South Fork Wildcat Creek Watershed Management Plan

A Project of the Clinton Co. Soil & Water Conservation District

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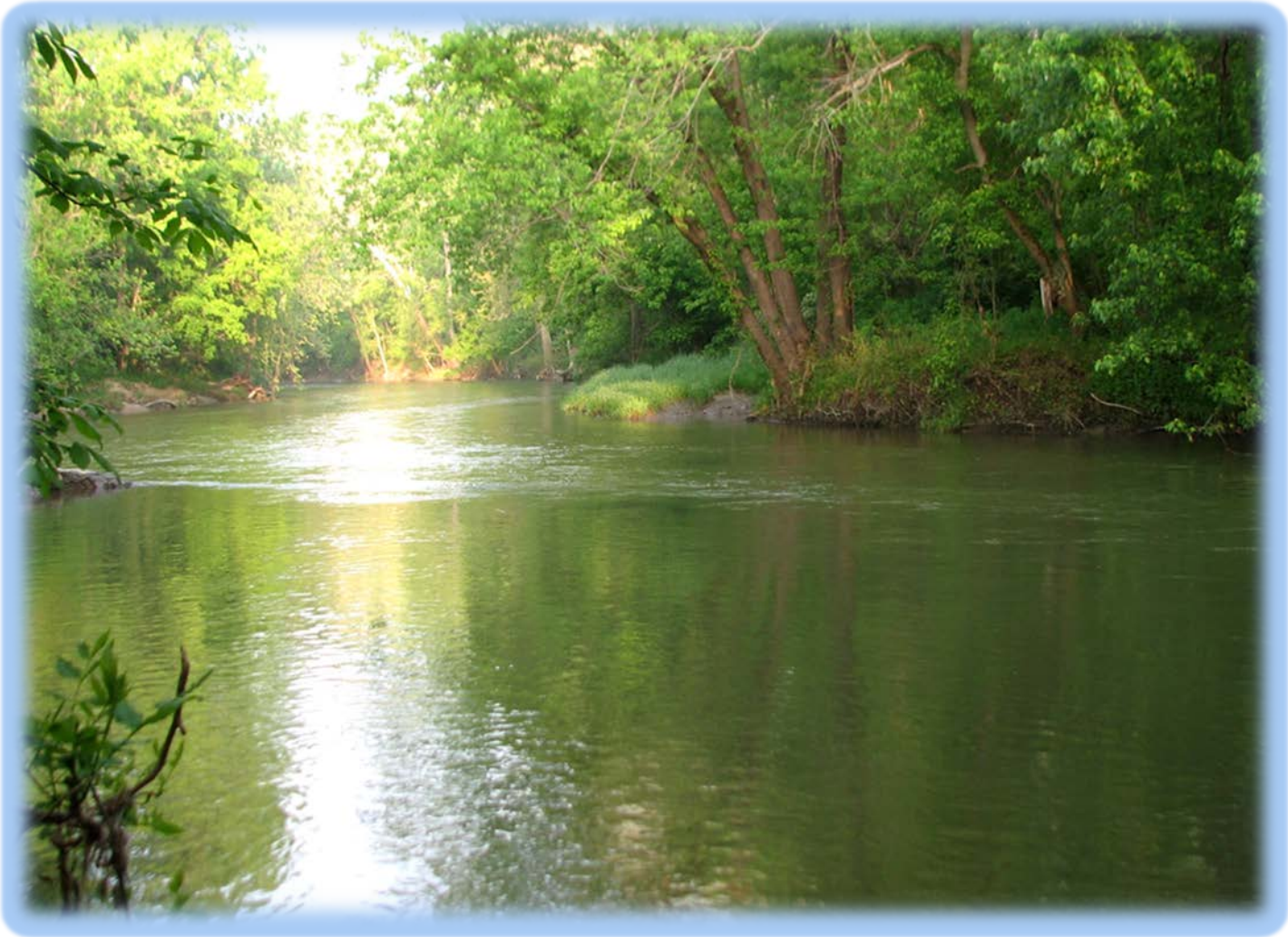

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This plan is the result of a three year watershed planning effort to identify causes of water quality impairments within the South Fork Wildcat Creek Watershed, potential sources of pollutants, and to develop a strategy to restore our local waters. A number of public agencies, private organizations, and citizens were involved as part of this planning process. A special thank you goes out to Leah Harden, Cindy Muffett, Doug Scircle, and Sandy Smith who all made contributions to the South Fork Wildcat Creek Watershed Management Plan. Also recognition should be given to the members of the Steering Committee and the numerous volunteers who helped with windshield inventories and various outreach activities. This project has been funded in part by the United States Environmental Protection Agency under assistance agreement C600E720-01 to the Indiana Department of Environmental Management. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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1.0 COMMUNITY WATERSHED INITIATIVE

The South Fork Wildcat Creek Watershed was chosen as a high priority area for the creation of a Watershed Management Plan (WMP) due to the large amount of stakeholder interest in water quality improvement, the high levels of agricultural activity, and known water quality problems such as impaired biotic communities and high levels of Escherichia *coli (E. coli) bacteria*. According to the U.S. Environmental Protection Agency (EPA), over 44% of all stream miles within the South Fork Wildcat Creek Watershed are defined as impaired (Figure 1). The majority of these segments can attribute their impairment to high levels of *E. coli* or degraded biotic communities. Other segments are listed as impaired due to the discovery of polychlorinated biphenyls (PCB's) in fish tissues and/or low levels of dissolved oxygen (DO).

Further proof of the need for a watershed management plan to address these impairments was indicated when the Indiana Dept. of Environmental Management (IDEM) Watershed Planning Branch conducted a Total Maximum Daily Load (TMDL) study for the South Fork Wildcat Creek Watershed. This study was completed in 2008 and indicated a need for significant load reductions of *E. coli*, Nitrate-

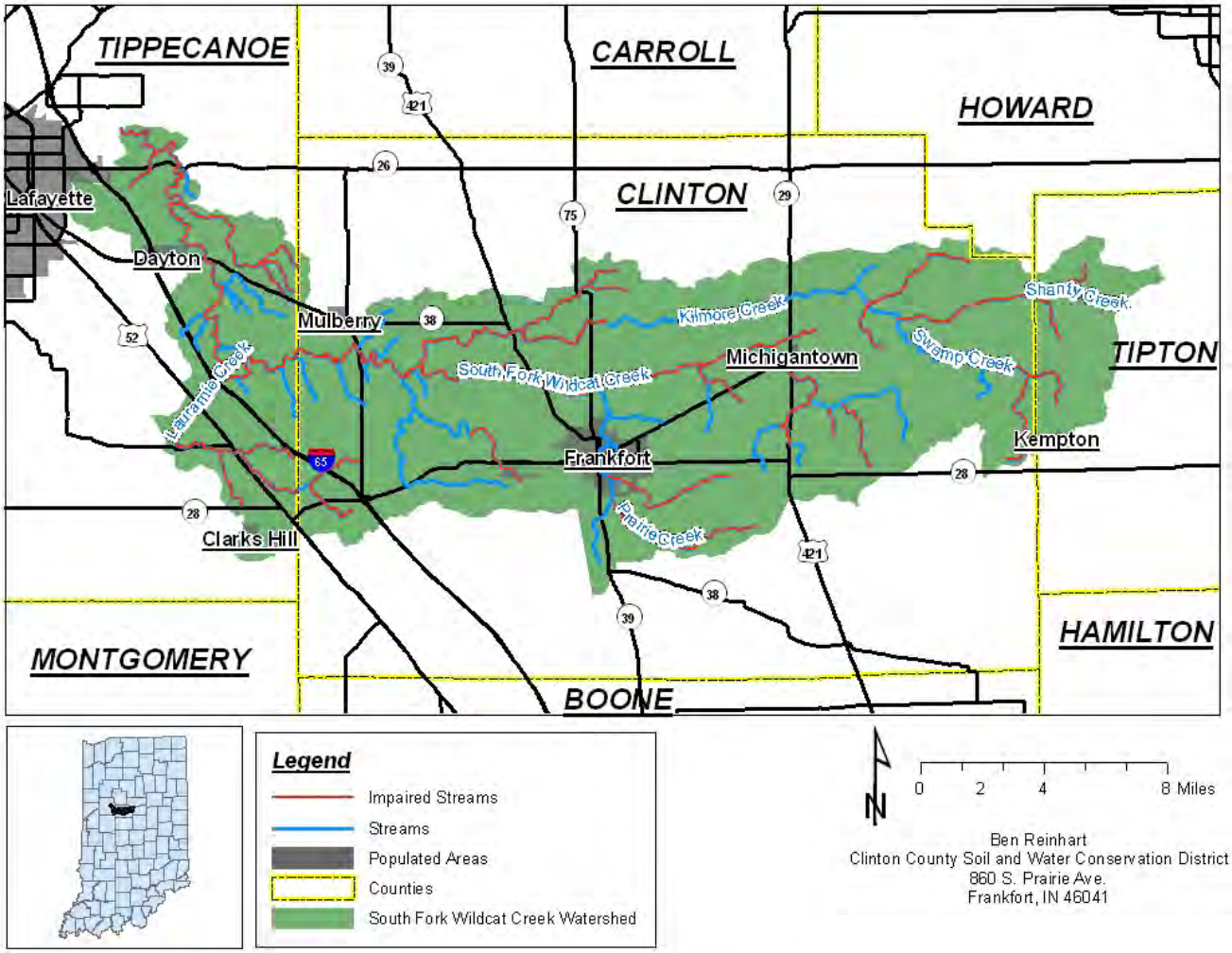

Figure 1. Impaired Waterways of the South Fork Wildcat Creek Watershed

Nitrite, and total suspended solids. Previous water quality data collected during past watershed studies in various subwatersheds of the greater South Fork Wildcat Creek Watershed indicated excessive levels of nutrients (i.e. phosphorus and nitrogen), *E. coli*, Atrazine, and total suspended solids. These areas included Blinn Ditch, Boyle's Ditch, Stump Ditch, Lauramie Creek, and Spring Creek-Lick Run. Finally, given the number of previous studies completed within areas of the watershed, local stakeholders desired to complete a comprehensive management plan for the area as a whole which would result in a single, coordinated effort for watershed protection and restoration.

Soil erosion and sedimentation is a widespread concern in the watershed and can originate from both rural and urban sources. Row crop farming occurs extensively throughout the watershed and livestock have access to open water resulting in potentially high rates of soil erosion as well as nutrient and bacteria loading into local waters. Urban areas, with increased concentrations of impervious surfaces and land disturbing construction activities, can significantly impact local waterways through accelerated runoff and concentrated pollutant loads. Illegal dumping has also been reported as a problem in the watershed, and discharge from septic systems is a concern. In fact, Purdue University estimated that 70% of septic systems in Indiana fail providing potential pathways for various pollutants and waste products to enter local waters. All of these activities have the potential to directly influence the local water quality in the South Fork Wildcat Creek Watershed.

The South Fork Wildcat Creek is listed as one of Indiana's State Scenic Rivers, a State Heritage Program Site; a State designated Canoe Trail, and is a High Water Quality River, according to the Natural Resources Commission Information Bulletin #4. In order to preserve all of these designations, the Clinton County Soil & Water Conservation District (CCSWCD) and its Partners felt it was imperative to create a comprehensive WMP that would address the water quality impairments of the present and plan for the future.

The CCSWCD Board of Supervisors and Staff are the local leaders of the project and formed a Steering Committee of partners and watershed residents to help guide the process. All of the partners who were invited to participate in the planning process have a vested interest in the outcome of the WMP, and many of them are currently working to improve the water quality in the Wildcat Watershed.

1.1 Community Leadership

A Steering Committee was assembled with representatives from local government, environmental organizations, and citizens (Table 1). Potential members were encouraged to become involved through direct mailings and solicitations during the first official Stakeholder Meeting.

The Steering Committee for the project wishes to have a long lasting impact in the watershed and help plan for a sustainable future. A vision statement was established to provide direction throughout the planning process. The vision of the South Fork Wildcat Creek Watershed Management Plan is to have a clear, natural and inviting stream highly regarded for recreation and wildlife opportunities.

Table 1. Steering Committee Members and Affiliations

NAME	AFFILIATION
Al Parsons	Citizen
Anita Hiatt	Tipton County SWCD
Brandy Daggett	USDA-Natural Resources Conservation Service
Calvin Hartman	Howard County SWCD
Chris Remley	Tippecanoe County SWCD
Chuck Calvert	Clinton County SWCD Board Supervisor
Clint Orr	Agricultural Producer
Curt Emanuel	Clinton County Extension
Dan Towery	Wildcat Creek Foundation
Dennis Kern	Wildcat Guardians
Devin Bell	Clinton County SWCD Board Supervisor
Dustin Johnson	Clinton County SWCD Board Supervisor
Greg Bright	Commonwealth Biomonitoring, Inc.
Hilary Barnhart	USDA-Natural Resources Conservation Service
Jeff Mathews	Citizen
Jerry Batts	Clinton County SWCD Board Supervisor
Jim Fleeger	Citizen
Joe O'Donnell	Wildcat Creek Watershed Alliance
Leah Harden	Clinton County SWCD
Lisa Christie	Tippecanoe County Surveyors Office
Mark Newhart	Clinton County SWCD Board Supervisor
Matt Kelley	Clinton County SWCD Board Supervisor
Matt Shively	Tippecanoe County Surveyors Office
Megan Benage	Tippecanoe County SWCD
Rene Weaver	Howard County SWCD
Sarah Brichford	Wildcat Guardians
Steve Yeary	Clinton County Health Department
Sue Gerlach	Indiana State Department of Agriculture

*** Soil & Water Conservation District (SWCD)**

Figure 2. The Steering Committee discusses stakeholder concerns and comments gathered during public meetings

1.2 Stakeholder Involvement

Planning and decision making is a joint venture of the stakeholders, Project Coordinator, Partners, and the Clinton County SWCD Board of Supervisors. In order to attain input from the many residents, agencies, industries, and businesses that will be impacted by the WMP, stakeholder involvement was generated through various education and outreach efforts. Throughout the project, information and calls for involvement were distributed through resources such as the local media, newsletters, public meetings and local events, and watershed signage. In addition a pre- and post-project survey was conducted to gather information on local knowledge and views within the South Fork Wildcat Creek Watershed. Public involvement is essential to the long-term success of the WMP, which ultimately belongs to the stakeholders and residents who help create it.

A total of six stakeholder meetings were held throughout the life of the project (Table 2). The first stakeholder meeting was held during January 2010 with the primary purpose of providing local residents with information on the goals of the project. Another focus of this first meeting was to begin collecting water quality concerns from community members. A wide variety of concerns were collected from the 21 meeting attendees. One other meeting was held during the 2010 calendar year. This second meeting took on more of an educational focus. Videos were shown which highlighted the unique and scenic characteristics of the Wildcat Creek system as well as a video on public water supplies and the importance of water quality.

Table 2. Public Meetings and Topics

Public Meeting Date	Meeting Topics
January 21, 2010	Introduce project goals, Collect water quality concerns, Recruit committee members
December 6, 2010	Show educational videos, General project update
March 2, 2011	General project update
December 6, 2011	Present water quality information
December 8, 2011	Present designated Critical Areas and Priority Protection Areas
September 5, 2012	Review of South Fork Wildcat Creek Watershed Management Plan

Three public meetings were held during 2011 to provide updates on the development of the South Fork Wildcat Creek Watershed Management Plan. These meetings provided local stakeholders and residents an opportunity to provide input on land use/water quality evaluations and analysis as well as the designation of Critical Areas for future implementation projects.

In addition to hosting meetings, information was delivered during other events such as county fairs and meetings of partnering organizations. Presentations were made to groups such as the Greater Wabash Resource Conservation & Development Council (RC&D), Wildcat Creek Foundation, SWCD annual meetings, and Clinton County's Natural Resources Focus Group for their Comprehensive Plan Update. These presentations provided updates and information on the development of the South Fork Wildcat Creek WMP as well as provided an opportunity for additional water quality concerns from local residents to be collected. Print materials with information on the South Fork Wildcat Creek WMP and watershed restoration were given away during the 2010-2012 Clinton County Fair and displayed during SWCD annual meetings of partnering counties. Information was also provided at the 2010 Earth Day Celebration hosted by Frito-Lay in Frankfort.

Workshops and volunteer cleanup days were held to engage local residents in the watershed planning and restoration efforts. Workshop topics included information on Best Management Practices (BMP) such as the use of cover crops, proper septic system management, and soil health. Volunteer cleanup days generated a lot of interest due to local concerns regarding littering and illegal dumping. Stream cleanups were held during 2010, 2011, and 2012. These events resulted in approximately 668 volunteer Hours and over 31,000 pounds of metal, trash, and waste tires removed. Cleanup volunteers came from all parts of the community. However, strong commitments have been seen from the Clinton Central FFA (Future Farmers of America) Program as well as recreational groups such as the Wildcat Foundation and Indiana Smallmouth Alliance.

Other methods for reaching out to local stakeholders and community members included quarterly mailings (13 total). Informational articles and project updates were published in the quarterly Clinton Co. Conservation Newsletter as well as the Guardian Gazette distributed by the Wildcat Guardians. Press releases (15 total) advertising local events were provided to local media outlets such as the Frankfort Times and Lafayette Journal & Courier. A website for the South Fork Wildcat Creek WMP was created and linked to the Clinton SWCD site. This watershed website provided an online presence to

advertise for local events and to post updates to the South Fork Wildcat Creek WMP. Watershed signage (8 total) was posted at locations around the South Fork Wildcat Creek Watershed. Signage was targeted towards heavily traveled routes and public areas. The primary intent of these signs was to deliver the message that all land within the watershed impacts the South Fork Wildcat Creek.

1.3 Stakeholder Concerns

Initial stakeholder concerns were gathered during the first Stakeholder and Steering Committee meetings in two formats. Attendees were invited to voice their concerns and have them recorded on flip charts during the meetings (Figure 3). For those attendees that did not feel comfortable voicing concerns, worksheets were provided to each individual to allow them to list their concerns and make further comments. During this meeting, three of the active environmental organizations in the watershed (the Wildcat Creek Foundation, Wildcat Creek Watershed Alliance, and the Wildcat Guardians) gave presentations on their historic and current work in South Fork Wildcat Creek Watershed and presented concerns that they have witnessed in the watershed. These presentations were meant to generate discussion between present stakeholders. In total, 21 stakeholders representing Clinton, Howard, and Tippecanoe Counties attended this first public meeting to provide input. Additional stakeholder concerns were solicited in the press releases announcing the public meeting and in two newsletter articles. Table 3 includes all concerns collected during the first meeting by stakeholders and steering committee members.

Table 3. Stakeholder Concerns Gathered During Initial Public Meetings

Drainage &Flooding	Drainage and Flooding Issues
	Development Impact
	Altered Hydrology
	Shifting Channels
	Education on Drainage Law
	2-Stage ditches as tributaries to creek
	Appropriate wildlife control (beavers)
	Construction in the Floodplain
	Allowing creek to be used as drain affects the property of others
	Changing the water holding capacity through filling and riprap
Pathogens & *E. coli*	High levels of *E. coli*
	Small unsewered towns and lack of septic absorption fields
	Improper waste utilization
	Livestock in creeks
	E. coli and its source
	Combined Sewer Overflow's (source of raw sewage)
	Septic systems (improperly maintained, non-functioning, and lack of)
	Poop in creek - numerous small towns without septic systems dumping in watershed
	Building wastewater treatment plants and collection systems
	E. coli
	Septic system maintenance

Table 3 Continued. Stakeholder Concerns Gathered During Initial Public Meetings

Urban & Industrial	PCBs and their source
	Industrial and Urban Pollution
	Incorporate bio-engineered stabilization over "hard armored" stabilization
	Landfill expansion - monitoring and testing below sites
	State Road 26 widening project and how it will affect the South Fork
	Development Impact
	Residential use of pesticides and nutrients
Sediment & Nutrients	Streambank Erosion
	South Fork and tributaries carry an excessive amount of sediment
	Excessive nutrients and pesticides/organics from agricultural land
	Lack of buffers/filter strips
	Tillage
	Lack of conservation practices paired with continuous no-till
	Excessive sediments and nutrients
	Not enough land in no-till
	Groundwater
	Grass area between every field and water body (including ditch)
	Sediment
	Inadequate buffers - poor incentives to establish and maintain buffers
	Too much sediment runoff
Under Appreciation of the Resource	Illegal dumping
	No public appreciation of the resource
	Lack of public knowledge
	No public access points or trails
	Recreational opportunities
	Need for education
	Change in local regulations to protect
	Protection of private property adjacent to stream (i.e. outlets, drain)
	Water test results and timely distribution of results to property owners in watershed
	Need increased awareness (travelogues, speeches, photo displays, school presentation)
	Education for all age groups
Wildlife	Lack of quality wildlife habitat
	Lacking 100+' riparian forest buffer
	Trees along creek
	Establish riparian buffers and encourage wildlife in the buffered area

NOTE. Each concern is listed only once. Concerns that fall under multiple categories are listed in the most relevant category.

Figure 3. Joe O'Donnell discusses the Wildcat Creek Watershed Alliance's concerns in the Wildcat Creek Watershed at the first Public Meeting held January 21, 2010.

1.4 Social Indicator Survey

Surveys have been used traditionally in local watershed projects to collect information on the attitudes, knowledge, and behavior of local residents. Those attitudes, knowledge, and behaviors serve as social indicators which can be tracked over time. The measurement of these indicators allows natural resource managers to document progress towards a particular goal, in this case watershed restoration and/or protection. The South Fork Wildcat Creek WMP used a protocol referred to as the Social Indicator Planning and Evaluation System (SIPES) for Nonpoint Source Management. This protocol was developed by a team of university researchers from the Midwestern land grant universities for use by the U.S. EPA and state level environmental agencies. Developed specifically for U.S. EPA Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin), the SIPES Handbook provides a specific methodology for developing and administering a Social Indicator Survey to show change over time in various social indicators. Along with the Social Indicators Data Management & Analysis (SIDMA) tool, this methodology was used to construct and administer a survey titled, "Community Views of the South Fork Wildcat Creek Watershed". All survey results can be found in Appendix C.

Surveys were administered to two separate target audiences. The first target audience included only individuals or landowners involved in agricultural production. The second target audience included individuals not involved in agricultural production such as members of urban, suburban, and rural residential land uses. Mailing lists for agricultural producers in each county with land within the watershed were requested from the Farm Service Agency. This included producers in Clinton, Howard,

Tippecanoe, and Tipton counties. Addresses where geocoded using ESRI ArcGIS software. This allowed for the selection of addresses based on their geographic location. Over 80% of all addresses where matched to their specific geographic locations with a strength >80 (on a scale of 100). All addresses contained by or within one mile of the watershed boundaries of the South Fork Wildcat Creek were selected for a total of 185 agricultural producers/landowners. After removing duplicate addresses a total of 166 addresses were used for the survey.

Mailing lists for non-agricultural residents were collected using a tool called Audience Targeter from Water Words that Work, LLC. This tool allows users to select targeted audiences based on various geographic and demographic characteristics. Addresses are compiled from more than 30 different databases which are updated monthly and used by various Fortune 500 companies. Selections were made by property type (e.g. single family dwelling, condo, mobile home, etc.) to identify community members in urban, suburban, and rural residential areas. A total of 11,152 addresses were geocoded with over 80% of all addresses matched to their specific geographic locations with a strength >80 (on a scale of 100). Of these, only 4,963 addresses were located within the South Fork Wildcat Creek Watershed. A sample of 881 addresses was randomly selected from the pool of 4,963. The total number of selected addresses is based on guidelines given by the SIPES methods. After removing duplicate addresses a total of 857 addresses were used for the survey.

Agricultural Producers

The survey response rate for agricultural producers within the South Fork Wildcat Creek Watershed was 45%. This met the minimum response threshold (40%) of the SIPES protocol. The average respondent was a 64 year old male, living on a farm, with at least a high school education, most with at least some college training. Farm management was primarily made alone or with family members. Approximately 24% made decisions with input from a tenant farmer. The average farm size was about 460 acres. 69% percent responded that their property touches a stream, river, lake, or wetland. Almost 51% indicated that they currently have a nutrient management plan in place. The majority of these plans were developed through private-sector agronomists or crop consultants. Common sources of information regarding soil and water conservation were: newsletters and fact sheets, conversations with others, internet, magazines, and workshops or meetings, in that order. Approximately 86% indicated they read a local newspaper. The most trusted sources of information included the Soil and Water Conservation District, Natural Resources Conservation Service, and Purdue Extension. The least trusted source of information was “environmental groups”.

Overall, respondents rated water quality as “Okay”. Approximately 50% of respondents rated the scenic quality of local water resources as “Good” while about 20% rated local waters as “poor” for recreational activities such as fishing, canoeing, and kayaking. When asked which activities were most important, 34% indicated providing fish habitat or eating locally caught fish while 45% indicated scenic beauty. Respondents were well aware of how runoff is conveyed across their properties with 81% indicating they knew where water leaves their land. Attitudes related to local water quality show that the majority of respondents believe that water quality is important, their actions do have an impact on water quality, and they are responsible for helping to protect the quality of their water resources. Despite this, respondents were hesitant to indicate that they would be willing to pay more to help protect water quality and only slightly more willing to change their management practices to improve local water quality. No specific impairment was overwhelmingly rated as “Severe” with the average response indicating most water quality impairments as “Slight” or “Moderate” problems. The three impairments

with the highest average scores were trash/debris, sediment (i.e. dirt and soil), and bacteria/viruses. Responses regarding sources of impairments show a similar pattern with littering/dumping, soil loss from agriculture, and failing septic systems being the highest perceived threats. Interestingly, "animal feeding operations" ranked lower than "natural sources" as a source of impairments. Concerns regarding negative impacts resulting from impaired water quality focused most on fishing, followed by concerns regarding scenic and recreational characteristics as well as algae growth. Two out of the three lowest ranking concerns were impacts to drinking water quality and cost of treatment for drinking water. However, all listed concerns were only seen as a "slight problem".

The second half of the survey focused on land management practices and constraints to change. Some of the most common practices in use were maintaining crop residues on cropland, nutrient and pest management, and septic system maintenance. Practices which rated highest as "not relevant" included: manure management practices, prescribed grazing, wetland restoration, and heavy use area protection. The most little known practices were regulating tile flow and heavy use area protection. When asked about general constraints to changing land management practices cost, appropriate equipment, available cost-share assistance, and governmental program restrictions ranked highest. Constraints related to four specific management practices were also evaluated. Currently 61% of respondents are applying variable rate fertilizers. Sixty-eight percent responded "yes or already do" and 20% "maybe" when asked if they would be willing to try the practice. The highest ranking constraints were: lack of equipment, cost, and "desire to keep things the way they are". The use of cover crops saw a lower adoption rate with about 26% indicating they currently use the practice. When asked about their willingness to try the practice 48% responded "yes or already do" and 37% "maybe". The highest ranking constraints were: cost, lack of equipment, and time required. The use of livestock fencing along waterways was relatively uncommon with about 58% indicating it was "not relevant". The majority of respondents (47%) marked they would not be willing to try the practice while 35% responded "maybe". The highest ranking concerns were: lack of equipment, cost, and time required. Conservation tillage saw a high adoption rate with almost 67% of respondents indicating they currently use the practice. Regarding their willingness to try 75% responded "yes or already do" and 17% "maybe". None of the listed constraints ranked highly. The most significant constraints focused on lack of equipment, traditions, and compatibility of conservation tillage with site characteristics.

Non-Agricultural Producers

In addition to surveying agricultural producers, residential and urban audiences were surveyed for their opinions, attitudes, and behaviors related to local water quality. These non-agricultural surveys were customized to include information regarding lawn maintenance practices, waste disposal, and other residential issues more relevant for this target audience. The survey response rate for this audience was 24% which does not meet the recommended minimum response threshold (40%) of the SIPES protocol. Results should be interpreted with this fact in mind. The average respondent was a 59 year old male, living within a town or city, and owning a ¼ acre or less sized lot. Approximately 30% indicated they lived in an isolated rural residence or rural subdivision. Just over 30% of respondents had at least some college education while 42% possessed a high school education. Commercial lawn care was fairly uncommon among respondents with 69% indicating that they do not pay for lawn care service. Among this audience print publications (e.g. newspapers, newsletters, brochures, etc.) and the internet were the most commonly accessed sources of water quality information. The most trusted source of

information came from the local Purdue Extension office. The local watershed group was the most unfamiliar source for information.

Overall, respondents rated water quality as “Okay”. The highest ranking characteristic of water quality was “Scenic Beauty” while recreational activities such as fishing and boating were ranked lower. When asked which activities were most important, almost 40% indicated “Scenic Beauty”. Approximately 38% fishing activities were most important. Only about half of all respondents knew where storm water runoff from their properties drain to. Attitudes related to local water quality show that the majority of respondents believe that water quality is important, their actions do have an impact on water quality, and they are responsible for helping to protect the water of their water resources. Despite this, most were hesitant to indicate that they would be willing to pay more to help protect water quality and only slightly more willing to change their management practices to improve local water quality. No specific impairment was rated as “Severe” with the average response indicating most impairments as “Slight” or “Moderate”. The three highest scoring impairments were pesticides, bacteria and viruses, and trash. Illegal dumping and trash in streams was rated as “Severe” more than any other listed impairment. The lowest ranking impairments were flow alterations and sedimentation issues. Results also showed that nutrient impairments (i.e. nitrogen and phosphorus) were relatively new issues and most indicated they didn’t know the impact these impairments were having on local water quality. In regards to sources of water quality impairments, most were seen as “Slight” to “Moderate” threats. The most significant sources indicated by respondents were littering/dumping, farming practices (e.g. fertilizers, pesticides, manure, erosion, etc.), landfills, and septic system discharges. Littering and dumping was rated as “Severe” more than any other listed source. The lowest ranking sources were soil erosion from construction sites and natural sources such as wildlife. Concerns regarding negative impacts from water quality impairments focused primarily on scenic and recreational characteristics on local waterways and less on threats to drinking water supplies or property values.

Some of the common practices currently being used among respondents was proper disposal of household wastes (61%) and keeping yard wastes out of waterways (55%). Almost 25% of respondents indicated that they knowingly do not follow lawn fertilization recommendations. The least understood practices focused on utilizing native plants or other vegetation next to waterways to help protect water quality and filter runoff. When asked about general constraints to changing land management practices, cost, lack of equipment, and availability of technical assistance on installing practices ranked highest. Constraints related to four specific management practices were evaluated in more detail. Currently 41% of respondents have never heard of rain gardens and only 6% indicated they are currently using this practice. When asked if they would be willing to try this practice 28% responded “Yes or already do” while 49% indicated they may be willing to install rain gardens on their property. The biggest constraints related to rain gardens were cost as well as lack of knowledge on installing vegetated areas to collect and filter storm water runoff. Filter strips were another practice that was unfamiliar to respondents with 60% indicating they were not very familiar with the practice. When asked if they would be willing to install the practice 31% indicated “Yes or already do” while 31% responded that they may be willing to implement filter strips on their property. The biggest constraints associated with filter strips were cost and knowledge of how the practice is installed. Rain barrels, or rain water harvesting, was split with 40% indicating that they knowingly do not use the practice while 43% of remaining respondents indicating they weren’t familiar with rain barrels. When asked if they would be willing to install rain barrels 38% responded “Yes or already do” while 33% indicated they may be willing to install

the practice on their property. The biggest constraints to rain water harvesting were lack of equipment and cost of implementation.

2.0 Description of the South Fork Wildcat Creek Watershed

2.1 Geology and Topography

Geology

Until 20,000 years ago, the Wisconsin glacier covered the region. The glacial drift ranged from 100 to 400 feet thick. Due to the sand and gravel layers in the glacial till, wells are the main source of water in the watershed. Much of the South Fork flows through relatively flat farmland, but glacial mounds, known as kames, may be seen in the creek valley. The Teays River system was a pre-glacial system which ran in a general east-west direction across central Indiana. The old river channel was abandoned when its course was diverted southward to the Ohio River drainage by the movements of the early Pleistocene ice and the emplacement of glacial deposits approximately two million years ago (Figure 4). Part of the pre-glacial Teays River system supplies well water for the City of Frankfort.

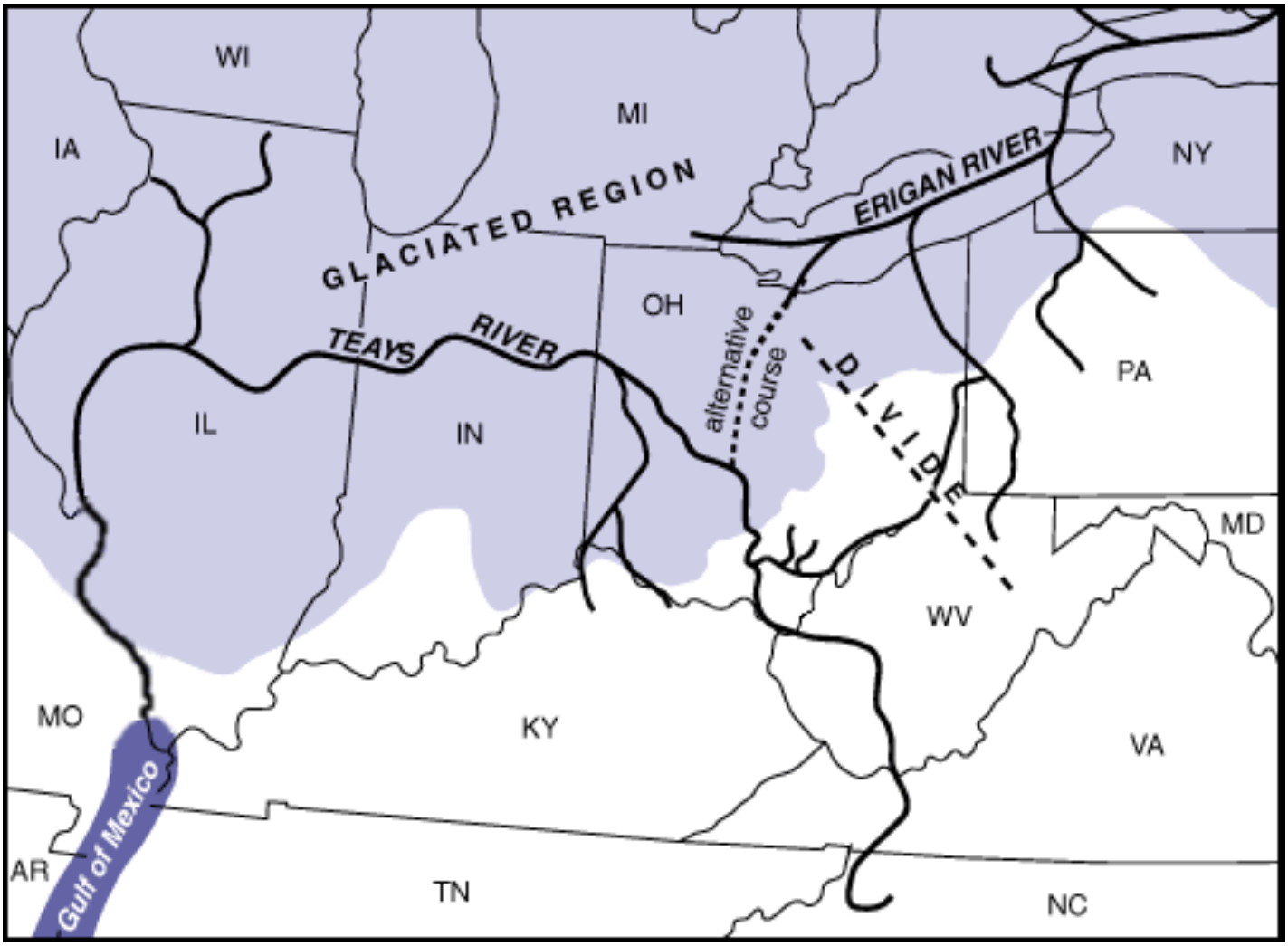

Figure 4. Pleistocene Glaciated Region in Indiana

Topography

The South Fork Wildcat Creek Watershed is located within the Tipton Till Plain. The region is characterized by relatively flat, gently rolling land resulting from glaciations during the most recent ice age. Elevation ranges from 930 feet above sea level at the highest point in the headwaters to about 545 feet downstream (Figure 5). The watershed slopes towards the west from its headwaters in Tipton County before turning north/northwest after entering Tippecanoe County. The average slope in the watershed is approximately 4%, according to the South Fork Wildcat Creek TMDL study. However, steeper slopes are not uncommon along local waterways as you move farther downstream in the watershed (Figure 6).

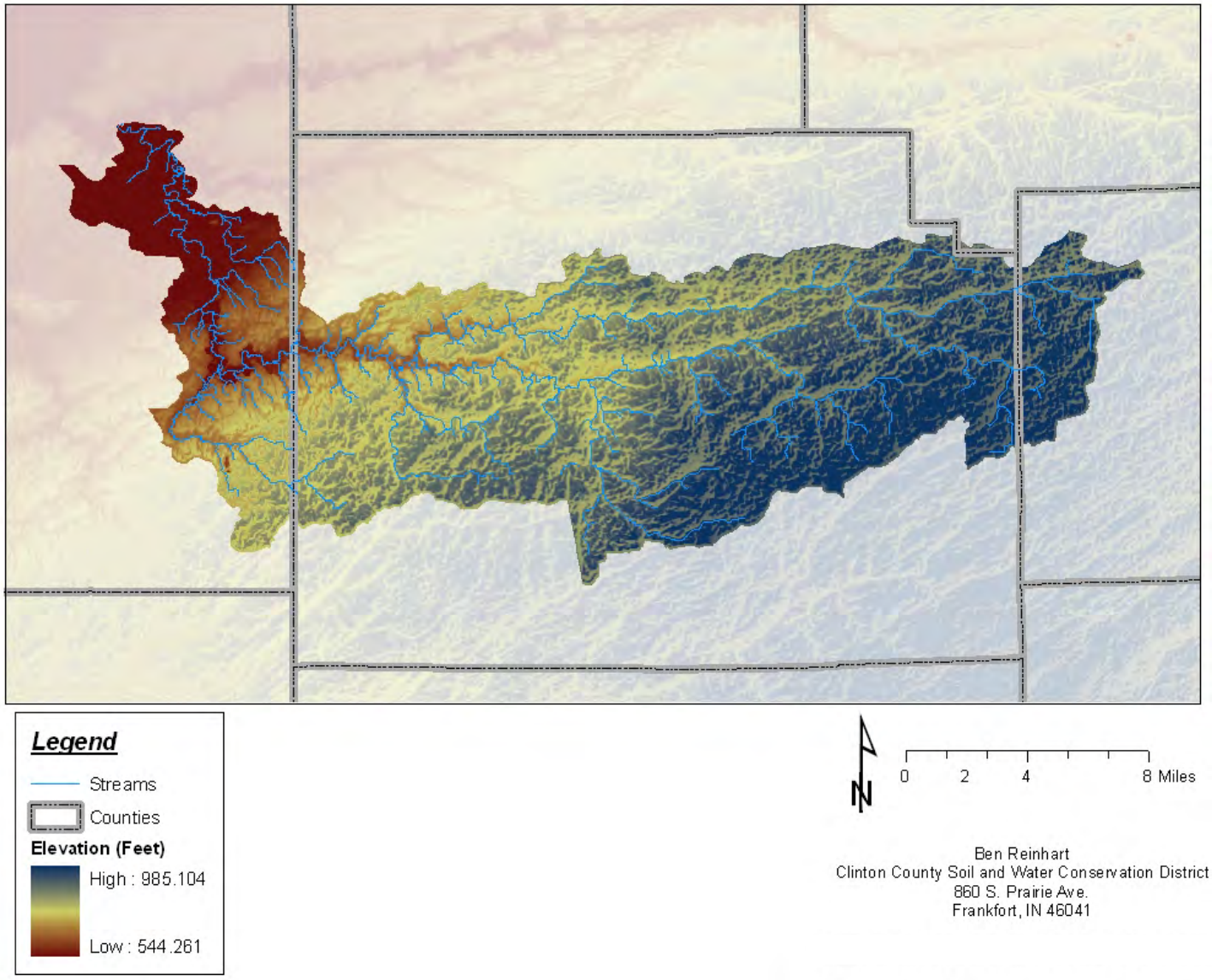

Figure 5. Elevation Map of the South Fork Wildcat Creek Watershed

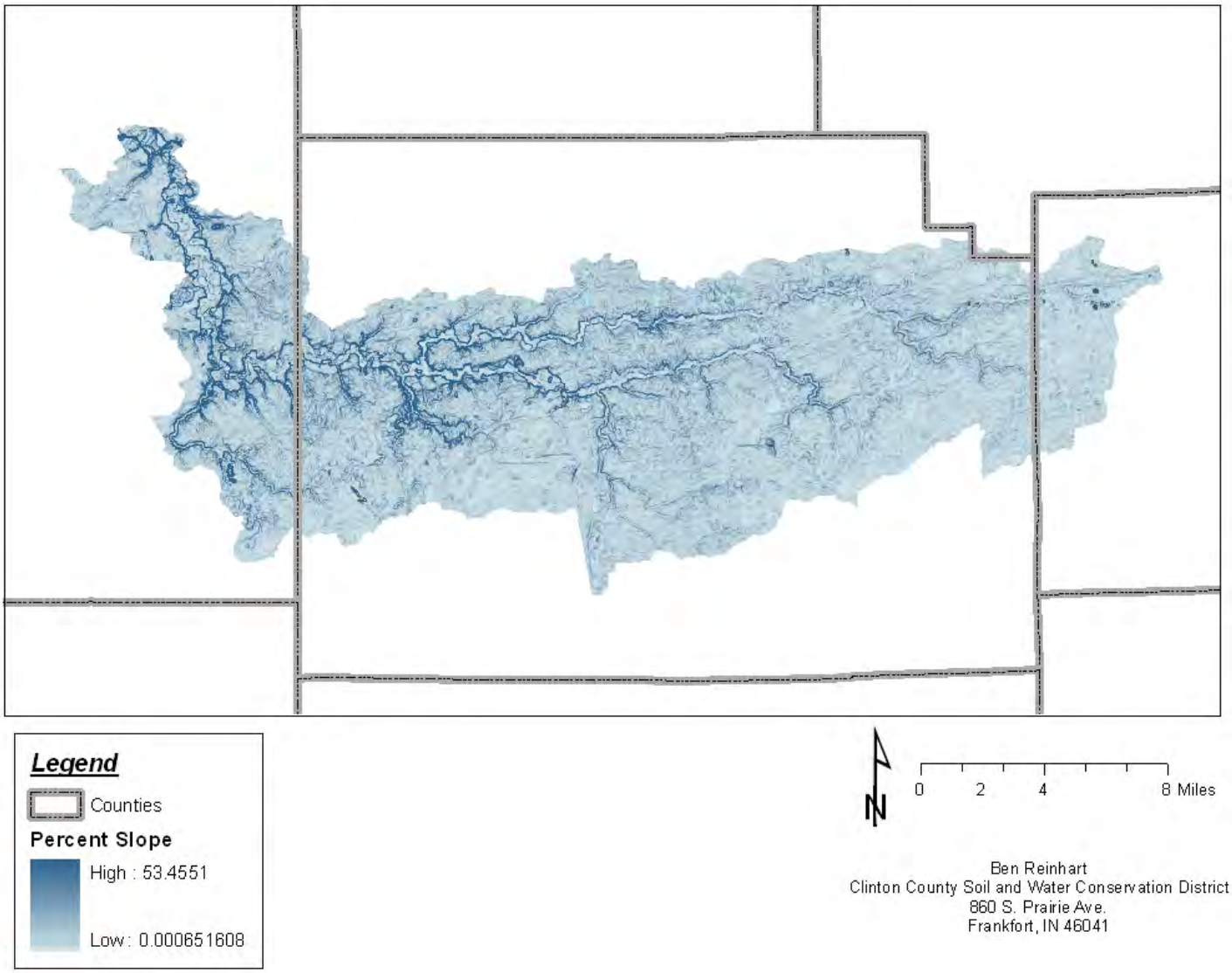

Figure 6. Sloping Lands of the South Fork Wildcat Creek Watershed

2.2 Hydrology

The South Fork Wildcat Creek watershed drains 250 square miles and covers portions of Clinton, Howard, Tipton, and Tippecanoe Counties. Its waterways flow for 63 miles in an east to north-west direction from near Kempton, IN to Lafayette, IN where it empties into the main channel of Wildcat. Approximately 36 miles of the South Fork Wildcat Creek and Kilmore Creek have been listed as Outstanding Rivers by the Natural Resource Commission (Figure 7). As such, a number of stakeholders utilize local water resources for aesthetic or recreational purposes such as fishing and canoeing. It should be mentioned that there are a number of other uses of waterways in the South Fork Wildcat Creek Watershed. Various concerns have been expressed by stakeholders regarding the impact of livestock on local waterways, especially when there is clear access to the water, depletion of surface and groundwater by high-capacity irrigation, and other rural uses of natural water resources. (See 1.3 Stakeholder Concerns).

Due to the high percentage of agricultural row crop farming and drainage limitations on local soils, open ditches and subsurface tile systems (both public and private) are widely used and seen as a means for drainage (Table 4). This type of hydrologic modification has helped create highly productive soils for crop production as well as create outlets for flood waters that may threaten fields, roads, or developed areas. However, these modifications do also have potential to negatively impact local waters. Artificial drainage can actually increase downstream flooding since waters enter our ditches and waterways at a much faster rate than you would see in natural systems. This can result in those channels quickly filling up to their storage capacity and allowing flood waters to overtop their banks. Subsurface tile drainage prevents natural infiltration and soil cleansing processes. This prevents natural groundwater recharge of local aquifers as well as does not allow natural soil bacteria and microbes to break down pollutants before entering surface and groundwater. Some of the natural headwater streams have undergone maintenance (e.g. channelization, dredging, etc.) to be maintained as open drainage channels. Maintenance activities such as channelization and dredging can result in the destruction of aquatic organisms and their habitats as well as create a disturbance in physical or chemical processes of the waterway leading to unstable or unproductive waterways. Figure 8 shows a location of artificial drainage in the South Fork Wildcat Creek Watershed.

Table 4. Natural and Artificial Waters of the South Fork Wildcat Creek Watershed

Streams	213.5 Miles
Open Ditches	96 Miles
County Tile	198.1 Miles
Private Tile	31.3 Miles
Wetlands	11,535.7 Acres
Lakes, Ponds, and Reservoirs	352.6 Acres (277 Bodies of Water)

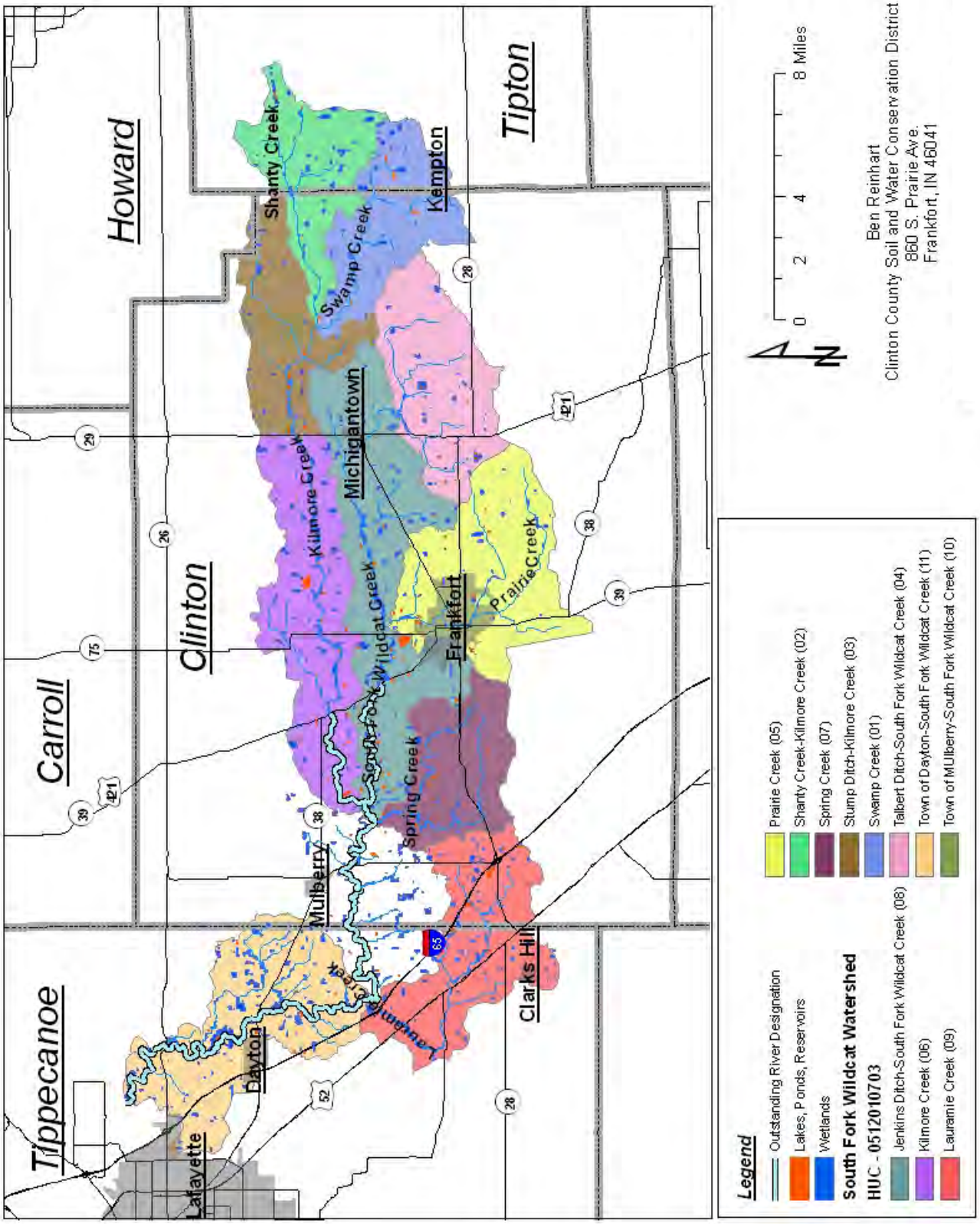

Figure 7. Waterbodies of the South Fork Wildcat Creek Watershed

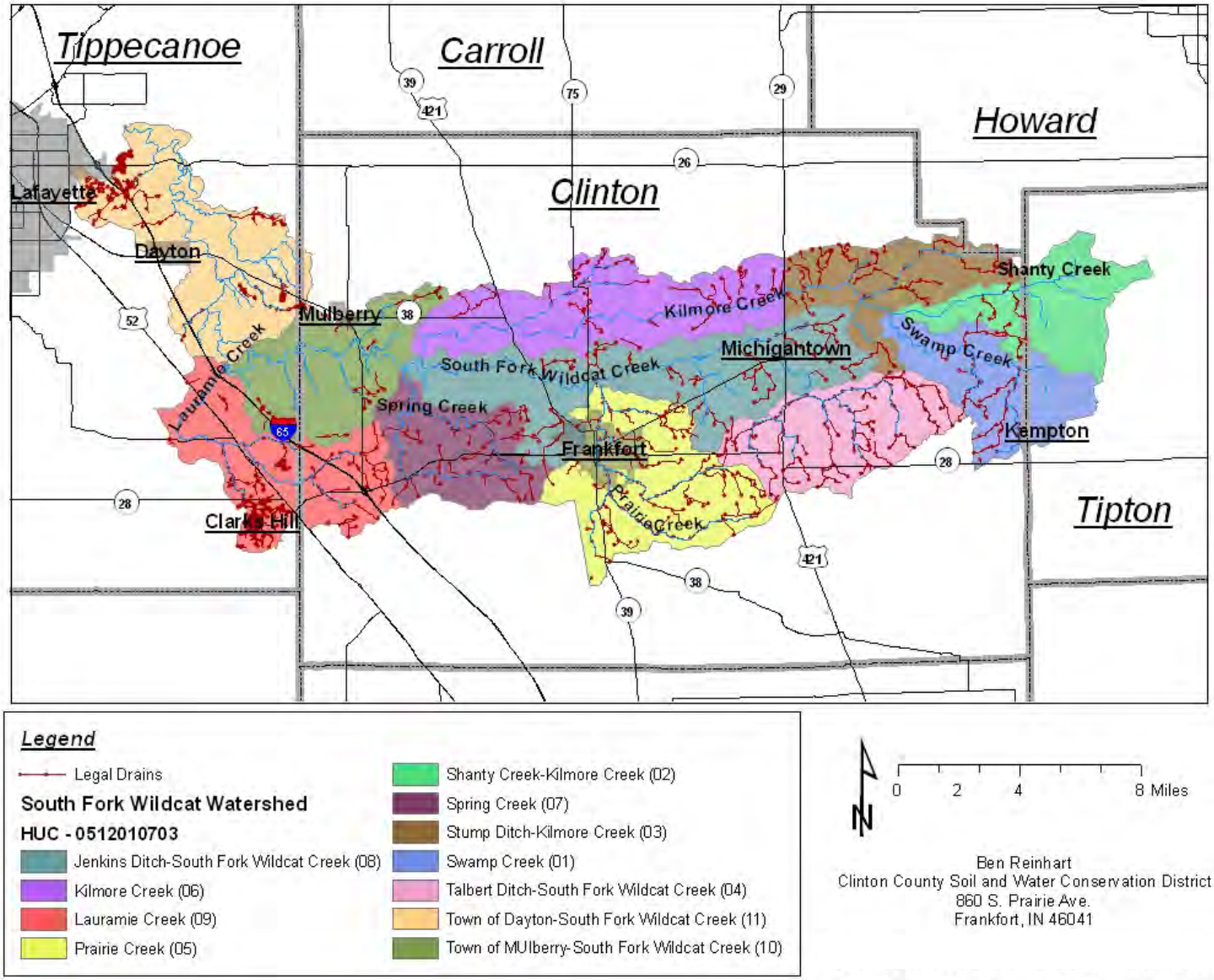

Figure 8. Tile and Open Drains within the South Fork Wildcat Creek Watershed

2.3 SOILS

Soils within the watershed can be grouped and described by looking at various physical and chemical characteristics. One such characterization is called STATSGO which stands for the State Soil Geographic Database. This database groups together soil types into general associations based upon their general characteristics. Another characterization is called SSURGO which stands for the Soil Survey Geographic Database. SSURGO is a much more detailed database than STATSGO and can differentiate between various soil types even at very detailed levels such as single farm tracts. Both databases are maintained by the US Dept. of Agriculture's (USDA)-Natural Resources Conservation Service (NRCS).

Soil types in the watershed are generally derived from two general groups: alluvial and gray-brown podzolics. The podzols originally developed from deciduous forest situations and are located on uplands and slopes. Alluvial soils developed under water-based systems (e.g. rivers) and are generally located in bottomlands. The soils in the watershed vary in maturity but many have been exposed long enough to form distinct soil horizons in the soil profile. However, some soils that have formed from recent alluvial

material lack these distinct horizons. Processes that have been involved in the formation of the soils include: accumulation of organic matter; solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. A total of eight general soil associations are found within the South Fork Wildcat Creek Watershed. However, over 70% of the watershed is designated primarily to only two soil associations (Figure 9).

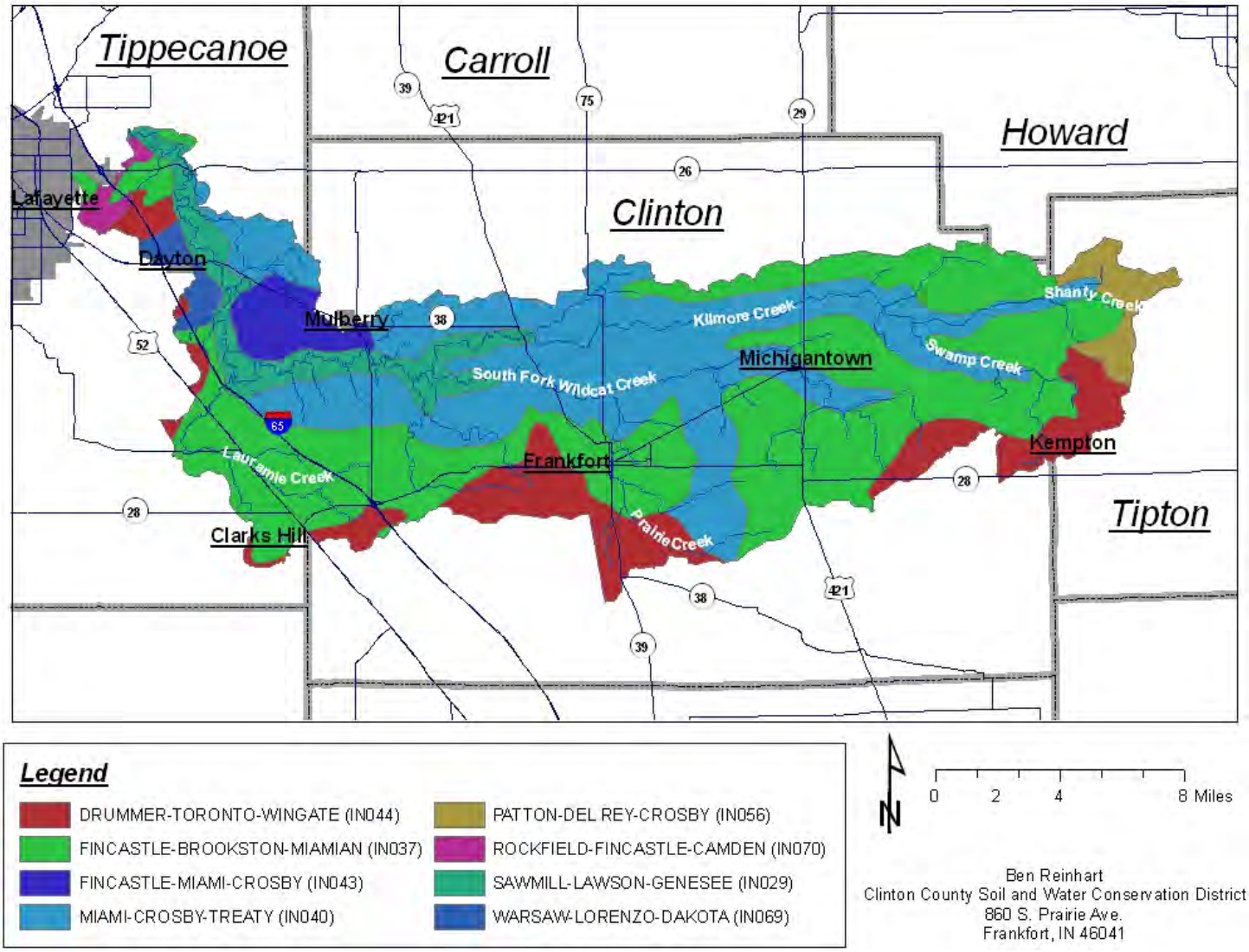

Figure 9. General Soil Associations within the South Fork Wildcat Creek Watershed

Septic Suitability

Roughly 92% of soils within the watershed area are poorly suited to handle on-site wastewater treatment systems (i.e. septic systems) (Table 5). Common soil limitations focus on issues such as high water tables and excessively slow infiltration rates. The result of these limitations is often the input of raw sewage into local waterways. In an effort to get around these soil limitations many county health departments require perimeter drains and large absorption fields. However, even these larger, more modern wastewater systems require periodic maintenance to ensure proper functioning and limit environmental impacts.

Table 5. General Soil Characteristics within the South Fork Wildcat Creek Watershed

Drummer-Toronto-Wingate (12.1% of Watershed Area)	Sawmill-Lawson-Genesee (6.7% of Watershed Area)	Fincastle-Brookston-Miamian (41.3% of Watershed Area)	Miami-Crosby-Treaty (32.1% of Watershed Area)
Nearly level, poorly drained and somewhat poorly drained, silty soils; on till plains **Poorly suited for sanitary facilities*	Nearly level, well drained to very poorly drained, formed in loamy alluvium; in bottomlands	Nearly level, deep somewhat poorly drained on slight rises on broad till plains, silt loam **Poor suitability for sanitary facilities*	Strongly sloping to nearly level, well drained and somewhat poorly drained, silty and loamy soils; on till plains **Poorly suited for sanitary facilities*
Fincastle-Miami-Crosby (3.1% of Watershed Area)	**Patton-Del Rey-Crosby (2.5% of Watershed Area)**	**Rockfield-Fincastle-Camden (0.8% of Watershed Area)**	**Warsaw-Lorenzo-Dakota (1.4 % of Watershed Area)**
Nearly level and gently sloping, somewhat poorly drained; silty material on till plains * *Moderate to severe limitation for sanitary facilities*	Nearly level poorly drained soils formed in silty and sandy sediments on lake plains and till plains **Unsuitable for private sanitary facilities*	Nearly level, gently sloping, moderately well drained to somewhat poorly drained soil; on till plains; silt loam **Poorly suited for sanitary facilities*	Nearly level to strongly sloping, well drained; gravelly coarse sand formed in loamy sediments; on outwash plains and terraces

Other potential impacts from wastewater exist in communities that operate without modern treatment systems. A number of communities within the watershed are unsewered (Figure 10). Many times these areas are operating on old and out-dated septic systems that may be discharging raw sewage into local waterways and present local health risks. Fortunately, there has been interest by some communities to address this issue as can be seen by the switch to city sewer by the Town of Jefferson and participation from the Kempton community in a Septic System Maintenance Workshop. Many stakeholders acknowledge these communities as sources of waste discharge and *E. coli* loading (Table 3). However, due to long distances for connection to existing infrastructure and small landowner bases to cover the cost of new infrastructure development, many of these communities currently have limited options for reducing their impacts. Various grant and loan programs have been discussed for certain communities such as Kempton.

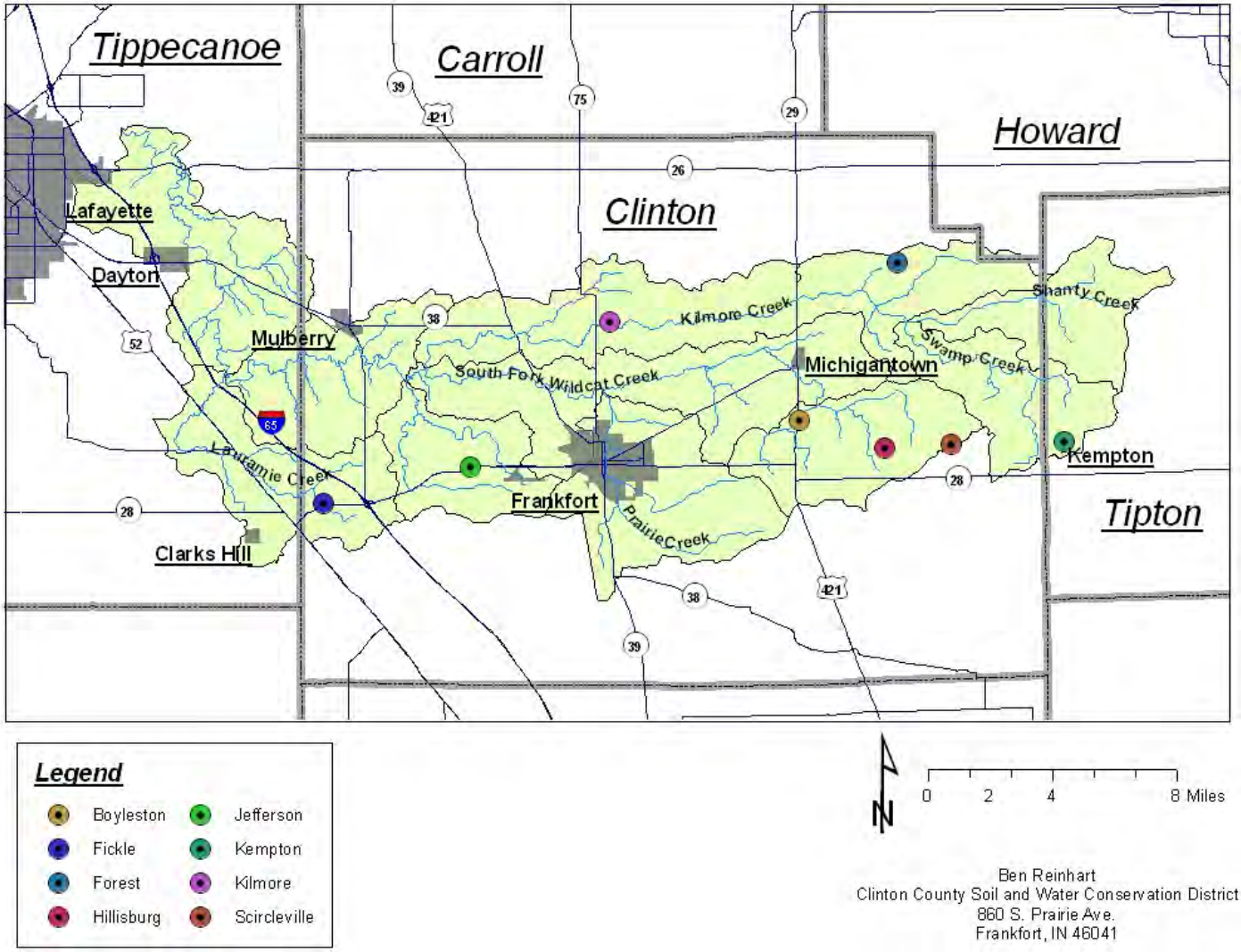

Figure 10. Unsewered Communities within the South Fork Wildcat Creek Watershed

Highly Erodible Lands

As was noted by stakeholders, erosion and sedimentation is a concern within the watershed. Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity. The redistribution of eroded soils into local waterways represents the process of sedimentation. Highly erodible lands (HEL) describe those areas that are potentially exposed to soil erosion by wind or water. A number of factors go into determining if any particular farm or unit of land can be classified as HEL. Some of these factors include: the amount and intensity of rainfall or wind, the inherent erodibility of a certain soil type, and the topography (e.g. slope and slope length). The USDA Natural Resources Conservation Service makes determinations on HEL or potential HEL (PHEL) and has compiled a list of soils, by county, which they commonly see in these situations. Soils are classed as 1 (Highly Erodible), 2 (Potentially Highly Erodible), and 3 (Not Highly Erodible). Lands that are determined to be HEL can contribute a significant amount of sediment, nutrients, and chemicals to local waterways, especially if those areas are cropped and lack appropriate conservation measures. In addition, tons and tons of productive soil are lost from farmland during each rain event impacting not only local streams but also the yields of local farmers. About 6% of the South Fork Wildcat Creek watershed is classified as HEL soils. The majority of these soil types are located primarily in the bottom third of the watershed

and adjacent to waterways. Almost 30% of the watershed area can be classified as PHEL and these soils are widely distributed across the area (Figure 11).

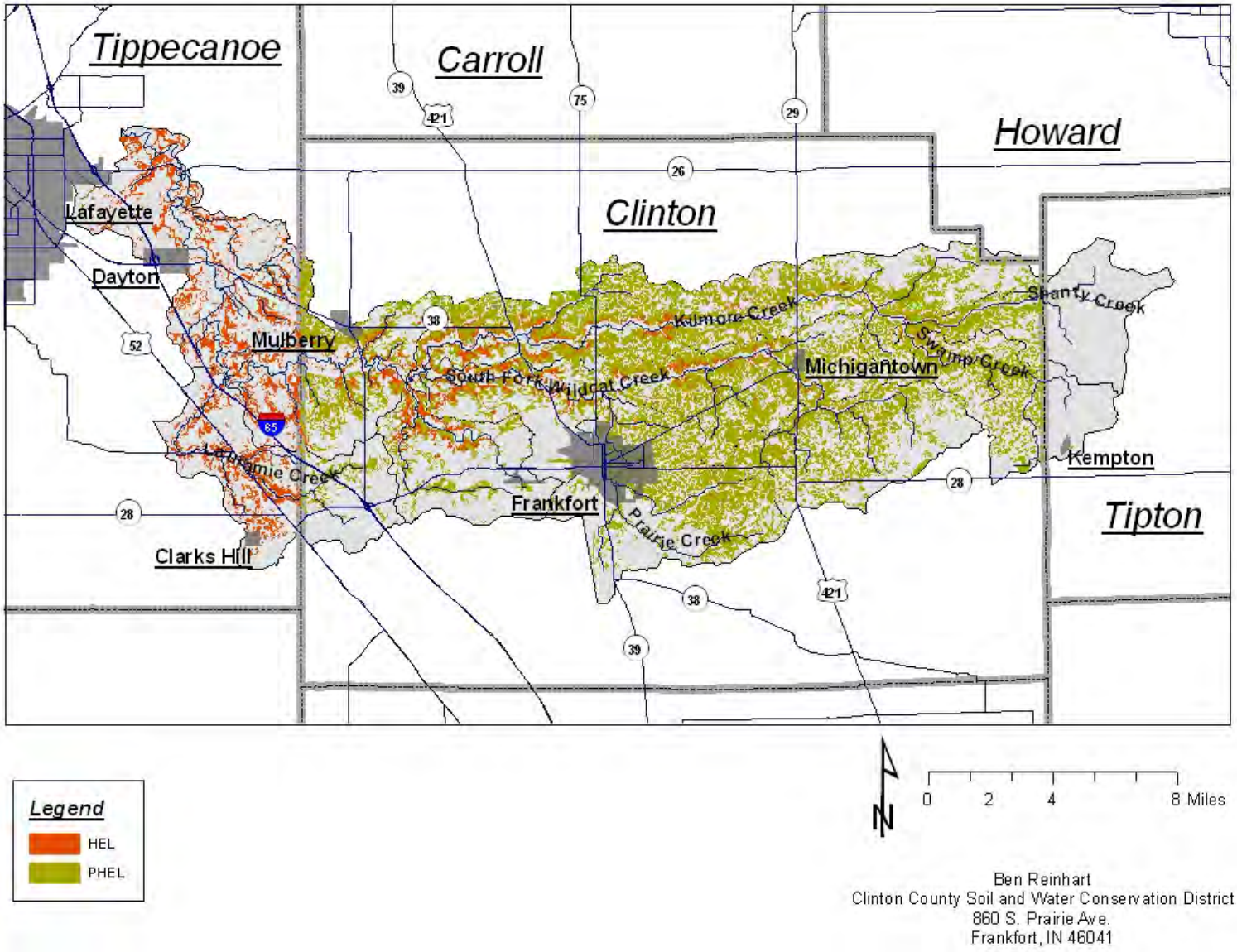

Figure 11. Highly Erodible and Potentially Highly Erodible Lands within the South Fork Wildcat Creek Watershed

Hydric Soils

Hydric soils describe those soil types which are wet or ponded with water long enough that they start to develop anaerobic (i.e. low oxygen) conditions in the upper parts of their layers. Many times the presence of hydric soils indicates where a wetland once was or currently is located. This soil designation is important for the natural occurrence or restoration of wetland ecosystems. Hydric soils are capable of supporting wetland ecosystems which act like natural wastewater treatment plants, removing various water pollutants and helping to cycle excess nutrients through the environment. Wetlands are also extremely important wildlife habitat and can support diverse collections of birds, amphibians, reptiles, mammals, insects, and plants. The lack of appropriate wildlife habitat was one major concern for stakeholders. It is also important to understand that while a number of areas of hydric soil have been artificially drained or filled in, they still retain their hydric capabilities. This means that areas of hydric soil are excellent candidates for the restoration of wetland habitats due to their natural ability to hold water. Roughly 34% of the watershed area is classified as hydric soils. The vast majority of these areas is cropland and artificially drained providing a direct conduit for nutrient loading into local waterways. A high percentage of the soils within the headwaters of the South Fork Wildcat Creek watershed are hydric (Figure 12).

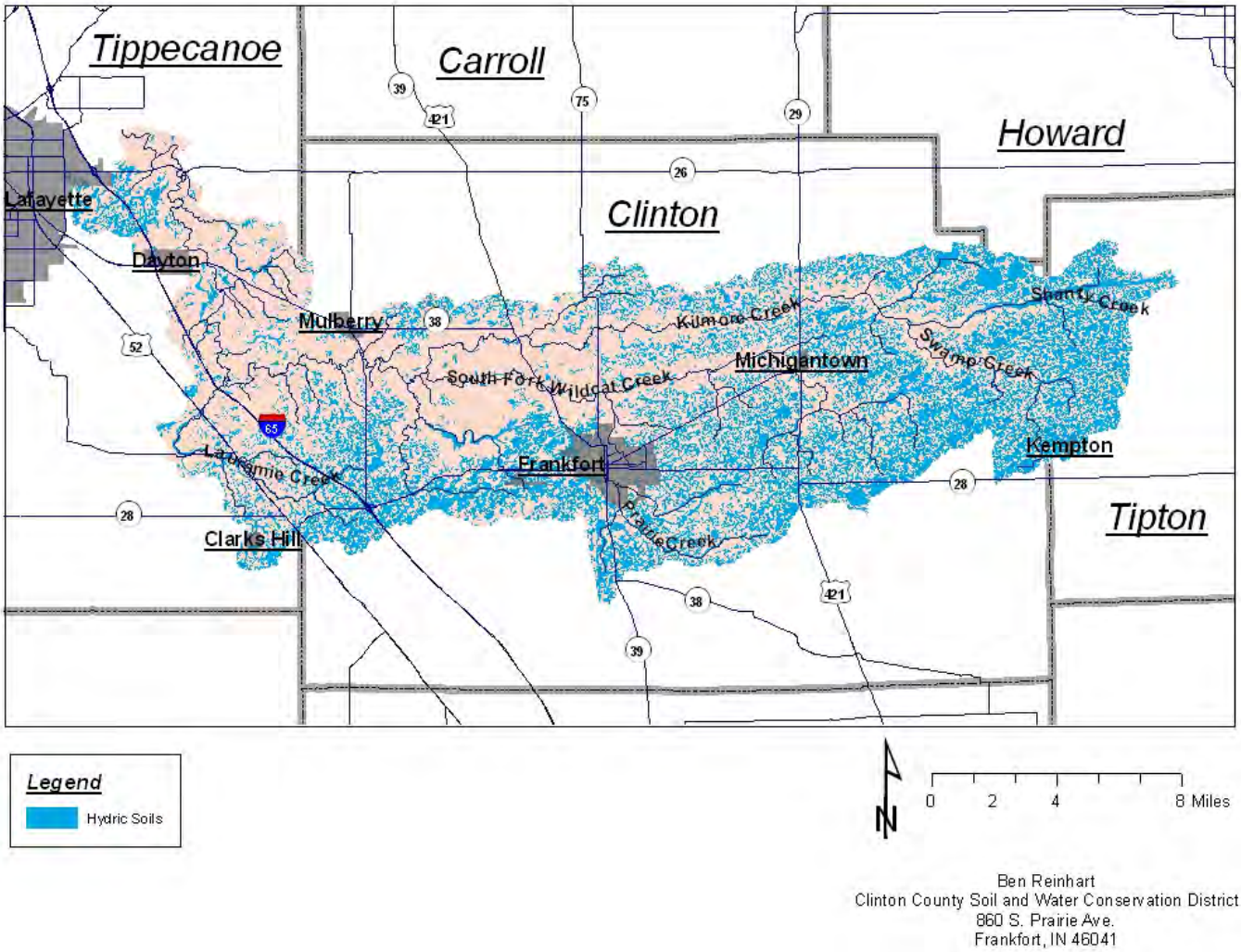

Figure 12. Hydric Soils within the South Fork Wildcat Creek Watershed

Tillage Transect

The region contains some of the most productive soils in the United States. Almost 22% of soils within the South Fork Wildcat Creek watershed are classified as Prime Farmland while another 69% are considered prime farmland given proper drainage (Figure 13). Combined with our humid-continental climate and good management, crop yields are consistently high within the watershed.

Tillage transects are windshield surveys that collect data and current and past crop use, tillage practices, and various soil loss factors. Data from these surveys provide valuable information on trends in cropland use and acceptance of conservation practices such as conservation tillage and cover crops. Tillage transects are generally completed in Indiana counties every other year. Comparisons from 1990 to 2007 have shown drastic increases in the adoption of no-till soybeans through the local counties while no-till corn has seen more modest adoption rates. Tippecanoe County has recorded relatively high levels of no-till rates for both corn and soybeans when compared with other counties contributing land

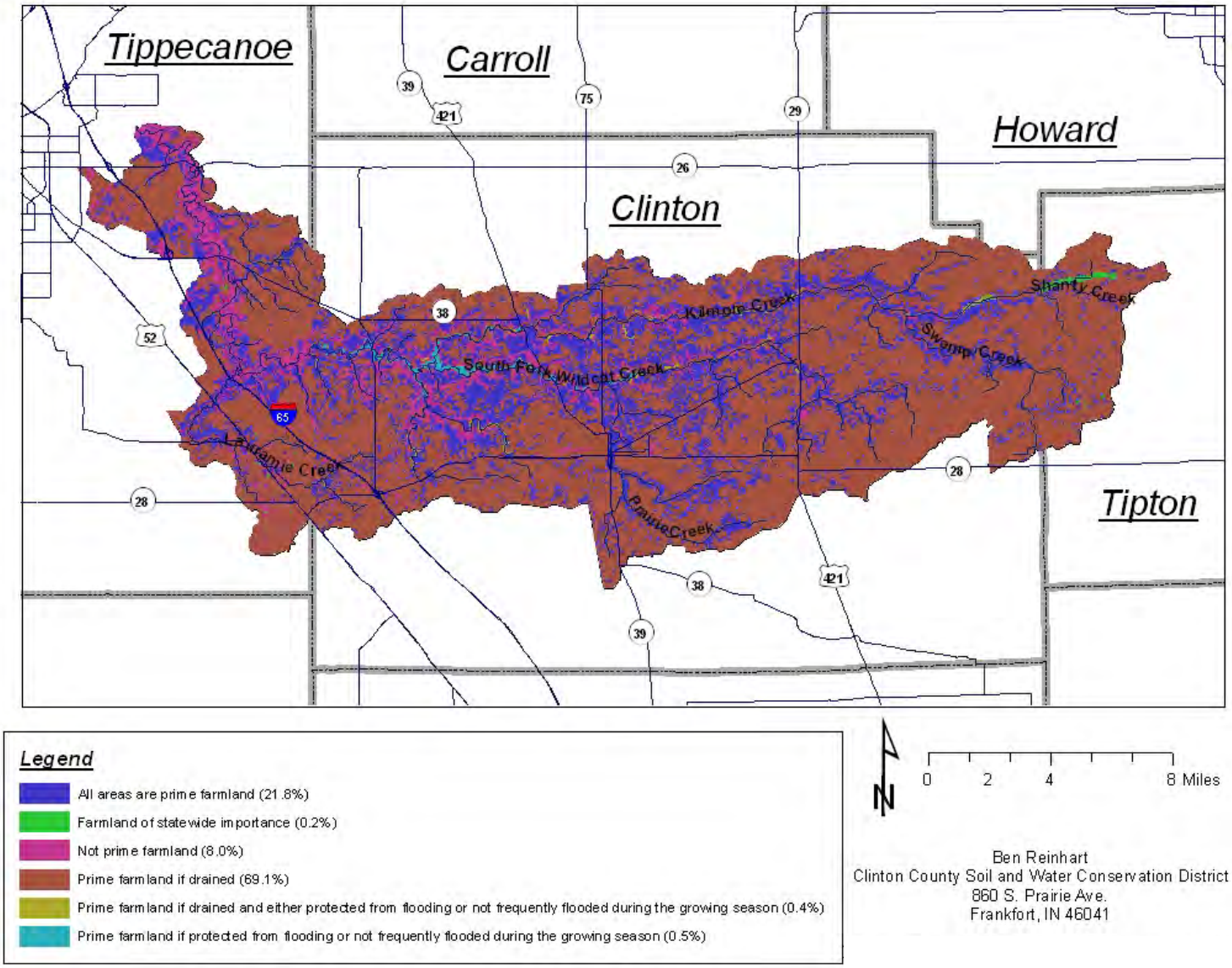

Figure 13. Farmland Classifications within the South Fork Wildcat Creek Watershed

to the watershed area. Both Tipton and Howard County have had relatively low no-till levels but have maintained high participation levels in reduced tillage practices when compared with Tippecanoe and Clinton Counties. Estimates for conventional, reduced, mulch till and no-till practices for both corn and soybeans were calculated for each county with land area within the South Fork Wildcat Creek Watershed during the years 2004, 2007, 2009, and 2011. These estimates were averaged across the seven years and weighted by the percentage of watershed area occupied by each county. This provided an overall estimate of tillage practices for the entire South Fork Wildcat Creek Watershed (Table 6). One assumption of this method is that tillage practices in each county are evenly distributed which is likely not true. For example, in the Tippecanoe County portion of the watershed no-till practices for corn are much more common than in some of the flatter areas of the county. This would result in estimates for the South Fork Wildcat Creek Watershed slightly underestimating true no-till adoption rates. Nevertheless, these estimates provide an approximate value for planning purposes.

Table 6. Tillage Transect Data

Watershed Average (Percentage)				
	Conventional	***Reduced***	***Mulch Till***	***No-Till/Strip Till***
Corn	70	17	5	8
Soybeans	9	12	12	66
Watershed Average (Acres)				
Corn	43,251	9,886	3,089	4,943
Soybeans	4,953	6,604	6,604	36,871

2.4 Rare, Threatened, or Unique Wildlife and Their Habitats

According to the Indiana Department of Natural Resources Division of Nature Preserves and the Natural Resources Conservation Service, several endangered, threatened, and rare plants and animals have been identified in the watershed (see specific species habitat information below). A detailed field study of these plants and animals was not conducted to verify their actual presence in the South Fork Wildcat Creek Watershed.

Mammals

Lasiurus borealis – Eastern Red Bat

The Eastern Red Bat is currently listed as an Indiana Species of Special Concern. During the summer, the Eastern Red Bat prefers to roost in dense foliage. The red coloring of the Eastern Red Bat can help camouflage them from predators, particularly for bats roosting in sycamore, oak, elm, and box elder trees. Not coincidentally, these trees seem to be the bat's preference. The largest trees, high off the ground and near the canopy edge, are where these bats are often found roosting. It is possible that these roosting locations are chosen to shelter the bats from high temperatures, both by filtering sunlight and the cooling effect of evapotranspiration. A permanent water source nearby is also part of the bat's preferred habitat. A bat can return to the same roosting area yearly, which is indicative of the site making a good breeding ground.

The Eastern Red Bat will forage in different habitats, with their preference being in forested environments. They will also forage along the edge of pastures, fields and open areas that have

deciduous trees present. The bat will travel 2,000 to 3,000 feet from the day roosting site to the feeding area and may return to the area on consecutive nights.

During the winter, these bats will hibernate in tree hollows or exposed tree trunks. There have been recent discoveries of these bats hibernating on the ground covered by grass and leaf litter which may make them vulnerable to certain management activities (e.g. prescribed burning, timber clearing, etc.) during winter months.

Farmers find the Eastern Red Bat a beneficial mammal to keep nearby and would benefit to foster a hedgerow roosting area along crop boundaries. Thought and consideration should be used on how pesticides are used to minimize the bats eating inflicted insects.

Myotis sodalist – Indiana Bat

The Indiana Bat is listed as Federally Endangered. The Indiana Bat winters in cool caves, or mines, with stable temperatures around 40° F. The relative humidity of the caves or mines is from 66% to 95%. As the wintering caves are further south than Delphi, Indiana, further detail has been omitted but can be provided if desired.

In early spring, the Indiana Bat wakes from hibernation and migrates to its summer roosting and foraging area. The females spend the summers separate from the males. The females will develop maternity colonies of 50 to 100 individuals. The maternity colony can be formed in hollow trees or under the loose bark of dying and dead trees that retain large slabs of peeling bark. The primary roosting trees are exposed to direct sunlight for more than half the day. The roosts can be found along a fence line, the edge of a forest, or in an opening in the forest canopy. Rivers and streams are near the maternity roosting site. At least 100 feet of natural vegetation needs to be on either side of the water's bank. The maternity roosts occur in riparian forests, floodplains, wooded wetlands, as well as upland forests. Where the male bat spends its summer is not well documented. Some male bats will migrate to upland forest and floodplains and some male bats will remain close to the hibernation location. The few male roosting spots found during the summer have been located near water. Indiana Bats are extremely loyal to their hibernation and roosting sites and will not roost or hibernate in man-made structures.

Indiana Bats consume large quantities of insects. Indiana Bats begin to forage for food approximately half an hour after sundown. The bats prefer to forage in a dense riparian forest near the canopy but they will also forage in the treetops located in floodplains, low fields and pastures, and upland forests.

Loss of roosting habitat occurs from human interference such as streamside deforestation, timber harvesting, agricultural development, pesticide use, and conversion of forested land.

Birds

Lanus ludovicianus – Loggerhead Shrike

Listed as State Endangered in Indiana, the Loggerhead Shrike prefers land with a variety of uses. The Loggerhead Shrike utilizes open land with lookout perches for hunting. The Loggerhead Shrike prefers the hunting ground to have shorter vegetation such as recently plowed fields, well grazed grasslands, roadside ditches, and lawns. Grassland with scattered trees or shrubs would be a preferred area for the Loggerhead Shrike as that would provide hunting ground with lookout posts as well as nesting spots.

Branches, thorns, or barbed wire fences are utilized by the Loggerhead Shrike to impale their prey, helping the bird to tear the prey into bite size pieces or possibly to store the food for a later point in time. The availability of these items might be an important part of habitat selection.

The Loggerhead Shrike nests in bushy vegetation either in hedgerows or isolated trees and shrubs near their preferred hunting area. More than half of the shrike nests discovered in Indiana have been in red cedar trees although sassafras, multiflora rose, and other plant types are used. The cover the plant provides to the nest is valued over the type of plant actually used. The nests are sturdy but bulky nests made from sticks and roots. The nests are lined with hair, cotton and feathers. Nesting sites can be reused the following year if left undisturbed.

Activities that benefit landowners as well as the shrikes would be to fence out livestock from dugouts, converting cropland to grassland, planting isolated trees or shrubs in yards or pastures, and/or implementing a rotational grazing system.

Buteo lineatus – Red Shouldered Hawk

Listed as an Indiana Species of Special Concern, Red Shouldered Hawks are year round inhabitants of mature deciduous or mixed deciduous-conifer forests. Typically these forests have wetlands nearby such as lowland forests, beaver ponds and wet meadows. The wetland areas are used for foraging. The hawks enjoy a dead tree in which to perch and view the forest floor.

During non-breeding, the hawk is less selective about its habitat, utilizing smaller forests, open areas and edges. During breeding, the hawks shy away from fragmented woodlots and forests that do not contain trees large enough to provide a nesting area. The Red Shouldered Hawk requires 250 to 620 acres of wooded land. The forest needs to have a closed canopy of tall trees, an open subcanopy and varying amount of understory cover. These hawks use a variety of mature tree types in which to build their nests such as American beech, birch, ash, oak, pine, maple, elm, hickory, and tulip poplar. Tree structure and not tree species seems to hold the greatest influence on nest placement. Nests are normally found 35-40 feet above the ground and within 1/8th of a mile of wetland. The nests are kept away from human activity. The Red Shouldered Hawk is an extremely territorial breeder and will reuse its nest and breeding site for many years. Incubating hawks, nestlings and eggs can be the target of predation by the red-tailed hawk, great horned owl and raccoons.

Ardea Herodias – Great Blue Heron

The Great Blue Heron can be found commonly along inland freshwater lakes and rivers, lagoons, and wetlands. Not listed as threatened and endangered in Indiana, many people recognize and have a natural affinity for this bird. Nesting occurs in single-species or mixed colonies usually formed in trees, but ground, rock, reeds or rushes may also be used. They are inclined to nest in the same area year after year. The Great Blue Heron forages by walking slowly or standing motionless in water and striking at pray. Fishing requires shallow waters with a firm substrate, and main prey items include fish and amphibians.

Nycticorax nycticorax – Black-crowned Night-Heron

Endangered in Indiana, the Black-crowned Night-Heron suffers from long-term declines due to ongoing habitat loss and chemical threats from insecticides. This species are wetland habitat generalists, utilizing

marshes, swamps, lagoons, flooded fields, and mudflats. They are omnivores and forage for small fish, crayfish, snakes, mice, and insects at night time. They nest in colonies of mixed species in the southern portion of their range.

Aquatic

Lamsilis fasciola, Pleurobema clava, Ptychobranchus fasciolaris, Toxolasma lividus

The Wavy-Rayed Lampmussel (Indiana Species of Special Concern), Clubshell (Federally Endangered), Kidneyshell (Indiana Species of Special Concern), and Purple Lilliput (Indiana Species of Special Concern) are all found in similar habitats. Once common in natural streams, freshwater mussels are now rare and uncommon. The common components of good mussel habitat exist in medium sized streams to small rivers with gravelly and/or sandy substrates. The water should be clear with a good steady flow. The largest threats to freshwater mussels are stream flow alterations, siltation, pollution, and exotic species such as the zebra mussel.

Plants

Poa wolfii – Wolf Bluegrass

Wolf Bluegrass is listed as a rare species in Indiana and is generally found in woods along streams, rocky wooded slopes, and in prairie patches.

2.5 Land Use

The primary use of land within the South Fork Wildcat Creek Watershed is dedicated to cultivated crops and agricultural purposes (Figure 14). The remaining use of land is split up between developed areas and natural (e.g. woods, shrublands, grasslands, wetlands, etc.) land cover. Deciduous, or non-evergreen, woodlands are the primary type of natural areas within the watershed. The vast majority of developed lands fall under the category of either open space or low-intensity developments. Land uses represented by “Developed, Open Space” include areas such as single-family residences, parks, golf courses, or undeveloped lots. Generally speaking these land areas include some impervious surfaces, usually less than 20%, but are mostly comprised of short vegetation such as lawn grasses. Common land uses within “Developed, Low Intensity” include areas such as single-family residences but can also include large-lot residential subdivisions or other sprawling developments in rural areas. Under these situations the total coverage of impervious surfaces such as roads, sidewalks, and rooftops increase to 20-49% of the total land area. These land uses present situations where turf management (e.g. lawn fertilizers, pesticides, yard waste, etc.) may impact local water quality. Also, some of these areas may be situated away from municipal services such as wastewater treatment and as a result rely more on on-site wastewater treatment (i.e. septic systems) which can be prone to discharge sewage into local waterways. When plotting land use information spanning from the year 2000 to 2010 we can see a drop in land use for agricultural purposes while the amount of developed land use and natural areas have seen slight increases in total land coverage (Table 7). These trends may be explained by the conversion of agricultural lands to rural residential developments and subdivisions, which also allows for a greater variety of vegetation to grow. Many local residents and stakeholders have notice increased residential growth around the Town of Mulberry in Clinton County and Town of Dayton in Tippecanoe County.

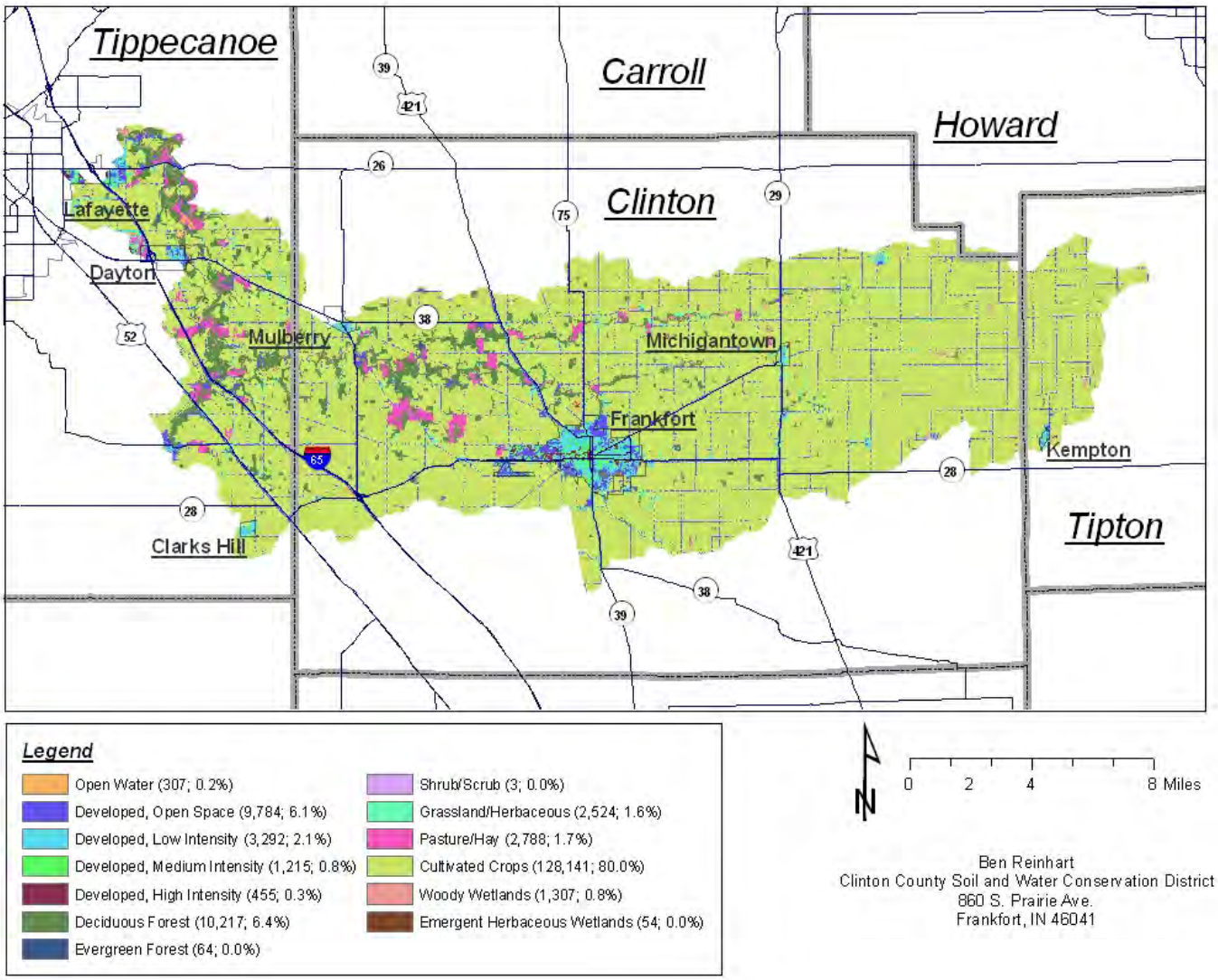

Figure 14. Land Use of the South Fork Wildcat Creek Watershed

Table 7. Land use trends within the South Fork Wildcat Creek Watershed

Watershed Land Use						
	2000	**2002**	**2004**	**2006**	**2008**	**2010**
Agriculture	93%	93%	88%	90%	77%	80%
Natural	4%	6%	8%	7%	12%	11%
Developed	3%	2%	4%	3%	11%	9%

The amount of impervious surface occurring within the watershed is important to consider. These surfaces, as well as compacted earth (i.e. lawns and some cultivated areas), prevent natural infiltration of water into the ground and disrupt the natural water cycle which helps the environment maintain adequate levels of clean water throughout the South Fork Wildcat drainage area. Often times these areas also contribute higher loads of pollutants such as excess nutrients, chemicals, sediment, and waste products as these pollutants are carried away by storm water runoff without having the chance to be filtered out or broken down as would normally occur in more natural environments. According to the Center for Watershed Protection's *'Watershed Protection Techniques'*, there is a direct relationship between the amount of impervious surfaces in a watershed and the quality and quantity of water found within that drainage. Where less than 10% of a watershed is covered in impervious surfaces, the

streams are generally protected; where 11-25% of a watershed is covered in impervious surfaces, the streams are most likely impacted; where over 25% of a watershed is covered in impervious surfaces, the streams are most likely degraded. If going by these standards, development within the South Fork Wildcat Creek Watershed is right on the edge of potentially producing significant impacts on our natural waters. Under any situation, continual development within the South Fork Wildcat Creek Watershed is likely to increase the potential for further degradation unless conscious efforts are made to plan and develop with water and soil resources in mind.

Table 8 shows a comparison between primary stakeholder concerns and major land use types. Below, all stakeholder concerns gathered during the initial meetings were consolidated and refined by the Steering Committee. These concerns were then listed against the land use types where they most commonly occur. Agriculture and livestock uses include cultivated crops and animal operations. Rural land uses include natural and undeveloped areas as well as rural subdivisions, unsewered communities, and old mining or dump sites. Urban land uses include more developed areas that contain relatively high-density development and often have public utilities established. Given the widespread agricultural land use, highly fragmented natural or artificial (e.g. stormwater ponds) habitats, and lack of many highly urbanized locations, the impact of pet waste and natural wildlife is assumed to be minimal across the watershed.

Table 8. Stakeholder Concerns by Land Use

Stakeholder Concerns	Agriculture & Livestock	Rural	Urban
Development and land use change has resulted in more frequent flood events and problems with drainage	✓	✓	✓
Mismanagement of our floodplains and streams (e.g. construction in floodplain, use of natural waterways as drains, channel filling, etc.) has altered the natural hydrology of the watershed resulting in unstable channels and flows as well as reduced flood storage.	✓	✓	✓
Developing areas are contributing pathogens and *E. coli* through Combined Sewer Overflow events and other wastewater discharges.	-	✓	✓
Livestock and the spreading of their manure increase pathogen and *E. coli* loads in local waters	✓	-	-
Lack of septic systems, or maintenance of older systems, increase pathogen and *E. coli* levels especially near local unsewered communities	-	✓	-
Urban and industrial areas are contributing various environmental toxins including PCB's	-	-	✓
Current and past landfill sites are introducing sediments and pollutants into local waters	-	✓	-
Stormwater runoff from developed or developing areas contain high levels of water quality pollutants	-	✓	✓
Lawn runoff from high-residential areas contain elevated levels of pesticides and nutrients	-	-	✓

Table 8. Stakeholder Concerns by Land Use (continued)

Stakeholder Concerns	Agriculture & Livestock	Rural	Urban
Streambank erosion and slope failures input high levels of sediment directly into local streams	✓	✓	✓
The lack of conservation tillage practices in the county is contributing to high levels of sediment and nutrients in our waterways	✓	-	-
The lack of buffers, filter strips, and grass waterways allow agricultural land to introduce a lot of sediment and nutrients across the watershed	✓	-	-
Many people are not aware or know much about the watershed	✓	✓	✓
There is low public appreciation and support for the watershed as can be seen through illegal dumping activities, passive regulations, and lack of maintained access points or other recreational amenities	✓	✓	✓
Forested riparian habitat is limited across the watershed impacting local wildlife and water quality	✓	✓	✓

Agriculture

Within the South Fork Wildcat Creek Watershed area much of the agricultural ground is dedicated to the farming of corn and soybeans (Figure 15). Considering this, agricultural lands likely play a significant role in nonpoint source pollution within the South Fork Wildcat Creek Watershed. The total acreages planted to these crops each year have stayed fairly consistent over the past decade (Table 9). Pasture and other rangelands are also somewhat common throughout the drainage area but their total acreage has appeared to decrease during that same timeframe. There are a number of other crops that are grown throughout the watershed but do not account for significant acreage. Most commonly these include various small grains and alfalfa. Estimates on fertilizer and pesticide use, as well as other farm statistics, were gathered from the 2007 Census of Agriculture (Table 10 and 11). Watershed averages were calculated by weighting each county value by the amount of land area within the South Fork Wildcat Creek Watershed. Again, as mentioned with data from tillage transects, this assumes an even distribution across each county. In addition to commercial or manure-based fertilizers, biosolids from municipal wastewater operations are occasionally applied in a few localized areas throughout the watershed (Figure 16). Total amount and incorporation method of biosolids varies annually.

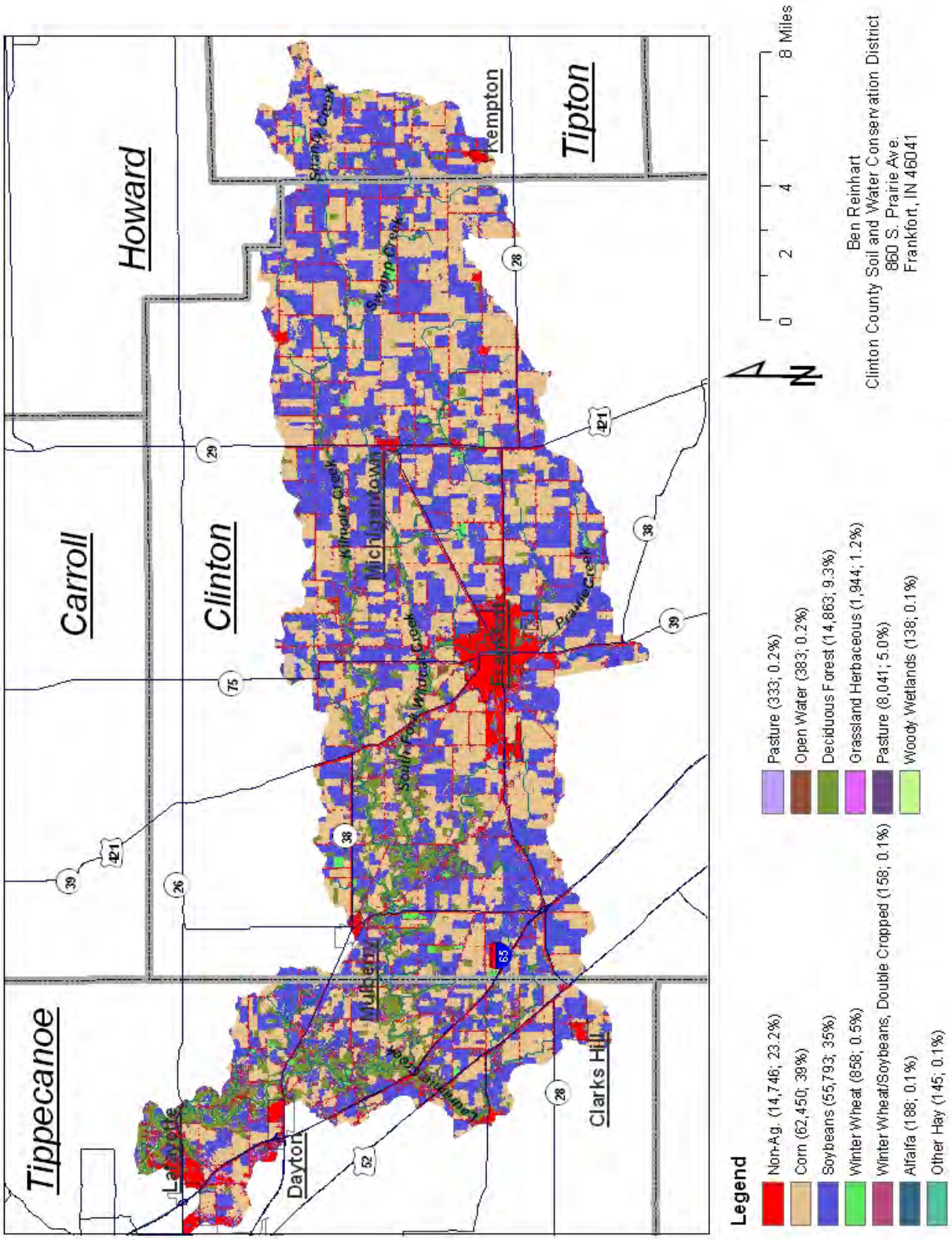

Figure 15. Cultivated Lands of the South Fork Wildcat Creek

Table 9. Primary Crops of the South Fork Wildcat Creek (% of Ag. Lands)

	2000	2002	2004	2006	2008	2010
Corn	35%	37%	42%	38%	40%	39%
Soybeans	35%	37%	33%	35%	31%	35%
Pasture	22%	18%	11%	14%	6%	6%
Other	1%	1%	2%	3%	1%	1%

Table 10. Farm Statistics for the South Fork Wildcat Creek Watershed.

Farm Statistics	Clinton	Howard	Tipton	Tippecanoe	Watershed Average
Percentage of Watershed Land Area	73.5	<1	6.5	20	-
Farms (#)	693	601	458	757	690
Avg. Farm Size (Acres)	368	270	362	288	352
Conservation Methods Applied (% of farms)	46.8%	35.8%	49.1%	40.2%	46%
Commercial Soil Amendments Applied (Acres)	192,476	111,517	129,523	156,329	181,146
Manure Applied (Acres)	6,078	4,741	5,380	4,202	5,660

Table 11. Estimated Pesticide Use for Croplands in the Watershed

Pesticide Use by Crop	Planted Acres in Watershed (10 yr Avg.)	Assumed Application Rate (lb. /ac.)	Estimated Applied Product (lbs.)
Soybeans (Glyphosate)	55,031	0.91	50,078
Corn (Atrazine)	61,787	1.31	80,941

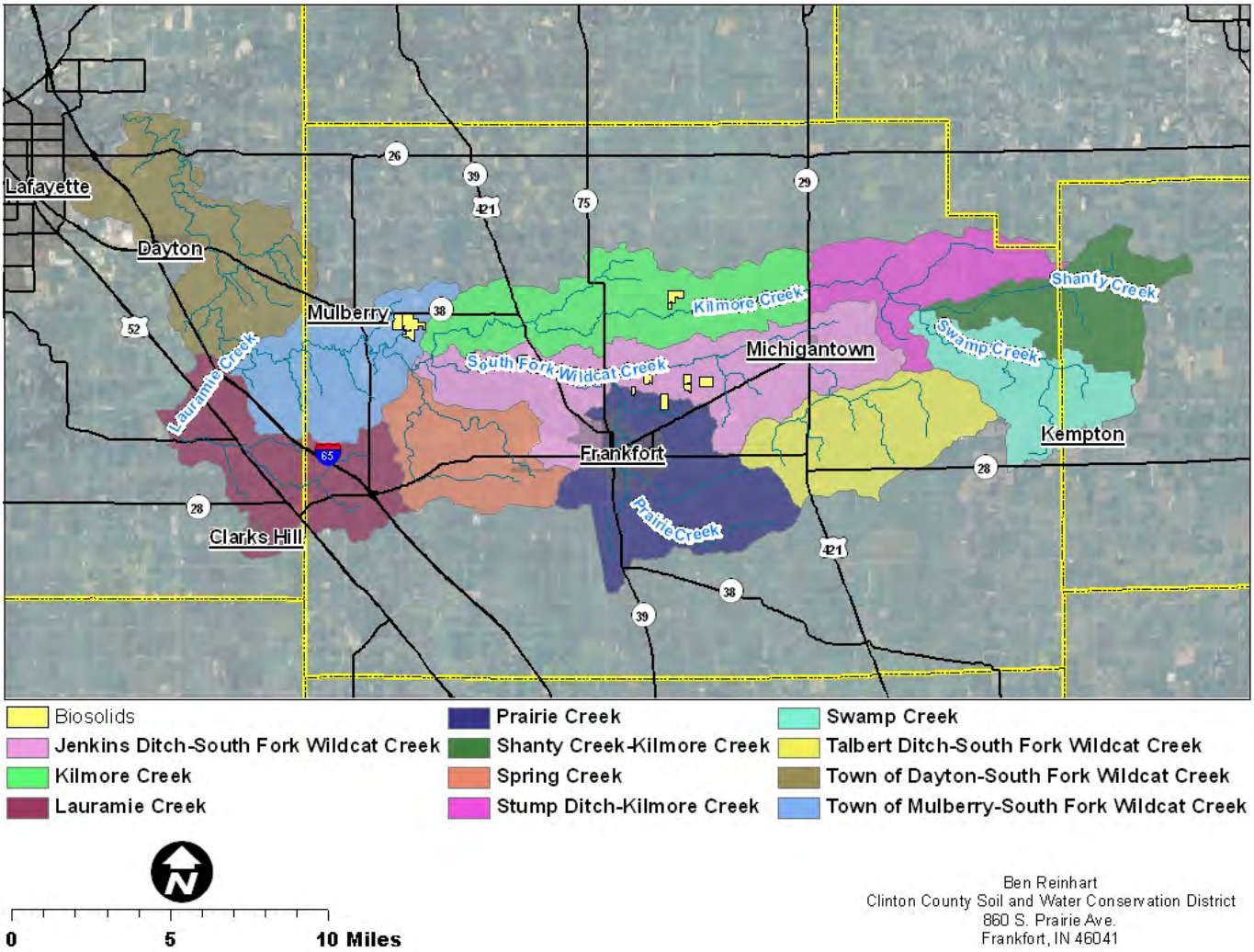

Figure 16. Approximate Location of Lands Receiving Biosolids from Local WWTP Facilities

2.6 Local Planning Efforts

The South Fork Wildcat Creek Watershed covers parts of four counties: Clinton, Howard, Tippecanoe, and Tipton. Each county has undergone various planning efforts to help guide future development and growth across their land base. In relation to water quality within the South Fork Wildcat Creek Watershed, these planning efforts were reviewed to take in consideration how local communities are intending to manage their water resources. Figure 17 shows general zoning classes and urban growth boundaries for lands within the South Fork Wildcat Creek. Figure 18 shows platted subdivisions across the South Fork Wildcat Creek Watershed. These areas can serve as an indicator for future residential development and where construction site runoff could pose a threat to local water quality.

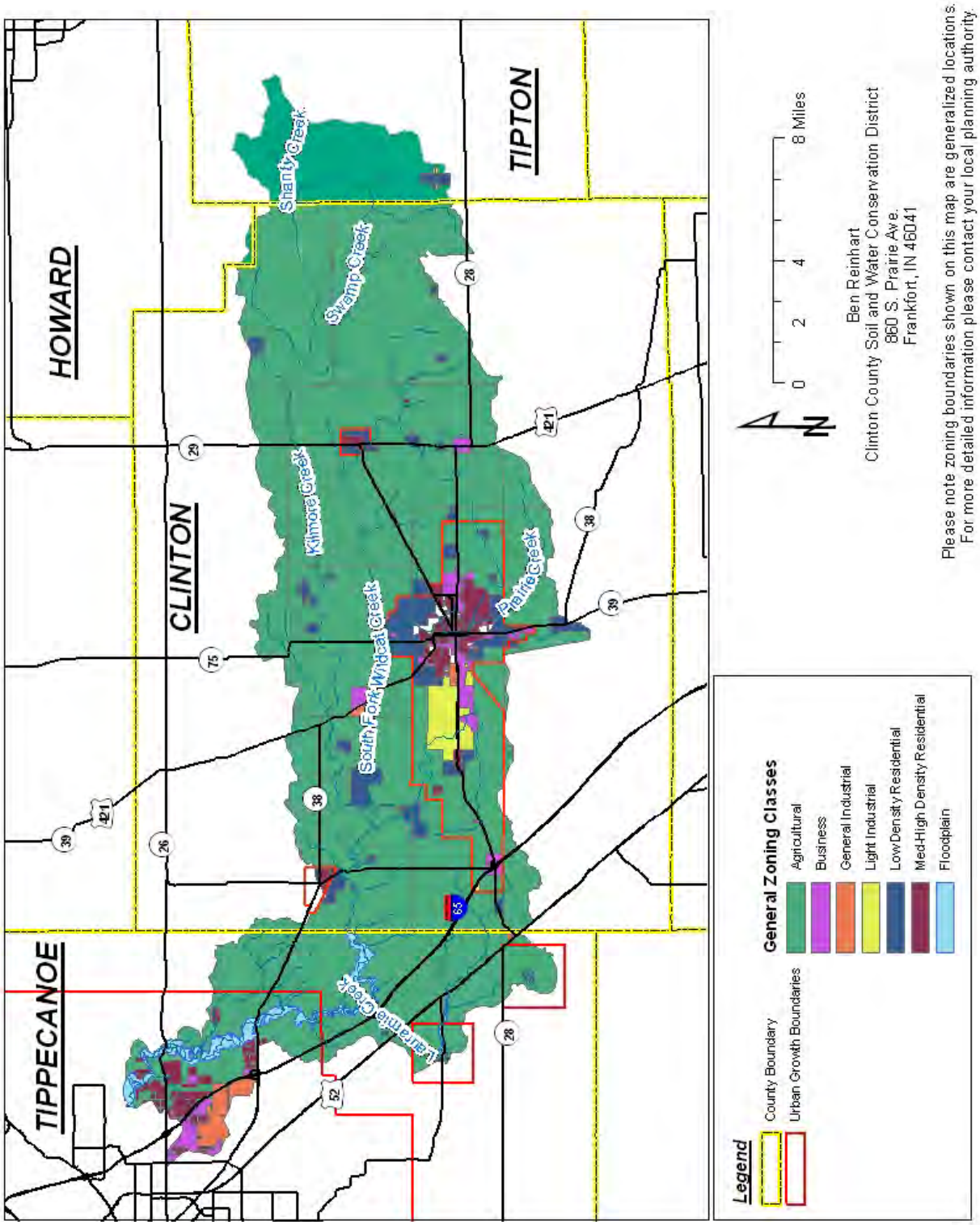

Figure 17. General Zoning Map and Urban Growth Boundaries for the South Fork Wildcat Creek

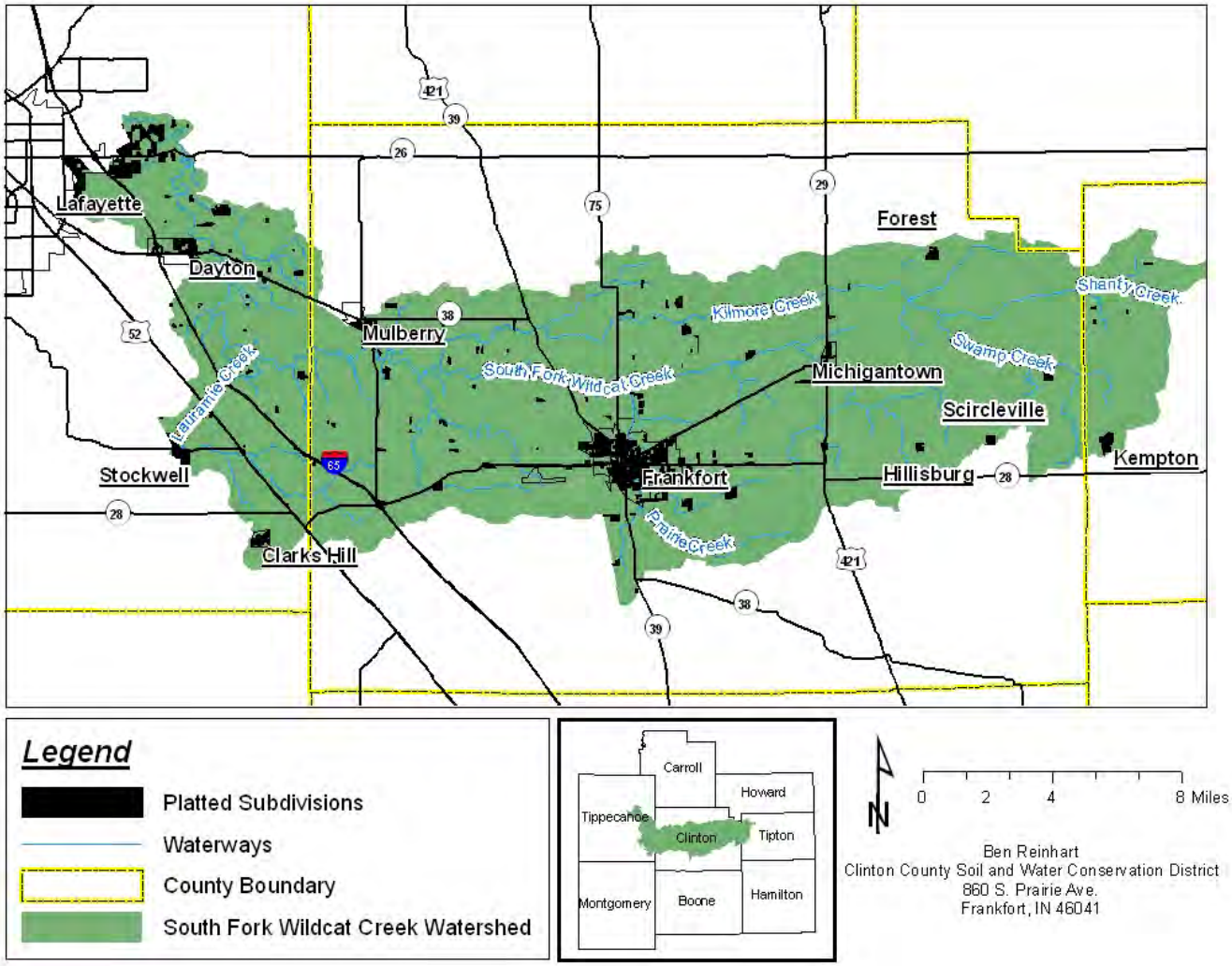

Figure 18. Platted Subdivisions of the South Fork Wildcat Creek Watershed

Clinton County

Clinton County recently went through an update to their 1993 Comprehensive Plan with the approved updates being released in early 2012. This update included information from the City of Frankfort's 2007 Comprehensive Plan as well as a number of new development initiatives such as wind energy development and regional landfill activities.

The Clinton County Comprehensive Plan includes six goals related to the future management of natural resources in the county (Table 12). Also, the Clinton County Comprehensive Plan establishes an overlay land use for stream protection which emphasizes the set aside of riparian and floodplain areas for recreational and environmental benefits. Overall the plan looks to put continued emphasis on farmland protection while encouraging new development within designated Urban Growth Areas. Little growth in total population size is expected over the next 30 years.

Table 12. Natural Resource Goals from Clinton County Comprehensive Plan

	Goals	Strategies
Clinton County	Preserve and Protect Natural Soils	Protect Prime Ag. Soils from Development
		Develop and Implement County Drainage Plan
		Encourage Soil Conservation Plans and BMPs for Erosion Control
		Minimum Setbacks for regulated drains
		Encourage sustainable farming practices
		Encourage regular septic system maintenance
	Preserve and Protect Water Resources	Establish committee on groundwater supply and management
		Develop database of abandoned wells and well records
		Promote Clean Water Act and continue to require necessary permits for development
		Restrict development in wetlands and discourage wetland disturbances
		Continue enforcement of Clinton County Drainage Ordinance
		Deny development in areas with severe drainage problems
		Establish county-wide drainage districts and regulated drains
		Review and regulate development along major waterways and encourage appropriate BMPs
		Utilize natural waterways as greenways and open space

Table 12. Natural Resource Goals from Clinton County Comprehensive Plan (Continued)

Goals	Strategies
	Adopt zoning standards for floodplain management
	Encourage watershed planning and implementation
	Encourage strict enforcement of illegal dumping laws
	Encourage regular septic system maintenance
Preserve and Protect Plant Life	Encourage participation in IDNR Classified Forest and Wildlands Program
	Encourage and protect tree plantings, habitat establishment, and landscaping
	Promote the establishment of easements and nature preserves
	Restrict development in wetlands and discourage wetland disturbances
	Promote the control of invasive species
Preserve and Protect Wildlife	Limit wetland disturbances and require all necessary permits for development
	Promote the establishment of easements, nature preserves, and habitat for endangered wildlife
Promote Air Quality	Inform public on Clean Air Act
	Encourage establishment of affordable waste removal opportunities

Howard County

Howard County has operated primarily through a zoning ordinance which was first developed in 1956 and updated in 1977 and 2010. However, the county has also developed a Comprehensive Plan which became official in 2005.

The Howard County Comprehensive Plan emphasizes the preservation of the rural character of the county by encouraging the consideration of natural water features, forest lands, fence rows, and farmland during future development. The Howard County Plan also establishes environmentally sensitive areas (i.e. floodplains and natural waterways) as a separate land use where development and disturbance will be strongly restricted. Other natural resource issues which are strongly emphasized in

the plan are an effective watershed management approach within the Wildcat Creek Watershed, protection and management of woodlots, wetland conservation, and the overall quality of ground and surface waters. Some specific strategies are listed in Table 13.

Table 13. Natural Resources Strategies from Howard County Comprehensive Plan

	Strategies
Howard County	Revise county's zoning and subdivision ordinance to minimize soil erosion and promote water quality
	Maintain flood storage potential through well-designed stormwater features, restrictions on floodplain disturbances, and support of basin-wide effort to protect floodplain storage capacity
	Work with municipalities to minimize Combined Sewer Overflows and implementation of Long Term Control Plan
	Encourage small cluster subdivisions within rural areas
	Adopt ordinance to restrict impervious surfaces within developments and encourage natural features to be incorporated
	Establish legally binding means for management of stormwater features by adjacent or benefiting property owners
	Continue to support groups with community cleanups and water quality monitoring on Kokomo and Wildcat Creeks
	Regular maintenance of regulated drains in an environmentally sensitive approach
	Support implementation of separate municipal storm sewer system
	Provide recreational access along streams

Tippecanoe County

Tippecanoe County originally completed their Comprehensive Plan in 1981 with numerous amendments being adopted since then to address development issues. The most recent amendment was to the Housing Element of the Comprehensive Plan which was accepted in 2010.

The plan is largely focused on protecting prime farmland areas while encouraging continued residential growth. While the plan states “wooded and sloped areas adjacent to our rivers and creeks can be

expected to remain undisturbed" residents rated "multi-purpose development of Wildcat Creek" highest during a public meeting. Various goals and policies throughout the plan do acknowledge designations given to Wildcat Creek as a Scenic River and look to promote public consideration of these areas. The primary implementation strategy to achieve these goals and policies rely almost entirely on established floodplain regulations as can be seen through zoning maps. In comparison to plans developed by other counties with land within the South Fork Wildcat Creek Watershed, Tippecanoe County has fewer strategies to establish environmental protections related to the South Fork Wildcat Creek.

Tipton County

The current Master Comprehensive Plan for Tipton County was adopted at the end of 2003. Currently updates are being made to these plans which are expected to be completed by 2013. The 2003 Master Plan contains no goals or objectives related to water quality or natural resources. Largely the plan is focused on protecting farming interests within the county, including Confined Feeding Operations, as well as guiding future development proximal to current municipal areas and the U.S. 31 corridor.

Watershed Management Plans

Several watershed management plans have been previously completed within the South Fork Wildcat Creek Watershed at the historic 14-digit watershed scale. However, these plans vary in the amount of detail provided regarding land use and water quality within their respective areas and were largely developed in isolation from one another. Rather than updating, and managing, each of these smaller plans individually, it was decided that a more holistic approach would be to incorporate each of them into a single South Fork Wildcat Creek Watershed Management Plan.

Three communities regulated as Municipal Separate Storm Sewer Systems (MS4) areas do impact land within the South Fork Wildcat Creek Watershed. The Howard County MS4 area constitutes a very small land base while the City of Frankfort MS4 and Tippecanoe County MS4 are the primary urban stormwater areas. Each of these MS4 areas maintains storm water plans with the intent to protect water quality during development activities and daily operations of municipal facilities. The South Fork Wildcat Creek watersheds with complete plans as well as MS4 areas are indicated in Figure 19. Also noted is the coverage of the South Fork Wildcat Creek TMDL which is covered in more detail in Chapter 3.2, Historical Water Quality Data.

The South Fork Wildcat Creek-Blinn Ditch & Kilmore Creek-Boyle's Ditch Watershed Management Plan completed in 2008 and is the most up to date plan in the watershed. Additionally, it is the only plan written in house by a local agency. The WMP addresses several causes of water quality impairments in the watersheds based on scientific data and visual observations by the Steering Committee and Soil & Water Conservation District staff. The causes addressed in this plan are Atrazine; sediment and nutrients; *E. coli*; garbage, trash, appliances, tires, and debris; and stream corridor degradation. Baseline water quality testing combined with stakeholder input pointed to the following sources of impairments: farm field runoff, construction site runoff, illegal dumping, lack of sufficient buffer strips,

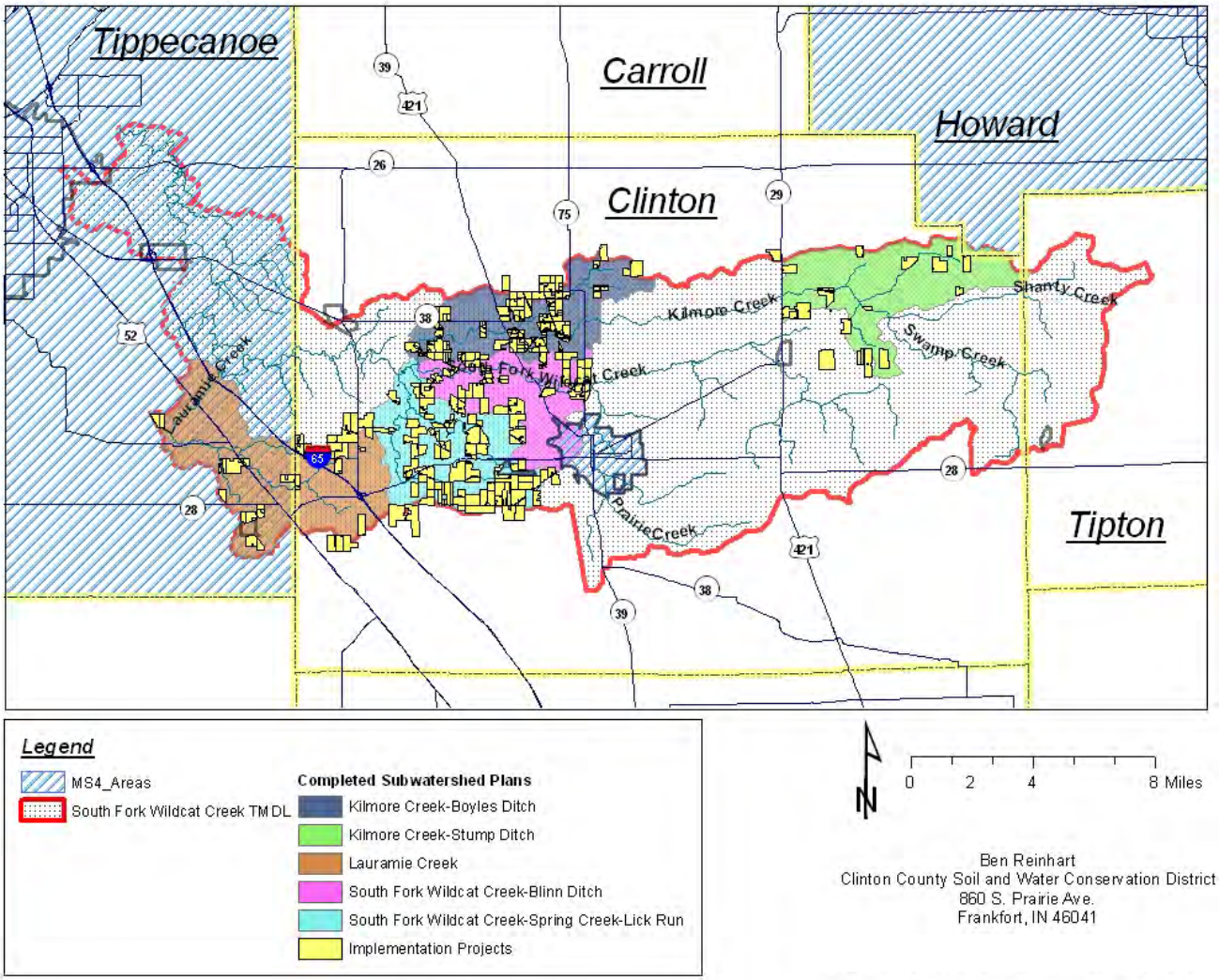

Figure 19. Completed Subwatershed Plans & Implementation Projects of the South Fork Wildcat Creek Watershed
(6 Rain Barrels and 1 Rain Garden were also implemented in the Lauramie Creek drainage area)

conventional tillage practices, lack of appreciation for the creek, and application of lawn fertilizer to name several.

The Lauramie Creek Watershed Management Plan was completed in 2005 by Christopher B. Burke Engineering, Inc. and was sponsored by the Tippecanoe County Commissioners. The WMP examines and discusses information that described the current water quality conditions in the watershed. The

firm researched and compiled information on past studies, analyzed trends, and conducted a chemical monitoring program.

The water quality concerns outlined in the WMP included elevated concentrations of *E. coli* and nutrients, sedimentation, and the potential for toxic chemicals associated with traffic accidents and hazardous spills to enter Lauramie Creek. Sources include runoff from agricultural lands, impervious surfaces, and failing residential septic systems. Increased sedimentation is also linked to severely eroded streambanks and the lack of a healthy riparian corridor or agricultural filter strips in the watershed.

The Spring Creek-Lick Run Watershed Management Plan was completed in 2003 by Goode & Associates, Inc and sponsored by the Wildcat Creek Watershed Alliance. The emphasis of this WMP was improving water quality and addressing non-point sources of pollution from agricultural practices and urban development.

In 2001, the Clinton County SWCD completed a general subwatershed plan for the Stump Ditch-Kilmore Creek drainage area. This plan identified priority areas in and around the Town of Forest, due to the reported occurrences of outdated and failing septic systems discharging into Stump Ditch, as well as highly erodible land areas within the subwatershed. The primary goals of this plan were to reduce sediment and nutrient loading from cultivated cropland and livestock facilities and to address concerns related to *E. coli* and nutrient loading from on-site wastewater systems (i.e. septic systems).

2.7 Watershed Summary

Agriculture is a primary driver of many relationships throughout the South Fork Wildcat Creek Watershed. Given the relatively flat and rolling topography and productive soils, row crops dominate. Artificial drainage speeds up the delivery of storm water to receiving streams and provides a direct conduit for fertilizer and chemical runoff. Regular management of open ditches and conversion of idle lands to row crop result in losses of environmentally valuable land which would normally provide benefits such as water quality improvement, flood protection, and wildlife habitat.

With agriculture comes rural residential development as opposed to more concentrated urban settings. A number of small rural communities are spread throughout the watershed. Generally these communities do not carry services such as centralized wastewater treatment which are normally seen in today's populated areas. This creates potential for significant impacts from wastewater discharges to waterways. Also of note is that many of the soils within the South Fork Wildcat Creek Watershed are naturally unsuitable for on-site septic systems, often requiring perimeter drains and other protections. Many of these older or unmaintained systems fail resulting in additional wastewater discharges to our streams and creeks.

Urbanized areas do exist within the watershed, most notably the City of Frankfort and southeast corner of Lafayette. These areas present different threats to water quality in the form of urban residential, commercial, and industrial impacts. Many of these urban relationships have yet to be fully evaluated but work is being done by both city and county personnel to collect and analyze this information (e.g. urban stream stability, outfall monitoring, illicit discharge detection, stormwater retrofit opportunities, etc.) to provide a more holistic view of how urban areas are impacting the South Fork Wildcat Creek.

In light of the various threats which exist to water quality and the high quality of the South Fork Wildcat Creek, local communities and various agencies have committed a number of resources to help guide future management of the South Fork Wildcat Creek Watershed. Many communities have completed updates to Comprehensive Plans which outline future protections for water resources. Also a number of smaller Watershed Management Plans have already been developed and implemented to address concerns. The South Fork Wildcat Creek Watershed Management Plan will bring all of these efforts together to provide a comprehensive guiding document for the protection and management of the South Fork Wildcat Creek and its tributaries.

3.0 Environmental and Water Quality Data

3.1 Water Quality Targets

Water Quality targets for each parameter has been selected based on applicable Indiana Administrative Code, the South Fork Wildcat Creek TMDL, and other standards accepted by the Indiana Department of Environmental Management. Table 14 details selected water quality parameters and target levels being used for the South Fork Wildcat Creek Watershed to assess the water quality throughout the drainage area. A more detailed description of these parameters is included in Appendix D.

Table 14. Water Quality Parameters and Target Levels in the South Fork Wildcat Creek Watershed

Parameter	Target Level	Source
pH	> 6 or < 9	Indiana Administrative Code
Temperature	Monthly standard	Indiana Administrative Code
Dissolved Oxygen	> 4 mg/L and <100%	Indiana Administrative Code
E. coli	• 125 colony forming units/100 mL *(measured as a geometric mean of ≥ 5 samples within a 30-day period)* • 235 colony forming units/100 mL *(as a one time sample)*	Indiana Administrative Code
Total phosphorus	< .30 mg/L	South Fork Wildcat Creek TMDL
Nitrate+Nitrite	< 10 mg/L	South Fork Wildcat Creek TMDL
Total Suspended Solids	< 30 mg/L	South Fork Wildcat Creek TMDL
Qualitative Habitat Evaluation Index	> 51 points	IDEM 2008 303d List; Criteria for Aquatic Life Use Support
Macroinvertebrate Index of Biotic Integrity	> 35	IDEM

3.2 Historical Water Quality Data

A variety of historical sources of water quality data were reviewed in an effort to determine long term trends in data. A brief review of these data sources is included below. More detailed discussions of these data are included in their respective subwatershed descriptions. Maps showing all locations with water quality data for each subwatershed can be found in Appendix E.

City of Frankfort Combined Sewer Overflow – Stream Reach and Characterization Evaluation Report (2000)

The City of Frankfort maintains a combined sewer overflow (CSO) as part of its wastewater treatment system. A combined sewer system collects both stormwater and wastewater for the Frankfort Wastewater Treatment Plant. A CSO essentially acts as an emergency overflow during times when the combined sewer system and/or storage at the Frankfort Wastewater Treatment Plant (WWTP) may become overwhelmed. During these times wastewater and sewage can be discharged directly into local waterways. The City of Frankfort's CSO discharges into Prairie Creek. As part of Frankfort's CSO control plan it is required to establish baseline water quality conditions and determine if the local CSO events are degrading local waterways. This is done through a Stream Reach and Characterization Evaluation Report (SCREC). Frankfort's SCREC was completed in 2000 by Commonwealth Biomonitoring.

This study was completed using evaluations of aquatic habitat and measures of biological integrity at four selected points along Prairie Creek and near its confluence with the South Fork Wildcat Creek. Aquatic habitat quality was measured using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA. Under this technique, various habitat categories (e.g. substrate, riparian vegetation, channel morphology, etc.) are measured and converted to numerical scores. All scores are summed across the site with a maximum score of 100. Higher total scores indicate higher quality aquatic habitat. Indices of biological integrity focused on an assessment of both macroinvertebrate (i.e. aquatic insects) and fish communities in comparison with "reference" conditions. Within this approach, reference conditions represent a high-quality waterway of similar size and geographic location. Differences in local samples versus reference conditions can allow the assumption of local water impairments. Macroinvertebrate communities were sampled using a dip net in riffle areas and were analyzed for ten separate metrics within a laboratory setting. Fish communities were sampled using electrofishing gear and tallied in the field. Final counts of fish communities were analyzed for 12 separate metrics to analyze water quality. Specific results from this study are discussed within the Prairie Creek subwatershed description.

Kilmore Creek-Stump Ditch Watershed Management Plan (2001)

The Kilmore Creek-Stump Ditch (KCSD) Watershed Management Plan was completed by the Clinton County Soil and Water Conservation District in 2001. No quantitative water quality data appears to have been collected as part of this planning project but the primary impairments were determined to be sediments, nutrients, and bacteria. Sources of impairments were primarily identified through visual assessments of the watershed conducted by Indiana Dept. of Natural Resources (IDNR) and USDA-NRCS personnel, along with the Wildcat Creek Technician. Agricultural runoff, on-site wastewater systems (i.e. septic systems), and confined feeding operations were interpreted to be the primary sources of impairments within the watershed. Priority areas within the KCSD Watershed Plan were determined to be the area around the Town of Forest, due to the role of failing septic systems, and the western third of the watershed, due to more highly erodible lands. Collection of current water quality data will be useful in confirming these proposed sources or determining other sources for impairments.

Also, included in the development of the KCSD Watershed Management Plan was implementation of a cost-share program to encourage conservation practices within the drainage area. As a part of this effort, pest and nutrient management plans were completed for 1,694 acres; 1,341 of these acres also included enrollment in conservation tillage practices.

Spring Creek-Lick Run Watershed Management Plan (2003)

The Spring Creek-Lick Run (SCLR) Watershed Management Plan was completed in 2003. The project was coordinated by the Wildcat Creek Watershed Alliance Inc. who hired the consulting company, Goode & Associates, Inc. The study indicated most waterways within the SCLR subwatershed consist of small headwater streams and manmade drainage ditches. Around 45% of these waterways did have an adequate vegetative buffer. As part of this plan, it was decided to focus on utilizing existing water quality data rather than conducting their own water quality analysis. The SCLR Watershed Management Plan utilized a number of water quality sources such as IDEM's 305(b) and 303(d) reports, Hoosier Riverwatch data, and the Fish Consumption Advisory (each source discussed below). However, the SCLR Watershed Management Plan also included data review from the 1998 Upper Wabash Basin Survey completed by IDEM. This survey included water quality data from six test sites located within the SCLR Watershed. Another data source that was included was the Unified Watershed Assessment (UWA) which was a joint effort between the USDA-NRCS and IDEM. These assessments were similar to the current Rapid Watershed Assessments completed by the NRCS in that the purpose was to quickly identify resource concerns in watersheds across the state and provide a logical process for determining where resources can be leveraged between common partners. The results of this assessment process specifically identified the entire South Fork Wildcat Creek Watershed as being a high priority for funding due to total percent cropland and aquatic vulnerability. Specific water quality results from the SCLR Watershed Plan are discussed in the Spring Creek subwatershed description.

Lauramie Creek Watershed Management Plan (2005)

The Lauramie Creek Watershed Management Plan was completed in 2005 by Christopher B. Burke Engineering, Ltd. (CBBEL) who was hired by the Tippecanoe County Commissioners. This planning effort included a review of past water quality data including sources such as IDEM's 305(b) and 303(d) reports, a TMDL study addressing *E. coli* loads in Lauramie Creek, Hoosier Riverwatch, and the Fish Consumption Advisory. Additional sampling was done by CBBEL and included data from two sampling events, one shortly after a rain event and one during dry conditions, from a total of seven sites. Water quality parameters that were measured included dissolved oxygen, pH, conductivity, total phosphorus, ammonia, turbidity, nitrates, and *E. coli*. Also, the physical characteristics of Lauramie Creek were measured using the Citizen's Qualitative Habitat Evaluation Index (CQHEI). A more detailed review of the water quality results is included in the Lauramie Creek subwatershed description.

South Fork Wildcat Creek-Blinn Ditch & Kilmore Creek-Boyle's Ditch Watershed Management Plan (2007)

Commonwealth Biomonitoring, Inc. conducted a baseline water quality study for the South Fork Wildcat Creek-Blinn Ditch and Kilmore Creek-Boyle's Ditch (SFK-KC) sub watersheds as a part of a watershed planning project. *E. coli* samples were collected by the Clinton County Soil and Water Conservation District and then analyzed by the Frankfort Wastewater Treatment Plant using the Colilert Quanti-Tray method. The study began in April 2006 and was completed in October of 2007. Physical, chemical, and biological parameters that were measured are shown in Table 15. Specific results from this study are discussed further in the Kilmore Creek and Jenkins Ditch-South Fork Wildcat Creek subwatershed descriptions.

Table 15. SFK-KC Water Quality Sampling

Measurement	Parameters	Timetable
Habitat	Qualitative Habitat Evaluation Index at eight sites in each watershed (total of 16). One sample per year for two years.	May 2006 & 2007
Biological	Macroinvertebrate IBI at eight sites in each watershed (a total of 16 sites). One sampling event each year for two years using the Ohio EPA protocol.	May 2006 & 2007
Chemical and Physical	Nitrogen (nitrates-nitrites), total phosphorus, total suspended solids, pH, temperature, conductivity, dissolved oxygen, stream flow. These parameters were measured at eight sites in each watershed (a total of 16 sites). Measurements were made four times a year for two years. One event each year will be immediately following a storm.	April, June, August, and October 2006 & 2007
Atrazine	Atrazine analysis at four sites in each watershed (a total of eight sites). Three sampling events per year for two years.	April -June 2006 - 2007
E. coli	*E. coli* was measured at eight sites in each watershed (a total of 16 sites). Samples will be collected and analyzed weekly from April 1 to October 31st during a two year period.	April 1 to October 31 2006 & 2007

South Fork Wildcat Creek- Total Maximum Daily Load Study (2007)

Total Maximum Daily Load (TMDL) studies are preformed on waterways that have been previously listed on the state's 303(d) List of Impaired Waterways. These studies look to identify more specifically what types of pollutant are leading to impairments and what needs to be done to address those threats so that state water quality goals would be achieved. The South Fork Wildcat Creek Watershed TMDL was conducted in 2007 and the report was made available in 2008. This study looked specifically to address high levels of Escherichia coli bacteria (i.e. *E. coli*), low dissolved oxygen levels, and impaired biotic communities by analyzing *E. coli*, total suspended solids, total phosphorus, and total nitrogen.

Water quality data were compiled from various agencies and organizations. These water quality measurements were used to estimate the current pollutant loads at specific points throughout the South Fork Wildcat Creek Watershed. Estimated pollutant loads were then used to prescribe the necessary reductions in pollutant loads to achieve accepted target levels. State standards were available for *E. coli* but no state-accepted environmental standards are developed for nutrients or total suspended solids. However, benchmarks from other reputable sources were adopted for this TMDL study (Table 16.).

This TMDL study also included some additional computer modeling in efforts to identify potential sources of pollutant loading (Figure 20). Stormwater runoff from rural lands showed up as large amounts of nitrogen, phosphorus, sediments, and *E. coli* in local waterways. However, one would expect this to be true given that rural lands greatly outnumber developed lands in the South Fork Wildcat Creek Watershed. Some interesting results showed that streambank erosion potentially being a significant contributor towards high levels of total suspended solids. Also, urban runoff and on-site wastewater treatment systems (i.e. septic systems) may be contributing significant amounts of harmful

bacteria and *E.coli* into local waterways. Larger industrial facilities and wastewater treatment plants showed relatively minor signs of nitrogen and phosphorus pollution. However, given the fact that these facilities are constantly discharging into local waters, they may play a larger role in local impairments during low-flow months (i.e. summer) when stormwater runoff inputs may be less. A more detailed review of the water quality data is included in the subwatershed descriptions.

Table 16. South Fork Wildcat Creek TMDL Target Levels

Water Quality Parameter	Accepted Target Levels	Source
E. coli	125 counts/100 mL*	State of Indiana Standard
Nitrate-Nitrite	≤ 10 mg/L	Indiana Drinking Water Standard
Total Phosphorus	≤ 0.30 mg/L	Ohio EPA
Total Suspended Solids	≤ 30 mg/L	Permit Limit for NPDES
** Geometric mean of five consecutive weekly samples*		

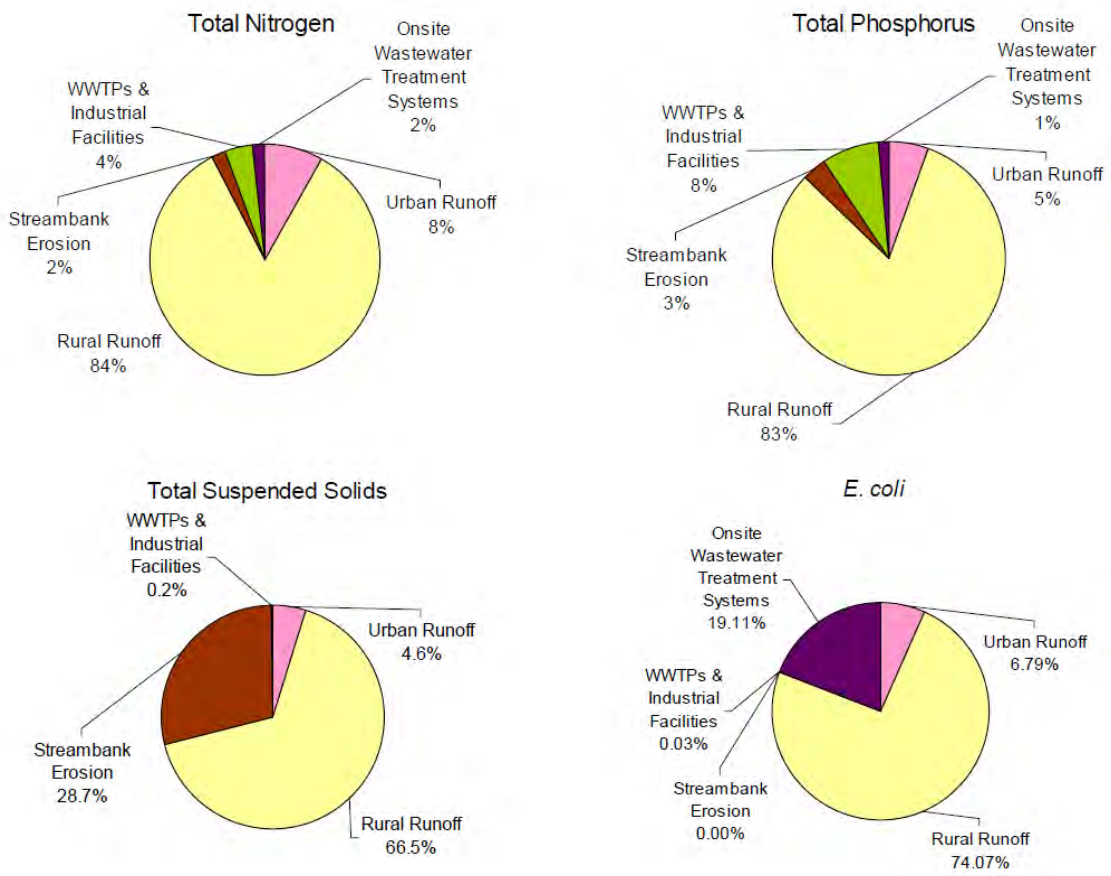

Figure 20. South Fork Wildcat Creek TMDL Modeled Loadings

Indiana Water Quality Atlas – IDEM Assessment Information Management Systems (1991-2008)

The Indiana Water Quality Atlas is an online, interactive mapping application that can be used for watershed management and water quality analysis. Sampling locations and water quality results from IDEM's Assessment Information Management Systems (AIMS) can be accessed and downloaded for use. The AIMS data represents an extensive database of water quality information from a wide variety of sites. This data includes nutrient and bacteria data, fish and macroinvertebrate studies, and environmental toxicity monitoring. Within the AIMS database, water quality information within the South Fork Wildcat Creek Watershed spans from the spring of 1991 to the spring of 2008 and a total of 141 sampling locations, some of these being documented sampling locations from other water quality projects and sampling efforts such as those mentioned in this section (Figure 21). Data from the South Fork Wildcat Creek Watershed was downloaded to analyze for general trends across the drainage area. Also, this information is useful in filling data gaps left from other water quality data sources that are discussed in this section. A more detailed review of the water quality data is included in the subwatershed descriptions.

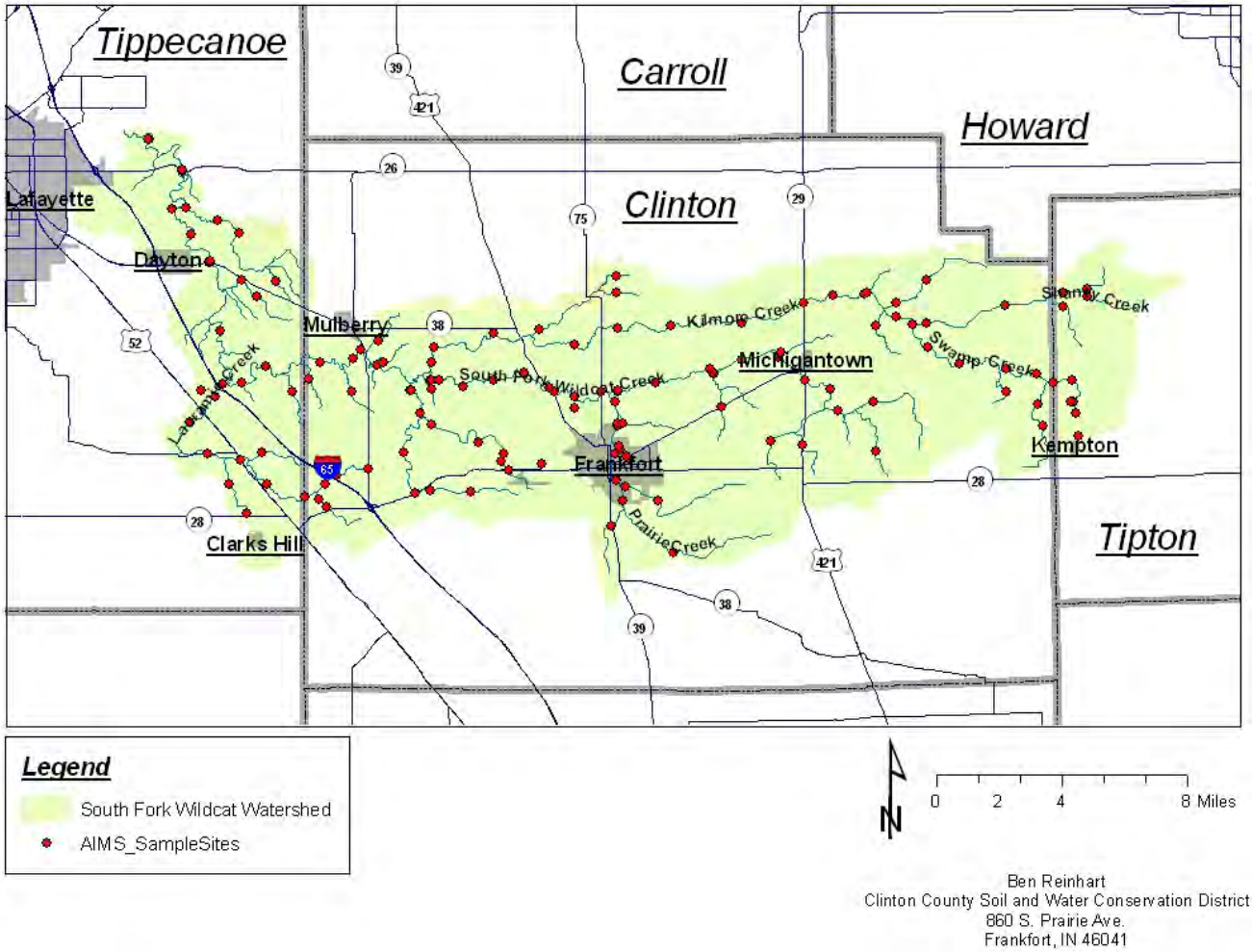

Figure 21. AIMS Sampling Locations within the South Fork Wildcat Creek Watershed

Frankfort Area Source Identification Study (2008)

IDEM's Source Identification – Water Quality Impairment Program (Source ID) is conducted to follow up on known water quality impairments in an effort to better isolate the origins of the pollutants. The Frankfort Area Source ID study took place within both the Prairie Creek and Jenkins Ditch-South Fork Wildcat Creek subwatersheds, which included the City of Frankfort. This area was chosen for study due to historical documentation of high phosphorus levels in Prairie Creek and in the downstream segments of the South Fork Wildcat Creek. Several previous studies have shown that the potential sources of the elevated levels may be from two major NPDES (National Pollutant Discharge Elimination System) dischargers: the Frankfort Municipal Wastewater Treatment Plant (WWTP) and the local Frito Lay factory. Another concern focused on the potential for toxic organic compounds (e.g. fuel, oil, antifreeze, etc.) entering local surface waters from a large junkyard near the confluence of Prairie Creek and the South Fork Wildcat Creek

Sampling took place during the summer of 2008 at a variety of sites along both Prairie Creek and the South Fork Wildcat Creek. Sampling sites were located upstream and downstream of suspected pollutant sources. Information was collected on water chemistry, nutrients, bacteria, and a variety of other parameters (Table 17). Water sampling was done both intensively during a 24-hour period as well as through follow-up samples from specific fixed points. A datasonde multi-parameter device was installed at selected locations to measure daily variations of certain water quality parameters. These datasonde multi-parameter devices are installed at select locations to automatically generate data samples at 15-minute intervals. Results on the Frankfort WWTP are discussed in the Prairie Creek subwatershed description. Results on the Frito Lay outfall and junkyard are discussed in the Jenkins Ditch-South Fork Wildcat Creek subwatershed description.

Table 17. Water Quality Parameters and Locations from IDEM's Frankfort Area Source Identification Study

Site ID	Stream/Facility	Location	Parameters/Tasks
WAW040-0012	Prairie Cr	Kyger St @ Park	GC, Nx, Flow
WAW040-0045	Prairie Cr	Bridge U/S of Outfall	GC, Nx, Mts, TTO, Sed., EC, Flow
WAW040-0047	Frankfort STP	001 Final Effluent	GC, Nx, Mts, TTO, Flow
WAW040-0013	Unnamed Trib	CR 100N	GC, Nx, EC, Flow
WAW040-0014	Prairie Cr	CR 150N	GC, Nx, Flow
WAW040-0006	S Fk Wildcat Cr	CR 00 Rd	GC, Nx, Mts, TTO, Sed., EC, Algae, Sonde, Flow
WAW040-0015	S Fk Wildcat Cr	SR 75	GC, Nx, Mts, TTO, Sed., EC, Algae, Sonde, Flow
WAW040-0016	Blinn Ditch	Union Rd	GC, Nx, EC, Flow
WAW040-0017	S Fk Wildcat Cr	Union Rd (130 W)	GC, Nx, Flow
WAW040-0018	S Fk Wildcat Cr	CR 200N	GC, Nx, EC, Algae, Sonde, Flow
WAW040-0049	Frito Lay	001 Final Effluent	GC, Nx, Flow
WAW040-0019	S Fk Wildcat Cr	CR 300W	GC, Nx, Flow
WAW040-0020	S Fk Wildcat Cr	CR 400W	GC, Nx, Mts, TTO, Sed., EC, Flow
WAW040-0021	S Fk Wildcat Cr	CR 500W (Gasline Rd)	GC, Nx, Flow
WAW040-0130	S Fk Wildcat Cr	CR 580W (Hamilton Rd)	GC, Nx, EC, Algae, Sonde, Flow
WAW040-0043	S Fk Wildcat Cr	SR 26	GC, Nx, Mts (Fixed Station Only Site)
Abbreviation Key - GC=General Chemistry, Nx=Nutrients, Mts=Metals (including Mercury), TTO=Total Toxic Organics, Sed.=Sediment, EC=Escherichia Coli, Algae=Algal Biomass, Sonde=Datasonde			

Kempton Area Source Identification Study – 2008

In 2008, IDEM conducted a Source ID study to evaluate documented water quality impairments within some headwater areas of the South Fork Wildcat Creek Watershed near the Town of Kempton. These areas appeared to be primarily attributable to sewage input into Mott, Floyd, and Paris Ditches which combine to form Swamp Creek. Based on previous studies in 1998 and 2004, excessive levels of ammonia, phosphorus, and chloride were documented in Mott Ditch at CR. 1150 West (Tipton County). Excessively low levels of dissolved oxygen and a low Index of Biotic Integrity (IBI) scores were documented on Swamp Creek at CR. 1000 East (Clinton County). These results indicated pollutants may be entering Mott Ditch and could be leading to downstream impacts on Swamp Creek. It was indicated from background a straight pipe sewage discharge from the Town of Kempton emptied directly into Mott Ditch which may be leading to local impairments.

IDEM conducted sampling during the summer of 2008 at eleven sites covering the Kempton Discharge location, Mott Ditch, Paris Ditch, and Swamp Creek. Each site was sampled for a variety of water quality information (Table 18). Sites were sampled intensively over a 24-hour period to try and determine daily variations in pollutant loads. A datasonde multi-parameter device was installed at selected locations to measure daily variations of certain water quality parameters. These datasonde multi-parameter devices are installed at select locations to automatically generate data samples at 15-minute intervals. Bacteria and algal biomass was also sampled at a subset of sites repeatedly over the course of August and September of 2008. A detailed description of the results is included in the Swamp Creek subwatershed description.

Table 18. Water Quality Parameters and Locations from IDEM's Kempton Area Source Identification Study

Site ID	Stream/Facility	Location	Parameters/Tasks
WAW040-0215	Sewer in Park	King St & Mill St	GC, Nx, EC
WAW040-0209	Mott Ditch	Kempton Discharge	GC, Nx, EC, Sonde, Flow
WAW040-0210	Mott Ditch	CR 50N	GC, Nx, EC, Algae, Sonde Flow
WAW040-0211	Unnamed Trib from Pond	CR 1150W	GC, Nx, Flow
WAW040-0101	Mott Ditch	CR 1150W	GC, Nx, Flow
WAW040-0212	Mott Ditch	County Line (CR 1400W)	GC, Nx, EC, Algae, Sonde Flow
WAW040-0100	Paris Ditch	CR 1350E	GC, Nx, EC, Flow
WAW040-0102	Swamp Creek	CR 1350E	GC, Nx, EC, Algae, Flow
WAW040-0213	Swamp Creek	CR 1250E	GC, Nx, Flow
WAW040-0104	Swamp Creek	CR 1100E	GC, Nx, EC, Algae, Flow
WAW040-0023	Swamp Creek	CR 1000E	GC, Nx, Flow
WAW040-0214	Swamp Creek	CR 400N	GC, Nx, EC, Algae, Flow
Abbreviation Key - GC=General Chemistry, Nx=Nutrients, EC=Escherichia Coli, Algae=Algal Biomass, Sonde=Datasonde			

Indiana Department of Environmental Management – 305(b) and 303(d) Reporting (2008)

Every two years, the Indiana Department of Environmental Management – Office of Water Quality creates a report on the quality of waterbodies throughout the state as required by Chapter 305(b) of the Clean Water Act. The report is a compilation of all water quality data collected by IDEM and other

organizations with high-quality data. Each assessed waterbody is assigned a water quality rating based on its ability to meet Indiana's Water Quality Standards, which were developed in efforts to make all Indiana waters swimmable, fishable, and drinkable. Those waterways that fail to meet Indiana standards are declared as "Impaired Waterways" and become part of a list called the 303(d) list. The state maintains this list, as required by the Federal Clean Water Act, and uses it to identify particular impairments on local waterways and to determine where further studies should be focused. Prioritizations and final decisions are made based on the IDEM's Consolidated Assessment and Listing Methodology (CALM). This decision system is updated every two years to adequately incorporate state water quality goals as well as include guidance from the U.S. EPA. Indiana's CALM establishes five separate categories for grading Indiana waterways (Table 19). A more detailed review of the water quality data is included in the subwatershed descriptions.

Table 19. Listing Categories for IDEM's Consolidated Assessment and Listing Methodology

Category		Description
1		Attaining water quality standards, designated uses not threatened
2		Attaining some water quality standards, insufficient data to determine threat to other designated uses
3		Insufficient data
4		One or more designated use is impaired or threatened; No TMDL is required
	A	TMDL is already completed
	B	Other pollution control measures can be reasonably expected to address impairments or threats
	C	Impairments or threats are not caused by a pollutant
5		Water quality standards are not being attained
	A	TMDL is required
	B	Mercury and/or PCBs present above human health criteria

Hoosier Riverwatch (2000-2010)

The Hoosier Riverwatch program trains citizen volunteers to coordinate and conduct monitoring on Indiana streams and rivers. Citizen volunteers collect chemical, biological, and physical data on waterways. Physical data is collected based on adaptations from methods used by professional staff of the Ohio Environmental Protection Agency called the Qualitative Habitat Evaluation Index (QHEI). This citizen's QHEI (CQHEI) provides a measure of stream and riparian habitat that can be used to compare changes between sites or within sampling sites over time. Primarily volunteers look for conditions in substrate type, fish cover, stream shape and any human alterations (e.g. dams), adjacent forests and wetlands, stream depth and velocity, and occurrence of riffles and runs.

Biological data is collected by analyzing aquatic bugs and insects. These are more technically referred to as benthic macroinvertebrates and due to their various life history characteristics are good indicators of stream or river quality. Volunteers can collect samples using a couple different methods most commonly based on stream type. Generally shallow, wadeable waterways where riffles are available

are sampled using a kick seine. This method collects macroinvertebrates in a net positioned just downstream of someone disturbing the natural stream bottom, usually by making kicking motions. Where riffles are absent, usually dip nets are used to sample. This method involves taking at least 20 separate samples from various in-stream habitats by disturbing the stream bottom with a dip net. After samples are collected, macroinvertebrates are sorted by taxa (i.e. insect family) based on their pollution tolerance (e.g. intolerant, moderately intolerant, fairly tolerant, very tolerant). Scores are then calculated by multiplying the number of taxa within each tolerance category by a weighting factor. The sum of these numbers indicates a Pollution Tolerance Index Rating.

Chemical sampling is done to measure parameters such as temperature, dissolved oxygen, biological oxygen demand, pH, nutrients, turbidity, and bacteria. A variety of methods are used to gather this water quality data which is then converted to Q-values. Q-values are essentially conversions to help standardize the data to allow for easier interpretation. These Q-values are multiplied by a weighting factor and then added to come up with a Water Quality Index. Volunteers then enter all of their physical, biological, and chemical data that they collect into the Hoosier Riverwatch online database.

From 2000 – 2010 several volunteers collected water quality samples from waterways within the South Fork Wildcat Creek Watershed. Not all samples were complete and some sites have been more regularly sampled than others. Sampling sites included Spring Creek, Swamp Creek, Prairie Creek, Kilmore Creek, Mann Ditch, Lauramie Creek and multiple sites on the South Fork Wildcat Creek. A more detailed review of the water quality data is included in the subwatershed descriptions.

Fish Consumption Advisory (2010)

The Indiana Department of Environmental Management, Indiana Department of Natural Resources, and the Indiana State Department of Health collaborate annually with support from Purdue University to produce the Fish Consumption Advisory (FCA). The FCA is based on statewide collection and analysis of fish tissue samples for long-lasting contaminants (e.g. heavy metals, polychlorinated biphenyls (PCBs), and pesticides). Samples are taken from fish that feed at all depths of the water. Based on the results, specific ratings are given to fish for various waterways (Table 20). Table 21 shows results for waterways in the South Fork Wildcat Creek Watershed.

Table 20. Advisory Groups of the Indiana Fish Consumption Advisory

Group 1	Unrestricted consumption. **One meal per week for women who are pregnant or breast-feeding, women who plan to have children, and children under the age of 15.**
Group 2	Limit to one meal per week (52 meals per year) for adult males and females. **One meal per month for women who are pregnant or breast-feeding, women who plan to have children, and children under the age of 15.**
Group 3	Limit to one meal per month (12 meals per year) for adult males and females. **Women who are pregnant or breast-feeding, women who plan to have children, and children under the age of 15 do not eat.**
Group 4	Limit to one meal every 2 months (6 meals per year) for adult males and females. **Women who are pregnant or breast-feeding, women who plan to have children, and children under the age of 15 do not eat.**
Group 5	**No consumption (DO NOT EAT).**

Table 21. FCA Advisory for South Fork Wildcat Creek Waterways

Waterway	Fish Type	Size (in.)	Group
All Indiana Waterways (Unless Specified Otherwise)	Common Carp	15-20	3
		20-25	4
		25+	5
Kilmore Creek (Clinton Co.)	Common Carp	Up to 12	1
	Creek Chub	Up to 7	1
South Fork Wildcat (Clinton Co.)	All Other Species		3/5*
	Common Carp (Statewide Standard)		
South Fork Wildcat (Tippecanoe Co.)	All Other Species		2/3**
	Channel Catfish	13+	3
	Common Carp	Up to 18	2
		18-26	3
		26+	4
***General Population - Group 3; Sensitive Population - Group 5**			
**** General Population - Group 2; Sensitive Population - Group 3**			

South Fork Wildcat Creek Water Quality Assessment (2010-2011)

As part of this watershed planning project for the South Fork Wildcat Creek Watershed, current information was gathered and analyzed by Commonwealth Biomonitoring and the Clinton County Soil and Water Conservation District (Figure 22). Our water quality assessment included macroinvertebrate monitoring, aquatic habitat assessment, water chemistry monitoring, Atrazine levels, and *E.coli* sampling at 16 sites across the watershed (Table 22). Two additional sites were added later in the monitoring program. Site 17 was used as a substitute site for macroinvertebrate sampling to Site 3 due to lack of water during the summer months. Site 18 represents an additional sampling location, requested by the

Steering Committee, where supplementary chemical data was collected downstream of an old landfill site. Monitoring occurred from May 2010 to May 2011.

Stream habitats were measured during a single sampling event at all 16 sampling sites. The primary method used to collect habitat data was the Qualitative Habitat Evaluation Index (QHEI) protocol produced by the Ohio Environmental Protection Agency. The QHEI is a physical habitat index created to provide an unbiased, quantifiable evaluation of the general habitat characteristics that are important to aquatic organisms. It is based on rapid assessment of six metrics: substrate, in-stream cover, channel morphology, riparian zone, pool/glide and riffle/run quality, and map gradient. Each metric is observed in the field and recorded on data forms with corresponding point scores. The maximum QHEI score is 100.

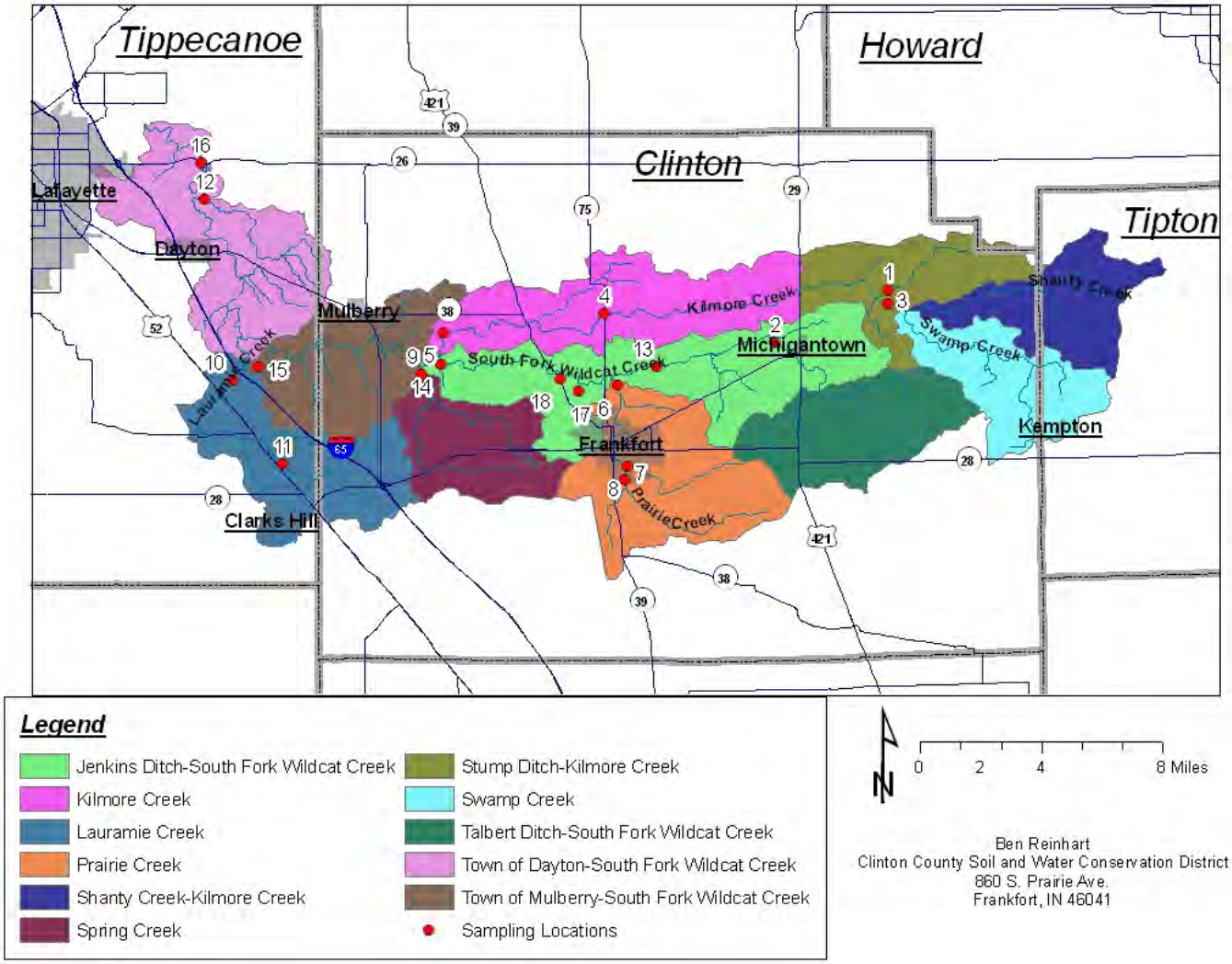

Figure 22. Sampling Locations for the South Fork Wildcat Creek Water Quality Assessment

Biological data was collected during a single sampling event completed at all 16 sampling sites. The primary method used to collect biological data was IDEM's multi-habitat macroinvertebrate collection procedure (MHAB). Collected samples are then evaluated using 12 metrics that combine several aspects of the benthic (i.e. bottom-dwelling) community composition. The metrics measure species richness, evenness, composition, and density. The results from these measurements are then converted into a macroinvertebrate Index of Biotic Integrity (mIBI) score and summed. Total scores less of 35 generally

indicate impaired biological communities. Biological data was not collected at Site 3 due to a lack of streamflow and depth. Site 17 was used as a substitute sampling location. Site 17 was chosen as a substitute site since previous monitoring data was available from this location and new data could be compared to discern any noticeable trends.

Water chemistry was collected every other month for one year at various sampling sites. Parameters included temperature, flow, dissolved oxygen, pH, and conductivity. Temperature and dissolved oxygen were measured with a Hach meter while the conductivity was measured with a Hanna instrument conductivity probe. The pH was measured with a field pH meter. .

Atrazine was sampled at eight sites in May, July and September of 2010. Samples were analyzed in a laboratory setting using gas chromatography procedures.

Table 22. Water Quality Parameters of South Fork Wildcat Creek Water Quality Assessment

Parameter	Site(s)	Method
Habitat Measurements - Qualitative Habitat Evaluation Index (QHEI)		
QHEI	1-16	Ohio EPA
Biological Measurements – Macroinvertebrate Index of Biotic Integrity (mIBI)		
mIBI	1-16	IDEM
Chemical and Physical Measurements		
Nitrogen (nitrates+nitrites)	1-6, 9-10, 13-16	SM 4500NO3-E
Total Phosphorus (TP)	1-6, 9-10, 13-16	SM 4500P-F
Total Suspended Solids (TSS)	1-6, 9-10, 13-16	SM 2540D
pH	1-6, 9-10, 13-16	SM 4500H
Temperature	1-6, 9-10, 13-16	EPA 170.1
Conductivity	1-6, 9-10, 13-16	SM 2510A
Dissolved Oxygen (DO)	1-6, 9-10, 13-16	
Stream Flow	1-6, 9-10, 13-16	ASTM D3858
Atrazine	2, 3, 5, 6, 9, 10, 14, 16	EPA 507
E.coli	1-6, 9-10, 12-16	SM 9223B

E. coli sampling occurred during the fall of 2010 and in the spring of 2011 at 13 sampling sites. During both the fall and spring sampling efforts, weekly grab samples were collected during a five-week sampling period. At seven of those sites, water chemistry measurements were taken for temperature, flow, dissolved oxygen, pH, conductivity, and nitrate. The water chemistry measurements were taken using a YSI multi-parameter probe, and the flow was taken using a current meter. *E. coli* samples were analyzed by the Frankfort Wastewater Treatment Plant.

A more detailed review of the water quality data is included in the subwatershed descriptions. All water quality data collected as part of this project is included in Appendix G. Additional information on the methodologies of the South Fork Wildcat Creek Water Quality Assessment can be found in the Quality Assurance Project Plan located in the Appendix F.

3.3 Watershed Inventories

In addition to historical water quality data, land use and other inventories on potential sources of pollutants were analyzed for the South Fork Wildcat Creek Watershed. A brief review of these inventories is included below. More specific discussions of these inventories are included in the subwatershed descriptions.

Indiana Department of Environmental Management, Office of Land Quality

The Indiana Department of Environmental Management-Office of Land Quality is responsible for a variety of environmental compliance issues and works in accordance with the EPA. Often times the Office of Land Quality works with land uses such as agricultural and solid waste, auto salvage, concentrated animal feeding operations, hazardous waste, industrial waste, and underground storage tanks. The primary goal of the Office of Land Quality is to make sure that these developments are achieving the goals established by their official permits.

A survey of areas within the South Fork Wildcat Creek Watershed that are under compliance with the Office of Land Quality was completed. Using location information from the Office of Land Quality locations of various permitted land uses were mapped. A total of 40 active Confined Feeding Operations (CFO) are spread out across the South Fork Wildcat Creek Watershed. By law these areas are described as any area housing at least 300 cattle, 500 horses, 600 swine or sheep, or 30,000 fowl (i.e. turkey, chickens, etc.) for more than 45 days in areas of less than at least half natural vegetation cover (327 IAC 19).

A number of other land uses of concern are seen throughout the watershed. High concentrations of potential threats such as underground storage tanks and old dump sites are seen near some of the more developed areas in the watershed. These are discussed more specifically within each subwatershed.

NPDES Facilities

Several facilities are regulated by National Pollution Discharge Elimination System (NPDES) permits within the watershed. Indiana uses the NPDES to control direct discharges to waters of the state. These permits establish limits on the amount of pollutants that may be discharged by each facility. There are several different types of permits that are issued and they include: Municipal, Industrial, and Wet Weather. In total, nine facilities are located within the South Fork Wildcat Creek watershed. Table 23 provides the name of each NPDES facility, general location, and receiving waters. Each facility's compliance with their NPDES permits will be evaluated in the sub-watershed section of this plan.

Wildcat Creek Watershed – Rapid Watershed Assessment (2008)

The USDA-Natural Resources Conservation Service (NRCS) created Rapid Watershed Assessments (RWA) to provide initial estimates of where conservation practices would best address the concerns of land owners, conservation districts, and community organizations. Essentially these assessments include a quick screen of existing natural resource data such as soils, topography, and impaired waterways to

identify broad scale resource concerns for the watershed. The Wildcat RWA, completed in 2008, included not only the South Fork but also the Middle and North Forks of Wildcat Creek. There were a number of resource concerns listed for the entire Wildcat Creek Watershed (Table 24).

Table 23. NPDES Facilities in South Fork Wildcat Creek Watershed

NPDES Facility Name	Location	Receiving Waters
Clarks Hill Municipal Wastewater Treatment Plant	CLARKS HILL	Tributary to Lauramie Creek
Frankfort Wastewater Treatment Plant	FRANKFORT	Prairie Creek
Frankfort Old Stoney Building	FRANKFORT	Prairie Creek
CF Industries, Inc.	FRANKFORT	Lick Run
Frito Lay, Inc.	FRANKFORT	Heavilon Ditch, Blinn Ditch, South Fork Wildcat Creek
Wainwright Middle School	LAFAYETTE	Lauramie Creek
Mulberry Municipal Wastewater Treatment Plant	MULBERRY	South Fork Wildcat Creek
Michigantown Municipal Wastewater Treatment Plant	MICHIGANTOWN	South Fork Wildcat Creek
Lauramie Township Regional Sewer District Wastewater Treatment Plant	STOCKWELL	Lauramie Creek

Table 24. Resource Concerns Identified in Wildcat Creek, Rapid Watershed Assessment

Surface Water Quality	Approximately 68% (471 miles) of the 689 total miles of streams in the Wildcat Creek have identified impairments for excessive amounts of sediments, nutrients, and bacteria.
Ground Water Quality	In excess of 30,700 acres of soils in the Wildcat Watershed have a high leaching index (>10) which allows contaminants on the land surface to be easily carried to the ground water through infiltration. Additionally, within the Wildcat Watershed, 20,100 acres are located inside wellhead protection areas.
Air Quality	Approximately 1% of the Wildcat Watershed has been identified by the Environmental Protection Agency (EPA) as having an air quality concern.
Threatened & Endangered Species	Over 7% of the 519,780 acres in the Wildcat watershed contain known ranges of Threatened & Endangered Species.
Soil Quality	Based on the data available, over 5,000 acres are eroding at twice the tolerable level.

Despite this study being done at a bigger scale than the South Fork Wildcat Creek many of the resource concerns are similar to concerns expressed by other studies. For example, previous studies and assessments have expressed concern regarding the amount of impaired waterways within the South Fork Wildcat Creek Watershed and listed primary impairments as being sediments, nutrients, and bacteria. Also, other studies have listed soil erosion as a concern with the South Fork Wildcat Creek Watershed. Due to these similarities, we will assume for the purpose of this plan other resource concerns associated with ground water quality, air quality, and threatened and endangered wildlife can be applied to areas within the South Fork Wildcat Watershed.

Windshield Inventory (2010-2011)

Members of the South Fork Wildcat Creek Watershed Steering Committee volunteered to complete Windshield Inventories throughout the watershed during the summer and fall of 2010. The Windshield Inventories were conducted by driving local routes throughout the watershed and visually inspecting the local land use and environmental characteristics at each bridge. Each volunteer or pair of volunteers drove sections of the watershed they were familiar with and documented their findings using photographs, GPS units, and field sheets. This information was then compiled and areas of concern were mapped using Geographic Information Systems (GIS) software. The majority of concerns that were noted throughout the watershed included:

- Areas with little or no riparian buffers
- Animal and livestock operations including both larger Confined Feeding Operations and smaller, hobby farms
- Areas where livestock and animals had direct access to local waterways
- Areas of active erosion including sheet, rill, gully, and bank erosion.

Desktop Inventory

In addition to a Windshield Inventory, the Watershed Coordinator used GIS to analyze water courses lacking riparian buffers by cross-referencing land cover data with floodplain and riparian zones. For this evaluation floodplains were delineated using the Flood Insurance Rate Maps from the Indiana DNR. In areas where floodplains were not delineated, a 100' riparian zone width was used. This information was used to calculate the percentage of floodplain and riparian areas containing natural vs. modified land uses. Modified land uses included various types of development including developed, open spaces (i.e. golf courses, large grassy lots, etc.), cultivated crops, and areas dedicated to pasture or hay. Natural land uses included deciduous and evergreen forest, herbaceous grasslands, and wetlands. All GIS used during this project is listed in Appendix B.

The steering committee also wanted to measure participation in available conservation programs. To accomplish this, we used the NRCS Integrated Data and Enterprise Analysis (IDEA) application. This application provides a centralized database of information tracking conservation practices planned and applied by producers as part of NRCS conservation programs. Using this tool, calculations of total practices applied and acres with applied practices were compiled for each subwatershed. Also, by comparing applied conservation acres against total drainage area and water quality data, we can start to identify areas lacking conservation practices and look for trends between areas of high applied conservation acres and high water quality.