Impairment												
					pH [1]	DO [1]	Total Mn	Sulfates	TDS	Total Boron	Dissolved Zinc [6]	Dissolved Iron	Total Silver	Dissolved Copper [6]	TP	Atrazine [5]	Ammonia
					s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
Little Wabash	Elm River	CD02A	9/12/2006	12:51		**3.8**											
		CD02	9/8/2006	17:45		8.1											
		CD01	4/18/2006	14:30												0.12	
			4/26/2006	11:15												0.16	
			5/1/2006	11:00												0.27	
			5/17/2006	9:30												**19.00**	
			5/24/2006	11:20												**15.00**	
			5/31/2006	11:30												8.30	
			6/7/2006	11:25												5.70	
			6/15/2006	9:50												2.80	
			6/22/2006	11:15												1.20	
			6/27/2006	9:15												4.20	
			7/5/2006	11:50												2.40	
			7/12/2006	11:30												0.92	
			7/20/2006	11:15												2.40	
			7/27/2006	11:05												2.60	
			8/1/2006	9:20												2.60	
			8/8/2006	12:20												1.60	
	Little Wabash River	C33 [4]	4/18/2006	11:00												0.55	
			4/26/2006	12:15			**0.35**									1.10	
			5/1/2006	11:45			**0.50**									0.71	
			5/10/2006	12:20			**0.41**										
			5/17/2006	14:00												**19.00**	
			5/24/2006	12:15			**0.38**									8.10	
			5/31/2006	12:40			**0.37**									**13.00**	
			6/7/2006	12:30			**0.44**									6.30	
			6/15/2006	11:05												5.30	
			6/22/2006	12:00			**0.76**									2.60	
			6/27/2006	11:50												2.50	
			7/5/2006	13:00			**0.50**									1.70	
			7/12/2006	12:30			**0.54**									1.00	
			7/20/2006	12:20			**0.46**									2.30	
			7/27/2006	12:10												0.64	
			8/1/2006	10:30												0.66	
			8/8/2006	13:30												0.50	

Table 2-3: Data Associated with Impairment Status

Watershed	Water body	Sample Site	Date	Time	Causes of Impairment												
					pH[1]	DO[1]	Total Mn	Sulfates	TDS	Total Boron	Dissolved Zinc [6]	Dissolved Iron	Total Silver	Dissolved Copper [6]	TP	Atrazine [5]	Ammonia
					s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
Little Wabash	Little Wabash River	C09	3/17/2005	8:00		14.9											
			4/19/2005	14:30		7.3											
			5/9/2005	10:30		6.7											
			6/23/2005	7:30		5.1											
			8/23/2005	13:00		**4.2**											
			9/27/2005	16:00		7.5											
			10/27/2005	14:00		8.7											
			12/6/2005	13:00		11.8											
			2/1/2006	12:30		9.3											
			3/15/2006	10:00		6.2											
			4/18/2006	16:00												0.27	
			4/26/2006	10:00									ND			0.62	
			5/1/2006	9:45									ND			0.59	
			5/10/2006	10:00									ND				
			5/17/2006	11:00									ND			**20.00**	
			5/24/2006	9:45									ND			6.30	
			5/31/2006	10:20									ND			**24.00**	
			6/7/2006	10:15									ND			4.20	
			6/15/2006	8:50									ND			1.80	
			6/22/2006	10:05									ND			1.20	
			6/27/2006	10:40									ND			1.50	
			7/5/2006	10:30									ND			1.20	
			7/12/2006	10:30									ND			0.96	
			7/20/2006	10:00									ND			1.60	
			7/27/2006	10:00									ND			0.72	
			8/1/2006	8:30									ND			0.63	
			8/8/2006	11:05									ND			0.40	
			8/18/2006	16:00									ND				
Mary's River/North Fork Cox Creek	North Fork Cox Creek	IIHA31	9/9/2006	17:10				**1610**	**3110**								
			10/18/2006	14:45				**1830**	**2830**								
		IIHA01	9/9/2006	17:40				**1850**	**3090**								
			10/18/2006	14:25				**1630**	**2540**								
		IIHA-STE1	9/9/2006	15:40					**3090**								
			10/18/2006	13:40					**1340**								
		IIHA-STC1	9/9/2006	16:15					**2530**								
			10/18/2006	14:00					**1400**								
	Maxwell Creek	IIKSPC1	9/7/2006	15:30		**2.0**											
			10/17/2006	8:20		20.2											
		IIKSPC3A	9/7/2006	15:00		**2.6**											
			10/17/2006	8:45		6.5											
	Randolph County Lake	RIB-1[3]	9/9/2006	12:00											0.04		
			10/18/2006	10:45											**0.130**		
		RIB-2 [3]	9/9/2006	14:00											0.04		
			10/18/2006	12:05											**0.053**		
		RIB-3 [3]	9/9/2006	13:00											0.04		
			10/18/2006	11:15											**0.100**		

Table 2-3: Data Associated with Impairment Status

Watershed	Water body	Sample Site	Date	Time	Causes of Impairment												
					pH[1]	DO[1]	Total Mn	Sulfates	TDS	Total Boron	Dissolved Zinc [6]	Dissolved Iron	Total Silver	Dissolved Copper [6]	TP	Atrazine [5]	Ammonia
					s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
Sangamon River/ Lake Decatur	Owl Creek	EZV01	8/30/2006	12:50		8.5											
			11/2/2006	9:25		12.2											
		EZVA1	8/30/2006	11:05		6.5											
			11/2/2006	10:33		11.8											
		EZVE1	8/30/2006	10:45		11.1											
			11/2/2006	12:59		12.5											
		EZVC1	8/30/2006	10:25		**5.0**											
			11/2/2006	12:20		11.7											
Shoal Creek	Shoal Creek	OI05	9/1/2006	12:35		9.1											
			10/17/2006	11:30		8.5											
		OI05B	9/1/2006	14:20		10.8											
			10/17/2006	11:15		8.7											
		OI05C	9/1/2006	15:40		10.2											
			10/16/2006	10:30		9.4											
	Locust Fork	OIC01	10/19/2006	12:20		**3.8**	0.18										
		OIC02	8/31/2006	17:50		9.4	0.35										
			10/17/2006	13:00		5.2	0.08										
	Cattle Creek	OIP10	10/17/2006	12:05		**2.0**			928[2]					0.021			5.8
South Fork Saline River/ Lake of Egypt	Briers Creek	ATHS01	9/11/2006	11:30	7.6	9.1	0.65	**1250**	**1960**		0.020	0.310	ND				
			9/27/2006	9:00	7.3	10.2	**2.00**	**951**	**1490**		0.022	ND	ND				
			10//2006	11:30							ND	ND					
			10/30/2006	16:30			**1.50**	**656**	**1120**		0.035	ND	ND				
			11/15/2006	10:25			**1.40**	281	469		0.028	**1.10**	ND				
		ATHS01A	9/27/2006	11:30	7.5	9.7	0.10	294	678		ND	**1.10**	ND				
			10/4/2006	10:50							ND	ND					
			11/2/2006	12:00	8.0	8.5	0.11	219	597		0.012	ND	ND				
			11/15/2006	11:10	6.8	5.4	0.12	65	213		ND	**1.40**	ND				
		ATHS01B	9/13/2006	10:40			0.18	143	418			ND	ND				
			9/27/2006	10:35	6.7	9.7	0.17	196	414		ND	ND	ND				
			10/4/2006	11:05							0.013	ND					
			11/2/2006	12:20	7.4	9.9	0.22	373	608		0.018	ND	ND				
			11/15/2006	11:30	6.8	**4.0**						**2.10**					
		ATHS01C	9/11/2006	12:55			**8.70**	**1290**	**2150**			**5.00**	ND				
			9/27/2006	9:30	7.0	9.8	**4.10**	**1100**	**1660**		ND	0.78	ND				
			10/4/2006	11:20							ND	**2.20**					
			10/31/2006	14:30	7.4	9.4	**1.90**	**691**	**1190**		ND	0.17	ND				
			11/15/2006	10:45	7.0	8.8	0.93	338	667		ND	0.470	ND				

Table 2-3: Data Associated with Impairment Status

Watershed	Water body	Sample Site	Date	Time	pH(1)	DO(1)	Total Mn	Sulfates	TDS	Total Boron	Dissolved Zinc (6)	Dissolved Iron	Total Silver	Dissolved Copper (6)	TP	Atrazine (5)	Ammonia
					Causes of Impairment												
					s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L
South Fork Saline River/ Lake of Egypt	East Palzo Creek	ATHV01A	9/11/2006	10:40	6.9	6.7	**1.40**		**1560**			ND					
			10/31/2006	13:40	6.5	7.6	**1.80**		375			0.160		ND			
			11/15/2006	10:00	**6.3**	5.1	0.09		211			**2.60**		ND			
		ATHV01	9/11/2006	10:40	6.9	6.7	0.38		262			ND					
			10/4/2006	12:30								0.13		ND			
			10/31/2006	13:40	6.5	7.6	**1.80**		375			0.16		ND			
			11/15/2006	10:00	**6.3**	5.1	**2.10**		324			0.340		ND			
		ATHV01B	9/11/2006	8:55	6.9	6.0	0.41		388			ND					
			9/26/2006	12:30	**6.2**	10.9	1.00		323			ND		ND			
			10/4/2006	11:50								ND		ND			
			10/31/2006	13:00	**6.4**	8.7	**1.60**		341			ND		ND			
			11/15/2006	9:35	**6.1**	5.6	**1.60**		225			0.100		ND			
	South Fork Saline River	ATHLEC2	9/26/2006	9:45		9.4											
			10/31/2006	12:00		9.6											
		ATH08	9/26/2006	10:20		8.7											
			10/31/2006	11:15		8.8											
South Fork Sangamon River/ Lake Taylorville	South Fork Sangamon River	EO13A	8/30/2006	19:55		9.7	0.61			0.05							
		EO13	8/30/2006	18:10		6.3	0.49			0.20							
			11/2/2006	16:50		6.5	0.33			0.08							
		EO13B	8/30/2006	19:25		8.3	**1.18**			0.20							
		EO13C	8/30/2006	18:55		**3.8**	**5.49**			0.27							
			11/2/2006	16:25		5.8	0.38			0.13							

Shaded cells indicate exceedances of the applicable water quality standard

1 pH and DO values in this table represent field parameters sampled using the In-Site 9500 Profiler. Continuous DO and pH data are available in Appendix D.

2 Value shown is for conductivity. TDS standard corresponds to 1667 uS/cm specific conductance

3 Values shown were collected at one-foot depth.

4 Segment C33 is a source of public water. Therefore the applicable manganese standard is 150 ug/L.

5 Chronic criteria for atrazine is 9 ug/L and a single exceedance of this value indicates a potential cause of impairment

6 Corresponding hardness values were used to calculate standards. Analytical data can be found in Appendix C.

Section 3
Quality Assurance Review

A review was conducted to assess the quality and usability of data generated from Stage 2 work activities and to review compliance with the original sampling plan and objectives developed for the QAPP. Field and laboratory methods were deemed in accordance with the QAPP. Minor deviations from the original plan occurred and all are discussed below.

3.1 Deviations from original Sampling Plan (QAPP)

The following issues and/or concerns developed during the sampling events:

- Sampling during the week of September 25th followed a heavy precipitation event which resulted in high stream flows and flooding at Bay Creek Ditch segment AJK01A and East Palzo Creek segment ATHV01.
- In-field filtering was not performed for dissolved phosphorus or dissolved metal samples. Illinois EPA requested additional information on this procedure. CDM along with ARDL, Inc drafted text for Illinois EPA to validate this sampling practice. Total versus dissolved samples are discussed further in section 3.2.2.
- All locations on Chicken Creek (OIO09) were dry during both sample periods; therefore no samples were collected for this segment.
- The following sites had no water during either sampling event: Maxwell Creek IIKSPA1 and IIKSPE1A, and Cattle Creek OIP10A. Alternate locations were not found.
- Access was not available to the following sites during either sampling event: Shoal Creek OIO5A, South Fork Saline River sites ATH14 and ATHLEC1. Alternate locations were not found.
- Site EZVA1 on Owl Creek was moved from the location proposed in the QAPP to the intersection of Owl Creek and County Road 3100 due to better stream flow.
- Only one round of sampling was conducted at the following sites due to access or water volume issues (refer to Table 2-2 for specific dates and issues): Locust Fork OIC01, Cattle Creek OIP10, Crab Orchard Creek ND15, Little Crab Orchard Creek NDA99, Pond Creek CCFFD1A, East Palzo Creek ATHV01 and ATHV01A, and Bay Creek Ditch AJK01A.
- Due to field crew error only one round of sampling was conducted at South Fork Sangamon River EO13A and EO13B and Elm River locations CD02 and CD02A.

3.2 Data Verification and Validation

A data quality review was performed on all laboratory data. The review consisted of an evaluation of laboratory QC and field QC samples. Laboratory QC included an evaluation of method blanks, matrix spikes, matrix spike duplicates, laboratory control samples and holding times. Field QC included an evaluation of field duplicates. No decontamination rinsate blanks were collected.

No laboratory violation resulted in the qualification of CDM collected data. While some matrix spikes had percent recoveries outside of the established limits, all other QC associated with the samples were acceptable. When a matrix spike was reported outside of the control limits, the laboratory control samples had percent recoveries within the established control limits, indicating a matrix effect on the sample analysis and no need to qualify the data. All samples were analyzed within the control limits.

An evaluation of the phosphorus data (total versus dissolved) was performed to determine the effects of filtering the samples immediately versus waiting up to 48 to 64 hours. All samples were received by the laboratories on ice and at 4^0C (+/-). A total of 161 samples have been analyzed for both total and dissolved phosphorus by method 365.2. Of the 161 samples, a total of 10 samples sets had a phosphorus concentration of greater than 1 mg/L (100 times higher than the reporting limit and considered significant when controlling based on RPDs). One of these samples had relative percent difference (RPD) between the total and dissolved fraction of the sample of greater than 100. Precision values of less that 25 % RPD are considered acceptable for sample results reported significantly above the reporting limit. Sample EO13C had total phosphorus measured at 2.09 mg/L and dissolved phosphorus measured at 0.52 mg/L. The TSS measured in this sample was 159 mg/L. The suspended solids contained in this sample may have absorbed the available phosphorus, but all other results in samples with phosphorus concentrations above 1mg/L show that this reaction is not taking place. Sampling or analytical variations may explain the elevated RPD between the sample and the duplicate. Total phosphorus and dissolved phosphorus results for samples with phosphorus concentrations above 1 mg/L are not significantly different.

Looking at all other results, there does not appear to be a correlation between the difference of total and dissolved phosphorus and the TSS concentration. Suspended solids absorbing dissolved phosphorus would be the likely mechanism for lowering the dissolved phosphorus concentrations. Based on the lack of this correlation, dissolved phosphorus concentration would not be significantly different if the samples were filtered immediately versus filtering at the laboratory 48-hours after collection.

Finally, field and laboratory quality control data were collected to assess bias associated between field and laboratory methods. Positive sample results and relative percent difference (RPD) are presented in Table 3-1.

3.3 Data Quality Objectives

The data generated during the Stage 2 investigation conformed to the data quality objectives established in the QAPP. A completeness criterion of 90% was established and easily achieved. No data have been qualified that were collected by CDM personnel and analyzed by ARDL, Inc or Prairie Analytical laboratories. Data qualifiers were applied to some of the data collected by Illinois EPA personnel. All qualifiers are included with the laboratory data contained in Appendix C.

Table 3-1: Duplicate Pair Sample Results

SampleLocation	Parameter	Result	Units	Collection Date	RPD(%)
AJK01-DUP	Solids, total suspended	24.2	MG/L	9/25/2006	
AJK01	Solids, total suspended	25	MG/L	9/25/2006	3.252033
ATHS01A-DUP	Hardness (CA/MG)	435.1	MG CACO3/L	11/2/2006	
ATHS01A	Hardness (CA/MG)	445	MG CACO3/L	11/2/2006	2.249744
ATHS01A-DUP	Solids, total dissolved	604	MG/L	11/2/2006	
ATHS01A	Solids, total dissolved	597	MG/L	11/2/2006	-1.1657
ATHS01A-DUP	Chloride	5.13	MG/L	9/27/2006	
ATHS01A	Chloride	5.1	MG/L	9/27/2006	-0.64556
ATHS01A-DUP	Solids, total dissolved	675	MG/L	9/27/2006	
ATHS01A	Solids, total dissolved	678	MG/L	9/27/2006	0.443459
ATHS01A-DUP	Sulfate	290.63	MG/L	9/27/2006	
ATHS01A	Sulfate	294	MG/L	9/27/2006	1.154242
ATHS01C-DUP	Chloride	5.38	MG/L	9/11/2006	
ATHS01C	Chloride	5.4	MG/L	9/11/2006	0.388903
ATHS01C-DUP	Sulfate	1297.83	MG/L	9/11/2006	
ATHS01C	Sulfate	1290	MG/L	9/11/2006	-0.60514
ATHS01-FIELDDUP	Alkalinity	113	MG/L	10/30/2006	
ATHS01	Alkalinity	108	MG/L	10/30/2006	-4.52489
ATHS01-FIELDDUP	Chloride	4.9	MG/L	10/30/2006	
ATHS01	Chloride	4.9	MG/L	10/30/2006	0
ATHS01-FIELDDUP	Hardness (CA/MG)	673	MG CACO3/L	10/30/2006	
ATHS01	Hardness (CA/MG)	668	MG CACO3/L	10/30/2006	-0.74571
ATHS01-FIELDDUP	Iron	68200	MG/KG	10/30/2006	
ATHS01	Iron	93800	MG/KG	10/30/2006	31.60494
ATHS01-FIELDDUP	Manganese	1130	MG/KG	10/30/2006	
ATHS01	Manganese	1480	MG/KG	10/30/2006	26.81992
ATHS01-FIELDDUP	Manganese	1.5	MG/L	10/30/2006	
ATHS01	Manganese	1.5	MG/L	10/30/2006	0
ATHS01-FIELDDUP	Nitrate-Nitrite	0.06	MG/L	10/30/2006	
ATHS01	Nitrate-Nitrite	0.06	MG/L	10/30/2006	-11.9658
ATHS01-FIELDDUP	Phosphorus, diss	0.05	MG/L	10/30/2006	
ATHS01	Phosphorus, diss	0.05	MG/L	10/30/2006	8.163265
ATHS01-FIELDDUP	Phosphorus, total	0.04	MG/L	10/30/2006	
ATHS01	Phosphorus, total	0.03	MG/L	10/30/2006	-26.8657
ATHS01-FIELDDUP	Solids, total	69.7	%	10/30/2006	
ATHS01	Solids, total	74.5	%	10/30/2006	6.65742
ATHS01-FIELDDUP	Solids, total dissolved	1040	MG/L	10/30/2006	
ATHS01	Solids, total dissolved	1070	MG/L	10/30/2006	2.843602
ATHS01-FIELDDUP	Solids, total suspended	4.3	MG/L	10/30/2006	
ATHS01	Solids, total suspended	5.6	MG/L	10/30/2006	26.26263
ATHS01-FIELDDUP	Sulfate	662	MG/L	10/30/2006	
ATHS01	Sulfate	604	MG/L	10/30/2006	-9.16272
ATHS01-FIELDDUP	Zinc	106	MG/KG	10/30/2006	
ATHS01	Zinc	116	MG/KG	10/30/2006	9.009009
ATHS01-FIELDDUP	Zinc, diss	0.02	MG/L	10/30/2006	
ATHS01	Zinc, diss	0.03	MG/L	10/30/2006	8.333333
ATHS01-DUP	Alkalinity	60.9	MG/L	11/15/2006	
ATHS01	Alkalinity	56.8	MG/L	11/15/2006	-6.96686
ATHS01-DUP	Hardness (CA/MG)	340.14	MG CACO3/L	11/15/2006	
ATHS01	Hardness (CA/MG)	337	MG CACO3/L	11/15/2006	-0.92743
ATHS01-DUP	Solids, total dissolved	481	MG/L	11/15/2006	

Table 3-1: Duplicate Pair Sample Results (continued)

SampleLocation	Parameter	Result	Units	Collection Date	RPD(%)
ATHS01	Solids, total suspended	151	MG/L	11/15/2006	-104.43
ATHS01-DUP	Hardness (CA/MG)	1035.17	MG CACO3/L	9/27/2006	
ATHS01	Hardness (CA/MG)	1030	MG CACO3/L	9/27/2006	-0.50069
ATHV01B-DUP	Alkalinity	15.3	MG/L	9/26/2006	
ATHV01B	Alkalinity	15.3	MG/L	9/26/2006	0
ATHV01B-DUP	Solids, total	72.5	%	9/26/2006	
ATHV01B	Solids, total	71.9	%	9/26/2006	-0.83102
CCFFD1-DUP	Chlorophyll	5.5	MG/CU.M.	9/9/2006	
CCFFD1	Chlorophyll	5	MG/CU.M.	9/9/2006	-9.52381
CE01A-DUP	Solids, total suspended	134	MG/L	9/12/2006	
CE01A	Solids, total suspended	137	MG/L	9/12/2006	2.214022
CJA02-DUP	Biological Oxygen Demand	4	MG/L	11/8/2006	
CJA02	Biological Oxygen Demand	3.7	MG/L	11/8/2006	-7.79221
EO13-DUP	Biological Oxygen Demand	6.3	MG/L	11/2/2006	
EO13	Biological Oxygen Demand	6.3	MG/L	11/2/2006	0
EO13-DUP	Solids, total suspended	8.4	MG/L	11/2/2006	
EO13	Solids, total suspended	7.6	MG/L	11/2/2006	-10
IIAA01-DUP	Chloride	21.71	MG/L	9/9/2006	
IIAA01	Chloride	21.7	MG/L	9/9/2006	-0.0258
IIAA01-DUP	Sulfate	1832.11	MG/L	9/9/2006	
IIAA01	Sulfate	1850	MG/L	9/9/2006	0.971725
IIHA01-DUP	Chloride	21.71	MG/L	9/9/2006	
IIHA01	Chloride	21.7	MG/L	9/9/2006	-0.0258
IIHA01-DUP	Sulfate	1832.11	MG/L	9/9/2006	
IIHA01	Sulfate	1850	MG/L	9/9/2006	0.971725
IIHA31-DUP	Hardness (CA/MG)	1290.87	MG CACO3/L	9/9/2006	
IIHA31	Hardness (CA/MG)	1300	MG CACO3/L	9/9/2006	0.704783
IIHA31-DUP	Hardness (CA/MG)	1306.27	MG CACO3/L	10/18/2006	
IIHA31	Hardness (CA/MG)	1280	MG CACO3/L	10/18/2006	-2.0315
IIHA31-DUP	Chloride	19.5	MG/L	10/18/2006	
IIHA31	Chloride	19.4	MG/L	10/18/2006	-0.51363
IIHA31-DUP	Solids, total dissolved	2850	MG/L	10/18/2006	
IIHA31	Solids, total dissolved	2830	MG/L	10/18/2006	-0.70423
IIHA31-DUP	Sulfate	1783.35	MG/L	10/18/2006	
IIHA31	Sulfate	1830	MG/L	10/18/2006	2.582091
IIHA-STE1-DUP	Solids, total dissolved	3100	MG/L	9/9/2006	
IIHA-STE1	Solids, total dissolved	3090	MG/L	9/9/2006	-0.3231
IIKSPC3A-DUP	Biological Oxygen Demand	11	MG/L	9/7/2006	
IIKSPC3A	Biological Oxygen Demand	11	MG/L	9/7/2006	0
JQ01-DUP	Chlorophyll	11.8	MG/CU.M.	8/31/2006	
JQ-01	Chlorophyll	13.2	MG/CU.M.	8/31/2006	11.2
JQ01-DUP	Hardness (CA/MG)	221.3	MG CACO3/L	8/31/2006	
JQ-01	Hardness (CA/MG)	221	MG CACO3/L	8/31/2006	-0.13565
ND11-DUP	Solids, total suspended	16.2	MG/L	11/1/2006	
ND11	Solids, total suspended	15	MG/L	11/1/2006	-7.69231
ND11-DUP	Alkalinity	90.2	MG/L	9/6/2006	
ND11	Alkalinity	90.2	MG/L	9/6/2006	0
NDA01-DUP	Solids, total suspended	18.2	MG/L	9/6/2006	
NDA01	Solids, total suspended	16.6	MG/L	9/6/2006	-9.1954
NDB04-DUP	Chlorophyll	26.9	MG/CU.M.	11/2/2006	
NDB04	Chlorophyll	25.7	MG/CU.M.	11/2/2006	-4.56274
OI05C-DUP	Biological Oxygen Demand	4.6	MG/L	9/1/2006	
OI05C	Biological Oxygen Demand	5.1	MG/L	9/1/2006	10.30928
OIC02-DUP	Solids, total suspended	14	MG/L	8/31/2006	
OIC02	Solids, total suspended	13.7	MG/L	8/31/2006	-2.16606
OIC02-DUP	Solids, total suspended	18.5	MG/L	10/17/2006	

Table 3-1: Duplicate Pair Sample Results (continued)

SampleLocation	Parameter	Result	Units	Collection Date	RPD(%)
OIC02	Solids, total suspended	16.8	MG/L	10/17/2006	-9.63173
OIP10-DUP	Hardness (CA/MG)	278.52	MG CACO3/L	10/17/2006	
OIP10	Hardness (CA/MG)	286	MG CACO3/L	10/17/2006	2.650039
OZH-OK-A2A-DUP	Chlorophyll	155.4	MG/CU.M.	9/8/2006	
OZH-OK-A2A	Chlorophyll	126	MG/CU.M.	9/8/2006	-20.8955

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Section 4
Conclusions

Data collected during Stage 2 have been deemed adequate and usable for Stage 3 TMDL development (see discussion in Section 3). Table 4-1 contains information for each segment sampled during Stage 2 with regards to its impairment status. The table contains information on the number of historic samples available prior to Stage 2 data collection, the number of historic violations as well as the date of the last recorded violation. The intention of this table is to assist any future determination on the impairment status of the Stage 2 stream segments.

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Table 4-1: Impairment Status

Watershed	Stream Name	Segment	Parameter of Concern	Historic Data Count	Number of Historic Violations	Date of Last Recorded Violation	Stage 2 Data Count	Number of Violations	Suggested Status
Bay Creek	Cedar Creek	AJF16	Dissolved Oxygen	1	1	2000	Continuous	0	Delist
			Manganese	1	0	-	4	0	Delist
	Bay Creek Ditch	AJK01	Dissolved Oxygen	3	3	1987	Continuous	Multiple	Impaired
			Manganese	3	3	1987	3	0	Delist
Cahokia Creek/ Holiday Shores Lake	Cahokia Diversion Ditch	JQ07	Dissolved Oxygen	147	130	2005	Continuous	Multiple	Impaired
			Copper	5	1	1998	4	0	Delist
Cedar Creek	Big Muddy River	N99	Dissolved Oxygen	3	1	2002	Continuous	*	Impaired
			Sulfates	3	0	-	4	0	Delist
	Cave Creek	NAC01	Dissolved Oxygen	2	1	1995	Continuous	1	Impaired
Crab Orchard Lake	Crab Orchard Creek	ND11	Dissolved Oxygen	2	1	2000	Continuous	Multiple	Impaired
			Manganese	2	2	2000	2	0	Delist
			pH	3	2	2004	Continuous	Multiple	Impaired
	Crab Orchard Creek	ND12	pH	3	1	2004	Continuous	0	Delist
			Manganese	2	1	2000	2	0	Delist
	Crab Orchard Creek	ND13	Dissolved Oxygen	4	4	2000	Continuous	Multiple	Impaired
	Little Crab Orchard Creek	NDA01	Dissolved Oxygen	2	1	1995	Continuous	Multiple	Impaired
			Manganese	2	1	1995	3	1	Impaired
	Piles Fork	NDB03	Dissolved Oxygen	2	1	1995	Continuous	Multiple	Impaired
Crooked Creek	Plum Creek	OZH-OK-A2	Dissolved Oxygen	1	1	2002	Continuous	Multiple	Impaired
	Plum Creek		Manganese	1	1	2002	4	0	Delist
	Plum Creek	OZH-OK-C2	Dissolved Oxygen	1	1	2002	Continuous	Multiple	Impaired
	Plum Creek	OZH-OK-C3	Dissolved Oxygen	1	1	2002	Continuous	Multiple	Impaired
	Plum Creek		Manganese	1	1	2002	2	0	Delist
	Little Crooked Creek	OJA-01	Dissolved Oxygen	5	4	2002	Continuous	Multiple	Impaired
			Manganese	5	2	2002	4	0	Delist

Table 4-1: Impairment Status

Watershed	Stream Name	Segment	Parameter of Concern	Historic Data Count	Number of Historic Violations	Date of Last Recorded Violation	Stage 2 Data Count	Number of Violations	Suggested Status
Little Wabash	Little Wabash River	C09	Dissolved Oxygen	43	7	2003	Continuous	Multiple	Impaired
			Silver	43	1	2002	18	0	Delist
			Atrazine	2	1	1991	16	2	Impaired
		C33	Dissolved Oxygen	5	3	2002	Continuous	Multiple	Impaired
			Manganese	5	5	2002	10	10	Impaired
			Atrazine	NA	NA	NA	16	2	Impaired
	Village Creek	CE01	Dissolved Oxygen	1	0	NA	Continuous	Multiple	Impaired
			Manganese	1	1	2002	6	0	Delist
	Johnson Creek	CCAFFA1	Dissolved Oxygen	1	1	1997	Continuous	Multiple	Impaired
	Pond Creek	CCFFD1	Dissolved Oxygen	1	1	1997	Continuous	Multiple	Impaired
	Elm River	CD01	Atrazine	8	3	2002	16	2	Impaired
		CD02	Dissolved Oxygen	3	2	2003	Continuous	Multiple	Impaired
	Seminary Creek	CDGFLA1	Dissolved Oxygen	1	1	1998	Continuous	Multiple	Impaired
	Seminary Creek	CDFGLC6	Dissolved Oxygen	1	1	1998	Continuous	Multiple	Impaired
	Big Muddy Creek	CJ06	Dissolved Oxygen	3	1	2002	Continuous	Multiple	Impaired
			Manganese	2	1	2002	6	0	Delist
	Little Muddy Creek	CJA02	Dissolved Oxygen	4	3	2002	Continuous	Multiple	Impaired
			Manganese	4	3	2002	4	2	Impaired
	Big Muddy Diversion Ditch	CJAE01	Dissolved Oxygen	1	0	2000	Continuous	Multiple	Impaired
Mary's River/ North Fork Cox Creek	North Fork Cox Creek	IIHA31	Sulfates	2	2	1995	4	4	Impaired
			TDS	2	2	1995	4	4	Impaired
	North Fork Cox Creek	IIHA-STC1	TDS	1	1	1995	4	2	Impaired
	Maxwell Creek	IIKSPC1A	Dissolved Oxygen	2	2	19999	Continuous	Multiple	Impaired
	Randolph County Lake	RIB	Total Phosphorus	11	3	1993	6	2	Impaired
Sangamon River/ Lake Decatur	Owl Creek	EZV	Dissolved Oxygen	3	1	1998	Continuous	Multiple	Impaired

Table 4-1: Impairment Status

Watershed	Stream Name	Segment	Parameter of Concern	Historic Data Count	Number of Historic Violations	Date of Last Recorded Violation	Stage 2 Data Count	Number of Violations	Suggested Status
Shoal Creek	Shoal Creek	OI05	Dissolved Oxygen	3	1	2002	Continuous	0	Delist
	Locust Fork	OIC01	Dissolved Oxygen	3	1	1991	Continuous	Multiple	Impaired
			Manganese	3	1	1991	2	0	Delist
	Chicken Creek	OIO09	Dissolved Oxygen	2	1	1991	0	0	No Water
	Cattle Creek	OIP10	Dissolved Oxygen	3	2	1991	Continuous	Multiple	Impaired
			Ammonia	3	1	1991	1	0	Delist
			TDS	3	1	1991	1	0	Delist
South Fork Saline River/ Lake of Egypt	Briers Creek	ATHS01	Zinc	2	2	1993	13	0	Delist
			Iron	3	3	1993	16	3	Impaired
			Manganese	3	3	1993	8	4	Impaired
			Silver	3	1	1993	12	0	Delist
			Sulfates	3	3	1993	16	6	Impaired
			TDS	2	1	1993	16	9	Impaired
			pH	3	3	1993	Continuous	0	Delist
			Dissolved Oxygen	2	1	1993	Continuous	1	Impaired
	East Palzo Creek	ATHV01	Copper	3	2	1993	5	0	Delist
			Iron	3	3	1993	7	1	Impaired
			Manganese	3	3	1993	7	3	Impaired
			TDS	0		-	7	1	Impaired
			pH	3	3	1993	Continuous	Multiple	Impaired
	South Fork Saline River	ATH14	Dissolved Oxygen	8	1	2000	Continuous	0	Delist
South Fork Sangamon/ Lake Taylorville	South Fork Sangamon River	EO13	Dissolved Oxygen	1	1	1989	Continuous	Multiple	Impaired
			Boron	1	1	1989	6	0	Delist
			Manganese	1	1	1989	6	2	Impaired

* Continuous data did not violate the 5.0 mg/L instantaneous DO standard, however, continuous data collected at site N13 experienced more than 16 hours below 6.0 mg/L in a 24 hour period

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STAGE 2 APPENDICES AVAILABLE UPON REQUEST
CONTACT Illinois EPA at 217-782-3362

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Appendix G
South Fork Sangamon River
QUAL2K Files

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APPENDIX G
SOUTH FORK SANGAMON RIVER
QUAL2K INPUTS

	Results (Collected in August of 2006)	
Headwaters - EO13B	**8/30/2006**	**Units needed for model**
Flow	0.002	m3/second
Temperature	21.6	C
DO	8.3	mg/L
CBOD	4.83	mgO2/L
Organic Nitrogen	526	ugN/L
Ammonia	NA	ugN/L
Nitrate	82	ugN/L
Organic Phosphorus	71	ugP/L
Inorganic Phosphorus	25	ugP/L
Chlorophyll-a	41.4	ugA/L

	Location				
Reach	Upstream (km)	Downstream (km)	Length	Slope	
EO13B	32.23	16.66	15.57	0.976236352	
EO13	16.66	3.67	12.99	0.762124711	
EO13C	3.67	0	3.67	0.136239782	
Elevation					
Upstream (m)	Downstream (m)				
205.7	190.5				
190.5	180.6				
180.6	180.1				
Downstream					
Lat - Degrees	Lat - Minutes	Lat - Seconds	Long - Degrees	Long - Minutes	Long - Seconds
39	22	14.1	-89	18	28.3
39	26	34.4	-89	18	41.8
39	27	44.3	-89	17	38.4

APPENDIX G
SOUTH FORK SANGAMON RIVER
QUAL2K INPUTS

Point Source Data: T:\GIS\15 Sangamon River-S Fork_Taylorville Lake\Data\DMR\Sang-Taylorville DMR Data 6-28-05.xls

Point Sources	**Permit Number**	***NO DISCHARGE FOR AUGUST 2006**			
Olhman STP*	IL0032671	Location (km)	25.5		
	Min	**Max**	**Mean**	**Permit Limits**	**Units needed for model**
Flow (cms)	0.00017525	0.000876252	0.000449079	0.001095	m3/second
Temperature	N/A	N/A	N/A		C
DO	3	12	7.975	6	mg/L
CBOD	3.1	19	6.7375	25	mgO2/L
Organic N	N/A	N/A	N/A		ugN/L
Ammonia	N/A	N/A	N/A		ugN/L
NO2+NO3	N/A	N/A	N/A		ugN/L
Organic P	N/A	N/A	N/A		ugP/L
Inorganic P	N/A	N/A	N/A		ugP/L

Nokomis Quarry	ILG840055	Location (km)	15.4	***NO DISCHARGE FOR AUGUST 2006**	
	Min	**Max**	**Mean**	**Permit Limits**	**Units needed for model**
Flow (cms)	0.000876	1.209228	0.130239		m3/second
Temperature	NA	NA	NA		C
DO	NA	NA	NA		mg/L
CBOD	NA	NA	NA		mgO2/L
Organic N	NA	NA	NA		ugN/L
Ammonia	NA	NA	NA		ugN/L
NO2+NO3	NA	NA	NA		ugN/L
Organic P	NA	NA	NA		ugP/L
Inorganic P	NA	NA	NA		ugP/L

Christian County Limestone	ILG840105	Location (km)	9.6	***NO DISCHARGE FOR AUGUST 2006**	
	Min	**Max**	**Mean**	**Permit Limits**	**Units needed for model**
Flow (cms)	0.001008	0.146509	0.011674	0.006572	m3/second
Temperature	NA	NA	NA		C
DO	NA	NA	NA		mg/L
CBOD	NA	NA	NA		mgO2/L
Organic N	NA	NA	NA		ugN/L
Ammonia	NA	NA	NA		ugN/L
NO2+NO3	NA	NA	NA		ugN/L
Organic P	NA	NA	NA		ugP/L
Inorganic P	NA	NA	NA		ugP/L

APPENDIX G:
SOUTH FORK SANGAMON RIVER
QUAL2K INPUTS

Sampling Location	Lat - Degrees	Lat - Minutes	Lat - Seconds
EO13	39	24	26.2
EO13A	39	21	55.7
EO13B	39	21	47
EO13C	39	27	30.6

Sampling Location	Long - Degrees	Long - Minutes	Long - Seconds	Location (km)
EO13	-89	18	58	9.5
EO13A	-89	11	15.4	30.8
EO13B	-89	16	10.4	21.3
EO13C	-89	17	48.8	0.6

Sampling Location	**Min Flow**	**Max Flow**	**Avg. Flow**	**Flow on Aug 30**	**Change In Flow**
EO13A	0.000	2.836	0.032	0.00013	
EO13B	0.000	34.932	0.392	0.00164	0.002
EO13	0.000	39.634	0.445	0.00186	0.000
EO13C	0.000	52.995	0.595	0.00249	0.001

Depth Estimates	Width Estimates	Flow Estimate	Estimated Velocity
0.0508	4.27	0.00164	0.015126953
0.3050	7.3	0.00186	0.001673222
1.5250	19.52	0.00249	0.000167336

Diffuse Concentrations	(sample site EO13B - 8/30/2006)
Temperature	21.6
DO	8.3
CBOD	4.83
Organic N	526
Ammonia	0
Nitrate	82
Organic P	71
Inorganic P	0
chlorophyll-a	41.4

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Appendix H
Manganese Analysis

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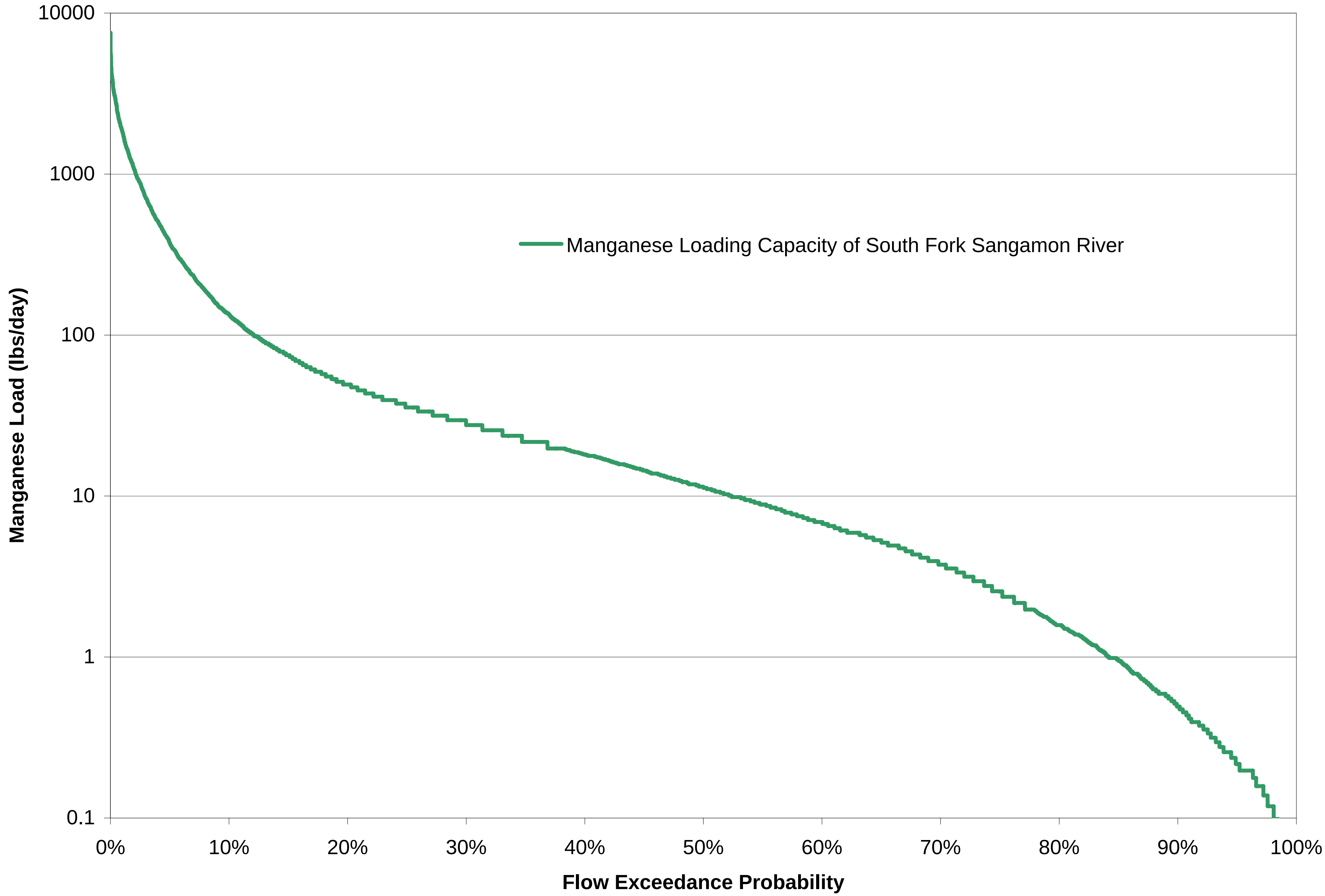
APPENDIX H:
MANGANESE ANALYSIS
SOUTH FORK SANGAMON RIVER



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Appendix I
Lake Taylorville
BATHTUB Model Files

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APPENDIX I:
BATHTUB FILES
LAKE TAYLORVILLE

Title: **Lake Taylorville**
Notes:

	Historic Data	Units	Model Input	Model units
Averaging Period:	NA		1	yr
Precipitation	36.2	inches	0.91948	meters
Evaporation	33.2	inches	0.84328	meters
Increase in Storage	NA	NA		meters
Atmospheric Loads	NA	NS		

	inches to meters
Conversions:	0.0254

APPENDIX I:
BATHTUB FILES
LAKE TAYLORVILLE

Number of Tributaries 5

Tributary Name:	South Fork Sangamon River				
Segment:	Segment 1: REC-3				
Tributary Type:	Monitored Inflow				
	Historic Data	Units	Model Input	Model units	Notes
Total Watershed Area			175.782493	km2	
Flow Rate		cfs	47.091	million meters3/yr	
TP Conc		mg/L	609	ug/L	

Tributary Name:	Locust/Cottonwood				
Segment:	Segment 1: REC-3				
Tributary Type:					
	Historic Data	Units	Model Input	Model units	Notes
Total Watershed Area			81.1572774	km2	
Flow Rate		cfs	21.7415441	million meters3/yr	
TP Conc		mg/L	609	ug/L	

Tributary Name:	Overland Flow to REC-3				
Segment:	Segment 1: REC-3				
Tributary Type:					
	Historic Data	Units	Model Input	Model units	Notes
Total Watershed Area			43.131072	km2	
Flow Rate		cfs	11.5545535	million meters3/yr	
TP Conc		mg/L	609	ug/L	

Tributary Name:	Overland Flow to REC-2				
Segment:	Segment 2: REC-2				
Tributary Type:					
	Historic Data	Units	Model Input	Model units	Notes
Total Watershed Area			9.78497508	km2	
Flow Rate		cfs	2.62133568	million meters3/yr	
TP Conc		mg/L	609	ug/L	

Tributary Name:	Overland Flow to REC-1				
Segment:	Segment 3: REC-1				
Tributary Type:					
	Historic Data	Units	Model Input	Model units	Notes
Total Watershed Area			13.1519596	km2	
Flow Rate		cfs	3.52333049	million meters3/yr	
TP Conc		mg/L	609	ug/L	

APPENDIX I:
BATHTUB FILES
LAKE TAYLORVILLE

Internal Loads	
Segment 1	15
Segment 2	15
Segment 3	15

Loadings	Observed	Predicted
Segment 1-REC-3	286.8	276.7
Segment 2-REC-2	229.1	238.3
Segment 3- REC-1	187.6	188.3
Area-Wtd Mean	243.0	240.5

Current Load Component: — **Predicted TOTAL P**

Trb	**Type**	**Seg**	**Name**	**Load kg/yr**	**%Total**
1	1	1	South Fork Sangamon	28683.9	35.4%
2	1	1	Locust	13239.7	16.3%
3	1	1	Segment 3-DF	7034.0	8.7%
4	1	2	Segment 2-DF	1595.6	2.0%
5	1	3	Segment 1-DF	2143.7	2.6%
PRECIPITATION				154.5	0.2%
INTERNAL LOAD				28215.6	34.8%
TRIBUTARY INFLOW				52696.8	65.0%
***TOTAL INFLOW				81066.8	100.0%
ADVECTIVE OUTFLOW				16305.7	20.1%
***TOTAL OUTFLOW				16305.7	20.1%
***RETENTION				64761.2	79.9%

APPENDIX I:
BATHTUB FILES
LAKE TAYLORVILLE

	Percent Reduction												
Tributary Concentrations		80	85	**86**	87	88	89	90	91	92	93	**94**	95	100
	609	121.8	91.35	85.26	79.17	73.08	66.99	60.9	54.81	48.72	42.63	**36.54**	30.45	0
Internal Loading														
	15	3	2.25	**2.1**	1.95	1.8	1.65	1.5	1.35	1.2	1.05	0.9	0.75	0

Change Segment Concentrations to 50

Overall Mass Balance Based Upon Component:

Trb	Type	Seg	Name	Predicted TOTAL P Load kg/yr	%Total
1	1	1	South Fo	1721.0	23.7%
2	1	1	Locust	794.4	10.9%
3	1	1	Segmen	422.0	5.8%
4	1	2	Segmen	95.7	1.3%
5	1	3	Segmen	128.6	1.8%
PRECIPITATION				154.5	2.1%
INTERNAL LOAD				3950.2	54.4%
TRIBUTARY INFLOW				3161.8	43.5%
***TOTAL INFLOW				7266.5	100.0%
ADVECTIVE OUTFLOW				4190.4	57.7%
***TOTAL OUTFLOW				4190.4	57.7%
***RETENTION				3076.1	42.3%

Table 2-7 TMDL Summary for Walnut Point Lake

Load Source	LC (lb/day)	WLA (lb/day)	LA (lb/day)	MOS (lb/day)	Current Load (lb/day)	Reduction Needed (lb/day)	Reduction Needed (percent)
Total	43	0	43	0	488.8	445.8	91%
Internal	23.9	0	23.9	0	170.4	146.5	86%
External	19.1	0.21	18.89	0	318.4	299.3	94%

APPENDIX I:
BATHTUB FILES
LAKE TAYLORVILLE

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Overall Water & Nutrient Balances

Overall Water Balance — **Averaging Period = 1.00 years**

Trb	Type	Seg	Name	Area km^2	Flow hm^3/yr	Variance (hm3/yr)^2	CV -	Runoff m/yr
1	1	1	South Fork Sangamon	175.8	47.1	0.00E+00	0.00	0.27
2	1	1	Locust	81.2	21.7	0.00E+00	0.00	0.27
3	1	1	Segment 3-DF	43.1	11.6	0.00E+00	0.00	0.27
4	1	2	Segment 2-DF	9.8	2.6	0.00E+00	0.00	0.27
5	1	3	Segment 1-DF	13.1	3.5	0.00E+00	0.00	0.27
6	4	3	Water Supply Outtake		1.2	0.00E+00	0.00	
PRECIPITATION				5.2	4.7	0.00E+00	0.00	0.92
TRIBUTARY INFLOW				323.1	86.5	0.00E+00	0.00	0.27
***TOTAL INFLOW				328.2	91.3	0.00E+00	0.00	0.28
GAUGED OUTFLOW					1.2	0.00E+00	0.00	
ADVECTIVE OUTFLOW				328.2	85.7	0.00E+00	0.00	0.26
***TOTAL OUTFLOW				328.2	86.9	0.00E+00	0.00	0.26
***EVAPORATION					4.3	0.00E+00	0.00	

Overall Mass Balance Based Upon Component: **Predicted TOTAL P** — **Outflow & Reservoir Concentrations**

Trb	Type	Seg	Name	Load kg/yr	%Total	Load Variance (kg/yr)^2	%Total	CV	Conc mg/m^3	Export kg/km^2/yr
1	1	1	South Fork Sangamon	1721.0	23.7%	0.00E+00		0.00	36.5	9.8
2	1	1	Locust	794.4	10.9%	0.00E+00		0.00	36.5	9.8
3	1	1	Segment 3-DF	422.0	5.8%	0.00E+00		0.00	36.5	9.8
4	1	2	Segment 2-DF	95.7	1.3%	0.00E+00		0.00	36.5	9.8
5	1	3	Segment 1-DF	128.6	1.8%	0.00E+00		0.00	36.5	9.8
6	4	3	Water Supply Outtake	57.9		0.00E+00		0.00	48.2	
PRECIPITATION				154.5	2.1%	0.00E+00		0.00	32.6	30.0
INTERNAL LOAD				3950.2	54.4%	0.00E+00		0.00		
TRIBUTARY INFLOW				3161.8	43.5%	0.00E+00		0.00	36.5	9.8
***TOTAL INFLOW				7266.5	100.0%	0.00E+00		0.00	79.6	22.1
GAUGED OUTFLOW				57.9	0.8%	0.00E+00		0.00	48.2	
ADVECTIVE OUTFLOW				4132.6	56.9%	0.00E+00		0.00	48.2	12.6
***TOTAL OUTFLOW				4190.4	57.7%	0.00E+00		0.00	48.2	12.8
***RETENTION				3076.1	42.3%	0.00E+00		0.00		

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Appendix J
Responsiveness Summary

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Responsiveness Summary

This responsiveness summary responds to substantive questions and comments received during the public comment period from August 9 through August 23, 2007 postmarked, including those from the August 16, 2007 public meeting discussed below.

What is a TMDL?

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. The South Fork Sangamon River-Lake Taylorville watershed TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to the impaired water bodies and ensure compliance with applicable water quality standards. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and regulations thereunder.

Background

The watershed targeted for TMDL development is South Fork Sangamon River-Lake Taylorville, located in Christian and Montgomery counties. The watershed encompasses an area of approximately 83,142 acres (130 square miles). Land use in the watershed is predominately agriculture. South Fork Sangamon River segment EO-13 is approximately 20 miles in length, and Lake Taylorville is approximately 1,148 surface acres and is used as a public water supply for the City of Taylorville. South Fork Sangamon River segment EO-13 is listed on the Illinois EPA 2006 Section 303(d) List as being impaired for boron, manganese, dissolved oxygen, and chlordane; Lake Taylorville (REC) is listed for manganese, dissolved oxygen, total phosphorus, chlordane, and total suspended solids. The Clean Water Act and USEPA regulations require that states develop TMDLs for waters on the Section 303(d) List. Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards. Additional monitoring data for South Fork Sangamon River segment EO-13 showed that boron is no longer violating water quality standards. Therefore, manganese and dissolved oxygen causes are addressed in the report. A TMDL was developed for total phosphorus for Lake Taylorville. The reduction of total phosphorus is expected to also reduce the manganese and address the low dissolved oxygen impairment in the lake. Illinois EPA contracted with CDM to prepare the a TMDL report for the South Fork Sangamon-Lake Taylorville watershed.

Public Meetings

Public meetings were held at the University of Illinois Christian County Extension office on July 12, 2006 and August 16, 2007. The Illinois EPA provided public notice for both meetings by placing display ads in the Taylorville Breeze-Courier. This notice gave the date, time, location, and purpose of the meeting. The notice also provided references to obtain additional information about this specific site, the TMDL Program and other related issues. Approximately 72 individuals and organizations were also sent the public notice by first class mail. The draft TMDL Report was available for review at the Christian County Conservation District office, the University of Illinois Christian County Extension office, and also on the Agency's web page at http://www.epa.state.il.us/public-notices/.

A public meeting started at 6:00 p.m. on Thursday, August 15, 2007. It was attended by approximately 1 person and concluded at 7:00 p.m. with the meeting record remaining open until midnight, August 23, 2007.

Questions and Comments

1. The local agencies (SWCD and NRCS) do their best at implementing BMP's, with the money they are allocated. CPP funds are competitive within the county, and EQIP is competitive state-wide.

   Response: Thank you for your comment. Besides utilizing state and federal funds from the USDA, Illinois EPA, through the United States Environmental Protection Agency, offers 319 grant funding for implementing nonpoint source practices for restoring water quality. Information about this program is discussed in the implementation plan section of the TMDL report.

2. Waterways seem to be one of the more popular BMPs in this county. Some recent CPP projects include waterway maintenance of existing structures.

   Response: Thank you for your comment.

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