COFFEE CREEK
WATERSHED MANAGEMENT PLAN

Porter County, Indiana

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The Coffee Creek Watershed Conservancy, in collaboration with Save the Dunes Council, Town of Chesterton, Northwestern Indiana Regional Planning Commission, Porter County Surveyor's Office, Indiana Department of Natural Resources, Division of Nature Preserves, Izaak Walton League of Porter County, Porter County Natural Resources Conservation Service, Shirley Heinze Environmental Fund, Northwest Indiana Steelheaders, Chesterton High School Student Action for the Environment Club, Indiana Department of Natural Resources, Lake Michigan Research Station, and numerous other concerned stakeholders, created this Coffee Creek Watershed Management Plan. The plan serves as the community's road map to achieve the watershed stakeholders' vision for Coffee Creek, which states that *Coffee Creek supports a healthy cold water biological community and provides and attractive resource for citizens*.

The continued effort of committed stakeholders is needed to implement this plan and ensure its success in achieving the stakeholders' vision for the creek. If you would like to be involved in the plan's implementation or would like additional information on the plan and its development history, please contact:

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1.0 INTRODUCTION

This Coffee Creek Watershed Management Plan addresses the non-point source pollution issues of concerned landowners within the Coffee Creek watershed and those of other concerned citizens living with the larger Little Calumet River basin. The Coffee Creek Watershed Conservancy (CCWC) initiated the development of the watershed management plan by obtaining funding and organizing watershed stakeholders. The plan details the current and historical condition of the watershed through a review of historical reports and sampling the biological, chemical, and physical condition of waterbodies in the watershed. More importantly, the planning process provided a forum for watershed stakeholders to discuss their water quality concerns related to Coffee Creek and its tributaries and develop an action plan to address those concerns. This plan documents the stakeholders' concerns and vision for the future of Coffee Creek. It outlines the stakeholders' strategies and action items selected to achieve their vision. Finally, the plan includes methods for measuring stakeholders' progress toward achieving their vision and timeframes for periodic refinement of the plan. Ultimately, the plan serves to guide and educate the stakeholders on the importance of improving water quality in the Coffee Creek watershed.

In 1998, the Coffee Creek Watershed Conservancy was created as a 501 C3 in the state of Indiana. The creation of this conservancy grew out of the need to restore and steward the 167 acres of protected land within Coffee Creek Center (CCC), an environmentally sensitive, neo-traditionalist, planned community in Chesterton, Indiana. Realizing that the environmental concerns impacting the 167-acre protected area within CCC crossed property boundaries, the group expanded their mission to include the protection, restoration, and enhancement of the overall health of the entire Coffee Creek watershed.

The board of directors of the CCWC consists of individuals from existing local environment groups. These groups are recognized as major stakeholders in efforts to protect and improve the greater watershed (the Little Calumet River watershed). The board includes a representative from Save the Dunes Council, one of the oldest grassroots conservation organizations in the country committed to improving the environmental quality of the Dunes region of northwest Indiana; Shirley Heinze Environmental fund, a charitable land trust dedicated to preserving and protecting the unique ecosystems of the Indiana Dunes Region; Izaak Walton League Porter County chapter, one of the oldest conservation organizations dedicated to protecting the soil, air, woods, waters, and wildlife of Porter County, Indiana; Northwest Indiana Steelheaders, Inc., a non-profit organization dedicated to educating the public in improving, preserving, and promoting anadromous sport fishing in the Great Lakes and their tributary streams; Coffee Creek Life Center, dedicated to protecting injured wild animals in Porter County; and Chesterton High School SAFE (Student Actions for the Environment) Club, a group of students interested in becoming involved with environmental issues.

The Coffee Creek watershed lies in the northeastern portion of Porter County, northeast of the City of Valparaiso (Figure 1). The watershed covers approximately 15.7 square miles (Figure 2). It encompasses the western half of the Sand Creek/Coffee Creek 14-digit watershed (HUC 04040001060030) and lies in the center of the 8-digit Little Calumet-Galien River watershed (HUC 04040001) (Figure 3). The watershed includes portions of Jackson, Liberty, Washington, and Westchester townships as well as a portion of the Town of Chesterton. Four main tributaries, Shooter Ditch, Pope O'Connor Ditch, Johnson Ditch, and the Suman Road Tributary, flow into Coffee Creek. Coffee Creek flows into the Little Calumet River north of the Penn Central Railroad in the northeast corner of Chesterton. The Little Calumet River flows into Lake Michigan less than 10 miles west of its confluence with Coffee Creek, near Ogden Dunes.

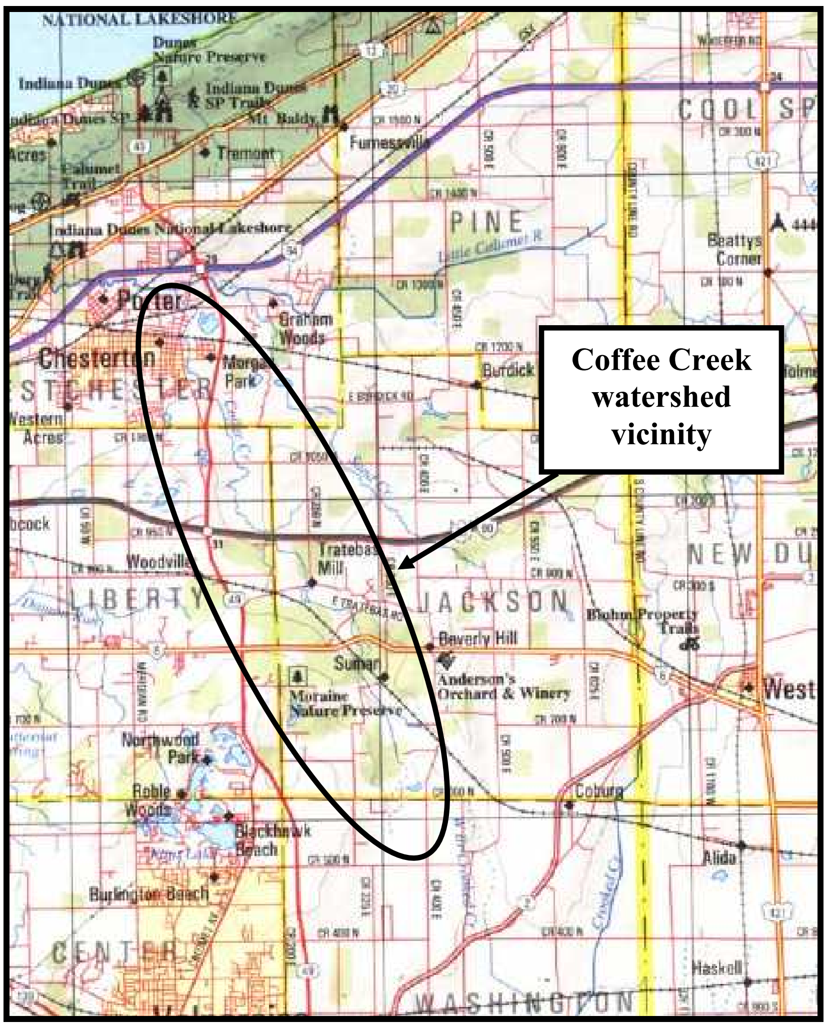

Figure 1. Coffee Creek watershed location map.
Source:DeLorme, 1998.

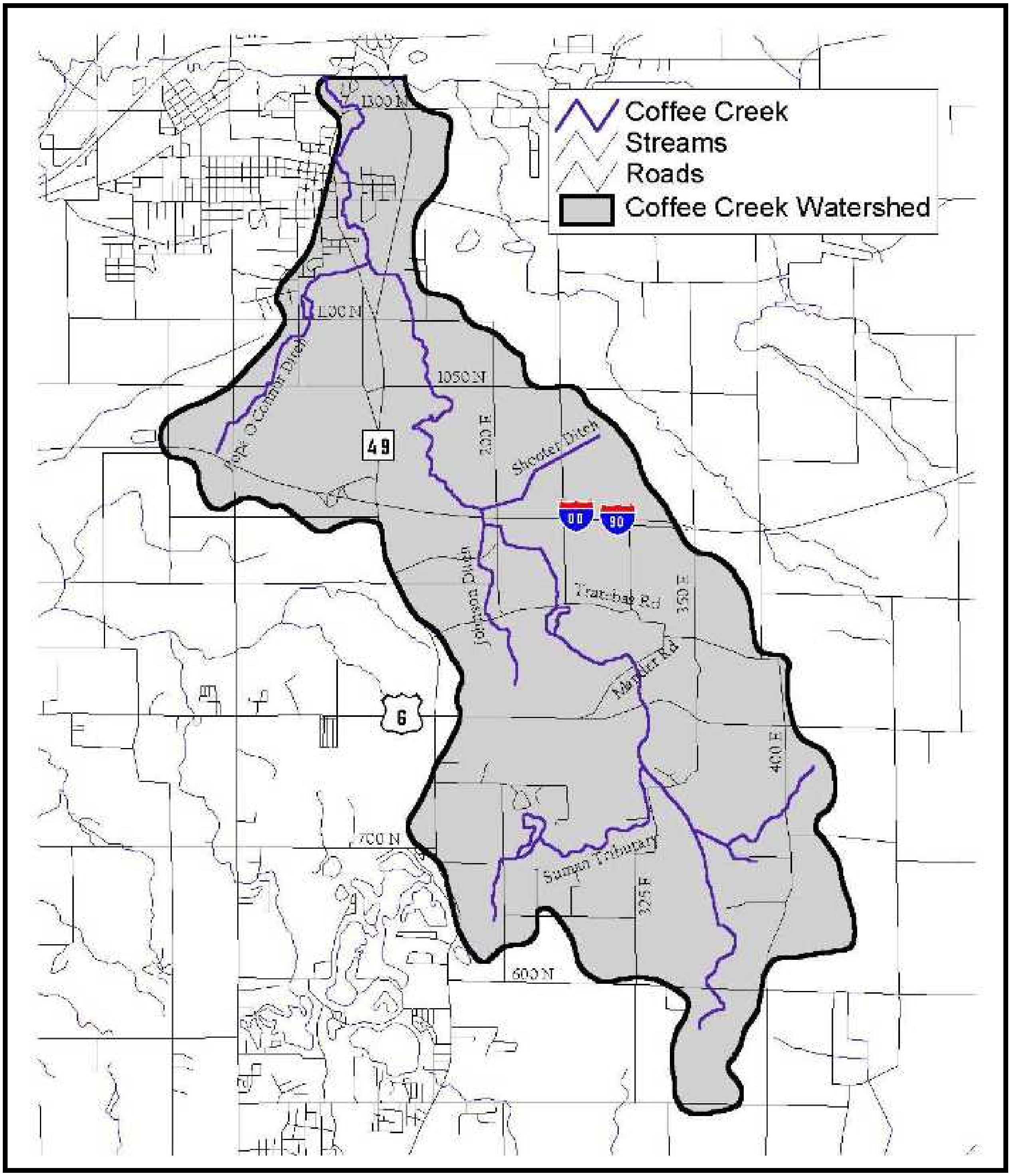

Figure 2. Coffee Creek watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

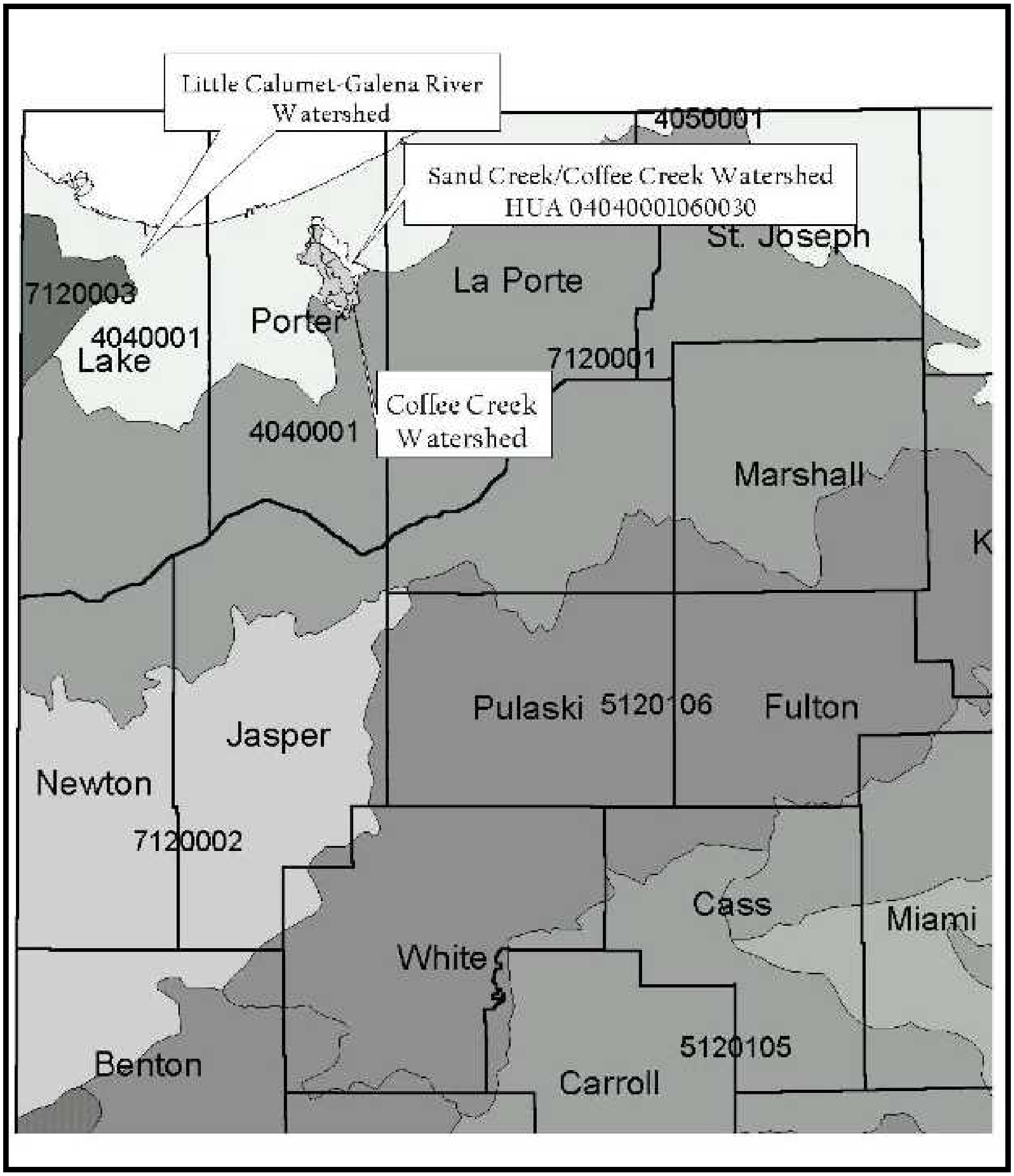

Figure 3. Little Calumet-Galien River watershed.
Source: See Geographic Information System map data sources appendix (Appendix A).

1.1 Initial concerns

State agencies in the past have collected sporadic data related to fisheries, water quality, and physical habitat in Coffee Creek. Certain parameters, such as *E. coli* data obtained from the February 2001 Interagency Task Force Report, indicated that Coffee Creek had the lowest *E. coli* levels of all sampled waters in the Lake Michigan Basin (Forsness et al., 2001). (The Interagency Task Force's Coffee Creek sampling site was located on CR 1050 N.) Coffee Creek, however, was not without its problems: it was listed on the 2002 303(d) list as impaired for *E. coli*[§]; there were concerns over an abandoned dump site that may have not been closed properly; and landowners increasingly worried about the conversion of a primarily wooded landscape to housing developments. The state-owned Moraine Nature Preserve, concentrated in Coffee Creek's headwaters, continues to grow in size but is becoming increasingly subjected to pressures from adjacent development. The CCWC worked to form a coalition of partners that together address these issues and other issues of concern in the watershed. As part of that effort, the Coffee Creek Watershed Conservancy applied for and received a Section 319 grant from the Indiana Department of Environmental Management (IDEM) in 2000 to develop a watershed management plan for the Coffee Creek watershed.

1.2 Stakeholder Involvement

All interested stakeholders were encouraged to attend public meetings and become a part of the watershed management plan development process. The Coffee Creek Watershed Conservancy identified an initial list of potential partners and stakeholders. Individuals on this list included the CCWC board members, members of local environmental organizations, current donors to the Coffee Creek Watershed Conservancy, representatives from the Town of Chesterton and Porter County, and representatives from local natural resource agencies including the Indiana Department of Natural Resources (IDNR), Natural Resources Conservation Service (NRCS), and IDEM. The CCWC also developed a partial list of landowners in the watershed using Porter County Courthouse records. To encourage additional participation in the plan's development, the CCWC advertised the initial and subsequent public meetings in the Chesterton Tribune, The Post Tribune, and The Vidette Times. (Appendix B contains press releases written during the plan's development.) At public meetings, attendees were asked to sign in and provide their email addresses. The CCWC used The Save the Dunes Council electronic list serve which includes over 300 address of people who primarily live in the region, to disseminate information regarding upcoming public meetings and other information about the planning effort. Appendix C provides a list of current major stakeholders. (Names of individual property owners or stakeholders are not included in Appendix C to preserve stakeholder privacy.) As interest grows in the watershed, the list of stakeholders will continue to be updated.

In June of 2001, the CCWC and their consultant, JFNew held an initial public meeting to introduce the public to the plan and gauge interest level in public involvement. The CCWC provided an overview of the purpose of the watershed management plan, an outline of the public meeting schedule, and a schedule of each of the annual field days. At this initial meeting, the CCWC indicated that the watershed development planning process would follow the guidance provided in the *Watershed Action Guide for Indiana* (IDEM, 1999). The CCWC provided copies of *Watershed Action Guide for Indiana* to all interested parties at the first meeting to help stakeholders understand the watershed management plan development process. An IDEM representative was also present at this initial meeting to answer questions about the planning process. Meeting participants began the planning process at this initial meeting by documenting their water quality and related concerns. These concerns included:

[§] Under the Indiana Department of Environmental Management's current schedule, development of a Total Maximum Daily Load (TMDL) to manage *E. coli* in the Coffee Creek basin will occur in 2015-2020. No activities related to TMDL development have begun as of 2003. However, TMDL development to manage *E. coli* in the Little Calumet River has begun. Subsequent sections of this document detail this and outline how management activities in the Coffee Creek watershed will address future TMDL work in the Coffee Creek watershed.

Point Source
*combined sewer overflow (CSO) pipes
*undocumented pipes

Non-Point Source
*increased runoff
*sedimentation/erosion
*retention/detention ponds
*thermal pollution
*pesticides
*soil types/runoff

Habitat Issues
*conversion from forest to impervious surface
*ditching of creek
*loss of species diversity/habitat (plants, animals, macroinverts)
*need to create buffer

Education/Outreach
*define boundaries, make information public
*benefit to humans
*reaching adjacent landowners
*public buy-in
*local school participation
*county participation
*zoning/ordinances
*little funding through parks

Following the first meeting in June 2001, the CCWC and JFNew held quarterly public meetings throughout the course of the watershed management planning process. A core group of stakeholders continued to attend and participate in public meetings throughout the planning process. In the meetings following the initial watershed stakeholder meeting, the stakeholders prioritized issues of concern (listed above), developed an overall problem statement encompassing those concerns, and created vision and mission statements to guide the watershed management planning process. Once this framework was in place, watershed stakeholders established prioritized goals and developed strategies and action items for achieving those goals. Public meetings also included an educational component. Information that was shared at public meetings included a slide showcase of the human, animal and plant communities native to the Coffee Creek watershed, cost-sharing opportunities available from the NRCS and the Indiana Forest Legacy Program, and a highlight of Moraine Nature Preserve from the regional DNR ecologist. The public meetings were complemented by the field days held concurrently with the Chesterton Hometown Picnic in June. Field days included tours of Coffee Creek Center and highlighted unique features that aid in non-point source pollution reduction throughout the development.

The Coffee Creek Watershed Conservancy will continue to direct the Coffee Creek Watershed Management Plan into the future. A web site has been created to advertise all watershed related meetings and events to the stakeholders and the public. This website will provide a link to the final Coffee Creek Watershed Management Plan. This website's address is http://www.coffeecreekwc.org/ccwc/ccwcmission/319_grant.htm.

1.3 Coffee Creek Vision and Mission

The intent of a vision is to simply guide the watershed management planning process. The vision can be written as an empowering statement that defines the long term view of the watershed that the stakeholders want change to create. A mission statement more specifically defines the who, what, and how to accomplish the vision goal. Stakeholders involved in developing the Coffee Creek Watershed Management Plan developed a vision and mission statement for the plan after the initial watershed concerns were identified.

As a preface to defining a vision and mission for the plan, a statement was also developed that defines the core watershed issue, known as the problem statement, which was the impetus behind the development of the Coffee Creek Watershed Management plan.

The problem statement, vision, and mission statement reads as follows:

Problem Statement*: Coffee Creek does not support the community's desired uses of providing a healthy habitat for the creek's biota and an attractive resource for citizens.*

The vision*: Coffee Creek supports a healthy cold water biological community and provides an attractive natural resource for citizens to enjoy.*

The mission: *The Coffee Creek Watershed Community is a coalition of existing conservation groups and concerned citizens dedicated to developing and implementing a successful watershed plan to protect, maintain, and enhance Coffee Creek and its inhabitants.*

2.0 WATERSHED CHARACTERISTICS

2.1 Climate

2.1.1 Indiana Climate

Indiana's climate can be described as temperate with cold winters and warm summers. The National Climatic Data Center summarizes Indiana weather in its 1976 Climatology of the United States document No. 60. "Imposed on the well known daily and seasonal temperature fluctuations are changes occurring every few days as surges of polar air move southward or tropical air moves northward. These changes are more frequent and pronounced in the winter than in the summer. A winter may be unusually cold or a summer cool if the influence of polar air is persistent. Similarly, a summer may be unusually warm or a winter mild if air of tropical origin predominates. The action between these two air masses of contrasting temperature, humidity, and density fosters the development of low-pressure centers that move generally eastward and frequently pass over or close to the state, resulting in abundant rainfall. These systems are least active in midsummer and during this season frequently pass north of Indiana"

(National Climatic Data Center, 1976). Prevailing winds are generally from the southwest, but are more persistent and blow from a northerly direction during the winter months.

2.1.2 Porter County Climate

The climate of Porter County has characteristic warm summers and cold and snowy winters that typically provide enough precipitation, in the form of snow, to supply the soil with sufficient moisture to minimize drought conditions when the hot summers begin. Winters are cold, averaging 27º F (-3º C), while summers are warm, averaging 71º F (22ºC). The highest temperature ever recorded was 98º F (37º C) on July 20, 1954. Mild drought conditions occur occasionally during the summer when evaporation is highest. During summer, average relative humidity differs greatly over the course of a day averaging 80 percent at dawn and dropping to an average of 65 percent in mid-afternoon. The average annual precipitation is 40.06 inches (101.7 cm). In 2001, nearly 39 inches (98 cm) of precipitation (Table 1) was recorded at Valparaiso, Indiana in Porter County. When compared to the 2001 annual rainfall, the 24-year average for the area exceeded the 2001 annual by slightly more than one inch. Nearly 32 (81 cm) inches of precipitation occurred during 2002. Rainfall in 2002 was lower than both precipitation in 2001 and the average annual rainfall.

Table 1. Monthly rainfall data for 2001 and 2002 as compared to average monthly rainfall in Valparaiso, Indiana. Averages are based on available weather observations taken during the years of 1971-2000.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
2001	1.33	4.85	0.84	2.59	4.08	3.88	4.65	4.78	2.77	5.24	2.74	1.06	38.81
2002	2.57	1.74	3.37	5.29	5.37	1.65	1.31	2.26	2.75	2.71	2.03	0.67	31.72
Average	2.11	1.82	2.93	3.64	3.85	4.66	3.82	3.91	3.68	3.20	3.56	2.88	40.06

Source: Purdue Applied Meteorology Group, 2002.

2.2 Geology

The advance and retreat of the glaciers in the last ice age shaped much of the landscape found in Indiana today. As the glaciers moved, they laid thick till material over the northern two thirds of the state. Ground moraines left by the glaciers cover much of the central portion of the state. In the northern portion of the state, ground moraines, end moraines, lake plains, and outwash plains create a more geologically diverse landscape compared to the central portion of the state. End moraines, formed by the layering of till material when the rate of glacial retreat equals the rate of glacial advance, add topographical relief to the landscape. Several large, distinct end moraines, including the Valparaiso Moraine, are scattered throughout the northern portion of the state. Major rivers in northern Indiana cut through sand and gravel outwash plains. These outwash plains formed as the glacial meltwaters flowed from retreating glaciers, depositing sand and gravel along the meltwater edges. Lake plains, characterized by silt and clay deposition, are present where lakes existed during the glacial age.

In northwest Indiana, the glaciers left three distinct physiographic zones: the Calumet Lake Plain, the Valparaiso Moraine Area, and the Kankakee Outwash and Lake Plain (Malott, 1922). The Coffee Creek watershed lies in two of these physiographic zones: the Valparaiso Moraine Area and the Calumet Lake Plain. Coffee Creek and its headwater tributaries originate on the north side of the Valparaiso Moraine. This moraine, which is actually a series of end moraines (Hartke et al., 1975), roughly marks the terminal position of the Lake Michigan Lobe of the last

Wisconsinian glacier. The Lake Michigan Lobe flowed from the north toward the south and southeast in Indiana, carving out the lake bottom of present day Lake Michigan. Where the Valparaiso Moraine exists today, the Lake Michigan Lobe of the glacier stalled depositing an arc-shaped band of till from southwestern Michigan, around northwestern Indiana, and into northeastern Illinois. This arc-shaped band parallels the shore of present day Lake Michigan.

A closer look at the Valparaiso Moraine reveals that the moraine consists of two till layers separated by a sand and gravel outwash layer. The lower till layer is likely a ground moraine formed by initial glacial movement. The upper till layer is an end moraine formed by the most recent glacial advance in the area. In general, the upper till layer of the Valparaiso Moraine in the Coffee Creek watershed consists of silty clay loam sediments (Hartke, et al., 1975). It is this upper till layer that has the greatest impact on water quality in the Coffee Creek watershed.

As Coffee Creek flows north, it leaves the Valparaiso Moraine Area physiographic zone and enters the Calumet Lake Plain. The Calumet Lake Plain encompasses the area covered by historic Lake Chicago. As the Lake Michigan Lobe of the last Wisconsinian glacier receded, meltwater from the glacier flowed south across northwest Indiana. As the meltwater flowed south, the Valparaiso Moraine served as a large earthen levee, trapping the glacial meltwater and forming Lake Chicago between the receding glacier and the Valparaiso Moraine.

Glacial movement and meltwaters from the Lake Michigan Lobe left a heterogeneous mixture of sediments covering the Calumet Lake Plain. As the Lake Michigan Lobe advanced during the beginning of the Wisconsinian period, it left the same ground moraine over the Calumet Lake Plain as the one found under the lower layer of the Valparaiso Moraine. Silt and clay sediments cover large portions of this ground moraine in the Calumet Lake Plain. These smaller sediments settled out of Lake Chicago during periods when lake water levels were stable. Currents of outwash from the receding Lake Michigan Lobe deposited caches of sand and gravel throughout the lake plain. In addition to these sand and gravel deposits, three distinct sand ridges or dunes are visible on the Calumet Lake Plain. These ridges mark three relatively stable positions of Lake Chicago.

This geologic history has shaped the topography and natural features found on the Coffee Creek watershed landscape today. Figure 4 highlights the change in topographical relief between the southern part of Coffee Creek watershed (Valparaiso Moraine Area) and the northern portion of the watershed (Calumet Lake Plain). The characteristic knob and kettle topography of end moraines is noticeable in the southern portion of the watershed. Here steep hills (knobs) and ravines surround small lakes and ponds (kettles). These kettle lakes and ponds formed when ice blocks that were trapped in the end moraine melted. Some of these kettle depressions have filled with peat over the years (geologic time), creating wetland habitat. The flatter topography of the Calumet Lake Plain supports a different set of natural features. In the northern portion of the watershed, wetland soils and habitat developed where rainwater and surface drained and ponded over clay and silt deposits from Lake Chicago. The course of Coffee Creek itself reflects the watershed's geological history as well (Hartke, et al., 1975). As rainwater, and snowmelt during cold periods, flowed from the higher elevations of the moraine, a path was cut through the more erodible sand and gravel deposits, largely avoiding clay and silt deposits where possible. This created a more winding stream morphology compared to the straighter channel morphology of streams that flow through the Kankakee outwash plain on the south side of the Valparaiso Moraine.

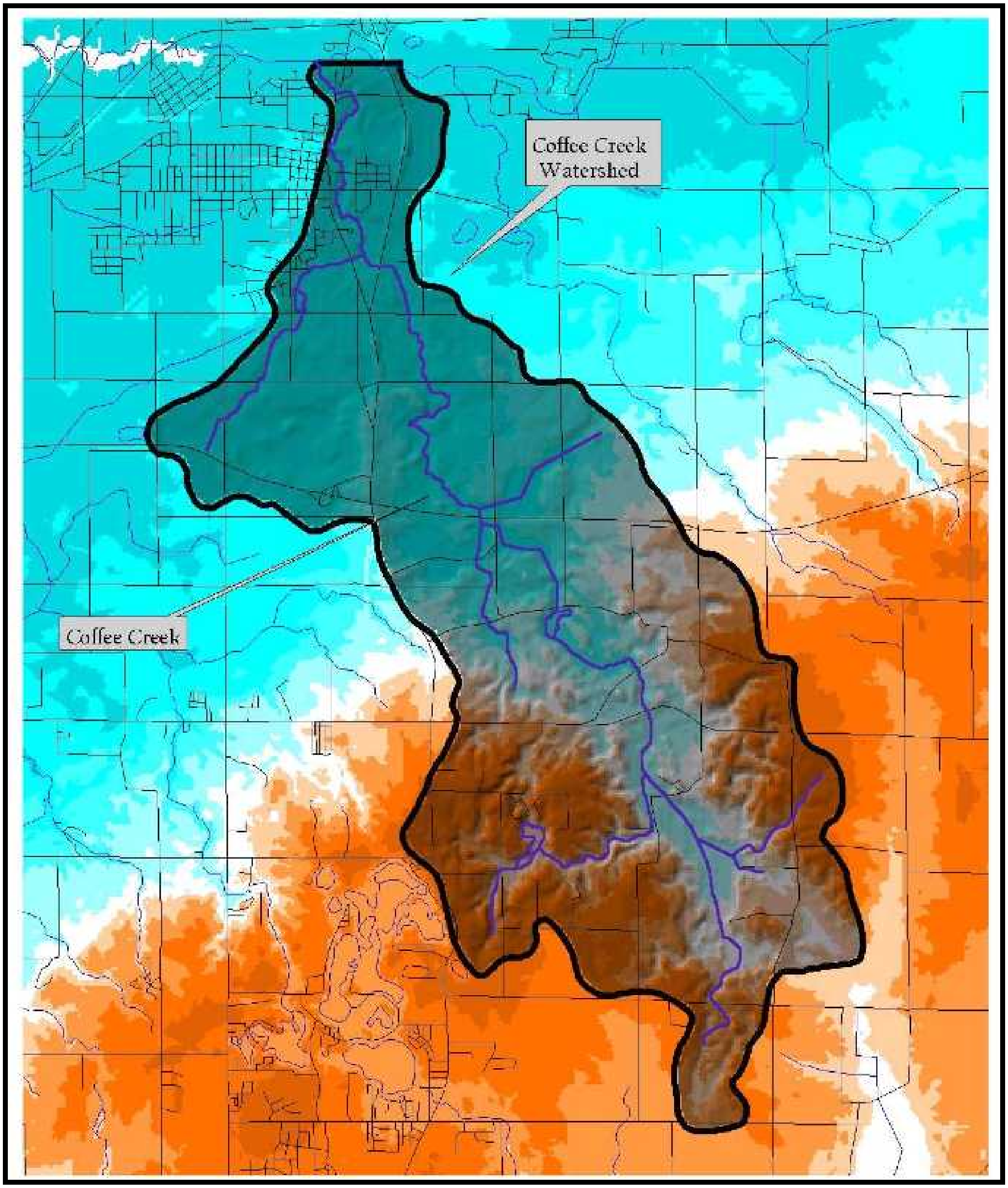

Figure 4. Topographical relief of the Coffee Creek watershed. Orange represents the steeper topography present in the southern portion of the Coffee Creek watershed, while blue indicates the flatter area with less topographical relief in the northern portion of the watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

The watershed's geologic history also affects the type of use the landscape will support. The topographical relief of the Valparaiso Moraine area prevented the conversion of this area for agricultural uses. The steep slopes have also limited large scale residential development in the moraine area. Although early settlers to the area harvested much of the forested lands (Historic Landmarks Foundation of Indiana, 1991), the limitations of this land for agricultural and residential use has allowed the establishment of second growth forest. The steep slopes and clay deposits within the moraine may also prevent the use of certain areas for septic system leach fields. The flatter landscape and fertile soils of the northern portion of the watershed made this portion of the watershed more attractive for agricultural production. As is the case in the moraine area, the prevalence of silt and clay deposits in the lake plain can prevent proper functioning of septic systems. The soils section provides more details on the use of watershed soils for septic system leach fields.

2.3 Soils

The soil types found in Porter County are a product of the original parent materials deposited by the glaciers that covered this area 12,000 to 15,000 years ago. The main parent materials found in Porter County are glacial outwash and till, lacustrine material, alluvium, and organic materials. The interaction of these parent materials with the physical, chemical, and biological variables found in the area (climate, plant and animal life, time, landscape relief, and the physical and mineralogical composition of the parent material) formed the soils of Porter County today. Furr (1981) maps and describes specific soils found in Porter County. The following relies heavily on Furr's work.

Four major soil associations, Riddles-Tracy, Morley-Blount-Pewamo, Elliott-Markham-Pewamo, and Whitaker-Milford-Del Ray, cover the Coffee Creek watershed. The Riddles-Tracy and Morley-Blount-Pewamo associations cover the southern portion of the watershed, while the Elliot-Markham-Pewamo and Whitaker-Milford-Del Rey associations occupy the northern portion of the watershed. The Riddles-Tracy soil association exists on nearly level ridge and knoll tops to strongly sloping side slopes of these geological features in morainal areas. This association can also be found on outwash and till plains. Soils in this association are well drained and silty to loamy in texture. In general, Riddles soils account for approximately 46% of the total soils in the association, while Tracy soils account for 28% of the soil association. The remaining portion of the soil association consists of minor soil components including Morley, Rawson, Blount and Haskins. These soils support agricultural production when the topography is level to moderately sloped. Steeply sloped areas containing these soils are more suitable for forests or residential development. Land use in the Coffee Creek watershed reflects this as forested land and residential development occupy the steeper sloped, morainal areas of the watershed and the level portions of the watershed are in agricultural production.

Like the Riddles-Tracy soils association, the Morley-Blount-Pewamo soil association covers nearly level to steeply sloped till plains and morainal areas. Morley soils are the dominant soil unit in the Morley-Blount-Pewamo soil association, accounting for 26% of the association. Morley soils are moderately well drained to well drained and occupy high swells, knolls, and side slopes along streams. Blount soils, which make up roughly 18% of the Morley-Blount-Pewamo soil association, occur on flatter areas of the watershed. Pewamo soils are wetland soils occurring in depressional areas and swales. Approximately 10% of the Morley-Blount-Pewamo soil association consists of Pewamo soils. Furr (1981) notes that this soil association is poorly suited for use as a sanitary facility (septic leach fields).

The Elliot-Markham-Pewamo and Whitaker-Milford-Del Rey soil associations cover the flatter, northern portion of the watershed. In contrast to the wide range of topographical relief (0 to 35 percent slopes) found in the southern portion of the watershed, these soil associations exist on nearly level to very gently sloping (0 to 6 percent slopes) land. The Elliot-Markham-Pewamo association exists on flat till plains and very gently sloping morainal areas. As such these soils delineate the transition between the Valparaiso Moraine Area and Calumet Lake Plain physiographic zones in the Coffee Creek watershed. Elliott soils dominate the Elliot-Markham-Pewamo association, accounting for approximately 40% of the association. Markham and Pewamo soils account for roughly 16% and 12% of the association, respectively. Elliott soils exist largely on upland flats, while Pewamo soils lie in depressional areas and swales. Markham soils occupy knolls and side slopes along streams. Because the northern portion of the Coffee Creek watershed contains few knolls, Markham soils are not a major soil in the watershed. Minor components in the Elliot-Markham-Pewamo association include Blount, Haskins, Morley, and Rawson soils. Like the Morley-Blount-Pewamo soil association, the Elliot-Markham-Pewamo association is poorly suited for use as a sanitary facility.

The Whitaker-Milford-Del Rey soil association covers northeastern and northwestern portions of the Coffee Creek watershed. Soils in this association are characteristic of flat lake and outwash plains. Approximately 30% of the association consists of Whitaker soils, while Milford and Del Rey soils account for 20% and 18% of the association, respectively. Like Elliot soils, Whitaker and Del Rey soils exist on broad, flat, upland areas. Milford soils occupy lower depressional flats. Martinsville, Sebewa, Warners, and Selfridge soils are minor components of the Whitaker-Milford-Del Rey soil association.

Soils in the watershed, and in particular their ability to erode or sustain certain land use practices, can impact the water quality of a waterbodies in a watershed. For example, highly erodible soils are, as their name suggests, easily erodible. Soils that erode from the landscape are transported to waterways or waterbodies where they impair water quality and biotic integrity and often interfere with recreational uses by forming sediment deltas in the waterbodies. In addition, such soils carry attached nutrients, which further impair water quality by fertilizing macrophytes (rooted plants) and algae. Soils that are used as septic tank absorption fields deserve special consideration as well. The presence of highly erodible land and the use of septic fields in the Coffee Creek watershed are described in further detail below.

2.3.1 Highly Erodible Soils and Land

Different natural resource agencies categorize highly erodible soils and highly erodible land differently. Based on common soil characteristics such as slope and soil texture, the NRCS classifies soil units that are likely to erode from the landscape as highly erodible soils. The NRCS maintains a list of highly erodible soil units for each county. Table 2 lists the soil units in the Coffee Creek watershed that the NRCS considers to be highly erodible. The county list or the one provided in Table 2 can be cross referenced with the county soil survey to locate highly erodible soils on the landscape. Not surprisingly, most of the highly erodible soils in the Coffee

Creek watershed are concentrated in the morainal region of the upper watershed. Steep slopes and the origin of the soils (glacial till) create ideal conditions for soil erosion.

Table 2. Highly erodible soils units in the Coffee Creek watershed.

Soil Unit	Soil Name	Soil Description
MrE	Morley silt loam	18 to 30 percent slopes
RmD2	Riddles loam	12 to 18 percent slopes, eroded
TcD	Tracy silt loam	12 to 18 percent slopes

Source: Porter County NRCS.

Highly Erodible Land (HEL) is a designation used by the Farm Service Agency (FSA). For a field or tract of land to be labeled HEL by the FSA, at least one-third of the parcel must be situated in highly erodible soils. Unlike the soil survey, these tracts must be field checked to ensure the accuracy of the mapped soils types. Farm fields mapped as HEL are required to file a conservation plan with the FSA in order to maintain eligibility for any financial assistance from the USDA. Figure 5 shows the location of HEL fields in the Coffee Creek watershed. Approximately, 428 acres of HEL exist within boundaries of the Coffee Creek watershed, most of which lies in the morainal area of the watershed. This acreage represents about 4% of the Coffee Creek landscape.

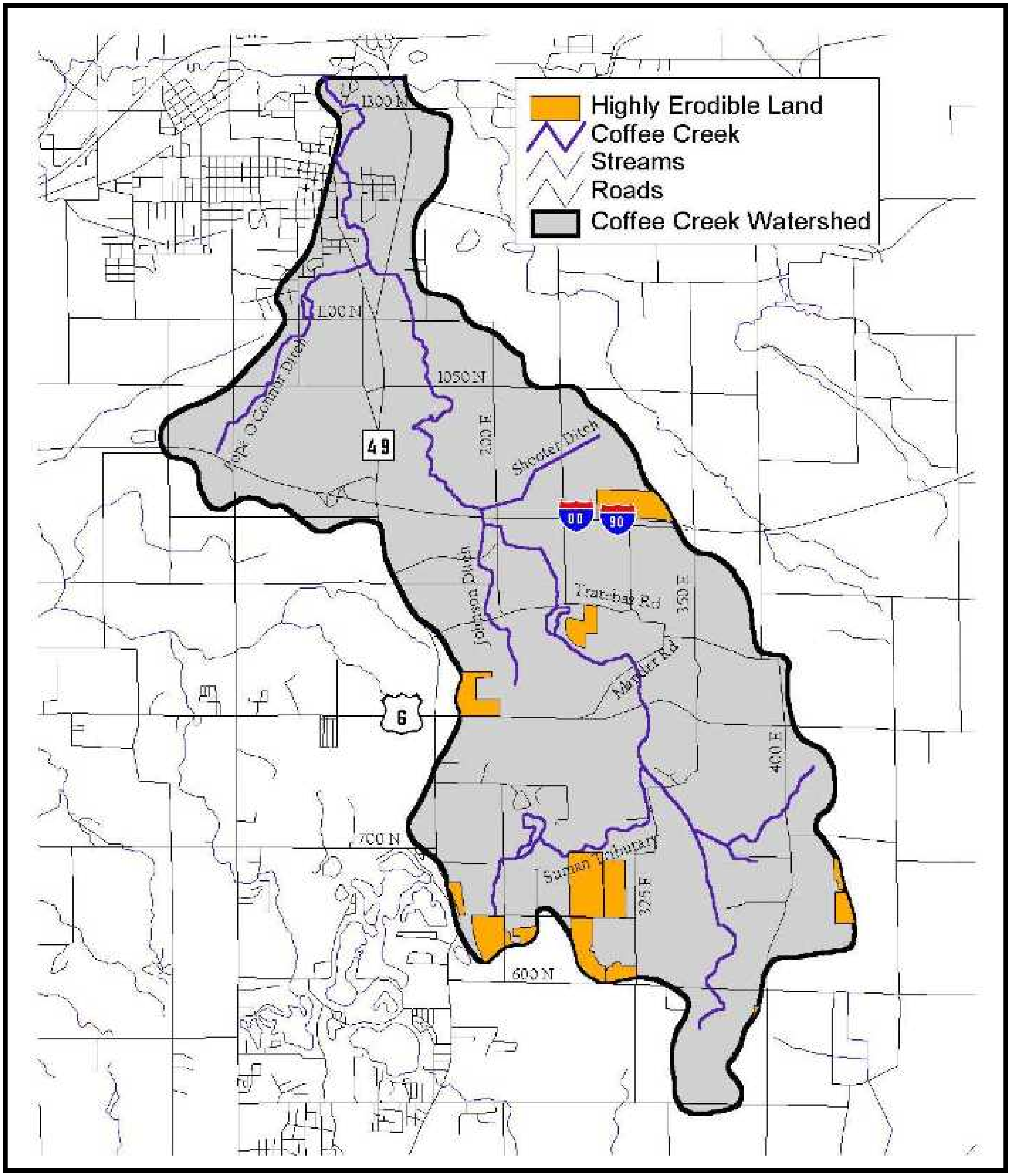

Figure 5. Highly Erodible Land in the Coffee Creek watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

2.3.2 Septic System Use

As is common in many areas of Indiana, septic tanks and septic tank absorption fields are utilized for wastewater treatment in the rural portions of the Coffee Creek watershed. This type of wastewater treatment system relies on the septic tank for primary treatment to remove solids and the soil for secondary treatment to reduce the remaining pollutants in the effluent to levels that protect surface and groundwater from contamination. Soil conditions such as slow permeability and high water table, coupled with poor design, faulty construction, and lack of maintenance reduce the average life span of septic systems in Indiana to 7-10 years (Jones and Yahner, 1994). Other factors affecting the effectiveness of effluent treatment include the position of the septic system in the landscape, the slope on which the septic leach field is placed, the soil texture, the soil structure of the septic leach field, the soil consistency, and the septic system's depth to limiting layers (Thomas, 1996).

Many of the nutrients and pollutants of concern are removed safely if a septic system is sited correctly. Most soils have a large capacity to hold phosphate. On the other hand, nitrate (the end product of nitrogen metabolism in a properly functioning septic system) is very soluble in soil solution and is often leached to the groundwater. Care must be taken in siting the system to avoid well contamination. Nearly all organic matter in wastewater is biodegradable as long as oxygen is present. Pathogens can be both retained and inactivated within the soil as long as conditions are right. Bacteria and viruses are much smaller than other pathogenic organisms associated with wastewater and therefore, have a much greater potential for movement through the soil. Clay minerals and other soil components may adsorb them, but retention is not necessarily permanent. During storm flows, they may become resuspended in the soil solution and transported in the soil profile. Inactivation and destruction of pathogens occurs more rapidly in soils containing oxygen because sewage organisms compete poorly with the natural soil microorganisms, which are obligate aerobes requiring oxygen for life. Sewage organisms live longer under anaerobic conditions without oxygen and at lower soil temperatures because natural soil microbial activity is reduced.

The Natural Resources Conservation Service (NRCS) has ranked each soil series in terms of its limitations for use as a septic tank absorption field. Each soil series is placed in one of three categories: slightly limited, moderately limited, or severely limited. Use of septic absorption fields in moderately or severely limited soils generally requires special design, planning, and/or maintenance to overcome the limitations and ensure proper function. Table 3 summarizes the soils series in the Coffee Creek watershed in terms of their suitability for use as septic tank absorption fields.

Table 3. Septic system suitability of the soils in the Coffee Creek watershed.

Symbol	Name	High Water Table	Suitability for Septic Tank Absorption Field
BaA	Blount silt loam	1.0-3.0 ft	Severe: Wetness, percs slowly
Br	Bourbon sandy loam	1.0-3.0 ft	Severe: Wetness
De	Del Rey silt loam	1.0-3.0 ft	Severe: Wetness, percs slowly
Ed	Edwards muck, drained	+0.5-0.5 ft	Severe: Ponding, percs slowly
Fh	Fluvaquents	1.0-3.0 ft	Severe: Flooding, wetness
Gf	Gilford sandy loam	+0.5-1.0 ft	Severe: Ponding, poor filter
HaA	Hanna sandy loam	3.0-6.0 ft	Severe: Wetness, poor filter
HkA	Haskins loam	1.0-2.5 ft	Severe: Wetness, poor filter
Hm	Houghton muck, ponded	+2.0-0.5 ft	Severe: Ponding, percs slowly
Ho	Houghton muck, drained	+0.5-1.0 ft	Severe: Ponding, percs slowly
MfA-MfB	Martinsville loam	>6.0 ft	Slight
MoB	Metea loamy fine sand	>6.0 ft	Moderate: Percs slowly
Mp	Milford silty clay loam	+0.5-2.0 ft	Severe: Ponding, percs slowly
MrB2-MrC2	Morley silt loam	3.0-6.0 ft	Severe: Wetness, percs slowly
MrE	Morley silt loam	3.0-6.0 ft	Severe: Wetness, percs slowly, slope
MsC3	Morley silty clay loam	3.0-6.0 ft	Severe: Wetness, percs slowly
Pa	Palms muck, drained	+0.5-1.0 ft	Severe: Percs slowly, ponding
Pe	Pewamo silty clay loam	+1.0-1.0 ft	Severe: Percs slowly, ponding
Ph	Pinhook loam	0-1.0 ft	Severe: Wetness
RaB, RaC2	Rawson loam	2.5-4.0 ft	Severe: Wetness, percs slowly
R1A, R1B	Riddles silt loam	>6.0 ft	Moderate: Percs slowly
RmC2-RmD2	Riddles loam	>6.0 ft	Moderate: Percs slowly, slope
Sb	Sebewa loam	+1.0-1.0 ft	Severe: Poor filter, ponding
So	Suman silt loam	0-0.5 ft	Severe: Floods, wetness, percs slowly
TcA-TcB	Tracy silt loam	>6.0 ft	Slight
TcC	Tracy silt loam	>6.0 ft	Moderate: Slope
TcD	Tracy silt loam	>6.0 ft	Severe: Slope, poor filter
UbA, UcG	Udorthents	--	Variable: Onsite investigation required
Ue	Urban land-Martinsville complex	>6.0 ft	Slight
Wa	Wallkill silt loam	+0.5-0.5 ft	Severe: Ponding
Wh	Washtenaw silt loam	+0.5-1.0 ft	Severe: Ponding, percs slowly
Wt	Whitaker loam	1.0-3.0 ft	Severe: Wetness

Source: Furr, 1981.

2.4 Natural Features

Community ecologists have divided Indiana into natural regions or ecoregions for the purposes of classifying the natural communities that define an area (Homoya, 1985; Omernik and Gallant, 1988; Lindsey, 1966; Petty and Jackson, 1966; Meyer, 1952.) Areas within a natural region generally have been formed through the same geologic processes; thus, have similar climate, soils, and topography. These factors together support the vegetation community that inhabits an area; therefore, each ecoregion shares similar characteristic floral (plant) and faunal (animal) communities. In most natural region classification schemes, the Coffee Creek watershed falls within two adjacent natural regions. For example, according to Homoya (1985) the watershed falls within two sections of the Northwestern Morainal Natural Region, with roughly the southern half falling within the Valparaiso Moraine section and the northern half falling within the Chicago Lake Plain section. Omernik and Gallant (1988) ecoregion descriptions include the Coffee Creek watershed primarily within the Northern Indiana Till Plains, with only a small portion of the southern tip within the Central Corn Belt Plains. The northern and southern extremes of this watershed support characteristic ecological communities that have distinct differences from each other.

The Coffee Creek watershed historically contained a rich mosaic of forested and wetland communities, with forests dominating the landscape as seen in Figure 6 (McCartney, 1952). Beech-maple woods were the predominant forest type throughout, but more so in the southern area of the watershed, with characteristic knob and kettle topography. Oak-hickory forests were interspersed primarily in the upper or southern portion of the watershed. In the lower or northern portion of the watershed, where topographic relief is less extreme, scattered oak savannas occurred mixed with small pockets of prairie communities. Groundwater is recharged as water passes through the sloping mixed morainal soils in the upper watershed. Within this sloping landscape, springs, and seeps discharge groundwater and contribute to the constant flow of mineral-rich water that feeds much of the upper watershed of Coffee Creek. Various wetland communities, including wooded swamps, marshes, and fens were historically associated with seeps, depressional areas, and slow-moving tributaries of the creek.

A diversity of landscape types support unique floral and faunal features within the Coffee Creek watershed. (This is covered in more detail in the **Endangered, Threatened, and Rare Species** Section of this report.) The Coffee Creek watershed is included in the complex and floristically rich Chicago Region as defined in Plants of the Chicago Region (Swink and Wilhelm, 1994). Many species that are supported in the Coffee Creek watershed are unique to the morainal region along the southern shore of Lake Michigan and often are uncommon elsewhere, rare, or disjunct. Of particular importance are the beech-maple mesic woodland and fen communities, increasingly uncommon because of the progressive transition of landscapes to agriculture and development, and alteration of historical hydrological movement through this native landscape. Additionally, the greater Chicago Region marks the western extent of the beech-maple community type.

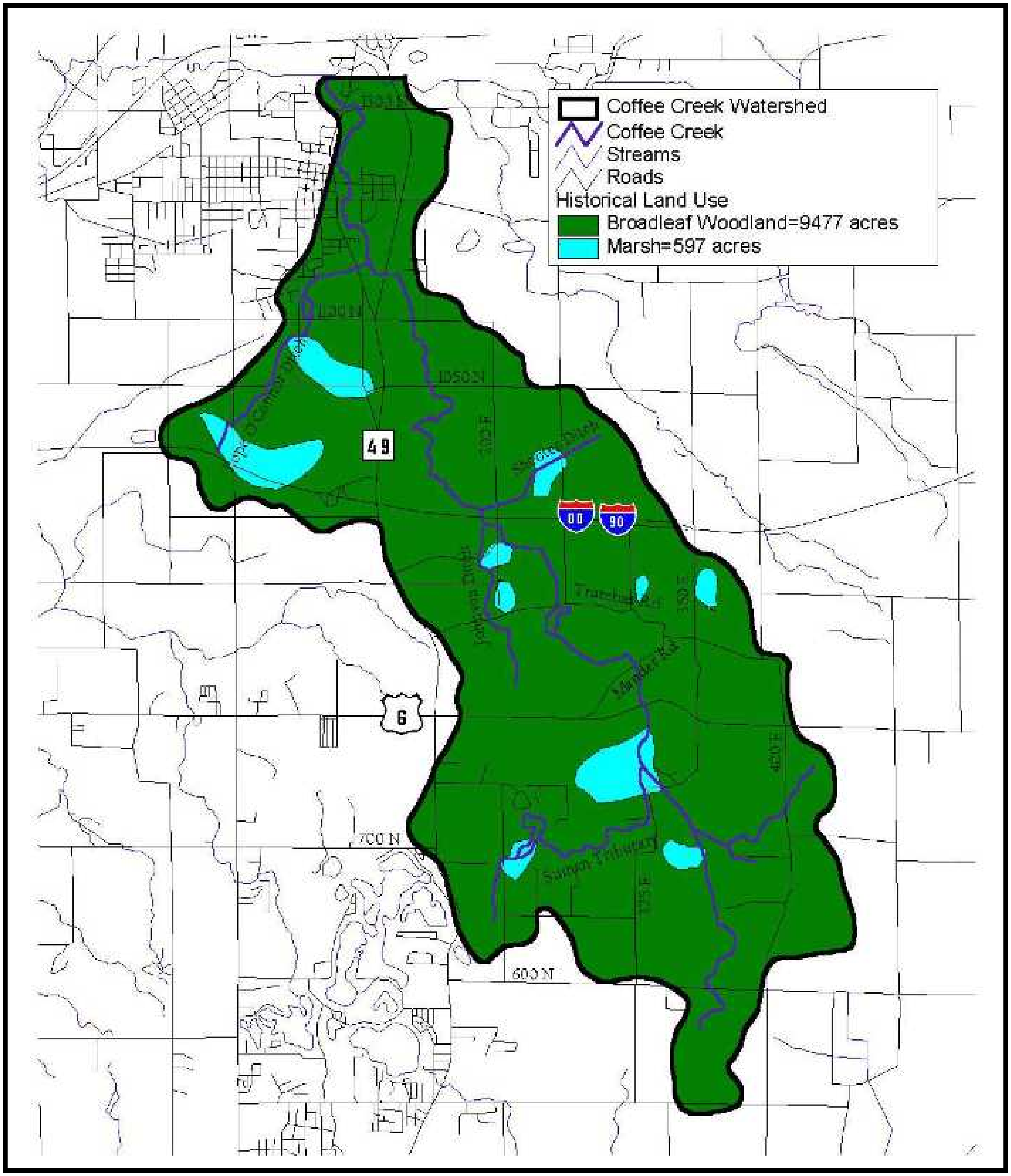

Figure 6. Historic land use in the Coffee Creek watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

The historic natural features of the Coffee Creek watershed, and the biota that are supported within these features, have been affected by the changes that have occurred across the landscape over the past 170 years. The main effect of these changes has been the significant alteration of the course of the natural flow of water through the landscape in addition to increased water pollution. The landscape no longer predominantly supports a base flow system where groundwater is recharged by infiltration of precipitation through the upland landscapes and ultimately, flows slowly toward the creek. Rather, due to impermeable conditions, water runs over the land, taking sediment, nutrients and other pollutants with it to the creek. The impermeable conditions that now predominate in the watershed include urbanized land, specifically buildings, roofs, asphalt, and concrete, and intensely farmed agriculture areas. In intensely farmed areas the hard packed layer of soil below the surface layer acts as a barrier, providing little infiltration capacity. Additionally, the replacement of the deep-rooted native vegetation with a monoculture of row crop agriculture means that the infiltration and filtering capacity of the landscape is almost completely eliminated, and erosion of soil predominates. In addition to changes to the hydrologic flow, more pollutants are being discharged either directly or indirectly to aquatic systems within the watershed. Fertilizers, pesticides, animal wastes, and chemically treated municipal and industrial wastes can now be detected in many waterbodies in the watershed. As hydrologic systems are altered, the biotic community composition, structure, and ultimately, health, and diversity are affected.

Historically, forested land predominated across the entire landscape; now forested land predominates along stream corridors and areas of more extreme topographic relief in the upper watershed. Development and agriculture exist in many of these areas that were once forested. Areas that have remained forested have lost much of their historical structure. Much of the land has been logged with varying degrees of intensity in order to extract valuable timber. Forested land has also been used as pasture for primarily cattle and pigs. These practices often cause irreversible damage to native vegetation and the historic soil profile. Forested land now supports many fewer species of native flora and fauna not only due to fragmentation and species loss, but also because erosion has taken much of the topsoil and corresponding seedbank to the nearest stream or tributary.

Where past disturbance has occurred most native landscapes have given way to rudimentary landscapes. Invasive exotic plant species thrive in disturbed areas, fallow fields, and within the non-cultivated areas at the fringe of urbanization. These species, without their natural competitors, can easily overtake native plant species and often provide little to no habitat for native fauna. Many landscapes, where some evidence of natural structure can still be found, provide unique opportunities for native plant community restoration. Examples of ongoing community restoration can be viewed at Coffee Creek Watershed Preserve, a 167-acre preserve within Coffee Creek Center, east of 49, between SR 1050 and the Indiana Toll Road. Intact plant communities as well as ongoing restoration can also be found at Moraine Nature Preserve, which comprises approximately 700 acres in the upper watershed of Coffee Creek. Though the opportunities for restoration exist, there is no place within the watershed where the landscape has not been changed in some way by European settlement, agriculture, and development influences over the last 170 years. Nevertheless, small remnants of historical natural features can be found throughout the watershed today (Figure 7).

The Coffee Creek watershed lies within a region designated as a Forest Legacy area. Forest Legacy is a program established by Congress as part of the 1990 Farm Bill, and is administered through the Indiana Department of Natural Resources. The purpose of the program is to identify and protect important forest resources in the state that are threatened by development. If a forested property is accepted into the program, the state purchases the development rights to the property and holds them in perpetuity, while the landowner still holds other forested resource rights including harvesting of timber. The Forest Legacy region in which the Coffee Creek watershed lies is the Northwest Morainal Area, where diverse assemblages of northern morainal forest ecosystems are under development pressures from the expanding Chicago region.

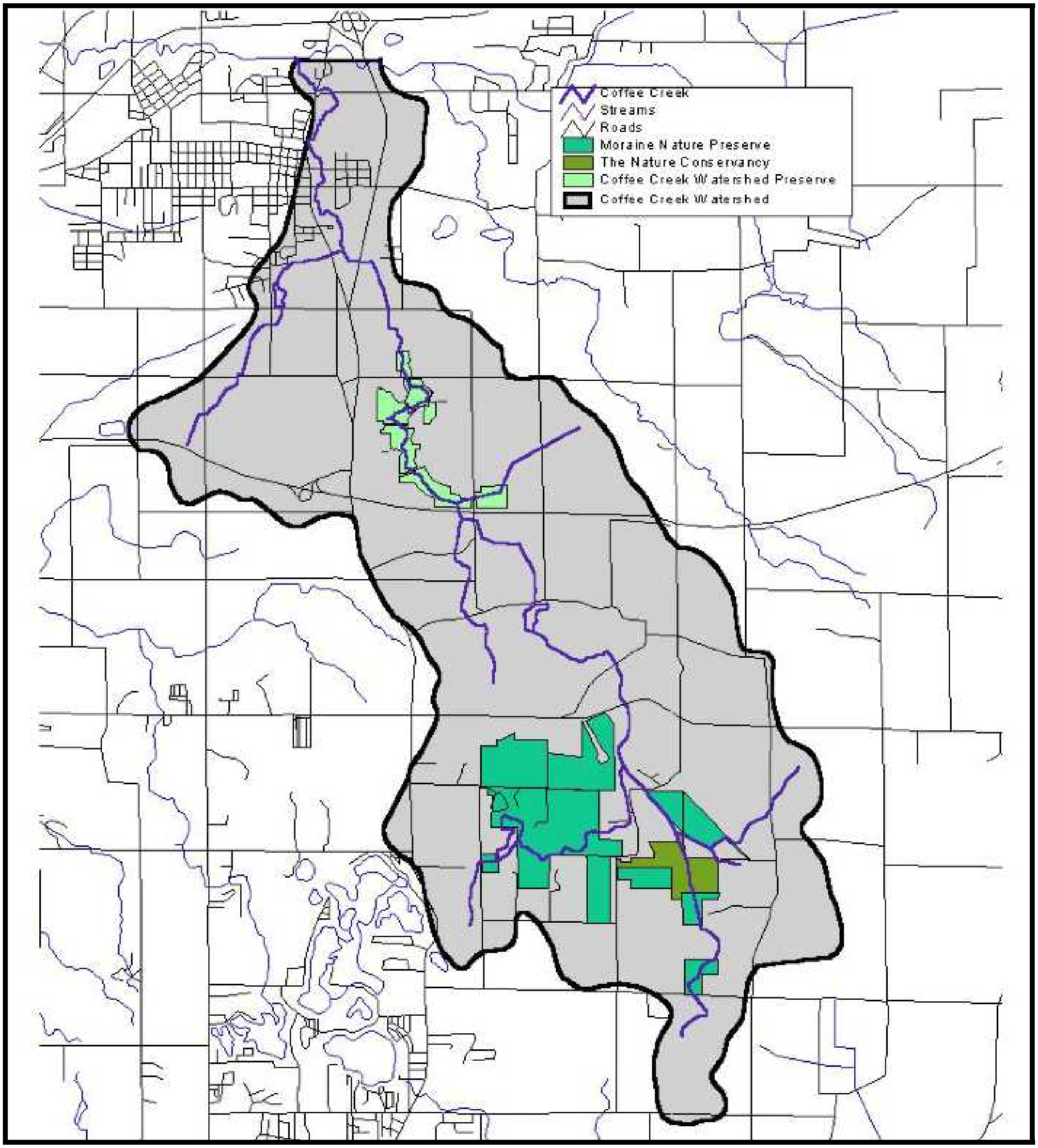

Figure 7. Natural feature restorations and preserves in the Coffee Creek watershed.
Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

2.5 Endangered, Threatened, and Rare Species

The Indiana Natural Heritage Data Center database provides information on the presence of endangered, threatened, or rare species, high quality natural communities, and natural areas in Indiana. The Indiana Department of Natural Resources (IDNR) developed the database to assist in documenting the presence of special species and significant natural areas and to serve as a tool for setting management priorities in areas where special species or habitats exist. The database relies on observations from individuals rather than systematic field surveys by the IDNR. Because of this, it does not document every occurrence of a special species or habitat. At the same time, the listing of a species or natural area does not guarantee that the listed species is present or that the listed area is in pristine condition. To assist users, the database includes the date that the species or special habitat was last observed in a specific location.

Appendix D presents the results from the database search for the Coffee Creek watershed. (For additional reference, Appendix D also provides a listing of endangered, threatened, and rare species documented in Porter County.) The database records the presence of significant natural areas within the Coffee Creek watershed. All of these areas lie in the southern portion of the watershed. Moraine Nature Preserve supports four of these significant natural areas including a dry-mesic forest (2), a mesic forest (2), a shrub-scrub swamp wetland (2), and a pond (7). The two remaining significant areas, a fen (5) and a sedge meadow wetland (5), lie within the undedicated portion of the Moraine Nature Preserve. (Numbers indicate the map location in Figure 8 where each of these was historically located.)

The habitat within the watershed supports or at least historically supported six state endangered animal species including the least bittern (*Ixobrychus exilis*; 21), loggerhead shrike (*Lanius ludovicianus*; 21), sedge wren (*Cistothorus platensis*; 19 and 20), marsh wren (*Cistothorus palustris*), spotted turtle (*Clemmys guttata*; 21), and blanding's turtle (*Emydoidea blandingi*; 6 and 22). The database locates the sedge wren in the southern portion of the watershed, south of State Road 6, near the Moraine Nature Preserve, the marsh wren in the Coffee Creek Watershed Preserve, and the other two listed birds in the northern portion of the watershed near Chesterton (Figure 8). The database indicates that the spotted turtle (21) was observed in the Moraine Nature Preserve, while the blanding's turtle (6 and 22) was observed in the Chesterton area near Coffee Creek. The sedge wren and blanding's turtle listings are recent (1994 and 1987-1989 respectively), while the loggerhead shrike, the least bittern, and the spotted turtle species are older (1951, 1940, and 1939 respectively). The database contains six additional animal records including four birds and two amphibians. These animals are all state species of concern.

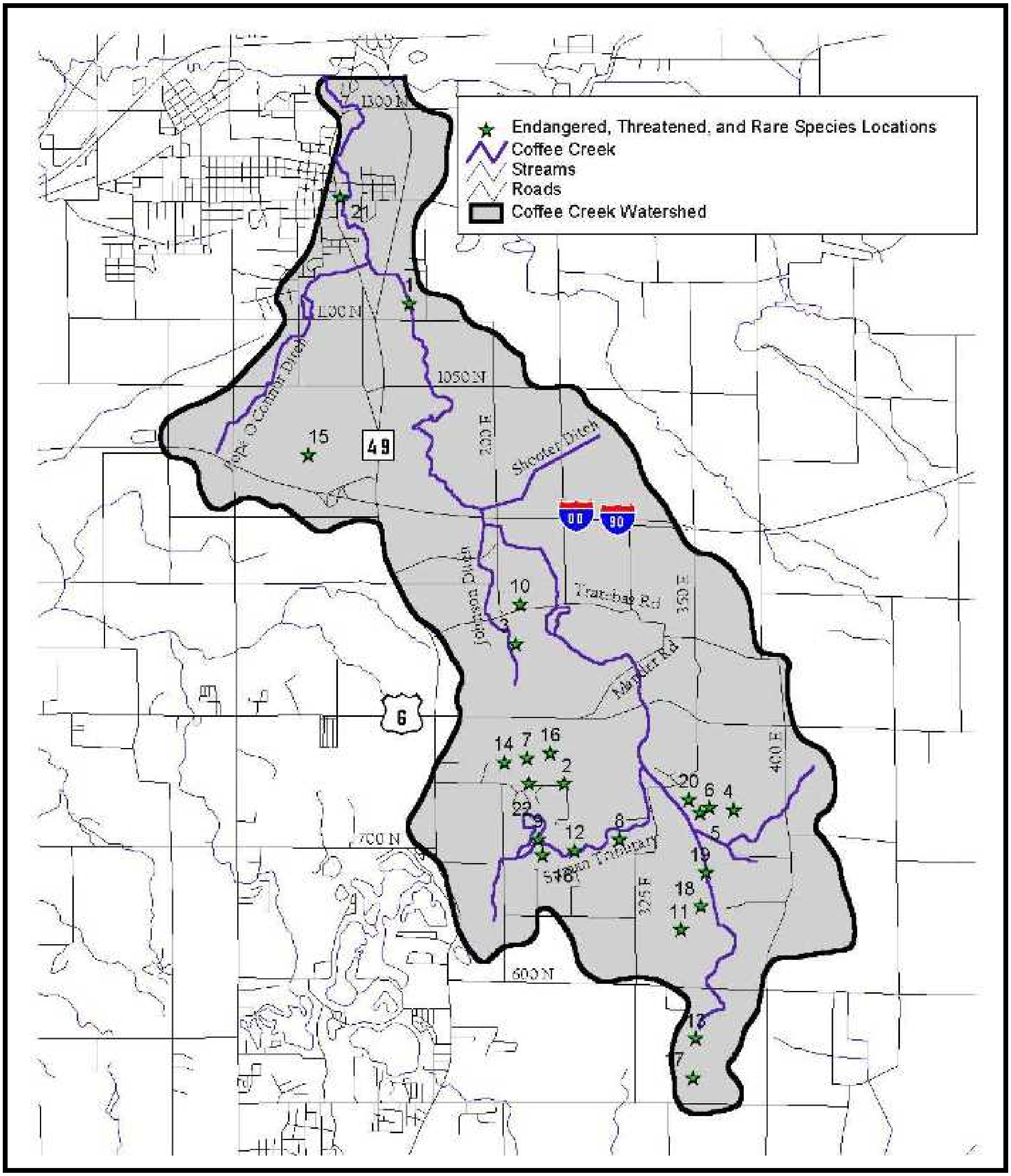

Figure 8. Endangered, threatened, and rare species in the Coffee Creek watershed. Reference numbers indicate the siting of a particular species or habitat. Refer to Appendix D for the complete list of endangered, threatened, and rare species and their locations in the Coffee Creek watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

The database also documents the occurrence of seven plant species in the watershed. The pipewort (*Eriocaulon aquaticum*; 15), finely-nerved sedge (*Carex leptonervia*; 11), and vasey's pondweed (*Potamogeton vaseyi*; 2) are all state endangered species. The database maps the pipewort in the wetland in the wetland complex immediately northwest of the intersection of Interstate 80/90 and SR 49 and finely-nerved sedge and Vasey's pondweed in the southern portion of the watershed (Figure 8). The pipewort listing is prior to European settlement (1919), while the vasey's pondweed and finely-nerved sedge listings are fairly recent (1983 and 1970, respectively). The database also includes three state threatened plant species listings, branching bur-reed (*Sparganium androcladum*; 2), Chamomile grape-fern (*Botrychium matricariifolium*; 9), and American golden-saxifrage (*Chysosplenium americanum*; 18), in the watershed. The database places all three plants in the southern portion of the watershed near Moraine Nature Preserve. The saxifrage sighting is fairly recent (1998) and the bur-reed and grape-fern sightings are older (1983 and 1970, respectively).

2.6 Hydrological Features

The Coffee Creek watershed supports unique water features including a variety of wetland and stream community types. These water features perform important functions in the landscape and are critical in defining the natural communities and the flora and fauna that depend on them. Wetland communities within the watershed include morainic ponds, wooded swamps, shrub wetlands, emergent marshes, fens, sedge meadows, and wet prairies. Historically, large wetland complexes covered approximately 600 acres of the watershed, though this figure likely underestimates the smaller isolated wetlands from the calculation (Figure 6).

Wetland communities exist across the landscape gradient, but predominate in depressional areas and along streams or their slack-water tributaries. Unique systems in this watershed are the fen communities, where mineral-rich ground water discharges to the surface, in fact, most of the wetland types in the watershed include a component of ground water discharge due to the mixed morainal soils that are found predominately in the upper watershed. Man-made wetland types include constructed ponds and detention basins. Although these created wetland types do not replace functions of naturally occurring wetland systems, they can provide some elements of functioning wetlands. Functioning wetlands filter sediments and nutrients in runoff, store water for future release, provide an opportunity for groundwater recharge or discharge, and serve as nesting habitat for waterfowl and spawning sites for fish. By performing these roles, healthy, functioning wetlands often improve the water quality and biological health of streams and lakes located downstream of the wetlands. The land use table (Table 5) indicates that wetlands cover approximately 11% of the Coffee Creek watershed. (See the **Land Use** Section for more details.) Figure 9 maps the wetlands in the Coffee Creek watershed by type. Table 4 presents the acreage of wetlands by type.

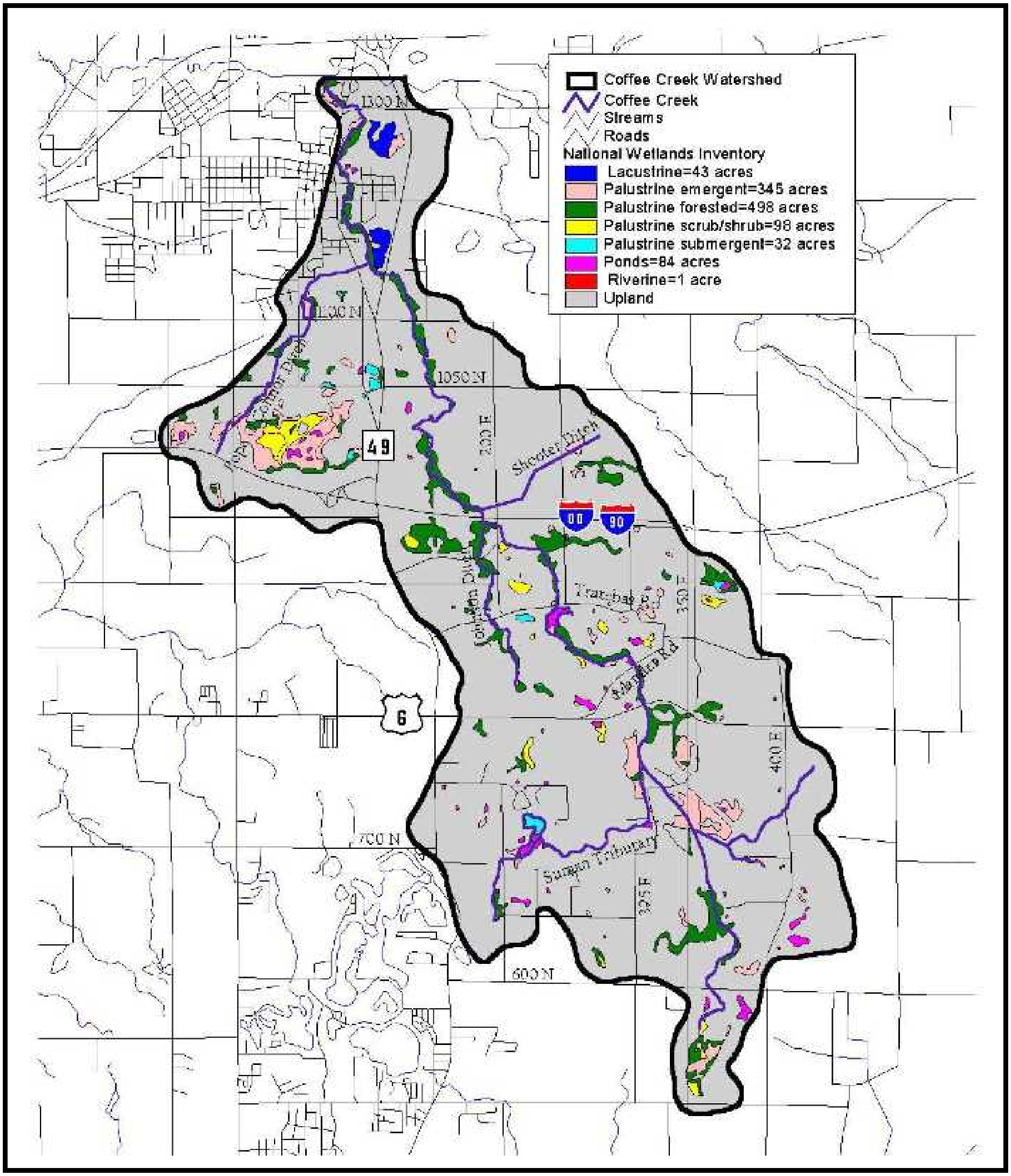

Figure 9. National wetland inventory map. Scale: 1”=5,000’
Source: See Geographic Information System map data sources appendix (Appendix A).

Table 4. Acreage and classification of wetland habitat in the Coffee Creek watershed.

Wetland Type	Area (acres)	Percent of Watershed
Forested	497.5	4.9%
Herbaceous	376.6	3.7%
Shrubland	98.2	1.0%
Pond	83.6	0.8%
Lake	42.7	0.4%
River	1.2	0.01%
Total	**1,099.8**	**10.9%**

Source: USFWS National Wetland Inventory (NWI).

Coffee Creek and its tributaries can be considered the defining waterbodies of this watershed. Extensive portions of the creek still maintain some elements of the historical structure, however, being the lowest point in the watershed, no portion of the creek has been unimpacted as the watershed developed over the last 170 years. Portions of the creek have been channelized as agriculture expanded, and Shooter Ditch, Pope O' Connor Ditch, and Johnson Ditch (5,860 feet, 7,585 feet, and 11,672 feet respectively) were dug at least partly in historical wetland communities. Throughout the length of Coffee Creek today, channelized ditches total 25,117 linear feet, while the unchannelized stream lengths total 20,717 linear feet. Based on approximations from old maps, Coffee Creek historically extended roughly 66,000 linear feet in length, and today extends to approximately 52,993 linear feet in length, including all ditches and tributaries; a difference of about two and a half miles throughout its entire length.

2.7 Early History

Prior to European settlement of Chesterton and northern Porter County in the early 1830s, the entire Lake and Calumet Region was frequently visited and transversed by Native American tribes from other regions (Cannon et. al, 1927). The Pottawattomies, however, called this region their home. They were a resourceful tribe and lived in this region year-round, frequently camping along the shores of the lakes and larger streams and rivers including the Calumet River. Hunting, fishing, trapping, and gathering were a part of their culture; however, they also cultivated gardens for certain staple products. They sustainably harvested resources from the woods, wetlands, and prairies that dominated the land around them. Ultimately, as the pioneers infiltrated the region, the majority of the Pottawattomies departed the region in the mid to late 1830s to their federally designated reservation in Kansas.

Chesterton, the largest town in northern Porter County, was inhabited early in the 1830s supporting a post office as early as 1833. Initial incorporation attempts in 1869 failed; incorporation of the town did not officially occur until 1899. Prior to being named Chesterton, the names Coffee Creek and Calumet were used for the town. Chesterton originally began along a trading route from Chicago to points east; eventually industry, factories, and ultimately the railroad defined the town location where it is today. Many historical structures are still present in the town and within the larger watershed. As shown in Figure 10, the Historic Landmarks Foundation of Indiana (1991) maps 31 sites historical structures or sites and at least some portion of two historic districts within the Coffee Creek watershed.

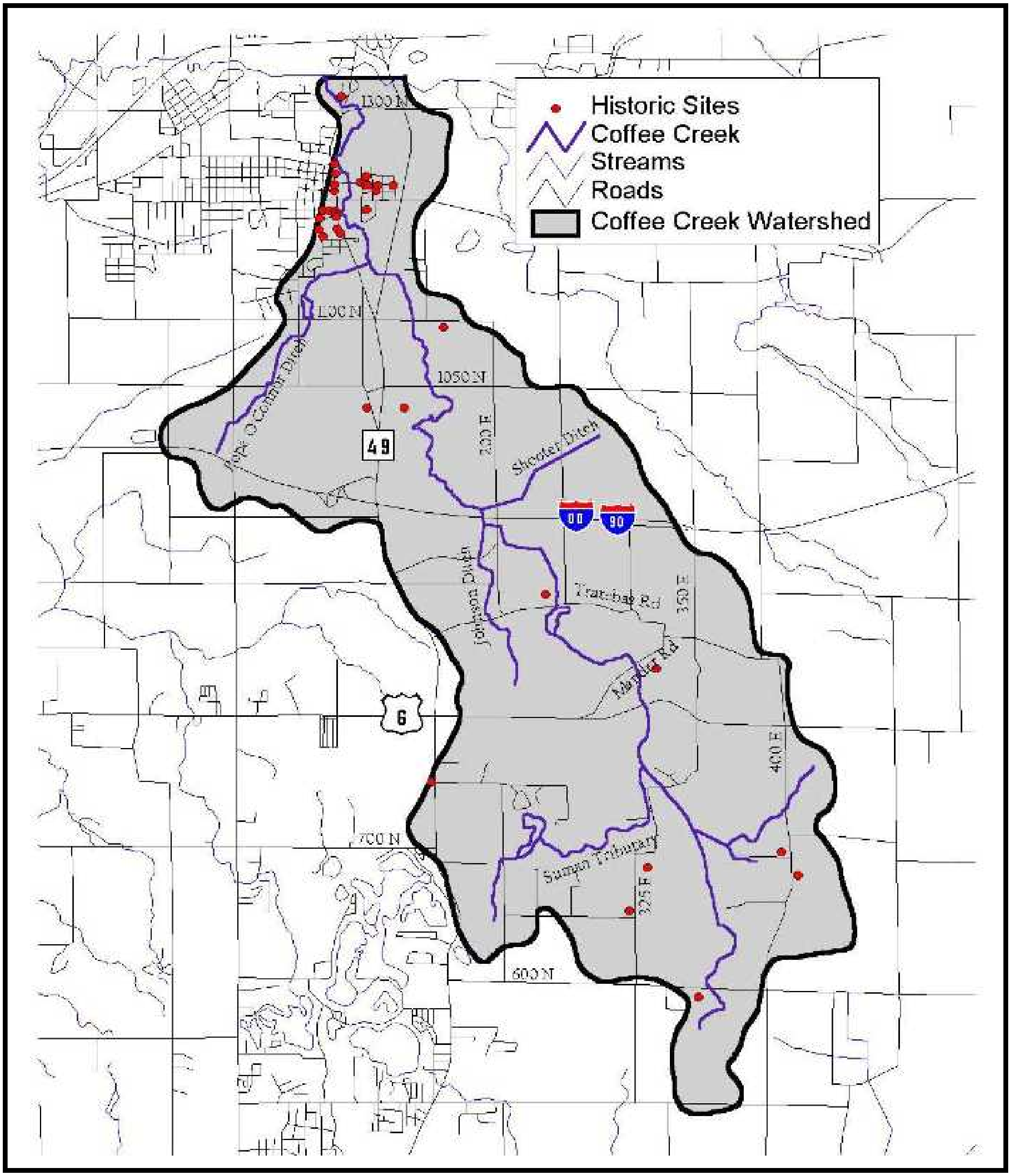

Figure 10. Historical structures and sites in the Coffee Creek watershed. Scale: 1”=5,000’
Source: See Geographic Information System map data sources appendix (Appendix A).

Immediately upon settling in the area, pioneers in the Coffee Creek watershed began altering the natural landscape. In an effort to cultivate the rich ground, forests were logged for their resources. Once cleared, the forests, in addition to the prairies, were plowed for crops and pasture. Many of the rivers, streams, and tributaries were channelized and wetland areas drained.

The rapid and constant flow of Coffee Creek supported many mills along its length. At Long's Mill in Section 20 of Jackson Township, the water supply was sufficient to turn a large turbine wheel all year (Blatchley, 1897). Over time cultivated land and livestock numbers increased across the watershed. Urbanization also increased, primarily along the lake and out from the larger towns of Chesterton, in the northern portion of the watershed, and Valparaiso, just southwest of the Coffee Creek headwaters.

2.8 Land Use

Table 5 and Figure 11 present the land use information for the Coffee Creek watershed. Land use data from the U.S. Geological Survey forms the basis of Figure 10. JFNew field checked the data and corrected it to reflect current conditions in the watershed. In the Indiana Land Cover Data Set, the USGS defines high intensity residential areas as areas with high entities of multi-family residences (apartment complexes, condominiums, etc.). Hardscape covers approximately 80-100% of the landscape in the high intensity residential land use category. Low intensity residential areas consist largely of single family homes and hardscape covers only 30-80% of the landscape. Appendix E provides the land use data for the subwatersheds of the four main tributaries of Coffee Creek.

Table 5. Detailed land use in the Coffee Creek watershed.

Land use	Area (ac)	Area (ha)	Percent of the watershed
Deciduous forest	2,288.1	926.4	22.7%
Pasture	1,823.0	738.0	18.1%
Evergreen forest	1,587.8	642.8	15.8%
Row crop agriculture	1,378.8	558.2	13.7%
Woody wetlands*	761.5	308.3	7.6%
Low intensity residential	588.1	238.1	5.8%
Grassland/herbaceous	539.2	218.3	5.4%
Emergent herbaceous wetlands*	377.8	153.0	3.8%
Grassland/parks	222.1	89.9	2.2%
High intensity commercial	222.0	89.9	2.2%
High intensity residential	149.1	60.4	1.5%
Open water	132.9	53.8	1.3%
Small grains	1.7	0.7	0.02%
TOTAL	**10,072.0**	**4077.7**	**100%**

Source: USGS Indiana Land Cover Data Set. Data set was corrected based on field investigations conducted in 2002.
*Acreages differ slightly from the USFWS acreage estimates given in Table 4. This difference reflects the different methodologies and definitions the two agencies used in developing their land use coverages.

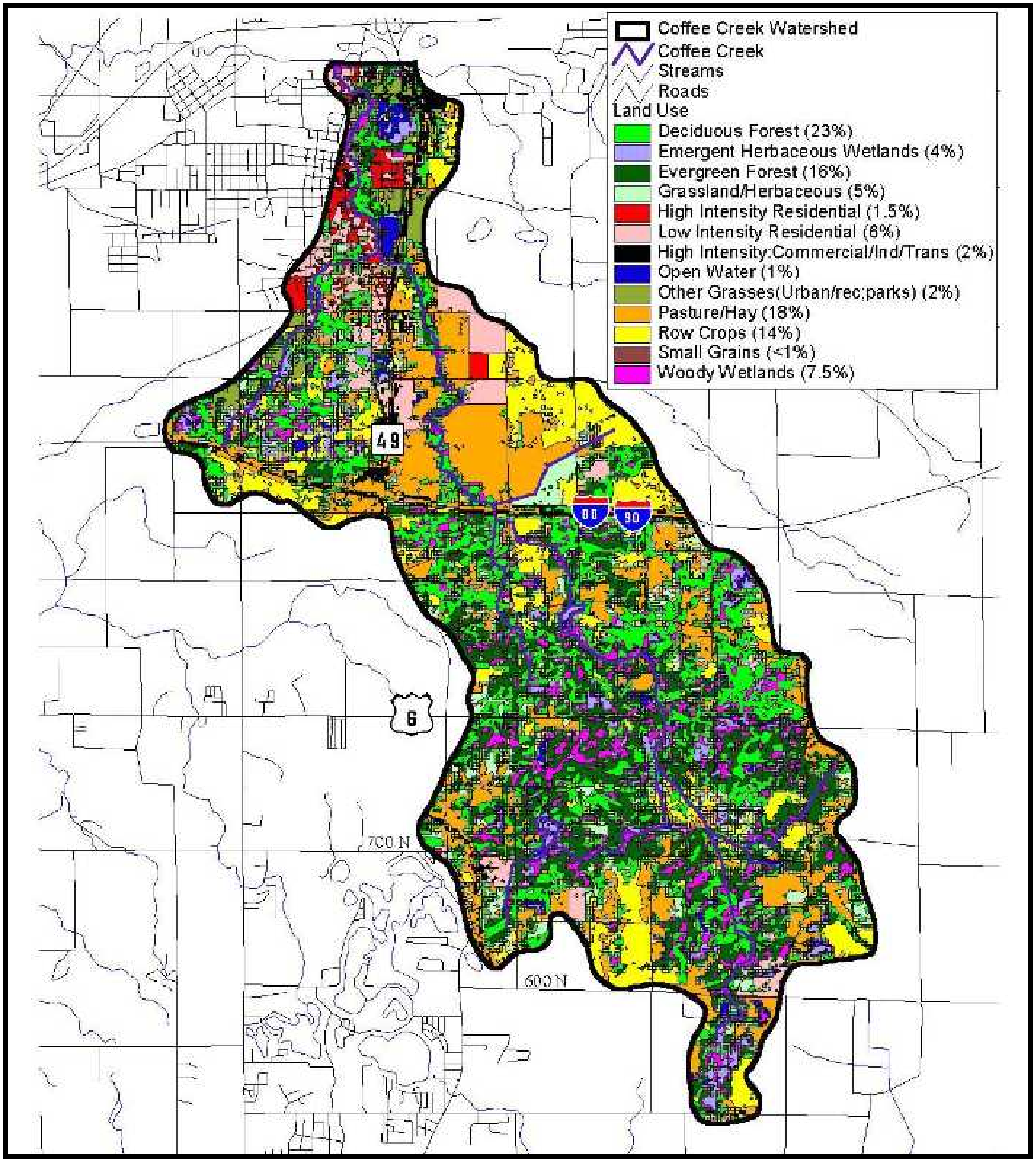

Figure 11. Land use in the Coffee Creek watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

Unlike much of Porter County where agricultural land uses dominate the landscape (Furr, 1981), natural landscapes dominate the Coffee Creek watershed. Forested areas cover approximately 40% of the watershed. Wetlands account for another 11-12% of the watershed (depending upon whether one uses the USGS data or the USFWS data), while grasslands account for another 9% of the watershed. Most of the natural areas lie in the portion of the watershed south of Interstate

80. Old field habitat, fallow farmland or pasture, exists on approximately 18% of the watershed. Developers often consider this land promising for commercial and residential development. The old field areas north of Interstate 80/90 and east of State Road 49 are ideal for development due to their proximity to adjacent residential and commercial areas. It is likely that, in coming years, much of this area will be developed.

Urban land uses, those mapped as high and low intensity residential and high intensity commercial, exist on a smaller portion of the watershed. High density residential areas cover nearly 1.5% of the watershed; low density residential areas occupy approximately 6% of the watershed. Most of the residential areas are located northwest of the intersection of State Road 49 and Interstate 80 within the town of Chesterton. Commercial areas cover slightly more than 2% of the watershed. Much of the commercial areas lie within the State Road 49 corridor.

Although a majority of the Coffee Creek watershed remains in natural land cover, forest land, and wetlands, much of the historic broadleaf forested land has been lost. The northern portion of the watershed is now dominated by urban and agricultural land uses. Any remaining forest land in the part of the watershed is only remnant fragments of historic tracts of woodland. In the southern portion of the watershed large tracts of forest land remain. However, these tracts may quickly be divided and subdivided as urban growth extends into this portion of the watershed.

3.0 IDENTIFIED PROBLEMS

An array of water quality and related concerns were identified during development of the Coffee Creek Watershed Management Plan. Watershed stakeholder outlined some initial concerns at the first public meeting. (See the **INTRODUCTION** Section for a list of stakeholder concerns.) JFNew expanded the problems list through a review of existing water quality and related reports from a variety of sources; conversations with representatives from local natural resource agencies; water quality assessment; and subwatershed modeling. The following section summarizes the key reference documents and the results of the water quality assessment and subwatershed modeling conducted as a part of this plan's development.

3.1 <u>Key Reference Documents</u>

Below is a list of key documents used in identifying water quality and related problems in Coffee Creek, its watershed and tributaries, and the larger Little Calumet River basin. Although some of the documents listed below may not have been used directly in identifying water quality concerns, they are included below since they provide an excellent overview of water quality and related issues in the larger Little Calumet River-Galien River basin and may be useful in future planning efforts in the Coffee Creek watershed. It is important to note that the Northwestern Indiana Regional Planning Commission is working on a management plan for much of northwestern Indiana including the Coffee Creek watershed. Once this plan is completed, a brief summary of it should be added to this list. Additionally, a Watershed Restoration Action Strategy is in the development phases at this time. Once this document becomes available, it should be included in the following list.

- Frommell, B. and R. Vander Kelen. 2002. Draft of An Evaluation of Planning and Regulation for the Protection of Lake Michigan. Department of Urban and Regional

Planning, University of Illinois, Urbana-Champaign. This study focuses on planning and land use regulations. It evaluates the effectiveness of these tools in protecting land and water resources. Although the study's scope was the entire Lake Michigan shoreline, it includes Lake, Porter, and LaPorte Counties in Indiana.

- Forsness et al., 2001. Draft Final Report for the Non-Point Source Monitoring Project for the Indiana Lake Michigan Basin in Lake, Porter, and LaPorte Counties, Indiana. Indiana Department of Natural Resources. This study documents the results of *E. coli* sampling conducted throughout the Lake Michigan basin in northwest Indiana. Two of the project's sampling sites were located within the Coffee Creek watershed.

- Indiana Department of Environmental Management. 1994. 305(b) Report, 1992-1993. Division of Water. Indianapolis, Indiana. Indiana Department of Environmental Management completed the "Indiana 305(b) Report, 1992-1993". 305(b) refers to Section 305 (b) of the Clean Water Act. The 305(b) report is IDEM's biennial report to Congress outlining the conditions of the state's water resources and reporting on the progress the state has made toward achieving the goals of the Clean Water Act (i.e. that all waters are fishable and swimmable).

- Indiana Department of Environmental Management. 1996. 305(b) Report, 1994-1995. Division of Water. Indianapolis, Indiana. Indiana Department of Environmental Management completed the "Indiana 305(b) Report, 1994-1995". 305(b) refers to Section 305 (b) of the Clean Water Act. The 305(b) report is IDEM's biennial report to Congress outlining the conditions of the state's water resources and reporting on the progress the state has made toward achieving the goals of the Clean Water Act (i.e. that all waters are fishable and swimmable).

- In 1998, IDEM switched to a five basin rotating system for reporting the status of the state's waterbodies. As a result, the 1998 305(b) reported covered only the White River, West Fork and Patoka River watersheds and the 2000 305(b) report assessed waterbodies in the Upper Wabash River, Great Miami, and White River, East Fork watersheds. IDEM has not published the 2002 305(b) report; however, IDEM assessed waterbodies in the Little Calumet-Galien River watershed during this most recent rotation. Watershed stakeholders should review this report when it is published and update Tables 6 through 9 with any new information as appropriate.

- Indiana Department of Environmental Management. 1999. Unified Watershed Assessment. Division of Water. Indianapolis, Indiana. Indiana Department of Environmental Management completed the "Unified Watershed Assessment". This report documents input from local, state, and federal agencies and the public to identify both healthy and impaired 11-digit watersheds.

- Indiana Department of Environmental Management. 2002 303(d) list. Office of Water Quality. Indianapolis, Indiana. In 2002, the Indiana Department of Environmental Management completed its 2002 "303(d) List". "303 (d)" refers to Section 303 (d) of the Clean Water Act. Under the Clean Water Act, states must report to Congress those waterbodies which do not meet their designated uses. The 2002 303(d) list is IDEM's draft list of waterbodies in Indiana that do not meet their designated uses.

- Indiana Department of Environmental Management. Raw water chemistry, fish community, and macroinvertebrate community data collected by IDEM's Biological Studies Section was analyzed during this plan's development. This data is available upon request to the public.

- J.F. New and Associates, Inc. 2002. Draft 2002 Monitoring Report Coffee Creek Watershed Preserve, City of Chesterton, Porter County, Indiana. J.F. New and Associates, Inc. completed the 2002 Monitoring Report of the Coffee Creek Watershed Preserve. The report documents the results of plant, bird, and fish community and water quality monitoring conducted during 2002 within the 167 acre preserve.

- J.F. New and Associates, Inc. 2001. 1997-2000 Monitoring Report Coffee Creek Watershed Preserve, City of Chesterton, Porter County, Indiana. J.F. New and Associates, Inc. completed the 1997-2000 Monitoring Report of the Coffee Creek Watershed Preserve. The report documents the results of plant, bird, and fish community and water quality monitoring conducted from 1997 to 2000 within the 167 acre preserve.

- J.F. New and Associates, Inc. 2002. 2001 Monitoring Report Coffee Creek Watershed Preserve, City of Chesterton, Porter County, Indiana. J.F. New and Associates, Inc. completed the 2001 Monitoring Report of the Coffee Creek Watershed Preserve. The report documents the results of plant, bird, and fish community and water quality monitoring conducted during 2001 within the 167 acre preserve.

- Ledet, N.D. 1977. A fisheries survey of the East Branch of the Little Calumet River watershed, Porter and LaPorte Counties, Indiana. Indiana Department of Natural Resource, Division of Fish and Wildlife, Indianapolis, Indiana. In 1977, the Indiana Department of Natural Resources Division of Fish and Wildlife completed the fisheries survey which reports total number of fish, number of species, and species size and weight ranges.

- NOAA et al., 2001. The Indiana Department of Natural Resources Division of Water produced this report in conjunction with the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management to comply with the federal Coastal Zone Management Act of 1972. The report consists of a description of Indiana's Lake Michigan Coastal Program and a draft Environmental Impact Statement for the program. The lengthy report includes a good overview of the historical and current environmental conditions in northwest Indiana. It also provides general information on the existing regulatory framework in place to protect the region's coastal natural resources.

- O'Leary et al., 2001. Watershed Diagnostic Study of the Little Calumet-Galien River Watershed. Prepared for the Indiana Department of Natural Resources, Division of Water. This report provides an overview of the Little Calumet-Galien River watershed.

The report compiles maps from existing data to help evaluate water quality and make management recommendations in the watershed. The authors conducted limited water quality sampling. As a result, recommendations are often made with limited information. Additionally, users should read the supporting documentation in the text to understand why the authors made the recommendations they did and how the authors prioritized areas. Regardless, the report is a good place to start for understanding water quality on a basin wide scale.

- Simon, T.P. 1991. Development of Index of Biotic Integrity expectations for the ecoregions of Indiana. I. Central Corn Belt Plains. U.S. Environmental Protection Agency, Region V, Environmental Sciences Division, Monitoring and Quality Assurance Branch: Ambient Monitoring Section, Chicago, Illinois. EPA 905/9-91/025. Simon examined fish communities at nearly 200 sites located throughout the Central Corn Belt Plains and developed a modified Index of Biotic Integrity to assess fish community health in streams located in the Central Corn Belt Plains. This report documents the results of this examination and IBI development.

- Whittman Hydro Planning and Associates, Inc., 2002. Watershed Restoration Action Strategy for the Little Calumet-Galien Watershed. Prepared for the Indiana Department of Environmental Management, Office of Water Quality, Indianapolis, Indiana. Whittman Hydro Planning completed the "Watershed Restoration Action Strategy for the Little Calumet-Galien Watershed" to provide baseline background information. The report documents water quality concerns and recommends mechanisms for improving water quality throughout the 8-digit Little Calumet-Galien Watershed.

3.2 Water Quality Assessment Summary

The water quality in Coffee Creek and its tributaries was assessed by collecting water grab samples and surveying the benthic macroinvertebrate community and in-stream/riparian habitat at eight sites in the watershed (Figure 12; Table 6). The water samples were collected four times throughout the course of the plan's development. Samples were analyzed for basic water quality parameters (temperature, dissolved oxygen, pH, and conductivity), nutrients (nitrogen and phosphorus), sediment, and *E. coli*. The benthic macroinvertebrate community was surveyed twice and evaluated using IDEM's macrioinvertebrate Index of Biotic Integrity (mIBI). The in-stream/riparian habitat was assessed once using the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI). The following briefly describes the results of this sampling. Appendix F provides a complete report on the water quality assessment conducted as part of the plan's development. Appendix G contains the water quality assessment's Quality Assurance Project Plan.

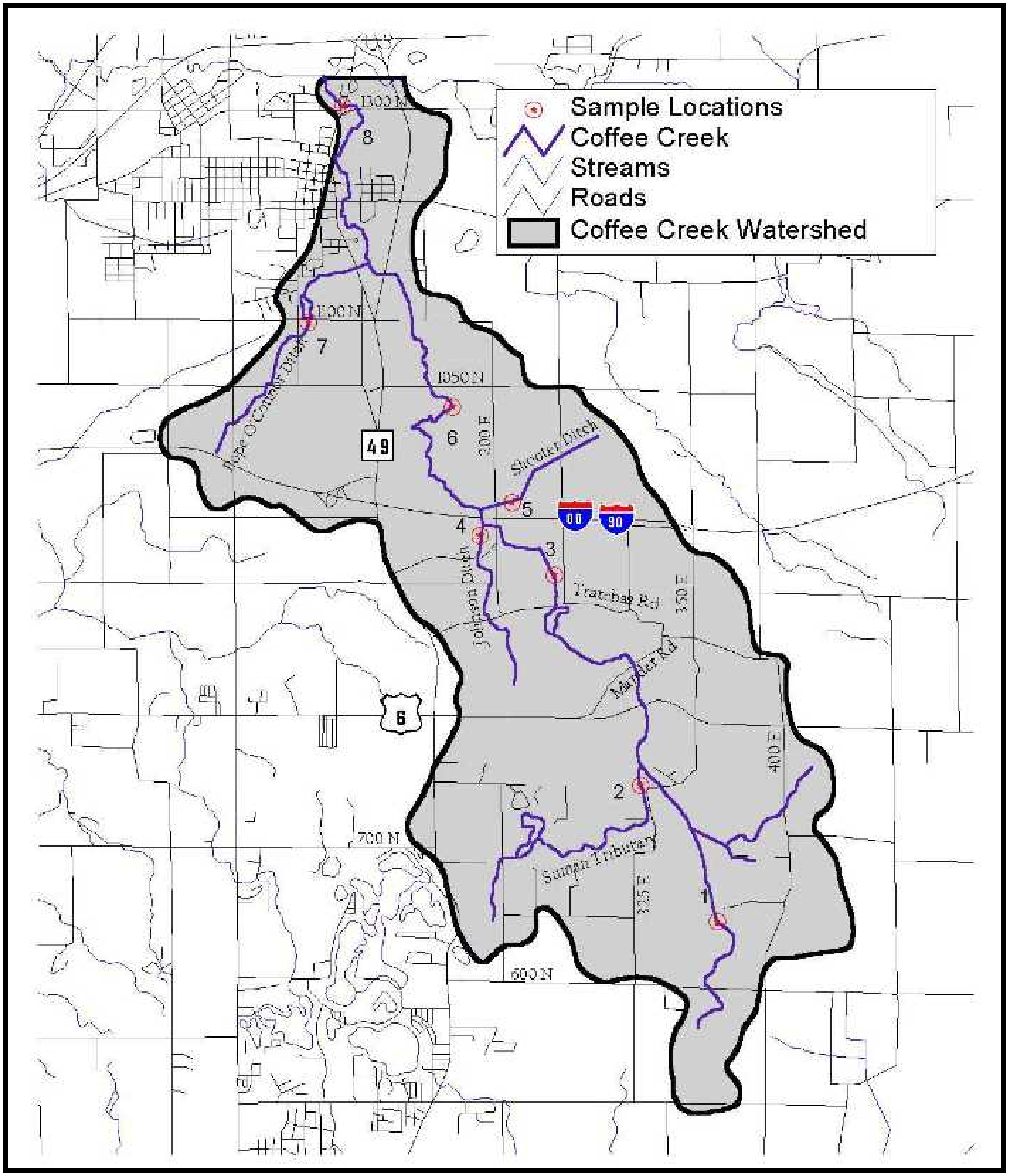

Figure 12. Sampling locations in the Coffee Creek watershed. Scale: 1"=5,000'
Source: See Geographic Information System map data sources appendix (Appendix A).

Table 6. Detailed sampling location information for the Coffee Creek watershed.

Site	Stream Name	Road Location	Place Sampled
1	Coffee Creek	Old State Road 49 immediately north of Indiana Boundary Road	upstream of Old State Road 49
2	Pope O'Connor Ditch	CR 1100 North immediately east of 5th Street	downstream of CR 1100 North
3	Coffee Creek	within Coffee Creek Center	1200' feet upstream of CR 1050 North
4	Shooter Ditch	east of CR 200 East and north of I-80/90	near eastern edge of property boundary
5	Johnson Ditch	dead end gravel road west of CR 200 East and south of I-80/90	upstream of road crossing
6	Coffee Creek	intersection of Mander Road	upstream of road crossing
7	Suman Road Tributary	near a 90-degree bend in Suman Road north of CR 700 North	upstream of road access point
8	Coffee Creek	within the St. Andrews residential development	lot number 21 downstream of bridge

Water quality conditions were generally better in the Coffee Creek mainstem, particularly the middle section of the mainstem (Sites 3 and 6), compared to the water quality conditions in the Coffee Creek tributaries. With respect to water chemistry, nutrient concentrations were closer to the Ohio EPA's standards to protect aquatic life (Indiana does not possess numeric nutrient criteria) and dissolved oxygen concentrations were sufficient to protect salmonid species in the mainstem. High water temperatures observed in July 2002 and the *E. coli* concentrations that exceeded the state standard were the water chemistry issues of most concern in Coffee Creek's mainstem. Habitat scores were also higher in the mainstem compared to the tributaries. QHEI scores ranged from 43 (Coffee Creek at Mander Road; Site 6) to 53 (Coffee Creek at Coffee Creek Center; Site 3) at the mainstem sites, suggesting moderate impairment of the in-stream and riparian habitat. The macroinvertebrate communities found at the mainstem sites reflected the better water chemistry and habitat conditions. mIBI scores ranged from a low of 0.4 (Coffee Creek headwaters; Fall 2002) indicating severe impairment to a high of 5.2 (Coffee Creek at Coffee Creek Center; Fall 2002) indicating only slight impairment. mIBI scores in Coffee Creek at the Coffee Creek Center (Site 3) and Coffee Creek at Mander Road (Site 6) were consistently higher than the tributaries. The Fall mIBI score in Coffee Creek at the Coffee Creek Center (Site 3) suggested this reach is capable of supporting its aquatic life use designation. mIBI scores in Coffee Creek at Mander Road and near its confluence with the Little Calumet River indicated that these reaches were at least partially supportive of the creek's aquatic life use designation.

Coffee Creek tributaries, Shooter Ditch Johnson Ditch, Pope O'Connor Ditch and the Suman Road Tributary, generally possessed poorer water quality conditions than the Coffee Creek mainstem. Nutrient concentrations in Shooter Ditch (Site 4) and Pope O'Connor Ditch (Site 2) were generally higher than those observed in the Coffee Creek mainstem and other tributaries. Nitrate-nitrogen and total phosphorus levels in these tributaries exceeded Ohio EPA numeric criteria set to protect aquatic life. These same tributaries also exhibited low oxygen levels. The high nutrient levels are likely impairing the aquatic communities in Shooter and Pope O'Connor Ditches and preventing the use of these waterbodies by mainstem biota as refuges. High ammonia-nitrogen and high total phosphorus levels were also observed in the Coffee Creek headwaters (Site 8) and Johnson Ditch (Site 5) respectively. Total sususpended solids concentrations were of concern in Shooter Ditch (Site 4) and the Suman Road Tributary (Site 7). *E. coli* concentrations were generally higher in the tributaries compared to the mainstem.

Macroinvertebrate communities in the tributaries typically reflected the poor water chemistry conditions described above. mIBI scores ranged from a low of 0.4 (Pope O'Connor Ditch; Spring 2002 and Shooter Ditch; Fall 2002) indicating severe impairment to a high of 3.4 (Suman Road Tributary; Fall 2002) indicating moderate impairment. The macroinvertebrate communities in Pope O'Connor Ditch and Shooter Ditch were characterized by a dominance of tolerant organisms and overall low diversity. The Suman Road Tributary's fall sampling suggested the site possessed at least moderate diversity with an average number of more sensitive taxa. Poor habitat in the tributaries likely also shaped the macroinvertebrate communities in the tributaries. Tributary QHEI scores ranged from a low of 23 (Shooter Ditch) to a high of 43 (Suman Road Tributary). Although it was not measured as a part of this study, hydrological modifications, particularly in Shooter Ditch and Pope O'Connor Ditch likely limit the biotic integrity in these ditches as well.

The results of the water quality assessment indicate that watershed management efforts should focus on a two-fold objective: 1. maintain water quality in the mainstem and 2. improve water quality in the creek's tributaries. Of particular importance in protecting the mainstem is limiting the input of nutrients, maintaining/increasing canopy cover to limit heat gain by the mainstem, improving in-stream and riparian habitat, using new technology to prevent development of the watershed from increasing thermal pollution to the mainstem, and reducing the input of pathogens to the creek. Restoration/enhancement of the tributaries should focus on Pope O'Connor Ditch and Shooter Ditch first. These tributaries exhibited the poorest water quality and therefore possess the greatest potential to impair the mainstem's water quality. Additionally, management efforts should target sediment loss prevention from the Suman Road Tributary subwatershed as sediment loading data suggest this tributary may be delivering more sediment than other tributaries to the mainstem.

3.3 Subwatershed Modeling Summary

The U.S. Environmental Protection Agency's Spreadsheet Tool for Estimating Pollutant Loading (STEPL) version 2.0 model was utilized as a screening tool to identify which subwatersheds are releasing the greatest pollutant loads from the Coffee Creek watershed landscape. Results from the modeling exercise indicate that the Pope O'Connor Ditch subwatershed is contributing the greatest amount of nitrogen, phosphorus, oxygen demanding substances, and sediment to its respective tributary to Coffee Creek. (Appendix H provides a complete report of the modeling performed as part of the Coffee Creek Watershed Management Plan development.) Urban and agricultural land uses are responsible for the majority of the pollutant load in the Pope O'Connor subwatershed. When the model results are examined on "pollutant released per acre of subwatershed" basis, the Shooter Ditch subwatershed releases more phosphorus and sediment per acre of subwatershed than any of the other subwatersheds. Cropland in the subwatershed is the primary source of these pollutants. In general the modeling results are consistent with qualitative observations, water quality analysis, and biotic integrity evaluations of each subwatershed's respective tributary. Pollutant loading from these subwatersheds may be impairing Coffee Creek's (mainstem) water quality, habitat, and biological communities. It is important to note, however, that it is unlikely that all of the pollutant load reaching each of Coffee Creek's tributaries reaches the mainstem. The tributaries and their respective biological communities assimilate some of the pollutant load. Based on the model results, watershed restoration efforts should target the Pope O'Connor Ditch and Shooter Ditch subwatersheds.

3.4 Identified Problems Summary

Tables 7 through 10 summarize the water quality and related problems identified through public meetings; a review of existing water quality and related reports from a variety of sources; conversations with representatives from local natural resource agencies; water quality assessments (water, biotic, and habitat sampling); and subwatershed modeling. The problems are separated into four groups: 1. problems affecting the Coffee Creek mainstem, 2. problems affecting the Coffee Creek tributaries, 3. problems affecting the Coffee Creek watershed, which includes problems associated with landscape processes that affect water quality, and 4. problems affecting the Little Calumet River basin to provide a broader context for the problems faced in the immediate Coffee Creek watershed. The tables list the concern on the far left side of the table. The center columns of the tables document the location of the problems and/or specific evidence of the problem. The final column in each table provides information on the implications of the problem on stream ecosystems and, where appropriate, lists sources or causes for the problem. In cases where evidence of a problem existed but would require a lengthy explanation, the phrase "water quality sampling" or "modeling" was placed in the Evidence/Symptoms column. Individuals should refer to the appendices for a complete documentation of the evidence for listing that concern (Appendix F: Water Quality Assessment; Appendix H: Subwatershed Modeling). Although many problems are listed in Tables 7 through 10, stakeholders input, the water quality assessment, and subwatershed modeling indicate that the Shooter Ditch and Pope O'Connor subwatersheds are of greatest concern. Figure 13 shows the location of these critical areas. Stakeholders recognize that watershed management in these subwatersheds is critical to achieving their vision for Coffee Creek.

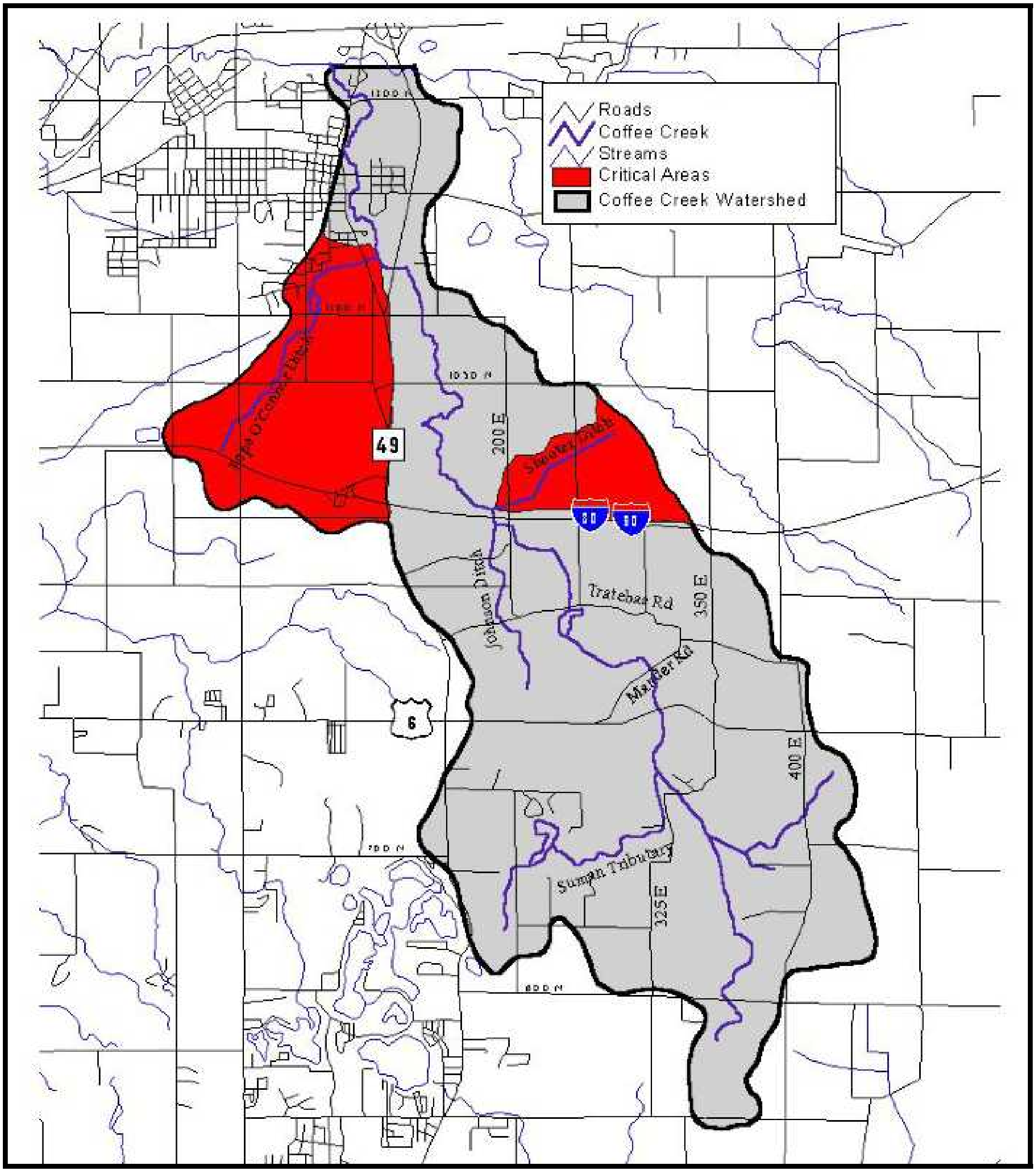

Figure 13. Critical areas targeted for improvement by the Coffee Creek Watershed Management Plan.
Source: See Geographic Information System map data sources appendix (Appendix A).

Table 7. Identified issues in the Coffee Creek mainstem.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
Non-support of recreational use/ High *E. coli* concentration	High *E. coli* measurements	Coffee Creek	305 (b) Report (1992-1993)	*E. coli* indicates the presence of pathogenic organisms in the water. Pathogenic organisms, such as bacteria and viruses, can potentially harm the biota living in the stream. Such organisms can also make humans who come in contact with the water sick. Common sources of pathogens include human and wildlife waste, fertilizers containing manure, previously contaminated sediments, septic tank leachate, combined sewer overflows, and illicit connections to stormwater sewers.
	High *E. coli* measurements	Coffee Creek	305 (b) Report (1994-1995)	
	Exceeded geometric mean state standard (125 col/100 mL)	Coffee Creek at Morgan Avenue	IDEM (2000)	
	Exceeded grab sample state standard (235 col/100 mL)	Coffee Creek Center sample sites	JFNew (1999-2002)	
	Exceeded grab sample state standard (235 col/100 mL)	319 Grant sample sites	JFNew (2001-2002)	
	High *E. coli* measurements	Coffee Creek basin	303 (d) list (2002)	
Pathogens	Suspected problem (Pathogens were not directly measured during the development of the watershed management plan. *E. coli* concentrations, an indicator for the presence of pathogenic organisms, were measured.)	Coffee Creek	Watershed stakeholders public meeting (2002)	Bacteria, viruses, and other pathogens are contaminants of concern in most watersheds. Common sources of these pathogens include human and wildlife waste, fertilizers containing manure, previously contaminated sediments, septic tank leachate, combined sewer overflows, and illicit connections to stormwater sewers. Pathogenic organisms can threaten human health by causing a variety of serious diseases, including infectious hepatitis, typhoid, gastroenteritis, and other gastrointestinal illnesses. Pathogens can also impair the recreational value of a stream and impair its biological community.
High biological oxygen demand (BOD)	BOD exceeded typical Indiana range (1.1-2.2 mg/L)	Coffee Creek at CR 1100 North	IDNR Fisheries Report (1978)	Like their terrestrial counterparts, aquatic fauna require oxygen to live. During respiration, aquatic fauna consume oxygen in the water column. The degradation of certain organic substances also

Table 7. Identified issues in the Coffee Creek mainstem.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
				utilizes oxygen in the water column. A variety of sources contribute oxygen demanding organic wastes to a stream, including soil erosion, human/animal waste, household or industrial chemicals, lawn clippings, and pesticides. (IDNR biologists hypothesized that high BOD measured at this site could be attributed to a septic system leak.) High BOD suggests the presence at least some of the aforementioned pollutants in the water column. As bacteria utilize dissolved oxygen to degrade these pollutants the amount of oxygen available to aquatic fauna decreases. This can impair the aquatic fauna community, which, in turn, can impair a stream's ability to assimilate nutrients and perform other necessary functions. It also degrades the biological integrity of the stream and may reduce fishing opportunities.
Silt/High total suspended solid concentration	Suspected problem	Coffee Creek	Watershed stakeholders public meeting (2002)	Silt in streams indicates an erosion problem in the watershed and/or streambank erosion. The erosion can be a current or historical problem. While there are many sources of silt and causes of erosion, active construction sites, unvegetated stream banks, and poorly managed farm fields are the most common sources of sediment to a stream. The addition of sediment to the stream system impairs habitat for the stream biota. It can also directly harm aquatic biota by clogging gills, smothering eggs, and via other mechanisms. Typically, silt entering a stream has nutrients attached to it. These nutrients can also impair the biota, altering biotic structure, and ultimately limiting the functioning of the stream ecosystem. In addition, silty water presents aesthetic problems for human users of the system.
	Silt deposition (visual observation)	Coffee Creek downstream of CR 1050 North	JFNew (2002)	
Thermal pollution	Suspected problem	Coffee Creek	Watershed stakeholders public meeting (2002)	Thermal pollution (an increase in temperature) is of particular concern in coldwater streams like Coffee Creek. In these streams native fish populations require low water temperatures and the corresponding high dissolved oxygen levels to survive. If the ambient water temperature increases and therefore the water's ability to hold oxygen decreases, the fish community composition

Table 7. Identified issues in the Coffee Creek mainstem.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
	Temperature exceedence of the state coldwater water quality standard.	Coffee Creek at Indian Boundary Road, Coffee Creek Center, and Mander Road	JFNew (2002)	will shift away from its native array of species toward a fish community dominated by more tolerant species. Thus, thermal pollution can degrade the biological integrity of a coldwater stream and may reduce its fishing opportunities. By changing its species composition, thermal pollution may also affect a stream's ability to function. Thermal pollution is often caused by removal of streamside vegetation. Shifts in system hydrology that occur as a watershed develops (i.e. the increase in the ratio surface water inputs to groundwater inputs) can increase stream water as well. This is of significant concern in a developing watershed such as the Coffee Creek watershed.
Pesticides/ High organic compound concentrations	Suspected problem	Coffee Creek	Watershed stakeholders public meeting (2002)	Pesticide concentrations at high levels can be toxic to macroinvertebrates, fish, and land animals. Ultimately, toxic pesticide levels can impair the biotic community of streams. This could affect a stream's ability to assimilate nutrients. Sampling for pesticides and other organic compounds was not conducted during the development of the watershed management plan. The most common sources of pesticides are agricultural, residential, and commercial landscapes.
Nutrients/High nutrient concentrations	Suspected problem	Coffee Creek	Watershed stakeholders public meeting (2002)	High nutrient concentrations and, in particular, phosphorous and ammonium alter a stream's biotic community by creating conditions that favor autotrophy (algae) growth in a headwater stream where heterotrophs (macroinvertebrates) should dominate. This will impair a stream's ability to assimilate nutrients and perform other necessary functions. It also impairs the biological integrity of the stream. Common sources of nutrients (phosphorus and nitrogen) include fertilizers, human and animal waste, atmospheric deposition, and yard waste or other plant material that reaches the stream. Nitrogen can also diffuse from the air into streams. Atmospheric nitrogen is then "fixed" by certain algae species (cyanobacteria) into a usable form of nitrogen.

Table 7. Identified issues in the Coffee Creek mainstem.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
Impaired biotic communities	Skewed fish community (dominance of rough fish)	Coffee Creek at CR 1100 North and Old Indian Treaty Road	IDNR Fisheries Report (1978)	High populations of rough fish can reduce the quality of the game fishery by out-competing game fish for food resources and habitat. A dominance of rough fish can also be indicative of poor water quality and/or impaired habitat. High populations of rough fish limit fishing opportunities in the stream.
	Poor quality sport fishery (game fish account for 7% of fish population)	Coffee Creek at Old Indiana Treaty Road, CR 1100 N, CR 200 E, and at Mander Road	IDNR Fisheries Report (1978)	A poor quality sport fishery reduces the available fishing opportunity in the stream.
	Low natural reproduction of brown trout	Coffee Creek at CR 200 East	IDNR Fisheries Report (1978)	Poor reproductive success of native brown trout could be indicative of a variety of issues, including, but not limited to, poor habitat (lack of gravel substrate for spawning, lack of cover/refuges for brown trout young, etc.), poor water quality (silt smothering of eggs, silt clogging gills of fish, high water temperatures/low dissolved oxygen), and biological factors (predation, competition, parasitism, etc.). Poor reproductive success can also limit recreation (fishing) opportunities on the creek.
	Poor IBI score (36)	Coffee Creek at CR 200 East	Simon (1990)	Poor IBI scores indicate that omnivores, tolerant forms, and habitat generalists dominate the fish community. Biotic community impairment can negatively affect a creek's ability to function and can also reduce recreational opportunities on the creek.
	Poor-fair IBI score (28-44)	Coffee Creek Center sample sites	JFNew (1997-2001)	
	Moderately to slightly impaired mIBI score (2-5.6)	Coffee Creek at CR 1100 North	IDEM (1990)	Degradation of the biotic communities can impact a stream's ability to function—particularly its ability to absorb and sequester pollutants. Impaired macroinvertebrate communities can negatively impact fish community structure. Degraded biotic communities can also reduce recreational opportunities on the waterbody.
		319 Grant sample sites	JFNew (2002)	
	No specific data reported	Coffee Creek	305 (b) Report (1992-1993)	

Table 7. Identified issues in the Coffee Creek mainstem.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
	No specific data reported	Coffee Creek	305 (b) Report (1994-1995)	
	No specific data reported	Coffee Creek	303 (d) list (2002)	
Impaired stream habitat	Low QHEI scores (range: 43-53)	319 Grant sample sites	JFNew (2002)	Degraded habitat can affect both stream water quality and the stream's biotic community in many ways. For example, stream bank erosion, one form of habitat degradation, adds sediment and sediment-attached pollutants to the water column. Similarly, the lack of riffle/pool development, another form of habitat degradation, can shape a stream's biotic community by creating conditions that favor tolerant, generalist species. The impact of water quality and biotic impairment caused by specific types of habitat impairment are outlined throughout this table. Specifics areas of habitat impairment in Coffee Creek's mainstem included poor riffle/pool development, poor in-stream cover for fauna, and modified channel characteristics.
Streambank erosion and stabilization	Suspected problem	Coffee Creek	Watershed stakeholders public meeting (2002)	Eroding stream banks deposit soil and soil-attached pollutants (nutrients, toxins, pathogens) directly into waterways. Soil in streams degrade habitat, impair biotic communities, and reduce the aesthetic and recreational value of the waterbody. Nutrients and other pollutants attached to the eroded soil can have similar impacts. Refer to the information outlined above detailing the impact of soil and other pollutants on receiving waterbodies.
	Poor channel erosion score in QHEI	Coffee Creek in the headwaters	JFNew (2002)	
Loss of natural channel form	Suspected problem	Coffee Creek	Watershed stakeholders public meeting (2002)	Ditching creates a homogeneous stream habitat. This limits the streams ability to support a diverse aquatic fauna, which in turn, can limit the stream's ability to function and provide recreational opportunities.
	Moderate to low QHEI scores for channel form metrics	319 Grant sample sites	JFNew (2002)	

IDEM=Indiana Department of Environmental Management; IDNR=Indiana Department of Natural Resources

Table 8. Identified issues in the tributaries to Coffee Creek.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
High *E. coli* concentration	Exceeded grab sample state standard (235 col/100 mL)	319 Grant Tributaries (Shooter Ditch, Pope O'Connor Ditch, Johnson Ditch, and Unnamed Tributary at Suman Road)	JFNew (2002)	*E. coli* indicates the presence of pathogenic organisms in the water. Pathogenic organisms, such as bacteria and viruses, can potentially harm the biota living in the stream. Such organisms can also make humans who come in contact with the water sick. Common sources of pathogens include human and wildlife waste, fertilizers containing manure, previously contaminated sediments, septic tank leachate, combined sewer overflows, and illicit connections to stormwater sewers.
	Exceeded grab sample state standard (235 col/100 mL)	Coffee Creek Center Tributaries (Shooter Ditch and Unnamed Tributary)	JFNew (1999-2002)	
Pathogens	Suspected problem (Pathogens were not directly measured during the development of the watershed management plan. *E. coli* concentrations, an indicator for the presence of pathogenic organisms, were measured.)	Coffee Creek Tributaries	Watershed stakeholders public meeting (2002)	Bacteria, viruses, and other pathogens are contaminants of concern in most watersheds. Common sources of these pathogens include human and wildlife waste, fertilizers containing manure, previously contaminated sediments, septic tank leachate, combined sewer overflows, and illicit connections to stormwater sewers. Pathogenic organisms can threaten human health by causing a variety of serious diseases, including infectious hepatitis, typhoid, gastroenteritis, and other gastrointestinal illnesses. Pathogens can also impair the recreational value of a stream and impair its biological community.
Pesticides/ High organic compound concentrations	Suspected problem	Coffee Creek Tributaries	Watershed stakeholders public meeting (2002)	Pesticide concentrations at high levels can be toxic to macroinvertebrates, fish, and land animals. Ultimately, toxic pesticide levels can impair the biotic community of streams. This could affect a stream's ability to function. The most common sources of pesticides are agricultural, residential, and commercial landscapes.
Silt or high total suspended solid concentration/loads	Suspected problem	Coffee Creek Tributaries	Watershed stakeholders public meeting (2002)	Silt in streams indicates an erosion problem in the watershed and/or streambank erosion. The erosion can be a current or historical problem. While there are many sources of silt and

Table 8. Identified issues in the tributaries to Coffee Creek.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
	319 Grant physical habitat survey (low substrate scores)	Shooter Ditch and Pope O'Connor Ditch	JFNew (2002)	causes of erosion, active construction sites, unvegetated stream banks, and poorly managed farm fields are the most common sources of sediment to a stream. The addition of sediment to the stream system impairs habitat for the stream biota. It can also directly harm aquatic biota by clogging gills, smothering eggs, and via other mechanisms. Typically, silt entering a stream has nutrients attached to it. These nutrients can also impair the biota, altering biotic structure, and ultimately limiting the functioning of the stream ecosystem. In addition, silty water presents aesthetic problems for human users of the system.
	319 Grant water quality sampling (Appendix F)	Coffee Creek Tributaries	JFNew (2002)	
	319 Grant modeling (Appendix H)	Shooter Ditch and Pope O'Connor Ditch	JFNew (2002)	
	Silt deposition (visual observation)	Shooter Ditch and Pope O'Connor Ditch	JFNew (2202)	
Thermal pollution	Suspected problem	Coffee Creek Tributaries	Watershed stakeholders public meeting (2002)	Thermal pollution (an increase in temperature) is of particular concern in coldwater streams like Coffee Creek. In these streams native fish populations require low water temperatures and the corresponding high dissolved oxygen levels to survive. If the ambient water temperature increases and therefore the water's ability to hold oxygen decreases, the fish community composition will shift away from its native array of species toward a fish community dominated by more tolerant species. Thus, thermal pollution can degrade the biological integrity of a coldwater stream and may reduce its fishing opportunities. By changing its species composition, thermal pollution may also affect a stream's ability to function. Thermal pollution is often caused by removal of streamside vegetation. Shifts in system hydrology that occur as a watershed develops (i.e. the increase in the ratio surface water inputs to groundwater inputs) can increase stream water as well. This is of significant concern in a developing watershed such as the Coffee Creek watershed.

Table 8. Identified issues in the tributaries to Coffee Creek.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
High nutrient concentrations/ loads	Suspected problem	Coffee Creek Tributaries	Watershed stakeholders public meeting (2002)	High nutrient concentrations and, in particular, phosphorous and ammonium alter a stream's biotic community by creating conditions that favor autotrophy (algae) growth in a headwater stream where heterotrophs (macroinvertebrates) should dominate. This will impair a stream's ability to assimilate nutrients and perform other necessary functions. It also impairs the biological integrity of the stream. Common sources of nutrients (phosphorus and nitrogen) include fertilizers, human and animal waste, atmospheric deposition, and yard waste or other plant material that reaches the stream. Nitrogen can also diffuse from the air into streams. Atmospheric nitrogen is then "fixed" by certain algae species (cyanobacteria) into a usable form of nitrogen.
	Water quality sampling (TP, TKN) (Appendix F)	319 Grant Tributaries	JFNew (2002)	
	319 Grant modeling (TP, TN) (Appendix H)	Pope O'Connor Ditch	JFNew (2002)	
Low dissolved oxygen/High BOD (biological oxygen demand)	Measurements below 6 mg/L; percent saturation near or below 50%	Shooter Ditch and Pope O'Connor Ditch	JFNew (2002)	Low dissolved oxygen levels suggest the presence of oxygen demanding pollutants (animal/human waste, organic debris, pesticides/other chemicals, trash, etc.) As bacteria utilize dissolved oxygen to degrade these pollutants the amount of oxygen available to aquatic fauna decreases. This can impair the aquatic fauna community, which in turn can limit a stream's ability to assimilate nutrients and perform other necessary functions. It also degrades the biological integrity of the stream and may reduce fishing opportunities.
	319 Grant modeling (BOD) (Appendix H)	Shooter Ditch and Pope O'Connor Ditch	JFNew (2002)	
Impaired stream habitat	Low QHEI scores (range: 23-43)	319 Grant Tributaries	JFNew (2002)	Degraded habitat can affect both stream water quality and the stream's biotic community in many ways. For example, stream bank erosion, one form of habitat degradation, adds sediment and sediment-attached pollutants to the water column. Similarly, the lack of riffle/pool development, another form of habitat degradation, can shape a stream's biotic community by creating conditions that favor tolerant, generalist species. The impact of water quality and biotic impairment caused by specific types of habitat impairment are outlined throughout this table. Specifics areas of habitat impairment in Coffee Creek tributaries included poor riffle/pool development, poor in-stream cover for fauna,

Table 8. Identified issues in the tributaries to Coffee Creek.

Concern	Evidence/ Symptoms	Location	Identified By (Date)	Comments
				poor substrate, and modified channel characteristics. The channelization of Shooter and Pope O'Connor Ditches contributed greatly to the poor QHEI scores observed at these locations.
Impaired biotic communities	No specific data reported	Coffee Creek Tributaries	305(b) Report (1992-1993)	Degradation of the biotic communities can impact a stream's ability to function—particularly its ability to absorb and sequester pollutants. Impaired macroinvertebrate communities can negatively impact fish community structure. Degraded biotic communities can also reduce recreational opportunities on the waterbody.
	No specific data reported	Coffee Creek Tributaries	305(b) Report (1994-1995)	
	Severely to moderately impaired mIBI score (0-3.4)	319 Grant Tributaries	JFNew (2002)	
Streambank erosion and stabilization	Suspected problem	Coffee Creek Tributaries	Watershed stakeholders public meeting (2002)	Eroding stream banks deposit soil and soil-attached pollutants (nutrients, toxins, pathogens) directly into waterways. Soil in streams degrade habitat, impair biotic communities, and reduce the aesthetic and recreational value of the waterbody. Nutrients and other pollutants attached to the eroded soil can have similar impacts. Refer to the information listed above detailing the impact of soil and other pollutants on receiving waterbodies.

Table 9. Identified issues in the Coffee Creek watershed.

Concern	Identified By (Date)	Comments
Highly erodible land	Watershed stakeholders public meeting (2002)	Soil and soil-attached pollutants (nutrients, toxins, and pathogens) easily erode from highly erodible lands. Soil in streams degrades habitat, impairs biotic communities, and reduces the aesthetic and recreational value of the waterbody. Nutrients and other pollutants can have similar impacts. Refer to the tables detailing stream issues (Tables 7 and 8) for additional information on the impact of soil and other pollutants on receiving waterbodies. Figure 5 shows the location of highly erodible land (using the NRCS definition) in the watershed, and Table 2 lists the highly erodible soil units in the watershed.
	JFNew (2002)	
Combined sewer overflows	Watershed stakeholders public meeting (2002)	Combined sewer overflows (CSOs) convey pollutants (sediment, nutrients, and pathogens) from sewer systems and impervious surfaces directly to waterbodies without any treatment. The impact of sediment, nutrients, and pathogens on stream ecosystems and the human community that utilizes these systems are outlined In the Coffee Creek Mainstem and Coffee Creek Tributaries concerns tables (Table 7 and 8) in greater detail. State and local officials have given stakeholders conflicting information regarding the existence and location of CSOs in the Coffee Creek watershed. More investigation is needed to determine if and where CSOs are located in the watershed.
Undocumented pipes	Watershed stakeholders public meeting (2002)	Failing, old, or poorly-sited/designed septic systems or straight pipes can leach or deliver nutrients and pathogens to nearby waterways and groundwater. The addition of these pollutants to waterways impair the water quality, alter the trophic structure of the water's biotic communities, and decrease the recreational and aesthetic value of waterways. (See the Coffee Creek Mainstem and Coffee Creek Tributaries concerns tables (Tables 7 and 8) for more details on how these pollutants impact stream ecosystems and the humans that utilize those systems.) Leaking septic systems also contaminate groundwater used for drinking water. Undocumented pipes are also a concern in the Coffee Creek watershed. These pipes could contribute organic pollutants, hydrocarbons, industrial toxins, and many of the same pollutants as septic pipes. These additional pollutants impair water quality and degrade the biotic integrity of the receiving waterways.
Water volume entering watershed waterbodies	Watershed stakeholders public meeting (2002)	Wetland loss, the conversion of natural landscapes to impervious surfaces, and, to some extent, combined sewer overflows and undocumented pipes have increased the volume of water entering Coffee Creek watershed streams. An increase in water volume entering a stream can erode the stream banks and scour the stream's channel thereby increasing the sediment and sediment-attached pollutant concentrations within the water column. A corollary concern accompanying wetland loss and the conversion of natural landscapes to impervious surfaces is the change in hydrological regime of a stream. The typical change in hydrological regime is a shift toward increased peak discharges and decreased base flows. This change in hydrology affects a stream capacity to assimilate pollutants and shifts its biotic communities toward ones with a prevalence of tolerant species.

Table 9. Identified issues in the Coffee Creek watershed.

Concern	Identified By (Date)	Comments
Reduction in water storage capacity	Watershed stakeholders public meeting (2002)	Retention/detention basins perform critical water quality functions similar to those provided by wetlands. These functions include water storage, runoff filtering, groundwater recharge and discharge, and providing wildlife habitat. A reduction in the number or surface acreage of retention/detention basins can lead to flooding downstream and degrade watershed water quality. Conversion of natural landscape to hardscape (paved areas) as the watershed develops also decreases the landscape's ability to store water. Rainwater that falls to hardscape will run off and, if not intercepted, discharge to a nearby waterbody. As the water moves over the landscape, it collects any pollutants on the landscape and transports these to the waterbody as well. This can degrade the waterbody's water quality. Additionally, surface water runoff is often warmer than groundwater discharge to a stream. Thus, an increase in surface water runoff could lead to thermal pollution of the stream. Figures 6, 9, and 11 illustrate that wetland loss and alteration of the landscape (agricultural, residential, commercial development) has occurred in the watershed. It is likely that more land will be converted to residential and commercial uses in the near future in the watershed.
Wetland loss	Watershed stakeholders public meeting (2002)	Wetland loss and/or impairment reduces the ability of the landscape to perform the critical water quality functions. These functions include water storage, runoff filtering, groundwater recharge and discharge, and providing wildlife habitat. The loss of wetlands can lead to flooding downstream and degrade watershed water quality. Figures 6, 9, and 11 illustrate that wetland loss and alteration of the landscape (agricultural, residential, commercial development) has occurred in the watershed.
	JFNew (2002)	
Loss of forest land	Watershed stakeholders public meeting (2002)	Forested land typically exports the least amount of pollutants to nearby waterways. Loss of forested land in a watershed usually results in an increase in pollutant loading to watershed streams. Prior to European settlement, it is likely that much of the Coffee Creek watershed was forested. Figures 6 and 11 show that loss of forested land has occurred in the watershed.
	JFNew (2002)	
Habitat loss	Watershed stakeholders public meeting (2002)	Habitat loss results from the conversion of natural landscape (forests, wetlands, etc.) to developed landscapes (urban uses, agricultural uses, etc.). This loss of habitat can degrade biotic communities in the watershed. In severe cases, impairment of stream biotic communities can affect a stream's ability to assimilate pollutants, thereby degrading the stream's water quality. Figures 6, 9, and 11 illustrate that habitat loss and alteration of the landscape (agricultural, residential, commercial development) has occurred in the watershed.
Conversion of natural landscapes to impervious	Watershed stakeholders public meeting (2002)	The conversion of natural landscapes such as forests and wetlands prevents the infiltration of water into the soil. This reduces groundwater recharge and increases overland or surface flow into streams, shifting a stream hydrological regime toward increased peak discharges and decreased base flows. This change in hydrology affects a stream capacity to assimilate pollutants and shifts its biotic communities toward ones with a prevalence of tolerant species.
	JFNew (2002)	

Table 9. Identified issues in the Coffee Creek watershed.

Concern	Identified By (Date)	Comments
Low species diversity	Watershed stakeholders public meeting (2002)	Low species diversity in stream ecosystems is symptomatic of degraded habitat and water quality conditions. Unbalanced biotic communities may reduce a stream's ability to assimilate pollutants, thereby degrading the stream's water quality. The poor biotic integrity scores observed at many of the 319 sampling sites was partially the result of low species diversity in the creek's mainstem and tributaries (See Tables 7 and 8).
	JFNew (2002)	
Lack of public awareness	Watershed stakeholders public meeting (2002)	Coffee Creek provides both recreational opportunities and aesthetic value to community members. Generating interest from adjacent landowners, community members, and public officials regarding the opportunities and value provided by Coffee Creek will enhance the ability of concerned stakeholders to protect this resource.
Lack of planning/zoning ordinances	Watershed stakeholders public meeting (2002)	Planning done prior to development can help prevent degradation of stream ecosystems. Without such planning, land managers are forced to repair degradation after it has occurred. After-the-fact fixes are often less effective and more costly than preventing degradation in the first place. Zoning ordinances are one tool land planners and managers have to restrict or limit development practices that degrade stream ecosystems. Land use planning and the use of zoning ordinances in the Coffee Creek watershed will help in the protection and preservation of the Coffee Creek's habitat, species diversity, and water quality.

Table 10. Identified issues in the Little Calumet River Basin.

Concern	Location	Identified By (Date)	Comments
Non-support of recreational use (high *E. coli* measurements)	Little Calumet River	305 (b) Report (1992-1993)	*E. coli* indicates the presence of pathogenic organisms in the water. Pathogenic organisms, such as bacteria and viruses, can potentially harm the biota living in the stream. Such organisms can also make humans who come in contact with the water sick. Common sources of pathogens include human and wildlife waste, fertilizers containing manure, previously contaminated sediments, septic tank leachate, combined sewer overflows, and illicit connections to stormwater sewers.
		305 (b) Report (1994-1995)	
		303 (d) list (2002)	
Impaired biotic communities	Little Calumet River	305 (b) Report (1992-1993)	Degradation of the biotic communities can impair a stream/river's ability to function—particularly its ability to absorb and sequester pollutants. Degraded biotic communities can also reduce recreational opportunities on the waterbody.
		305 (b) Report (1994-1995)	
Fish consumption advisory for polychlorinated biphenyls (PCBs) and mercury (Hg)	Little Calumet River	305 (b) Report (1992-1993)	Fish contamination can limit recreational opportunities on a waterbody. It can also impact the larger food web if fish are consumed by piscivorous birds. Although the use of PCBs in the US is not permitted, PCBs remain in the environment due to the longevity of the compound. The most common source of PCBs is the unregulated disposal of waste oils, transformers, capacitors, and other PCB-containing materials (Whitmann Hydroplanning, 2002). The most common means for mercury to enter a waterbody is through atmospheric deposition.
		305 (b) Report (1994-1995)	
		303 (d) list (2002)	
High cyanide concentrations	Little Calumet River	305 (b) Report (1992-1993)	High cyanide concentrations can kill aquatic fauna and limit recreational opportunities on a waterbody. Industrial sources are the most common origin of cyanide.
		305 (b) Report (1994-1995)	
High pesticides concentrations	Little Calumet River	305 (b) Report (1992-1993)	High pesticide concentrations can kill aquatic fauna and limit recreational opportunities on a waterbody. The most common sources of pesticides are agricultural, residential, and commercial landscapes.
		305 (b) Report (1994-1995)	
Low dissolved oxygen levels	Little Calumet River	303 (d) list (2002)	Low dissolved oxygen levels suggest the presence of oxygen demanding pollutants (animal/human waste, organic debris, pesticides/other chemicals, trash, etc.) As bacteria utilize dissolved oxygen to degrade

Table 10. Identified issues in the Little Calumet River Basin.

			these pollutants the amount of oxygen available to aquatic fauna decreases. This can impair the aquatic fauna community, which in turn can limit a stream's ability to assimilate nutrients and perform other necessary functions. It also degrades the biological integrity of the stream and may reduce fishing opportunities.
Relatively high density of septic systems	11 digit watershed (includes Reynolds Creek, Kemper Ditch, Sand Creek, Coffee Creek, and part of the Little Calumet River)	UWA (1999)	Failing, old, or poorly-sited/designed septic systems can leach nutrients and pathogens to nearby waterways and groundwater. The addition of these pollutants to water impairs the water quality, alters the trophic structure of the water's biotic communities, and decreases the recreational and aesthetic value of waterways. Leaking septic systems also contaminate groundwater used for drinking water.
Relatively high number of endangered species or critical habitat	11 digit watershed (includes Reynolds Creek, Kemper Ditch, Sand Creek, Coffee Creek, and part of the Little Calumet River)	UWA (1999)	This concern highlights the need to protect any listed species or special habitats in this 11 digit watershed. Figure 8 shows the location of listed species and special habitats in the Coffee Creek watershed.
Relatively high number of people using surface waters	11 digit watershed (includes Reynolds Creek, Kemper Ditch, Sand Creek, Coffee Creek, and part of the Little Calumet River)	UWA (1999)	This concern highlights the need in this 11 digit watershed to protect surface water from degradation since a relatively high number of people utilize surface water.

UWA=Unified Watershed Assessment Draft

4.0 GOALS AND DECISIONS

The previous sections of this watershed management plan describe the unique characteristics and challenges presented by the Coffee Creek watershed's natural landscape and the human processes operating on the landscape. Previous sections also summarize the water quality and related problems faced in the Coffee Creek watershed. Armed with this information, Coffee Creek watershed stakeholders discussed which problems were of greatest concern to them and set goals to address those problems. Keeping in mind the qualities of strong, effective goals (i.e. goals should be clear, achievable, and measurable), stakeholders set seven goals to serve as an initial starting point for achieving their vision for the creek. Selected goals were written to maintain flexibility and allow for revisions as new information became available. For example, most of the goals include a target condition to be achieved. Where insufficient information was available to set a target condition, the goal incorporated objectives to enable stakeholders to revise goals once information was available. Finally, stakeholders revised and prioritized the goals during several public meetings. Each stakeholder present at the December 2, 2002 public meeting ranked the goals individually. Several stakeholders who were not able to attend the December meeting ranked the goals via telephone and/or email correspondence. Individual stakeholder rankings were tallied to obtain a final prioritization for the goals.

Once the stakeholders set goals for addressing the problems of greatest concern in the Coffee Creek watershed, stakeholders agreed upon a course of action for achieving these goals. The course of action includes objectives and action items for each goal. Stakeholders revised these objectives and action items through debate at public meetings. The CCWC also posted the action plan on their web site and solicited comments to give a voice to those stakeholders who were not able to attend the public meetings. In addition to agreeing to an action plan, stakeholders identified time frames and potentially responsible parties for implementing the action plan. Stakeholders identified potentially responsible parties by objective rather than by action item with the recognition that the potentially responsible party would be responsible for the implementation of the objective but would likely receive assistance from other stakeholders in completing various action items.

The stakeholder debate over potential objectives and action items that would achieve the goals the stakeholders set included intense discussion over whether the proposed actions were feasible (ecologically, economically, politically, physically, legally, etc.). The agreed upon action plan reflects this debate. For example, stakeholders debated which management measure would be best to treat issues in the Shooter Ditch and Pope O'Connor subwatersheds, areas identified as critical areas during the watershed inventory phase of plan development. Stakeholders considered two management measures, sediment trap installation and wetland restoration. Because stakeholders determined they would need more information to assess the economic and legal issues involved with implementation of either of these measures, stakeholders chose to pursue a feasibility study to address these issues more fully. Importantly, the stakeholders chose to take action (pursue a feasibility study) given the water quality, habitat, and biological evaluation of these areas rather than choosing to do nothing. Stakeholders agreed that doing nothing would allow these areas to continue contributing pollutants to the mainstem of Coffee Creek.

The following action plan also reflects the stakeholders' recognition of social impacts of the proposed actions. Stakeholders understood that they were not in a position to promulgate regulations through this watershed management plan. However, affecting people's attitudes toward Coffee Creek and the natural features of the creek and its watershed, largely through education, was very important to the stakeholders. Action items under Goals 2, 3, 4, and 5 strive to educate citizens. Additionally, stakeholders placed an emphasis on working cooperatively to achieve their goals rather than confrontationally by carefully wording action items. For example, Goal 2, Objective 3 and Goal 3, Objective 4 specifically state stakeholders will work "cooperatively with municipal and county planning officials to….." Similarly, Goals 2 and 3 intentionally use the word "encourage" to convey the positive approach stakeholders hope to take in achieving these goals. In summary, stakeholders anticipate only positive social impacts, such as increased awareness of the watershed's natural resources and increased cooperation in implementing watershed management techniques, from implementation of the following action plan.

Economic impacts of their proposed actions were of great concern to stakeholders, as well. How stakeholders would pay for each action item in the plan was discussed at length. Stakeholders elected to include only those action items that would potentially qualify for funding from some of the known major funding sources or could be accomplished by volunteers. Additionally, stakeholders included a review of potential funding sources as action items under some of the objectives to ensure smaller funding sources were not overlooked in the pursuit of implementation monies. Finally, stakeholders discussed the costs of inaction. Primarily, this discussion focused on the cost of implementing more costly management methods in the future if stakeholders did not take action now. For example, stakeholders chose to encourage buffer implementation rather than channel dredging. Over the long-term, repeated channel dredging is more expensive than buffer strip implementation and maintenance.

During the course of debate over who would be the potentially responsible parties for various objectives, it became clear that additional help would be required to implement the Coffee Creek Watershed Management Plan. Stakeholders opted to add a new goal to their list of goals. This goal states their desire to hire a watershed coordinator to help in implementing the watershed management plan. Because implementation of the remaining goals depends, at least in part, on achieving this first goal, the new goal received top priority.

Following a thorough debate, stakeholders agreed upon a course of action. The following presents the goals, in order of priority, and action plan for achieving the stakeholders' vision for the Coffee Creek watershed. The action plan also includes time frames for achieving the goals. Figure 13 presents a general time line for guiding the overall plan. This time line includes two dates for major plan revision. Reviewing, revising, and updating the watershed management plan based on current information is essential to the successful implementation of any watershed management plan. The first date for plan revision is set for the end of 2004. This will give stakeholders the opportunity to reassess the plan once they have started implementing the plan. As stakeholders begin to implement the plan, they will make some immediate discoveries on what works and what may not work. A discussion of this and revision of goals, action items, time frames, and/or potentially responsible parties may be appropriate based on this new information. The second major revision to the plan will occur at the end of 2008 or early 2009 once stakeholders have implemented the action plan. At this point, stakeholders will assess their progress toward their goals and vision for the watershed through a review of monitoring data. (See **MEASURING SUCCESS** Section.) They will also revise existing goals and set new goals as appropriate. While Figure 14 outlines two major revision dates, an ongoing dialogue among stakeholders about the goals and how to best achieve them will increase the effectiveness of the plan.

Table 11 summarizes the action plan and its time frame and presents important information on potentially responsible parties for implementing the plan's objectives, general cost estimates[§], and potential funding sources for implementing the action plan. As noted above, the potentially responsible parties are those groups who have agreed to take responsibility for the implementation of specific objectives at this time. Individual actions taken to achieve each objective may be performed by other stakeholders. Successful implementation of the action plan will require the effort of all stakeholders. Potential funding sources listed in Table 11 are simply a starting point for researching grant opportunities and other resources available to help fund the action plan. Additional funding sources and/or other resources are likely available for implementing the fund. Appendix I provides a summary of different funding sources and resources that ***may*** be available to help implement the Coffee Creek Watershed Management Plan.

Action Plan
Goal 1: We want to hire a watershed coordinator to assist in implementing the watershed management plan.

Goal time frame: The goal should be reached by the end of 2003.

Objective 1: Define the watershed coordinator position.

Actions:

- Meet with watershed stakeholders to discuss potential duties of the watershed coordinator position using the Coffee Creek Watershed Management Plan as a guide.
- Develop list of duties and job description for the watershed coordinator position.
- Determine which stakeholder group is best suited to direct the position.

Objective 2: Obtain funding for the watershed coordinator position.

Actions:

- Identify potential funding sources for the watershed coordinator position.
- Watershed stakeholder group identified in the third action item under the first objective of this goal applies for funding for the watershed coordinator position.

[§] General cost estimates are based upon the professional experience of an ecological consulting firm (JFNew).

Goal 2: We want to establish/encourage permanently protected, vegetated streamside buffers along Coffee Creek and its tributaries.

Goal notes: The acreage and condition of existing riparian buffers is not known at this time. Habitat sampling and walking tours of Coffee Creek and its tributaries conducting as a part of this plan's development provide a rough estimate of buffer coverage. However, stakeholders agreed that a more detailed survey of the buffer coverage would be necessary to set a target condition for riparian buffers. The action plan described below includes a complete survey of the riparian zone of Coffee Creek and its tributaries so that stakeholders can refine this goal in future revisions to the watershed management plan.

Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2004.

Objective 1: Map the zone extending approximately 150 feet from the edge of each creek bank along Coffee Creek and its tributaries.

Actions:

- Identify all property owners along Coffee Creek and its tributaries using plat maps and information from the county assessor's office.
- Identify which portions of Coffee Creek and its tributaries are legal drains on which the county might hold easements to access the waterbody.
- Develop a spreadsheet/database containing all property owners and their addresses.
- Obtain permission to survey the entire length of Coffee Creek and its tributaries.
- Survey the entire length of Coffee Creek and its tributaries. The survey area should include the zone extending approximately 150 feet from the edge of each creek bank.
- Map the results of the survey in a GIS or similar system. Attributes such as the type of vegetation, width of each vegetation zone, presence of invasive species, and condition of vegetation should be included with the geographical data.

Objective 2: Educate watershed landowners on the importance of riparian buffers to protect water quality and biotic life in Coffee Creek and its tributaries.

Actions:

- Meet with county drainage board representatives to identify which "Best Management Practices" are recommended along legal drains to protect, enhance, and manage riparian buffers and how landowners may obtain permission to implement these practices.
- Once the database documenting where buffer restoration or improvement should be targeted is available, work cooperatively with the NRCS on agricultural properties to encourage landowners to use available funds to restore or improve buffer zones.
- Work cooperatively with the county drainage board on properties that lie adjacent to legal drains (some overlap with agricultural properties noted above is likely) to encourage landowners to implement best management practices to restore and protect buffer zones.
- Identify non-agriculturally oriented funding sources to assist residential and commercial property owners with restoring riparian zones.

- Organize and hold two annual demonstration days with NRCS, IDNR, county drainage board, or private landowners to demonstrate a healthy, functioning riparian buffer. One demonstration day will occur in an agricultural setting, while the second demonstration day will occur in a residential/commercial setting.
- Publish brochure/newsletter containing information on the importance of riparian buffers for protecting water quality and biotic life in Coffee Creek and its tributaries and how to receive funding to restore riparian buffers.
- Develop a web site or place a link on the Coffee Creek Watershed Conservancy web site documenting the importance of riparian buffers for protecting water quality and biotic life in Coffee Creek and its tributaries and how to receive funding to restore riparian buffers.
- Publish biannual columns for the local newspaper emphasizing the importance of riparian buffers for protecting water quality and biotic life in Coffee Creek and its tributaries and how to receive funding to restore riparian buffers.

Objective 3: Work cooperatively with the municipal and county planning officials to establish riparian buffer requirements.

Actions:
- Attend two planning commission meetings annually to draw attention to the need for increased riparian zone protection along Coffee Creek and its tributaries.
- Investigate existing ordinances (from other states, cities, counties) protecting riparian zones.

Goal 3: We want to encourage the conservation, management, and improvement of existing forested land in the upper portion of the watershed. At a minimum, we want to prevent a decrease in the amount (acreage) of forested land in the upper watershed (i.e. "no net loss" of forested acreage).

Goal notes:
- The phrases "upper watershed" or "upper portion of the watershed" mean that portion of the Coffee Creek watershed above (upstream of) the creek's confluence with Shooter Ditch. Thus, it includes the Johnson Ditch subwatershed, but not the Shooter Ditch subwatershed. Roughly, it is that portion of the watershed south of the Indiana Toll Road. The upper watershed encompasses 6051 acres or approximately 60% of the entire Coffee Creek watershed. USGS land use maps indicate that approximately 48% of the upper watershed is forested.
- It is important to the watershed stakeholders that this goal is achieved through a cooperative effort of watershed stakeholders (including forested land property owners). Consequently, the following objectives reflect this imperative.
- Conserve here means no loss of forested acreage. In other words, the target condition of this goal is for all existing forested land to remain forested. This does not mean that harvesting is prohibited. Appropriate harvesting/thinning to improve the health of the forested areas is encouraged.
- Watershed stakeholders want to prioritize the conservation aspect of this goal. Stakeholders will review the goal in 10 years to evaluate whether the conservation

portion of this goal is feasible. If the conservation portion of the goal is not feasible over the next 10 years, stakeholders will focus on the "no-net-loss" alternative.

Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2005.

Objective 1: Identify areas that are forested and property owners of the forested areas.

Actions:
- Work with local IDNR forester (stationed at Kankakee Fish and Wildlife Area in North Judson) to use available resources to identify large tracts of forested land and property owners of those forested areas.
- Use existing land use maps to identify large forested tracts of land.
- Field check existing land use maps to ensure accuracy; correct any errors.
- Use plat maps and information from the county assessor's office to identify property owners of those tracts.
- Create a spreadsheet/database containing property owner, location, and size information on existing forested tracts in the upper watershed. If possible, store data in a GIS. This information will be used for comparison to future years to determine if the conservation portion of the goal is being achieved.

Objective 2: Educate upper watershed landowners on the importance of forested land conservation for protecting the water quality of Coffee Creek and its tributaries.

Actions:
- Publish brochure/newsletter containing information on the importance of forested land conservation for protecting the water quality of Coffee Creek and its tributaries.
- Hold annual field day with natural resources agencies such as The Nature Conservancy, NRCS, or the Indiana Department of Natural Resources to tout the importance of forested land conservation for protecting the water quality of Coffee Creek and its tributaries.
- Develop a web site or place a link on the Coffee Creek Watershed Conservancy web site documenting the importance of forested land conservation for protecting the water quality of Coffee Creek and its tributaries.
- Write biannual columns for the local newspaper emphasizing the importance of forested land conservation for protecting the water quality of Coffee Creek and its tributaries.

Objective 3: Establish a "forested land conservation" committee that will provide a resource for landowners who want to conserve forested land on their properties.

The purpose of the committee will be to:
- Establish working relationships with The Nature Conservancy, the Indiana Department of Natural Resources (Forest Legacy Program and the local forester), Northwest Territory RC&D, and/or other appropriate local natural resource entities to facilitate the purchase, transfer, and/or protection of forested land in the upper watershed.
- Identify and publicize funding opportunities available to landowners for conservation of forested land. This can be achieved through newsletters, contact letters, an informational

brochure, posting to a web site, or other means. For parcels meeting the program's requirements, one source of funding is the Forest Legacy Program
- Create a fund/foundation to buy forested properties that go up for sale in the upper watershed.

Objective 4: Work cooperatively with the municipal and county planning officials to conserve forested land in the upper portion of the watershed.

Actions:
- Attend two planning commission meetings annually to draw attention to the need for forested land conservation in Coffee Creek's upper watershed.
- Work with local forester to identify where the forester may provide assistance.
- Investigate existing ordinances (from other states, cities, counties) that protect forested land.

Goal 4: We want to educate/inform stakeholders of the value of Coffee Creek and ways to protect its water quality and aquatic life.

Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2006.

Objective 1: Publicize the value of Coffee Creek and ways to protect its water quality and aquatic life through various forms of media.

Actions:
- Develop a list of "Best Management Practices" that protect water quality in nearby waterways for agricultural land.
- Develop a list of "Best Management Practices" that protect water quality in nearby waterways for residential and commercial land.
- Summarize the value of Coffee Creek in language understood by a non-technical audience.
- Publish a biannual newsletter containing information outlined in the first three action items of this objective.
- Develop a web site or place a link on the Coffee Creek Watershed Conservancy web site containing information outlined in the first three action items of this objective.

Objective 2: Organize and hold at least two annual field days highlighting the value of Coffee Creek and ways to protect its water quality and aquatic life. One will emphasize water quality protection in an agricultural setting; the other will demonstrate water quality protection in a residential/commercial setting.

Actions:

- Work with NRCS representatives to identify members of the agricultural community in the watershed who are participating in a conversation program or utilizing conservation tillage. Work with those individuals to hold demonstrations on their properties. A NRCS representative has already been contacted and has tentatively agreed to assist with this action item.
- Support the Coffee Creek Watershed Conservancy's field days and assist in the Conservancy's effort to publicize innovative residential/commercial development practices that limit water quality and aquatic community degradation.
- Invite IDNR biologists or other experts to speak about the value of Coffee Creek at field days.

Objective 3: Complete the proposed project at the Coffee Creek Park in Chesterton. The project will have educational components highlighting the value of Coffee Creek and ways to protect it.

Actions:

- Assist the Town of Chesterton finalizing project plans.
- Identify and apply for funding to implement the proposed project.
- Develop a Request for Proposals (RFP) for the project. If permits are needed for the project, include permitting in the RFP. Additionally, if hydrological modeling is needed for the project, include this work in the RFP.
- Select contractor to complete the project.

Objective 4: Participate in the Hoosier Riverwatch program.

Actions:

- Support the Coffee Creek Watershed Conservancy's effort to participate in this program.
- Identify other groups (local schools, girl/boy scouts, girls and boys club, 4-H, etc.) that may be interested in participating in Riverwatch.
- Identify landowners along Coffee Creek and its tributaries that would be willing to allow a group to conduct Riverwatch sampling on their property. Focus on property owners of sites sampled during development of the watershed management plan.
- Have at least one watershed stakeholder become a Riverwatch trainer.
- Advertise results of the work to the community through various forms of media mentioned in Objective 2.

Goal 5: In two years, we want to have a better understanding of the processes involved in identifying the sources of *E. coli* (i.e. failing septic systems, wildlife, domestic pets, etc.), and we want to educate watershed stakeholders on management techniques available to reduce pathogenic contamination of Coffee Creek and its tributaries.

Goal notes:

- As part of sampling done during the development of the watershed management plan, we have identified that *E. coli* concentrations are of particular concern in the Pope O'Connor and Johnson Ditch subwatersheds. Identification of the source of the *E. coli* (i.e. failing septic systems, wildlife, domestic pets, etc.) is necessary to direct the management of this pollutant. Similarly, identification of the source is necessary to setting a goal for reduction of *E. coli* in the watershed. Once we better understand processes involved in identifying the sources of *E. coli*, we will be able to target management efforts appropriately in the subwatersheds of concern. We will also be able to set a realistic reduction goal. We will revisit this goal during the next revisions to the watershed management plan.

- The presence of significant livestock operations in the Coffee Creek watershed was discussed with the Porter County NRCS representatives. No livestock operations currently exist in the Coffee Creek watershed.

Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2005.

Objective 1: Learn more about the identifying the sources of *E. coli* from the Total Maximum Daily Load development process for the Little Calumet River. (The Little Calumet River is on the 303(d) list for *E. coli* contamination.)

Action:

- Attend and participate in the Total Maximum Daily Load development process for the Little Calumet River. (The Little Calumet River is on the 303(d) list for *E. coli* contamination.)
- Create and distribute (via email) meeting minutes to major watershed stakeholders.

Objective 2: Publicize best management practices available to reduce pathogenic contamination of Coffee Creek and its tributaries.

Actions:

- Meet with the Porter County Health Department to discuss “Best Management Practices” available to maintain properly functioning septic systems.
- Develop list/summary of “Best Management Practices” available to reduce the risk of pathogenic contamination of watershed waterbodies. The list should include management techniques that address contamination from all sources, including domestic and wild animals, in the watershed. Additionally, the list should be written in language that is understood by a non-technical audience.
- Publish a newsletter to watershed stakeholders containing the list/summary of “Best Management Practices” available to reduce the risk of pathogenic contamination of watershed waterbodies.
- Develop a web site or place a link on the Coffee Creek Watershed Conservancy web site containing the list/summary of “Best Management Practices” available to reduce the risk of pathogenic contamination of watershed waterbodies.

Goal 6: We want to document the contribution (loads) of sediment, nutrients, and bacteria from the surface and subsurface drains that discharge to Coffee Creek and its tributaries by the end of 2006. Only drains from which loads were not documented as part of this watershed management plan development are included in this goal. (Concentrations and loads in Coffee Creek and its major tributaries (Pope O'Connor Ditch, Shooter Ditch, Johnson Ditch, and Suman Road Tributary) are already recorded in this watershed management plan.)

Goal notes: The water quality sampling conducted as part of this watershed management plan documented water quality in Coffee Creek and its major tributaries. Watershed stakeholders expressed concern over other surface and subsurface drains that may be contributing pollutants to Coffee Creek and its tributaries. Identification of these drains and quantification of pollutant loading from these sources is necessary to completely address pollutant loading to Coffee Creek and therefore to target management efforts. This goal developed as a result of these concerns and needs.
Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2006.

Objective 1: Identify and map all surface and subsurface drains that discharge to Coffee Creek and its tributaries.

Actions:
- Work cooperatively with the county drainage board to identify locations of known surface and subsurface drains based on county drainage board maps and personnel's field knowledge of the watershed.
- Work with IDEM to obtain a map of all permitted point source outlets to Coffee Creek and its tributaries.
- Identify all property owners along Coffee Creek and its tributaries using plat maps and information from the county assessor's office. A portion of this action item has been completed during the development of this watershed management plan.
- Identify which portions of Coffee Creek and its tributaries are legal drains on which the county might hold easements to access the waterbody.
- Develop a spreadsheet/database containing the addresses of all property owners along Coffee Creek and its tributaries.
- Obtain permission to survey the entire length of Coffee Creek and its tributaries.
- Survey the entire length of Coffee Creek and its tributaries. Surveys should be conducted from within the stream itself where possible.
- Enter data/map locations of all surface and subsurface drains in a GIS or similar system. Attributes such as size of pipe/ditch, whether it is a surface or subsurface drain, whether it carries water continuously or is simply a wet-weather conduit, and potential pollutants associated with it should be attached to the location information for each drain.

Action notes: Some of the action items listed under this objective are the same as ones listed under Goal 1, Objective 1. Watershed stakeholders should consider accomplishing the riparian buffer survey and surface and subsurface drain surveys at the same time.

Objective 2: Measure pollutant (sediment, nutrients, and bacteria) loads from the surface and subsurface drains.

Actions:

- Work with IDEM to identify pollutant concentration and loading limits from permitted point sources in the watershed.
- Identify funding sources to support sampling effort.
- Develop a plan to measure pollutant loads. Sampling protocol will have to be developed once the extent of surface and subsurface drains is known. Sampling protocol will also depend upon the funding available to sample the surface and subsurface drains. In other words, it may not be economically feasible to sample all of the surface and subsurface drains.
- Develop spreadsheet/database to hold sampling results.
- Compare results of this sampling to results of sampling conducted during the development of the watershed management plan.

Goal 7: In ten years, we want to reduce the amount of sediment reaching Coffee Creek via the Pope O'Connor Ditch by 65% and the amount of nutrients reaching Coffee Creek via the Pope O'Connor Ditch by 40%.

Goal notes:

- The Pope O'Connor Ditch subwatershed was identified during the problem assessment phase of the plan's development as a critical area. Management efforts focused in the Pope O'Connor Ditch watershed are vital to reaching stakeholders' vision of Coffee Creek.
- Percent reductions are based on approximate removal efficiencies of sediment and nutrients by sediment traps and wetlands. Current research suggests such structural management practices may remove more than 80% of sediment and approximately 45% of nutrients (Winer, 2000; Claytor and Schueler, 1996; and Metropolitan Washington Council of Governments, 1992). Removal efficiencies depend upon site conditions and factors related to the structure's design, operation, and maintenance. Nutrient removal efficiencies differ vary depending upon the form of the nutrient measured. For example, total phosphorus removal efficiencies are often greater than ammonia-nitrogen removal efficiencies. The percent removal targets listed in this goal may need to be revised once a management technique is selected through the feasibility study proposed in Objective 1 below and/or additional conservation/management opportunities are identified through the subwatershed specific site investigation proposed in Objective 2 below.

Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2007.

Objective 1: Determine if a structural Best Management Practice is available to achieve the pollutant reductions outlined in the goal. (Watershed stakeholders have identified wetland restoration, sediment trap installation, and other sediment removal techniques as potential structural Best Management Practices that should be explored to achieve this goal.)

Actions:

- Investigate whether the Northwest RC&D would be willing to coordinate the feasibility study.
- Apply for a Lake and River Enhancement Program Feasibility Study to evaluate the feasibility of various structural Best Management Practices. The study would address whether a technique can achieve the outlined pollutant reduction goals, can physically be implemented, is acceptable to affected landowners, is economically justifiable, and is acceptable to the appropriate regulatory agencies (county drainage board, U.S. Army Corps of Engineers, and Indiana Department of Environmental Management).
- Once the feasibility study is complete, watershed stakeholders should develop steps to implement any recommended projects. These steps will be outlined in the next revisions to the watershed management plan.

Objective 2: Collect site-specific information on the Pope O'Connor Ditch subwatershed.

Actions:

- Survey the entire ditch to identify areas where bank stabilization is needed and/or larger riparian buffers are needed. Any identified areas of concern should be considered for project implementation when the watershed management plan is updated and revised.
- Work with the NRCS, specifically the Conservation Tillage Coordinator, to identify which property owners in the Pope O'Connor Ditch watershed are using conservation tillage methods and/or the land conservation programs. Where possible or appropriate, assist the NRCS in encouraging agricultural property owners not using conservation tillage or not participating in conservation programs to utilize these programs.
- Work with NRCS to determine parcels and/or landowners in the watershed that may be eligible to receive Environmental Quality Incentives Program (EQIP) funds.
- Work with local developers to develop erosion control plans during residential/commercial development and current landowners to implement best management practices on residential/commercial land to prevent the discharge of soil and soil attached pollutants to Pope O'Connor Ditch.

Action notes: Surveys conducted to accomplish Goal 1, Objective 1 and Goal 5, Objective 1 could include the collection of data to satisfy the first action item listed under this objective.

Objective 3: Follow and participate in the MS4 (municipal separate storm sewer systems) program development process for the Town of Chesterton and Porter County.

Actions:

- Identify which municipal department is spearheading Chesterton's MS4 program development.
- Meet with the Town of Chesterton's and Porter County's Rule 13 coordinators to discuss the establishment of water quality goals and selection of Best Management Practices to achieve those goals. Work with the coordinators to ensure the Town's water quality goals and this management plan's water quality goals are compatible.

- Support the Town of Chesterton's efforts to conduct public education and outreach for their MS4 program. (Public education and outreach is a required component of any MS4 program.)
- Create and distribute (via email) minutes of MS4 public meetings.

Objective 4: Continue to monitor the water quality and biological integrity of Pope O'Connor Ditch and Coffee Creek downstream of its confluence with Pope O'Connor Ditch.

Actions:
- Identify funding sources for continued monitoring.
- Collect water quality and biological integrity data in Pope O'Connor Ditch and Coffee Creek downstream of its confluence with Pope O'Connor Ditch. Select sampling site locations to evaluate the ditch upstream and downstream of any potential project locations identified in the feasibility study conducted under Objective 1 of this goal. Where possible use the sites sampled during the development of this watershed management plan to provide a baseline reference.
- Enter data in a database or GIS.

Goal 8: In ten years, we want to reduce the amount of sediment reaching Coffee Creek via Shooter Ditch by 65% and the amount of nutrients reaching Coffee Creek via Shooter Ditch by 40%.

Goal notes:
- The Shooter Ditch subwatershed was identified during the problem assessment phase of the plan's development as a critical area. Management efforts focused in the Shooter Ditch watershed are vital to reaching stakeholders' vision of Coffee Creek.
- Percent reductions are based on approximate removal efficiencies of sediment and nutrients by sediment traps and wetlands. Current research suggests such structural management practices may remove more than 80% of sediment and approximately 45% of nutrients (Winer, 2000; Claytor and Schueler, 1996; and Metropolitan Washington Council of Governments, 1992). Removal efficiencies depend upon site conditions and factors related to the structure's design, operation, and maintenance. Nutrient removal efficiencies differ vary depending upon the form of the nutrient measured. For example, total phosphorus removal efficiencies are often greater than ammonia-nitrogen removal efficiencies. The percent removal targets listed in this goal may need to be revised once a management technique is selected through the feasibility study proposed in Objective 1 below and/or additional conservation/management opportunities are identified through the subwatershed specific site investigation proposed in Objective 2 below.

Goal time frame: Except for annual/biannual/continuous tasks, the goal should be reached by 2008.

Objective 1: Determine if a structural Best Management Practice is available to achieve the pollutant reductions outlined above. (Watershed stakeholders have identified wetland restoration, sediment trap installation, and other sediment removal techniques as potential structural Best Management Practices that should be explored to achieve this goal.)

Actions:

- Investigate whether the Northwest RC&D would be willing to coordinate the feasibility study.
- Apply for a Lake and River Enhancement Program Feasibility Study to evaluate the feasibility of various structural Best Management Practices. The study would address whether a technique can achieve the outlined pollutant reduction goals, can physically be implemented, is acceptable to affected landowners, is economically justifiable, and is acceptable to the appropriate regulatory agencies (county drainage board, U.S. Army Corps of Engineers, and Indiana Department of Environmental Management).
- Once the feasibility study is complete, watershed stakeholders should develop steps to implement any recommended projects. These steps will be outlined in the next revisions to the watershed management plan.

Objective 2: Collect site-specific information on the Shooter Ditch subwatershed.

Actions:

- Survey the entire ditch to identify areas where bank stabilization is needed and/or larger riparian buffers are needed. Any identified areas of concern should be considered for project implementation when the watershed management plan is updated and revised.
- Work with the NRCS, specifically the Conservation Tillage Coordinator, to identify which property owners in the Pope O'Connor Ditch watershed are using to identify which property owners in the Shooter Ditch watershed are using conservation tillage methods and/or the land conservation programs. Where possible or appropriate, assist the NRCS in encouraging agricultural property owners not using conservation tillage or not participating in conservation programs to utilize these programs.
- Work with NRCS to determine parcels and/or landowners in the watershed that may be eligible to receive Environmental Quality Incentives Program (EQIP) funds.
- Work with local developers to develop erosion control plans during residential/commercial development and current landowners to implement best management practices on residential/commercial land to prevent the discharge of soil and soil attached pollutants to Shooter Ditch.

Action notes: Surveys conducted to accomplish Goal 1, Objective 1 and Goal 5, Objective 1 could include the collection of data to satisfy the first action item listed under this objective.

Objective 3: Continue to monitor the water quality and biological integrity of Shooter Ditch and Coffee Creek downstream of its confluence with Shooter Ditch.

Actions:

- Identify funding sources for continued monitoring.
- Collect water quality and biological integrity data in Shooter Ditch and Coffee Creek downstream of its confluence with Shooter Ditch. Select sampling site locations to evaluate the ditch upstream and downstream of any potential project locations identified in the feasibility study conducted under Objective 1 of this goal. Where possible use the sites sampled during the development of this watershed management plan to provide a baseline reference.
- Enter data in a database or GIS.

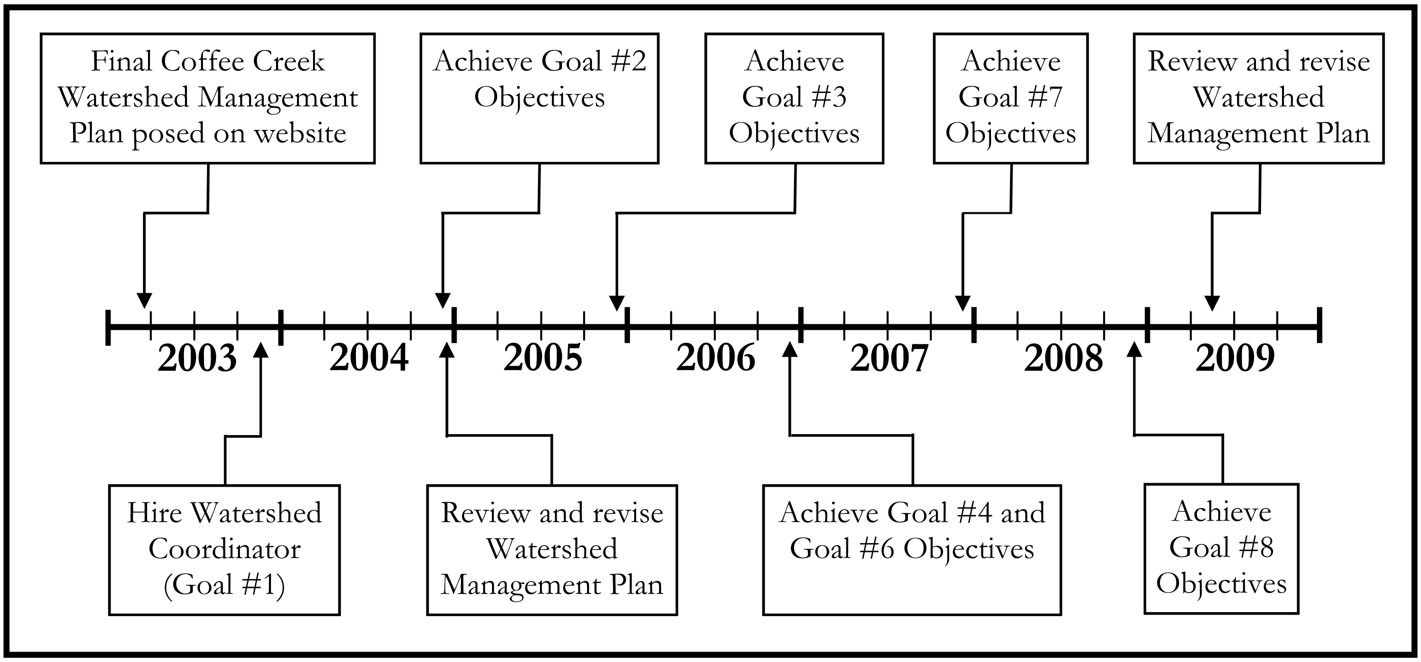

Figure 14. Overall timeline for the Coffee Creek Watershed Management Plan.

Table 11. Summary of potentially responsible parties, estimated costs, potential funding sources, and time frames for each objective in the Coffee Creek watershed action plan.

Goals/Objectives	Potentially Responsible Party	Estimated Cost⁺	Potential Funding Sources*	Date to be Completed
Goal #1: We want to hire a watershed coordinator to assist in implementing the watershed management plan.				
Define the watershed coordinator position.	Coffee Creek Watershed Conservancy	🕓		2003
Obtain funding for the watershed coordinator position.	Coffee Creek Watershed Conservancy	$$$-$$$$	Section 319	2003
Goal #2: We want to establish/encourage permanently protected, vegetated streamside buffers along Coffee Creek and its tributaries.				
Map the zone extending approximately 150 feet from the edge of each creek bank along Coffee Creek and its tributaries.	Watershed Coordinator	🕓	Section 319; Coastal Zone Management	2004
Educate watershed landowners on the importance of riparian buffers to protect water quality and biotic life in Coffee Creek and its tributaries.	Coffee Creek Watershed Conservancy	🕓 ¢	National Fish and Wildlife Foundation; USEPA Education Grant	continuous
Work cooperatively with the municipal and county planning officials to establish riparian buffer requirements.	Watershed Coordinator	🕓		continuous
Goal #3: We want to encourage the conservation, management, and improvement of existing forested land in the upper portion of the watershed.				
Identify areas that are forested and property owners of the forested areas.	Watershed Coordinator	🕓	Community Forestry Grant	2005
Educate upper watershed landowners on the importance of forested land conservation for protecting the water quality of Coffee Creek and its tributaries.	Coffee Creek Watershed Conservancy	🕓 ¢	Community Forestry Grant	continuous

Table 11. Summary of potentially responsible parties, estimated costs, potential funding sources, and time frames for each objective in the Coffee Creek watershed action plan.

Goals/Objectives	Potentially Responsible Party	Estimated Cost+	Potential Funding Sources*	Date to be Completed
Establish a "forested land conservation" committee that will provide a resource for landowners who want to conserve forested land on their properties.	Coffee Creek Watershed Conservancy	⏲ ¢	Community Forestry Grant	2005
Work cooperatively with the municipal and county planning officials to conserve forested land in the upper portion of the watershed.	Coffee Creek Watershed Conservancy	⏲	Community Forestry Grant	continuous
Goal #4: We want to educate/inform stakeholders of the value of Coffee Creek and ways to protect its water quality and aquatic life.				
Publicize the value of Coffee Creek and ways to protect its water quality and aquatic life through various forms of media.	Coffee Creek Watershed Conservancy	⏲ ¢	National Fish and Wildlife Foundation; USEPA Education Grant; Coastal Zone Management; Section 319	continuous
Organize and hold at least two annual field days highlighting the value of Coffee Creek and ways to protect its water quality and aquatic life.	Coffee Creek Watershed Conservancy/ Natural Resource Conservation Service	⏲ ¢	National Fish and Wildlife Foundation; USEPA Education Grant; Coastal Zone Management; Section 319	continuous
Complete the proposed project at the Coffee Creek Park in Chesterton.	Town of Chesterton Parks Department	⏲ $$$-$$$$$	National Fish and Wildlife Foundation; USEPA Education Grant; Coastal Zone Management; Section 319	2006
Participate in the Hoosier Riverwatch program.	Coffee Creek Watershed Conservancy	⏲ ¢		2004/ continuous

Table 11. Summary of potentially responsible parties, estimated costs, potential funding sources, and time frames for each objective in the Coffee Creek watershed action plan.

Goals/Objectives	Potentially Responsible Party	Estimated Cost⁺	Potential Funding Sources*	Date to be Completed
Goal #5: In two years, we want to have a better understanding of the processes involved in identifying the sources of *E. coli*, and we want to educate watershed stakeholders on management techniques available to reduce pathogenic contamination of Coffee Creek and its tributaries.				
Learn more about the identifying the sources of *E. coli* from the Total Maximum Daily Load development process for the Little Calumet River.	Northwestern Indiana Regional Planning Commission	⏱		begin immediately
Publicize best management practices available to reduce pathogenic contamination of Coffee Creek and its tributaries.	Coffee Creek Watershed Conservancy	⏱ ¢		continuous
Goal #6: We want to document the contribution (loads) of sediment, nutrients, and bacteria from the surface and subsurface drains that discharge to Coffee Creek and its tributaries by the end of 2006.				
Identify and map all surface and subsurface drains that discharge to Coffee Creek and its tributaries.	Watershed Coordinator	⏱	Section 319	2006
Measure pollutant (sediment, nutrients, and bacteria) loads from the surface and subsurface drains.	Watershed Coordinator	⏱ $-$$$	Section 319	2006
Goal #7: In five years, we want to reduce the amount of sediment reaching Coffee Creek via the Pope O'Connor Ditch by 65% and the amount of nutrients reaching Coffee Creek via the Pope O'Connor Ditch by 40%.				
Determine if a structural Best Management Practice is available to achieve the pollutant reductions outlined in the goal.	Coffee Creek Watershed Conservancy	$$-$$$$	Lake and River Enhancement Program; Section 319; Watershed Protection	2007

Table 11. Summary of potentially responsible parties, estimated costs, potential funding sources, and time frames for each objective in the Coffee Creek watershed action plan.

Goals/Objectives	Potentially Responsible Party	Estimated Cost⁺	Potential Funding Sources*	Date to be Completed
			and Flood Prevention Program; Great Lakes Basin Soil Erosion and Sediment Control	
Collect site-specific information on the Pope O'Connor Ditch subwatershed.	Watershed Coordinator	⌚	Lake and River Enhancement Program; Section 319; Watershed Protection and Flood Prevention Program; Great Lakes Basin Soil Erosion and Sediment Control	2007
Follow and participate in the MS4 (municipal separate storm sewer systems) program development process for the Town of Chesterton and Porter County.	Save the Dunes	⌚		begin immediately
Continue to monitor the water quality and biological integrity of Pope O'Connor Ditch and Coffee Creek downstream of its confluence with Pope O'Connor Ditch.	Watershed Coordinator	⌚ **$-$$**	Lake and River Enhancement Program; Section 319	continuous
Goal #8: In five years, we want to reduce the amount of sediment reaching Coffee Creek via Shooter Ditch by 65% and the amount of nutrients reaching Coffee Creek via Shooter Ditch by 40%.				
Determine if a structural Best Management Practice is available to achieve the pollutant reductions outlined above.	Coffee Creek Watershed Conservancy	**$$-$$$$**	Lake and River Enhancement Program; Section 319; Watershed Protection and Flood Prevention Program; Great Lakes Basin Soil Erosion and Sediment Control	2008

Table 11. Summary of potentially responsible parties, estimated costs, potential funding sources, and time frames for each objective in the Coffee Creek watershed action plan.

Goals/Objectives	Potentially Responsible Party	Estimated Cost⁺	Potential Funding Sources*	Date to be Completed
Collect site-specific information on the Shooter Ditch subwatershed.	Watershed Coordinator	🕐	Lake and River Enhancement Program; Section 319; Watershed Protection and Flood Prevention Program; Great Lakes Basin Soil Erosion and Sediment Control	2008
Continue to monitor the water quality and biological integrity of Shooter Ditch and Coffee Creek downstream of its confluence with Shooter Ditch.	Watershed Coordinator	🕐 $-$$	Lake and River Enhancement Program; Section 319	continuous

⁺Each 🕐 indicates an undetermined amount of personal time; each dollar sign ($) indicates and estimated cost of $10,000; a cent sign (¢) indicates an estimated cost of less than $2,500. Generally, it (¢) notes the costs of supplies associated with hosting a field day or publishing a newsletter or brochure. Cost estimates are based on the professional experience of an environmental consulting firm (JFNew).

*Potential funding sources are listed based upon grant agency information in December 2002. Funding sources should be considered recommendations due to possible changes in funding agency goals and funds available to specific agencies. Funding sources identified during completion of the watershed management plan are listed in more detail in Appendix I. Other funding sources might be available in the future and should be considered.

☙Cost will depend upon whether the group hosting the position has the necessary facilities and supplies (including computer software such as GIS software) for the watershed coordinator to complete their duties or if these supplies must be acquired.

5.0 MEASURING SUCCESS

As noted previously in this plan, measuring stakeholders' success at achieving their goals and assessing progress toward realizing their vision for Coffee Creek is a vital component of the plan. The following describes concrete milestones for stakeholders to reach and tangible deliverables produced while they work toward each goal. It also provides mechanisms for measuring the success in achieving their goals. Stakeholders will use this evaluation plan when reviewing and revising the Coffee Creek Watershed Management Plan.

Monitoring and Evaluation

Goal 1: *We want to hire a watershed coordinator to assist in implementing the watershed management plan.*

Milestones: (**Each milestone should be reached by the end of 2003.)**

- List of duties for watershed coordinator completed.
- Job description for watershed coordinator completed.
- Potential funding sources identified and application submitted

Measuring success:

- Funding for hiring watershed coordinator obtained.
- Watershed coordinator hired.

Goal 2: *We want to establish/encourage permanently protected, vegetated streamside buffers along Coffee Creek and its tributaries.*

Stakeholders agreed that a detailed survey of the stream buffer coverage would be necessary to set target conditions for riparian buffers. The action plan describes methods to conduct a complete riparian zone survey of Coffee Creek and its tributaries so that stakeholders can refine this goal to include a target condition in future revisions of the watershed management plan.

Milestones: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2004.)**

- Property owners of riparian land spreadsheet created.
- Map of riparian buffers completed and preliminary acreage of buffer areas determined.
- List of drainage board and Natural Resources Conservation Service (NRCS) suggested best management practice recommendations completed.
- Funding sources for best management practice implementation identified and published.
- Demonstration days conducted.
- Brochure/newsletter published.
- Web site developed/link established on Coffee Creek Watershed Conservancy website.
- Newspaper articles submitted and published.
- Planning commission meetings attended.
- Existing riparian zone ordinances investigated.

<u>Measuring success</u>:

- Establish existing acreage and condition of streamside buffers along Coffee Creek and its tributaries.
- Number of projects identified by watershed stakeholders, the drainage board, and the NRCS.
- Number of attendees at the demonstration days.
- Number of brochures/newsletters distributed.
- Number of newspaper articles submitted.
- Number of planning commission meetings attended.
- Number of existing ordinances identified.
- Number of hits on the website.

Goal 3: *We want to encourage the conservation, management, and improvement of existing forested land in the upper portion of the watershed.*

This goal focused on the 6,051 acres of the Coffee Creek watershed upstream of the creek's confluence with Shooter Ditch. Stakeholders agreed that documentation of current location and acreage of forested land is required to set a target acreage. Stakeholders will review the goal in 2013 to determine whether increasing the acreage of forested land in the Coffee Creek watershed is feasible.

<u>Milestones</u>: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2005.)**

- Tracts of forested land identified.
- Property owners of forested land spreadsheet created.
- Brochure/newsletter published.
- Field day conducted.
- Newspaper articles submitted and published.
- Forested land conservation committee established.
- Forested land conservation funding opportunities identified and published.
- Forested land conservation fund established.
- Planning commission meetings attended.
- Existing forested land conservation ordinances investigated.

<u>Measuring success</u>:

- Establish existing acreage of forested land.
- Number of field day attendees.
- Number of newsletters/brochures distributed.
- Number of newspaper articles submitted.
- Number of planning commission meetings attended.
- Number of existing ordinances identified.
- Number of hits on the website.

Goal 4: *We want to educate/inform stakeholders of the value of Coffee Creek and ways to protect its water quality and aquatic life.*

Milestones: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2006.)**

- List of Best Management Practices (BMPs) to protect agricultural land developed.
- List of BMPs to protect residential and/or commercial land developed.
- Newsletter published.
- Web site developed/link to Coffee Creek Watershed Conservancy website established.
- Field day conducted.
- Proposed project at Coffee Creek Park in Chesterton completed.
- Hoosier Riverwatch data collected and submitted.

Measuring success:

- Number of BMPs identified for agricultural land.
- Number of BMPs identified for residential and/or commercial land.
- Number of newsletters distributed.
- Number of field day attendees.
- Number of Hoosier Riverwatch sampling events conducted.
- Number of people involved in Hoosier Riverwatch sampling.
- Coffee Creek Park Project completed.

Goal 5: *In two years, we want to have a better understanding of the processes involved in identifying the sources of E. coli (i.e. failing septic systems, wildlife, domestic pets, etc.), and we want to educate watershed stakeholders on management techniques available to reduce pathogenic contamination of Coffee Creek and its tributaries.*

Identification of the source of *E. coli* is necessary to direct the management of this pollutant. Once the processes are identified, management efforts can be more appropriately targeted. This goal will be revisited during the next revision of the watershed management plan to target efforts.

Milestones: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2005.)**

- Little Calumet River TMDL meetings attended.
- List of BMPs to reduce pathogen contamination of surface water completed.
- Newsletter published.
- Web site developed/link to Coffee Creek Watershed Conservancy website established.

Measuring success:

- Number of Little Calumet River TMDL meetings attended.
- Number of people receiving TMDL meeting minutes.
- Number of pathogenic contamination reduction BMPs identified.
- Number of newsletters distributed.
- Number of hits on the website.

Goal 6: *We want to document the contribution (loads) of sediment, nutrients, and bacteria from the surface and subsurface drains that discharge to Coffee Creek and its tributaries by the end of 2006.*

Development of this watershed management plan included documentation of sediment, nutrient, and bacteria loads from major tributaries to Coffee Creek. Stakeholders expressed concern over pollutant load from surface and subsurface drains not sampled during watershed management plan development.

Milestones: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2006.)**

- Surface and subsurface drains identified and mapped.
- Property owners along Coffee Creek and its tributaries identified.
- Legal drains in the Coffee Creek watershed identified.
- Property owner database developed.
- NPDES permitted facility effluent limits determined.
- Sample collection funding source identified.
- Pollutant load sampling plan developed.
- Sampling of surface and subsurface drains completed.

Measuring success:

- Number of surface and subsurface drains identified.
- Number and location of legal drains identified.
- Number of property owners identified.
- Number of samples collected.
- Establishment of pollutant loads from all surface and subsurface drains.

Goal 7: *In ten years, we want to reduce the amount of sediment reaching Coffee Creek via the Pope O'Connor Ditch by 65% and the amount of nutrients reaching Coffee Creek via the Pope O'Connor Ditch by 40%.*

Milestones: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2007.)**

- Feasibility study completed.
- Bank stabilization/riparian buffer survey completed.
- Property owners using conservation tillage/land conservation program identified.
- Property owners eligible for EQIP funding identified.
- Erosion control plan developed.
- Town of Chesterton department in charge of MS4 development identified.
- Meetings with Porter County and the Town of Chesterton Rule 13 coordinators completed.
- MS4 meeting minutes distributed.
- Water quality (water chemistry and biological integrity) monitoring funds identified.
- Water quality and data collected and entered into database.
- Improvement in macroinvertebrate biotic integrity from severely impaired to moderately impaired.

<u>Measuring success</u>:

- Number of property owners identified.
- Number of bank stabilization and/or riparian buffer projects identified.
- Number of development sites where erosion control plans were implemented.
- Number of MS4 meetings attended.
- Number of people receiving MS4 meeting minutes.
- Number of water quality sampling events conducted.
- Improvement in macroinvertebrate biotic integrity such that the biotic integrity in Pope O'Connor Ditch is on par with the biotic integrity observed in the Coffee Creek mainstem (i.e. moderately - mIBI score of 2-4 - to slightly impaired - mIBI score of 4-6).
- Reduction in sediment (65%) and nutrient (40%) loading rates in Pope O'Connor Ditch.
- Biotic integrity in Coffee Creek is maintained at its current level or improved such that a mIBI score of 4-6 (slightly impaired) is achieved.

Goal 8: *In ten years, we want to reduce the amount of sediment reaching Coffee Creek via Shooter Ditch by 65% and the amount of nutrients reaching Coffee Creek via Shooter Ditch by 40%.*

<u>Milestones</u>: **(Except for annual/biannual/continuous tasks, each milestone should be reached by 2008.)**

- Feasibility study completed.
- Bank stabilization/riparian buffer survey completed.
- Property owners using conservation tillage/land conservation program identified.
- Property owners eligible for EQIP funding identified.
- Erosion control plan developed.
- Water quality monitoring funds identified.
- Water quality and biological integrity data collected and entered into database.
- Improvement in macroinvertebrate biotic integrity from severely impaired to moderately impaired.

<u>Measuring success</u>:

- Number of property owners identified.
- Number of bank stabilization and/or riparian buffer projects identified.
- Number of development sites where erosion control plans were implemented.
- Number of water quality sampling events conducted.
- Improvement in macroinvertebrate biotic integrity such that the biotic integrity in Shooter Ditch is on par with the biotic integrity observed in the Coffee Creek mainstem (i.e. moderately - mIBI score of 2-4 - to slightly impaired - mIBI score of 4-6).
- Reduction in sediment (65%) and nutrient (40%) loading rates in Shooter Ditch.
- Biotic integrity in Coffee Creek is maintained at its current level or improved such that a mIBI score of 4-6 (slightly impaired) is achieved.

6.0 FUTURE CONSIDERATIONS

There are several considerations stakeholders should keep in mind as they implement the Coffee Creek Watershed Management Plan. Many of these considerations are noted in the proceeding sections of this text, but due to their importance, they warrant reiteration.

Permits, Easements, and Agreements: As noted in the **GOALS AND DECISIONS** Section, stakeholders must obtain landowner permission before entering private property. Obtaining landowner permission is listed as an action item if access to private property is necessary to complete any objective. Additionally, property owner permission is necessary to install any structural BMP recommended by the feasibility studies outlined under Goals 7 and 8. One property owner has already provided tentative permission for the installation of a BMP along Shooter Ditch. Finally, any restoration work that involves excavating material from or placing material in the mainstem of Coffee Creek or any of its tributaries will likely require a Clean Water Action Section 404 from the U.S. Army Corps of Engineers and Section 401 Water Quality Certification from the Indiana Department of Environmental Management. Depending upon the location and type of work, a Construction in a Floodway permit from the Indiana Department of Natural Resources, Division of Water and local permits from the Porter County Drainage Board may also be required. During the public meetings, stakeholders discussed a variety of activities that may require permits. These activities include but are not limited to dredging, sediment trap installation and maintenance, and wetland restoration (depending upon how it is completed). Representatives from the respective agencies or an environmental consultant would be able to assist stakeholders in identifying and obtaining the appropriate permits for any planned work.

Operation and Maintenance: Currently, implementation of specific structural BMPs, such as filter strips or sediment traps, is not included in the Coffee Creek Watershed Management Plan. However, the expected outcome of several of the objectives of the action plan is the recommendation and implementation of a specific structural BMP. Future versions of the Coffee Creek Watershed Management Plan must contain information detailing who and how these BMPs will operate and be maintained. For example, if following a feasibility study, stakeholders elect to install a sediment trap in Pope O'Connor Ditch, the revised version of the Coffee Creek Watershed Management Plan should detail when the trap will be cleaned (frequency), who will clean it, where trapped materials will be deposited, etc. Assigning maintenance and operation responsibility is essential to ensure proper functioning of installed BMPs.

Monitoring: Monitoring the success of actions taken to achieve stakeholders' goals is vital. Without monitoring, stakeholders will not know when or whether they have achieved their goals; or worse, they will not make timely refinements to their actions to ensure the actions they are taking will achieve their goals. The watershed stakeholders recognized the importance of monitoring by writing water chemistry and biotic integrity monitoring into the watershed's action plan. The **MEASURING SUCCESS** Section details how stakeholders will monitor their progress toward achieving the goals set in this watershed management plan.

Specific water chemistry monitoring plans to determine whether loads reductions proposed in Goals 7 and 8 were achieved have not been developed. Such plans cannot be developed until the feasibility study is complete and the type of management practice to be installed has been determined. Once stakeholders determine which management practice they will use, a variety of mechanisms are available to ensure that the management practice is achieving the targeted load reductions. The most accurate and also the most expensive means to determine whether the management practice is achieving the targeted load reductions is to directly measure annual or, possibly, seasonal loads. This requires collecting and analyzing water quality samples and measuring discharge (i.e. directly calculating pollutant loads). Stakeholders will likely need to invest in automated sampling equipment to complete this because measuring loads via this mechanism generally requires frequent (on the order of daily) sample collection. Baseline sampling or the use of an upstream/downstream protocol may be necessary and should be considered when developing a sampling regime. Stakeholders may also use models to ensure load reductions; however, stakeholders must be aware that models assume the values of some variables rather than directly measuring the variables. In order words, the load reductions on site may not be the same as those modeled. Alternatively, stakeholders may ensure load reductions by adhering to construction standards for the management practices. As with the use of models, the stakeholders will not know with certainty that the management practice is achieving the desired load reductions. These three options for evaluating the load reductions vary in cost. Because of this difference in cost, the exact monitoring protocol may depend upon funding available to complete the monitoring. These are issues stakeholders must consider once they determine which management practice they will employ to reach Goals 7 and 8. Future revisions of the Coffee Creek Watershed Management Plan should include monitoring for these goals and any other additional agreed upon goals.

The **MEASURING SUCCESS** Section also includes biological indicators to help measure progress toward achieving Goals 7 and 8. Improvement in the biotic integrity in Pope O'Connor Ditch and Shooter Ditch is expected as water quality in the two ditches improves. Similarly, a modest improvement in mainstem biotic integrity may be expected as pollutant loading from those two sources declines. (Only a modest improvement is expected since the mainstem of Coffee Creek already exhibits some of the best biotic integrity scores (fish and macroinvertebrate) in the Little Calumet River basin. Therefore, large scale improvements may be unrealistic.) Biotic integrity will be monitored using the same procedures that were used during the development of this plan. In other words, the ditches and the mainstem will be monitored using IDEM's macroinvertebrate sampling protocol; biotic integrity will be evaluated using IDEM mIBI. IDEM's macroinvertebrate sampling protocol requires that two kick-net samples be collected from a hard substrate sampling area and macroinvertebrates collected in the kick-net samples be identified to the family level. (Appendix G: Quality Assurance Project Plan provide more detailed information on IDEM's sampling procedures.) Identified macroinvertebrates are then evaluated using IDEM's ten mIBI metrics. (Appendix F: Water Quality Assessment provides more detailed information on IDEM's mIBI and the mIBI metrics.) Currently, both Pope O'Connor Ditch and Shooter Ditch exhibited relatively poor mIBI scores. These scores fell in the severely impaired range (mIBI = 0-2). Improvement into the next category (moderately impaired, mIBI = 2-4) or possibly into the range on par with the mainstem (slightly impaired, mIBI = 4-6) is targeted.

Total Maximum Daily Load (TMDL) Development: The 2002 303 (d) list for Indiana includes the Coffee Creek basin for non-support of recreational use (high *E. coli* concentrations). IDEM has slated TMDL development in the Coffee Creek basin for 2015-2020. Stakeholders have expressed an interest in being involved with TMDL development for Coffee Creek. Goal 5 provides stakeholders a means to begin familiarizing themselves with the TMDL development process and working on the issues facing the Coffee Creek basin. Once a TMDL is completed for the Coffee Creek basin, the Coffee Creek Watershed Management Plan will be amended, if necessary, to be consistent with the load allocations outlined in the TMDL.

Plan Revisions: The Coffee Creek Watershed Conservancy will be responsible for holding and revising the Coffee Creek Watershed Management Plan. Copies of the plan are available to the public via a link on the Coffee Creek Watershed Conservancy web site (www.coffeecreekwc.org/ccwc/ccwcmission/319_grant.htm). As described in the **GOALS AND DECISIONS** Section, the Coffee Creek Watershed Management Plan will be reviewed and, if necessary, revised at the end of 2004. This will give stakeholders the opportunity to reassess the plan once they have started implementing the plan. As stakeholders begin to implement the plan, they will make some immediate discoveries on what works and what may not work. A discussion of this and revision of goals, action items, time frames, and/or potentially responsible parties may be appropriate based on this new information. The second major revision to the plan will occur at the end of 2008 or early 2009 once stakeholders have implemented the action plan. At this point, stakeholders will assess their progress toward their goals and vision for the watershed through a review of monitoring data. (See **MEASURING SUCCESS** Section.) They will also revise existing goals and set new goals as appropriate. The Coffee Creek Watershed Conservancy may delegate revision duties to the watershed coordinator. To assist with record keeping and to ensure actions are being completed, stakeholders should complete the simple Action Register form provided in Appendix I. This form should be returned to the watershed coordinator or the Coffee Creek Watershed Conservancy. The Coffee Creek Watershed Conservancy will keep completed action registers in a three ring binder and review action registers to ensure tasks are being completed. The forms will also help document the success of actions taken in the watershed.

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