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CHRISTOPHER B. BURKE ENGINEERING, LTD. - INDIANA

Lower Fall Creek
Watershed Management Plan

Prepared For:
The Marion County Soil & Water Conservation District

May 2009

LOWER FALL CREEK WATERSHED MANAGEMENT PLAN

Prepared For:

Marion County Soil & Water Conservation District
Lower Fall Creek Watershed Alliance

May 2009

Prepared By:

Christopher B. Burke Engineering, Ltd.
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CBBEL Project Number 07-116

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EXECUTIVE SUMMARY

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1.0 WATERSHED PLANNING

A watershed is an area of land that collects and drains water to a specific point. Similar to water poured into a bowl, a portion of the precipitation that falls on a watershed will move through the landscape, collecting and concentrating in low areas, creeks, and streams, until it exits through an outlet point. A watershed is a measurable and practical landscape feature that is based on how water moves, interacts with, and behaves on the landscape. Watershed planning is especially important to preserve watershed functions, help prevent future water resource problems and ensure future economic, political, and environmental health. This section provides information on the funding, purpose, and stakeholders involved in the development of the Lower Fall Creek Watershed Management Plan.

1.1 BACKGROUND

In the fall of 2006, the Marion County Soil and Water Conservation District (SWCD) submitted a Section 319 Non Point Source Program grant application to the Indiana Department of Environmental Management (IDEM) to develop a Watershed Management Plan (WMP) for the Lower Fall Creek Watershed. The grant application was approved, and the SWCD received a grant in March of 2007. The tasks, timeline, and checklist for this project are in **Appendix 1**. The SWCD retained the professional services of Christopher B. Burke Engineering, Ltd. (CBBEL) to serve as the Watershed Coordinator for the development of the WMP. CBBEL assisted in the development, coordination, and facilitation of stakeholder discussions, the collection and analysis of water quality data, and is the primary author of the WMP.

1.2 PURPOSE

The purpose of this WMP is to gain a greater understanding of the water quality impairments in the Lower Fall Creek Watershed and engage the diverse stakeholders to identify and implement sustainable and local solutions.

The Marion County SWCD believes that a WMP is a guiding document that examines the historical and existing water resource issues in a particular watershed and presents specific actions to address those water resource issues based on the values and needs of the community. The SWCD hopes that the successful completion of the Lower Fall Creek WMP will serve as a benchmark for all future urban watershed efforts in the State of Indiana. Fall Creek is a highly recognizable recreational and drinking water supply resource which traverses a varied landscape socially, economically, and geographically.

1.3 STAKEHOLDER INVOLVEMENT

A WMP represents the efforts of the stakeholders, including water resource professionals, local government leaders, and interested citizens, to understand, analyze, and become an integral part of the solution to improve impaired water quality. In recognition of the social, physical, and economic diversity present in the Lower Fall Creek Watershed, a Steering Committee, work groups, workshops, public meetings, and educational materials were used to engage stakeholders and develop the WMP.

Steering Committee

The Lower Fall Creek WMP Steering Committee was made up of individuals representing municipalities, counties, economic development organizations, neighborhood associations, universities, and environmental groups; and was the primary committee utilized to guide the overall direction of the WMP. The Steering Committee (**Figure 1-1**) met on a quarterly basis from May of 2007 through January of 2009. **Table 1-1** identifies the Steering Committee members. **Appendix 2** includes Steering Committee meeting agendas and summaries.

Figure 1-1: Steering Committee

Other individuals that served as Steering Committee members during the development of this WMP include Lori Kaplan while serving Director of the City of Lawrence DPW, Christ Blassaras formerly with the Madison County SWCD, Angie Dye while employed with Veolia Water, and Kelly Wood while serving as the Neighborhood Liaison for the City of Indianapolis.

Table 1-1: Steering Committee

Name	Representing
Chris Barnett	Near North Development Corporation
Robert Barr	IUPUI – CEES
Cindy Newkirk	Hancock County SWCD
Carl Clark	Indianapolis Mayor's Office
Victoria Cluck	Indianapolis DPW
Josh Goode	IACT
Tina Jones	Indy Parks
Joe King	Dirty Dozen Hunting & Fishing Club
Ron Lauster	Marion County SWCD
Bob Masbaum	Indianapolis DPW
Brad Newman	Madison County Surveyor's Office
Donna Price	Indianapolis DMD
John South	Hamilton County SWCD
Pam Thevenow	Marion County Health Department
Kenton Ward	Hamilton County Surveyor
Gwen White	IDNR – LARE Program
Paul Whitmore	Veolia Water
Jerry Wilkey	Lawrence MS4 Coordinator

In addition to guiding the development of the WMP, the Steering Committee discussed the larger issues of 1) land use and land use change, 2) source water protection, and 3) flooding in the Lower Fall Creek Watershed. A summary of these discussions are below, and a detailed discussion in Section 2.0 of this WMP.

The first topic of interest, Land Use and Land Use Change, was discussed at the February 12, 2008 Steering Committee meeting. Using US Census data and aerial photography, CBBEL staff illustrated the dramatic growth and development that has occurred within the Lower Fall Creek Watershed in the last 50 years. Research on land use and development practices as sources of sediment, nutrients, and pathogens as well as the direct relationship between imperviousness and water quality was presented to the Steering Committee. To further illustrate this point the Land Use Central Indiana (LUCI) and the Long-Term Hydrologic Impact Analysis (L-THIA) were used in different growth scenarios. Members of the Steering Committee engaged in a fruitful discussion regarding the opportunities and challenges of land use planners and stormwater managers working together to develop watershed solutions to improve water quality.

The second topic of interest, the Relationship of Surface Water and Groundwater Quality, was discussed at the May 13, 2008 Steering Committee meeting. CBBEL staff presented research on the connectivity of groundwater and surface water, gaining and losing streams, and potential pollutant sources from land uses in Wellfield Protection Areas (WFPAs). Approximately 25% of the land in the Lower Fall Creek Watershed is within a WFPA. The Steering Committee discussed the implications of implementing stormwater quality management measures designed for sediment removal and filtration of pollutants in WFPAs. Chris Barnett with the Marion County Wellfield Education Corporation (MCWEC) also provided valuable insight to the potential impacts of contaminated groundwater as he serves on the Board for MCWEC.

The third topic of interest, Flooding and Flooding Impacts was discussed at the August 12, 2008 Steering Committee meeting. CBBEL staff provided an overview of notable historic flood events in the Lower Fall Creek Watershed and flood-related losses. Maintenance practices of regulated and non-regulated drains were discussed. Throughout the Lower Fall Creek Watershed, there are very good examples of floodplain management. These include: adopting compensatory storage/No Adverse Impact (NAI) language, participation in the Community Rating System (CRS), reactivating stream gages for flood warning, implementation of a Flood Preparedness/Response Plan, delineate floodplain on unstudied streams, implement 2-stage ditch design on regulated drains, and implementation of Low Impact Development (LID) techniques.

Work Groups

Three work groups were formed to focus on Public Education & Outreach, Land Use & Economic Development, and Water Quality in the Lower Fall Creek Watershed. Participation in the work groups was open to stakeholders with expertise or interest. The work groups met 3 to 4 times to assist with collecting and interpreting data; identify and prioritize Critical Areas; recommend programs, policies, and projects to improve water quality; and review and comment on the Lower Fall Creek WMP. Summaries from work group meetings are in Appendix 2. **Table 1-2, Table 1-3,** and **Table 1-4** lists the individuals invited to participate in each of the work groups. Not all the individuals listed were able to physically attend the meetings but were able to assist in the development of the Lower Fall Creek WMP via email, phone, or one-on-one meetings with the Marion County SWCD and CBBEL staff.

Table 1-2: Public Education & Outreach Work Group

Name	Representing
Lou Ann Baker	Veolia Water Company
Eric Becker	Lake Maxinhall
Cindy Newkirk	Hancock County SWCD
Bonnie Chastain	Windridge Development
Carl Clark	Indianapolis DMD - Neighborhoods
Dean Farr	Watershed Resident

Name	Representing
Tina Jones	Indy Parks
Joe King	Dirty Dozen Hunting and Fishing Club
Ron Lauster	Marion County SWCD
Mark McCauley	Hamilton County SWCD
Linda Prokopy	Purdue University
Mark Rumreich	Indian Lake HOA
Shaena Smith	Hamilton County SWCD
Karen Terrel	Indianapolis DMD - Neighborhoods
John Ulmer	Central Indiana Watershed Group
Gwen White	IDNR – LARE

Table 1-3: Land Use & Economic Development Work Group

Name	Representing
Chris Barnett	Near North Development Corporation
Tammy Bowman	Madison County Economic Development
Jerry Bridges	Madison County of Governments
Tom Crouch	Lawrence Economic Development
Kathy Davidson	Indianapolis Economic Development
Michael Hershman	Madison County Planning
Jennifer Janke	Fishers Development Department
Anna Jetmore-Vargas	Indianapolis DPW
Roger Johnson	Noblesville Planning Department
Kevin Kelly	Noblesville Economic Development
Chuck Kiphart	Hamilton County Plan Commission
Ron Lauster	Marion County SWCD
Dennis Malloy	Hancock County Economic Development
Mark Rumreich	Indian Lake
Dennis Slaughter	Indianapolis Planning Department
John South	Hamilton County SWCD
Gwen White	INDR – LARE
Christi Wolfe	Fishers Economic Development

Table 1-4: Water Quality Work Group

Name	Representing
Robert Barr	IUPUI – CEES
Fred Beyne	Mallard Lake Association
Dean Farr	Watershed Resident
Bill Guertal	USGS
Jim Hoskins	Indian Lake HOA
Joe Ketterman	Marion County Health Department
Ron Lauster	Marion County SWCD
Gary Rosenberg	Windridge Development
Andy Van Treese	Indian Lake HOA
Paul Werdertich	Indianapolis DPW
Gwen White	IDNR - LARE

Public Meetings

Public participation is essential to the long-term success of any watershed planning effort. Education and outreach efforts can effectively change the public's behaviors and attitudes toward water quality, improve local awareness of the relationship between land use and water quality, and demonstrate how day-to-day activities impact the quality of rivers and streams in the Lower Fall Creek Watershed.

Two Public Meetings were conducted (**Figure 1-2**). The purpose of the Public Meetings was to introduce Lower Fall Creek Watershed stakeholders to the planning process, solicit stakeholder participation in work groups, identify critical areas, recommend programs, policies, and projects to improve water quality, and build support for the long-term implementation of the Lower Fall Creek WMP.

Figure 1-2: Public Meeting

Both public meetings were advertised through a targeted direct mailing campaign to Neighborhood Associations in the Lower Fall Creek Watershed, and press releases were sent to local media outlets, the SWCD, and the Lower Fall Creek Watershed website. **Appendix 3** includes the materials distributed.

The first Public Meeting was held on July 24, 2007 at the City of Lawrence Government Center and was attended by 30 Lower Fall Creek Watershed stakeholders representing citizens, neighborhood groups, environmental groups, state and local government agencies. CBBEL staff provided an overview of the 319 grant program describing the need for a WMP, the Steering Committee, and the anticipated outcomes of the planning effort. An open discussion regarding the current status of the entire watershed was facilitated by CBBEL staff. Comments from the audience were recorded, discussed, and were later provided to the Steering Committee for further comment and discussion. Information was disseminated, which described the 3 work groups (Education & Outreach, Land Use & Economic Development, and Water Quality) along with the dates and locations for the initial meetings of each work group. Opportunities for collaboration were also discussed and many attendees provided contact information and discussed the ability to include updates in neighborhood newsletters and websites.

The second Public Meeting was held on January 15, 2009 at the City of Lawrence Government Center. Approximately 25 Lower Fall Creek Watershed stakeholders were in attendance as highlights from the draft WMP were presented. Information included an overview of the planning process, the education and outreach efforts throughout the development of the WMP as well as the proposed management measures developed by the work groups and the Steering Committee. Representatives from the Indian Lake Watershed as well as Windridge Condominiums were present to discuss their recent actions (detailed in later sections) to protect and enhance water quality. Both groups were also very interested in the continuation of efforts within the Lower Fall Creek Watershed. A representative from Purdue University was also present to provide a summary of the next steps of the Social Indicator Survey completed within the watershed. Due to a low response rate, a series of small focus groups will be held to obtain better insight and similar information as was sought with the mailed survey.

Workshops

While it is critical to engage citizens and stakeholders as a component of developing a WMP, it is equally as important to provide stakeholders with educational opportunities that extend beyond the conceptual boundaries of watershed planning. In recognition of this concept, 3 workshops were conducted. Each of these workshops was designed to target specific stakeholders in urban, suburban, or rural communities in the Lower Fall Creek Watershed. Brochures were prepared and distributed to advertise each workshop (Appendix 3).

The first workshop focused on assisting suburban lake and stream shoreline residents to develop a Management Plan for their property to reduce water quality impacts (**Figure 1-3**). This workshop was held in two sessions, the first on June 12, 2008 and the second on August 21, 2008. Both sessions were held at the Garrison at the Fort Benjamin Harrison State Park.

The first session, with approximately 30 people in attendance, featured presentations from Mark Mongin, SePro Corporation and Heather Buck, CBBEL. Mark's presentation provided the background information on what a watershed is, the importance of working on a watershed level, and examples of projects that representative lake communities in Indiana have completed to protect their shoreline, their homes, and the quality of their lake or pond.

Figure 1-3: Shoreline Stewards Workshop

A representative case study of a shoreline assessment was presented to the participants indicating important information that their assessments should include. During the assessment discussion, participants were able to ask questions and provide information related to their specific location and situation. The evening ended with final guidance on completing the blank assessment sheets for each participant. It is expected that during the August session, the individual assessments will be reviewed, and any further questions will be addressed.

The focus of the second session of the Shoreline Stewards workshop was several topic related round table discussions. Approximately 10 participants returned with draft shoreline management plans in hand and several questions for the round table discussions. Topics and discussion leaders for this portion of the workshop included:

- Plant pests and invasive species – Mark Mongin, SePro Corp.
- Nutrient Management and Water Quality Concerns – Matt Johnson, Aquatic Control, Inc
- Nuisance animal control – Shannon Winks, IDNR
- Shoreline and streambank stabilization – Matthew Kerkhof, Hoosier Aquatic Management and Simon Davies, JF NEW
- Backyard conservation and naturescaping techniques – Shaena Smith, Hamilton County SWCD and Ben Reinhart, Indiana Wildlife Federation
- Resources and information for land management – Glenn Lange, Marion County SWCD
- Resources and information for lake and stream management – Angela Sturdevant, Indiana Lake Management Society

Participants were encouraged to visit each topic table to address specific questions related to their shoreline, or to learn more about each of the topics.

The second Workshop focused on establishing backyard conservation practices at existing residential, commercial, and institutional properties in the urbanized portions of the watershed (**Figure 1-4**). With the focus of assisting urban watershed residents utilize their own backyards to make a difference in the water quality of Lower Fall Creek, a Backyard Conservation workshop was held on November 12, 2008 at the Broadway United Methodist Church. Jackie Nytes, Executive Director of the Mapleton Fall Creek Community Development Corporation, welcomed nearly 30 people to the evening's workshop. Following the welcome, Ron Lauster, Marion County SWCD, discussed the basics of a rain barrel and the benefits of rain barrels to homeowners and Lower Fall Creek. With a brief overview of rain barrel construction, groups of 5 participants joined together to design and construct a functioning rain barrel that was awarded to one of the group members at the end of the workshop.

Figure 1-4: Backyard Conservation Workshop

After construction of the rain barrels, Michele Conyer or Indy Parks, Environmental Education, provided participants with tips for attracting wildlife to their backyards while also deterring unwanted species. Ben Reinhart of the Indiana Wildlife Federation described the certification process by which homeowners can have their backyards declared a Backyard Wildlife Habitat. Brooke Klejnot of the Mapleton Fall Creek Community Development Corporation and Danielle Fluhr of Eden in Indianapolis also helped to coordinate the evening's events. Several local businesses assisted with the success of the workshop through donations of refreshments and additional supplies for the installation of the rain barrels. At the conclusion of the workshop, participants were given all the necessary supplies and a barrel to construct their own rain barrels.

The third Workshop focused on the rural issues pertaining to regulated and non-regulated drains, buffers for water quality, and maintenance procedures (**Figure 1-5**). The "Regulated Drains and Natural Waterways" workshop was held at the Lapel Public Library in Lapel, Indiana. Presentations included an overview of regulated drains by Kent Ward, Hamilton County Surveyor; log jams and permitting issues by George Bowman, IDNR Division of Water and Brad Baldwin, IDEM; funding opportunities through USDA by Henry Wallis, NRCS, District Conservationist, Boone and Marion Counties; and 2-stage ditch design overview by John South of the Hamilton County SWCD.

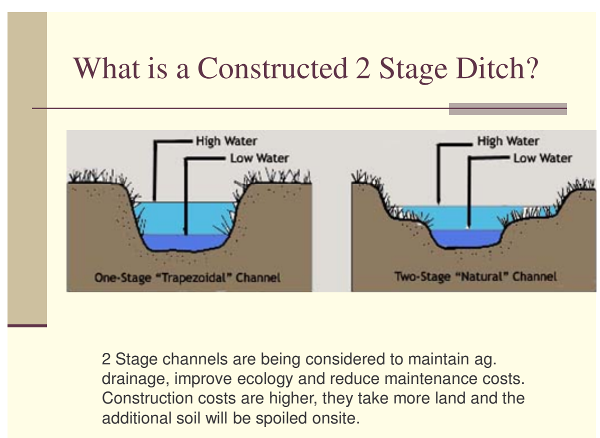


Figure 1-5: Regulated & Non-Regulated Drain Workshop

Website

The Lower Fall Creek Watershed website (**Figure 1-6**) was developed to ensure local stakeholders had up-to-date information regarding the status of the Lower Fall Creek WMP. The website also became a clearinghouse of information related to the Steering Committee, work groups, public meetings, and workshops. Educational materials developed as a part of the project were also made available. The website, www.lowerfallcreek.org was developed and maintained through a Clean Water Indiana grant and hosted by the Hoosier Heartland Resource Conservation & Development (HHRC&D) Council.

Figure 1-6: Lower Fall Creek Website

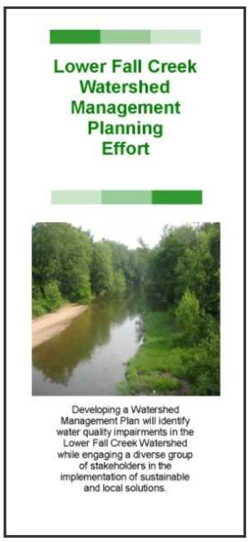


Figure 1-7: Lower Fall Creek Brochure

Brochure and Newsletters

In the summer of 2007, a Lower Fall Creek Watershed brochure was developed. The brochure included a map of the Lower Fall Creek Watershed, water quality information, facts and statistics regarding the land use. The brochure was distributed to stakeholders throughout the planning process via direct mailings to Neighborhood Associations in the Lower Fall Creek Watershed, Steering Committee meetings, work group meetings, public meetings, workshops, and other local events. A copy of the brochure is included in Appendix 3.

Three Lower Fall Creek Watershed Newsletters were developed and distributed to watershed stakeholders as part of the SWCD Newsletters. The Lower Fall Creek Newsletter kept stakeholders abreast of upcoming meeting dates and announced various project milestones and successes. Copies of newsletters are also available in Appendix 3 of this plan.

Social Indicators Survey

In the fall of 2008, the Lower Fall Creek Watershed participated in a US EPA Region 5 pilot program designed to evaluate the use of social indicators in non-point source pollution management. According to the Draft Social Indicators for NPS Management Handbook 2.0, Social Indicators are measures that describe the capacity, skills, awareness, knowledge, values, beliefs, and behaviors of individuals, households, organizations, and communities.

Dr. Linda Prokopy from Purdue University guided the Education & Outreach Work Group through the important process of developing a Social Indicators Survey which asks questions regarding attitudes toward water quality, types and sources of water pollution, the knowledge of practices that can improve water quality, as well as the willingness of the landowner to adopt those practices. In September 2008, the survey was directly mailed to over 1,000 residences within the Lower Fall Creek Watershed; however, only approximately 700 addresses were valid. Of the nearly 700 valid mailings, the survey achieved a 27% response rate receiving 187 completed surveys. Of the completed surveys, over half of the respondents indicated that they agree that local economic stability depends upon good water quality, that it is their personal responsibility to help protect water quality, and that their actions have a direct impact on water quality. When surveyed about which pollutants were present in the Lower Fall Creek Watershed, the majority of respondents indicated that they "don't know" how much of a problem pollutants such as sediments, nitrates, phosphorus, and *E. coli* posed.

Due to the lower response rate, Purdue University representatives plan to hold a series of small, neighborhood based focus groups to evaluate residents' awareness, attitudes, and practices related to water quality, similar to the survey. As of the development of this WMP, only one focus group has been conducted and data from that assessment has not been provided by Purdue University.

Appendix 3 includes a copy of the Social Indicator Survey and a summary of the results as provided by Purdue University. Results of this comprehensive survey will be utilized to develop future education and outreach campaigns in the Lower Fall Creek Watershed and it is intended to repeat this survey as a component of an IDEM Section 319 Implementation Project.

2.0 WATERSHED OVERVIEW

The Lower Fall Creek Watershed is a unique watershed. It drains land from the largest and fastest growing municipalities in Indiana and is rapidly converting from agriculture to urban land uses. This section provides an overview of the physical and social landscape of the Lower Fall Creek Watershed as well as the 3 topics of interest to the Lower Fall Creek Watershed Steering Committee: Land Use and Land Use Change, Groundwater and Surface Water, and Flooding and Flooding Impacts.

2.1 WATERSHED DESCRIPTION

The Lower Fall Creek Watershed drains approximately 57,800 acres (90 square miles) of rural, suburban, and urban land in Central Indiana (**Figure 2-1**). As shown in **Figure 2-2**, this land includes portions of Madison County, Hamilton County (City of Noblesville, Town of Fishers), Hancock County (Town of McCordsville), and Marion County (City of Indianapolis, City of Lawrence). The Lower Fall Creek Watershed consists of 6 14-digit Hydrologic Unit Code (HUC) watersheds. These include: 05120201110-010, 020, 030, 040, 050, and 060.

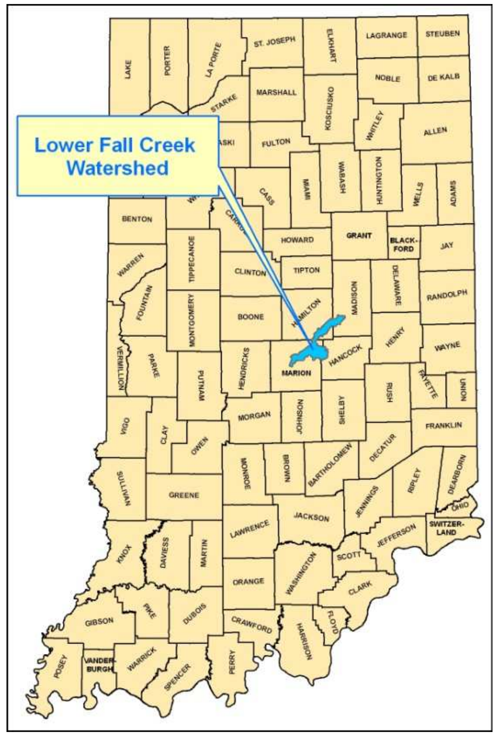


Figure 2-1: Lower Fall Creek Watershed

<u>*Physical Landscape*</u>

Based on current land use data, 38% of the Lower Fall Creek Watershed is in agriculture production followed by 32% low-density residential development, 20% commercial, industrial, and institutional land uses, 6% open space, 2% golf courses and 2% open water. With the exception of Madison County, the existing agricultural land has been zoned for residential, commercial, or industrial development.

There are 44 publicly-owned parks in the Lower Fall Creek Watershed. This accounts for 6% or 3,250 acres of the land use. The largest of these parks is the 1,700-acre Fort Harrison State Park managed by the Indiana Department of Natural Resources (IDNR). The remaining parklands are owned and operated by Indy Parks, Fishers Parks and Recreation Department, and the Lawrence Parks Department. The Fall Creek Watershed is unique in that much of the land along Fall Creek in Marion County is protected as parkland as was the design in the 1909 Indianapolis Park and Boulevard Plan. This area was added to the National Register of Historic Places in 2003. According to the 2004 Indianapolis-Marion County Parks, Recreation & Open Space Master Plan, the intent of the 1909 Park and Boulevard Plan was to "link the city in a network of transportation and recreation corridors that also function to guide urban growth, conserve the natural environment, limit water pollution, and provide flood control".

In addition to the park areas, natural features in the Lower Fall Creek Watershed provide a home for unique plant and animal species. As shown in **Appendix 4,** there are 78 endangered, threatened, or rare plants and animals that have been identified in Hamilton, Hancock, Madison,

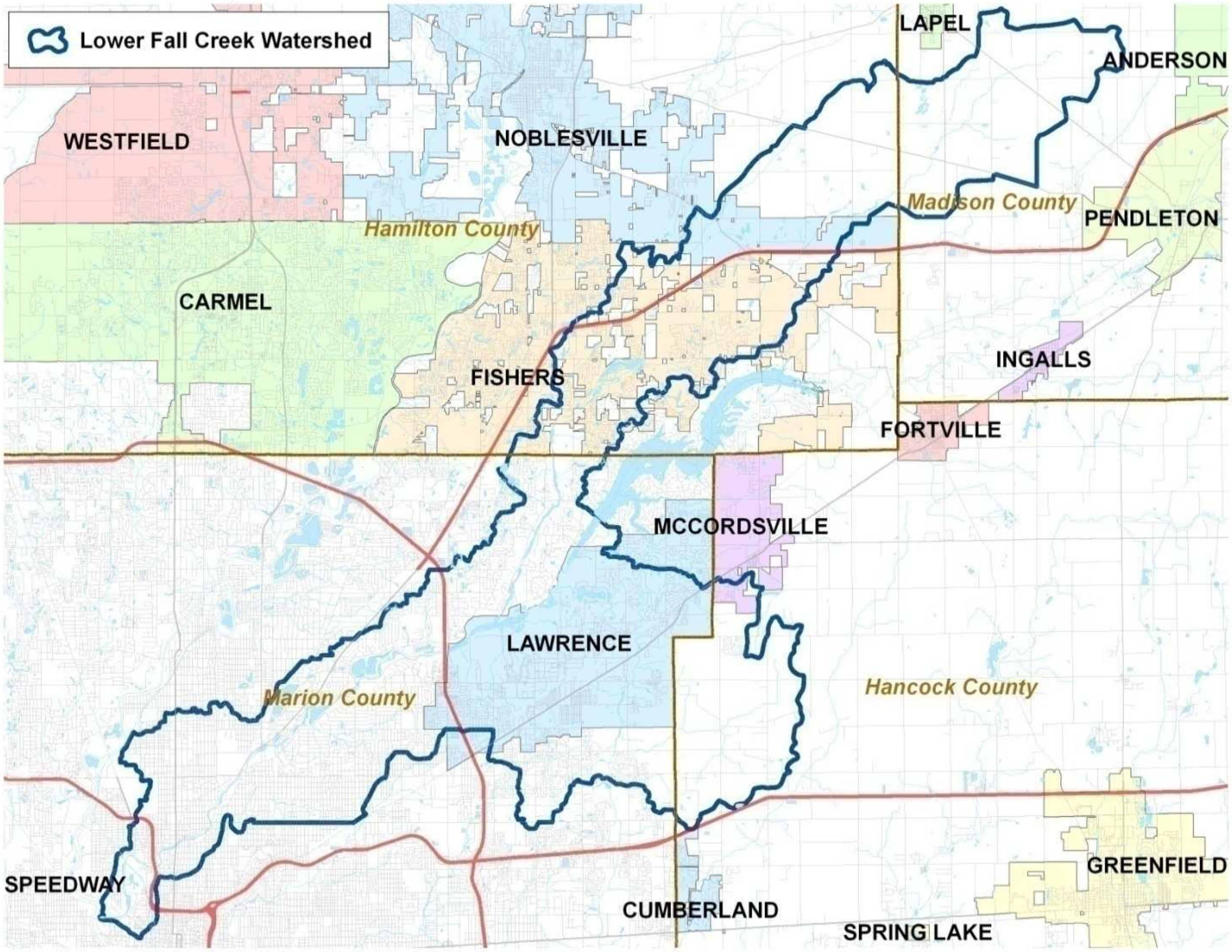


Figure 2-2: Lower Fall Creek Watershed

and Marion Counties. A detailed study to verify whether these plants and animals are located in the Lower Fall Creek Watershed has not been conducted.

The relief and soils of the Lower Fall Creek Watershed were influenced by three glacial periods. As the last of these glaciers retreated, the watershed was scoured to a relatively flat plain with a gently rolling surface, with elevations ranging from approximately 690 to 870 feet above sea level. The more distinctive slopes in the watershed have been formed by the actions of the rivers, streams, and tributaries in the watershed. Some of the greatest relief in the watershed occurs along Fall Creek and Mud Creek in and around the City of Lawrence.

The soils of the Lower Fall Creek Watershed formed from Wisconsin glacial till, glacial outwash, and recently deposited alluvium. According to the Soil Surveys for Hamilton, Hancock, Madison, and Marion Counties, there are 10 predominant soil associations in the Lower Fall Creek Watershed. In the low-lying, floodplain areas, the Genesee-Sloan and Shoals–Genesse associations dominate; whereas in the upland areas, the Crosby-Brookston associations are more prevalent.

There are approximately 126 miles of waterways in the Lower Fall Creek Watershed. These waterways are identified in **Table 2-1** and illustrated in **Exhibit 2-1**. In addition to these waterways there are numerous subsurface drains, storm sewer systems, and other man-made conveyance systems that drain the Lower Fall Creek Watershed.

Within the Lower Fall Creek Watershed there are several lakes and ponds that may also have impacts on the water quality and quantity in the area. These lakes and ponds can have a direct connection to Fall Creek or tributaries via inlets and outlets to and from these water systems. Further, some lakes and ponds were constructed through sand and gravel mining practices and are located in the recharge zones of wellfields utilized to provide drinking water to a high percentage of the population of central Indiana. These lakes and ponds are listed in Table 2-1 and located on Exhibit 2-1; however many are unnamed.

Table 2-1: List of Named Waterbodies

Alexander Hare Drain	George Burke Drain	Mud Creek
Atkinson Creek	Heinrich Ditch	Nancy Kimberlin Drain
Bartholomew Irwin Drain	Henry Ditch	Newton Teter Drain
Bells Run	Henry Ebbert Drain	O'Brien Ditch
Berkshire Creek	Hillcrest Creek	Osborn Ditch
Billings Creek	Hoss Creek	Pistol Run
Blue Creek	Hunter Mitthoefer Ditch	Russell Johnson Drain
Booth and Snead Drain	Indian Branch	Sand Creek
Brave Creek	Indian Creek	Sand Creek Tile Drain
Brian Ditch	Indian Lake	Sarah Morgan Drain
Camp Creek	Indianapolis Water Co. Canal	Schoen Creek
Chime Run	James D. McCarty Drain	Scout Branch
Daniel Heiney Drain	Jay Ditch	Squaw Run
Devon Creek	John Beaver Drain	Stanford Baughm Drain
Dunn Ditch	Kesslerwood Lake (East/West)	Steele Ditch
EE Bennett Drain	Kynett Ditch	Stonebridge Lake
Exit Ten Drain	Laurel Run	TJ Patterson Drain
Fall Creek	Lake Maxinhall	Trittipo Ditch
Field Creek	Margaret Goodwin Drain	Wesley Creek
Fort Branch	Meadows Brook	William McKinstray Drain
Frank Keiser Drain	Minnie Creek	Woollen Run
Garden Run	Mock Creek	

Social Landscape

The Lower Fall Creek Watershed is located in the most populated, and fastest growing, municipalities in Indiana – the City of Indianapolis, Town of Fishers, City of Lawrence, and City of Noblesville. A 2007 Indiana University Kelley School of Business report on the 20 largest cities in 2006, indicated that between 2000 and 2006, the Town of Fishers grew 62.6% (8.1% since 2005), the City of Lawrence grew 7.4% (2.2% since 2005), and the City of Noblesville grew 38.0% (3.3% since 2005). The 2010 growth projections for Hamilton County indicate the county will grow by another 19%, and reach a total population of 298,642. Correspondence with local planning departments confirms that a significant portion of this growth has, and will continue, in the Lower Fall Creek Watershed.

Race and ethnicity vary throughout the Lower Fall Creek Watershed. In the watershed portion of Marion County, 46% of the reporting population is African-American. In comparison, Hamilton, Hancock, and Madison Counties African-Americans account for 3.1%, 1.3%, and 8.1% of each county's respective population. Within the watershed, these populations represent less than 0.5% of the population. Between 1990 and 2000 the Hispanic population has increased between 100% and 200% throughout Marion County and by more than 300% in Hamilton County. However, within the Lower Fall Creek Watershed, the Hispanic population accounts for approximately 2.5% of the population.

As with population and ethnicity, median income and poverty varies throughout the Lower Fall Creek Watershed as well. According to Stats Indiana, Hamilton County had the highest median income ($79,927) and lowest poverty rate (3.9%) in the State followed by Hancock County with a median income of $60,343 (ranked 3rd) and poverty rate of 4.7% (ranked 90th) compared to Marion County's median income of $42,129 (ranked 54th) and poverty rate of 15.2% (ranked 12th) and Madison County's median income of $40,747 (ranked 63rd) and poverty rate of 11.9% (ranked 33rd). **Appendix 5** includes the most recent Stats Indiana profiles for Marion, Hamilton, Madison, and Hancock Counties.

2.2 LAND USE & LAND USE CHANGE

In 2005, the US EPA, with assistance from the American Planning Association (APA) published "Using Smart Growth Techniques as Stormwater Best Management Practices". This landmark publication discusses the nexus between land development patterns and water quality and quantity – especially as it relates to nonpoint source (NPS) pollution. NPS pollution originates when precipitation (rainfall or snowmelt) moves over and through the ground carrying pollutants and then depositing them into lakes, rivers, and aquifers.

Similar studies by the Center for Watershed Protection have illustrated how imperviousness related to land use and land use change can significantly impact water quality. Impervious areas (rooftops, roads, parking lots, driveways, sidewalks, etc.) decrease infiltration and increase the volume and velocity of stormwater runoff. The Center's studies have shown that a stream's ecology begins to degrade with only 10% imperviousness in the watershed. At 25% imperviousness, water quality problems include increases in bacteria concentrations, additions of toxic materials, increases in sediment loads, alterations of water temperature, and reductions in dissolved oxygen concentrations. **Table 2-2** summarizes some of the research completed by the Center for Watershed Protection.

Table 2-2: Impact of Imperviousness on Water Quality

Watershed Imperviousness	Stream Impact	Impact on Water Quality
0-10%	Minimal	Reduced macro invertebrate diversity.
10-15%	Low	Degraded habitat.
15-25%	Medium	Increased pollutant loads, toxic materials, and water temperatures.
25-50%	High	Higher peak flows. Impaired stream chemistry, biology
50%+	Severe	Severe changes in hydrology, hydraulics, morphology, water quality. Few natural attributes remaining.

<u>Specific to the Lower Fall Creek Watershed</u>

Within the Lower Fall Creek Watershed, the continued growth of the Indianapolis Metropolitan Area has greatly influenced land use and land use change. As recent as 50 years ago, the area outside of I-465 was primarily agricultural with some scattered, low-density residential development. However, these areas have, and continue to, rapidly urbanize. The most dramatic change has occurred in the Town of Fishers. As shown in **Figure 2-3** and **Figure 2-4**, almost the entire area in the Lower Fall Creek Watershed has been developed. Thirteen of the 20 fastest growing municipalities in Indiana are in the Indianapolis Metropolitan Area, including the Town of Fishers, the City of Lawrence, and the City of Noblesville in the Lower Fall Creek Watershed.

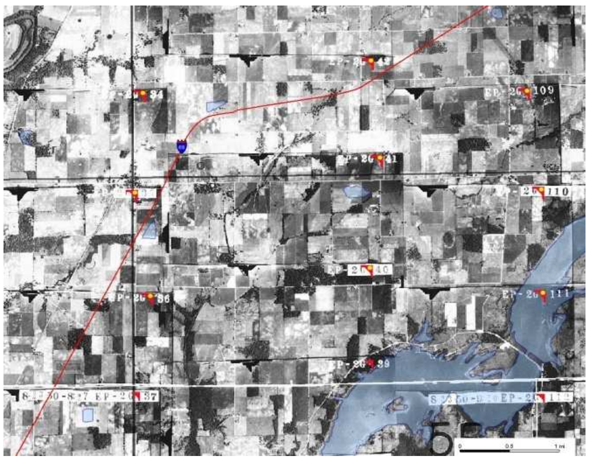


Figure 2-3: Fishers 1950

Figure 2-4: Fishers 2003

Recognizing the recent growth and anticipated continued growth in the Lower Fall Creek Watershed, the Land Use & Economic Development Work Group created a unique land use map that combines similar land uses based on their risk to water quality. Rather than displayiing generic land use classifications such as residential, commercial, industrial, etc., the Work Group combined the land uses in the Lower Fall Creek Watershed into 7 categories:

1. *Agriculture*: Land used for cultivation of crops, pasturage, horticulture, animal husbandry with necessary buildings for housing and storage:
2. *Low-density Residential*: Single family suburban development on ½ acre or larger lots; public water and sewer facilities may or may not be present; large mowed or wooded lots and paved streets connecting individual homes;
3. *Commercial, Industrial, Educational, Medium-to-High Residential*: Subruban and urban development with greater than 75% imperviousness, no NPDES permit; typical of neighborhood commercial districts, general commercial districts, high intensity commercial districts, and commercial-industrial districts; public water and sewer facilities required; single family residential development on ¼ acre lots; multi-family townhouses, condomimiums, and high-rise apartments in proximity to schools and businesses; extensive network of streets, rooftops, parking lots, and on-street parking;
4. *Commercial, Industrial*: development greater than 75% imperviousness, NPDES permit, listed on IDEM's Community Right to Know due to type and quantity of potentially harmful materials stored and handled on-site; includes light, medium, and heavy industry (based on amount of dirt, noise, glare, odor, etc.); large buildings, parking, and depending on use, outdoor storage;
5. *Open Space*: active and passive recreational uses, nature preserves, greenway corridor; limited imperviousness (access road, parking, paths, and park facility); fertilizer application dependent on use;

6. *Golf Courses*: public and private golf course facilities; limited imperviousness (access road, parking, paths, and club house); exentsive fertilizer application to maintain greens; and
7. *Active Construction*: development in progress regulated under IDEM Rule 5 program requiring erosion and sediment control practices .

Exhibit 2-2 illustrates these land use categories in the Lower Fall Creek Watershed.

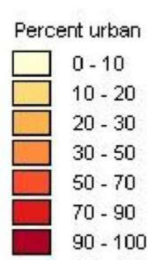
In an effort to address how the land uses in the Lower Fall Creek Watershed were changing, the Land Use & Economic Development Work Group created a Land Use Influences map. This map, shown in Exhibit 2-2, illustrates areas of anticipated growth and development, including the Town of Fishers, the City of Noblesville, and the Town of McCordsville. The Work Group identified 2 significant land use changes including the redevelopment of former commercial and industrial land into Bio Crossroads, at the confluence of Fall Creek and White River and the 700-acre Corporate Campus and Saxony Development at Exit 10 in the City of Novblesville (north of I-69) and Town of Fishers (south of I-69). Other areas of proposed or anticipated land use change include the proposed Technology Park Development at Exit 5 in the Town of Fishers, proposed residential and commercial development of Wayne Township in the City of Noblesville, the proposed airport south of Lapel, the Mt. Comfort Airport in Hancock County, the proposed McCord Square Develpoment in the Town of McCordsville, as well as the influence and proximity of I-69 and I-74 in the Lower Fall Creek Watershed.

Central Indiana Growth Models

In 2003, the Indiana University-Purdue University Indianapolis Center for Urban Policy and the Environment released the Land Use in Central Indiana model (LUCI) for planners, policymakers, and citizens to explore the implications of policy choices and alternative assumptions on future development patterns. According to literature from the Center, LUCI predicts the conversion of non-urban land to urban use, the general development pattern, and the resulting population density through 2040.

The Land Use & Economic Development Work Group used LUCI to predict 2040 land use for 3 growth scenarios:

1) Current Growth Model – maintain current density, limited restriction on sensitive lands, some restrictions on agricultural lands, no urban growth boundaries, current dispersal of development, proximity to existing utilities not required
2) Build-Out Growth Model – decrease density, no restriction on sensitive lands, no restrictions on agricultural lands, no urban growth boundaries, more dispersed development, proximity to existing utilities not required
3) Conservation Growth Model – minimum density, restriction on sensitive lands (wetlands, riparian buffers, steep slopes, forested areas), restrictions on agricultural lands,



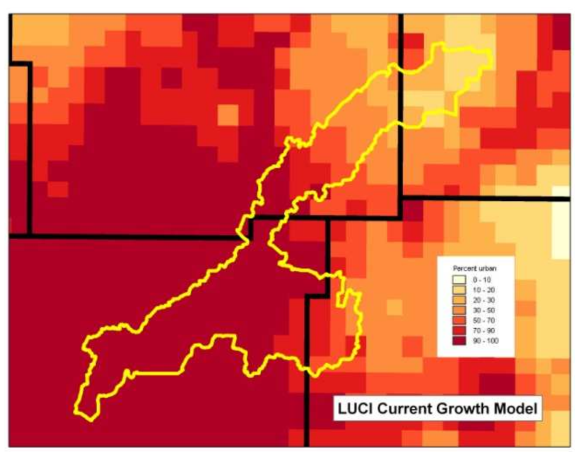


Figure 2-5: LUCI 2040 Current Growth Model

establish an urban growth boundary, less dispersed development, access to existing utilities required

Figure 2-5, **Figure 2-6** and **Figure 2-7** illustrate the result of these 3 growth models. As shown in **Table 2-3**, the percentage of each land use in the Current and the Conservation Growth Models are similar. However, as shown in Figure 2-3 and Figure 2-5, the distribution is very different. Not surprisingly, the Build-Out Growth Model shows an increase in residential, commercial, industrial, and educational development in lieu of agricultural land uses.

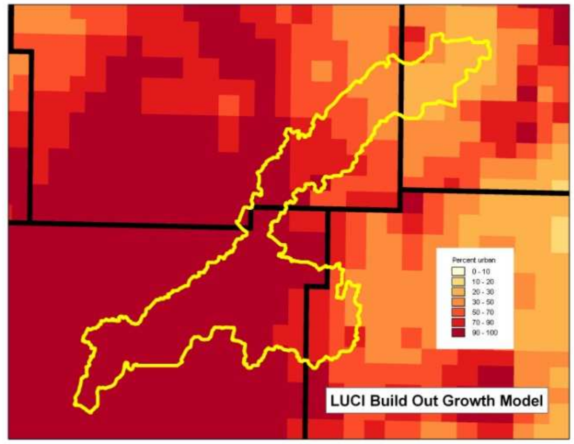


Figure 2-6: LUCI 2040 Build-Out Growth Model

The 2040 land uses from the LUCI growth models were entered into Purdue University's Long-Term Hydrologic Impact Assessment (L-THIA) tool to determine the impact of each scenario on water quality. L-THIA was designed to help community planners, developers, and citizens quantify the impact of land use change on the quantity and quality of water. The following summarizes the results from L-THIA:

- Average Annual Runoff Volume – increase (10%) in Build-Out Growth Model and 5% increase in urbanized portion of Conservation Growth Model
- Nutrient Loading – significant decrease (74%) in nitrogen and phosphorus in Build-Out Growth Model (eliminated agricultural land uses); slight decrease (2%) in Conservation Growth Model
- Sediment Loading – significant decrease (77%) in suspended solids in Build-Out Growth Model (eliminated agricultural land uses); minimal decrease (0.5%) from Conservation Growth Model
- Pathogen Loading – significant increase (194%) *fecal streptococcus* in Build-Out Growth Model (greatest increases associated with residential land uses); 15% increase in Conservation Growth Model

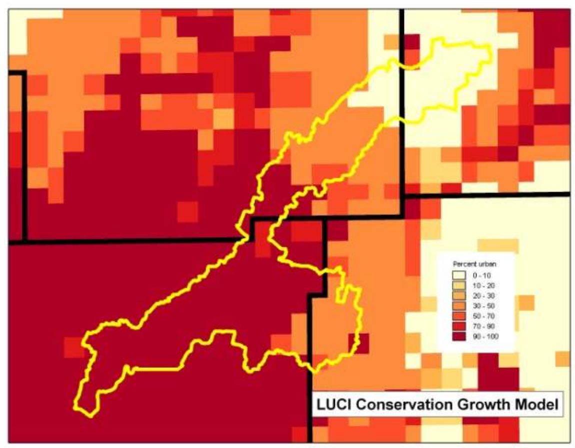


Figure 2-7: LUCI 2040 Conservation Growth Model

Table 2-3: Current and Projected Land Use

Land Use	Local Data & Aerials	LUCI GROWTH MODEL 2040		
		Current	Build-Out	Conservation
Agricultural	38.5%	37.7%	0.0%	31.6%
Low-Density Residential	32.4%	22.5%	49.0%	24.2%
Commercial, Industrial, Educational, Medium to High-Density Residential [1]	19.8%	30.8%	43.4%	35.3%
Commercial, Industrial [2]	0.5%			
Open Space	5.9%	8.9%	7.6%	8.8%
Golf Course	2.3%			
Rule 5	0.6%	NA	NA	NA

[1] greater than 75% imperviousness
[2] greater than 75% imperviousness; NPDES Permit, Community Right to Know

Recommendations & Discussion

The municipalities in the Lower Fall Creek Watershed have invested significant time and resources into developing a Comprehensive Plan and Ordinance(s) that are unique to how they wish to see their community grow and develop in the future. These documents are important in that they determine the location density, and design of development (and redevelopment). However, these documents do not always consider the impact of land use and land use change on water quality (and quantity), causing communities to work harder to meet regulatory requirements such as NPDES Phase II, TMDLs for impaired streams, drinking water standards, compensatory flood storage, and ultimately quality of life.

In 2008, the Center for Watershed Protection published “Managing Stormwater in Your Community”. Chapter 3 of this document is dedicated to the land use planning and water quality/quantity. **Table 2-4** highlights land use planning strategies that should be considered to protect and enhance water resources.

Table 2-4: Land Use Planning Strategies

Watershed Characteristics	Land Use Planning Strategy
Special receiving water	• Overlay zoning and performance standards • Conservation development • Special stormwater criteria • Low impact development
Existing flooding problem	• Overlay zoning and performance standards • Special stormwater criteria • Low impact development • Street design • Fee-in-lieu program
Impaired stream	• Special stormwater criteria • Special use permits for certain uses • Performance standards • Low impact development • Conservation development

(CWP, 2008)

There has been a growing interest of utilizing green infrastructure to filter sediments and pollutants from stormwater before it drains to receiving waters. Many local governments and groups associated with protecting surface water resources have begun to investigate and incorporate Low Impact Development (LID) techniques into their planning and development regulations. LID principles include:

- Minimizing stormwater impacts to the extent practicable through reducing imperviousness, conserving natural resources and ecosystems, maintaining natural drainage courses, reducing use of pipes, and minimizing clearing and grading;
- Providing runoff storage measures dispersed uniformly throughout a site's landscape with the use of a variety of detention, retention, and runoff practices;
- Maintain predevelopment time of concentration by strategically routing flows to maintain travel time and control the discharge; and
- Implementing effective public education programs to encourage property owners to use pollution prevention measures and maintain the on-lot hydrological functional landscape management practices.

2.3 RELATIONSHIP OF GROUNDWATER & SURFACE WATER

Groundwater Concerns

Groundwater resources and Wellfield Protection Areas (WFPAs) should be an important consideration during the development and implementation of the WMP. A WFPA is the land above and surrounding wells drilled into an aquifer where the water seeps into the ground and recharges the aquifers from which the wells extract water. Typically these WFPAs are divided into two areas of concern, the 1-year and 5-year times of travel. These areas are based on the amount of time needed for groundwater to reach the well.

Under natural hydrologic conditions, a large percentage of stormwater is allowed to infiltrate the soil and recharge the groundwater resources. As indicated in **Figure 2-8** the amount of infiltration and groundwater recharge is diminished as more development and more impervious surface is added to the watershed landscape.

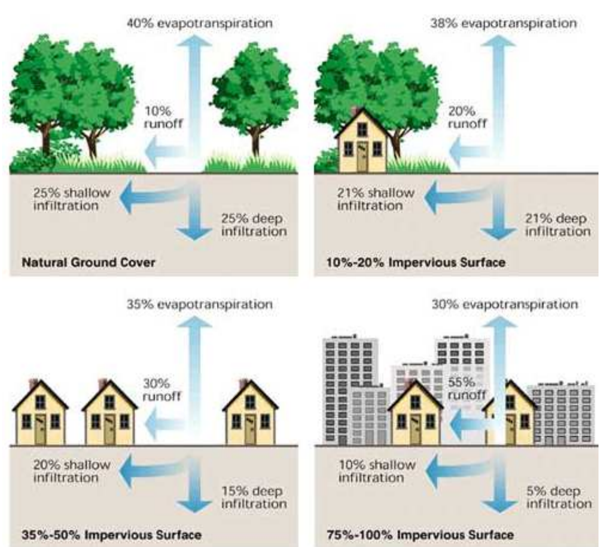


Figure 2-8: Infiltration and Imperviousness

Within central Indiana, some of the most productive aquifers follow the major river systems of White River, Eagle Creek, and Fall Creek. With this in mind, it is very important to know if a stream or river is a gaining stream or a losing stream. In **Figure 2-9**, the top illustration indicates how the gaining stream is fed by groundwater resources. This provides the base flow for this stream. In the bottom illustration, the losing stream provides groundwater recharge as water is lost from the stream into the water table.

If streams and rivers are losing streams, the potential for groundwater contamination is greater and planning efforts should account for this increased risk. Unfortunately, within the Lower Fall Creek Watershed, this information is not readily available. It is not known at this time if Fall Creek and its tributary streams are gaining or losing streams. Hydrologic information, especially as it pertains to drinking water sources, has become sensitive information and is not readily shared between agencies and offices.

Primary pollutants of concern regarding WFPAs include:

- Nutrients – especially nitrates in cool, wet weather due to reduced de-nitrification, volatilization, limited microbial action, and plant uptake
- Pesticides – can be in high concentrations in dry flows such as those related to landscape irrigation
- Pathogens – especially near CSO areas
- Metals – Aluminum, Copper, Iron, Lead, and Nickel can be present in stormwater runoff
- Salts – Ice prevention and removal treatments can cause high concentrations in snow melt and runoff
- Pharmaceutical & Personal Care Products – recent studies have shown that 93% of USGS Groundwater samples contained low levels of steroids, nonprescription drugs, and/or insect repellants.

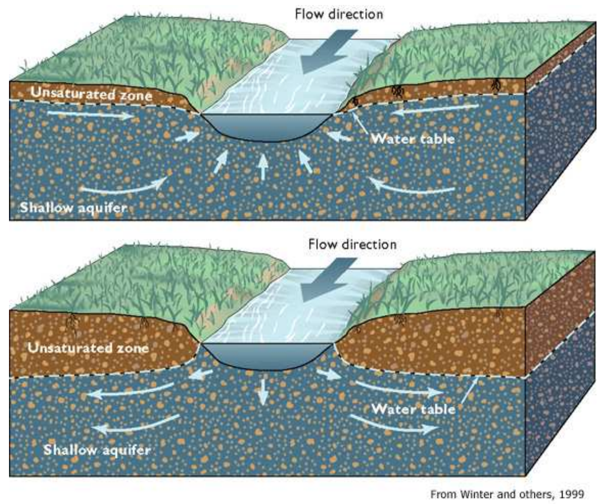


Figure 2-9: Gaining (top) and Losing (bottom) Streams

Specific to the Lower Fall Creek Watershed

In the Lower Fall Creek Watershed, approximately 25% of the watershed is designated as a WFPA. It is estimated that 20% of the Central Indiana population is serviced by the wells protected by the WFPAs. Rural residents within the Hancock and Madison County portions of the watershed are primarily serviced by private residential wells. The WFPAs within the Lower Fall Creek Watershed are indicated on **Figure 2-10**.

The City of Indianapolis has adopted a Wellfield Protection Zoning Ordinance with zoning classifications W-1 for the 1-year time of travel and W-5 for the 5-year time of travel areas. Within these areas, all new site development plans must be reviewed by a Technically Qualified Person (TQP) to ensure that groundwater resources will be protected and that the facility does not pose and unreasonable risk to the groundwater. Restrictions and requirements to ensure this risk is lowered include connections to sanitary sewers, covering of areas where maintenance will occur, and secondary containment for chemical storage areas.

The Marion County Wellfield Education Corporation (MCWEC) was developed as part of the Wellfield Protection Zoning Ordinance to prevent contamination of the groundwater resource through public awareness and education – targeting pre-existing commercial and industrial businesses in the WFPAs. MCWEC maintains a Potential Source Inventory (PSI) database for each wellfield (a list of existing and potential sources of contamination within the WFPAs which might represent a threat to the public water supply system), visits each facility to discuss groundwater issues, and conducts confidential detailed on-site assessments for interested business owners. Through the efforts of MCWEC, Marion County has been designated as a Groundwater Guardian Community by the National Groundwater Foundation since 1998.

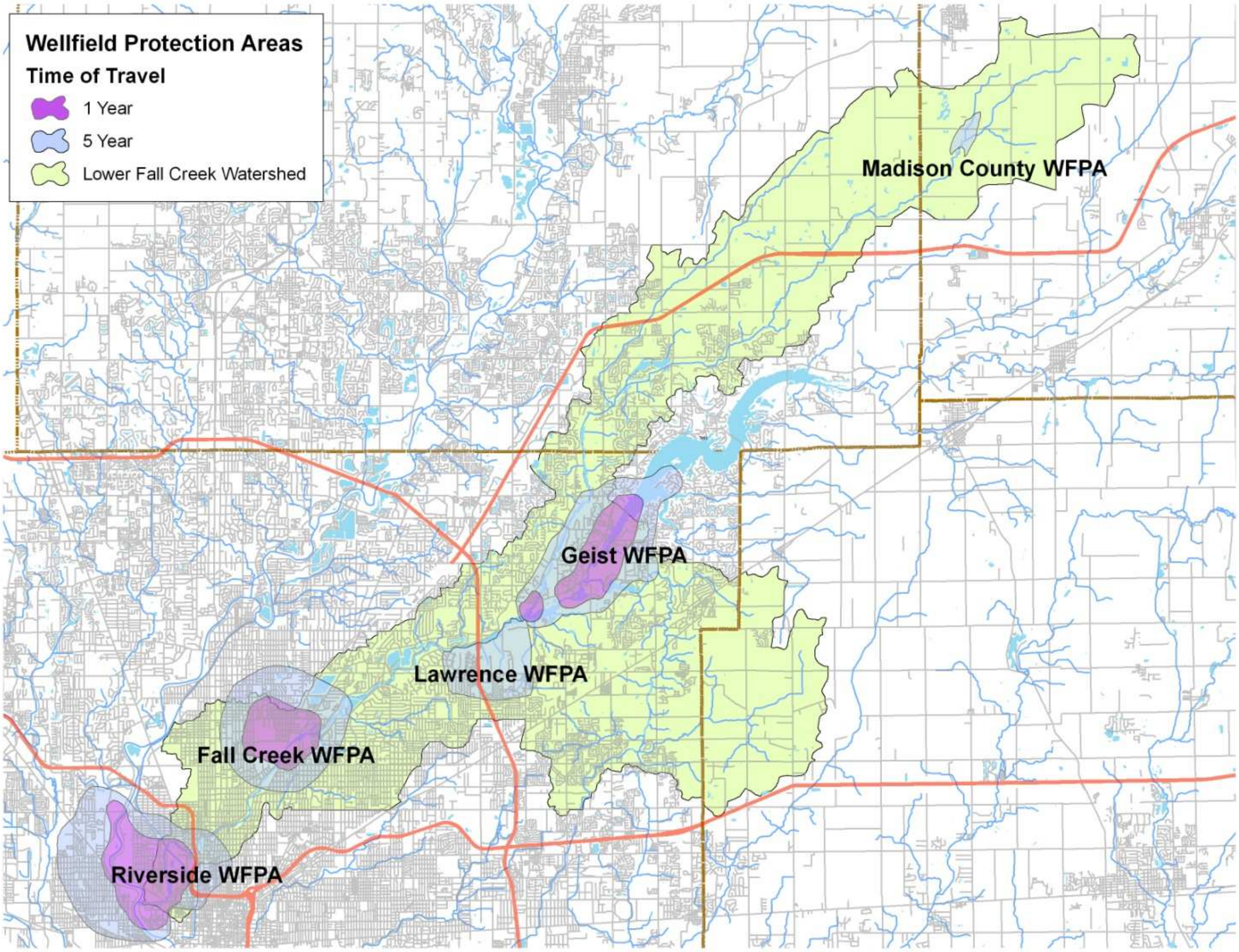


Figure 2-10: Wellfield Protection Areas

According to the PSI database, the Riverside WPFA has 175 facilities with chemicals stored or handled on-site that, if mishandled, could potentially contaminate the groundwater. More than half of these are within the W-1 or 1-year time of travel. MCWEC considers the Riverside WFPA as their highest priority because of the large number and age of the commercial and industrial facilities. The Fall Creek WFPA has 112 facilities (52 in the W-1). The land use of the Fall Creek WFPA has a mix of commercial, industrial, educational, and high-density residential land uses. Further upstream, in the Lawrence and Geist WFPAs, the land use transitions to residential, open space, and some commercial. Both of these wellfields have significantly fewer facilities of concern. Lawrence has 11 active facilities identified on the PSI (none in the W-1) and Geist has 4 facilities listed with 2 in the W-1. The Madison County WFPA is in currently in agriculture production. An ordinance to regulate land uses in this WFPA has not been adopted.

Surface Water Concerns

Veolia Water utilizes surface water from Fall Creek to provide Indianapolis residents with clean, safe drinking water. Real-time water quality sampling takes place near the surface water intake on Fall Creek. These samples are tested for over 90 parameters on a monthly basis. According to Veolia representatives, phosphorus reductions in the ambient surface water in Fall Creek would serve to reduce the treatment efforts and process required to treat the water.

Issues of debris, such as litter and uprooted trees are also a concern, as these can restrict flow and clog intake pipes creating a concern for both water quantity and water quality. Algal blooms, such as those occurring in Geist Reservoir in 2007 and 2008, create taste and odor problems that have affected the drinking water quality for years. To address the algal blooms, remote sensing technologies have been employed to better detect, map, and characterize the blooms which lead to a decrease in the number of taste and odor complaints. Further, by utilizing these technologies, chemicals used to treat algal blooms have decreased from 9,000 pounds to 900 pounds annually. In 2002, Veolia entered into a long-term partnership with the Center for Earth and Environmental Science at IUPUI to conduct applied research targeted at both protecting and improving water quality.

Recommendations and Discussion

LID techniques can be important to protecting surface water quality and may be utilized to protect groundwater quality as well. However, infiltration techniques such as vegetated swales, bio-retention areas, and porous pavements on commercial or industrial properties within the WFPAs may pose a threat to groundwater resources.

Therefore within the 1-year time of travel, it may be best to limit infiltration practices such as vegetated swales and small bio-retention areas to residential or other low intensity land uses. Demonstration BMPs such as these may be placed on individual residential lots, in common areas throughout neighborhoods, or in open areas on school properties. School properties may provide the best partnership opportunity as BMPs such as vegetated swales, rain gardens, or small bio-retention facilities can be utilized for educational purposes as well and these properties typically allow for high accessibility and visibility. Within the 5-year time of travel, infiltration practices may also be utilized on smaller commercial properties and higher intensity residential facilities, such as multi-family dwellings and apartment complexes.

2.4 FLOODING & FLOODING IMPACTS

Flooding is defined as an inundation of land by the rise and overflow of a body of water caused by heavy rainfall and/or melting ice and snow, increased imperviousness, floodplain encroachment, deforestation, stream obstruction, or failure of a flood control structure. Flooding can result in widespread impacts in both rural and urban areas. Impacts of flooding include: damage to property and inventory; damage to utilities/disruption of service; impassible roads and bridges; injuries, fatalities, mental/physical stress; degradation of water quality; and channel/riparian modification.

Floodplains are lands adjacent to streams, rivers, and creeks that combine to form a complex, dynamic physical and biological system. When portions of floodplains are preserved in (or restored to) their natural state, they provide many benefits to both human and natural systems. Floodplains can provide temporary storage for floodwaters, provide ideal settings for wetlands, improve water quality, offer green space that can be used as buffers, greenways or other functions, and provide important habitat for wildlife.

Flooding can be expected to occur in the floodplain or Special Flood Hazard Area (SFHA). **Figure 2-11** illustrates a plan view and cross section of a floodplain.

The terms are defined as:

- Floodway – essential part of stream conveyance system. It includes the stream channel plus adjacent floodplain area.
- Floodway Fringe – the area subject to flooding by the regulatory or base flood. The regulatory or base flood is defined as an area with a 1% or greater annual probability of flooding also known as the 100-year flood.

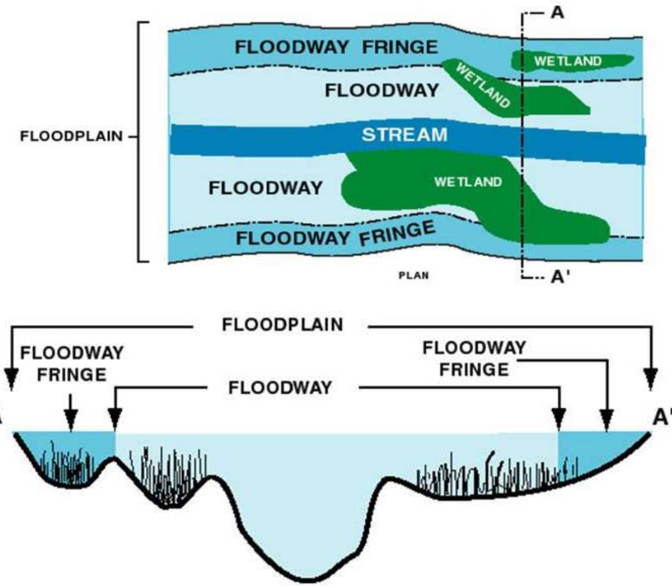


Figure 2-11: Floodplain Areas

Flooding may also occur outside of the floodplain area as a result of increased urbanization relying on antiquated or undersized drainage systems that are unable to deal with the increase volume and velocity of stormwater. The increased volume and velocity of water can be detrimental to receiving streams resulting in severe erosion, scouring, and undercutting of streambanks and ultimately loss of aquatic and terrestrial habitat. Runoff associated with floodwaters may carry extremely toxic substances such as gasoline, oil, and pesticides that results in downstream deterioration of water quality.

Specific to the Lower Fall Creek Watershed

According to FEMA's most recent Flood Insurance Rating Maps (FIRMs), Fall Creek, Grassy Creek, Mud Creek, and Sand Creek are the only waterways that have been studied in detail and base flood elevations have been determined (**Figure 2-12**). The remaining waterways are unstudied or classified as Unnumbered Zone a streams which means the base flood elevations have only been approximated.

In the Lower Fall Creek Watershed, development in the floodplain is regulated through local Floodplain Ordinances. Each local ordinance is based on the State of Indiana Model Floodplain Ordinance and states that 1) no development in the SFHA shall create a damaging or potentially damaging increase in flood heights or velocity or threat to public health and safety and 2) all buildings to be located in the SFHA shall be protected from flood damage below the flood protection grade (elevation of the regulatory flood plus 2 feet at any given location in the SFHA). The City of Indianapolis (includes City of Lawrence), City of Noblesville, Town of Fishers, Hamilton County, and Hancock County all participate in the Community Rating System (CRS) of the National Flood Insurance Program (NFIP). This program provides reduced flood insurance premiums to participating communities that go above and beyond the minimum NFIP requirements.

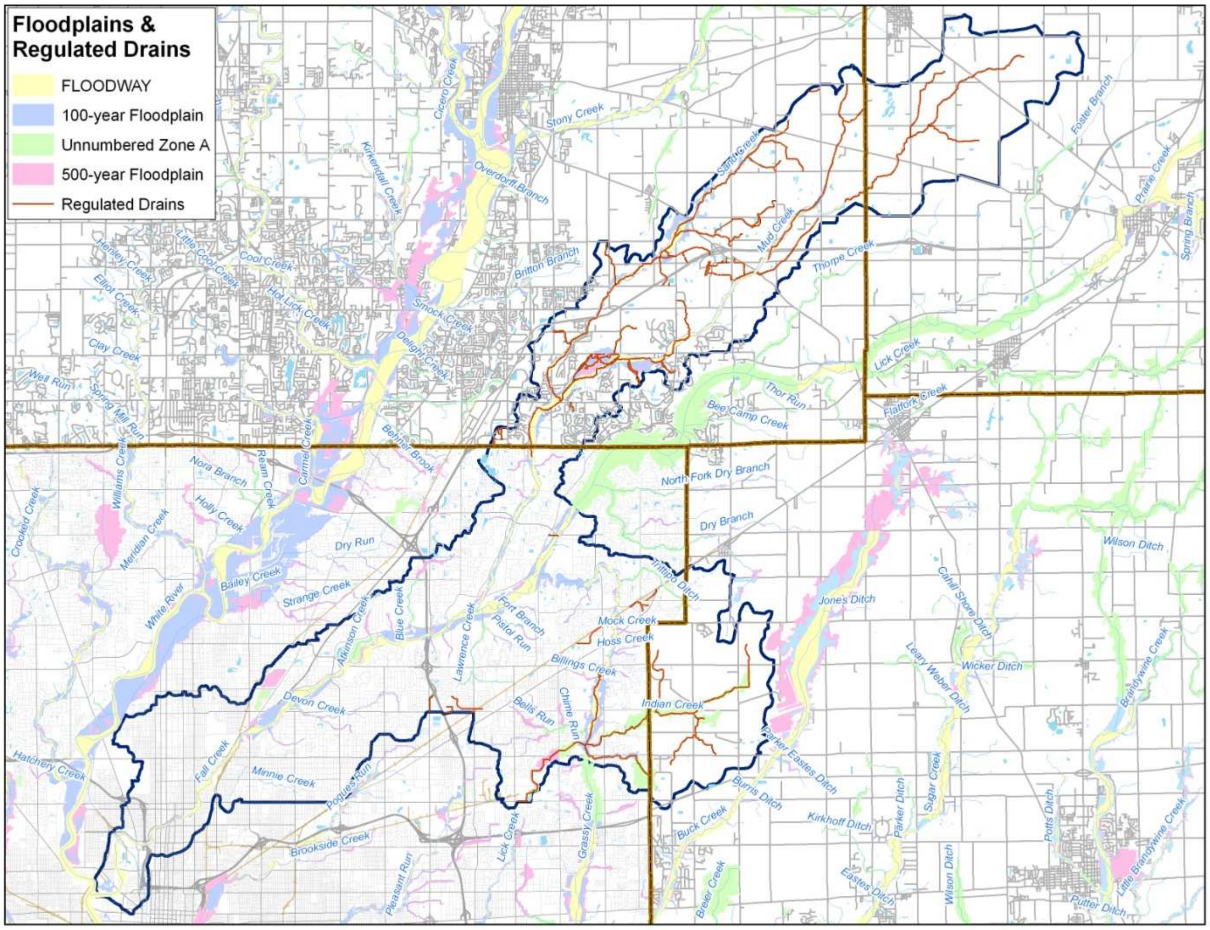


Figure 2-12: Floodplains and Regulated Drains

Hamilton County, Town of Fishers, City of Noblesville, Town of McCordsville, and Hancock County have each adopted Stormwater Management Ordinances that includes a No Net Loss Floodplain/Compensatory Storage Policy. This policy is above and beyond the minimum Floodplain Ordinance requirements. Compensatory storage is required when a portion of the floodplain is filled, occupied by a structure, or when as a result of a project a change in the channel hydraulics occurs that reduces the existing available floodplain storage. Compensatory storage should be located adjacent or opposite the placement of the fill and maintain an unimpeded connection to an adjoining floodplain area.

Maintenance of waterways, including clearing fallen trees, log jams, and debris is essential to maintaining stream flow during high water and reduce flooding. Approximately 60% of the waterways in the Lower Fall Creek Watershed are regulated drains. A regulated drain can be an agricultural drain, urban storm sewer, or open ditch. As shown in Figure 2-12, these are primarily located in Hamilton, Madison, and Hancock County and under the jurisdiction of the local Drainage Board. In Marion County, the City of Indianapolis DPW is responsible for regulated drains. Land owners within the drainage area of a regulated drain pay for maintenance and reconstruction based on an assessment process. Maintenance of non-regulated drains is the responsibility of adjacent landowners. The SWCD in each county and the IDNR Division of Water is able to provide some guidance on stream maintenance to individual landowners.

Flood complaints are tracked and addressed in each county by the Surveyor's Office, Indianapolis DPW, and SWCDs. In the Lower Fall Creek Watershed, there have been few flood complaints in the headwaters in Madison County and Hamilton County. In Hancock County, flood complaints have been documented by residents along the Trittipo Ditch. In Marion County, flood complaints are tracked through the Mayor's Action Center.

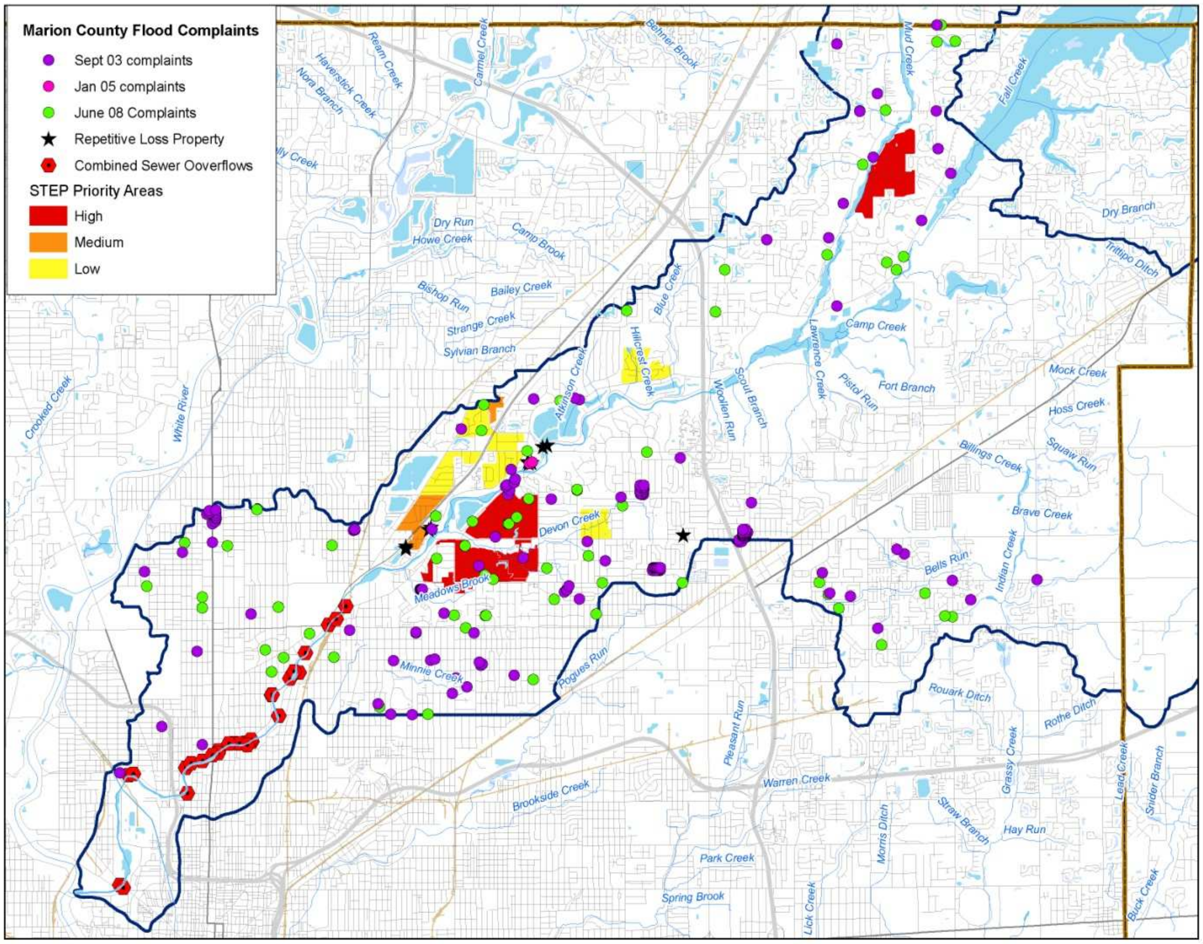


Figure 2-13: Flood Complaints

Figure 2-13 illustrates flood complaints in the Lower Fall Creek Watershed during the last 3 significant rain events: September 1, 2003, January 3, 2005, and June 7, 2008. A number of flood complaints were received outside of the regulatory floodplain and were attributed to the storm sewers, open ditches, and small tributaries. These systems were trying to convey larger volumes of water from more impervious area than they are typically designed for. Flood complaints were also documented in priority Septic Tank Elimination Program (STEP) areas of the Lower Fall Creek Watershed. During a flood or heavy rainstorm, excessive water can accumulate in the leach field and cause the septic system to become sluggish, back up, or stop functioning. Raw sewage may accumulate on the ground or get washed into receiving waters and result in long-term water quality problems.

Recommendations and Discussion

The impacts of flooding and flood-related losses can be greatly reduced through better design and planning. LID has been discussed as a method to improve water quality and reduce flood storage areas (for smaller rain events only). **Figure 2-14** (top) illustrates a typical stormwater management practice of draining the entire site to a single pond and a large volume of water leaving the site. The bottom of Figure 2-14 shows the LID technique that uses small stormwater infiltration and retention facilities distributed throughout the site to capture rainfall and reduce the volume of water leaving the site. This technique reduces the volume and velocity of water to conveyance systems (storm sewers, open ditches) as well as improving the water quality that does make its way to the receiving waters.

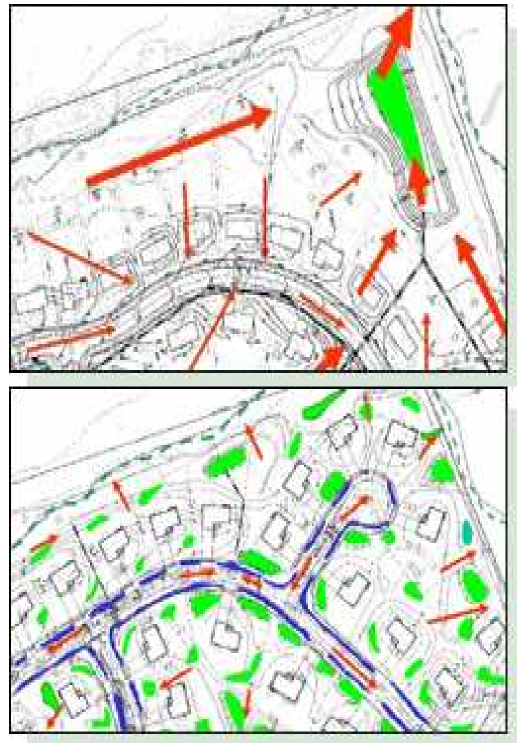


Figure 2-14: Low Impact Development

Although flooding complaints along the regulated drains have been minimal, these conveyance systems could be modified into 2-stage ditches to store and filter floodwater in the headwaters of the watershed and reduce the impact of flooding in the downstream urban areas.

Flood-related losses could be reduced by understanding actual flood depths along unstudied or unnumbered Zone A streams. This would ensure that new buildings are elevated above the regulatory floodplain and existing structures could be protected from flood damage. Flood-related losses could also be reduced through improved flood warning systems like additional stream gages on Mud Creek (Hamilton County) and Indian Creek (Hancock County). This will become increasingly important to the City of Indianapolis and the City of Lawrence as the upstream communities of the City of Noblesville, Town of Fishers, and Town of McCordsville continue to grow and less land is available to retain floodwaters.

Many of these issues are further detailed and potential mitigation measures are included in existing plans developed such as the Multi-Hazard Mitigation Plans developed for each of the 4 counties, the City of Indianapolis Flood Response Plan, and the Community Rating System (CRS) programs developed by Hamilton County, Hancock County, the City of Indianapolis, and the City of Noblesville.

3.0 WATER QUALITY PROBLEMS, CAUSES & SOURCES

As part of the watershed planning process, an inventory and assessment of the watershed and existing water quality studies relevant to the watershed was conducted. Examination of previous work showed that data already gathered is sufficient for determining the magnitude and extent of water quality conditions, or may indicate that additional studies are needed to characterize the water quality problems. Once analysis of these studies was completed, water quality problems and links to pollution sources in the watershed could be determined. The following section provides a summary of water quality assessments, identifies pollutants of concern, links pollutants with potential sources, estimates existing pollutant loads, and concludes by establishing problem statements for the Lower Fall Creek Watershed.

3.1 STAKEHOLDER CONCERNS

Individuals living and working in the Lower Fall Creek Watershed have proven to have a wealth of knowledge as it relates to water quality, water quantity, and other natural resource issues in the watershed. Listed in **Table 3-1** are water quality issues of concern that were identified by Lower Fall Creek Watershed stakeholders.

Table 3-1: Stakeholder Concerns

Pollutant	Concern
Sediment	Lack of erosion control on construction sites
	Streambank erosion (lack of buffers)
	Tillage practices
Nutrients	Commercial and residential fertilizer application
	Inadequately functioning septic systems
	Combined Sewer Overflow's
Pathogens	Inadequately functioning septic systems
	Illicit storm sewer connections
	Waterfowl near waterways and retention ponds (Wildlife)
	Stormwater Runoff
	Combined Sewer Overflow's
	Livestock and Manure Management
	Indiana State Fairgrounds
Other	Invasive species
	Herbicide and pesticide applications
	Localized drainage and flooding problems
	Growth and Development
	Groundwater/Drinking Water Sources

3.2 WATER QUALITY BASELINE STUDIES

In addition to stakeholder input, a wide variety of water quality information was evaluated in order to ensure that the planning process considered the best available water quality information relevant to the Lower Fall Creek Watershed. Within this section, a summary of baseline water quality studies completed within the Lower Fall Creek Watershed is provided. In order to better compare water quality data, a suite of parameters and parameter benchmarks were identified to conduct water quality evaluations. **Table 3-2** identifies the water quality parameters and benchmarks that were chosen for the Lower Fall Creek Watershed. In many cases, water quality data is presented by 14-digit subwatershed (**Figure 3-1**).

Table 3-2: Water Quality Benchmarks

Parameter	Benchmark	Source
Dissolved Oxygen (DO)	4.0 mg/L	State Water Quality Standard
E. coli	125 CFU/100ml (5-week Geometric Mean) or 235 CFU/100ml (single grab sample)	State Water Quality Standard
Fecal coliform	200 colonies/100ml	EPA Recommendation
Nitrogen	10 mg/L	Indiana TMDL Guideline
Total Phosphorus	0.076 mg/L	EPA Recommendation
Atrazine	3.0 ppb	Drinking Water Standard
TSS	80 mg/L	IDEM Correspondence
Turbidity	10.4 NTU	EPA Recommendation

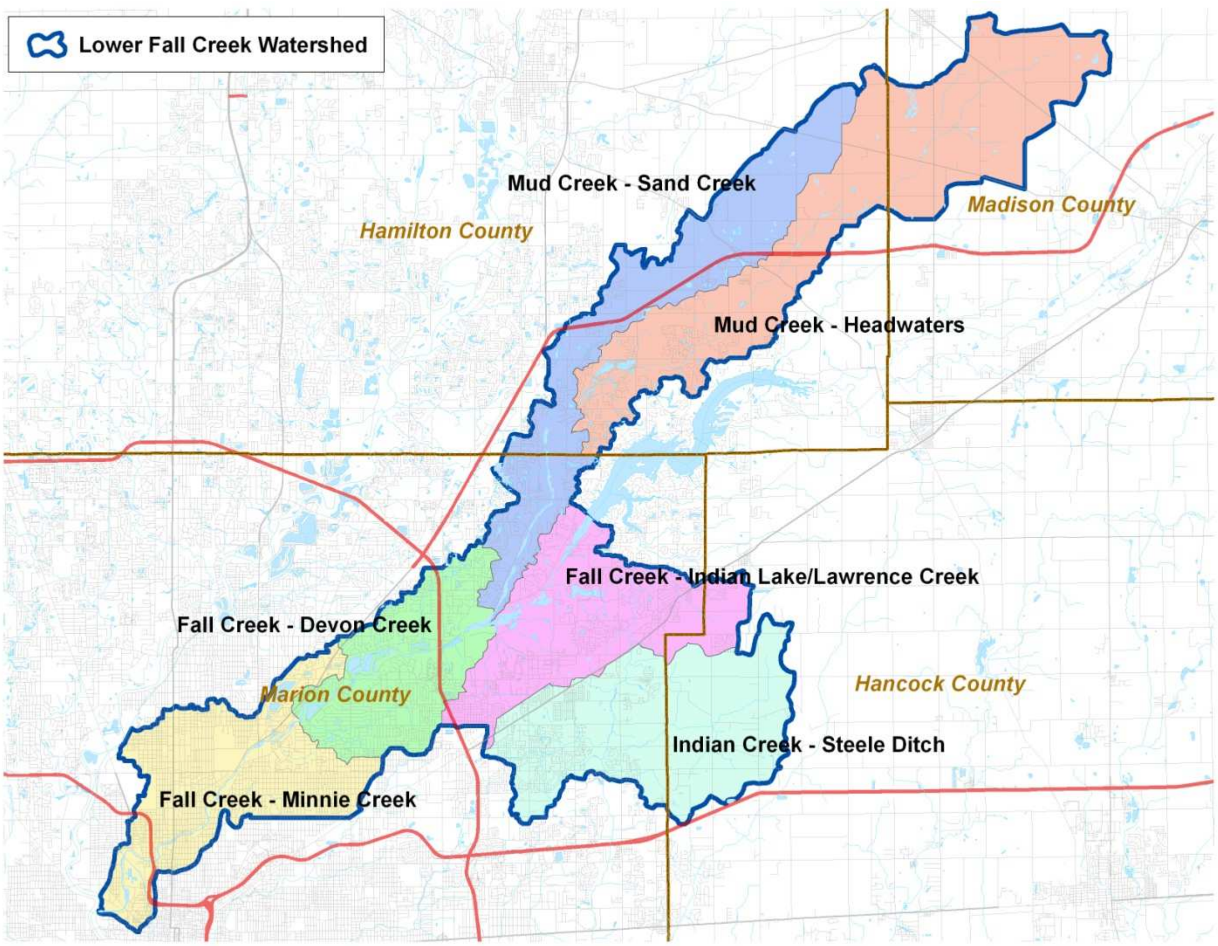


Figure 3-1: 14-digit Subwatersheds

Integrated Water Monitoring and Assessment

The Indiana Department of Environmental Management (IDEM) is the primary agency involved in surface water quality monitoring and assessment in the State of Indiana. In conjunction with the requirements of the Clean Water Act and the State's goals for protecting its natural and recreational resources, the IDEM operates several monitoring programs designed to monitor and assess the chemical, physical, and biological conditions of Indiana's rivers, streams, and lakes.

The IDEM's Office of Water Quality's Integrated Water Monitoring and Assessment strategy is designed to describe the overall environmental quality of each major river basin in the state and to identify monitored water bodies that do not fully support designated uses. All IDEM water quality data is evaluated by IDEM's 305(b) Coordinator and interpreted for each 14-digit HUC subwatershed. Each subwatershed is given a water quality rating relative to its streams status in meeting Indiana's Water Quality Standards (WQS). WQS are set at levels necessary for protecting a waterway's designated uses, such as swimmable, fishable, or drinkable. Each subwatershed is given a rating of its designated uses. **Table 3-3** below identifies known impairments of the Lower Fall Creek Watershed according to the 2008 Integrated Water Monitoring Assessment report.

Table 3-3: 2008 305(b) Report

Waterbody Name	Impairment
Fall Creek - Lawrence Creek (05120201110020)	PCBs in fish tissue
Fall Creek - Devon Creek (05120201110050)	PCBs in fish tissue
Fall Creek - Minnie Creek (05120201110060)	*E. coli* Mercury in fish tissue PCBs in fish tissue

(IDEM, 2006)

Based on the Integrated Water Monitoring and Assessment Report the following conclusions have been drawn:

- The *E. coli* water quality standard is consistently exceeded along Fall Creek in the Fall Creek – Minnie Creek Subwatershed.
- PCBs and Mercury concentrations are elevated along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.
- Lead levels are elevated along Fall Creek in the Fall Creek - Minnie Creek Subwatershed.

2008 303(d) List of Impaired Waters

Chapter 303(d) of the Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards. States are also required to develop a priority ranking for these waters, taking into account the severity of the pollution and the designated use of the waters. Once this listing and ranking of waters is completed, States are required to develop Total Maximum Daily Loads (TMDL) for these waters in order to achieve water quality standards. As shown in **Table 3-4,** 5 waterbodies within the Lower Fall Creek Watershed are listed on the 2008 303(d) List of Impaired Waters.

Table 3-4: 2008 303(d) Impaired Waters

Waterbody Name	Impairments
Fall Creek	PCBs
Minnie Creek Tributaries	*E. coli,* Mercury, PCBs
Devon Creek	PCBs

(IDEM, 2008)

Based on the List of Impaired Waters the following conclusions have been drawn:

- The *E. coli* water quality standard is consistently exceeded along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.
- PCB and Mercury levels are elevated from the Geist Reservoir Spillway to the confluence of White River.

Fish Consumption Advisory (FCA)

Each year since 1972, three agencies have collaborated to create the Indiana Fish Consumption Advisory. These agencies include the Indiana Department of Environmental Management (IDEM), the Indiana Department of Natural Resources (IDNR), and the Indiana State Board of Health (ISBH). Each year, members from these agencies meet to discuss the findings of recent fish monitoring data and to develop the statewide fish consumption advisory.

The 2006 advisory is based on levels of PCBs and Mercury found in fish tissue. In each area, samples were taken of bottom-feeding fish, mid-water column feeding fish, and top-feeding fish. Fish tissue samples were analyzed for polychlorinated biphenyls (PCBs), pesticides, and heavy metals. Of those samples, the majority contained at least some Mercury. However, not all fish tissue samples had Mercury at levels considered harmful to human health. **Table 3-5** shows the fish consumption advisories within the Lower Fall Creek Watershed. A Level 3 advisory recommends limiting consumption to one meal per month (12 meals per year) for adults. Women who are pregnant or breast-feeding, women who plan to have children, and children under the age of 15 are under a zero consumption advisory. A Level 4 advisory limits consumption to one meal every 2 months (6 meals per year) for adults. Women who are pregnant or breast-feeding, women who plan to have children, and children under the age of 15 are under a zero consumption advisory. A Level 5 advisory is a zero consumption advisory (Do Not Eat).

Table 3-5: Fish Consumption Advisories

Waterway	Fish Species	Fish Size	Advisory
Fall Creek	Carp	<20 inches	3
		>20 inches	5
	Channel Catfish	<18 inches	3
		18 -20 inches	4
		>20 inches	5
	Large Mouth Bass	14 + inches	3

(ISDH, 2007)

Based on the Fish Consumption Advisory the following conclusions have been drawn:

- Fall Creek is under a fish consumption advisory from the Geist Reservoir Spillway to the confluence with the White River.

Fall Creek TMDL Study

Water quality data has been collected from Fall Creek by numerous state and local entities since 1991. In 1998, the IDEM determined that segments of Fall Creek do not consistently comply with the state's water quality standards for *E. coli* bacteria. As a result, segments of Fall Creek were listed on the 1998 303(d) list and required to have a TMDL evaluation for *E. coli* bacteria. This study was prepared for the City of Indianapolis and for IDEM pursuant to a contract with the State of Indiana. Data collected by several agencies was obtained for the water quality model development. For analysis purposes, Fall Creek was divided into segments. One segment consisted of areas up-stream of all of Indianapolis' Combined Sewer Overflow (CSO) outfalls, and another segment consisted of areas downstream of the most upstream CSO outfall. Fall Creek downstream of Keystone Avenue to the confluence with the White River is the stretch of river considered to be in the CSO area. CSO locations are indicated on **Exhibit 4-3**.

Based on the Fall Creek TMDL the following conclusions have been drawn:

- The *E. coli* water quality standard is consistently exceeded along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.
- A 52% reduction of *E. coli* loadings is needed upstream of the CSO area in order to meet water quality standards.
- A 99.5% reduction of *E. coli* bacteria loadings is needed in the CSO area in order to meet water quality standard.

Stream Reach Characterization and Evaluation Report

In 2002, the City of Indianapolis completed a Stream Reach Characterization Evaluation Report (SRCER) as a component of the CSO Long Term Control Plan. The purpose of the SRCER was to enable the City to undergo technically sound CSO planning by providing baseline water quality information within the City of Indianapolis.

Based on the SRCER the following conclusions have been drawn;

- Dissolved Oxygen (DO) levels are depressed within the Fall Creek Watershed.
- The *E. coli* water quality standard is consistently exceeded along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.
- Biological communities are impaired along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.

NPDES Permitted Facilities

Wastewater point source discharges include municipal (city, town, or county) and industrial wastewater treatment plants and small domestic wastewater treatment systems that may serve schools, commercial offices, residential subdivisions, and individual homes. Stormwater point source discharges include stormwater discharges associated with industrial activities and stormwater discharges from municipal separate storm sewer systems (MS4) operated by municipalities and counties.

Industrial point source dischargers in Indiana must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state. Discharge permits are issued under the NPDES program, which is delegated to DIEM by the US EPA. Within the boundaries of the Lower Fall Creek Watershed, there are 6 active NPDES permitted facilities. These facilities are:

- Indianapolis Water Company – White River
- Indianapolis Water Company – Fall Creek

- Mount Comfort Elementary School
- Peerless Pump
- Indianapolis Water Company – Geist Station
- IH Sewer Corporation (Exit 10)

Department of Public Works – Office of Environmental Services

The City of Indianapolis, Department of Public Works - Office of Environmental Services (DPW) has 3 primary surface water quality monitoring programs relevant to the Lower Fall Creek Watershed. The water quality monitoring programs are primarily used to monitor the success of the City's Stormwater Management and CSO strategies as they are implemented in accordance with State and Federal guidelines. However, this data is very broad based and is relevant and valuable to the Lower Fall Creek Watershed planning process.

DPW's Monthly White River Monitoring Program was implemented in January of 1991 to monitor the ambient quality of surface water passing through Marion County on a long-term basis, specifically in the West Fork of the White River and its tributaries. Currently, DPW is collecting water quality samples at 3 locations within the Lower Fall Creek Watershed as a component of their Monthly White River Monitoring Program: Fall Creek at 16th Street in the Fall Creek - Minnie Creek Subwatershed, Fall Creek at 71st Street in the Fall Creek – Devon Creek Subwatershed, and Fall Creek and Emerson Way in the Fall Creek – Lawrence Creek Subwatershed.

Based on monthly White River sampling data the following conclusions have been drawn:

- The *E. coli* water quality standard is consistently exceeded along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.
- Mean phosphorus concentrations along Fall Creek between Emerson Way and 16th Street are above EPA recommended thresholds.
- Mean nitrogen concentrations are below Indiana TMDL guidelines.
- Mean Total Suspended Solid (TSS) levels are typically below IDEM recommended thresholds.

DPW also conducts a continuous DO monitoring program, which monitors DO concentrations at strategic locations that have the potential for water quality impairment. Monitoring is typically conducted from mid-April/early-May through December. Continuous DO monitoring provides DPW the ability to observe diurnal and long-term patterns of DO changes at specific sites. Currently, Fall Creek at 16th Street in the Fall Creek-Minnie Creek Subwatershed is the only active site within the Lower Fall Creek Watershed

Based on Continuous DO sampling data the following conclusions have been drawn:

- Depressed DO levels and diurnal fluctuations are a concern in the Fall Creek- Minnie Creek Subwatershed.

Marion County Health Department (MCHD)

Historically, Marion County has conducted 4 Water Quality Sampling Programs throughout Marion County, an Ambient Water Quality Program, an Herbicides Program, a Public Access/Recreation Sampling Program, and a Macroinvertebrate Sampling Program.

In January of 1997, MCHD started an ambient sampling project for Fall Creek. This project consisted of 9 sites sampled 5 times per month, with geometric means calculated for each site's *E. coli* data. The purpose of the project was to find non-CSO influences of *E. coli* to Fall Creek. In 1999, the sampling points were adjusted to coincide with the City's CSO projects to help determine their overall impact to water quality, as well as to maintain data for historical comparison and continue working on non-CSO influences.

Presently, 6 sites on Fall Creek are sampled 5 times per month as a component of the ambient program, with geometric means calculated for each site's *E. coli* data. Active ambient sampling sites on Fall Creek are located on Fall Creek at Stadium Drive, Martin Luther King Jr. Street, Illinois Street, Central Avenue, 30th Street, and 39th Street in the Fall Creek–Minnie Creek Subwatershed.

Based on the ambient sampling data the following conclusions have been drawn:
- The *E. coli* water quality standard is consistently violated along Fall Creek within the Fall Creek - Minnie Creek Subwatershed.
- Phosphorus concentrations have typically been below detection limits of laboratory equipment utilized to analyze water quality samples. However, because the EPA recommended phosphorus threshold is lower than laboratory detection limits it is assumed that mean concentrations of phosphorus are at the existing detection limit of 0.19mg/L.
- Mean nitrogen concentrations are below Indiana TMDL guidelines.

In 1995, MCHD started an herbicide monitoring program for Eagle Creek, Fall Creek and White River to evaluate the level of herbicides in Marion County source water. Historically, samples have been collected at 7 sites in the Lower Fall Creek Watershed. Those sites consist of Fall Creek at 79th Street, Indian Creek at Indian Creek Road, Lawrence Creek at Shatner Rd, and Fall Creek at Emerson Way in the Fall Creek - Lawrence Creek Subwatershed, Mud Creek at Fall Creek Road in the Mud Creek - Sand Creek Subwatershed, and Fall Creek at Keystone Avenue in the Fall Creek - Minnie Creek Subwatershed. Currently, samples are only collected from Fall Creek at the Keystone Avenue site.

Based on the Herbicide sampling data the following conclusions have been drawn:
- Mean atrazine levels at Fall Creek and Keystone are above the state water quality standard.
- Phosphorus concentrations have typically been below detection limits of laboratory equipment utilized to analyze water quality samples. However, because the EPA recommended phosphorus threshold is lower than laboratory detection limits it is assumed that mean concentrations of phosphorus are at the existing detection limit of 0.19mg/L.
- Mean nitrogen levels are below Indiana TMDL guidelines.

For many years, the MCHD has collected monthly grab samples for *E. coli* from the major waterways in Marion County during the recreational season (April through October). The purpose of the Recreational sampling program, is to warn people of potentially elevated *E. coli* levels in areas frequented for recreation. Such places are in/or near parks, greenways, canoe launches, schools, and fishing areas. Currently the Health Department is not conducting any public recreation monitoring within the Lower Fall Creek Watershed.

Based on historic recreational season sampling data the following conclusions have been drawn:
- The *E. coli* water quality standard is consistently exceeded along Fall Creek and its tributaries.

In 1998, MCHD completed its first annual collection of benthic macroinvertebrates from streams throughout Marion County. There are many advantages of using benthic macroinvertebrates to assess the quality of a stream. First, monitoring of biological communities is relatively inexpensive in comparison to the cost of assessing chemical or bacterial parameters. It also has minimal detrimental effects on the resident biota. Benthic macroinvertebrates are also good indicators of localized conditions, as many of the animals have limited migration patterns. Sensitive life stages respond quickly to stress while the overall community will respond more slowly. Within the Lower Fall Creek Watershed, the MCHD is actively collecting macroinvertebrate samples on Fall Creek at 16th Street, Central Avenue, and 39th Street in the Fall Creek - Minnie Creek Subwatershed, Emerson Way in the Fall Creek-Devon Creek Subwatershed, and at 79th Street in the Fall Creek – Lawrence Creek Subwatershed.

Based on MCHD macroinvertebrate data the following conclusions have been drawn:

- Biological communities in Fall Creek at Emerson Way are considered to be good under the Hilsenhoff Biological Index (HBI). A score of good is indicative of some organic pollution.
- Biological communities in Fall Creek at 39th Street are considered to be good under the HBI.
- Biological communities in Fall Creek at 79th Street are considered fairly poor under the HBI. A score of fairly poor is indicative of significant organic pollution.
- Biological communities in Fall Creek at Central Avenue are considered fairly poor under the HBI.
- Biological communities in Fall Creek at 16th Street are considered poor under the HBI. A score of poor is indicative of very significant organic pollution.

Mud Creek Bioassessment 2003

During May, June, and October 2003, students from Indiana University Southeast used rapid bioassessment protocols to assess the status of Mud Creek. In particular, the study looked at eight sites located within the Mud Creek Headwaters Subwatershed and the Mud Creek - Sand Creek Subwatershed. Three of those sites, Mud Creek at Atlantic Road, Mud Creek at Olio Road, and Mud Creek at Brook School Avenue, were located in the Mud Creek Headwaters Subwatershed; and five of those sites, Sand Creek near Verizon Wireless Entertainment Complex, Sand Creek at Mud Creek near 106th Street, Mud Creek at 106th Street, Mud Creek at Cumberland Road, and Mud Creek at 96th Street were located in the Mud Creek - Sand Creek Subwatershed.

Based on the Mud Creek Bioassessment the following conclusions have been drawn:

- *Fecal coli form* concentrations in Mud Creek and Sand Creek are exceeding EPA recommended thresholds.
- Phosphorus concentrations in Mud Creek and Sand Creek are exceeding EPA recommended thresholds.
- Nitrogen concentrations in Mud Creek and Sand Creek are below Indiana TMDL guidelines.
- Turbidity levels (NTU) in Mud Creek and Sand Creek are exceeding EPA recommended reference conditions.
- Macroinvertebrate communities in Mud Creek and Sand Creek are classified as slightly impaired.
- Habitat in Mud Creek and Sand Creek is classified as slightly impaired.

1991 – 2005 Fixed Station Water Quality Results

Under IDEM's Fixed Station Water Quality Monitoring Program, IDEM scientists collect water samples and field analytical data every month from 160 sampling sites at selected rivers, streams, and lakes throughout the state. This program has been collecting water quality samples from two sites within the Lower Fall Creek Watershed since February of 1991. The first site is located on Fall Creek at Keystone Avenue in the Fall Creek - Minnie Creek Subwatershed; the second site is also located on Fall Creek in the Fall Creek - Minnie Creek Subwatershed, but further downstream at Stadium Drive.

Based on Fixed Station sampling data, the following conclusions have been drawn:

- The *E. coli* water quality standard is consistently exceeded along Fall Creek from the Geist Reservoir Spillway to the confluence of the White River.
- Mean phosphorus concentrations on Fall Creek at Stadium Drive area above EPA recommended thresholds.
- Mean nitrogen concentrations are below Indiana TMDL guidelines.
- Mean Total Suspended Solid (TSS) levels are typically below IDEM recommended thresholds.

Lower Fall Creek IUPUI Assessment 2007

In October of 2007 two IUPUI students completed Citizen Qualitative Habitat Evaluation Index (CQHEI) assessment sheets at 16 specified locations (**Figure 3-2**) within the upper reaches of the Lower Fall Creek Watershed.

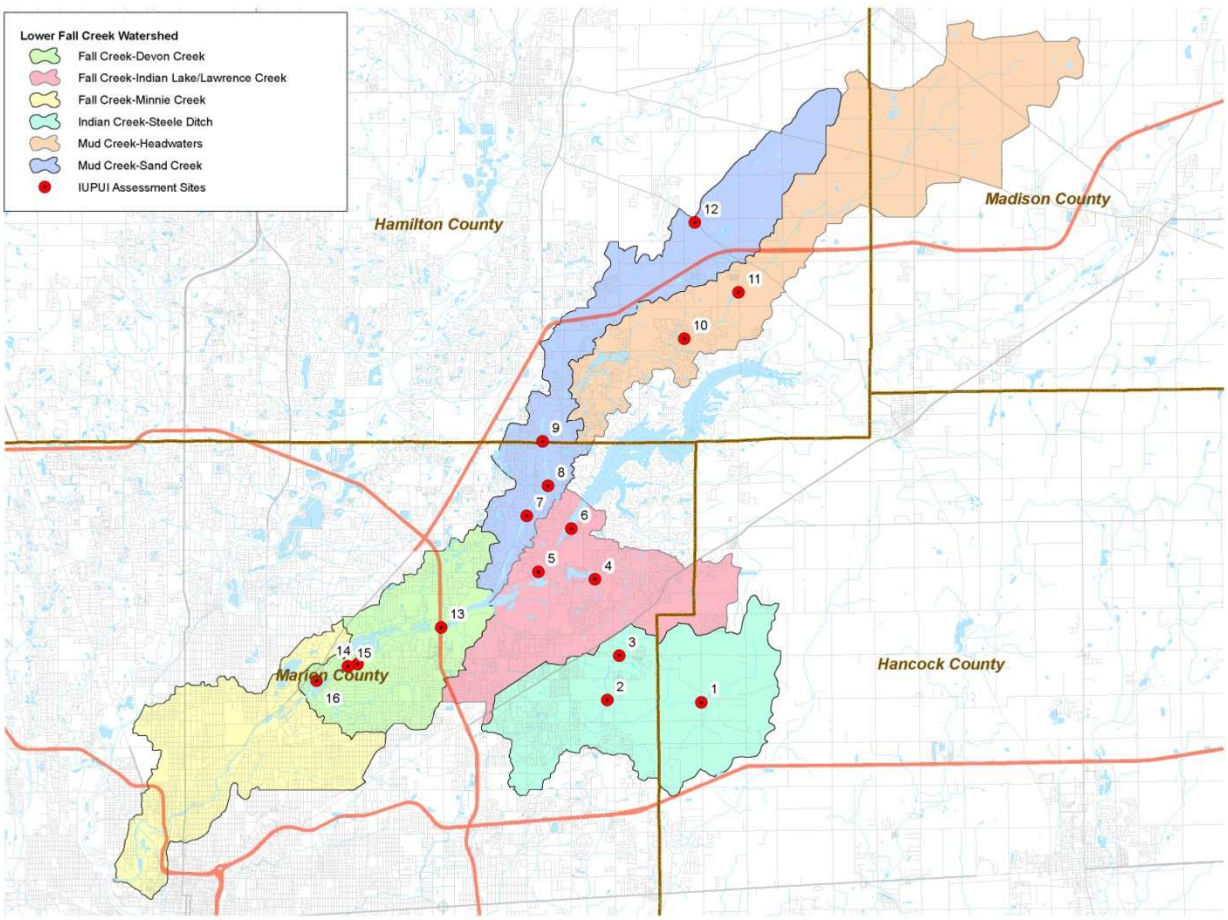


Figure 3-2: IUPUI Assessment Sites

The CQHEI was developed by the Ohio EPA to provide a measure of the stream habitat and riparian health that generally corresponds to physical factors affecting fish and other aquatic life. The CQHEI produces a total score, with a maximum of 114, which can be utilized to compare changes at one site over time or to compare 2 different sites. Further, Ohio EPA has determined that "CQHEI scores > 60 have been found to be generally conducive to the existence of warmwater fauna".

Parameter sections are given an individual score and the total of those sections is the overall site score.

Parameters that are evaluated include:

- Substrate (bottom type)
- Fish Cover (hiding places)
- Stream Shape and Human Alterations
- Stream Forests & Wetlands (Riparian Area) & Erosion
- Depth and Velocity
- Riffles/Runs (areas where current is fast/turbulent, surface may be broken)

Based on CQHEI data the following conclusions have been drawn:

- Of 16 sites, 9 received scores >60 in part due to high scoring Substrate and Stream Forests & Wetlands sections.
- Of those 9 sites receiving > 60, 4 sites received scores >80 and all were along the main stem of Fall Creek.
- Sites 12 and 1, both in the upper reaches of the watershed, received the lower scores of 20 and 34 respectively. Both CQHEI scores indicate a very fine (silt) substrate, stream alterations, and no riffle/run sequences.
- CQHEI scores seemed to generally increase from upstream to downstream throughout the watershed.

<u>Lower Fall Creek Commonwealth Biomonitoring Assessment 2008</u>

As a part of the Lower Fall Creek WMP development, macro-invertebrate sampling and geomorphic assessments were completed by Commonwealth Biomonitoring, Inc. While there have been several studies measuring the chemical water quality throughout the watershed, there is very little data related to the biological water quality. The objectives of this bioassessment were to characterize the biological and physical integrity of Lower Fall Creek and its tributaries and to make recommendations to solve any identified problems. This was accomplished by utilizing the Index of Biotic Integrity (IBI) and the Qualitative Habitat Evaluation Index (QHEI) at 12 sites in the watershed. In addition, Rapid Stream Assessments were completed measuring river corridor encroachments, bank measurements, sinuosity, and bed substrate. **Figure 3-3** identifies the macroinvertebrate sampling locations.

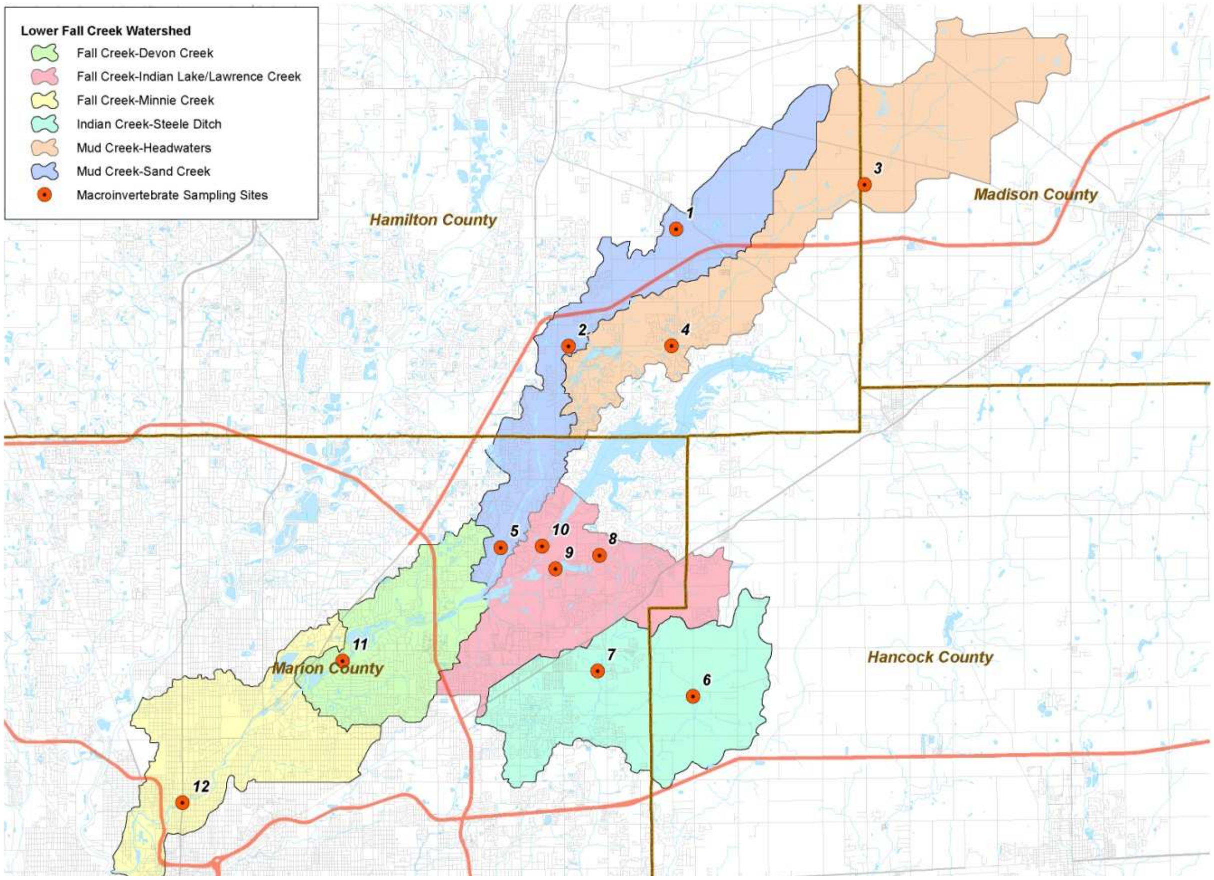


Figure 3-3: Macroinvertebrate Sampling Sites

Based on the findings of the Commonwealth Biomonitoring assessment, the following conclusions have been drawn:

- Heavy silt deposits were observed at all sites within the Indian Creek subwatershed.
- Habitat quality was limited by a lack of in-stream cover and riparian vegetation in the Fall Creek subwatershed.
- While habitat quality at the sites within the Mud Creek subwatershed were reduced by past channelization, it was overall good.
- Sand Creek subwatershed sites had the poorest habitat scores due to heavy silt deposits, unstable substrates, and evidence of recent channelization.

Commonwealth Biomonitoring also provided 4 recommendations as to enhance the overall water quality and macroinvertebrate assemblages within the Lower Fall Creek Watershed. These include:

1. Control inflow of sediment and silt into streams with special emphasis placed on the Indian Lake subwatershed.
2. Investigate status of water quality within Geist Reservoir as it may be impairing biotic integrity downstream in Fall Creek.
3. Enhance habitat by planting riparian vegetation especially upstream of site 6 and downstream of site 12.
4. Avoid future channelization of streams.

A report provided by Commonwealth Biomonitoring, as well as the data collected through the assessment, is located in **Appendix 7.**

<u>Summary of Water Quality Conclusions</u>

Based on the analysis of water quality studies and data, the following quality conclusions have been drawn:

- Bacteria concentrations exceed EPA recommended thresholds and Water Quality Standards throughout the Lower Fall Creek Watershed.
- Phosphorus levels are exceeding EPA recommended thresholds throughout the Lower Fall Creek Watershed.
- Depressed DO levels and diurnal fluctuations are a concern in the Fall Creek- Minnie Creek Subwatershed.
- Biological communities are stressed throughout the Lower Fall Creek Watershed.
- Habitat is degraded within the Mud Creek - Sand Creek and Mud Creek Headwaters Subwatersheds.
- Atrazine concentrations are exceeding the State Water Quality Standard in the Fall Creek – Minnie Creek Subwatershed.
- PCB and Mercury levels are elevated throughout the Lower Fall Creek Watershed.

For the purposes of this planning effort, the focus of the WMP will be placed on reducing sediment, nutrient, and pathogen loadings to the Lower Fall Creek Watershed. These 3 main pollutants were discussed and agreed upon by the Steering Committee and the 3 Working Groups. While TSS levels were typically below IDEM recommended thresholds, the Steering Committee and Working Groups felt that this issue was prevalent throughout the watershed and warranted focus in the WMP.

It was discussed that insufficient data and studies have been collected and completed regarding invasive species, herbicide and pesticide applications and associated water quality problems, as well as localized drainage and flooding problems. While it is known that these issues exist and impact water quality, there is currently not enough data to support water quality conclusions regarding the Lower Fall Creek Watershed.

While the baseline studies mentioned above do not specifically indicate water quality problems associated with sedimentation or elevated levels of TSS, several stakeholders have brought this issue to the discussion. Erosion and sedimentation especially as it relates to streambank destabilization and stormwater runoff were discussed and will therefore be included in this WMP.

It can be anticipated that some of the water quality impacts associated with depressed DO levels, stressed biological communities, and habitat degradation will also be reduced through the potential management measures identified in **Section 5.0** for the purpose of addressing sediment, nutrient, and pathogen loadings. Further, it was determined that while it is important to identify areas affected by, and the water quality impacts associated with, increased Atrazine, PCBs, Lead, and Mercury levels, it is not feasible for the WMP to address these issues. Much of the work associated with Atrazine, PCBs, Lead, and Mercury contamination in streams and rivers needs to be addressed and remediated at the State and Federal levels. In addition, much of the CSO issues and associated *E. coli* loadings will be addressed during the implementation of the City of Indianapolis' LTCP.

3.3 CAUSES AND SOURCES OF POLLUTION

For each pollutant to be addressed within this WMP (sediment, nutrients, and pathogens), potential sources of that pollutant within the Lower Fall Creek Watershed will be discussed in further detail. The Land Use & Economic Development Work Group, in working to create the land use categories for Lower Fall Creek, also developed **Table 3-6** Land Use Categories and Associated Pollutants. This table is designed to highlight land use categories and potential sources of pollutants that are associated with those land use categories.

Table 3-6: Land Use Categories and Associated Pollutants

Land Use Category	Associated Pollutant
1. **Agriculture**	Sediment – tillage practices, streambank erosion from encroachment Nutrients – fertilizer application, livestock and manure management Pathogens – failing septic systems, livestock, wildlife, and manure management
2. **Low-Density Residential**	Sediment – streambank erosion from encroachment and stormwater runoff Nutrients – fertilizer application and failing septic systems Pathogens – failing septic systems, stormwater runoff, domestic pet and wildlife waste
3. **Commercial, Industrial, Educational, Medium-to-High Residential** (without NPDES permit)	Sediment – streambank erosion from encroachment and stormwater runoff Nutrients – fertilizer application, combined sewer overflows Pathogens – stormwater runoff, domestic pet and wildlife waste, combined sewer overflows, illicit stormwater connections
4. Commercial, Industrial (with NPDES permit)	Sediment – streambank erosion from encroachment and stormwater runoff Nutrients – combined sewer overflows Pathogens – stormwater runoff, combined sewer overflows, illicit stormwater connections
5. **Open Space**	Sediment – streambank erosion from encroachment and stormwater runoff Nutrients – fertilizer application Pathogens – stormwater runoff, domestic pet and wildlife waste
6. **Golf Course**	Sediment – streambank erosion from encroachment and stormwater runoff Nutrients – fertilizer application Pathogens – stormwater runoff, wildlife waste
7. **Active Construction**	Sediment – failing erosion and sediment control practices

<u>Sediment</u>

By volume, sediment is the greatest pollutant entering our nation's surface waters. Erosion and sedimentation occur when wind or water runoff carries soil particles from an area, such as a farm field, stream bank, or construction site and transports them to a water body. Within Lower Fall Creek Watershed, sediment loads are anticipated to originate from conventional tillage practices where loosened soils remain exposed to weather, streambank erosion exacerbated by encroachment of activities such as tillage or development, and failing sediment and erosion control practices on active construction sites.

Like nutrients, sediment also impacts fisheries, drinking water supplies, and recreational uses of waterways. By reducing the amount of sunlight reaching aquatic plants, the availability of fish cover and food is greatly reduced, and mating practices are impacted. Sediment also impacts fish communities by covering and filling fish spawning areas and smothering benthic food supplies. Sediment loads also tend to increase drinking water treatment costs and can result in damage to pumps and other water treatment equipment. Finally, sediments impact recreational uses by reducing water clarity, aesthetic value, and sport fishing populations. There are three primary sources of sediment within the Lower Fall Creek Watershed, tillage practices, construction and development, and stream bank erosion.

Tillage Practices

One way to minimize sedimentation and erosion associated with agricultural activities is to implement conservation tillage practices. No-till refers to any direct seeding system, including strip preparation, with minimal soil disturbance. Mulch till refers to any tillage system leaving greater than 30% crop residue cover after planting, excluding no-till. No-till and mulch till are often grouped together into conservation tillage. **Table 3-7** compares various tillage methods utilized within the Lower Fall Creek Watershed.

During various water quality sampling and habitat assessment events it has been noted that turbidity and siltation levels are increased in areas where conventional tillage practices still occur. An increase in conservation tillage practices in the Lower Fall Creek Watershed will likely reduce the loading of fine clay particulates and surface erosion materials that are delivered to adjacent waterways. Water quality impacts associated with conventional tillage practices can be exacerbated when they occur on highly erodible lands (HEL). If not managed properly, HELs can erode at accelerated rates and may lead to excessive soil deposition in waterways. HELs are determined based on slope and other erodibility factors. According to the USDA, the soil of an entire crop field is considered erodible if at least one-third of the field has highly erodible soils. There are approximately 13,500 acres of highly erodible soils within the Lower Fall Creek Watershed (**Exhibit 4-1**). HELs are primarily a concern for erosion associated with agricultural practices.

Table 3-7: Percent of Crop Acres in Conservation Tillage

County	Crop	% No Till (2004)	% Mulch-Till	% Conventional Till	State Rank
Hamilton	Corn	25%	5%	61%	36 of 92 Counties
	Soybeans	74%	74%	8%	21 of 92 Counties
Hancock	Corn	2%	3%	70%	89 of 92 Counties
	Soybeans	47%	22%	10%	73 of 92 Counties
Madison	Corn	11%	2%	81%	63 of 92 Counties
	Soybeans	68%	5%	16%	31 of 92 Counties
Marion	Corn	*No Data*	*No Data*	*No Data*	*No Data*
	Soybeans	*No Data*	*No Data*	*No Data*	*No Data*

(ISDA, 2004)

It is also noted that within the middle reaches of the watershed (Hamilton County), rapid growth and development is converting agricultural lands to other land uses, such as residential and commercial. As this rate of development is one of the highest in Indiana, it is anticipated that agricultural land, and specifically tillage practices, will be of little concern in the near future. In the Madison County portions of the watershed, agriculture remains the primary land use. While growth and development are not occurring as rapidly as in Hamilton County, it is anticipated that eventually this area, especially as the Interstate 69 corridor is developed, will be converted from agricultural land use to commercial, industrial or residential land use. Throughout this time of land use conversion, efforts to reduce the erosion occurring from conventional tillage practices and HELs on agricultural lands will best be led by the individual county SWCDs by utilizing existing federal funding sources through USDA.

Construction and Development Practices

Construction and development practices can also result in excessive sediment loading to local waterways. As stormwater flows over a construction site, it picks up pollutants like sediment, debris, and other pollutants associated with land-disturbing activities. As was the case with tillage practices, when land disturbing activities occur on HELs, sediment loads to local waterways have the potential to increase substantially. Exhibit 4-1 identifies areas of known and potentially HEL classified soils. Exhibit 4-1 paired with Exhibit 2-2 can be used to further highlight areas where growth and development is being planned and where HEL or PHEL classified soils exist, especially in the Mud Creek and Sand Creek subwatersheds.

The NPDES Stormwater Phase I and Phase II programs require operators of construction sites greater than or equal to 1 acre (including smaller sites that are part of a larger common plan of development) to obtain authorization to discharge stormwater under an NPDES construction stormwater permit. Within the Lower Fall Creek Watershed there are several local and state agencies responsible for ensuring local compliance with stormwater requirements. Included among the agencies are the Hamilton, Hancock, Madison, and Marion County SWCDs, the City of Indianapolis DPW, the Hamilton and Hancock County Surveyor's Office, the Fishers Department of Engineering and Public Works, the Noblesville Wastewater Department, the

Lawrence Department of Public Works, the McCordsville Town Engineer, and the IDEM. Despite the number of agencies charged with monitoring erosion and sediment control practices on construction and development sites within the watershed, enforcement efforts tend to be inconsistent, and program resources tend to be underfunded.

Efforts to reduce stormwater runoff and related erosion from construction and development within the Lower Fall Creek Watershed could greatly reduce the sediment loadings to Fall Creek and tributary streams. As continued urbanization and re-development occurs throughout the Lower Fall Creek watershed, practices such as Low Impact Development (LID) and proper erosion control practices during construction could result in a significant reduction in sediment loadings.

Streambank Erosion

Overall streambank erosion is a natural phenomenon. When a stream is healthy, it balances water flow, sediment loads, and its overall shape and energy. However, excessive erosion tends to pollute water supplies, smother aquatic habitat, and threaten property and infrastructure.

Surrounding land use activities have a tremendous impact on the rate at which streambank erosion occurs within a watershed. As development and impervious surface increase in a watershed, so to do stream flow volumes and peak discharges, which accelerate erosion. As impervious areas and developed acres increase, the amount of pervious surfaces and open space uses, such as riparian buffers tend to decrease in the watershed. Riparian buffers are one of the most beneficial types of open space in any watershed. These areas consist of large overstory trees, smaller woody shrubs, and herbaceous groundcover that act as natural barriers against stream bank erosion. However, as riparian vegetation is changed from woody species to annual grasses and/or forbs, which is often the case on development sites, the internal strength of the stream bank is weakened and erosion rates are increased.

Areas where little to no riparian vegetation exists, as in the primarily agricultural areas of Hancock and Madison County portions of the watershed, are considered to be areas of concern regarding sedimentation and potential streambank erosion. This concern is validated by the findings of the 2007 IUPUI Assessment and the 2008 Bio assessment. In both assessments, the sites associated with the most marked erosion are located in the upper reaches of the watershed; in Hamilton and Hancock Counties. Of notable significance is the Hancock County sampling site within the 2008 Bioassessment. At this site, no trees were present and clumps of streambank were slumping into the channel.

Significant streambank erosion problems in more urban areas, such as the Windridge Condominiums site discussed in Chapter 4 have been identified through stakeholder input and the IUPUI Assessment. Several residents and neighbors of Windridge Condominiums expressed deep concern over the magnitude of the erosion and failing of the streambank in that area. Further, the IUPUI assessment indicated undercut banks, downed trees, and a combination of stable and eroding banks in Marion County (sites #14, 15, and 16).

Estimated Existing Sediment Loads

In order to estimate existing sediment loadings, EPA's Spreadsheet Tool for Estimating Pollutant Loads (STEP-L) was utilized. STEP–L employs simple algorithms to calculate nutrient and sediment loads from different land uses and load reductions that would result from the implementation of various best management practices (BMPs). Based on STEP-L results, existing sediment loads within the Lower Fall Creek Watershed are estimated at 13,748 Tons/Year.

Efforts to reduce the sediment loads to the Lower Fall Creek Watershed focus on reducing the inputs from construction and development practices as well as streambank stabilization measures, both structural and non-structural. These are discussed further in **Section 5.0** of this WMP. Agricultural practices to reduce sediment loadings within the Lower Fall Creek watershed were considered but are not the focus of this planning effort. As urbanization and development occurs throughout the upper reaches of the watershed, agricultural sediment sources will be reduced. Due to the transitional nature of the watershed, the Steering Committee and Work Groups chose to focus on measures designed to prevent future loadings from developed lands.

Nutrients (Phosphorus and Nitrogen)

According to the EPA, nutrient pollution, especially from nitrogen and phosphorus, has consistently ranked as one of the top causes of degradation of waters of the US for more than a decade. Nutrients impact fisheries by promoting algal blooms that reduce plant growth and by reducing dissolved oxygen concentrations through increased productivity and decay of organic matter. Nutrients impact drinking water supplies by increasing treatment costs. Finally, nutrient concentrations, especially phosphorus, can limit recreational uses of waterways. Blue-Green algae, also known as cyanobacteria, which resulted in the use restrictions on Geist Reservoir in the summer of 2007, thrive in phosphorus rich waters. There are 3 primary sources of nutrients within the Lower Fall Creek Watershed, 1) fertilizer application, 2) inadequately functioning septic systems, and 3) combined sewer overflows. An additional source of nutrient loading is manure from agricultural and hobby operations in the more rural areas of the watershed. More detail on the agricultural impact will be provided later in this section as bacteria and pathogens are the primary pollutants of concern regarding manure.

Fertilizer Application

Nutrients such as phosphorus and nitrogen in the form of commercial fertilizers are often applied by agricultural users to enhance crop production. Similarly, residential and commercial property owners in the Lower Fall Creek Watershed routinely utilize fertilizers to promote the growth of turf grass and other landscaping.

The Office of Indiana State Chemist (OISC) annually publishes the total tonnages of commercial fertilizers sold in each Indiana County. The list includes single nutrient fertilizers, multi-nutrient fertilizers, as well as organic and micronutrient fertilizers. **Table 3-8** estimates the annual nutrient application based on the amount of nutrients sold in the Lower Fall Creek Watershed. Total countywide application rates were multiplied by the percent of the County's land area within the Lower Fall Creek Watershed in order to estimate watershed wide application.

Table 3-8: Estimate of Nutrient Applications

County	% of County in Watershed	x	Total Nutrients (tons)		X 2,000 lbs/ton	Nutrients in watershed (lbs)	
			N	P2O5		N	P2O5
Hamilton	5.97%	x	1,425	1,079	X 2000	170278	128,934
Hancock	3.40%	x	307	764	X 2000	20,889	51,986
Madison	2.72%	x	641	1,327	X 2000	34,882	72,213
Marion	10.75%	x	410	549	X 2000	88,174	118,067
Total						314,224	371,199

(OISC, 2007)

The table shown above describes an estimate of the amount of fertilizer applied in the Lower Fall Creek Watershed and is not intended to serve as an estimate of loadings to waterways. Based upon nutrient removal rates from crops and turf grasses, it is expected that only a portion of the applied fertilizer nutrients would be mobilized to local waterways, as a majority of the macronutrient would be utilized by the vegetation to which it was applied.

Lawn and garden practices associated with residential and commercial land uses are expected to be a substantial source of the excess nutrients in the watershed as these land uses are the most prevalent. Much of the estimated nutrients applied within the Lower Fall Creek Watershed are within Hamilton and Marion Counties, as indicated in Table 3-7. As land uses transition within the watershed (as identified on Exhibit 2-2) the anticipation is that an increase in fertilizers and nutrients applied to residential and commercial lawns will increase accordingly. The Hamilton County portion, and eventually the Hancock and Madison County areas, would be the area expected to see the largest rise in applications of these additives.

Professional lawn and garden chemical applicators receive training and are required to maintain application records, but the average citizen does not. Therefore, the typical resident and business owner may often over-apply lawn and garden chemicals, which are easily washed away and contribute significant nutrient loads to adjacent waterbodies. Applications of fertilizers from either a professional or an individual home or business owner need to be completed according to the product’s instructions, but also in accordance with the needs of the soil. Many times, even in cases where professional services are utilized, soil nutrient levels are not analyzed.

Additionally, yard wastes such as grass clippings, leaves, and dead plants are high in organic matter, and when piled or dumped on nearby stream banks, they can potentially smother naturally stabilizing vegetation. This smothering can lead to increased bank erosion and decreased levels of dissolved oxygen. The long-term effects of yard waste dumping is increased levels of nutrients from the decomposition of the waste, as well as the increased nutrient levels associated with increased sedimentation and destabilization of streambanks. Yard wastes are considered a source of pollution in the Lower Fall Creek Watershed, however the relative extent of that pollution is not known at this time.

Based on decisions made by the Steering Committee and Work Groups, the focus of efforts to reduce nutrient loadings from fertilizer application and yard wastes will be directed to golf courses and residential lakes over 50 acres in size. There are 8 golf courses within the Lower Fall Creek Watershed; 1 located in a WFPA and 5 additional courses that are located directly adjacent to or spanning tributary streams. These public golf courses are highly visible and could be utilized as a demonstration area for practices reducing the application and potential runoff of excess nutrients.

Lakes larger than 50 acres and surrounded by residential land use were also selected as a focus area. These lakes are directly connected to either surface or ground water resources in the Lower Fall Creek Watershed and transferred water may carry with it increased levels of nutrients from fertilizers applied to the residential lawns surrounding these lakes. Specific details regarding these areas are provided in Chapter 4 in this WMP.

Inadequately Functioning Septic Systems

Inadequately functioning septic systems are a large source of nutrients in the watershed. According to the EPA, even fully functional septic systems reduce only 28% of nitrogen concentration and 57% of phosphorus concentration of household wastewater. As septic systems fall into disrepair, these removal capabilities are reduced even further. According to the Chesapeake Bay Journal, a properly operating septic system is releasing more than ten pounds of nitrogen per year to groundwater for each person using it, and approximately 26% of that is making its way to open waters.

Within the Lower Fall Creek Watershed, the Marion County Health Department and the Indianapolis DPW have identified areas serviced by residential septic systems and prioritized these areas for connection to sanitary sewer through the Septic Tank Elimination Program (STEP). These areas are illustrated on **Exhibit 4-3**.

While nutrients from inadequately functioning septic systems is a concern within the Lower Fall Creek watershed, the primary pollutant from these sources is pathogens. Therefore, more detailed information regarding the magnitude of the concern, location of unsewered areas will be found in the pathogens portion of this section.

Combined Sewer Overflows (CSOs)

Like septic systems, CSOs are also a source of nutrients to waterways within the lower portions of the Lower Fall Creek Watershed. The CSO locations within the watershed have been identified on Exhibit 4-3. Implementation of the Indianapolis CSO LTCP will greatly reduce the loadings of nutrients to Fall Creek. As mentioned above, the LTCP established a schedule of detailed actions that will be taken to reduce water quality problems associated with CSOs, and should be referenced for all CSO-related water quality improvements.

Estimated Existing Nutrient (Phosphorus and Nitrogen) Loads

Based on STEP-L results, existing phosphorus loads within the Lower Fall Creek Watershed are estimated at 85,590 lbs/year, and existing nitrogen loads are estimated at 405,439 lbs/year.

Efforts to reduce the nutrient loads to the Lower Fall Creek Watershed focus on reducing the inputs from fertilizer application to golf courses and residential properties surrounding lakes greater than 50 acres. These are discussed further in Section 5.0 of this WMP.

Pathogens

Bacteria concentrations within the Lower Fall Creek watershed have typically been measured via *E. coli* or fecal coliform concentrations. The presence of fecal coliform bacteria in aquatic environments indicates that water has been contaminated with the fecal material of humans or other animals. Similarly, *E. coli* bacteria is associated with the intestinal track of warm blooded animals and is widely used as an indicator of sewage pollution in surface waters. Where bacteria concentrations are elevated there is an increased likelihood that disease causing organisms may be present in surface waters. Bacteria have detrimental effects on fisheries, water supply, and recreational uses of water bodies. Bacteriological contamination exposes aquatic life to disease causing organisms, increases drinking water treatment costs and threatens public health by threatening the drinking water supply, and prevents recreational uses of waterbodies.

As discussed above, the 2003 Fall Creek TMDL Study quantified and established pollutant reduction targets for *E. coli* in the Lower Fall Creek Watershed. According to the TMDL, the primary sources contributing the greatest loadings of bacteria to surface waters in the Lower Fall Creek Watershed are 1) inadequately functioning septic systems, 2) illicit connections to the storm sewer, 3) wildlife and background levels, 4) urban stormwater, and 5) CSOs.

Inadequately Functioning Septic Systems

Failing and inadequately functioning septic systems are common sources of bacteria in waterbodies throughout Indiana. While septic systems can be a safe and effective method for treating wastewater if they are sized, sited, and maintained properly, they frequently fall into disrepair. Unfortunately, homeowners are often unaware of how septic systems function, where their system is located, or how they should maintain their system.

Within the Lower Fall Creek Watershed 92% of soils are considered to be moderately or severely limited for onsite wastewater treatment. These soil limitations are identified on Exhibit 4-1. **Table 3-9** identifies subdivisions within the Lower Fall Creek Watershed that have been prioritized under the City of Indianapolis' Septic Tank Elimination Program (STEP). These areas are also identified in Exhibit 4-3.

Table 3-9: STEP Priorities

Project Name	Primary Subwatershed	Priority Ranking
42nd and Sherman	Fall Creek – Devon Creek	High
42nd and Millersville	Fall Creek – Minnie Creek	High
46th and Millersville	Fall Creek – Devon Creek	High
82nd and Red Bud	Mud Creek – Sand Creek	High
46th and Emerson	Fall Creek – Devon Creek	High
48th and Allisonville	Fall Creek – Minnie Creek	Medium
61st and Allisonville	Fall Creek – Minnie Creek	Medium
Fall Creek and Johnson	Fall Creek – Devon Creek	Low
55th and Allisonville	Fall Creek – Minnie Creek	Low
56th and Fall Creek	Fall Creek – Devon Creek	Low
57th and Kessler	Fall Creek – Minnie Creek	Low
46th and Ritter	Fall Creek – Devon Creek	Low

Problems with inadequate septic systems are intensified when those systems are located in floodplain areas. Flooding leads septic systems to function improperly which can result in stormwater runoff that contains elevated concentrations of *E. coli,* nutrients, and other pollutants. None of the STEP subdivisions lie within a regulated floodplain area.

In the Lower Fall Creek Watershed, Hamilton County, the Town of Fishers, and the City of Noblesville are serviced by Hamilton Southeastern Utilities. Information regarding the sewer service area of Hamilton Southeastern Utilities was unavailable. It is assumed that areas outside of these sanitary service areas are served by on-site septic systems. As the Town of

Fishers and City of Noblesville grow, areas on septic are required to connect to sanitary sewer. As growth and development are planned throughout Hamilton County, especially in the portion of the watershed north of 146th Street and east to the Hamilton – Madison County line, existing residential septic systems will be replaced with sanitary sewer service, potentially reducing the pathogen loadings to Sand and Mud Creeks. Portions of Sand and Mud Creek in this area have delineated floodplains where few residential properties currently exist.

Development in the Madison County portion of the Lower Fall Creek is scattered, very low density, and serviced by septic systems. None of the streams in the Madison County portion of the watershed have delineated floodplains. In Hancock County, with the exception of some isolated septic systems, the developed areas are serviced by the Town of McCordsville Sewer District.

Illicit Connections to the Storm Sewer

In addition to falling into disrepair, septic systems are often tied directly into local drainage tiles, ditches, and storm sewer systems. While this connection may have been intentional at one time, often times current homeowners or tenants are unaware that their wastewater is tied directly into these conveyances. According to research completed by the Center for Watershed Protection, some of the most common types of illicit connections include broken sanitary lines, cross connections, sanitary sewer overflows, and direct connections from septic systems.

As part of NPDES Stormwater Phase I and Phase II requirements the City of Indianapolis, the City of Lawrence, the City of Noblesville, the Town of Fishers, and Hamilton, Hancock, and Madison Counties are required to screen their stormwater outfalls during periods of dry weather in an effort to identify illicit stormwater discharges. According to the Fall Creek TMDL, the City of Indianapolis has learned that approximately 8% of their 145 stormwater outfalls contain wet flows during periods of dry weather. As of the writing of this plan the City of Noblesville, the Town of Fishers, and Hamilton, Hancock, and Madison Counties have not begun their dry weather screening programs as regulatory schedules have not required this action.

Wildlife and Background Levels

Wildlife within the Lower Fall Creek Watershed is a source of bacteria loadings. It is difficult to determine the exact contribution that different animals have on *E. coli* loadings; however, in many central Indiana watersheds, waterfowl have been identified as a significant source of *E. coli* loading to local waterways. Many existing commercial and residential developments within the Lower Fall Creek Watershed have ponds or lakes with unrestricted access for Canada Geese to nest and raise their young. The number of these developments with ponds can be expected to increase in areas slated for future development, such as those highlighted on Exhibit 2-2.

Habitually, ducks and geese nest in colonies located in trees and bushes around rivers, streams, and lakes. *Lake Access* is a Minnesota based initiative that began in 1999 to deliver real-time water quality information on Minneapolis metropolitan lakes to the public using advanced sensor technology and the Internet. According to their research, the average goose dropping has a dry weight of 1.2 grams and each goose is responsible for approximately 82 grams of feces per day. Common management strategies for controlling Canada Geese and other waterfowl include reducing or eliminating all mowing activities within 50' – 75' of a waterbody, minimizing watering and fertilizing activities within 50' – 75' of a waterbody, planting less palatable species of grass and plants along the water's edge, prohibiting feeding, and utilizing auditory, visual, and physical scare tactics.

Additionally, recent water quality studies done by the Maryland Department of the Environment identified pet waste as the second most common source of bacteria in the Washington DC area. Pet wastes can be controlled through ordinances requiring collection and removal of the waste from curbsides, yards, parks, roadways, and other areas where the waste can be washed directly into receiving waters.

Stormwater Runoff
Differing land uses contribute different bacteria loadings to local waterways. Causes of bacteria in stormwater runoff include domestic pet waste, wildlife, and agricultural uses. According to the TMDL, "Average stormwater *E. coli* bacteria counts were estimated from literature values and based on Indianapolis Mapping and Geographic Infrastructure System (IMAGIS) land use and watershed coverages. These bacteria counts were applied to surface runoff flows from October 1991 to October 2001 as predicted using the city's watershed model". **Table 3-10** identifies estimated stormwater *E. coli* concentrations and percentages of land use types within the City of Indianapolis as identified in the Fall Creek TMDL study.

Table 3-10: *E. coli* Concentrations and Land Use Classes in the City of Indianapolis

	Com.	Res.	Historic & Hospital	Indust.	Parks	Highways	Spec. Uses	University
Assumed *E. coli* Concentration	2,500 CFU	2,000 CFU	2,500 CFU	5,000 CFU	2,000 CFU	5,000 CFU	3,000 CFU	3,000 CFU
Mud Creek	*Assumed to be the same as Fall Creek*							
Fall Creek upstream	3%	71%	0%	2%	4%	1%	19%	0%
Fall Creek CSO	9%	65%	1%	9%	4%	2%	9%	1%

(Fall Creek TMDL, 2003)

The TMDL also discusses the anticipated *E. coli* stormwater loads to Fall Creek that come from permitted, non-permitted, and out-of-county sources. It is anticipated that 45% of the *E. coli* loads originate from permitted (storm drain outfall) sources while the remaining 55% originate from outside of Marion County. The City of Indianapolis' stormwater programs are designed to address only the portion of the loads from within Marion County.

Combined Sewer Overflows
The City of Indianapolis built its first storm sewers hundreds of years ago in order to carry stormwater away from streets and homes and into rivers. However, when indoor plumbing became available, sewage lines from homes and business were tied directly into the existing storm sewer system, which discharged directly to local receiving waters. In recognition of the water quality and health problems that this system posed, the City eventually built wastewater treatment plants to treat and eliminate sewage before it entered local waterways.

During periods of dry weather, the capacity of the sewer system and wastewater treatment plants are sufficient, and nearly all stormwater and sewage in the combined sewer system is treated by the wastewater treatment plant. However, during rain events, the capacity of the combined sewer system is insufficient, and in order to prevent sewage from backing up into basements and onto streets, combined stormwater, sanitary and raw sewage overflows into local streams.

Within the Lower Fall Creek Watershed there are 28 CSO outfalls. These outfalls are identified on Exhibit 4-3. In order to correct problems associated with CSOs the City has developed the Raw Sewage Overflow Long Term Control Plan and Water Quality Improvement Plan (LTCP). In total, the City's LTCP will ultimately capture 95-97% of sewage entering streams during wet weather and is estimated to cost the City more than $1.73B. The LTCP has detailed actions that will be taken to reduce water quality problems associated with CSOs, and should be referenced for all CSO related water quality improvements.

Among the plans identified in the LTCP to reduce sewerage overflows in the Lower Fall Creek Watershed include:

- Digging underground tunnels that will store and carry sewage to the City's wastewater treatment plant.
- Building new, larger sewers to capture overflows and carry them to the tunnel.
- Installing inflatable dams and sluice gates at key point in the sewer system.
- Separating sewers in a neighborhood near 38th St.
- Removing the dam near Dr. Martin Luther King Junior Street and Fall Creek to improve stream flow and raise dissolved oxygen concentrations. This was completed in the fall of 2007.

Livestock and Manure Management

The Fall Creek TMDL focused on bacteria sources within Marion County, and considering the limited agricultural land uses within the county, the TMDL did not discuss agricultural sources of bacteria. However, within the Lower Fall Creek Watershed, more than 22,000 acres are currently in agricultural production. Further, the Indiana State Fairgrounds' has been discussed as a potential source of manure laden runoff leading to elevated levels of *E. coli* within Lower Fall Creek.

Manure, whether being stored, applied for crop nutrition, or simply the by-product of grazing is a water quality concern in the Lower Fall Creek Watershed. The best way to manage for and mitigate the potential water quality impacts of manure application and storage is to ensure that storage, application rates, and timing aspects are appropriately addressed through the implementation of nutrient management plans on agricultural lands.

A Confined Feeding Operation (CFO) is a livestock operation that has in excess of 600 hogs, 300 cattle, or 600 sheep. These facilities are required, by IAC 16-2-5, to obtain a permit from IDEM's Office of Land Quality. According to IDEM's records, there is only 1 active CFO located in the Lower Fall Creek Watershed. In addition to this CFO within the watershed, there are Animal Feeding Operations (AFOs) in the upper reaches of the Lower Fall Creek Watershed in Hamilton, Hancock, and Madison Counties. These operations continue to decline in number and in number of cattle, pigs, and sheep at each operation. Further, Hamilton County ranks among the top 10 counties in Indiana in regard to the number of horses. **Table 3-11** identifies the total number livestock and overall state rankings for Hamilton, Hancock, Marion, and Madison County.

Table 3-11: Livestock Statistics

	Cattle		Hogs		Sheep	
	Head	Rank	Head	Rank	Head	Rank
Hamilton	4,300	72	10,500	62	988	23
Hancock	2,900	80	37,082	29	1,941	6
Madison	4,500	70	26,875	42	655	39
Marion	1,000	92	N/A	N/A	252	66

(NASS, 2007)

Pasture management can be an effective management measure to reduce impacts that small livestock operations have on water quality. Pasture management leads to better weed control, better soil structure, increased productivity over longer periods of time, and healthier animals. It also helps the soil absorb excess water, manure, nutrients and other pollutants and ultimately protects water quality by reducing the amount and improving the quality of runoff. As discussed earlier within Section 3.3, related to tillage practices, the Steering Committee and Working Groups have agreed that agricultural related management efforts are best led by the individual county SWCDs. Local SWCD and NRCS staff have long-established relationships with agricultural landowners as well as an extensive knowledge of USDA programs designed to mitigate livestock and manure impacts as well as those designed to protect water quality in a livestock production area.

Estimated Existing Bacteria Loads

Bacteria load reductions identified within the 2003 Fall Creek TMDL were utilized to estimate bacteria loads for the Lower Fall Creek Watershed. Based on results from the TMDL existing bacteria loads within the Lower Fall Creek Watershed are estimated at 1.59E+14 CFU/recreational season (April to October). In order to meet the water quality standard identified in Table 3.2, the TMDL calls for a 1.57E+12 CFU reduction. This equates to a 52% reduction of *E. coli* loadings upstream of the CSO area and 99.5% reduction of *E. coli* loadings downstream of the CSO area.

Problem Statements

After analysis of Water Quality data, evaluation of pollutant causes and sources, and estimation of existing pollutant loads the following problem statements have been developed relevant to the Lower Fall Creek Watershed.

Problem Statement #1

Macroinvertebrate and habitat assessment scores at 17 of 28 (60%) of the sites assessed scored under 60 on the CQHEI or QHEI indices. The cause for this is assumed to be due to excessive siltation observed at these sites.

Problem Statement #2

Increased levels of nutrients throughout the Lower Fall Creek watershed have harmful impacts on drinking water, recreational use waters, and aquatic plant and animal life. The cause for this is Phosphorus concentrations that routinely exceed the EPA recommended threshold of 0.076 mg/L.

Problem Statement #3

Restrictions on primary contact recreation in Lower Fall Creek have been implemented and advertised in some areas while discouraged in others. The cause for this is due to *E. coli* concentrations routinely exceeding the State of Indiana's Water Quality Standard of (geometric mean) 125 CFU/100ml.

While sediment, excess nutrients, and the potential presence of pathogens seem to be the primary water quality problems in the Lower Fall Creek Watershed, other concerns such as invasive species, diurnal fluctuations of dissolved oxygen concentrations, poor habitat quality, and impaired biotic communities have also been identified. Problem statements have not been identified for these issues as it is expected that the implementation of mitigation measures intended to reduce loadings of pathogens, nutrients, and sediments will also serve to improve habitat and biological health, and reduce invasive species.

3.4 AREA OF CONCERN SUMMARY

As a method of better understanding the cumulative impacts of the areas of concern discussed within this section, a composite map was created and is shown as **Figure 3-4**. This map can be utilized to aid in the evaluation of areas and activities of concern, the development of Critical Areas, as well as a means to direct outreach efforts related to education or implementation of BMPs designed to reduce the water quality impacts within each subwatershed. For example, many areas of concern are located within the Fall Creek – Devon Creek subwatershed. Perhaps this would be a good subwatershed to begin when starting targeted education and outreach and implementation programs.

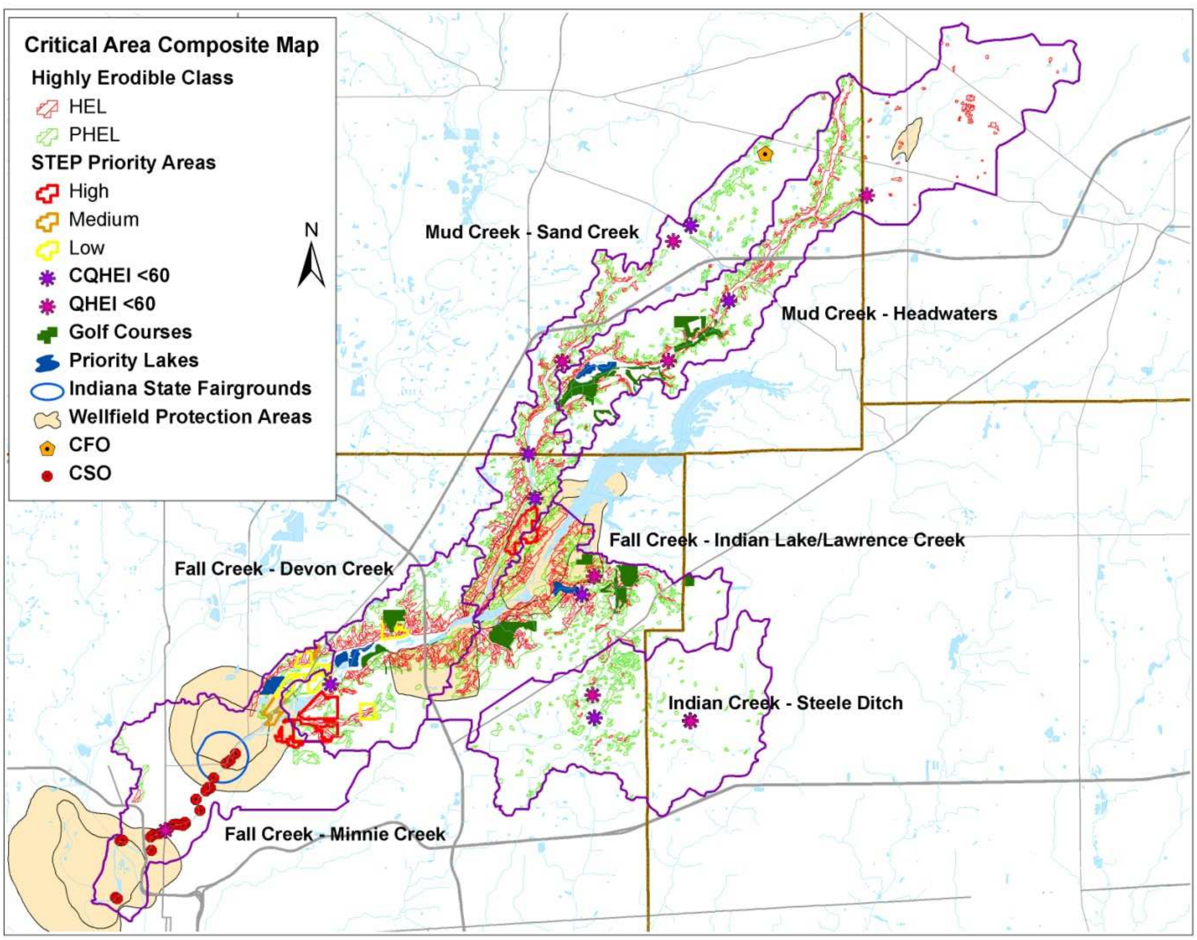


Figure 3-4: Critical Areas Composite Map

Figure 3-4 should be used in conjunction with Figure 2-2 highlighting existing land uses and areas where growth and development are expected or planned. As growth and development within the watershed is proposed, special considerations should be given to areas such as HEL or PHEL classified soils or WFPAs.

4.0 CRITICAL AREAS

Critical Areas are specific areas or activities in the watershed that are suspected of degrading water quality. Focusing on a few specific areas or activities should be more effective at improving water quality than a generalized watershed-based program. Implementation of management measures (programs, policies, or projects) for these specific areas or activities in the watershed should have the greatest impact on water quality. However, not all areas and activities identified as Critical Areas may be at a stage where management measures can be implemented. In this case, these are still valid Critical Areas because they provide an example of what is happening in the Lower Fall Creek Watershed and an opportunity to learn what, if anything could be done differently to improve water quality.

4.1 IDENTIFICATION OF CRITICAL AREAS

To identify Critical Areas in the Lower Fall Creek Watershed, each of the 3 work groups (Education & Outreach, Land Use & Economic Development, and Water Quality) met and reviewed the list of Stakeholder concerns from Table 3-1 and composite GIS maps showing wellfield protection areas, erodible lands, floodplains, sewer service areas, impaired streams, and land use.

Each work group discussed the impact of sediment, nutrients, and pathogens on aquatic life, recreation, and drinking water; the land use or land use practice associated with each pollutant; and then identified specific areas or activities in the Lower Fall Creek Watershed suspected of degrading water quality. **Table 4-1** is a copy of the exercise used to identify Critical Areas with each work group.

<u>Sediment Critical Areas</u>

As shown on **Exhibit 4-1**, the specific sediment Critical Areas include areas classified as HEL or PHEL, especially those areas lacking sediment and erosion controls and those with conservation tillage; the Indian Lake watershed, and streambanks identified as undergoing severe erosion.

HEL & PHEL Classified Soils

HEL determinations are made by the NRCS, are based on mathematical equations considering rainfall factors, erodibility of the soil type, allowable loss for that soil type, and the length and the slope of the area. Soil map units may be classified as Potentially Highly Erodible (PHEL) based on a varying range of length/slope values. In such instances, the final determination of erodibility must be made through an onsite investigation.

Approximately 20% of the soils within the watershed are classified as HEL or PHEL. Activities exposing HEL or PHEL soil types for periods of time, such as construction or conventional tillage, may exacerbate the erosion and sedimentation impact within the Lower Fall Creek Watershed.

- Lack of Erosion & Sediment Control

According to US EPA, the most environmentally dangerous period of development is the initial construction phase when land is cleared of vegetation and graded to create a proper surface for construction. The removal of natural vegetation and topsoil makes the exposed area particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas.

Figure 4-1: Poorly installed silt fencing

Erosion and sediment control is widely accepted as a necessary practice, but there are certain caveats to making it effective. First, communities need to have the staff and resources to adopt and enforce an Erosion & Sediment Control Ordinance. In addition, a Technical Standards or Manual (as part of the Erosion & Sediment Control Ordinance) needs to provide useful guidance on selecting erosion and sediment control measures. Finally, education of contractors, engineers, and designers regarding the importance and effective use of erosion and sediment controls is imperative to implementing effective erosion and sediment control. **Figure 4-1** shows an example of a poorly installed erosion and sediment control system.

Erosion and sediment control has been identified as a Critical Area (or critical activity) because of the current development and potential for development in the Lower Fall Creek Watershed. The City of Lawrence, City of Noblesville, Town of Fishers, Hamilton County, and Madison County are required to have a an Erosion & Sediment Control Ordinance in order to be in compliance with the NPDES Phase II Stormwater Program. The City of Indianapolis has an Erosion & Sediment Control Ordinance as a requirement of the NPDES Phase I Stormwater Program. As construction and development occur within the Lower Fall Creek Watershed, additional precaution should be taken in areas of HEL or PHEL soil classifications.

- Conventional Tillage Practices

Within the Lower Fall Creek Watershed approximately 22,000 acres are in agricultural production; while approximately 13,500 acres are classified as HEL. As identified in Table 3-7, much of those acres in Hamilton, Hancock, and Madison Counties associated with corn production are utilizing conventional tillage (no data is available for Marion County tillage types).

Conventional tillage systems disturb the entire soil surface, resulting in less than 15% residue cover after planting. Conventional tillage practices on HEL or PHEL classified soils allow those erodible soils to be exposed to the weather for periods of time, typically during the spring wet weather prior to planting, or after harvest in the fall, leaving the soil exposed during the spring thaw, or both.

Figure 4-2: Indian Lake

Indian Lake Watershed

Indian Lake is located in the City of Lawrence. Approximately 16,000 acres drain to this 54 acre lake (**Figure 4-2**). This ratio of 300:1 far exceeds the current standard of 100:1. The Hancock County portion of the Indian Lake subwatershed remains primarily undeveloped with the

exception of proposed growth in the Town of McCordsville. The Marion County portion is predominantly residential.

The Indian Lake Homeowners Association has been dredging approximately 3,000-5,000 tons of sediment from the lake on an annual basis. Due to this frequency and volume, the Association has found it to be more cost effective to purchase their own dredging equipment. In 2007, the Indian Lake Homeowners Association reached a settlement agreement with INDOT for damages due to negligence in erosion control during a 2005 Pendleton Pike road project. The settlement funds are to be put toward dredging cost.

Indian Lake was selected by the working groups and the Steering Committee based on the amount of sediment entering the lake necessitating dredging on a routine basis. Water quality, macroinvertebrate, and physical assessments completed within the Indian Lake watershed have attributed impaired waters or degraded habitats to the excessive amount of silt within the streams and tributaries leading to the lake.

Indian Lake can provide a good representation of the issues faced by many of the lakes within the Lower Fall Creek Watershed and is currently managed by an active Homeowners Association willing to put forth effort to protect the quality and aesthetic value of their lake.

Eroded Streambanks

During the assessments completed by IUPUI students in 2007 and by Commonwealth Biomonitoring in 2008 streambanks experiencing erosion were observed and noted. These areas, identified on Exhibit 4-1, and the upstream drainage areas should be further studied to determine the specific causes for the streambank erosion; lack of riparian vegetation, streambank encroachment by agricultural or development practices, or increases in conveyance volumes via surface runoff or direct piping to the receiving streams. In the more rural areas of the watershed, Commonwealth's Site 6, located in Hancock County is of significant interest. Clumps of streambank with vegetation attached, signifying recent erosion, and excess silt within the streambed were observed. While no areas of exceptional erosion were noted in the IUPUI assessment, only 5 of the 16 sites were noted as having stable banks.

Figure 4-3: Eroded Streambank at Windridge Condominiums

Several stakeholders present at the public meetings, Steering Committee meetings, and Work Group meetings discussed the effects of streambank erosion and how it can potentially have a direct effect on hundreds of property owners. One example of such significant damages caused by streambank erosion is located near the intersection of Emerson Way and 56th Street. Windridge Condominiums and the National Headquarters of Phi Kappa Psi experienced a significant loss of streambank in March 2007 requiring them to relocate approximately 400 linear feet of sanitary sewer along Fall Creek (**Figure 4-3**) and close to the main entrance to the Phi Kappa Psi house.

This area has been identified as a Critical Area within the Lower Fall Creek Watershed since it represents the magnitude of social, physical, and economic losses that result when streambank erosion is not addressed. Streambank erosion is usually a symptom of a larger problem in the watershed.

Further downstream, the accumulation of sediment and large woody debris from the eroded banks of Fall Creek have restricted flow and flooded commercial and residential developments. The Windridge Condominiums Homeowners Association have recently retained the services of a professional engineering firm to study the drainage area and determine the best solution to stabilize the banks of Fall Creek, reduce additional streambank erosion, and downstream flooding.

Nutrient Critical Areas

Nutrient Critical Areas or activities were identified as the over application of lawn fertilizers on residential lakes and golf courses. The Steering Committee and Work Groups worked to determine where to focus efforts on reducing nutrient loads with the anticipation of having the greatest overall watershed effect and a high visibility for implemented practices or BMPs. As a result, lakes greater than 50 acres in size and surrounded by residential land use and golf courses were identified. **Exhibit 4-2** illustrates the location of these 5 lakes and 8 golf courses in the Fall Creek Watershed.

Golf Courses

The maintenance practices of golf courses are often identified as a source of runoff polluted with excess nutrients and chemicals. Courses are also designed with several ponds or “water hazards” which may be attractive to water fowl such as Canada Geese, also commonly identified as a source of nutrient, and other pollutant, loadings. Without good course design and maintenance practices, golf courses can have a detrimental effect on riparian buffers, wetlands, and water quality. Further, groundwater may be impacted by heavily applied fertilizers and pesticides.

Of the 8 golf courses identified on Exhibit 4-2, only one, Indian Lake Country Club Golf Course, lies within a Wellfield Protection Area (Geist). In addition, there are 5 courses that are directly adjacent to or span across bodies of water: Brendonwood (Fall Creek); Fort Golf Course (Camp Creek); Gray Eagle (Mud Creek); Hawthorne (Mud Creek); and Ironwood (Mud Creek). The Fort Golf Course (**Figure 4-4**) is in the process of achieving certification through the Audubon International’s Cooperative Sanctuary Program for Golf Courses. The Ironwood Golf Course, shown in **Figure 4-5**, highlights the proximity of the golf course to Stonebridge Lake, which is one of the prioritized residential lakes within the Lower Fall Creek watershed.

Golf courses within the Lower Fall Creek Watershed have been identified as Critical Areas due to the potential for elevated levels of fertilizers and pesticides in runoff to surface waters or the potential for leaching into groundwater systems. These public courses are highly visible, visited by thousands of stakeholders each year, and may also serve as sites for future projects related to reduced fertilizer application, stormwater pollutant filtration measures, riparian buffers, and education and outreach efforts.

Figure 4-4: Fort Golf Course

Figure 4-5: Ironwood Golf Club

Residential Lakes

Inland lakes surrounded by residential land use may be severely impacted due to excess lawn fertilizers, pet & wildlife waste, and even failing residential septic systems. As the lake systems are impacted by increased bacteria and nutrient loadings human health issues, aesthetic value, and property values may also be negatively impacted as a result. Residential lakes were selected based on the potential concentrations of homeowners reached through education and outreach efforts focused through the HOA, the visibility of BMPs installed or measures implemented, and the ability to involve individual homeowners or the HOA through long-term monitoring and measurement of the impacts of BMP installation.

Five residential lakes greater than 50 acres were selected as Critical Areas. These include: Lake Kesslerwood (East & West), Lake Maxinhall, Stonebridge, and Indian Lake. These were selected because there is opportunity to build the partnerships needed to implement management measures and observe or monitor water quality improvements. Two of the 5 lakes (Indian Lake and Lake Maxinhall) were created through sand and gravel mining operations several years ago. These lakes also lie within WFPAs, further creating the need for designation as a critical area as there is a direct connection between surface water and ground water within these areas. **Figure 4-6** is of Lake Maxinhall, one of the lakes located within a WFPA. This particular lake is of particular interest because it is within proximity to several non-sewered neighborhoods along its eastern border. Other lakes considered critical have a direct connection to Fall Creek or tributary streams as Indian Creek travels through Indian Lake (also located within a WFPA), tributaries to Sand Creek travel through Stonebridge Lake, and Atkinson Creek flows to Lake Kesslerwood and an outlet to Fall Creek has been constructed in

Figure 4-6: Lake Maxinhall

this area.

More details regarding other sources of nutrient loading to the watershed, non-sewered areas and CSOs, will be included within the pathogens discussion.

Pathogen Critical Areas

Specific Critical Areas or activities for pathogens were identified by the Fall Creek TMDL, Steering Committee, Work Groups, and watershed stakeholders as non-sewered developments, livestock and manure management, and Wellfield Protection Areas. **Exhibit 4-3** shows the overall location of these Critical Areas or activities. Other areas discussed by these groups, but not considered as a Critical Area (or activity) within this WMP, are CSOs, waterfowl, and stormwater runoff.

Non-Sewered Development

Septic systems can be a safe and effective method for treating wastewater if they are sized, sited, and maintained properly. However, as discussed in Section 3.0, failing and inadequately functioning systems are a common source of bacteria and pathogens in waterbodies. The NRCS has rated 92% of the soil in the Lower Fall Creek as moderate or severely limited for septic system use.

An additional concern within non-sewered developments is the potential for septic systems to be tied directly to local drainage tiles, ditches and storm sewer systems. These illicit discharges serve as a direct conduit for bacteria and pathogens (and excess nutrients) to travel to streams within the watershed. As a part of the NPDES Stormwater Phase I and Phase II requirements, communities within the Lower Fall Creek Watershed are required to screen outfalls during periods of dry weather to identify these illicit discharges. For many of the Lower Fall Creek Watershed Communities, this process has not yet began as regulatory schedules have not required this action.

Development in the Madison County portion of the Lower Fall Creek Watershed is scattered, very low in density, and on septic. If growth and development follows the guidance of the Comprehensive Plan, this area is expected to remain this way. Further downstream, the Hamilton Southeastern Sewer District provides sewer service to the portions of Hamilton County, City of Noblesville, and Town of Fishers in the Lower Fall Creek Watershed. Similar to Madison County, the development in this portion of Hamilton County is scattered, very low density, and on septic. However, as the City of Noblesville grows into this area, sewer lines will be extended and new (and existing) development will be connected to a wastewater treatment facility. The Town of Fishers has recently implemented a program to assist homeowners in their jurisdiction to connect to sanitary sewer. All new development is required to be sewered.

In 2005, the City of Indianapolis DPW Clean Stream Team initiated a Septic Tank Elimination Program (STEP) to convert entire neighborhoods on septic to sewer by 2025. This program replaces the Barrett Law conversion program and is estimated to save homeowners 50% of the cost to connect to sanitary sewer. In the Lower Fall Creek Watershed, there are 12 neighborhoods that have been identified and prioritized in STEP.

The STEP areas include:

- High Priority Neighborhoods – 82nd and Redbud, 46th and Millersville, 46th and Emerson, 42nd and Sherman, 42nd and Millersville
- Medium Priority Neighborhoods – 62st and Allisonville, 46th and Allisonville

- Low Priority Neighborhoods – 57th and Kessler, 55th and Allisonville, Fall Creek and Johnson, 46th and Ritter

In Hancock County, with the exception of some isolated septic systems, the developed areas are serviced by the Town of McCordsville Sewer District.

Livestock and Manure Management

Manure, whether being stored, applied for crop nutrition, or simply the by-product of grazing is a water quality concern within Lower Fall Creek Watershed. The Fall Creek TMDL did not discuss agricultural sources of bacteria or pathogens due to the limited amount of agricultural land use within Marion County. However, elsewhere in the watershed, livestock and manure are more of a contributing factor.

- Confined Feeding Operations

A Confined Feeding Operation (CFO) is a livestock operation that has in excess of 600 hogs, 300 cattle, or 600 sheep. These facilities are required, by IAC 16-2-5, to obtain a permit from IDEM's Office of Land Quality. According to IDEM's records, there is only 1 active CFO located in the Lower Fall Creek Watershed. In addition to this CFO within the watershed, there are Animal Feeding Operations (AFOs) in the upper reaches of the Lower Fall Creek Watershed in Hamilton, Hancock, and Madison Counties. These operations continue to decline in number and in number of cattle, pigs, and sheep at each operation. Further, Hamilton County ranks among the top 10 counties in Indiana in regard to the number of horses.

As discussed earlier within previous sections, the Steering Committee and Working Groups have agreed that agricultural related management efforts are best led by the individual county SWCDs. Local SWCD and NRCS staff have long-established relationships with agricultural landowners as well as an extensive knowledge of USDA programs designed to mitigate livestock and manure impacts as well as those designed to protect water quality in a livestock production area.

- Indiana State Fair Grounds

In urban areas, runoff from impervious surfaces, such as parking lots and roads are major contributors to stream pollution. The Indiana State Fair Grounds was identified as a Critical Area because it comprised of more than 250 acres (approximately 70 acres of imperviousness) in the Lower Fall Creek Watershed. The State Fair is home to more than 300 events each year, including the annual Indiana State Fair. During the State Fair, the fairgrounds are populated with thousands of livestock, including horses, cattle, hogs, sheep, poultry and numerous others (**Figure 4-7**). The livestock are usually available for display in one of the fairgrounds 7 livestock barns.

Figure 4-7: Horse event at State Fair

Water quality data collected to date indicates that the State Fair grounds are contributing *E. coli* loadings to Fall Creek. Since 1993, the Health Department has collected grab samples on Fall Creek during the State Fair. This sampling program has included the collection of *E. coli* samples at 39th Street, which is located upstream of the fairgrounds, at the fairgrounds stormwater outfall, and downstream of the fairgrounds at 30th Street. A similar sampling program conducted since 1994 has demonstrated parallel results.

There has long been recognition that animal waste from the fairgrounds contributes to pollution to Fall Creek. In 1999, the City of Indianapolis DPW completed a 104(b)(3) water quality cooperative grant to design a wetland-type wastewater treatment system for runoff leaving the fairground site. However, this project was never constructed.

Wellfield Protection Areas
There are 5 Wellfield Protection Areas (WFPA) in the Lower Fall Creek Watershed. These include the Riverside, Fall Creek, Lawrence, Geist, and Southern Madison County Utilities wellfields.

Figure 4-8: Wellfield Protection Area

WFPAs were identified as a Critical Area because of the potential contamination to groundwater and drinking water supply to approximately 20% of central Indiana population. Pollutants of particular concern in these areas are nutrients and pathogens. Land use and land use practices in the 4 WFPAs in Marion County that may impact groundwater are regulated through a Wellfield Protection Ordinance (City County General Ordinance # 91, 2003). As part of this Ordinance, new development and redevelopment plans are reviewed by a Technically Qualified Person (TQP).

The Ordinance also established a Marion County Wellfield Education Corporation (MCWEC) whose mission is to prevent contamination of groundwater through public awareness and education – like the "Entering Wellfield Protection Area" roadside sign illustrated in **Figure 4-8**. MCWEC targets it education and outreach efforts toward the businesses in the WFPAs that were grandfathered under the Ordinance. Although a Source Water Protection Plan has been prepared for the WFPA in Madison County, an Ordinance regulating land use has not been adopted.

Other
As mentioned, the Fall Creek TMDL, as well as the Steering Committee, Work Groups, and stakeholders also mentioned concerns over the pathogen loadings attributed to CSOs, waterfowl (and other wildlife), and stormwater runoff within the Lower Fall Creek Watershed. While these are important considerations throughout the watershed, and throughout Indiana, this WMP will not highlight specific areas as Critical Areas.

Regarding CSOs within the watershed, the City of Indianapolis has developed their LTCP which will ultimately capture 95-97% of sewage entering streams during wet weather and it is estimated that the implementation of this plan will cost more than $1.73B. The LTCP has detailed actions that will be taken to reduce water quality problems associated with CSOs, and should be referenced for all CSO related water quality improvements.

It is anticipated that actions taken to reduce pollutant loadings within the Critical Areas previously discussed will also reduce pollutant loadings associated with waterfowl (and wildlife) and pollutant laden stormwater runoff. For example, stabilization of streambanks will help reduce sediment loadings, but will also help to reduce pollutant loadings from waterfowl as bank and overhanging vegetation along streambanks and shorelines prohibit Canada Geese from staying in areas for prolonged periods of time. Further reducing applications of nutrients, implementing erosion control practices, and conversion from conventional to conservational tillage practices will also decrease the amount of pollutants within stormwater runoff.

Table 4-1: Identifying Critical Areas Work Group Exercise

DOCUMENTED WATER QUALITY POLLUTANT IN LOWER FALL CREEK	TYPICAL LAND USE/LAND USE PRACTICE ASSOCIATED WITH POLLUTANT		CRITICAL AREAS IN LOWER FALL CREEK WATERSHED
SEDIMENT impacts: Aquatic Life – *reduces plant growth, smothers and covers spawning grounds and benthic habitats* Recreational Impact – *reduces water clarity, reduces aesthetic appeal, stresses sport fishing populations* Drinking Water – *increases drinking water treatment costs, damages pumps and infrastructure*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Conservation Areas • Post-Construction Practices	**DEGRADE** water quality: • Tillage Practices • Construction Practices • Streambank Erosion • Stormwater Runoff	• *Erosion and sediment control enforcement* • *HEL & PHEL Classified Soils* • *Indian Lake Watershed* • *Eroded Streambanks*
NUTRIENT (Phosphorus & Nitrogen) impacts: Aquatic Life – *promotes algal blooms, reduces dissolved oxygen concentrations* Recreational Impact – *causes algal blooms, reduces aesthetic appeal, and causes unpleasant odors* Drinking Water – *increases drinking water treatment costs (taste and odor), resultant algae can clog water intakes and filters*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Post-Construction Practices	**DEGRADE** water quality: • Fertilizer Application • Failing Septic Systems	• *Over application of fertilizers (residential lakes and golf courses)* • *Wellfield Protection Areas*
PATHOGENS (Bacteria & Viruses) *impacts:* Aquatic Life – *exposes aquatic life to disease causing organisms* Recreational Impact – *exposes recreational users to disease causing organisms* Drinking Water – *increases drinking water treatment costs*	**BENEFIT** water quality: • Sewer Service • Exclusionary Fencing	**DEGRADE** water quality: • Failing Septic Systems • Combined Sewer Overflows (CSO) • Illicit Connections to Storm Sewer • Wildlife • Stormwater Runoff • Livestock & Manure Management	• *Indiana State Fair Grounds* • *Wellfield Protection Areas* • *Non-sewered development* • *Wellfield Protection Areas* • *Livestock and Manure Management Areas*

4.0 CRITICAL AREAS

Critical Areas are specific areas or activities in the watershed that are suspected of degrading water quality. Focusing on a few specific areas or activities should be more effective at improving water quality than a generalized watershed-based program. Implementation of management measures (programs, policies, or projects) for these specific areas or activities in the watershed should have the greatest impact on water quality. However, not all areas and activities identified as Critical Areas may be at a stage where management measures can be implemented. In this case, these are still valid Critical Areas because they provide an example of what is happening in the Lower Fall Creek Watershed and an opportunity to learn what, if anything could be done differently to improve water quality.

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Approximately 20% of the soils within the watershed are classified as HEL or PHEL. Activities exposing HEL or PHEL soil types for periods of time, such as construction or conventional tillage, may exacerbate the erosion and sedimentation impact within the Lower Fall Creek Watershed.

- Lack of Erosion & Sediment Control

According to US EPA, the most environmentally dangerous period of development is the initial construction phase when land is cleared of vegetation and graded to create a proper surface for construction. The removal of natural vegetation and topsoil makes the exposed area particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas.

Erosion and sediment control is widely accepted as a necessary practice, but there are certain caveats to making it effective. First, communities need to have the staff and resources to adopt and enforce an Erosion & Sediment Control Ordinance. In addition, a Technical Standards or Manual (as part of the Erosion & Sediment Control Ordinance) needs to provide useful guidance on selecting erosion and sediment control measures. Finally, education of contractors, engineers, and designers regarding the importance and effective use of erosion and sediment controls is imperative to implementing effective erosion and sediment control. **Figure 4-1** shows an example of a poorly installed erosion and sediment control system.

Figure 4-1: Poorly installed silt fencing

Erosion and sediment control has been identified as a Critical Area (or critical activity) because of the current development and potential for development in the Lower Fall Creek Watershed. The City of Lawrence, City of Noblesville, Town of Fishers, Hamilton County, and Madison County are required to have a an Erosion & Sediment Control Ordinance in order to be in compliance with the NPDES Phase II Stormwater Program. The City of Indianapolis has an Erosion & Sediment Control Ordinance as a requirement of the NPDES Phase I Stormwater Program. As construction and development occur within the Lower Fall Creek Watershed, additional precaution should be taken in areas of HEL or PHEL soil classifications.

- Conventional Tillage Practices

Within the Lower Fall Creek Watershed approximately 22,000 acres are in agricultural production; while approximately 13,500 acres are classified as HEL. As identified in Table 3-7, much of those acres in Hamilton, Hancock, and Madison Counties associated with corn production are utilizing conventional tillage (no data is available for Marion County tillage types).

Conventional tillage systems disturb the entire soil surface, resulting in less than 15% residue cover after planting. Conventional tillage practices on HEL or PHEL classified soils allow those erodible soils to be exposed to the weather for periods of time, typically during the spring wet weather prior to planting, or after harvest in the fall, leaving the soil exposed during the spring thaw, or both.

Figure 4-2: Indian Lake

Indian Lake Watershed

Indian Lake is located in the City of Lawrence. Approximately 16,000 acres drain to this 54 acre lake (**Figure 4-2**). This ratio of 300:1 far exceeds the current standard of 100:1. The Hancock County portion of the Indian Lake subwatershed remains primarily undeveloped with the

exception of proposed growth in the Town of McCordsville. The Marion County portion is predominantly residential.

The Indian Lake Homeowners Association has been dredging approximately 3,000-5,000 tons of sediment from the lake on an annual basis. Due to this frequency and volume, the Association has found it to be more cost effective to purchase their own dredging equipment. In 2007, the Indian Lake Homeowners Association reached a settlement agreement with INDOT for damages due to negligence in erosion control during a 2005 Pendleton Pike road project. The settlement funds are to be put toward dredging cost.

Indian Lake was selected by the working groups and the Steering Committee based on the amount of sediment entering the lake necessitating dredging on a routine basis. Water quality, macroinvertebrate, and physical assessments completed within the Indian Lake watershed have attributed impaired waters or degraded habitats to the excessive amount of silt within the streams and tributaries leading to the lake.

Indian Lake can provide a good representation of the issues faced by many of the lakes within the Lower Fall Creek Watershed and is currently managed by an active Homeowners Association willing to put forth effort to protect the quality and aesthetic value of their lake.

Eroded Streambanks

During the assessments completed by IUPUI students in 2007 and by Commonwealth Biomonitoring in 2008 streambanks experiencing erosion were observed and noted. These areas, identified on Exhibit 4-1, and the upstream drainage areas should be further studied to determine the specific causes for the streambank erosion; lack of riparian vegetation, streambank encroachment by agricultural or development practices, or increases in conveyance volumes via surface runoff or direct piping to the receiving streams. In the more rural areas of the watershed, Commonwealth's Site 6, located in Hancock County is of significant interest. Clumps of streambank with vegetation attached, signifying recent erosion, and excess silt within the streambed were observed. While no areas of exceptional erosion were noted in the IUPUI assessment, only 5 of the 16 sites were noted as having stable banks.

Figure 4-3: Eroded Streambank at Windridge Condominiums

Several stakeholders present at the public meetings, Steering Committee meetings, and Work Group meetings discussed the effects of streambank erosion and how it can potentially have a direct effect on hundreds of property owners. One example of such significant damages caused by streambank erosion is located near the intersection of Emerson Way and 56th Street. Windridge Condominiums and the National Headquarters of Phi Kappa Psi experienced a significant loss of streambank in March 2007 requiring them to relocate approximately 400 linear feet of sanitary sewer along Fall Creek (**Figure 4-3**) and close to the main entrance to the Phi Kappa Psi house.

This area has been identified as a Critical Area within the Lower Fall Creek Watershed since it represents the magnitude of social, physical, and economic losses that result when streambank erosion is not addressed. Streambank erosion is usually a symptom of a larger problem in the watershed.

Further downstream, the accumulation of sediment and large woody debris from the eroded banks of Fall Creek have restricted flow and flooded commercial and residential developments. The Windridge Condominiums Homeowners Association have recently retained the services of a professional engineering firm to study the drainage area and determine the best solution to stabilize the banks of Fall Creek, reduce additional streambank erosion, and downstream flooding.

Nutrient Critical Areas

Nutrient Critical Areas or activities were identified as the over application of lawn fertilizers on residential lakes and golf courses. The Steering Committee and Work Groups worked to determine where to focus efforts on reducing nutrient loads with the anticipation of having the greatest overall watershed effect and a high visibility for implemented practices or BMPs. As a result, lakes greater than 50 acres in size and surrounded by residential land use and golf courses were identified. **Exhibit 4-2** illustrates the location of these 5 lakes and 8 golf courses in the Fall Creek Watershed.

Golf Courses

The maintenance practices of golf courses are often identified as a source of runoff polluted with excess nutrients and chemicals. Courses are also designed with several ponds or "water hazards" which may be attractive to water fowl such as Canada Geese, also commonly identified as a source of nutrient, and other pollutant, loadings. Without good course design and maintenance practices, golf courses can have a detrimental effect on riparian buffers, wetlands, and water quality. Further, groundwater may be impacted by heavily applied fertilizers and pesticides.

Of the 8 golf courses identified on Exhibit 4-2, only one, Indian Lake Country Club Golf Course, lies within a Wellfield Protection Area (Geist). In addition, there are 5 courses that are directly adjacent to or span across bodies of water: Brendonwood (Fall Creek); Fort Golf Course (Camp Creek); Gray Eagle (Mud Creek); Hawthorne (Mud Creek); and Ironwood (Mud Creek). The Fort Golf Course (**Figure 4-4**) is in the process of achieving certification through the Audubon International's Cooperative Sanctuary Program for Golf Courses. The Ironwood Golf Course, shown in **Figure 4-5**, highlights the proximity of the golf course to Stonebridge Lake, which is one of the prioritized residential lakes within the Lower Fall Creek watershed.

Golf courses within the Lower Fall Creek Watershed have been identified as Critical Areas due to the potential for elevated levels of fertilizers and pesticides in runoff to surface waters or the potential for leaching into groundwater systems. These public courses are highly visible, visited by thousands of stakeholders each year, and may also serve as sites for future projects related to reduced fertilizer application, stormwater pollutant filtration measures, riparian buffers, and education and outreach efforts.

Figure 4-4: Fort Golf Course

Figure 4-5: Ironwood Golf Club

Residential Lakes

Inland lakes surrounded by residential land use may be severely impacted due to excess lawn fertilizers, pet & wildlife waste, and even failing residential septic systems. As the lake systems are impacted by increased bacteria and nutrient loadings human health issues, aesthetic value, and property values may also be negatively impacted as a result. Residential lakes were selected based on the potential concentrations of homeowners reached through education and outreach efforts focused through the HOA, the visibility of BMPs installed or measures implemented, and the ability to involve individual homeowners or the HOA through long-term monitoring and measurement of the impacts of BMP installation.

Figure 4-6: Lake Maxinhall

Five residential lakes greater than 50 acres were selected as Critical Areas. These include: Lake Kesslerwood (East & West), Lake Maxinhall, Stonebridge, and Indian Lake. These were selected because there is opportunity to build the partnerships needed to implement management measures and observe or monitor water quality improvements. Two of the 5 lakes (Indian Lake and Lake Maxinhall) were created through sand and gravel mining operations several years ago. These lakes also lie within WFPAs, further creating the need for designation as a critical area as there is a direct connection between surface water and ground water within these areas. **Figure 4-6** is of Lake Maxinhall, one of the lakes located within a WFPA. This particular lake is of particular interest because it is within proximity to several non-sewered neighborhoods along its eastern border. Other lakes considered critical have a direct connection to Fall Creek or tributary streams as Indian Creek travels through Indian Lake (also located within a WFPA), tributaries to Sand Creek travel through Stonebridge Lake, and Atkinson Creek flows to Lake Kesslerwood and an outlet to Fall Creek has been constructed in

this area.

More details regarding other sources of nutrient loading to the watershed, non-sewered areas and CSOs, will be included within the pathogens discussion.

Pathogen Critical Areas

Specific Critical Areas or activities for pathogens were identified by the Fall Creek TMDL, Steering Committee, Work Groups, and watershed stakeholders as non-sewered developments, livestock and manure management, and Wellfield Protection Areas. **Exhibit 4-3** shows the overall location of these Critical Areas or activities. Other areas discussed by these groups, but not considered as a Critical Area (or activity) within this WMP, are CSOs, waterfowl, and stormwater runoff.

Non-Sewered Development

Septic systems can be a safe and effective method for treating wastewater if they are sized, sited, and maintained properly. However, as discussed in Section 3.0, failing and inadequately functioning systems are a common source of bacteria and pathogens in waterbodies. The NRCS has rated 92% of the soil in the Lower Fall Creek as moderate or severely limited for septic system use.

An additional concern within non-sewered developments is the potential for septic systems to be tied directly to local drainage tiles, ditches and storm sewer systems. These illicit discharges serve as a direct conduit for bacteria and pathogens (and excess nutrients) to travel to streams within the watershed. As a part of the NPDES Stormwater Phase I and Phase II requirements, communities within the Lower Fall Creek Watershed are required to screen outfalls during periods of dry weather to identify these illicit discharges. For many of the Lower Fall Creek Watershed Communities, this process has not yet began as regulatory schedules have not required this action.

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The STEP areas include:

- High Priority Neighborhoods – 82^{nd} and Redbud, 46^{th} and Millersville, 46^{th} and Emerson, 42^{nd} and Sherman, 42^{nd} and Millersville
- Medium Priority Neighborhoods – 62st and Allisonville, 46^{th} and Allisonville

- Low Priority Neighborhoods – 57th and Kessler, 55th and Allisonville, Fall Creek and Johnson, 46th and Ritter

In Hancock County, with the exception of some isolated septic systems, the developed areas are serviced by the Town of McCordsville Sewer District.

Livestock and Manure Management

Manure, whether being stored, applied for crop nutrition, or simply the by-product of grazing is a water quality concern within Lower Fall Creek Watershed. The Fall Creek TMDL did not discuss agricultural sources of bacteria or pathogens due to the limited amount of agricultural land use within Marion County. However, elsewhere in the watershed, livestock and manure are more of a contributing factor.

- Confined Feeding Operations

A Confined Feeding Operation (CFO) is a livestock operation that has in excess of 600 hogs, 300 cattle, or 600 sheep. These facilities are required, by IAC 16-2-5, to obtain a permit from IDEM's Office of Land Quality. According to IDEM's records, there is only 1 active CFO located in the Lower Fall Creek Watershed. In addition to this CFO within the watershed, there are Animal Feeding Operations (AFOs) in the upper reaches of the Lower Fall Creek Watershed in Hamilton, Hancock, and Madison Counties. These operations continue to decline in number and in number of cattle, pigs, and sheep at each operation. Further, Hamilton County ranks among the top 10 counties in Indiana in regard to the number of horses.

As discussed earlier within previous sections, the Steering Committee and Working Groups have agreed that agricultural related management efforts are best led by the individual county SWCDs. Local SWCD and NRCS staff have long-established relationships with agricultural landowners as well as an extensive knowledge of USDA programs designed to mitigate livestock and manure impacts as well as those designed to protect water quality in a livestock production area.

- Indiana State Fair Grounds

In urban areas, runoff from impervious surfaces, such as parking lots and roads are major contributors to stream pollution. The Indiana State Fair Grounds was identified as a Critical Area because it comprised of more than 250 acres (approximately 70 acres of imperviousness) in the Lower Fall Creek Watershed. The State Fair is home to more than 300 events each year, including the annual Indiana State Fair. During the State Fair, the fairgrounds are populated with thousands of livestock, including horses, cattle, hogs, sheep, poultry and numerous others (**Figure 4-7**). The livestock are usually available for display in one of the fairgrounds 7 livestock barns.

Figure 4-7: Horse event at State Fair

Water quality data collected to date indicates that the State Fair grounds are contributing *E. coli* loadings to Fall Creek. Since 1993, the Health Department has collected grab samples on Fall Creek during the State Fair. This sampling program has included the collection of *E. coli* samples at 39th Street, which is located upstream of the fairgrounds, at the fairgrounds stormwater outfall, and downstream of the fairgrounds at 30th Street. A similar sampling program conducted since 1994 has demonstrated parallel results.

There has long been recognition that animal waste from the fairgrounds contributes to pollution to Fall Creek. In 1999, the City of Indianapolis DPW completed a 104(b)(3) water quality cooperative grant to design a wetland-type wastewater treatment system for runoff leaving the fairground site. However, this project was never constructed.

Wellfield Protection Areas

There are 5 Wellfield Protection Areas (WFPA) in the Lower Fall Creek Watershed. These include the Riverside, Fall Creek, Lawrence, Geist, and Southern Madison County Utilities wellfields.

Figure 4-8: Wellfield Protection Area

WFPAs were identified as a Critical Area because of the potential contamination to groundwater and drinking water supply to approximately 20% of central Indiana population. Pollutants of particular concern in these areas are nutrients and pathogens. Land use and land use practices in the 4 WFPAs in Marion County that may impact groundwater are regulated through a Wellfield Protection Ordinance (City County General Ordinance # 91, 2003). As part of this Ordinance, new development and redevelopment plans are reviewed by a Technically Qualified Person (TQP).

The Ordinance also established a Marion County Wellfield Education Corporation (MCWEC) whose mission is to prevent contamination of groundwater through public awareness and education – like the "Entering Wellfield Protection Area" roadside sign illustrated in **Figure 4-8**. MCWEC targets it education and outreach efforts toward the businesses in the WFPAs that were grandfathered under the Ordinance. Although a Source Water Protection Plan has been prepared for the WFPA in Madison County, an Ordinance regulating land use has not been adopted.

Other

As mentioned, the Fall Creek TMDL, as well as the Steering Committee, Work Groups, and stakeholders also mentioned concerns over the pathogen loadings attributed to CSOs, waterfowl (and other wildlife), and stormwater runoff within the Lower Fall Creek Watershed. While these are important considerations throughout the watershed, and throughout Indiana, this WMP will not highlight specific areas as Critical Areas.

Regarding CSOs within the watershed, the City of Indianapolis has developed their LTCP which will ultimately capture 95-97% of sewage entering streams during wet weather and it is estimated that the implementation of this plan will cost more than $1.73B. The LTCP has detailed actions that will be taken to reduce water quality problems associated with CSOs, and should be referenced for all CSO related water quality improvements.

It is anticipated that actions taken to reduce pollutant loadings within the Critical Areas previously discussed will also reduce pollutant loadings associated with waterfowl (and wildlife) and pollutant laden stormwater runoff. For example, stabilization of streambanks will help reduce sediment loadings, but will also help to reduce pollutant loadings from waterfowl as bank and overhanging vegetation along streambanks and shorelines prohibit Canada Geese from staying in areas for prolonged periods of time. Further reducing applications of nutrients, implementing erosion control practices, and conversion from conventional to conservational tillage practices will also decrease the amount of pollutants within stormwater runoff.

Table 4-1: Identifying Critical Areas Work Group Exercise

DOCUMENTED WATER QUALITY POLLUTANT IN LOWER FALL CREEK	TYPICAL LAND USE/LAND USE PRACTICE ASSOCIATED WITH POLLUTANT		CRITICAL AREAS IN LOWER FALL CREEK WATERSHED
SEDIMENT impacts: Aquatic Life – *reduces plant growth, smothers and covers spawning grounds and benthic habitats* Recreational Impact – *reduces water clarity, reduces aesthetic appeal, stresses sport fishing populations* Drinking Water – *increases drinking water treatment costs, damages pumps and infrastructure*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Conservation Areas • Post-Construction Practices	**DEGRADE** water quality: • Tillage Practices • Construction Practices • Streambank Erosion • Stormwater Runoff	• *Erosion and sediment control enforcement* • *HEL & PHEL Classified Soils* • *Indian Lake Watershed* • *Eroded Streambanks*
NUTRIENT (Phosphorus & Nitrogen) impacts: Aquatic Life – *promotes algal blooms, reduces dissolved oxygen concentrations* Recreational Impact – *causes algal blooms, reduces aesthetic appeal, and causes unpleasant odors* Drinking Water – *increases drinking water treatment costs (taste and odor), resultant algae can clog water intakes and filters*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Post-Construction Practices	**DEGRADE** water quality: • Fertilizer Application • Failing Septic Systems	• *Over application of fertilizers (residential lakes and golf courses)* • *Wellfield Protection Areas*
PATHOGENS (Bacteria & Viruses) *impacts:* Aquatic Life – *exposes aquatic life to disease causing organisms* Recreational Impact – *exposes recreational users to disease causing organisms* Drinking Water – *increases drinking water treatment costs*	**BENEFIT** water quality: • Sewer Service • Exclusionary Fencing	**DEGRADE** water quality: • Failing Septic Systems • Combined Sewer Overflows (CSO) • Illicit Connections to Storm Sewer • Wildlife • Stormwater Runoff • Livestock & Manure Management	• *Indiana State Fair Grounds* • *Wellfield Protection Areas* • *Non-sewered development* • *Wellfield Protection Areas* • *Livestock and Manure Management Areas*

4.0 CRITICAL AREAS

Critical Areas are specific areas or activities in the watershed that are suspected of degrading water quality. Focusing on a few specific areas or activities should be more effective at improving water quality than a generalized watershed-based program. Implementation of management measures (programs, policies, or projects) for these specific areas or activities in the watershed should have the greatest impact on water quality. However, not all areas and activities identified as Critical Areas may be at a stage where management measures can be implemented. In this case, these are still valid Critical Areas because they provide an example of what is happening in the Lower Fall Creek Watershed and an opportunity to learn what, if anything could be done differently to improve water quality.

4.1 IDENTIFICATION OF CRITICAL AREAS

To identify Critical Areas in the Lower Fall Creek Watershed, each of the 3 work groups (Education & Outreach, Land Use & Economic Development, and Water Quality) met and reviewed the list of Stakeholder concerns from Table 3-1 and composite GIS maps showing wellfield protection areas, erodible lands, floodplains, sewer service areas, impaired streams, and land use.

Each work group discussed the impact of sediment, nutrients, and pathogens on aquatic life, recreation, and drinking water; the land use or land use practice associated with each pollutant; and then identified specific areas or activities in the Lower Fall Creek Watershed suspected of degrading water quality. **Table 4-1** is a copy of the exercise used to identify Critical Areas with each work group.

<u>Sediment Critical Areas</u>

As shown on **Exhibit 4-1**, the specific sediment Critical Areas include areas classified as HEL or PHEL, especially those areas lacking sediment and erosion controls and those with conservation tillage; the Indian Lake watershed, and streambanks identified as undergoing severe erosion.

HEL & PHEL Classified Soils

HEL determinations are made by the NRCS, are based on mathematical equations considering rainfall factors, erodibility of the soil type, allowable loss for that soil type, and the length and the slope of the area. Soil map units may be classified as Potentially Highly Erodible (PHEL) based on a varying range of length/slope values. In such instances, the final determination of erodibility must be made through an onsite investigation.

Approximately 20% of the soils within the watershed are classified as HEL or PHEL. Activities exposing HEL or PHEL soil types for periods of time, such as construction or conventional tillage, may exacerbate the erosion and sedimentation impact within the Lower Fall Creek Watershed.

- Lack of Erosion & Sediment Control

According to US EPA, the most environmentally dangerous period of development is the initial construction phase when land is cleared of vegetation and graded to create a proper surface for construction. The removal of natural vegetation and topsoil makes the exposed area particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas.

Figure 4-1: Poorly installed silt fencing

Erosion and sediment control is widely accepted as a necessary practice, but there are certain caveats to making it effective. First, communities need to have the staff and resources to adopt and enforce an Erosion & Sediment Control Ordinance. In addition, a Technical Standards or Manual (as part of the Erosion & Sediment Control Ordinance) needs to provide useful guidance on selecting erosion and sediment control measures. Finally, education of contractors, engineers, and designers regarding the importance and effective use of erosion and sediment controls is imperative to implementing effective erosion and sediment control. **Figure 4-1** shows an example of a poorly installed erosion and sediment control system.

Erosion and sediment control has been identified as a Critical Area (or critical activity) because of the current development and potential for development in the Lower Fall Creek Watershed. The City of Lawrence, City of Noblesville, Town of Fishers, Hamilton County, and Madison County are required to have a an Erosion & Sediment Control Ordinance in order to be in compliance with the NPDES Phase II Stormwater Program. The City of Indianapolis has an Erosion & Sediment Control Ordinance as a requirement of the NPDES Phase I Stormwater Program. As construction and development occur within the Lower Fall Creek Watershed, additional precaution should be taken in areas of HEL or PHEL soil classifications.

- Conventional Tillage Practices

Within the Lower Fall Creek Watershed approximately 22,000 acres are in agricultural production; while approximately 13,500 acres are classified as HEL. As identified in Table 3-7, much of those acres in Hamilton, Hancock, and Madison Counties associated with corn production are utilizing conventional tillage (no data is available for Marion County tillage types).

Conventional tillage systems disturb the entire soil surface, resulting in less than 15% residue cover after planting. Conventional tillage practices on HEL or PHEL classified soils allow those erodible soils to be exposed to the weather for periods of time, typically during the spring wet weather prior to planting, or after harvest in the fall, leaving the soil exposed during the spring thaw, or both.


Figure 4-2: Indian Lake

Indian Lake Watershed

Indian Lake is located in the City of Lawrence. Approximately 16,000 acres drain to this 54 acre lake (**Figure 4-2**). This ratio of 300:1 far exceeds the current standard of 100:1. The Hancock County portion of the Indian Lake subwatershed remains primarily undeveloped with the

exception of proposed growth in the Town of McCordsville. The Marion County portion is predominantly residential.

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- Confined Feeding Operations

A Confined Feeding Operation (CFO) is a livestock operation that has in excess of 600 hogs, 300 cattle, or 600 sheep. These facilities are required, by IAC 16-2-5, to obtain a permit from IDEM's Office of Land Quality. According to IDEM's records, there is only 1 active CFO located in the Lower Fall Creek Watershed. In addition to this CFO within the watershed, there are Animal Feeding Operations (AFOs) in the upper reaches of the Lower Fall Creek Watershed in Hamilton, Hancock, and Madison Counties. These operations continue to decline in number and in number of cattle, pigs, and sheep at each operation. Further, Hamilton County ranks among the top 10 counties in Indiana in regard to the number of horses.

As discussed earlier within previous sections, the Steering Committee and Working Groups have agreed that agricultural related management efforts are best led by the individual county SWCDs. Local SWCD and NRCS staff have long-established relationships with agricultural landowners as well as an extensive knowledge of USDA programs designed to mitigate livestock and manure impacts as well as those designed to protect water quality in a livestock production area.

- Indiana State Fair Grounds

In urban areas, runoff from impervious surfaces, such as parking lots and roads are major contributors to stream pollution. The Indiana State Fair Grounds was identified as a Critical Area because it comprised of more than 250 acres (approximately 70 acres of imperviousness) in the Lower Fall Creek Watershed. The State Fair is home to more than 300 events each year, including the annual Indiana State Fair. During the State Fair, the fairgrounds are populated with thousands of livestock, including horses, cattle, hogs, sheep, poultry and numerous others (**Figure 4-7**). The livestock are usually available for display in one of the fairgrounds 7 livestock barns.

Figure 4-7: Horse event at State Fair

Water quality data collected to date indicates that the State Fair grounds are contributing *E. coli* loadings to Fall Creek. Since 1993, the Health Department has collected grab samples on Fall Creek during the State Fair. This sampling program has included the collection of *E. coli* samples at 39th Street, which is located upstream of the fairgrounds, at the fairgrounds stormwater outfall, and downstream of the fairgrounds at 30th Street. A similar sampling program conducted since 1994 has demonstrated parallel results.

There has long been recognition that animal waste from the fairgrounds contributes to pollution to Fall Creek. In 1999, the City of Indianapolis DPW completed a 104(b)(3) water quality cooperative grant to design a wetland-type wastewater treatment system for runoff leaving the fairground site. However, this project was never constructed.

Wellfield Protection Areas

There are 5 Wellfield Protection Areas (WFPA) in the Lower Fall Creek Watershed. These include the Riverside, Fall Creek, Lawrence, Geist, and Southern Madison County Utilities wellfields.

Figure 4-8: Wellfield Protection Area

WFPAs were identified as a Critical Area because of the potential contamination to groundwater and drinking water supply to approximately 20% of central Indiana population. Pollutants of particular concern in these areas are nutrients and pathogens. Land use and land use practices in the 4 WFPAs in Marion County that may impact groundwater are regulated through a Wellfield Protection Ordinance (City County General Ordinance # 91, 2003). As part of this Ordinance, new development and redevelopment plans are reviewed by a Technically Qualified Person (TQP).

The Ordinance also established a Marion County Wellfield Education Corporation (MCWEC) whose mission is to prevent contamination of groundwater through public awareness and education – like the "Entering Wellfield Protection Area" roadside sign illustrated in **Figure 4-8**. MCWEC targets it education and outreach efforts toward the businesses in the WFPAs that were grandfathered under the Ordinance. Although a Source Water Protection Plan has been prepared for the WFPA in Madison County, an Ordinance regulating land use has not been adopted.

Other

As mentioned, the Fall Creek TMDL, as well as the Steering Committee, Work Groups, and stakeholders also mentioned concerns over the pathogen loadings attributed to CSOs, waterfowl (and other wildlife), and stormwater runoff within the Lower Fall Creek Watershed. While these are important considerations throughout the watershed, and throughout Indiana, this WMP will not highlight specific areas as Critical Areas.

Regarding CSOs within the watershed, the City of Indianapolis has developed their LTCP which will ultimately capture 95-97% of sewage entering streams during wet weather and it is estimated that the implementation of this plan will cost more than $1.73B. The LTCP has detailed actions that will be taken to reduce water quality problems associated with CSOs, and should be referenced for all CSO related water quality improvements.

It is anticipated that actions taken to reduce pollutant loadings within the Critical Areas previously discussed will also reduce pollutant loadings associated with waterfowl (and wildlife) and pollutant laden stormwater runoff. For example, stabilization of streambanks will help reduce sediment loadings, but will also help to reduce pollutant loadings from waterfowl as bank and overhanging vegetation along streambanks and shorelines prohibit Canada Geese from staying in areas for prolonged periods of time. Further reducing applications of nutrients, implementing erosion control practices, and conversion from conventional to conservational tillage practices will also decrease the amount of pollutants within stormwater runoff.

Table 4-1: Identifying Critical Areas Work Group Exercise

DOCUMENTED WATER QUALITY POLLUTANT IN LOWER FALL CREEK	TYPICAL LAND USE/LAND USE PRACTICE ASSOCIATED WITH POLLUTANT		CRITICAL AREAS IN LOWER FALL CREEK WATERSHED
SEDIMENT impacts: Aquatic Life – *reduces plant growth, smothers and covers spawning grounds and benthic habitats* Recreational Impact – *reduces water clarity, reduces aesthetic appeal, stresses sport fishing populations* Drinking Water – *increases drinking water treatment costs, damages pumps and infrastructure*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Conservation Areas • Post-Construction Practices	**DEGRADE** water quality: • Tillage Practices • Construction Practices • Streambank Erosion • Stormwater Runoff	• *Erosion and sediment control enforcement* • *HEL & PHEL Classified Soils* • *Indian Lake Watershed* • *Eroded Streambanks*
NUTRIENT (Phosphorus & Nitrogen) impacts: Aquatic Life – *promotes algal blooms, reduces dissolved oxygen concentrations* Recreational Impact – *causes algal blooms, reduces aesthetic appeal, and causes unpleasant odors* Drinking Water – *increases drinking water treatment costs (taste and odor), resultant algae can clog water intakes and filters*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Post-Construction Practices	**DEGRADE** water quality: • Fertilizer Application • Failing Septic Systems	• *Over application of fertilizers (residential lakes and golf courses)* • *Wellfield Protection Areas*
PATHOGENS (Bacteria & Viruses) *impacts:* Aquatic Life – *exposes aquatic life to disease causing organisms* Recreational Impact – *exposes recreational users to disease causing organisms* Drinking Water – *increases drinking water treatment costs*	**BENEFIT** water quality: • Sewer Service • Exclusionary Fencing	**DEGRADE** water quality: • Failing Septic Systems • Combined Sewer Overflows (CSO) • Illicit Connections to Storm Sewer • Wildlife • Stormwater Runoff • Livestock & Manure Management	• *Indiana State Fair Grounds* • *Wellfield Protection Areas* • *Non-sewered development* • *Wellfield Protection Areas* • *Livestock and Manure Management Areas*

5.0 GOALS AND DECISIONS

Setting realistic and measurable goals is key to the successful implementation of the WMP. A goal is the desired change or outcome as a result of the watershed planning effort. Depending on the magnitude of the problem, goals may be general, specific, long-term, or short-term. The goals in this WMP focus on improving water quality through the implementation of a variety of management measures.

5.1 GOALS

The Lower Fall Creek Watershed Steering Committee agreed to focus on three pollutants throughout the identification of Critical Areas, development of proposed management measures, and the development of goals and decisions to improve water quality. Those pollutants are sediment, excess nutrients, and pathogens. A goal for public education and outreach is also included as this is an important part of the planning or implementation of this WMP.

Sediment

- Problem: Macroinvertebrate and habitat assessment scores at 17 of 28 (60%) of the sites assessed scored under 60 on the CQHEI or QHEI indices.

- Goal: Reduce sediment delivery to waterbodies within the Lower Fall Creek Watershed.

- Target: To achieve CQHEI or QHEI scores above 60 and improved habitat assessments at all sampling locations throughout the watershed in 10 years.

Nutrients

- Problem: Phosphorus concentrations within the Lower Fall Creek Watershed routinely exceed the EPA recommended threshold of 0.076 mg/L.

- Goal: Reduce excess nutrient loadings to waterbodies within the Lower Fall Creek Watershed.

- Target: To reduce phosphorus concentrations to at or below the EPA recommended threshold of 0.076 mg/L within 25 years. Phosphorus concentrations in many of the water quality samples have been below the detection limits of laboratory equipment utilized to analyze water quality samples (0.19 mg/L). For this reason, a recommended threshold lower than Indiana's draft benchmark of 0.30 mg/L was selected.

Pathogens

- Problem: E. coli concentrations within the Lower Fall Creek Watershed routinely exceed the State of Indiana's Water Quality Standard for a single sample daily maximum of 235 CFU per 100 milliliters or the 5 day geometric mean of 125 CFU per 100 milliliters.

- Goal: Reduce pathogen loadings to waterbodies within the Lower Fall Creek Watershed.

- Target: To reduce E. coli loadings to levels indicated in the Fall Creek TMDL (52% reduction of E. coli loadings upstream of CSO area and 99.5% reduction of E. coli loadings downstream of CSO area) within 25 years.

Education and Outreach

- Problem: It is difficult to indicate the successes of public education and outreach efforts such as media releases, workshops, and brochures designed to raise awareness, change behaviors, and have a positive impact on water quality.

- Goal: Increase watershed related public education and outreach efforts within the Lower Fall Creek Watershed.

- Target: Utilize social indicator survey results to prepare future public education and outreach efforts for use in implementation of the proposed management measures and to assist with other outreach efforts such as MS4 Phase I and Phase II Public Education/Public Involvement, SWCD educational materials, and the larger 8-digit HUC Upper White River Watershed Alliance (UWRWA) on at least an annual basis.

5.2 DECISIONS

Throughout Steering Committee meetings, Work Group meetings, and with input from stakeholders, potential management measures were identified and recorded. During the May 13, 2008 Steering Committee members were invited to discuss, wordsmith, combine, and delete the list of potential management measures. Once the measures were agreed upon, the Steering Committee identified responsible partners, financial and technical resources, and an estimated timeframe for implementation. The management measures are grouped by goal (sediment, nutrient, pathogen, and education) in **Table 5-1** through **Table 5-4**.

Figure 3-4 was utilized with tables 5-1 through 5-4 to determine areas where proposed management measures could be targeted with beneficial impacts to water quality or where BMPs could be installed as demonstrational practices in highly visible or utilized areas throughout the watershed.

Table 5-1: Sediment Management Measures

Management Measures	Responsible / Partnering Entity	Financial / Technical Assistance Needed	Timeline for Implementation	Milestones for Implementation
Educate contractors and developers regarding Rule 5 & Rule 13 requirements, inspections, and enforcement. *Where:* • *City of Lawrence due to high percentage of HEL or PHEL classified soils* • *Town of Fishers, City of Noblesville, and Town of McCordsville as areas under development pressure*	IDEM Hoosier Heartland Resource, Conservation, & Development (HHRCD) MS4 Communities *All* SWCDs *All* Building Association of Greater Indianapolis (BAGI)	• Educational materials (IDEM, EPA) • List of contractors and developers to invite • List of construction sites for field exercise • Feedback mechanism to improve on annual training • Rule 5 & Rule 13 program expertise • Inspection forms • List of local, state, federal penalties for non-compliance • Training materials • *$3,500 per full day training*	5 years	1. Build partnerships with HHRCD, MS4s SWCD, BAGI, etc. 2. Develop training module (field and classroom) materials 3. Conduct annual pre-construction season training
Stabilize streambanks within the watershed with native vegetation (target adjacent publicly owned open spaces and golf courses), removing invasive species if present. *Where:* • *Public areas where access and willingness may be higher* • *Commonwealth Biomonitoring Site #6* • *IUPUI Assessment sites based on feasibility and cost/benefit* ***Estimated Load Reductions:*** *Utilizing STEPL: 300 linear feet, 15 feet height Severe lateral recession (0.3-0.5 ft/year), Clay soil* *Pre stabilization = 63.0 tons/year sediment load* *Post stabilization = 3.2 tons/year sediment load* *Reduction = 59.8 tons/year sediment* *(Also includes 110 lb/yr Nitrogen; 42 lb/yr Phosphorus; and 220 lb/yr BOD*	Parks Departments *All* Golf Course Managers Keep Indianapolis Beautiful (KIB) SWCDs *Hamilton County* *Marion County*	• GIS for mapping and prioritization • Detailed topography for design • Engineer to model stream and design stabilization alternatives • Invasive species field guide and hand tools • Volunteers • Contractors and equipment • Permits writer and fees • Stabilization materials (plants, stone, fabric) • *$200 - $1,000 per linear foot stabilized*	5 years	1. Starting with public owned open space and golf courses, conduct a comprehensive streambank inventory 2. Prioritize areas for stabilization 3. Starting with the high priority sites, develop design alternatives 4. Obtain permits, stabilization materials 5. Schedule construction, coordinate laborers 6. Stabilize streambank according to selected design

Management Measures	Responsible / Partnering Entity	Financial / Technical Assistance Needed	Timeline for Implementation	Milestones for Implementation
Develop a Lake Management Plan for priority lakes *Where:* • *Indian Lake due to observed and experienced problems* • *Other lakes as willing*	HOAs *All* Planning & Zoning Departments *Indianapolis DMD* *Town of Fishers* SWCDs *Marion County* *Hamilton County* Lower Fall Creek Watershed Alliance (LFCWA)	• Model Lake Management Plan • Coordinator (paid or volunteer) • GIS for analysis and exhibits • Existing physical, chemical, biological data • *$5,000 - $30,000 (will vary with size of lake/watershed)*	5-10 years	1. Identify pollutants, sources, and causes (collect data if needed) 2. Work with HOA and DMD to develop Lake Management Plan 3. "Adopt" Lake Management Plan by HOA 4. Work with DMD or Planning and Zoning Department to establish Overlay Zone or amend allowable land uses/densities upstream (if warranted)
Reduce soil erosion and stormwater runoff from construction sites. *Where:* • *Construction sites located on HEL or PHEL classified soils* ***Estimated Load Reductions:*** *[obtaining potential load reductions for construction BMPs]*	MS4 Communities *All* IDEM SWCDs *All* Developers and Contractors	• ESC and SWPP plan reviewers • Inspectors • Checklist for review and inspection • Enforcement support from MS4 and IDEM • Training for developers, contractors, plan reviewers, inspectors • *Cost will be dependent on status of MS4 program and staff availability*	10 years	1. Develop checklist for plan review and inspection 2. Review ESC practices, SWPP, etc for active construction sties 3. Inspect construction site, discuss deficiencies with contractor 4. Enforce penalty in ESC Ordinance for non-compliance
Create a Highly Erodible Land (HEL) Overlay Zone for planning & zoning purposes. *Where:* • *Throughout Lower Fall Creek Watershed*	Planning & Zoning Departments *All* SWCDs *All* Lower Fall Creek Watershed Alliance (LFCWA)	• GIS for mapping and analysis • NRCS Soil Data • Model HEL Ordinance • Legal to review Ordinance • HEL literature • *No direct cost if development of overlay is completed by Planning & Zoning Departments*	5-10 years	1. Draft language for HEL Overlay Zone. 2. Create HEL maps. 3. Build support with decision-makers. 4. Adopt HEL Overlay Zone into Development Ordinance.

Management Measures	Responsible / Partnering Entity	Financial / Technical Assistance Needed	Timeline for Implementation	Milestones for Implementation
Establish signage program to identify active construction sites or developers that are in compliance with IDEM's Rule 5 program. *Where:* • *City of Indianapolis as the largest community* • *Town of Fishers, City of Noblesville, Town of McCordsville due to development pressure*	Planning & Zoning Departments *All* SWCDs *All* LFCWA	• Examples elsewhere • Inspectors (trained) • Yard signs • GIS for tracking • *$300 per sign*	25 years	1. Establish criteria 2. Build support among decision-makers and contractors 3. Develop signs, inspection forms, tracking 4. Train inspectors 5. Inspect sites, install yard signs
Partner with County SWCD and NRCS to identify lands non eligible for CRP, EQIP or other federal programs and work with landowners to implement BMPs such as conversion to conservation tillage or establishment of filter strips. *Where:* • *Agricultural lands within Hamilton, Hancock, and Madison Counties*	SWCDs *All* NRCS *All* LFCWA	• GIS for mapping and analysis • NRCS eligibility guidelines • Staff for site visits to discuss program with landowners • *Existing staff time*	5 years	1. Meet with NRCS and SWCD representatives to determine areas in agricultural production. 2. Highlight areas not eligible for federal programs 3. Meet with landowners within the watershed to discuss their long-term goals for the land 4. Implement or install appropriate BMPs

Table 5-2: Nutrient Management Measures

Management Measures	Responsible / Partnering Entity	Financial / Technical Assistance Needed	Timeline for Implementation	Milestones for Implementation
Evaluate Development Ordinances based on the Center for Watershed Protection's "Code & Ordinance Worksheet Tool". *Where:* • *City of Indianapolis, City of Lawrence due to locations within WFPAs*	Planning & Zoning Departments *All* Upper White River Watershed Alliance (UWRWA) Ball State or IUPUI School of Planning	• Code & Ordinance Worksheet tool • Local Ordinances • Planning Students • Legal to review amended language • Support of decision-makers to adopt changes (if needed) • *Existing staff time*	5 years	1. Secure assistance of planning student(s) 2. Review Code & Ordinance Worksheet 3. Modify Worksheet (if needed) 4. Review Ordinances, meet with local planning for clarification (if needed) 5. Draft recommendations 6. Amend Ordinances
Prepare a Wellfield Protection Ordinance for the Madison County WFPA. *Where:* • *Madison County*	Health Departments *Madison County* Planning & Zoning Departments *Madison County*	• Model Wellfield Protection Ordinance • Legal to review Ordinance • GIS to map WFPA and Overlay Zone • *Existing staff time*	5-10 years	1. Review model Ordinance 2. Modify language to meet needs of Madison County 3. Build support among decision-makers 4. Adopt ordinance, create Overlay Zone
Encourage golf courses along Fall Creek and lakes larger than 50 acres to participate in the Audubon Cooperative Sanctuary Program, Groundwater Guardian Green Sites, National Wildlife Federation, or a similar conservation program. *Where:* • *Golf Courses and lakes located within WFPAs*	Golf Course Managers Marion County Wellfield Education Corporation (MCWEC) Office Indiana State Chemist (OISC) HOAs, Neighborhood Associations *Lake 50+ acres* *Adjacent to Fall Creek*	• Program information • GIS for targeting and tracking • Educational materials • Expertise to assist with program requirements and annual reporting (if needed) • *Existing staff time*	10 years	1. Review program materials 2. Identify target areas within focus group 3. Develop educational materials (if needed) 4. Conduct meetings with targeted Golf Course Managers, HOAs, and Neighborhood Associations 5. Assist with program requirements and annual reporting (if needed)
Integrate Low Impact Development (LID) practices into new or re-development projects. *Where:* • *(re)developments within WFPAs if appropriate* • *(Re)developments adjacent to streams and tributaries* ***Estimated Load Reductions:*** *Indiana Stormwater Quality Manual suggests the following potential removal rates:* *<u>Infiltration Trench</u>: 90% TSS, Bacteria and Metals; 60% Phosphorus and Nitrogen* *<u>Bio-retention area</u>: 90% TSS, Bacteria, and Metals; 60% Phosphorus and Nitrogen* *<u>Stormwater Wetland</u>: 67% TSS; 77% bacteria; 30-60% metals; 50% Phosphorus; and 28% Nitrogen*	Developers Planning & Zoning Departments *All* SWCDs *All* HHRCD MCWEC UWRWA Water Utilities	• LID factsheets and guidance • Specific on BMPs (infiltration rates, sizing, design details, etc.) • Model Ordinance • Legal to review Ordinance language • Incentives Programs • LID training (design, construction, maintenance) • *$500 - $10,000 (will vary with practice and size requirements)*	25 years	1. Research LID practices 2. Identify BMPs suitable for soils, climate, etc. 3. Develop design/technical standards 4. Integrate language from Model Ordinance into local Ordinance 5. Establish incentives 6. Build support of decision-makers, developers, and contractors 7. Train plan reviewers and inspectors 8. Amend Ordinance

Table 5-3: Pathogen Management Measures

Management Measures	Responsible / Partnering Entity	Financial / Technical Assistance Needed	Timeline for Implementation	Milestones for Implementation
Establish or enhance shoreline and streambank riparian buffers to reduce potential increases in bacteriological impacts from wildlife and domestic pets throughout the Lower Fall Creek Watershed. *Where:* • *Areas of (re)development where stormwater ponds are present* • *Priority lakes* • *Golf Courses* ***Estimated Load Reductions:*** *Studies indicate that approximately 80% of E. coli in stormwater runoff can be removed through a 100 foot vegetated filter strip.*	Health Departments *All* Planning & Zoning Departments *All*	• Educational materials • GIS to map and track progress • Model Ordinance language (vegetation mowed to 12 inches max) • Educational signage • Trees, shrubs, herbaceous plants for buffer • *$50 - $2,000 per acre established*	5 years	1. Identify and prioritize target areas 2. Review Model Ordinances and other resources 3. Draft Ordinance language for maintenance adjacent to waterbodies 4. Build support decision-makers, HOAs 5. Enhance shoreline/streambank 6. Install educational signage
Partner with the Indiana State Fair Board to reduce *E. coli* loadings to Fall Creek. *Where:* • *Indiana State Fairgrounds*	4-H / Future Farmers of America (FFA) Fair Board Fair Commission Health Departments *Marion County* Mapleton - Fall Creek Neighborhood Association	• Engineer to model stormwater runoff, design alternatives • Water quality data • "Pathway to Water Quality" materials • Construction equipment, materials for demonstration project • *Cost will vary with BMP alternative*	5-10 years	1. Confirm source of E.coli loadings 2. Research and prioritize alternatives 3. Build support of decision-makers 4. Construct demonstration project and outdoor laboratory to monitor changes in water quality 5. Enhance "Pathway to Water Quality"
Partner with County SWCD and NRCS to identify lands non eligible for CRP, EQIP or other federal programs and work with landowners to implement BMPs such as nutrient management or establishment of filter strips. *Where:* • *Agricultural lands within Hamilton, Hancock, and Madison Counties*	SWCDs *All* NRCS *All* LFCWA	• GIS for mapping and analysis • NRCS eligibility guidelines • Staff for site visits to discuss program with landowners • *Existing staff time*	5 years	1. Meet with NRCS and SWCD representatives to determine areas in agricultural production. 2. Highlight areas not eligible for federal programs 3. Meet with landowners within the watershed to discuss their long-term goals for the land 4. Implement or install appropriate BMPs

Support the Septic Tank Elimination Program (STEP) especially within the WFPAs and floodplains of the Lower Fall Creek Watershed.	Health Departments *Marion County* Indianapolis DPW Health & Hospital Corporation *Marion County* HOAs, Neighborhood Associations *High, Medium, Low Priority*	• STEP literature • Septic maintenance information • GIS to map individual septic systems • Water quality data • Grant writing and administration • *Existing staff time*	10-25 years	1. Identify septic systems in WFPAs 2. Target these areas for connection to sewers 3. Distribute literature to HOA 4. Prepare grants to assist homeowners with connection fees
Provide education and outreach to areas outside of Marion County that with anticipated inadequately functioning septic systems or illicit storm sewer connections.	Health Departments *All* Indiana State Department of Health LFCWA	• Existing septic system literature • Septic maintenance information • GIS to map individual septic systems • Water quality data • Hamilton South Eastern sewer service areas • Grant writing and administration	10-25 years	1. Gather and distribute existing literature to provide to homeowners 2. Obtain sanitary sewer service coverage layers from Hamilton South Eastern Utility

Table 5-4: Education Management Measures

Management Measures	Responsible / Partnering Entity	Financial / Technical Assistance Needed	Timeline for Implementation	Milestones for Implementation
Create education demonstration project(s) to illustrate good urban development or redevelopment practices and good stormwater management in critical watershed areas. **Appendix 6** includes a BMP Demonstration Report prepared as part of this WMP. *Where:* • *WFPAs* • *Areas of HEL or PHEL classified soils*	MS4 Communities *All* Planning & Zoning Departments *All* HOAs *All* Community Development Corporations (CDCs) *All*	• BMP Demonstration Report • Willing landowner, developer, contractor • Technical assistance for design, construction, and maintenance • Stormwater management literature • Engineer to design BMP • Permits writer and fees (if needed) • BMP materials • Construction equipment and laborers	5 years	1. Prioritize demonstration site using BMP Demonstration Report research 2. Identify landowner and willingness to participate 3. Conduct site inventory and analysis and determine suitability, identify stormwater practice to implement 4. Design and construct BMP 5. Monitor and document long-term effectiveness
Develop future education & outreach programs based on results of the Social Indicators Survey. *Where:* • *Areas will be dependent on survey results*	LFCWA Purdue University	• Survey results (Purdue interpretation) • Education materials, programs, etc. (depending on survey results) • Follow-up survey • *2nd survey to be completed by Purdue* • *Existing staff time*	5-10 years	1. Conduct survey, compile results 2. Identify target areas and message for education and outreach 3. Develop and distribute materials (format depending on survey results) 4. Develop follow-up survey (with Purdue)
Host an annual "Watershed Awareness" or "Celebrate Fall Creek" event (stream clean-up, water quality monitoring, educational workshops, safety, health and wellness). *Where:* • *Along Fall Creek in an Indy Park for accessibility and visibility*	LFCWA Natural Resources Education Council Parks & Recreation *All* UWRWA Health Departments *All* Fort Benjamin Harrison State Park MS4 Communities *All*	• Marketing expertise • Social Indicator Survey results (identify target audience, target message) • Event planner • Media coverage • *Cost will vary based on partnership and contributions*	5-10 years	1. Partner and coordinate with similar entities 2. Identify target stakeholders (Social Indicators Survey) and tailor event to attract them 3. Identify high profile work project to be the focus of event

Evaluate land use planning strategies based on the Center for Watershed Protection's "Managing Stormwater in Your Community". *Where:* • *City of Indianapolis, City of Lawrence due to locations within WFPAs* • *Communities along 303(d) listed streams* • *Areas of localized flooding per MHMPs, FRP, or Mayor's Action Center*	Planning & Zoning Departments *All* Upper White River Watershed Alliance (UWRWA) Ball State or IUPUI School of Planning	• CWP document • Local Ordinances • Planning Students • Legal to review amended language • Support of decision-makers to adopt changes (if needed) • *Existing staff time*	5 years	1. Secure assistance of planning student(s) 2. Review Managing Stormwater in Your Community 3. Review planning strategies, meet with local planning for clarification (if needed) 4. Draft recommendations 5. Amend Land Use Plan
Obtain funding for Urban Conservationist position within the Marion County SWCD *Where:* • *Marion County SWCD (or partnering organization such as Hoosier Heartland RC&D)*	Marion County SWCD Hoosier Heartland RC&D NRCS	• New employee with conservation and/or urban conservation experience • Office space and appropriate equipment (computer, GIS, etc.) • *Approximately $40,000 per annum*	5 years	1. Secure funding through grants or special partnership with another organization. 2. Interview potential hires 3. Utilize Lower Fall Creek WMP to implement management measures 4. Provide education and outreach to targeted audiences regarding urban conservation measures and outcomes.

6.0 MONITORING EFFECTIVENESS

Monitoring effectiveness is an essential part of implementation of the WMP. Monitoring is based on a series of indicators that describe how the implementation steps will be tracked and evaluated to ultimately measure the success of the WMP.

6.1 IDENTIFYING INDICATORS

An indicator is a fact or datum that can be measured to show rate of change. There are 3 types of indicators: 1) administrative, such as something that can be counted – the number of permits, number of grassed waterways, or policy and ordinances adopted or enforced; 2) environmental, are long-time measurements of water quality of habitat – concentration of phosphorous or nitrogen in water; and 3) social, indicating changes in stakeholder attitudes and behaviors.

Indicators have been identified for each goal and management measure. Section 5 of this WMP discussed the problem, goal, and target for sediment, nutrient, pathogen, and education/outreach. These goals are as follows:

1. Reduce sediment delivery to waterbodies within the Lower Fall Creek Watershed.
2. Reduce excess nutrient loadings to waterbodies within the Lower Fall Creek Watershed.
3. Reduce pathogen loadings to waterbodies within the Lower Fall Creek Watershed.
4. Increase watershed related public education and outreach efforts within the Lower Fall Creek Watershed.

Table 6-1 through **Table 6-4** identifies the administrative, environmental, and social indicators and the tracking process for each of the management measures identified in Section 5. For consistency with Section 5, indicators are identified by sediment, nutrient, pathogen, and education/outreach. The successful implementation of the Lower Fall Creek WMP depends on the participation of a number of responsible/partnering entities (Table 5-1). However, tracking progress of this WMP will be the responsibility of the Marion County SWCD and the Lower Fall Creek Watershed Alliance.

Table 6-1: Sediment Indicators

Management Measure	Indicator	Tracking Process
Educate contractors and developers regarding Rule 5 & Rule 13 requirements, inspections, and enforcement.	Environmental – reduce sediment runoff from construction sites Social – change attitude and behavior of contractors and developers	• Number and type of contractors and developers that participate in training(s)
Stabilize streambanks along Fall Creek with native vegetation (target adjacent publicly owned open spaces and golf courses), removing invasive species if present.	Administrative – number of linear feet of streambank stabilized with natives Environmental – reduce sediment from failing streambanks Social – increase awareness about natives and value for water quality, streambank stabilization	• Feet of streambank where bank stabilized, natives planted, and invasives removed • Volume of invasive species removed, natives added, and materials to stabilize streambank • Number and type of participants
Develop a Lake Management Plan for priority lakes.	Administrative – completed Lake Management Plan Social – through the development of the Plan, change attitudes and behaviors of lake residents	• Completed Lake Management Plan
Reduce soil erosion and stormwater runoff from construction sites.	Administrative – enforce erosion and sediment control ordinances Environmental – reduce sediment runoff from construction sites	• Number of ordinance violations issued • Volume of sediment runoff reduced
Create a Highly Erodible Land (HEL) Overlay Zone for planning & zoning purposes.	Administrative – adoption of a HEL Overlay Zone Environmental – reduce sediment runoff Social – increase awareness of HEL soils and need for protection	• Adopted HEL Overlay Zone
Partner with County SWCD and NRCS to identify lands non eligible for CRP, EQIP, or other federal programs and work with landowners to implement BMPs such as conversion to conservation tillage or	Administrative – Implementation of BMPs Environmental – reduce sediment runoff Social – increase awareness of benefits of conservation tillage or other BMPs	• Number of acres converted, number of acres of filter strips, or number of other BMPs implemented • Volume of sediment runoff

establishment of filter strips		reduced
Establish signage program to identify active construction sites or developers that are in compliance with IDEM's Rule 5 program.	Administrative – implement program Environmental – reduce sediment runoff from construction sites Social – change attitudes and behavior about construction BMPs	• Number of signs installed • Volume of sediment runoff reduced

Table 6-2: Nutrient Indicators

Management Measure	Indicator	Tracking Process
Evaluate Development Ordinances based on the Center for Watershed Protection's "Code & Ordinance Worksheet Tool".	Administrative – amend Development Ordinances Environmental – improved water quality through better land use and site design practices Social – change attitudes and behaviors about land use planning and water quality	• Amended Development Ordinances
Prepare a Wellfield Protection Ordinance for the Madison County WFPA.	Administrative – adopt Wellfield Protection Ordinance Environmental – reduce potential for surface and groundwater pollution by regulating land use Social – change attitudes and behaviors about land use planning and water quality	• Adopted Wellfield Protection Ordinance
Encourage golf courses along Fall Creek and lakes larger than 50 acres to participate in the Audubon Cooperative Sanctuary Program, Groundwater Guardian Green Sites, National Wildlife Federation, or a similar conservation program.	Environmental – reduce nutrient runoff Social – increase awareness among golf course managers and residential property owners about nutrient application	• Number of participants in programs
Integrate Low Impact Development (LID) practices into new or re-development projects.	Administrative – amend Development Ordinances to allow for LID practices Environmental – capture and treat nutrients on-site; reduce runoff to receiving water Social – change attitudes and behaviors among decision-makers, developers, and land owners	• Number of LID techniques installed • Volume of nutrients captured and treated with LID BMPs

Table 6-3: Pathogen Indicators

Management Measure	Indicator	Tracking Process
Establish or enhance shoreline and streambank riparian buffers to reduce potential increases in bacteriological impacts from wildlife and domestic pets throughout the Lower Fall Creek Watershed.	Environmental – reduced pathogens from wildlife and domestic animals Social – change attitudes and behaviors among landowners around lakes and along waterways	• Volume of pathogens reduced
Partner with the Indiana State Fair Board to reduce *E. coli* loadings to Fall Creek.	Environmental – reduce pathogens from State Fairgrounds Social – change attitudes and behaviors of fairground managers	• Volume of pathogens reduced
Partner with County SWCD and NRCS to identify lands non eligible for CRP, EQIP, or other federal programs and work with landowners to implement BMPs such as nutrient management or establishment of filter strips	Administrative – Implementation of BMPs Environmental – reduce pathogen laden runoff Social – increase awareness of benefits of nutrient management or other BMPs	• Number of Nutrient Management Plans developed, or number of other BMPs implemented • Volume of pathogen laden runoff reduced
Support the Septic Tank Elimination Program (STEP) especially within the WFPAs and floodplains of the Lower Fall Creek Watershed.	Administrative – implementation of STEP in WFPA and floodplain Environmental – reduced pathogens from failing septic systems	• Volume of pathogens reduced • Number of septic tanks eliminated in WFPA and floodplain
Provide education and outreach to areas outside of Marion County with anticipated inadequately functioning septic systems or illicit storm sewer connections.	Administrative – Educational materials distributed or provided Environmental – reduced pathogens from failing septic systems or illicit connections Social – increased awareness of septic system maintenance and water quality impacts	• Number of materials provided, homeowners reached

Table 6-4: Education Indicators

Management Measure	Indicator	Tracking Process
Create education demonstration project(s) to illustrate good urban development or redevelopment practices and good stormwater management in critical watershed areas. **Appendix 6** includes a BMP Demonstration Report prepared as part of this WMP.	Administration – BMP Demonstration Report implemented Environmental – reduced sediment, nutrients, and pathogen loads to receiving waters Social – change attitudes and behaviors of landowners installing BMPs and public viewing BMP	• Number of BMP Demonstration projects implemented • Volume of pollutants reduced
Develop future education & outreach programs based on results of the Social Indicators Survey.	Administrative – establish programs based on survey responses Social – change attitudes and behaviors of survey participates	• Number of programs established
Host an annual "Watershed Awareness" or "Celebrate Fall Creek" event (stream clean-up, water quality monitoring, educational workshops, safety, health and wellness).	Social – change attitudes and behaviors of event participants	• Number of participants • Number of workshops • Miles stream clean-up
Evaluate land use planning strategies based on the CWP's "Managing Stormwater in Your Community"	Administrative – amend Land Use Plans Environmental – improved water quality through better land use and site design practices Social – change attitudes and behaviors about land use planning and water quality	• Number of Land Use Plans amended

6.2 PLAN EVALUATION

The Marion County SWCD in partnership with the Lower Fall Creek Watershed Alliance will be responsible for the regular review and update of this WMP. This plan should be evaluated on a biannual basis to document and celebrate progress; assess effectiveness of efforts; modify activities to better target water quality issues; and keep implementation of the plan on schedule. The plan should be revised as needed to better meet the needs of the watershed stakeholders and to meet water quality goals.

REFERENCES

Camp, Dresser, & McKee (CDM). 2003. Fall Creek TMDL Study

Center for Watershed Protection. “Codes & Ordinances Worksheet (COW) Tool.” www.cwp.org

Center for Watershed Protection. 2008. Managing Stormwater in Your Community. www.cwp.org

City of Indianapolis. 2003. Stream Reach Characterization and Evaluation Report.

City of Indianapolis. 1991 – Present. Department of Public Works – Office of Environmental Services Water Quality Monitoring.

FEMA. “Community Ratings System (CRS)” http://www.fema.gov/nfip/crs.shtm

FEMA. 2003. Flood Insurance Rate Maps for Hamilton County, Indiana.

FEMA. 2006. Flood Insurance Rate Maps for Hancock County, Indiana.

FEMA. 1994. Flood Insurance Rate Maps for Madison County, Indiana.

FEMA. 2007. Flood Insurance Rate Maps for Marion County, Indiana.

Indiana Administrative Code 327 IAC 2-1 Water Quality Standards.

IDEM, Office of Water Quality, 2002. Section 319 Non-Point Source Program. http://www.in.gov/idem/resources/grants_loans/319h/index.html

IDEM, Office of Water Quality. 2003. Indiana Watershed Planning Guide.

IDEM, Office of Water Quality. 2008. “303(d) List of Impaired Waters”.

IDEM. Office of Water Quality. 2008. Indiana’s Integrated Water Monitoring and Assessment Report.

IDEM, 2007. Indiana Storm Water Quality Manual – Planning and Specification Guide for Effective Erosion and Sediment Control and Post-Construction Water Quality. www.idem.IN.gov/stormwater

Indiana State Department of Health. 2008. Indiana Fish Consumption Advisory.

Indiana University Kelley School of Business. 2007. “Population Change in Indiana Cities and Towns, 2000-2006.” www.incontext.indiana.edu/2007/august/5.html

Indiana University-Purdue University. Center for Urban Policy and the Environment. “LUCI: Land Use in Central Indiana Model.” http://luci.urbancenter.iupui.edu/about/introduction.asp

Jaffe, Martin and Frank DiNovo. 1987. Local Groundwater Protection. American Planning Association.

Jeer, Sanjay, et.al. 1997 Nonpoint Source Pollution: A Handbook for Local Government. Planning Advisory Service Report Number 476 American Planning Association.

Marion County Health Department. Water Quality Monitoring.

Mitchell, Martha S. 2000. "Land-Use Planning: The Ultimate BMP." Erosion Control. www.forester.net/ec_0004_land.html

National Oceanic and Atmospheric Administration (NOAA) National Data Climatic Center (NCDC). "Natural Hazard Query Results". http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevents~storms

Purdue University. Long-Term Hydrologic Impact Assessment (L-THIA). www.ecn.purdue.edu/runoff/lthia/lthia_index.htm

Purdue University. 2002. "The Relationship Between Land Use Decisions and the Impacts on Our Water and Natural Resources." Planning with POWER.

Office of Indiana State Chemist. 2008. Fertilizer Section.

Prince George's County, Maryland. 1999. Low-Impact Development Design Strategies: An Integrated Design Approach. Department of Environmental Resources – Programs and Planning Division.

Schueler, Thomas R. and Heather K. Holland. 2000. "The Importance of Imperviousness." The Practice of Watershed Protection. Center for Watershed Protection.

Stats Indiana. 2007. "Hamilton County IN Depth Profile." www.stats.indiana.edu/profiles/pr18057.html

Stats Indiana. 2007. "Hancock County IN Depth Profile." www.stats.indiana.edu/profiles/pr18059.html

Stats Indiana. 2007. "Madison County IN Depth Profile." www.stats.indiana.edu/profiles/pr18095.html

Stats Indiana. 2007. "Marion County IN Depth Profile." www.stats.indiana.edu/profiles/pr18097.html

University of Michigan at Flint. "Land Use and Water Quality". http://genesseelandnetwork.org/sprawl/landuse/waterquality.html

USDA, National Agricultural Statistics Service. 2006. Indiana County Data.

US EPA, 1987. Quality Criteria for Water 1986 [The Gold Book]. www.epa.gov/waterscience/criteria/goldbook.pdf

US EPA, 2000. Ambient Water Quality Criteria Recommendations – Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Nutrient Ecoregion VI.

US EPA 2003. Getting in Step: A Guide for Conducting Watershed Outreach Campaigns. US EPA.

US EPA. 2005. Using Smart Growth Techniques as Stormwater Best Management Practices. US EPA

US EPA. 2007. "Chapter 2 – Land Use Planning as the First BMP Review DRAFT, 08/27/07"

Water Encyclopedia. "Land Use and Water Quality". www.waterencyclopedia.com/La-Mi/Land-Use-and-Water-Quality.html

REFERENCES

Camp, Dresser, & McKee (CDM). 2003. Fall Creek TMDL Study

Center for Watershed Protection. "Codes & Ordinances Worksheet (COW) Tool." www.cwp.org

Center for Watershed Protection. 2008. Managing Stormwater in Your Community. www.cwp.org

City of Indianapolis. 2003. Stream Reach Characterization and Evaluation Report.

City of Indianapolis. 1991 – Present. Department of Public Works – Office of Environmental Services Water Quality Monitoring.

FEMA. "Community Ratings System (CRS)" http://www.fema.gov/nfip/crs.shtm

FEMA. 2003. Flood Insurance Rate Maps for Hamilton County, Indiana.

FEMA. 2006. Flood Insurance Rate Maps for Hancock County, Indiana.

FEMA. 1994. Flood Insurance Rate Maps for Madison County, Indiana.

FEMA. 2007. Flood Insurance Rate Maps for Marion County, Indiana.

Indiana Administrative Code 327 IAC 2-1 Water Quality Standards.

IDEM, Office of Water Quality, 2002. Section 319 Non-Point Source Program. http://www.in.gov/idem/resources/grants_loans/319h/index.html

IDEM, Office of Water Quality. 2003. Indiana Watershed Planning Guide.

IDEM, Office of Water Quality. 2008. "303(d) List of Impaired Waters".

IDEM. Office of Water Quality. 2008. Indiana's Integrated Water Monitoring and Assessment Report.

IDEM, 2007. Indiana Storm Water Quality Manual – Planning and Specification Guide for Effective Erosion and Sediment Control and Post-Construction Water Quality. www.idem.IN.gov/stormwater

Indiana State Department of Health. 2008. Indiana Fish Consumption Advisory.

Indiana University Kelley School of Business. 2007. "Population Change in Indiana Cities and Towns, 2000-2006." www.incontext.indiana.edu/2007/august/5.html

Indiana University-Purdue University. Center for Urban Policy and the Environment. "LUCI: Land Use in Central Indiana Model." http://luci.urbancenter.iupui.edu/about/introduction.asp

Jaffe, Martin and Frank DiNovo. 1987. Local Groundwater Protection. American Planning Association.

Jeer, Sanjay, et.al. 1997 Nonpoint Source Pollution: A Handbook for Local Government. Planning Advisory Service Report Number 476 American Planning Association.

Marion County Health Department. Water Quality Monitoring.

Mitchell, Martha S. 2000. "Land-Use Planning: The Ultimate BMP." Erosion Control. www.forester.net/ec_0004_land.html

National Oceanic and Atmospheric Administration (NOAA) National Data Climatic Center (NCDC). "Natural Hazard Query Results". http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevents~storms

Purdue University. Long-Term Hydrologic Impact Assessment (L-THIA). www.ecn.purdue.edu/runoff/lthia/lthia_index.htm

Purdue University. 2002. "The Relationship Between Land Use Decisions and the Impacts on Our Water and Natural Resources." Planning with POWER.

Office of Indiana State Chemist. 2008. Fertilizer Section.

Prince George's County, Maryland. 1999. Low-Impact Development Design Strategies: An Integrated Design Approach. Department of Environmental Resources – Programs and Planning Division.

Schueler, Thomas R. and Heather K. Holland. 2000. "The Importance of Imperviousness." The Practice of Watershed Protection. Center for Watershed Protection.

Stats Indiana. 2007. "Hamilton County IN Depth Profile." www.stats.indiana.edu/profiles/pr18057.html

Stats Indiana. 2007. "Hancock County IN Depth Profile." www.stats.indiana.edu/profiles/pr18059.html

Stats Indiana. 2007. "Madison County IN Depth Profile." www.stats.indiana.edu/profiles/pr18095.html

Stats Indiana. 2007. "Marion County IN Depth Profile." www.stats.indiana.edu/profiles/pr18097.html

University of Michigan at Flint. "Land Use and Water Quality". http://genesseelandnetwork.org/sprawl/landuse/waterquality.html

USDA, National Agricultural Statistics Service. 2006. Indiana County Data.

US EPA, 1987. Quality Criteria for Water 1986 [The Gold Book]. www.epa.gov/waterscience/criteria/goldbook.pdf

US EPA, 2000. Ambient Water Quality Criteria Recommendations – Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Nutrient Ecoregion VI.

US EPA 2003. Getting in Step: A Guide for Conducting Watershed Outreach Campaigns. US EPA.

US EPA. 2005. Using Smart Growth Techniques as Stormwater Best Management Practices. US EPA

US EPA. 2007. “Chapter 2 – Land Use Planning as the First BMP Review DRAFT, 08/27/07”

Water Encyclopedia. “Land Use and Water Quality”. www.waterencyclopedia.com/La-Mi/Land-Use-and-Water-Quality.html

REFERENCES

Camp, Dresser, & McKee (CDM). 2003. Fall Creek TMDL Study

Center for Watershed Protection. "Codes & Ordinances Worksheet (COW) Tool." www.cwp.org

Center for Watershed Protection. 2008. Managing Stormwater in Your Community. www.cwp.org

City of Indianapolis. 2003. Stream Reach Characterization and Evaluation Report.

City of Indianapolis. 1991 – Present. Department of Public Works – Office of Environmental Services Water Quality Monitoring.

FEMA. "Community Ratings System (CRS)" http://www.fema.gov/nfip/crs.shtm

FEMA. 2003. Flood Insurance Rate Maps for Hamilton County, Indiana.

FEMA. 2006. Flood Insurance Rate Maps for Hancock County, Indiana.

FEMA. 1994. Flood Insurance Rate Maps for Madison County, Indiana.

FEMA. 2007. Flood Insurance Rate Maps for Marion County, Indiana.

Indiana Administrative Code 327 IAC 2-1 Water Quality Standards.

IDEM, Office of Water Quality, 2002. Section 319 Non-Point Source Program. http://www.in.gov/idem/resources/grants_loans/319h/index.html

IDEM, Office of Water Quality. 2003. Indiana Watershed Planning Guide.

IDEM, Office of Water Quality. 2008. "303(d) List of Impaired Waters".

IDEM. Office of Water Quality. 2008. Indiana's Integrated Water Monitoring and Assessment Report.

IDEM, 2007. Indiana Storm Water Quality Manual – Planning and Specification Guide for Effective Erosion and Sediment Control and Post-Construction Water Quality. www.idem.IN.gov/stormwater

Indiana State Department of Health. 2008. Indiana Fish Consumption Advisory.

Indiana University Kelley School of Business. 2007. "Population Change in Indiana Cities and Towns, 2000-2006." www.incontext.indiana.edu/2007/august/5.html

Indiana University-Purdue University. Center for Urban Policy and the Environment. "LUCI: Land Use in Central Indiana Model." http://luci.urbancenter.iupui.edu/about/introduction.asp

Jaffe, Martin and Frank DiNovo. 1987. Local Groundwater Protection. American Planning Association.

Jeer, Sanjay, et.al. 1997 Nonpoint Source Pollution: A Handbook for Local Government. Planning Advisory Service Report Number 476 American Planning Association.

Marion County Health Department. Water Quality Monitoring.

Mitchell, Martha S. 2000. "Land-Use Planning: The Ultimate BMP." Erosion Control. www.forester.net/ec_0004_land.html

National Oceanic and Atmospheric Administration (NOAA) National Data Climatic Center (NCDC). "Natural Hazard Query Results". http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevents~storms

Purdue University. Long-Term Hydrologic Impact Assessment (L-THIA). www.ecn.purdue.edu/runoff/lthia/lthia_index.htm

Purdue University. 2002. "The Relationship Between Land Use Decisions and the Impacts on Our Water and Natural Resources." Planning with POWER.

Office of Indiana State Chemist. 2008. Fertilizer Section.

Prince George's County, Maryland. 1999. Low-Impact Development Design Strategies: An Integrated Design Approach. Department of Environmental Resources – Programs and Planning Division.

Schueler, Thomas R. and Heather K. Holland. 2000. "The Importance of Imperviousness." The Practice of Watershed Protection. Center for Watershed Protection.

Stats Indiana. 2007. "Hamilton County IN Depth Profile." www.stats.indiana.edu/profiles/pr18057.html

Stats Indiana. 2007. "Hancock County IN Depth Profile." www.stats.indiana.edu/profiles/pr18059.html

Stats Indiana. 2007. "Madison County IN Depth Profile." www.stats.indiana.edu/profiles/pr18095.html

Stats Indiana. 2007. "Marion County IN Depth Profile." www.stats.indiana.edu/profiles/pr18097.html

University of Michigan at Flint. "Land Use and Water Quality". http://genesseelandnetwork.org/sprawl/landuse/waterquality.html

USDA, National Agricultural Statistics Service. 2006. Indiana County Data.

US EPA, 1987. Quality Criteria for Water 1986 [The Gold Book]. www.epa.gov/waterscience/criteria/goldbook.pdf

US EPA, 2000. Ambient Water Quality Criteria Recommendations – Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Nutrient Ecoregion VI.

US EPA 2003. Getting in Step: A Guide for Conducting Watershed Outreach Campaigns. US EPA.

US EPA. 2005. Using Smart Growth Techniques as Stormwater Best Management Practices. US EPA

US EPA. 2007. "Chapter 2 – Land Use Planning as the First BMP Review DRAFT, 08/27/07"

Water Encyclopedia. "Land Use and Water Quality". www.waterencyclopedia.com/La-Mi/Land-Use-and-Water-Quality.html

APPENDIX 1

Acronyms

Project Task Summary

Project Timeline

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APA	American Planning Association
BAGI	Building Association of Greater Indianapolis
BMP	Best Management Practices
CBBEL	Christopher B. Burke Engineering, Ltd.
CFO	Confined Feeding Operation
CSO	Combined Sewer Overflow
CQHEI	Citizen's Qualitative Habitat Evaluation Index
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
FCA	Fish Consumption Advisory
HBI	Hilsenhorf Biological Index
HEL	Highly Erodible Land
HHRCD	Hoosier Heartland Resource, Conservation and Development
HOA	Homeowner's Association
HUC	Hydrologic Unit Code
IBI	Index of Biological Integrity
IDEM	Indiana Department of Environmental Management
ISDH	Indiana State Department of Health
IUPUI	Indiana University – Purdue University Indianapolis
KIB	Keep Indianapolis Beautiful
LFCWA	Lower Fall Creek Watershed Alliance
LID	Low Impact Development
LTCP	Long Term Control Plan
LTHIA	Long Term Hydrologic Impact Analysis
LUCI	Land Use Central Indiana
MCHD	Marion County Health Department
MCWEC	Marion County Wellfield Education Corporation
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPS	Non Point Source
OISC	Office of the Indiana State Chemist
PCB	Polychlorinated biphenyls
QHEI	Qualitative Habitat Evaluation Index
SRCER	Stream Reach Characterization Evaluation Report
STEP	Septic Tank Elimination Program
STEP-L	Spreadsheet Tool for Estimating Pollutant Loads
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Loads
TQP	Technically Qualified Person
TSS	Total Suspended Solids
UWRWA	Upper White River Watershed Alliance
WFPA	Wellfield Protection Area
WMP	Watershed Management Plan
WQS	Water Quality Standard

TASKS AS DEFINED BY IDEM/SWCD/CBBEL CONTRACT
Total Timeline = 30 months (December 21, 2006 through May 21, 2009)

Task A: Develop a Watershed Management Plan
- Develop a WMP according to IDEM's FFY 2003 "Watershed Management Plan Checklist".
- Submit 2 hard copies and 1 electronic copy of WMP to IDEM.
- Make DRAFT and FINAL copy of WMP available to local libraries, local officials, and land use planners in watershed, and on the Plan distribution list.
- Submit electronic copy of the draft plan and checklist to State for review and comment every 6 months.
- Submit completed plan to State 2 months prior to contract end date.
- Construct a comprehensive GIS for watershed including land use, streams, 303(d) listed streams, and monitoring site location data.

Task B: Macro Invertebrate Sampling
- Conduct a sampling program to identify water quality problems
- Develop a Quality Assurance Project Plan (QAPP) for monitoring activities and submit to State for review 1 month before initiating monitoring activities.
- Collect and analyze macro invertebrates twice at 10 sites in unstudied or understudied subwatersheds.

Task C: Education and Outreach
- Conduct Steering Committee meetings of 11-15 local stakeholders on a quarterly basis.
- Establish 3 Working Committees to meet as needed of less than 20 experts each to discuss land use, education, and water quality.
- Conduct 2 Stakeholder Meetings
- Conduct 3 Workshops
- Develop 1 educational brochure
- Develop 3 newsletter articles focusing on issues specific to the project
- Update SWCD monthly

Task D: BMP Demonstration Project Report
- Prepare a report identifying potential demonstration projects for BMPs in targeted critical areas with in the watershed.
- Provide pollutant load reduction estimates for BMPs implemented by the SWCD.

TIMELINE AS DEFINED BY IDEM/SWCD/CBBEL CONTRACT
Total Timeline = 30 months (December 21, 2006 through May 21, 2009)

First Quarter (Dec 2006, Jan, Feb 2007)	*Delayed start due to time needed to hire contractor and negotiate contract (contract signed May 8th)*
Second Quarter (Mar, Apr, May 2007)	• Begin analysis of existing watershed data • Conduct Steering Committee meeting #1 (5/31) • Develop GIS for watershed • Start drafting sections of the WMP
Third Quarter (Jun, Jul, Aug 2007)	• Continue developing GIS for watershed • Draft Newsletter #1 (7/20) • Conduct Public meeting #1 (7/24) • Distribute Brochure • Conduct Working Group meetings • Water Quality #1 (8/7) • Land Use/Economic Development #1 (8/14) • Education/Outreach #1 (8/16) • Conduct Steering Committee meeting #2 (8/22) • Continue drafting sections of the WMP • **Submit DRAFT WMP & Checklist *(1.0 Watershed Planning, 2.0 Watershed Overview)*** • Submit monthly reports to IDEM via SWCD
Fourth Quarter (Sep, Oct, Nov 2007)	• Continue developing GIS for watershed • Conduct Working Group meetings (as needed) • Water Quality #2 (11/13) • Land Use/Economic Development #2 (11/13) • Education/Outreach #2 (12/13) • Continue drafting sections of the WMP • Submit monthly reports to IDEM via SWCD
Fifth Quarter (Dec 2007, Jan, Feb 2008)	• Draft QAPP • Continue developing GIS for watershed • Conduct Working Group meetings • Water Quality (waiting on macro data) • Land Use/Economic Development #2 (2/12) • Education/Outreach #1 (2/28) • Conduct Steering Committee meeting #3 (2/12) *Topic: Land Use & Land Use Change* • Continue drafting sections of the WMP • Draft BMP Demonstration Project Report • **Submit DRAFT WMP & Checklist *(1.0 Watershed Planning; 2.0 Watershed Overview; 3.0 Water Quality Problems, Causes & Sources; 4.0 Identification of Critical Areas)*** (12/21) • **Submit QAPP** (draft 1/17; approved 3/17) • Submit monthly reports to IDEM via SWCD

Sixth Quarter (Mar, Apr, May 2008)	• Conduct macro invertebrate sampling #1 • Continue developing GIS for watershed • Conduct Working Group meetings (as needed) • Conduct Steering Committee meeting #4 (5/13) *Topic: Surface & Ground Water Quality* • Draft Newsletter #2 (3/30) • Continue drafting sections of the WMP • **Submit BMP Demonstration Project Report** • **Submit DRAFT WMP & Checklist *(1.0 Watershed Planning; 2.0 Watershed Overview; 3.0 Water Quality Problems, Causes & Sources; 4.0 Identification of Critical Areas; 5.0 Goals & Decisions)*** • Submit monthly reports to IDEM via SWCD
Seventh Quarter (Jun, Jul, Aug 2008)	• Finish developing GIS for watershed • Conduct Steering Committee meeting #5 (8/12) *Topic: Flooding & Flooding Impacts* • Conduct Workshop #1 (6/12 & 8/21) *Topic: Shoreline Stewards* • Finish drafting sections of the WMP • Submit monthly reports to IDEM via SWCD
Eight Quarter (Sep, Oct, Nov 2008)	• Conduct macro invertebrate sampling #2 • Incorporate comments on DRAFT WMP • **Submit full DRAFT WMP to IDEM** • Conduct Workshop #2 (11/12) *Topic: Backyard Conservation* • Submit monthly reports to IDEM via SWCD
Ninth Quarter (Dec 2008, Jan, Feb 2009)	• Draft Newsletter #3 • **Distribute full DRAFT WMP to Public** • Conduct Public Meeting #2 (1/15) *Topic: Present DRAFT WMP* • Conduct Workshop #3 (TBD) *Topic: Regulated Drains vs. Natural Waterways* • Conduct Steering Committee meeting #6 (1/29) *Topic: Project Wrap-up and Implementation* • Submit monthly reports to IDEM via SWCD
Tenth Quarter (Mar, Apr, May 2009)	• Calculate pollutant loads from BMPs implemented by SWCD • **Submit Final WMP & Checklist to IDEM** • **Submit Final Project Report to IDEM** • Submit monthly reports to IDEM via SWCD

APPENDIX 2

Meeting Agendas and Summaries

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Steering Committee Meetings
Agendas and Summaries

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

1:30 pm Thursday, May 31, 2007

held at
Christopher B. Burke Engineering, Ltd.
115 W. Washington St., Ste. 1368 Indianapolis

317-266-8000

AGENDA

1. Welcome and Introductions
2. Review Planning Grant Schedule and Requirements
3. Benefits of Watershed Planning
4. Overview of Lower Fall Creek Watershed
5. Desired Project Outcomes
6. Identify Key Stakeholders in Watershed
7. Next Steps
8. Closing and Adjournment

Directions: The Christopher B. Burke Engineering, Ltd. (CBBEL) office is located in Suite 1368 of the South Tower of the National City Center Building/Hyatt Hotel (115 West Washington Street) downtown Indianapolis. Parking is available in the Circle City Center Parking Garage (2 entrances – Maryland St. and Illinois St.), Plaza Park Garage (2 entrances – Maryland St. and Capitol Ave.) and metered street parking (if you're lucky). If you park in either of the garages, go to the 3rd parking level and enter the National City Center Building via the pedestrian bridge over Maryland St. Take the first set of elevators (once inside the National City Center) to the 13th floor. The entrance to Suite 1368 is visible once you leave the elevator. This reads much more daunting than it actually is. If additional help is needed call Burke Engineering at 317-266-8000.

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

1:30 pm Thursday, May 31, 2007

held at
Christopher B. Burke Engineering, Ltd.
115 W. Washington St., Ste. 1368 Indianapolis

317-266-8000

MEETING SUMMARY

Steering Committee Members Present:
Chris Barnett, Near North Development Corporation
Crist Blassaras, Madison County SWCD
Victoria Cluck, Indianapolis DPW
Josh Goode, Watershed Resident
Tina Jones, Indy Parks
Lori Kaplan, City of Lawrence DPW
Ron Lauster, Marion County SWCD
Bob Masbaum, Indianapolis DPW
Donna Price, Indianapolis DMD
John South, Hamilton County SWCD

Others Present:
Paula Baldwin, Marion County SWCD
Bob Barr, IUPUI CEES
Lisa Bihl, Empower Results
Zach Bishton, CBBEL
Heather Buck, CBBEL
Jill Hoffman, UWRWA & Empower Results
Anna Jetmore-Vargas, Indy Parks
Sheila McKinley, CBBEL
Sky Shelle, IDEM
John Ulmer, Central Indiana Watersheds
Leanne Whitesell, IDEM

1. Welcome and Introductions
Paula Baldwin from the Marion County SWCD Board of Supervisors welcomed everyone to the meeting. Paula provided background on the form and function of SWCDs in Indiana and specifically Marion County. Paula provided an overview of the Districts desire to prepare a Watershed Management Plan (WMP) for the 4-county Lower Fall Creek Watershed and the IDEM 319 grant that is funding this planning effort. Everyone followed by introducing themselves, who they were representing, and their interest in the Lower Fall Creek Watershed.

2. Review Planning Grant Schedule and Requirements
Sheila McKinley from CBBEL and Project Manager for the Lower Fall Creek WMP reviewed the WMP Checklist and Tasks that must be completed in order to fulfill the IDEM WMP grant requirements. The Tasks include: A) Developing a WMP; B) Conduct Water Quality Monitoring; C) Develop an Education and Outreach Program; and D) Implement a BMP Demonstration Project. Sheila reviewed the 30-month project Timeline and noted that the start of the project was delayed from December 2006 to May 2007 due to the time it took the SWCD to hire and negotiate the subcontract with CBBEL. Fortunately IDEM has been flexible with the lack of progress made in the first and second quarter. However, Sheila added that CBBEL staff will work diligently to get the project on schedule as quickly as possible.

3. Benefits of Watershed Planning
Sheila McKinley from CBBEL presented watershed planning as a means to 1) maintain, protect, and restore natural resources; 2) support environmental protection, quality of life, and economic development; and 3) establish partnerships between government, businesses, and citizens with a common goal. Comprehensive watershed planning efforts can have significant environmental, community, financial, and administrative benefits. Sheila reminded the Steering Committee that the impacts of clean water are far reaching and necessary for drinking water, manufacturing processes, agriculture production, economic development, recreation and tourism, and quality of life and that is precisely why such a diverse group of local leaders and decision-makers has been asked to serve on the Lower Fall Creek WMP Steering Committee.

4. Overview of Lower Fall Creek Watershed
Zach Bishton from CBBEL presented an overview of the current land use and known water quality impairments in the Lower Fall Creek Watershed. More than 50% of the Lower Fall Creek Watershed is developed for residential, commercial, industrial, and institutional type uses. Zach noted that the majority of the developed portion of the Lower Fall Creek Watershed is in Marion and Hamilton Counties. Zach presented data from IDEM's 2002 Fall Creek TMDL Report, IDEM's Fixed Station Data along Fall Creek, the Marion County Health Department from Fall Creek, Indianapolis DPW Combined Sewer Overflow (CSO) Long Term Control Plan, and Indiana University's 2003 Study of Mud Creek/Sand Creek. All studies indicate elevated nutrient concentrations, elevated bacteria concentrations, and impaired biological communities. Zach added that the suspected sources listed in these reports include failing septic systems, illicit connections, wildlife, stormwater, CSOs, and land application of pesticides. Zach reminded the Steering Committee that this was just an initial overview of the known water quality impairments and that an important part of developing the WMP is to identify known and probable causes and sources of water quality impairments in the Lower Fall Creek Watershed.

Heather Buck from CBBEL presented information on the ethnic, language, and economic diversity in the Lower Fall Creek. According to the US Census, the Hispanic population increased 300% in both Marion and Hamilton County between 1990 and 2000. During this same time, the Hispanic population decreased in Madison County. The African-American population is very small in Hancock, Madison, and Hamilton Counties but accounts for more than 20% of the population in Marion County. Similarly, languages other than English spoken at home were also greatest in Marion County. Median household income and owner occupied housing is considerably higher in Hamilton, Hancock, and Madison County than in Marion County. Heather reminded the Steering Committee that reaching the very diverse Stakeholders/Public in the Lower Fall Creek Watershed will require creative partnering with existing neighborhood associations, churches, and community-based organizations.

5. Desired Project Outcomes

Sheila McKinley opened the floor to the Steering Committee to 1) discuss what current programs, policies, and projects in Marion, Hamilton, Hancock, and Madison Counties would benefit the development of the Lower Fall Creek WMP and 2) to understand what each Steering Committee member would like to see come out of this planning effort.

Tina Jones with Indy Parks discussed the historic value of Fall Creek from Emerson Avenue to the White River, and that the promotion of the historic and cultural value of the watershed could go along way towards creating long-term public interest. Tina talked about the Indy Parks Land Stewardship program, public land holdings, and the greenway along Fall Creek. Tina discussed potential partnering opportunities associated with the annual Future Farmers of America (FFA) National Convention. The FFA convention has a National Service Day. She also suggested coordinating with FFA to conduct some restoration projects in the watershed as a part of their National Day of Service.

Bob Massbaum with Indianapolis DPW discussed the importance of working with the City in order to ensure that the watershed project is well coordinated with the City's CSO Long Term Control Plan implementation efforts. Bob stressed the importance that both groups understand how these two projects merge together.

Victoria Cluck with Indy DPW added that the City's CSO Long Term Control Plan is not limited in scope to CSO's and that it focuses on broader environmental efforts. She also mentioned that coordination with Keep Indianapolis Beautiful would be beneficial, and that illegal dumping issues are a problem in the watershed.

Lori Kaplan with Lawrence DPW discussed the new Fort Harrison Urban Village Development and suggested that there might be opportunities to incorporate some innovative stormwater BMPs into the project.

Donna Price with Indy DMD discussed her interest in developing incentive programs to encourage developers to implement innovative stormwater BMPs. Donna also discussed a need to heavily involve local schools and Girl Scout and Boy Scout troops. Donna suggested coordinating with these groups to conduct volunteer sampling and storm drain marking projects.

Crist Blassaras with the Madison County SWCD suggested promoting and soliciting participation in an Adopt-A-River program along Fall Creek. Crist also suggest coordinating with the Court system to utilize non-violent offenders for stream and open space clean-up efforts. Crist also suggested partnering with local Universities to conduct research studies in the watershed, as well as to promote local stewardship efforts.

Jill Hoffman with Empower Results discussed her organizations role with the Upper White River Watershed Alliance (UWRWA), and the UWRWA's support for the Lower Fall Creek Watershed project. Jill also discussed her hope that this project will result in tangible water quality improvement projects.

Chris Barnett with Near North Development Corporation discussed his hope that in the future Fall Creek and water quality will be viewed as valuable amenities to individual and businesses within the watershed. Chris also discussed that restoration and trail expansion projects would be of benefit both in terms of economic development and water quality. Chris is also the Vice Chair of the Marion County Wellfield Education Corporation (MCWEC), and mentioned that it will be important to understand the interplay between surface water and groundwater in the watershed.

Bob Barr with the Center for Earth and Environmental Science (CEES) at IUPUI said that they are very interested in this project and that the Fall Creek is very much in-line with the types of projects CEES has been involved with in the past. Bob said that naturalization projects along Fall Creek would be beneficial. Bob also stressed the fact that he would like to see this project go beyond the typical 319 project, and result in something that is tangible and around for the long-term.

John South with the Hamilton County SWCD mentioned that it would be good to have a representative from the Town of Fishers and the Hamilton County Surveyor's Office involved in the project. John also discussed the Hamilton County SWCD's Backyard Conservation Program, which is targeting landowners in the Fishers/Geist areas of Hamilton County.

6. Identify Key Stakeholders

Sheila McKinley from CBBEL noted that in order to be truly successful and develop a WMP that local community leaders, decision-makers, and the public will embrace and want to implement, there is a large number of people and organizations that need to be included in the development of the Lower Fall Creek WMP. Sheila suggested forming 3 Working Committees that focus specifically on 1) Education & Outreach, 2) Water Quality, and 3) Land Use & Economic Development. Participation in the Working Committees would be open to those with expertise and interest in one or more of the 3 topics. The intent would be to thoroughly discuss each topic, identify critical areas in the Lower Fall Creek Watershed, and recommend programs, policies, and projects to improve water quality.

Tina Jones from Indy Parks suggested focusing the Working Committees on the Urban, Suburban, and Rural land use and related issues. This idea generated much discussion among the Steering Committee members. Sheila offered to work with the SWCD and look into this idea further.

7. Next Steps

Ron Lauster from the Marion County SWCD commented that the planning process is just getting started and that there are plans for a Lower Fall Creek Watershed webpage complete with maps, meeting notes, meeting schedule, and a “blog” for discussion purposes. Ron noted that the Stakeholder/Public Meeting has been tentatively scheduled for the mid-July, followed by Working Committee meetings in mid-August, and a Steering Committee meeting in late August. Ron asked for suggestion for meeting locations that were somewhat centralized in the watershed. Several suggestions were mentioned including the Neighborhood Resource Center at the State Fair Grounds, the Julia Carson Center on Fall Creek Parkway, Fort Benjamin Harrison Park, and Lawrence Community Building. To lessen confusion, Ron would like all meetings to be held in the same location and will do some research to determine what facility would be best.

8. Closing and Adjournment

Paula Baldwin enthusiastically thanked everyone for their participation in a very productive first Steering Committee meeting of the Lower Fall Creek WMP, wished everyone well and looked forward to seeing them again in August.

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Wednesday, August 22, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Overview of Public Meeting
3. Issues Discussed in the Working Groups and Next Steps
4. Identify Topics for Steering Committee Meetings
5. Closing and Adjournment

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Wednesday, August 22, 2007
Lawrence Government Center
9001 East 59th Street

Meeting Summary

Steering Committee Members Present:
Ron Lauster, Marion County SWCD
Chris Barnett, Near North Development Corporation
Kelly Wood, City of Indianapolis Neighborhood Liaison
Crist Blassaras, Madison County SWCD
Gwen White, IDNR
Lori Kaplan, City of Lawrence DPW
Angie Dye, Veolia Water Company

Others Present:
Lisa Bihl, Empower Results
Heather Buck, CBBEL
Sheila McKinley, CBBEL
Sky Schelle, IDEM

1. Welcome and Introductions

Ron Lauster, Marion SWCD, welcomed everyone to the Steering Committee meeting while a sign in sheet was distributed. Those in attendance introduced themselves and indicated the agency or office which they represented. A Steering Committee contact list was distributed and those in attendance were asked for their preference on the type and amount of contact information they would like included on the Lower Fall Creek Watershed website. Ron also provided attendees with several informational pieces regarding the watershed activities, upcoming events, and newsletters.

2. Overview of Public Meeting

An overview of the Public Meeting held in the Lawrence Government Building on July 24 was provided by CBBEL staff. Bulleted highlights were also provided in a packet distributed. This information can be found in the rear of this meeting summary.

3. Issues Discussed in the Working Groups and Next Steps

An overview of the three Working Group meetings (Water Quality – 8/07/07, Land Use/Economic Development – 8/14/07, and Education & Outreach 8/16/07) was provided by CBBEL staff. Bulleted highlights were also provided in a packet distributed. This information can be found in the rear of this meeting summary. Several of the Steering Committee members informed the group of additional informational outlets that could be utilized throughout the planning effort and their willingness to assist in making those contacts.

4. Identify Topics for Steering Committee Meetings

Much time was spent discussing the topics of the upcoming quarterly Steering Committee meetings. Sky Schelle with IDEM noted that the intent of the planning process was to produce a document through the leadership of local figures that can take the plan and move into the implementation phase. It is important that this plan not be placed on a shelf.

Crist Blassaras noted that while in the planning phase, the Steering Committee and Working Groups should use the knowledge available such as IUPUI/CEES. Several other groups have completed monitoring, planning, and have implemented projects that can and should be used to further this planning effort.

Chris Barnett of the Near North Development Corporation noted that local ordinances and regulations should be reviewed to determine what impacts they have on water quality and quantity, noting that several ordinances may be in place that aren't typically thought of as having an effect on water (i.e. sidewalk ordinances). Chris also mentioned the need to align both the ground and surface water policies for the protection of the entire watershed.

Throughout the discussion several key topics such as changes in land use, drinking water, wellhead protection efforts, water quantity, stream management, Geist Reservoir, and stakeholder involvement were mentioned. Steering Committee members expressed the need to continue to gather information from stakeholders regarding watershed issues, provide that information to the Working Groups, and have the Working Groups formulate recommendations based on that information.

The group came to a consensus on the topics for the next several Steering Committee meetings: January 2008 – Land Use change in the Lower Fall Creek Watershed; March 2008 – Stream morphology and water quantity issues; and May 2008 – Drinking water quality and policies.

5. Closing and Adjournment

Ron Lauster provided the closing comments by reiterating the need to sign in and thanking everyone for their participation. Ron also mentioned that he would be meeting with a soils class from IUPUI and would like suggestions on possible student projects that can be completed within the watershed for the benefit of the students as well as the planning effort. The next Steering Committee meeting is scheduled for January 8, 2008 at the Lawrence Government Center to begin at 3:00 pm.

Lower Fall Creek WMP – Pubic Meeting
STEERING COMMITTEE UPDATE
8/22/07

BACKGROUND:
- 25 interested stakeholders met on 7/24/07
- Ron Lauster discussed the 319 grant
- CBBEL staff presented anticipated outcomes, grant requirements, and water quality data
- Brochures were provided

DECISIONS & DISCUSSION:
- Issues in the watershed.
    - Excessive sediment and debris build up: Emerson/Fall Creek Bridge
    - Standing water after small rain events: Millersville Rd/Mallard Lake
    - Conservation Reserve Enhancement Program (CREP) successes in Upper Fall Creek Watershed
    - Hoosier Heartland Resource Conservation & Development (HH RC&D) program success throughout Central Indiana
    - Health hazard warning signs below 46th St
    - Invasive species management
    - Concerns over management of Geist Spillway
    - Windridge Condominiums - severe erosion, main access closed
- Existing water quality data also presented.

NEXT STEPS:
- Those present were encouraged to participate in Working Groups
- Follow ups to those stakeholders wishing to include watershed updates in individual newsletters, websites, etc.
- Information discussed during the public meeting will be utilized during the upcoming Working Group meetings.
- Next Public Meeting will be in the 8th quarter of the grant (Sept – Nov 2008)

Lower Fall Creek WMP – Water Quality Working Group
STEERING COMMITTEE UPDATE
8/22/07

BACKGROUND:

- 16 interested participants met on 8/7/07
- Outlined role of Working Group:
  - Identify water resource problems
  - Assist in the analysis and synthesis of existing water quality data
  - Establish pollutant load reduction targets
  - Identify critical areas within the watershed
  - Propose best management practices to improve water quality

DECISIONS & DISCUSSION

- Discussed water quality monitoring requirements of the grant: collection of no less than eight (8) water chemistry samples from no less than ten (10) sites in the watershed.
  - existing water chemistry data seems sufficient
- Discussed collecting macroinvertebrate samples, habitat assessments, and geomorphic measurements from 10 sites in the watershed
- Future meeting topics:
  - Streambank erosion and effects on watershed
  - Rule 5 enforcement
  - Improved coordination and management of data collection
  - Geomorphic changes in Fall Creek
  - Identify Critical Areas and BMPs

NEXT STEPS:

- Water monitoring scope change
- Develop Quality Assurance Protection Plan (QAPP)
- Next meeting 3pm 11/13/07 at the Lawrence Government Center.

Lower Fall Creek WMP – Land Use & Economic Development Working Group
STEERING COMMITTEE UPDATE
8/22/07

BACKGROUND:
- 13 local land use planners/economic development staff and interested public met on 8/14/07
- Outlined role of Working Group:
  - Define land use categories (affecting water quality)
  - Identify where and how development/redevelopment is occurring
  - Identify Critical Areas and best management practices (BMPs)
  - Discuss standards for development/redevelopment
  - Determine if standards are good/bad for water quality and/or economic development

DECISIONS & DISCUSSION:
- Presented existing land use data 1992 satellite Multi-Resolution Land Characteristic data and State Land Use Codes – both dismissed
- Group developed land use categories to better reflect impact on water quality
  - Agriculture (cropland or pasture)
  - Woodland/Park/Preserves/Wetlands/Floodplains/Cemeteries
  - Golf Courses
  - Commercial/Industrial/Apartment Complexes (non-pollutant generating, non-NPDES)
  - Commercial/Industrial (pollutant generator, NPDES permit, CRTK, CAFO, auto salvage, landfill, private WWTP)
  - Active Rule 5 (land cleared for construction)
- Future meeting topics:
  - Determine rate of growth and land uses in transition
  - Identify Critical Areas and BMPs to improve water quality
  - Review Development Standards and impact on water quality and economic development

NEXT STEPS:
- Create land use map
- Review historic aerials to document rate of growth
- Document land uses in transition (economic development/Rule 5)
- Representation from all County and Community planners and economic development departments
- Next meeting 9 am 11/13/07 at Lawrence Government Center

Lower Fall Creek WMP – Education & Outreach Working Group
STEERING COMMITTEE UPDATE
8/22/07

BACKGROUND**:**

- 5 interested participants met on 8/16/07
- Outlined role of Working Group:
    - Provide educational opportunities to the stakeholders
    - Utilize existing sources to inform watershed stakeholders
    - Receive recommendations from other Working Groups

DECISIONS & DISCUSSION**:**

- Discussed existing education and outreach outlets
    - Marion County Alliance of Neighborhood Associations
    - Hamilton, Hancock, Madison, and Marion SWCD contacts
    - Alternative media contacts: 107.1 Spanish radio; Amos Brown; etc.
    - Recreation and Service Clubs: Boy/Girl Scouts, Canoe Club, Fishing Club
    - Eagle Creek and Upper White River Watershed groups
    - Utility bill inserts
    - Dick Wolfsie, WISH TV 8 (or other local news programming)
    - Locations for information distribution: Fall Creek Bait & Tackle, golf courses, Indy Parks
    - Area High School Science Teachers, Clubs, FFA, etc.
- Need to engage elected officials (Fed, State, City, and County levels)

NEXT STEPS:

- Review school district ethnicities
- Map legislative boundaries and identify representatives
- Receive guidance from other Working Groups
- Discuss workshop topics
- Next meeting 3 pm 12-13-07 at the Lawrence Government Center.

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Tuesday, February 12th 2008
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Land Use & Land Use Change in the Lower Fall Creek Watershed
3. Review and Prioritize Critical Areas Identified by Work Groups
4. Identify Management Measures *(if time permits)*
5. Closing and Adjournment

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MARION COUNTY SOIL AND WATER CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Tuesday, February 12, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Steering Committee Members Present:
Chris Barnett, Near North Development Corporation
Crist Blassaras, Madison County SWCD
Victoria Cluck, Indianapolis DPW
Josh Goode, IACT
Tina Jones, Indy Parks
Joe Ketterman (for Pam Thevenow) Marion County Health Department
Ron Lauster, Marion County SWCD
David Parnell, Lawrence City Council
Donna Price, Indianapolis DMD
Kent Ward, Hamilton County Surveyor's Office
Gwen White, IDNR

Others Present:
Heather Buck, CBBEL
Nancy Darr, Landowner Hancock County
Bonnie Elfritz, IDEM – OWQ
Stephen Hoback, Landowner Hancock County
Sheila McKinley, CBBEL
Sky Schelle, IDEM - OWQ

1. Welcome and Introductions

Ron Lauster welcomed everyone to the Steering Committee meeting while a sign in sheet was distributed. Those in attendance introduced themselves and indicated the agency, office, or organization which they represented.

2. Land Use and Land Use Change in the Lower Fall Creek Watershed

Before the presentation, Sheila McKinley reminded the Steering Committee because of the structure of this planning effort – with the Work Groups working through the details of the WMP – this allowed the Steering Committee time to focus on some of the bigger philosophical or policy issues in the Lower Fall Creek Watershed. Three topics were identified. These include: Land Use & Land Use Change (2/12/08), Surface & Ground Water Quality (5/13/08), and Flooding & Flooding Impacts (8/12/08).

Using 1990, 2006, and 2010 projected census data as well as 1950 and 2003 aerial photography, Sheila illustrated the dramatic growth and development that has occurred in the Lower Fall Creek Watershed in the last 50 years. The modified Land Use map prepared by the Land Use & Economic Development Work Group was presented to the Steering Committee. Rather than using standard Land Use Code categories, the Work Group identified land use classifications based on known risk to water quality. These include: 1) Agriculture, 2) low/medium-density Residential, 3) Open Space, 4) Golf Courses, 5) Commercial and Industrial (with NPDES permits), high-density Residential, Commercial, Industrial, and Educational; and active Rule 5 sites) The Land Use & Economic Development Work Group also prepared a map that illustrated Land Use Influences including development at Exit 10 (Noblesville & Fishers) and Exit 5 (Fishers) along I-69; the influence of I-69, I-74, Mt. Comfort Airport, and proposed Airport south of Lapel in Madison County; continued growth in Fishers, Noblesville, and McCordsville; and the BioCrossroads infill development (in wellfield) at the confluence of Fall Creek and White River.

Sheila presented research on land use practices as sources of sediment (tillage practices, construction practices, streambank erosion, and stormwater runoff), nutrients (fertilizer application and failing septic systems), and pathogens (failing septic systems, combined sewer overflows, illicit stormwater connections, wildlife, stormwater runoff, livestock/manure management). The research also shows the direct relationship of imperviousness to water quality. The overall imperviousness in the Lower Fall Creek is 25% which, according to the research, limits the ability to control for specific nutrients and toxic pollutants.

To further understand the relationship of land use to water quality in the Lower Fall Creek Watershed, the Land Use & Economic Development Work Group suggested utilizing the Land Use Central Indiana (LUCI) Model and the Long-Term Hydrologic Impact Analysis (L-THIA) Model. Three growth scenarios were used in LUCI – Current Growth Model, Build-Out Growth Model, and Conservative Growth Model. The percentage of land use from each of these models was inputted into L-THIA to determine the impact on water quality. The results were not surprising but do reaffirm the direct relationship between land use and water quality. The Conservative Growth Model showed a decrease in nutrients, sediments, and imperviousness. While the Build-Out Growth Model showed a decrease in nutrients and sediments (less agricultural land) there was an increase in pathogens, imperviousness, and stormwater runoff.

Sheila poised the question to the Steering Committee that if we agree that land use, imperviousness, and water quality are connected then rather than shouldn't we do a better job in our land use planning efforts? The EPA recently released a draft document called "Land Use Planning as the First BMP: Linking Stormwater to Land Use". Key concepts from this article are: location, density, and design of development dictated by Comprehensive Plans and Development Ordinances; missed opportunity to integrate stormwater management into planning; and mismatch between site and watershed planning efforts. An example from this document was presented to the Steering Committee. It used watershed characteristics (flooding, drinking water source, impaired stream, etc.) to determine the most appropriate planning tool. Sheila challenged the Steering Committee to think about how the existing land use plans and development ordinances in the Lower Fall Creek Watershed could better integrate water quality (and quantity) concerns. As well as how the land use planners in each community could work better with the stormwater managers to develop watershed solutions to improve water quality. Members of the Steering Committee engaged in a fruitful discussed about the opportunities and challenges of this somewhat common sense approach to improve water quality.

3. Review and Prioritize Critical Areas Identified by Work Groups

IDEM defines Critical Areas as “where the sources are causing the greatest damage and where treatment measures have the greatest effect”. Heather Buck noted that the Water Quality Work Group, Land Use & Economic Development Work Group, and Education Committee selected Critical Areas based on water quality and land use data that was presented to them. Heather presented the Critical Areas by pollutant – Sediment, Nutrient, and Pathogens.

Sediment Critical Areas include: streambank erosion at Windridge Condominiums, lack of Erosion and Sediment Control (ESC) Ordinance in the City of Lawrence, sediment loading in Indian Lake, and development at I-69 Exit 10 in Noblesville and Fishers. Nutrient Critical Areas include: 8 golf courses (Brendonwood County Club, Fort Golf Course, Gray Eagle Golf Club & Academy, Hawthorn Golf & County Club, Hillcrest Country Club, Indian Lake Country Club, Ironwood Golf Club, and Old Oakland Golf Course), 4 residential lakes over 50 acres (Lake Stonebridge, Lake Kesslerwood, Lake Maxinhall, and Indian Lake), and 6 wellfield protection areas. Pathogen Critical Areas include: Indiana State Fair Grounds, BioCrossroads Medical Research Facility, 6 wellfield protection areas, 11 non-sewered areas (4 High Priority according to the Septic Tank Elimination Program (STEP) 42nd & Sherman, 42nd & Millersville, 46th & Emerson, and 82nd & Redbud), and the neighborhood at 42nd and College Street (downstream from the State Fair Grounds) where kids play in Fall Creek.

Heather asked the Steering Committee to prioritize the Critical Areas within each of these pollutant groups. Members of the Steering Committee acknowledge the efforts of the Work Groups to filter through all of the water quality and land use data in the Lower Fall Creek to identify these Critical Areas and concluded that each one was equally important. Several Committee members offered that IDEM did not require them to prioritize then they would prefer not to. Sky Shelley confirmed that IDEM does not require Critical Areas to be prioritized.

4. Identify Management Measures *(if time permits)*

Insufficient time was available (as suspected) to discuss Management Measures. This item will be discussed at the 5/13/08 Steering Committee meeting.

5. Closing and Adjournment

Ron distributed an updated Project Timeline and pointed out the 3 workshops (Pond Maintenance, Backyard Conservation, and Regulated Drain vs. Natural Streams) being planned in partnership with the Education & Outreach Work Group. Ron encouraged everyone to periodically check the Lower Fall Creek WMP (www.lowerfallcreek.org) for updates and thanked everyone for their participation.

The next Steering Committee meeting is scheduled for Tuesday, May 13, 2008 at the Lawrence Government Center to begin at 3:00 pm.

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Tuesday, May 13th 2008
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Project Updates
3. Identify Projects, Resources and Timeline for Implementation
4. Relationship of Surface & Ground Water Quality and why it matters in the Lower Fall Creek Watershed
5. Closing and Adjournment

Next Meeting: 3 pm Tuesday, August 12th focusing on Flooding & Flooding Impacts in the Lower Fall Creek Watershed

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Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Tuesday, May 13th 2008
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Steering Committee Members Present:
Chris Barnett, Near North Development Corporation
Josh Goode, IACT
Ron Lauster, Marion County SWCD
Kent Ward, Hamilton County Surveyor's Office
Gwen White, IDNR
Jerry Wilkey, City of Lawrence DPW

Others Present:
Heather Buck, CBBEL
Nancy Darr, Landowner Hancock County
Stephen Hoback, Landowner Hancock County
Sheila McKinley, CBBEL
Sky Schelle, IDEM - OWQ

1. Welcome and Introductions

Ron Lauster welcomed everyone to the Steering Committee meeting while a sign in sheet was distributed. Those in attendance introduced themselves and indicated the agency, office, or organization which they represented.

2. Project Updates

Ron and Sheila discussed the updates needed to the Lower Fall Creek Watershed website (www.lowerfallcreek.org) and that these updates will be completed soon so that all information will be current.

Sheila indicated that the draft Watershed Management Plan (WMP) sections 1-5 will be submitted to IDEM later in May and will also be made available via the website for Steering Committee and Work Group members to review and comment.

Sheila indicated that Greg Bright has completed the first macro-invertebrate sampling in April. Results from that sampling event should be provided in the next few weeks. A second sampling event will be scheduled in October, 2008.

Ron reported that the proposed historic/native planting along Fall Creek as a BMP demonstration project will not be able to be completed this year. However, other options are being considered at Lake Maxinhall and Indian Lake as these communities have expressed an interest in partnering to install a BMP demonstration. Heather also provided information on the BMP report produced by CBBEL as a part of the 319 grant requirements. This report provides detailed information related to the Critical Areas identified by the Steering Committee and work groups where a structural BMP demonstration can be implemented. Golf Courses, residential lakes greater than 50 acres, and school properties were mapped, contact information was provided for each property or community, and a list of potential BMPS was provided within the report. This report will be made available on the Lower Fall Creek website.

Ron updated the Steering Committee on the upcoming workshops: Shoreline Stewards (June 12 and August 21, 2008) will be held at the Garrison at Fort Benjamin Harrison State Park and is designed to assist local lake communities and streambank property owners in developing a management plan to reduce pollutant loadings to the watershed. Local experts will be on hand at the second session to provide detailed information to attendees regarding the main issues of that community; Backyard Conservation (Fall) will soon be developed but is intended to highlight conservation measures such as rain gardens and porous pavement, that can be implemented on existing residential properties; and the Regulated Drain vs. Natural Waterway workshop (Winter) will be held to inform landowners what they can and cannot do along regulated drains and how that impacts their participation in Federal USDA incentive programs such as the Conservation Reserve Program to install filter strips along streambanks.

3. Identify Projects, Resources and Timeline for Implementation

Sheila presented the proposed management measures and invited the Steering Committee members to identify potentially responsible partners and the resources needed for implementation of those measures. After this portion was complete, Steering Committee members were asked to prioritize the proposed management measures with "dot" stickers representing <5 years, 5-10 years, and >25 years as an anticipated timeline for completion of the measure. The number of "votes" each management measure received is noted within the brackets in the "Timeline for Implementation" column of the table while the timeframe receiving the most votes is indicated in bold text. The outcomes of this exercise are attached to the rear of this summary.

4. Relationship of Surface & Ground Water Quality and why it matters in the Lower Fall Creek Watershed

Heather provided a brief power point highlighting the connectivity of surface water and groundwater and how that plays an important role in developing and implementing a WMP. The need for better information (or more information *sharing*) related to groundwater resources and the hydrology of the watershed was discussed. It is important to know the hydrology along Fall Creek (whether it is a gaining stream or a losing stream) to plan and implement stormwater conservation measures that filter pollutants while not impacting the groundwater. Much of the Lower Fall Creek Watershed (approximately 25%) lies within Wellfield Protection Areas (WFPA). Chris

Barnett also provided insight to the impacts to groundwater as he serves on the Board for the Marion County Wellfield Education Corporation.

5. Closing and Adjournment

The next Steering Committee meeting will be held Tuesday, August 12th at 3:00 pm and will focus on Flooding & Flooding Impacts in the Lower Fall Creek Watershed.

Lower Fall Creek Watershed Plan
DEVELOPMENT OF MANAGEMENT MEASURES

Note: *Steering Committee votes for implementation timelines are indicated in Bold text, while the total votes for each timeframe is indicated within the brackets.*

Suggested Management Measures to address…

SEDIMENT LOADS

Management Measure	Responsible / Partnering Entity	Resources Needed	Timeline for Implementation
Create a Highly Erodible Land (HEL) overlay zone for planning & zoning purposes.	Planning & Zoning Departments *All* Soil & Water Conservation Districts (SWCD) *All*	Lower Fall Creek support & education Soil maps Develop language to create overlay	5 year [1] 10 year [1] **25 year [3]**
Stabilize streambanks along Fall Creek with native vegetation and removal of invasives (target adjacent publicly owned open spaces and golf courses).	Parks Departments *All* Golf courses Keep Indianapolis Beautiful (KIB) SWCDs *Hamilton County* *Marion County*	Labor Permits Project design Plant material Education on invasive plants	**5 year [3]** 10 year [0] 25 year [1]
Reduce soil erosion and stormwater runoff from construction sites.	MS4 Communities *All* Indiana Department of Environmental Management (IDEM)	Education Funding Staff	5 year [1] **10 year [3]** 25 year [1]

Management Measure	Responsible / Partnering Entity	Resources Needed	Timeline for Implementation
	SWCDs *All* Developers and Contractors		
Educate contractors and developers regarding Rule 5 & Rule 13 requirements, inspections, and enforcement.	IDEM Hoosier Heartland Resource, Conservation, & Development (HHRCD) MS4 Communities *All* SWCDs *All* Building Association of Greater Indianapolis (BAGI)	Field Day associated with annual workshop Funding	**5 year [5]** 10 year [0] 25 year [0]
Establish a ~~3 tier (flag/sign) colored system~~ signage program to identify ~~excellent/good/poor~~ active construction sites or developers that are in compliance with IDEM's Rule 5 program.	Planning & Zoning Departments *All* SWCDs *All* Lower Fall Creek Watershed Alliance (LFCWA)	Planning, Zoning Inspectors Establish criteria by which to rate construction sites or developers	5 year [1] 10 year [1] **25 year [2]**
Develop a Lake Management Plan for Indian Lake.	Indian Lake Homeowners Association (HOA) Marion County SWCD LFCWA		5 year [2] 10 year [2] 25 year [1]
Stabilize shorelines of Indian Lake with native vegetation to reduce increased sedimentation.			

Management Measure	**Responsible / Partnering Entity**	**Resources Needed**	**Timeline for Implementation**
**This was discussed by the Steering Committee and was agreed that it is a component of the management measure above and was subsequently deleted.*			

NUTRIENTS LOADS

Management Measure	**Responsible / Partnering Entity**	**Resources Needed**	**Timeline for Implementation**
Evaluate Development Ordinances based on the Center for Watershed Protection's "Code & Ordinance Worksheet Tool".	Indianapolis Department of Public Works (DPW) Planning & Zoning Departments *All* Upper White River Watershed Alliance (UWRWA)	Copies of the worksheet Planning Graduate Student(s) *Ball State* *IUPUI*	**5 year [2]** 10 year [1] 25 year [1]
Integrate Low Impact Development (LID) practices into new or re-development projects.	Developers Planning & Zoning Departments *All* SWCDs *All* HHRCD Marion County Wellfield Education Corporation (MCWEC) UWRWA Water utilities	Ordinance language developed Guidance documents for practices Incentives for integration	5 year [1] 10 year [0] **25 year [3]**

Management Measure	Responsible / Partnering Entity	Resources Needed	Timeline for Implementation
Reduce application of phosphorus containing fertilizers on Indian Lake golf course, Brendonwood Golf Course, Hillcrest Country Club, and Ironwood Golf Club **This management measure was discussed by the Steering Committee and was agreed that it is a component of the conservation programs listed 2 rows below. It was subsequently removed.*			
Reduce application of phosphorus containing fertilizers on residential properties on Lake Maxinhall, Indian Lake, Kesslerwood Lake, and Stonebridge Lake **This management measure was discussed by the Steering Committee and was agreed that it is a component of the conservation programs listed below. It was subsequently removed.*			
Encourage golf courses and residential properties along Fall Creek or lakes larger than 50 acres to participate in the Audubon Cooperative Sanctuary Program, Groundwater Guardian Green Sites, National Wildlife Federation, or a similar conservation program.	Golf Course managers MCWEC Office of the Indiana State Chemist (OISC)	Speakers bureau Conservation program requirements Education on conservation programs	5 year [1] **10 year [5]** 25 year [3]
Adopt a WFPA Protection Overlay Ordinance for the Madison County WFPA.	Madison County Commissioners Madison County Health Department	Delineation or study of wellfield area	5 year [1] 10 year [1]

Management Measure	Responsible / Partnering Entity	Resources Needed	Timeline for Implementation
	Madison County Plan Commission Madison County Surveyor	Adoption of protection ordinance	25 year [0]

PATHOGEN LOADS

Management Measure	Responsible / Partnering Entity	Resources Needed	Timeline for Implementation
Establish or enhance shoreline and streambank riparian buffers to reduce potential increases in bacteriological impacts from wildlife and domestic pets throughout the Lower Fall Creek Watershed.	Health Departments *All* Planning & Zoning Departments *All*	Amendment to ordinance (>12 inches needs mowed) Education on buffers Signage for buffers	**5 year [5]** 10 year [0] 25 year [1]
Partner with the Indiana State Fair Board to reduce *E. coli* loadings to Fall Creek.	4-H / FFA Fair Board Fair Commission Marion County Health Department Mapleton - Fall Creek Neighborhood Association	Education Possible outdoor classroom	5 year [1] 10 year [1] 25 year [0]
Support the Septic Tank Elimination Program (STEP) especially within the WFPAs and floodplains of the Lower Fall Creek Watershed.	Marion County Health Department Indianapolis DPW Marion County Health & Hospital Corporation	Long-Term Control Plan implementation	5 year [2] 10 year [2] 25 year [2]

EDUCATION & OUTREACH

Management Measure	Responsible / Partnering Entity	Resources Needed	Timeline for Implementation
Host an annual “Watershed Awareness” or “Celebrate Fall Creek” event (stream clean-up, water quality monitoring, educational workshops, safety, health and wellness).	LFCWA Natural Resources Education Council Indy Parks UWRWA Health Departments *All* Fort Benjamin Harrison State Park	Possible display at Earth Day celebrations Possible addition to the Pathway to Water Quality at the Indiana State Fairgrounds	5 year [0] 10 year [0] **25 year [5]**
Develop future education & outreach programs based on results of the Social Indicators Survey.	LFCWA Purdue University	Survey materials Survey results	5 year [1] **10 year [3]** 25 year [0]
Create education demonstration project(s) to illustrate good urban redevelopment practices and good stormwater management in critical watershed areas.	MS4 Communities *All* Planning & Zoning Departments *All* HOAs Community Development Corporations *All*	Grants Technical assistance for project design Maintenance funding	**5 year [3]** 10 year [2] 25 year [0]

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

3:00 pm Tuesday, August 12th 2008
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Project Updates
   i. Watershed Management Plan
   ii. BMP Demonstration Projects
   iii. Workshops
   iv. Social Indicator Survey
   v. Implementation Grant
3. Flooding & Flooding Impacts in the Lower Fall Creek Watershed
4. Closing and Adjournment

Next Meeting: 3 pm Tuesday, November 18th

[8-12-08 minutes]

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

2:30 pm Thursday, January 29th 2009
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Project Updates
   i. Watershed Management Plan
   ii. BMP Demonstration Projects
   iii. Workshop
   iv. Social Indicator Survey
   v. Implementation Grant
3. Closing and Adjournment

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Lower Fall Creek Watershed Management Plan
STEERING COMMITTEE MEETING

2:30 pm Thursday, January 29th 2009
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Steering Committee Members Present:
Chris Barnett, Near North Development Corporation
John Hazlett, Office of Sustainability
Tina Jones, Indy Parks
Joe Ketterman, Marion County Health Department
Ron Lauster, Marion County SWCD
John South, Hamilton County SWCD
Paul Whitmore, Veolia Water

Others Present:
Heather Buck, CBBEL

1. Welcome and Introductions
Ron Lauster welcomed everyone to the Steering Committee meeting while a sign in sheet, recent editions of the Marion SWCD newsletter, and project summary information was distributed. Those in attendance introduced themselves and indicated the agency, office, or organization which they represented.

2. Project Updates
i. Watershed Management Plan
Heather indicated that a full draft of the Lower Fall Creek WMP was provided to IDEM at the end of December and that comments from IDEM reviewers are expected in early February. Ron provided copies of the WMP to those interested and reminded people that the draft is located on the Lower Fall Creek website (www.lowerfallcreek.org). A brief summary of the public meeting held on January 15, 2009 was also given. During this time, Heather also provided maps indicating the locations of the macroinvertebrate sampling sites. These maps were referenced while the October 2008 event findings and the overall observations and recommendations provided from Commonwealth Biomonitoring were discussed.

ii. BMP Demonstration Projects

Ron provided an update regarding the BMP demonstration projects as a part of this planning effort. He and other Marion SWCD staff have met with members of the Indiana State Fair Board and are developing plans to install 2 rain barrels and rain gardens near the greenhouse on the Indiana State Fairgrounds. Ron also mentioned the intent to include pervious concrete or pavers in the pathway leading to the greenhouse. Ron also discussed the rain garden to be located at the Mapleton Fall Creek Community Development office. The rain garden design and planting plan will need to be developed so that planting can occur in early spring.

iii. Workshop

Ron discussed the Backyard Conservation workshop held at the Broadway United Methodist Church on November 12, 2008. During this workshop over 25 participants learned the benefits of rain barrels, how to construct a rain barrel, as well as how to attract wildlife to their backyards. The Mapleton Fall Creek Community Development Office helped to plan this event.

Heather discussed the upcoming workshop, Regulated Drains vs. Non-Regulated Drains that is planned for March of this year. This workshop will be developed to provide landowners in the Lower Fall Creek Watershed with information on how to determine if their land is along a regulated drain, what that means for tree planting and streambank stabilization projects, permitting requirements for in-stream work, and potential funding sources available to them for conservation practices implemented on their land.

iv. Social Indicator Survey

Heather informed the group that the draft report from Social Indicator survey project has been received from Purdue University. A very low response rate of 27% was achieved so Purdue University plans to complete small, neighborhood-based focus groups to get a better sense of the awareness, attitudes, and practices related to water quality in the watershed. A few of the factors were discussed in more detail; such as where respondents had heard about water quality, zip codes with higher response rates, and where people turn to get reliable information regarding water quality. Information obtained from this survey, as well as information from the focus groups will be useful to the Lower Fall Creek Watershed and partnering agencies and offices during future education and outreach efforts.

v. Implementation Grant

Ron reminded the group that an application for IDEM 319 Implementation funds was developed and submitted. Ron has not yet heard of the success of that application. Proposed projects in the application, as well as measures detailed in the WMP were highlighted as Ron and Heather discussed the possibility of individual offices taking the lead on those projects should the implementation grant not be awarded. Several Steering Committee members expressed the need to track the locations of practices implemented through the planning grant, the possible implementation grant, as well as those practices completed by individual offices. This will enable the group and the watershed to better capture the benefit of these practices and potentially relate the practices to improved water quality within the watershed.

3. Closing and Adjournment

Ron and Heather thanked everyone for their attendance and efforts throughout the planning period, reminded them to look at the website for updates, and again encouraged them to review the draft WMP. It was noted that this is the last Steering Committee meeting to be held through this grant but that later meetings may be scheduled as needed to discuss implementation projects, partnering agency and office project updates, and other future opportunities.

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Public Meetings
Agendas and Summaries

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Marion County Soil and Water Conservation District

6960 S. Gray Road, Suite C, Indianapolis, Indiana 46237-3237 - (317) 786-1776 -Fax (317) 786-1757
www.marionswcd.org

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Glenn Lange
Julie Farr

DISTRICT STAFF-CONTRACTUAL

John Ulmer
Sheila McKinley

USDA-NRCS STAFF

Henry Wallis

Lower Fall Creek Watershed Management Plan
Public Meeting #1
July 24, 2007 6:30 pm
Lawrence Government Center

Agenda

1. Welcome
2. Overview of Grant Program
3. Discussion of Watershed Issues
4. Work Groups to be Established
    - Water Quality
    - Land Use/Economic Development
    - Education
5. Opportunities for Collaboration with Existing Efforts
6. Closing Remarks

www.lowerfallcreek.org

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MARION COUNTY SOIL AND WATER CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
Public Meeting #1
July 24, 2007 6:30 pm
Lawrence Government Center

Meeting Summary

1. Welcome
Ron Lauster, Director of the Marion County SWCD welcomed those in attendance and informed everyone of the agendas, brochures, and contact information located in the rear of the meeting room. Mr. Lauster provided background information regarding the grant awarded to the Marion County SWCD to complete the Lower Fall Creek Watershed Management Plan (WMP) utilizing a grass roots effort with support from the 4 Counties within the watershed.

2. Overview of Grant Program
Sheila McKinley with Christopher B. Burke Engineering, Ltd. (CBBEL) described the need to develop a WMP, the Steering Committee established for the Lower Fall Creek WMP project, and the anticipated outcomes of the process. Questions from the audience regarding the driving force behind the project were answered by Mr. Lauster and Sky Schelle, Watershed Manager at the Indiana Department of Environmental Management (IDEM).

3. Discussion of Watershed Issues
Heather Buck, CBBEL, facilitated an opening discussion with those in attendance regarding the current status of the entire watershed. Comments from the audience were recorded, discussed in detail, and will be provided to the Steering Committee for further comment and discussion.

- Watershed residents provided details of the excessive sediment and debris build up at the Emerson / Fall Creek bridge.
- Watershed residents provided details regarding Millersville Road at Mallard Lake/Devon Creek and the small rain event that resulted in over 9 feet of water (Sept. 2003) affecting the neighborhood and Millersville Road. Sedimentation of this area has also been identified as a potential cause for increased flooding.
- Crist Blassaras provide positive comments regarding the success of the Conservation Reserve Enhancement Program (CREP) in Madison County. This USDA program provides landowners with monetary incentives to install Best Management Practices (BMPs) to reduce non-point source pollution. Over 500 acres of trees and 25,000 feet of filter strips have been installed in the Upper Fall Creek watershed which drains to Geist Reservoir, eventually draining into the Lower Fall Creek watershed.

- The Hoosier Heartland Resource, Conservation, & Development (RC&D) programs were discussed as possible benefits to the watershed as well as an opportunity for collaboration on projects and outreach efforts.
- Signs warning residents against contact with the water below 46th street were discussed and questioned as to why these signs are there as well as questions related to the plans to remedy the situation and make the water safer.
- Invasive species were discussed as an obstacle for people to interact with Fall Creek as well as a detriment to the riparian corridors, wildlife, and flora of the watershed.
- A lengthy discussion occurred regarding the management of Geist spillway. Watershed residents discussed concerns over increased debris, large volumes of water overtopping the spillway, which authority oversees the management of the release, and the resulting downstream flooding.
- Several residents of Windridge Condominiums were present to discuss their concerns and needs regarding the severe erosion occurring along Fall Creek. This community has had to replace nearly 400 feet of water lines, access has been cutoff to neighboring communities as an entrance has been closed due to safety concerns, and an estimated 100 feet of streambank was lost in March of 2007 due to flooding.
- [Elaine ??] discussed the need to look into the effects of upstream urbanization and the amount of impervious surfaces along Geist Reservoir as a contributor to the increased volume of water being released from the spillway and affecting the downstream portions of the watershed.

4. Work Groups to be Established

A handout was provided to those in attendance summarizing the work groups (Water Quality, Land Use/Economic Development, and Outreach and Education) to be established. Also included were meeting dates and locations for the initial meetings for each of the work groups. Stakeholders are encouraged to participate in those work groups providing local insight, background expertise, and/or interest.

5. Opportunities for Collaboration with Existing Efforts

Heather Buck discussed the need for partnering with existing outreach and communication efforts. Existing newsletters, websites, homeowners associations, events, etc. will be helpful in getting the information related to the Lower Fall Creek WMP to numerous watershed residents and stakeholders. Many attendees provided contact information and mentioned the ability to include updates in neighborhood newsletters and websites.

6. Closing Remarks

Ron Lauster provided the closing remarks reminding everyone of the sign in sheet, informational materials available in the rear of the room, the upcoming work group meetings, and the need for local participation in preparing a valuable WMP.

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Henry Wallis

Lower Fall Creek Watershed Management Plan
Public Meeting #2
January 15, 2009 7:00 pm
Lawrence Government Center

Agenda

1. Welcome / Sign In ~ *Ron Lauster, Marion SWCD*
2. Overview of Grant Program ~ *Ron Lauster, Marion SWCD*
3. Presentation of the Lower Fall Creek Watershed Management Plan ~ *Heather Buck, Christopher B. Burke Engineering, Ltd.*
4. Closing Remarks ~ *Ron Lauster, Marion SWCD*

Lower Fall Creek Watershed Alliance website: www.lowerfallcreek.org

CONSERVATION – DEVELOPMENT – SELF-GOVERNMENT

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
Public Meeting #2
January 15, 2009 7:00 pm
Lawrence Government Center

Meeting Summary

1. Welcome / Sign In ~ *Ron Lauster, Marion SWCD*

Ron Lauster, Director of the Marion County SWCD welcomed those in attendance and informed everyone of the agendas, brochures, and contact information located in the rear of the meeting room. Ron also thanked the City of Lawrence for again allowing use of their facilities for the meetings.

2. Overview of Grant Program ~ *Ron Lauster, Marion SWCD*

Ron provided a brief overview the of the IDEM grant awarded to the Marion SWCD that provides funding for the development of a Watershed Management Plan (WMP) and demonstration projects within the watershed.

3. Presentation of the Lower Fall Creek Watershed Management Plan ~ *Heather Buck, Christopher B. Burke Engineering, Ltd.*

Heather provided a power point summarizing the Lower Fall Creek WMP and

- The purpose of the WMP
- Stakeholder involvement through Steering Committee, workshops, website, public meetings, etc.
- Stakeholder concerns of sediment, nutrients, pathogens, and others (invasive species, fertilizer and pesticide applications, drainage, and flooding)
- Problem statements to address those concerns
- Critical areas identified by the work groups and Steering Committee
- Proposed management measures
- Next steps

During the presentation, discussion developed regarding updates on the streambank stabilization at Windridge Condominiums and the lawsuit between the residents of Indian Lake and the Indiana Department of Transportation. Representatives from both groups encouraged other watershed residents to pay close attention to what is happening in their areas and be vocal when they observe activities detrimental to water quality and their property.

4. Closing Remarks ~ *Ron Lauster, Marion SWCD*

Ron closed the meeting by thanking everyone for attending the meeting and reminding them of the sign in sheet and information materials in the rear of the meeting room. He informed everyone that the planning process is near completion but with potential grant funds and continued partnership there may be additional opportunities for involvement.

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Education and Outreach Meetings Agendas and Summaries

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

3:00 pm Thursday, August 16, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introduction
2. Summary of Grant Requirements and Role of Working Committee
3. Identification of Existing Education & Outreach Efforts
4. Who is Missing From the Table?
5. Topics for Future Education & Outreach Working Committee Meetings
6. Next Meeting Date

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

3:00 pm Thursday, August 16, 2007
Lawrence Government Center
9001 East 59th Street

Meeting Summary

Working Group Members Present:
Dean Farr, Watershed Resident
Ron Lauster, Marion County SWCD
Gwen White, IDNR – LARE

Others Present:
Heather Buck, CBBEL
Sheila McKinley, CBBEL

1. Welcome and Introduction

With a small number of members present, introductions were not needed. Ron Lauster, Marion County SWCD, welcomed everyone to the meeting and a sign in sheet was passed around.

2. Summary of Grant Requirements and Role of Working Group

With a small number of members present, a summary of the grant requirements was not needed. The role of the Working Group will be to provide educational opportunities to the stakeholders of the Lower Fall Creek Watershed. Existing resources such as neighborhood liaisons, websites, local media outlets, and workshops will be utilized to inform watershed stakeholders of ways to reduce their impact on the watershed, upcoming opportunities, as well as the information and recommendations developed by the Water Quality and the Land Use/Economic Development Work Groups.

3. Identification of Existing Education & Outreach Efforts

Much time was spent discussing existing opportunities for education and outreach within the Lower Fall Creek Watershed. The group began by discussing the need to obtain more accurate data related to ethnicity and primary language spoken at home. This information will help to steer future efforts in reaching a diverse watershed population.

Ideas mentioned included:

- Local Churches
- The Amos Brown TV Show
- 107.1 Local Hispanic Radio programming
- Farm Co-Ops within the upland areas of the watershed

- Farm Bureau Councils
- Keep Indianapolis Beautiful
- Environmental Education Coordinator for Lawrence/Public schools
- service clubs such as Boy/Girl Scouts and Master Gardeners
- recreational clubs such as canoe clubs and fishing clubs
- coordination of efforts with neighboring watershed groups to reduce duplicative efforts and increase attendance and awareness of the issues.

Gwen White offered to display the Lower Fall Creek introductory brochures as well as the large watershed map within the IDNR display area at the Indiana State Fair. Ron Lauster provided her with several of the brochures.

Dean Farr provided the group with an insert that was recently included in the City of Lawrence utility statements. This insert, discussing the topic of Curbside recycling, may be altered to provide residents with information related to the Lower Fall Creek watershed. It was suggested that other areas should be contacted to see if they have the same capabilities.

4. Who is Missing From the Table?

Discussion focused on the need to identify Critical Areas within the watershed and obtain recommendations from the Water Quality Working Group and the Land Use/Economic Development Working Group. Once this has been completed, the information can be synthesized to prepare a targeted message and to ensure that the most relevant groups are activated and engaged in the process.

- It was also strongly suggested that the local and State governmental representatives for the watershed, as well as those currently residing in the watershed, be contacted and encouraged to become engaged in the process.

5. Topics for Future Education & Outreach Working Group Meetings

- The topics for future Working Group meetings will stem from recommendations provided by the Water Quality and the Land Use/Economic Development Working Groups, as well as needs identified by the Steering Committee.
- As part of the grant requirements, three workshops are needed and it was again suggested that these workshops be coordinated with other local efforts to reduce duplicative efforts. Suggestions were made regarding partnering with the Eagle Creek or Upper White River Watershed groups for those workshops. Other workshop ideas provided by those in attendance included a streambank stabilization project/demonstration and a workshop related to septic tank maintenance as well as highlighting the Septic Tank Elimination Program (STEP) within Marion County.
- The group also briefly discussed possible ideas for the demonstration project required through the grant. These ideas included invasive species removal and planting of native flora and a vegetated swale along the Fall Creek floodplain. Other ideas for the demonstration project are expected to come from the other Working Groups and the Steering Committee as those groups continue to meet.

6. Next Meeting Date

The next Education & Outreach Working Group meeting is scheduled for Thursday, December 13, 2007 to begin at 3:00 pm in the Lawrence Government Center.

MARION COUNTY SOIL AND WATER CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

3:00 pm Thursday, December 13, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introduction
2. Summary of Grant Requirements and Role of Working Committee
3. Identification of Critical Areas and Development of Outreach
4. Workshop/Clean Water Indiana Grant
5. Purdue Social Indicators Pilot Study
6. Indiana State Fair Grounds
7. Lake Management Issues
8. Next Meeting Date

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Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

3:00 pm Thursday, December 13, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Dean Farr, Watershed Resident
Tina Jones, Indy Parks
Ron Lauster, Marion County SWCD
Gwen White, IDNR – LARE

Others Present:
Heather Buck, CBBEL

7. Welcome and Introduction
Ron Lauster (Marion County SWCD) welcomed everyone, introductions were made, and a sign in sheet was passed around.

8. Summary of Grant Requirements and Role of Working Group
The role of the Working Group will be to provide educational opportunities to the stakeholders of the Lower Fall Creek Watershed in the form of news releases, workshops, and informational updates to the Steering Committee. Existing resources such as neighborhood liaisons, websites, local media outlets, and workshops will be utilized to inform watershed stakeholders of ways to reduce their impact on the watershed, upcoming opportunities, as well as the information and recommendations developed by the Water Quality and the Land Use/Economic Development Work Groups.

9. Identification of Critical Areas and Development of Outreach
Discussion of this topic was moved to follow Item #7 – Lake management issues.

10. Workshop/Clean Water Indiana Grant
Ron Lauster indicated that the Marion SWCD intends to prepare and submit applications for the 2008 Clean Water Indiana: Market Incentive Grant and the Sediment and Nutrient Reduction Grant. Ron discussed the possibility of utilizing the grant funding to provide outreach and education materials related to the proposed workshops for the Lower Fall

Creek Watershed Planning project. Further, demonstration sites or practices established with funding provided by these grants can be visited during the Lower Fall Creek workshops. Funding awards are not expected until April of 2008 and funds must be expended within one calendar year.

11. Purdue Social Indicators Pilot Study

Ron Lauster was contacted by Dr. Linda Prokopy, Assistant Professor, Purdue University, regarding the ongoing development of a Social Indicator framework. Dr. Prokopy was seeking the participation of the Lower Fall Creek WMP project as part of a pilot study. During this study, detailed surveys would be developed specifically for the stakeholders within the Lower Fall Creek, distributed to those within identified critical areas, and compiled as submitted. This process would be utilized pre and post project to indicate any changes in awareness and/or behavior, specifically as a result of the Lower Fall Creek project.

12. Indiana State Fair Grounds

Ron Lauster provided a conceptual view and draft budget regarding the proposed Indiana State Fairgrounds Constructed Wetland Stormwater Treatment System. This system was designed to assist with stormwater runoff treatment from the State Fairgrounds. This area is known for elevated *E. coli* levels. The discussion evoked several questions regarding the date of the design and budget preparation, ownership of the property, and the perceived ability to complete the project.

13. Lake Management Issues

Ron Lauster provided the group with handout materials presented at the Crystal Point Lake Meeting where he discussed the role of the SWCD and provide resource fact sheets regarding Pond Management, Managing Canada Geese, Filter strips, native vegetation, etc. Ron thought that this may be helpful to provide to other interested lake groups within the Lower Fall Creek watershed and to reproduce the fact sheets as handouts for the workshops.

3. Identification of Critical Areas and Development of Outreach

A worksheet identifying the critical areas for each pollutant (as determined by the Land Use/Economic Development Work Group and the Water Quality Work Group) was distributed. After discussion of items 4, 5, 6, and 7 above, the Education and Outreach Work Group decided to combine all three pollutants into one workshop and hold one workshop in each of the agricultural, sub-urban, and urban settings tailored to meet the needs and issues associated with those settings.

Ron Lauster and Tina Jones agreed to meet in early January to discuss the historic native planting area (Central Ave to Pennsylvania Ave) along Fall Creek and whether it can be combined with the spring workshop as a discussion topic and field visit. Outcomes of this meeting and ideas for the summer and fall workshops will be discussed at the next Education and Outreach Work Group meeting.

8. Next Meeting Date

The next Education & Outreach Working Group meeting is scheduled for Tuesday, February 12, 2008 to begin at 3:00 pm in the Lawrence Government Center.

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

3:00 pm Thursday, February 28, 2008
Lawrence Government Center
9001 East 59th Street

AGENDA

1. **Social Indicators Pilot Study** – Dr. Linda Prokopy, Purdue University

2. **Workshop information**

   a. **Shoreline Stewards** – Suburban – Guiding the landowner/HOA in developing a Lake/Shoreline Management Plan for their property and/or community
   b. **Backyard Conservation** – Urban – Presentations and hands on activity to show homeowners techniques to reduce polluted runoff leaving their property
   c. **Regulated Drain vs. Natural Waterway** – Rural – Channel maintenance techniques, log jams, riparian buffers and how projects differ when dealing with a regulated drain or a natural waterway

3. **BMP Demonstration Project**

4. **Next Meeting Date**

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

3:00 pm Thursday, February 28, 2008
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Dean Farr, Watershed Resident
Tina Jones, Indy Parks
Ron Lauster, Marion County SWCD

Others Present:
Heather Buck, CBBEL
Linda Prokopy, Ph.D., Purdue University

1. **Social Indicators Pilot Study** – Dr. Linda Prokopy, Purdue University

Dr. Linda Prokopy with Purdue University was present to discuss the Lower Fall Creek Watershed Project as a participant in the Social Indicators Pilot Study. This study is being driven by US Environmental Protection Agency (EPA) Region 5 to test a system for using social indicators in non-point source (NPS) pollution management. Social Indicators are measures that describe the capacity, skills, awareness, knowledge, values, belief, and behaviors of individuals, households, organizatoins, and communities. Many education and outreach attempts through 319 grants have been utilized to change behaviors or raise awareness in stakeholders in order to change behaviors and reduce NPS pollution. By completing this survey and analysis of results the group and other pilot study groups will be provided with consistant measure of changes within a watershed to better develop educational materials and gauge the success of their outreach efforts. More information on the Social Indicators and the US EPA Region 5 study can be found at:
http://www.uwex.edu/ces/regionalwaterquality/Flagships/Indicators.htm

2. **Workshop information**

Updates regarding the three workshops were provided.

a. **Shoreline Stewards**: *Suburban – Guiding the landowner/HOA in developing a Lake/Shoreline Management Plan for their property and/or community* - June 12, 2008 and August 21, 2008

Mark Mongin (SePro and Indiana Lake Management Society), Ron Lauster (Marion SWCD), and Heather Buck (CBBEL) have been meeting to develop the Shoreline Stewards workshop. The workshop will be divided into 2 sessions to allow ample time to produce a lake or property management plan designed to enhance and protect water quality. These sessions will be held at the Garrison at the Fort Benjamin Harrison State Park in Lawrence.

The first session will discuss the assessment of the property or lake shore and why planning is important. The second session will allow participants to discuss their issues with local experts during several round table sessions. A Clean Water Indiana Grant obtained by the Marion County SWCD will be utilized for printing of the Backyard Conservation Sheets which will be provided to the workshop attendees.

b. **Backyard Conservation**: *Urban – Presentations and hands on activity to show homeowners techniques to reduce polluted runoff leaving their property.*
Few details are available regarding this workshop as planning is just beginning. It is anticipated that this workshop will be held in the early fall with discussions on topics such as rain gardens, rain barrels, native plantings, porous pavement, and other such BMPs that can be implemented on existing residential properties. Suggestions for target communities included the Near Eastside Community Organization, and Community Development Corporations such as the Near North, Kennedy King, and Mapleton Fall Creek.

c. **Regulated Drain vs. Natural Waterway**: *Rural – Channel maintenance techniques, log jams, riparian buffers and how projects differ when dealing with a regulated drain or a natural waterway* It is anticipated that this workshop will be held in the winter in the Madison or Hancock portions of the watershed. Topics such as riparian buffers, set back, maintenance easements, and how these issues may affect USDA Incentive programs for establishment of riparian buffers or grass filter strips. More details will be provided as this workshop is developed.

3. BMP Demonstration Project

The potential BMP demonstration project with Indy Parks was discussed briefly. It was mentioned that a native planting project along Fall Creek was being planned through Indy Parks. Few details are available as this project will require grant funds and several other partnerships in order to be successfully implemented. Details will be provided as they become available.

4. Next Meeting Date

The next meeting will be held on May 13, 2008 to develop the Social Indicators survey.

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

11:00 am Tuesday, May 13, 2008
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Social Indicators Pilot Study – Dr. Linda Prokopy, Purdue University
3. Next Meeting

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
EDUCATION & OUTREACH WORKING GROUP MEETING

11:00 am Tuesday, May 13, 2008
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Dean Farr, Watershed Resident
Ron Lauster, Marion County SWCD
Georgie Perkins, lake Maxinhall Representative
Mark Rumreich, Indian Lake Representative
Gwen White, IDNR-LARE

Others Present:
Heather Buck, CBBEL
Dr. Linda Prokopy, Purdue University

1. Welcome and Introductions

Heather Buck opened the meeting with thanking everyone for attending the day's session and giving a brief discussion on why the Lower Fall Creek Watershed Alliance would be utilizing the Social Indicators survey.

Attendees introduced themselves.

Ron Lauster provided attendess with the general Lower Fall Creek Watershed brochure as well as the registration brochure for the upcoming Shoreline Stewards workshop to be held on June 12 and August 21, 2008.

2. Social Indicators Pilot Study – Dr. Linda Prokopy, Purdue University

Dr. Prokopy provided the group with background information on the Social Indicators research project. This project is a US EPA Region 5 pilot study to attempt to measure the changes in awareness, attitudes, and behaviors as a result of 319 education and outreach efforts. Survey packets were utilized to determine which questions would be asked of stakeholder regarding:

- Rating of water quality
- Opinions on how actions impact water quality
- Water quality impairments
- Sources of water pollutants
- Practices to improve water quality

- Consequences of poor water quality
- Making decisions regarding property maintenance
- Trusted sources of information
- Demographics

Dr. Prokopy will formulate the information provided by the group into a draft survey which will be distributed to the group for a second review. Once the group is comfortable with the draft document printing can be completed. It is anticipated that the first information will be sent to 1,000 randomly selected Lower Fall Creek Watershed residents on September 2, 2008. The following process will be utilized to distribute the surveys:

- On September 2, 2008 a letter will be mailed to selected residents letting them know that a survey will be sent to them and that it is important for them to return the completed survey.
- One week later, the survey will be mailed to selected residents with postage provided.
- 2 weeks after the survey has been mailed a reminder postcard will be sent to those resident that have not returned the completed survey.
- Finally, a second survey will be mailed via certified mail to those residents that have not submitted their completed survey 6 weeks after the survey was mailed.

The Lower Fall Creek Watershed Alliance will need to provide addresses for residential properties within the watershed an invite stakeholder representatives to a working meeting to develop the survey. Dr. Prokopy's groups will provide all costs for printing, mailing, data entry, and analysis of completed surveys.

3. Next Meeting

The comment and review of the draft survey will be complete electronically. The next meeting will be scheduled as needed to prepare for the Backyard Conservation and Regulated vs. Non-regulated Drain workshops.

Land Use and Economic Development Meetings Agendas and Summaries

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Lower Fall Creek Watershed Management Plan
LAND USE & ECONOMIC DEVELOPMENT WORKING GROUP MEETING

3:00 pm Tuesday, August 14, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introduction
2. Summary of Grant Requirements and Role of Working Group
3. Discuss Current Land Use and Land Use Information
4. Discuss Economic Development Plans and Projects
5. Topics for Future Working Committee Meetings
6. Next Meeting Date

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Lower Fall Creek Watershed Management Plan
LAND USE & ECONOMIC DEVELOPMENT WORKING GROUP MEETING

3:00 pm Tuesday, August 14, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Jason Armour, Fishers Engineering Department
Chris Barnett, Near North Development Corporation
Bonnie Chastain, Windridge Development Neighborhood Association
Tom Crouch, Lawrence Economic Development
Phil Harman, Windridge Development Neighborhood Association
Tim Hayes, Lawrence Planning Department
Jim Hoskins, Indian Lake Neighborhood Association
Anna Jetmore-Vargas, Indy Parks – Land Stewardship
Lori Kaplan, City of Lawrence DPW
Kevin Kelly, Noblesville Economic Development
Ron Lauster, Marion County SWCD
Gary Rosenberg, Windridge Development
Mark Rumreich, Indian Lake Neighborhood Association
Dennis Slaughter, Indianapolis Planning Department
Gwen White, IDNR – LARE

Others in Attendance:
Sheila McKinley, CBBEL
Sky Schelle, IDEM – OWQ

1. Welcome and Introduction
Ron Lauster opened the meeting by thanking those in attendance for their interest and participation and asked participants introduce themselves.

2. Summary of Grant Requirements and Role of Working Committee
Sheila McKinley explained that the Marion County SWCD submitted and received a 319 grant funds to prepare a Watershed Management Plan (WMP) for the Lower Fall Creek Watershed. Grant funds were awarded in December 2006 and expire in May 2008. CBBEL was hired by the SWCD in May 2007 to facilitate the planning process and prepare the WMP. IDEM's WMP Checklist requires the Plan to identify water quality

problems and causes, identify sources of water quality impairments, identify critical areas, and best management practices to improve water quality. Development of the WMP is being led by a Steering Committee of local leaders and decision-makers. Three Working Groups have been established to work through the specifics – Land Use & Economic Development, Water Quality, and Education & Outreach.

The role of the Land Use & Economic Development Working Group is to determine general land use categories; identify where and how development (and redevelopment) is occurring in the watershed; identify critical areas and best management practices; discuss current standards for development and redevelopment and determine if they are good or bad for water quality and/or economic development.

3. Discuss Current Land Use and Land Use Information

Sheila shared with the group 2 types of existing land use data – 1) Multi-Resolution Land Characteristic data derived from 1992 satellite imagery and 2) land use based on State Land Use Codes (LUC) for each county (shown below).

LAND USE CODE	Number of Categories / Land Use Code			
	HAMILTON COUNTY	HANCOCK COUNTY	MADISON COUNTY	MARION COUNTY
0 - Unknown	1	1	0	1
100 – Agriculture	4	3	2	1
300 – Industrial	4	6	0	2
400 – Commercial	19	12	0	6
500 – Residential	16	11	2	8
600 – Exempt	5	7	1	7
900 – Other	1	0	2	4
TOTAL	**50**	**40**	**7**	**29**

The Working Group quickly dismissed the 1992 data because so much has changed in the watershed since then – especially in Hamilton County. Following much discussion, the Working Group concluded that the categories from the Land Use Code did not represent the categories of land use that would impact water quality. The Working Group decided on the following 7 categories:

1) Agriculture (cropland or pasture)
2) Woodland/Park/Preserves/Wetlands/Floodplains/Cemeteries
3) Golf Courses
4) Residential (wooded, low and medium density)
5) Commercial/Industrial/Apartment Complexes (> 75% imperviousness, non-generating pollutant source, non-NPDES)
6) Commercial/Industrial (potential pollutant generators, NPDES permits – CRTK, CAFO, auto salvage, landfill, private WWTP)
7) Active Rule 5 (land cleared for construction)

Sheila agreed to work with the individual planning departments, parks, departments, SWCDs, and IDEM to produce an updated land use map for the watershed.

4. Discuss Economic Development Plans and Projects

Unfortunately the Working Group meeting ran out of time and didn't have time to discuss economic development plans and projects. All agreed to dedicate time to this important discussion at the next Working Group meeting. Sheila offered to compile what she could to aid with the discussion.

5. Topics for Future Water Quality Working Committee Meetings

The following summarizes the discussion throughout the Working Committee meeting for discussion at future meetings:

1) <u>Determine rate of growth and land uses in transition</u>
   - Review historic aerial photography to determine rate of growth in watershed
   - Identify short and long-term development plans in watershed

2) <u>Identify Critical Areas and BMPs to improve water quality</u>
   - Isolate land uses based on risk to water quality
   - Incorporate growth models/heat island research conducted by Butler, IUPUI – CEES, and KIB
   - Identify regulated drains and maintenance procedures
   - Incorporate septic information (Barrett Law, topography, soils, floodplains, etc.)
   - Identify agricultural areas with livestock
   - Identify transportation corridors (RR and Hwy)

3) <u>Review Development Standards</u>
   - Determine impact on water quality
   - If amended to improve water quality, determine impact on economic development
   - Ensure participation from the planning and economic development entities in Marion County, Hamilton County, Madison County, Hancock County, City of Lawrence, City of Noblesville, Town of Fishers, and Town of McCordsville.

6. Next Meeting Date

The next Land Use & Economic Development Working Group meeting is scheduled for Tuesday, November 13, 2007 at 9:00 am in Room 200 of the Lawrence Government Center.

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Lower Fall Creek Watershed Management Plan
LAND USE & ECONOMIC DEVELOPMENT WORKING GROUP MEETING

9:00 am Tuesday, November 13, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Project Update
3. Prioritize Critical Land Use/Economic Development Issues
4. Identify Critical Land Use/Economic Development Areas
5. Next Meeting Date

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Lower Fall Creek Watershed Management Plan
LAND USE & ECONOMIC DEVELOPMENT WORKING GROUP MEETING

9:00 am Tuesday, November 13, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Chris Barnett, Near North Development Corporation
Tom Crouch, Lawrence Economic Development
Tim Hayes, Lawrence Planning Department
Roger Johnson, Noblesville Planning Department
Ron Lauster, Marion County SWCD
Mark Rumreich, Indian Lake Neighborhood Association
Dennis Slaughter, Indianapolis Planning Department

Others in Attendance:
Sheila McKinley, CBBEL
Sky Schelle, IDEM – OWQ

1. Welcome and Introduction

Ron Lauster opened the meeting by thanking those in attendance for their interest and participation and asked participants introduce themselves.

2. Project Update

Sheila McKinley provided an overview of the changes that were made to the Land Use map to better reflect the impact land uses have on water quality as opposed to using standard land use codes. This process reduced the number of land use categories from as many as 50 into 1 of 7 groups.

LAND USE	DESCRIPTION	PERCENT
AG	cropland or pasture	37.6%
COM, IND	>75% imperviousness, potential pollutant generator, NPDES permits, CRTK, CAFO, auto salvage, landfill, private WWTP	0.5%
COM, IND, EDU, RES,	>75% imperviousness, non-generating pollutant source, non-NPDES	19.9%
GOLF		2.3%

OPEN SPACE	woodland, park, preserves, wetlands, floodplains, etc	5.7%
RES	wooded, low and medium density	33.6%
RULE 5	cleared for construction	0.4%

This modified land use information was used to run 3 different development scenarios in the Land Use Central Indiana (LUCI) projected into 2040. These included: Current, Build Out, and Conservative rates of growth. The resulting land uses were entered into the Long-Term Hydrologic Impact Analysis (L-THIA) model to determine impact of land use change on water quality. According to these results:

- similar water quality results between the Current and 2040 Conservation Scenario (exception oil & grease 88% increase)
- Build Out 75% decrease in Nitrogen, Phosphorus, and Suspended Solids (removal of agricultural practices)
- Build Out 68% increase in BOD (residential)
- Build Out 2 times bacteria (residential)

The scale of the LUCI model is fairly large and parameters somewhat limiting but a fruitful exercise to reaffirm how changes in land use can impact water quality.

Sheila added that CBBEL staff has been busy reviewing planning documents, talking to staff in Indianapolis, Lawrence, Fishers, Noblesville, Hamilton County, Madison County, and Hancock County to compile information on:

- Long Range Planning – plans for growth, development, and open space
- Critical Areas – identified in Plans of by staff
- Development Standards – requirements for Low Impact Development (LID), green development, smart growth, and floodplain development
- Rule 5 – estimated active development sites
- Tree Cover – percent cover based on studies and/or aerial photography; programs to preserve/enhance tree cover
- Waterways, Floodplains, and Regulated Drains – list, studied/unstudied, maintenance procedures

3. Prioritize Critical Land Use/Economic Development Issues

Sheila provided an overview of the data collected and mapped to date. The first exhibit included: CSOs, impaired waterways, sewer service areas, soil suitability, septic tank elimination program areas (STEP), and 100-year floodplains. The second illustrated the location of superfund site, brownfields, LUST/UST, NPDES, and CFO,

Members of the Work Group discussed land use/economic development issues in the watershed which resulted in a Land Use Influences Map including:

- development at Exit 10 (Noblesville & Fishers) and Exit 5 (Fishers) along I-69
- influence of I-69, I-74, Mt. Comfort Airport, proposed Airport south of Lapel
- growth in Fishers, Noblesville, and McCordsville
- BioCrossroads infill development (in wellfield) Indianapolis

4. Identify Critical Land Use/Economic Development Areas

Sheila led the Work Group through an exercise to identify Critical Areas in the Lower Fall Creek Watershed. This included sediment, nutrients, and bacteria; typical land uses associated with each pollutant; and critical areas in the Lower Fall Creek Watershed (blank). Critical Areas discussed by the Work Group included:

- Sediment
    - *Streambank erosion at Windridge Condominiums*
    - *Erosion and sediment control enforcement in City of Lawrence*
    - *Sedimentation of Indian Lake*
    - *Land development proposal at Exit 10*
- Nutrients
    - *Over application of fertilizers (residential and golf courses)*
    - *Wellfield Protection Areas*
- Bacteria
    - *Indiana State Fair Grounds*
    - *BioCrossroads Development*
    - *Wellfield Protection Areas*
    - *Septic areas*
    - *Low income neighborhood where kids frequently swim in Fall Creek*

Before the next meeting, CBBEL staff will gather additional information on each of these Critical Areas to assist with the prioritizing.

5. Next Meeting Date

The next Land Use & Economic Development Working Group meeting is scheduled for Tuesday, February 12, 2008 at 9:00 am in Room 200 of the Lawrence Government Center.

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
LAND USE & ECONOMIC DEVELOPMENT WORKING GROUP MEETING

9:00 am Tuesday, February 12, 2008
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introductions
2. Project Update
3. Review Critical Areas & Discuss Management Measures
4. Discuss Code & Ordinance Worksheet (COW) Tool
5. Discuss Review Schedule of DRAFT Watershed Management Plan

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Lower Fall Creek Watershed Management Plan
LAND USE & ECONOMIC DEVELOPMENT WORKING GROUP MEETING

9:00 am Tuesday, February 12, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Chris Barnett, Near North Development Corporation
Tom Crouch, Lawrence Economic Development
Roger Johnson, Noblesville Planning Department
Ron Lauster, Marion County SWCD
Mark Rumreich, Indian Lake Neighborhood Association
Dennis Slaughter, Indianapolis Planning Department

Others in Attendance:
Sheila McKinley, CBBEL

1. Welcome and Introduction
Ron Lauster opened the meeting by thanking those in attendance for their interest and participation.

2. Project Update
Ron provided an update on the planning and partnering efforts of the Education and Outreach Work Group. While the time, date, and details have yet to be worked out, 3 workshops are being planned for 2008. These include: Pond Maintenance, Backyard Conservation, and Regulated Drain vs. Natural Streams. Ron encouraged everyone to periodically check the Lower Fall Creek WMP (www.lowerfallcreek.org) for updates.

Sheila McKinley provided a review of the Land Use Influences discussed at the last Land Use & Economic Development Work Group meeting. These include:

- development at Exit 10 (Noblesville & Fishers) and Exit 5 (Fishers) along I-69
- influence of I-69, I-74, Mt. Comfort Airport, proposed Airport south of Lapel
- growth in Fishers, Noblesville, and McCordsville
- BioCrossroads infill development (in wellfield) Indianapolis

Sheila referred to large exhibits illustrating the Critical Areas identified at the last meeting. These include:

- Sediment
    - *Streambank erosion at Windridge Condominiums*
    - *Erosion and sediment control enforcement in City of Lawrence*
    - *Sedimentation of Indian Lake*
    - *Land development proposal at Exit 10*
- Nutrients
    - *Over application of fertilizers (residential and golf courses)*
    - *Wellfield Protection Areas*
- Bacteria
    - *Indiana State Fair Grounds*
    - *BioCrossroads Development*
    - *Wellfield Protection Areas*
    - *Septic areas*
    - *42nd & College Neighborhood where children frequently swim in Fall Creek*

3. Review Critical Areas & Discuss Management Measures

Sheila asked the Land Use & Economic Development Work Group to brainstorm possible Management Measures for the Critical Areas mapped. Management Measures to reduce Sediment included the need for the Lawrence to adopt/enforce an Erosion and Sediment Control (ESC) Ordinance. Ideally it would contain some sort of provision requiring contractors to have obtained an approved ESC training or certification. This training could be through a partnership with the Marion County SWCD and/or Hoosier Heartland RC&D. Highly Erodible Lands (HEL) needs to be acknowledged in the planning process – possibly as an overlay zone. Although there is not much the WMP can do to address the streambank erosion problem at Windridge Condominiums or the sedimentation of Indian Lake, both provide very good educational opportunities and lessons learned for future growth and development.

Management Measures to reduce Nutrients targeted over application of fertilizers on golf courses and residential lake properties. Mark Rumreich shared an article from Stormwater Magazine (November/December 2007) about restrictions that Minnesota has placed on phosphorus in fertilizers. Ron added that the SWCD has applied for cost-share money to assist lake communities better manage the neighborhoring properties. Marion County has a good Wellfield Protection Ordinance and a strong business education program through MCWEC (Marion County Education Corporation). A similar Wellfield Protection Ordinance is needed for the wellfield in Madison County.

Management Measures to reduce Pathogens should focus on understanding the relationship of groundwater and surface water. This effort could establish guidelines for development and redevelopment in wellfield protection areas. Other than bringing awareness to the issue, the Work Group agreed that there is really little they can do with regard to septic systems and limited resources should be focused elsewhere. The City of Indianapolis is implementing the Septic Tank Elimination Program (STEP) and Long-Term Control Plan (LTCP). Tom Crouch added that almost all of Lawrence is now on sewer. Roger Johnson noted that in Hamilton County development is required to connect to sewer if within 300 feet. The Work Group wondered if the effluent from the State Fair Grounds is being addressed by Health and Hospital and the Fair Board or as part of the City's LTCP.

4. Discuss Code & Ordinance Worksheet (COW) Tool

Sheila passed out copies of the DRAFT EPA document called "Land Use Planning as the First BMP: Linking Stormwater to Land Use" and the Center for Watershed Protection's DRAFT "Code and Ordinance Worksheet (COW) Tool". Both focus on the impact that land use and land development practices have on stormwater runoff and water quality. And the need for a stronger working relationship between stormwater managers and land use planners – focused on water quality at a watershed scale. The articles generated a very fruitful discussion within the Work Group and it sparked a curiosity among the land use planners to better understand stormwater issues and integration into land use planning and land development processes.

5. Discuss Review Schedule of DRAFT Watershed Management Plan

Sheila noted that this would be the last time the Land Use & Economic Development Work Group would need to meet as a group and thanked everyone for their participation during the meetings as well as between meetings. The DRAFT WMP should be available for the Work Group to review and comment in May 2008. Ron strongly suggested the Work Group check the Lower Fall Creek WMP website www.lowerfallcreek.org.

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Water Quality Working Group
Meetings Agendas and Summaries

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
WATER QUALITY WORKING GROUP MEETING

3:00 pm Tuesday, August 7, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and Introduction
2. Summary of Grant Requirements and Role of Working Committee
3. Summary Existing Water Quality Sampling Efforts
4. Identification and Selection of Water Quality Sampling Sites
5. Topics for Future Water Quality Working Committee Meetings
6. Next Meeting Date

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Lower Fall Creek Watershed Management Plan
WATER QUALITY WORKING GROUP MEETING

3:00 pm Tuesday, August 7, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Robert Barr, IUPUI-CEES
Fred Beyne, Mallard Lake Home Owners Association
Crist Blassaras, Madison County SWCD
Dean Farr
Bill Guertal, USGS
Jim Hoskins, Indian Lake Home Owners Association
Lori Kaplan, City of Lawrence DPW
Joe Ketterman, Marion County Health Department
Ron Lauster, Marion County SWCD
Gary Rosenberg, Windridge Development
Andy Van Treese, Indian Lake Home Owners Association
Lenore Tedesco, IUPUI-CEES
Paul Werderitch, City of Indianapolis DPW/OES
Gwen White, IDNR - LARE

Others in Attendance:
Zach Bishton, CBBEL
Sheila Mckinley, CBBEL
Crystal Rehder, IDEM - OWQ
Sky Schelle, IDEM - OWQ

1. Welcome and Introduction

Ron Lauster opened the meeting by thanking those in attendance for their interest and participation and asked participants to introduce themselves.

2. Summary of Grant Requirements and Role of Working Committee

Zach Bishton gave a summary of the requirements of the Lower Fall Creek Watershed Management Plan grant. Zach explained that the grant requires the collection of additional water chemistry data from 10 sites within the watershed during no less than eight sampling events. The parameters required by the grant include Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Kjeldahl Nitrogen (TKN), Nitrate, Orthophosphorus, Total Phosphate, Total Suspended Solids, and *E.coli.* The overall intent of the Water Quality Working Group was also discussed. It will be the role of the Working Group to determine the need for and the location where additional water quality sampling will be conducted, to oversee the analysis of water quality data that is collected, to determine pollutant loading targets, to identify water quality problems in the watershed, and to make recommendations for improving water quality problems and enhancing areas in the watershed that are considered to be beneficial to water quality.

3. Summary Existing Water Quality Sampling Efforts

Much existing water quality data has already been collected within the Lower Fall Creek Watershed. Working Group members received a map and spreadsheet that identified known active and existing water quality sampling sites within the watershed. Data in the watershed has been collected by the Marion County Health Department, the City of Indianapolis DPW, IDEM, USGS, and Indiana University South East. Robert Barr, with IUPUI also discussed a map identifying the location of known sampling sites within the Lower Fall Creek Watershed. The group then discussed whether it was necessary to collect additional water quality data within the watershed or if it would be more beneficial to begin analyzing and synthesizing existing water quality data.

4. Identification and Selection of Water Quality Sampling Sites

Zach presented a summary table which identified each of the six subwatersheds that make up the Lower Fall Creek Watershed, the total number of known active sampling sites that are located in each subwatershed, the predominant land use types within each subwatershed and the corresponding pollutant loading rankings for each subwatershed based on L-THIA and STEP-L pollutant loading models. The table is identified below.

Subwatershed	Active Sampling Sites	Land Use	LTHIA Pollutant Loading Ranking	STEP-L Pollutant Loading Ranking
Mud Creek Headwaters	0	Urban- 22% **Agricultural- 73%** Forest- 3%	1	1
Mud Creek - Sand Creek	0	Urban- 42% **Agricultural- 46%** Forest- 9%	3	3
Indian Creek - Steele Ditch	0	Urban- 39% **Agricultural- 56%** Forest- 3%	2	2
Fall Creek - Lawrence Creek	2	**Urban- 68%** Agricultural- 10% Forest- 19%	5	5
Fall Creek - Devon Creek	1	**Urban- 86%** Agricultural- 0% Forest- 11%	6	6
Fall Creek - Minnie Creek	9	**Urban- 97%** Agricultural- 0% Forest- 1%	4	4

Based on this data, the group continued to discuss the need for additional water quality data. Overall, group members seemed to agree that there was a need to focus future water quality monitoring efforts on biological health, habitat evaluations, and geomorphic changes within the watershed.

Ron mentioned that one of his concerns was whether or not the contract for the grant could be amended to change the scope to focus on biological and habitat evaluations as opposed to water chemistry evaluations. Sky Schelle, IDEM Project Manager mentioned that he would seek clarification from his supervisor regarding the possibility of amending the contract language.

The group agreed that future water quality sampling efforts, whether focusing on chemistry, biology, or habitat, should be concentrated in the more rural headwater subwatersheds, which were identified as having the greatest pollutant loading rankings and the least amount of historic water quality data.

5. Topics for Future Water Quality Working Committee Meetings

The group also discussed the following known water resource problems in the Lower Fall Creek Watershed:

- Members from the Indian Lake and Mallard Lake Home Owners Associations and Windridge Development raised numerous concerns regarding problems associated with flooding, sedimentation, and severe bank erosion in the watershed. The Indiana Lake Association has purchased its own dredge machine to help remove sediments from the lake.
- There seems to be a lack of local enforcement of Rule 5 and other erosion and sediment control ordinances throughout the watershed.
- There is a need for improved coordination and management between city, county, and state representatives with regard to management of Fall Creek and it's tributaries
- There is a need to enhance the public's awareness of the Lower Fall Creek Watershed Project to ensure that the final plan is effective and that local politicians are aware of the local support for the Watershed Management Plan.
- Concerns were also raised regarding geomorphic changes to Fall Creek and its tributaries as growth in the watershed continues to occur.

In addition the group continued to discuss the overall role of the Working Group. Crist Blassaras asked if the working committee would be responsible for setting water quality/pollutant loading targets. It was mentioned that the Fall Creek TMDL had already set pollutant reduction targets for *E.coli* concentrations in the portions of Fall Creek downstream of Geist Reservoir. The group agreed that a portion of one of the future meetings will be spent determining what pollutant loading targets will be established for other water quality parameters such as nitrogen, phosphorus, and sediment.

Several members mentioned the importance of making sure that the Water Quality Working Group be kept informed with regard to what the Land Use and Economic Development Working Group and the Public Education Working Group are discussing.

6. Next Meeting Date

The next meeting was scheduled for November 13, 2007 at 3:00pm in Room 200 of the Lawrence Government Center.

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MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

Lower Fall Creek Watershed Management Plan
WATER QUALITY WORKING GROUP MEETING

3:00 pm Tuesday, November 13, 2007
Lawrence Government Center
9001 East 59th Street

AGENDA

1. Welcome and introduction
2. Project status update
3. Discuss and prioritize water quality issues
4. Identify critical areas
5. Schedule next meeting date

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Lower Fall Creek Watershed Management Plan
WATER QUALITY WORKING GROUP MEETING

3:00 pm Tuesday, November 14, 2007
Lawrence Government Center
9001 East 59th Street

MEETING SUMMARY

Working Group Members Present:
Crist Blassaras, Madison County SWCD
Dean Farr, Private Citizen
Jim Hoskins, Indian Lake Home Owners Association
Joe Ketterman, Marion County Health Department
Ron Lauster, Marion County SWCD
Gail McDowell, Geist Watershed Alliance
Pam Thevenow, Marion County Health Department
Andy Van Treese, Indian Lake Home Owners Association
Paul Werderitch, City of Indianapolis DPW/OES

Others Present:
Zach Bishton, CBBEL

1. Welcome and Introduction

All those in attendance introduced themselves and identified the organization they were representing. Gail McDowell with the Geist Lake Watershed Alliance introduced herself and mentioned that she is assisting in the establishment of a citizen's group that is interested in education residents in the Geist Reservoir Watershed about the steps they can take to reduce the impact that their daily activities are having on water quality in the watershed. Crist recommended that Gail or another member of her group attend the Indiana Watershed Leadership Academy.

2. Project Status Update

Zach Bishton gave an update on the status of the Lower Fall Creek Watershed Project. A partial draft of the Lower Fall Creek Watershed Management Plan will be provided to the IDEM by the end of November. The draft will include the introduction, background and history, water quality problems and causes, and critical areas discussions. The Land Use Working Group met this morning to discuss and identify key issues and critical areas in the Lower Fall Creek Watershed. The Public Education Working Group meets again on December 13, 2008, and will discuss how best to develop education efforts addressing the key issues identified by both the Water Quality and Land Use Working Groups. A copy of the IDEMs letter approving the water quality sampling scope changed was distributed. Beginning in April, Commonwealth Biomonitoring will conduct macroinvertebrate sampling qualitative habitat evaluations in the Mud Creek, Sand Creek and Indian Creek Subwatersheds. The Group discussed the importance in ensuring that Commonwealth was aware of previous work conducted by the Health Department and the United States Geological Survey.

3. Discuss and Identify Water Quality Issues

A handout summarizing of baseline water quality information was distributed and is included at the end of this meeting summary. This spreadsheet identified the key data sets and studies that have been evaluated in order to begin identifying water quality problems in the Lower Fall Creek watershed. The Group discussed the potential impact that the watershed management planning process might have on mercury and PCB problems present throughout the watershed. The Group was in agreement that these issues would likely be a low priority for the project due to the fact that these pollutants are associated with legacy pollutant sources and because atmospheric deposition is likely the leading cause of mercury in surface water.

Sediments, nutrients, and pathogens were the pollutant sources of main concern in the Lower Fall Creek Watershed. Each pollutant was discussed in terms of the key issues and sources that are impacting pollutant loadings to fall creek waterways.

Sediments

- Need for enforcement of Rule 5 requirements throughout the watershed.
  - The Indian Lake Home Owners Association has reached a settlement with the Indiana Department of Transportation with regard to impacts that a local construction project had on sediment loadings to Indian Lake. The Group reported that they had received a $250,000 settlement from INDOT.
  - Group Members agreed that there is a need to develop a public outreach campaign that increases citizen awareness of Rule 5 requirements. The Group discussed the possibility of developing a program whereby developers would have to display the results of their most recent site inspections by displaying a certain color flag near the access point of their construction entrance. This effort would be coordinated with a public relations campaign promoting the meaning behind the flags. A green flag would indicate that the site passed it's most recent inspection and a red flag may indicate that the site failed it's most recent inspection.
  - Crist mentioned that there is software available that can be utilized to send email notifications to all active Rule 5 sites reminding them that it is time for their next self-inspection.
- Conservation Tillage Practices
  - John South mentioned that he believed that the conservation tillage practices in the Mud Creek and Sand Creek Watersheds are likely above average for Hamilton County. John also suggested that someone from the local SWCD may be able to conduct tillage transects for this portion of the watershed.

Nutrients

- Commercial and Residential Fertilizers

  - The Group discussed the lack of awareness among both residential and commercial landowners as it relates to fertilizer application. The Group discussed the possibility of coordinating with local nurseries to conduct education and outreach efforts at the point of sale.

  - The Group discussed the possibility of discussing fertilizer education programs directly with landowners who live on or adjacent to water bodies in the watershed.

  - Golf Courses were also identified as a contributing land use.

- Waterfowl and Wildlife

  - The Group discussed the impact that waterfowl populations have on waterways and discussed options for eliminating those problems through coordinating with landowners who live adjacent to waterways and by providing education to neighborhood associations.

Pathogens

- Failing or Inadequate Septic Systems

- The Group discussed the fact that the City's STEP program will be beneficial but also discussed the fact that the problem extends to areas not identified in the STEP program.

- CSOs

- CSOs are also a major form of the bacteria loadings in the watershed, but will be significantly reduced through the City's Long Term Control Plan (LTCP).

- The Group discussed the water quality impacts associated with the State Fairgrounds and mentioned that they thought further evaluation of the previously proposed constructed wetlands site should be considered as a result of the plan.

4. Identify Critical Areas

The table below identifies critical areas discussed during the meeting.

DOCUMENTED WATER QUALITY POLLUTANT IN LOWER FALL CREEK	TYPICAL LAND USE/LAND USE PRACTICE ASSOCIATED WITH POLLUTANT		CRITICAL AREAS IN LOWER FALL CREEK WATERSHED
SEDIMENT impacts: Aquatic Life – *reduces plant growth, smothers and covers spawning grounds and benthic habitats* Recreational Impact – *reduces water clarity, reduces aesthetic appeal, stresses sport fishing populations* Drinking Water – *increases drinking water treatment costs, damages pumps and infrastructure*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Conservation Areas • Post-Construction Practices	**DEGRADE** water quality: • Tillage Practices • Construction Practices • Streambank Erosion • Stormwater Runoff	• *Active construction sites (Lack of Erosion and Sediment Control)* • *Log jams and bank erosion – (Windridge Development)*
NUTRIENT (Phosphorus & Nitrogen) impacts: Aquatic Life – *promotes algal blooms, reduces dissolved oxygen concentrations* Recreational Impact – *causes algal blooms, reduces aesthetic appeal, and causes unpleasant odors* Drinking Water – *increases drinking water treatment costs (taste and odor), resultant algae can clog water intakes and filters*	**BENEFIT** water quality: • Riparian Buffers • Filter Strips • Post-Construction Practices	**DEGRADE** water quality: • Fertilizer Application • Failing Septic Systems	• *Commercial fertilizer and pesticide application* • *Residential fertilizer and pesticide application – Indiana Lake* • *Waterfowl near detention ponds* • *Golf courses* • *CSOs (Fort Ben, 106th St. and Cumberland Rd, Indian Lake)* • *State Fairgrounds*
PATHOGENS (Bacteria & Viruses) *impacts:* Aquatic Life – *exposes aquatic life to disease causing organisms* Recreational Impact – *exposes recreational users to disease causing organisms*	**BENEFIT** water quality: • Sewer Service • Exclusionary Fencing	**DEGRADE** water quality: • Failing Septic Systems • Combined Sewer Overflows (CSO) • Illicit Connections to	• *Failing or inadequate septic systems in rural areas and Marion County Septic Tank Elimination Program Areas.* • *CSO's*

Drinking Water – *increases drinking water treatment costs*		Storm Sewer • Wildlife • Stormwater Runoff • Livestock & Manure Management	• *State Fairgrounds*

APPENDIX 3

Brochure

Workshops

Newsletters

Social Indicators Survey

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Important Facts about the Lower Fall Creek Watershed

- The Lower Fall Creek Watershed covers more than 65,000 acres and contains 126 stream miles.
- Approximately 53% of the land use considered to be urbanized areas while 38% of the watershed is used for agricultural purposes.
- Approximately 73,000 people live within the Lower Fall Creek Watershed.
- The Indiana Department of Environmental Management has indicated that Fall Creek is impaired by *E. coli* which can serve as a warning sign for public health risks.
- Fall Creek drains to the White River.

The Lower Fall Creek Watershed includes Fall Creek (from Geist Reservoir to White River), plus Devon Creek, Indian Creek, Indian Lake, Lawrence Creek, Minnie Creek, Mud Creek, Sand Creek, and Steele Ditch. The watershed project affects portions of Hamilton, Hancock, Madison, and Marion Counties.

Interested individuals are encouraged to contact the Marion SWCD office with questions or comments. Christopher B. Burke Engineering, Ltd. will be assisting the SWCD as Project Manager for the Lower Fall Creek Watershed Project.

The SWCD's intent is to develop a truly "grass roots" watershed group that seeks to improve the water quality conditions within the watershed by involving citizens, neighborhood groups, local and state government agencies, and others within the watershed area.

Marion County Soil and Water Conservation District
6960 S Gray Road, Suite C
Indianapolis, IN 46237

Phone: 317-786-1776
Fax: 317-786-1757
E-mail: ron-lauster@iaswcd.org
www.marionswcd.org

Funding for this brochure was provided through an Indiana Department of Environmental Management 319 grant awarded to the Marion County SWCD.

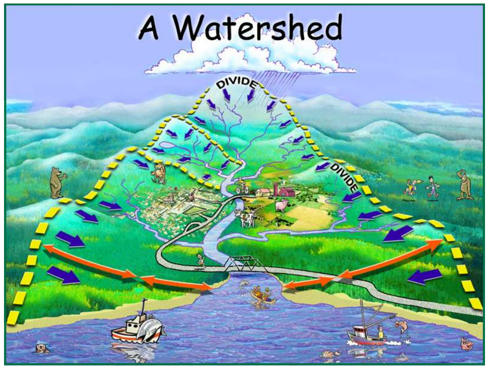
Lower Fall Creek Watershed Management Planning Effort

Developing a Watershed Management Plan will identify water quality impairments in the Lower Fall Creek Watershed while engaging a diverse group of stakeholders in the implementation of sustainable and local solutions.

Lower Fall Creek Watershed

What is the Lower Fall Creek Watershed?

A watershed is an area of land that collects and drains water to a specific point. In this case, Fall Creek. Precipitation such as rain and snow moves through the landscape from the highest point to the lowest point for that area.



The Lower Fall Creek Watershed drains portions of Hancock, Hamilton, Madison, and Marion Counties; as well as portions of the Town of Fishers, the City of Indianapolis, the Town of McCordsville, and the City of Lawrence. A map of the Lower Fall Creek Watershed (the area within the dark blue outline) has been provided for you inside this brochure.

A Watershed Management Plan (WMP) is a document that examines water resource issues and provides specific actions to address those issues based on the values and the needs of the community. The Marion County SWCD has been awarded grant funds to prepare a WMP for the Lower Fall Creek Watershed as it is a highly utilized recreational and drinking water resource.

Where do these pollutants come from?

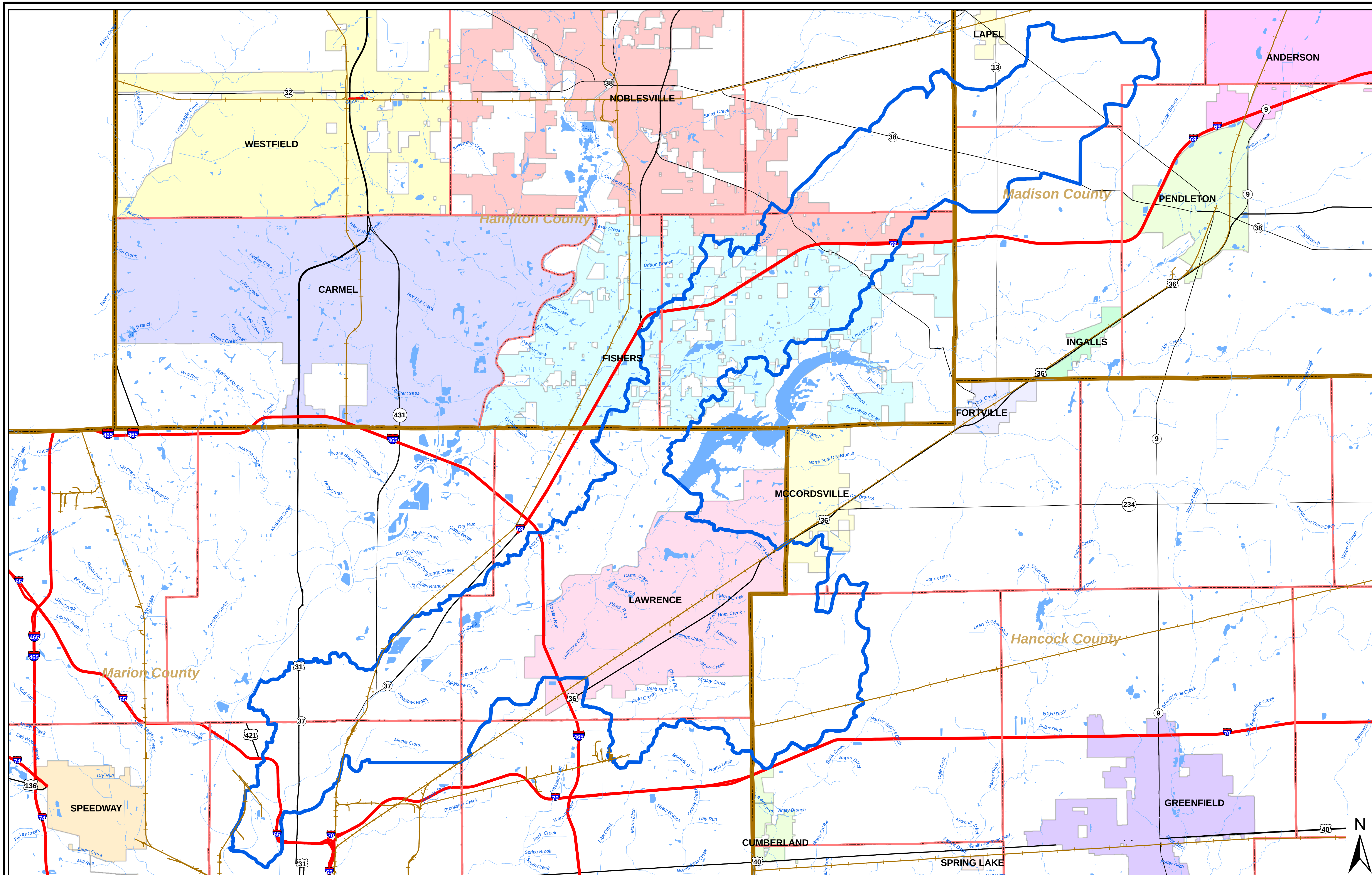
Human activities have a significant effect on the quality of the water moving through the system. Excess pollutants such as sediment, bacteria, oils & grease, and nutrients may be collected and the volume and velocity of the water entering Fall Creek may be increased due to these interactions.

Land Development: During the construction phases, bare soil may be exposed leading to increased erosion from the site. Runoff from impervious surfaces may contain increased amounts of oils & greases from automobiles, road-deicing additives, pesticides & nutrients, as well as thermal pollution from heat retaining surfaces such as asphalt.

Combined Sewer Overflows *(CSO):* Combined sewer systems carry both sewage and stormwater during high water events. Raw sewage depletes oxygen in the streams needed for fish to survive. High bacteria levels from untreated sewage make streams unsafe for adults and children to fish, swim, or play in.

Agriculture: Activities associated with livestock and crop production may introduce pesticides, nutrients (such as phosphorus and nitrogen), pathogens (such as *E. coli*), and sediment to streams and water courses within the watershed.

Septic Systems: When septic systems fail, excess nutrients and pathogens are potentially released directly into the streams and tributaries to the Lower Fall Creek.



LAPEL
ANDERSON
NOBLESVILLE
WESTFIELD
Madison County
PENDLETON
Hamilton County
CARMEL
FISHERS
INGALLS
FORTVILLE
MCCORDSVILLE
LAWRENCE
Hancock County
Marion County
SPEEDWAY
GREENFIELD
CUMBERLAND
SPRING LAKE
N

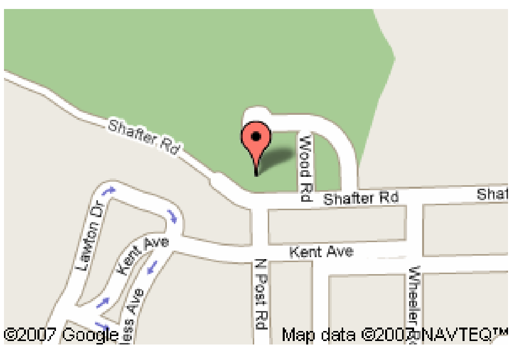
Event Sponsors

- **Aquatic Control, Inc**
- **Christopher B. Burke Engineering**
- **Hoosier Heartland RC&D**
- **Indiana Lakes Management Society**
- **Indiana Wildlife Federation**
- **Lower Fall Creek Watershed Alliance**
- **SePRO Corporation**
- **Soil & Water Conservation Districts in Boone, Brown, Hamilton, Hendricks, Hancock, Johnson, Marion, Monroe, Morgan, and Shelby Counties.**
- **USDA- Natural Resources Conservation Service**

This Shoreline Stewardship workshop is being facilitated by the Marion County and Hamilton County Soil & Water Conservation Districts (SWCDs) working with the sponsors listed above. Districts have been dedicated to conserving and improving soil, water, and related natural resources of their respective counties for over 35 years. This workshop is just one of the many ways districts promote wise land use and work to improve water quality in their counties.

If you have questions or concerns about the workshop contact the Marion Co. SWCD by phone at 317-786-1776.

Location



To get to the Garrison, take the E. 56 St. exit off of I-465 in the Northeast part of Indianapolis. Continue east on 56th St. to Post Rd., Turn left and continue going north to Shafter Rd. then turn right or east until you get to the entrance of the Garrison & Golf Course.

Marion Co. Soil & Water Conservation District
6960 South Gray Rd, Suite C
Indianapolis, IN 46237
www.marionswcd.org

Shoreline Stewards Workshop

Ecological Solutions for Sound Shoreline Management ...

for lakes, ponds, streams, & rivers

Thursday Evenings 7:00 - 9:00 p.m.
On June 12 & August 21, 2008

Classes held at
The Garrison at
Fort Benjamin Harrison State Park
6002 North Post Road,
Indianapolis, Indiana

Hosted by-

Hoosier Heartland Resource Conservation & Development (RC&D) Council, Inc.

Indiana Lake Management Society (ILMS)

Marion & Hamilton County Soil & Water Conservation Districts

Funded in part by an Indiana Department of Environmental Management (IDEM) 319 grant and an ISDA State Soil Conservation Board (SSCB) Clean Water Indiana (CWI) grant.

SHORELINE STEWARDS WORKSHOP - INDIANAPOLIS, INDIANA

The Garrison at Fort Ben

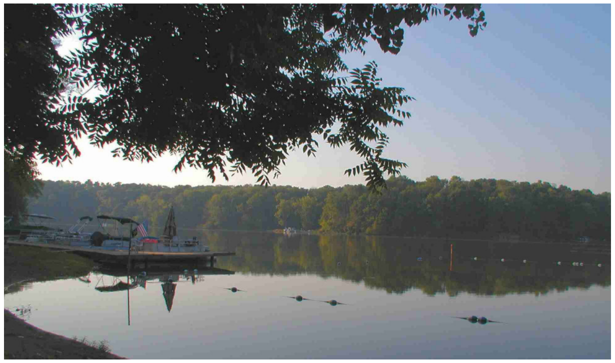
6002 North Post Road
Indianapolis, IN

The Shoreline Stewardship Workshop is an ideal opportunity for landowners, homeowners, home owner associations and other property managers who are interested in protecting and restoring the valuable natural resources at the waters edge. Worksheets will be provided to assist with common resource concerns such as nutrient management, pest management, and erosion and sediment control.

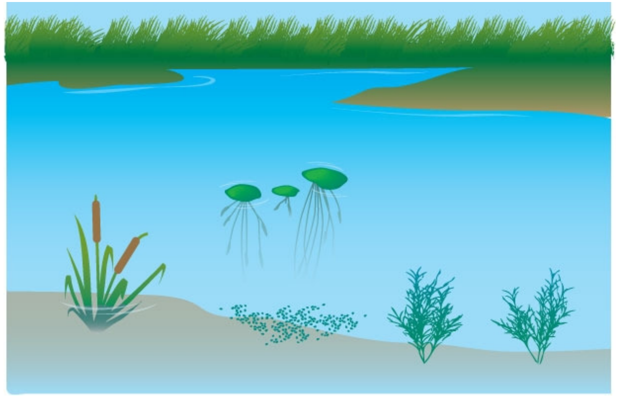
The focus of this program will be to provide valuable information to help attendees develop a management plan for their body of water shoreline area with the following elements:

- An inventory and assessment of the resources
- A developed management plan
- A list of action items to apply the plan
- An operation and maintenance schedule

The workshop will consist of two evening sessions covering two topics per night.



MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT



Agenda

Session 1: Thursday, June 12th , 7-9 pm

- Assessing Your Shoreline Situation: An Inventory
  Mark Mongin, SePRO Corporation
- Developing A Stewardship Plan: Why & How
  Heather Buck, Christopher B. Burke Engineering, LTD

Session 2: Thursday, August 21st , 7-9 pm

- Implementing A Plan: A Brief Discussion– Heather Buck
- Topical Experts Plan Reviews– Roundtable Sessions
- Plan Monitoring and Maintenance- Mark Mongin

Our sponsors will be providing refreshments each evening

The Hoosier Heartland RC&D Council, Inc. and our partnering organizations are equal opportunity providers and employers.

Registration Form:

Workshop is limited to 50 and registrations will be accepted on a first-come first-serve basis.

Name: ______________________________

Representing: ________________________

Address: ____________________________

____

Daytime Phone: _______________________

Email: ______________________________

Number Attending ____ X $30/person =

Total Enclosed $ _______________

Please send a check payable to the Marion County SWCD and mail to:

Marion County SWCD
6960 S. Gray Road, Suite C
Indianapolis, IN 46237

Registration Deadline is Thursday June 5th

Please note no refunds can be made after Thursday, June 5th.

Register Now!

LOWER FALL CREEK
WATERSHED ALLIANCE

FREE

BACKYARD CONSERVATION WORKSHOP

Broadway United Methodist Church
609 East 29th Street
November 12, 2008
6:30 pm - 8:00 pm

- The workshop is **FREE** but pre-registration is required.
- The workshop will be limited to the first **25** registrations.
- Others interested will be placed on a waiting list and will be contacted regarding future opportunities.

Attend this workshop to learn what you can do in your own backyard to protect the water quality of Fall Creek, beautify your neighborhood, attract birds and butterflies, and save money and time!

You will receive a barrel and required parts to create your own FREE rain barrel (minimal assembly will be required). Rain barrels are connected to your home's downspouts and rain water is stored in the barrel until needed for watering your lawn or flowers. This will help to reduce your monthly water bills in the summer!

You will also learn the benefits of planting native flowers, creating a backyard conservation area, and having your area certified by the Indiana Wildlife Federation as a backyard wildlife habitat!

To register for the workshop, contact:

Brooke Klejnot
Communications and Outreach Director
Mapleton-Fall Creek Development Corporation
130 East 30th Street
317-923-5514
brooke@mfcdc.org

Mapleton-Fall Creek Development Corporation

Marion County Soil & Water Conservation District

EDEN IN INDIANAPOLIS

INDIANA WILDLIFE FEDERATION

INDY PARKS and Recreation

LOWER FALL CREEK WATERSHED ALLIANCE

Regulated Drains & Natural Waterways

Debris causing a log-jam

Lapel Library
610 Main Street
Lapel IN
March 25, 2009
6:30 pm - 8:00 pm

Agenda

Welcome and Opening Remarks

- *Heather Buck, Christopher B Burke Engineering*

Regulated Drain Overview

- *Kent Ward, Hamilton County Surveyor*

Log Jams and Permitting Issues

- *George Bowman, IDNR, Division of Water*

BREAK

USDA Funding Opportunities

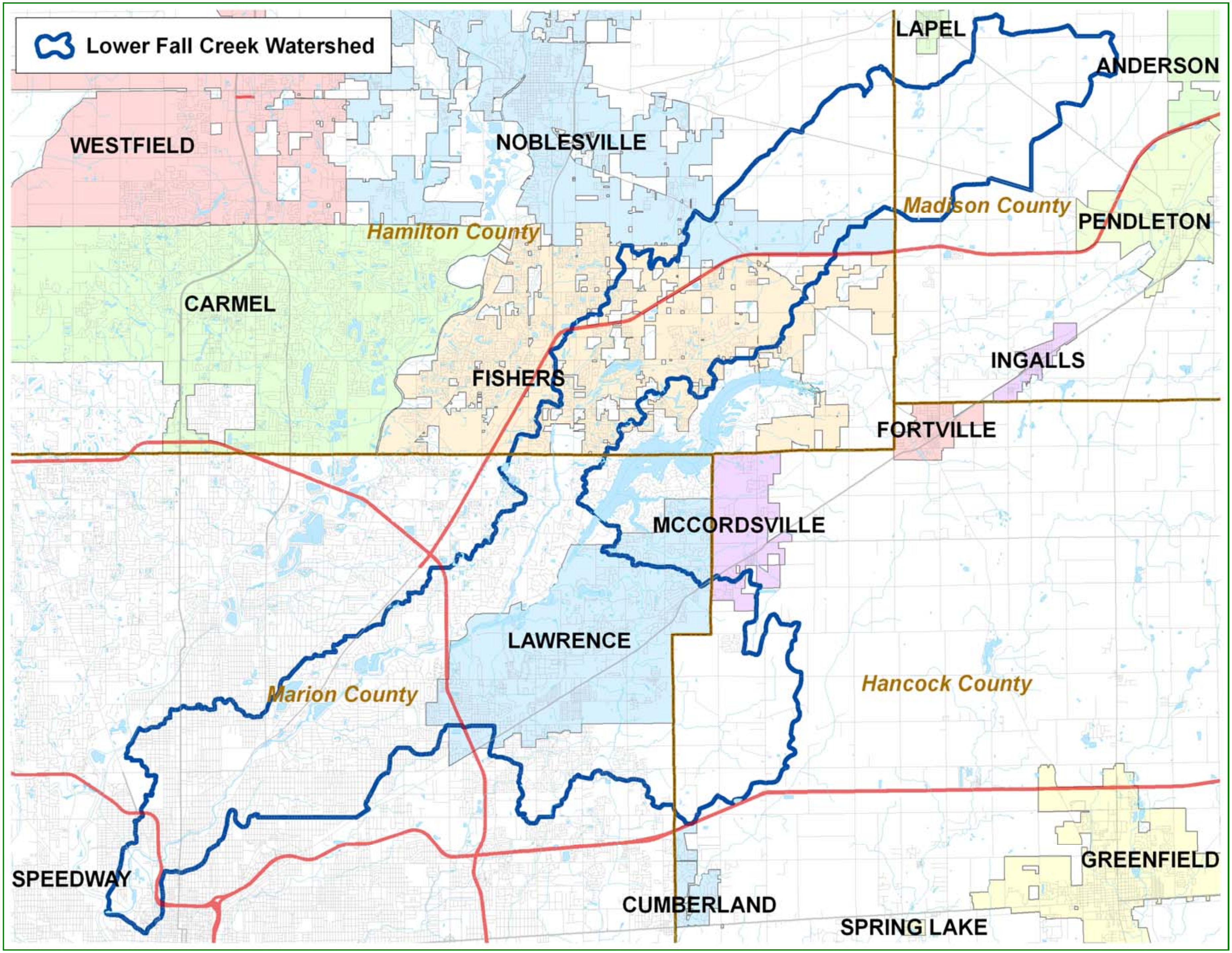
- *NRCS Representative*

2-Stage Ditch Design

- *John South, Hamilton County SWCD*

Newly constructed 2-stage ditch

The Marion County Soil and Water Conservation District was awarded an IDEM 319 grant to prepare a Watershed Management Plan for the Lower Fall Creek Watershed. This watershed covers portions of Hamilton, Hancock, Madison, and Marion Counties and is identified on the back of this flyer. For more information please contact the Marion SWCD at (317) 786-1776 or visit www.lowerfallcreek.org.



Lower Fall Creek Watershed
WESTFIELD
NOBLESVILLE
LAPEL
ANDERSON
PENDLETON
Madison County
Hamilton County
CARMEL
FISHERS
INGALLS
FORTVILLE
MCCORDSVILLE
LAWRENCE
Marion County
Hancock County
SPEEDWAY
CUMBERLAND
SPRING LAKE
GREENFIELD

Marion County Soil & Water Conservation District – News Release

Contact: Ron Lauster
Phone: 317-780-1765
Email: ron-lauster@iaswcd.org
Web site: www.marionswcd.org

News for Immediate Release

Marion County SWCD to Lead Planning Project for Large and Diverse Fall Creek Watershed

The Marion County Soil and Water Conservation District (SWCD) was awarded a Section 319 Nonpoint Source Pollution Management grant to study water quality in the Lower Fall Creek Watershed. Planning for this project began in the fall of 2006 and will wrap up with the development of a watershed management plan in May of 2009. The SWCD retained the professional services of Christopher B. Burke Engineering, Ltd. (CBBEL) to facilitate the planning process and prepare the watershed management plan.

The Lower Fall Creek Watershed is a large and diverse watershed that drains more than 65,000 acres of land in portions of Madison, Hamilton, Hancock, and Marion Counties. While 53% of the watershed has been developed for urban uses, 38% of the watershed remains in agricultural use. Water quality studies conducted by the Indiana Department of Environmental Management indicate that Fall Creek is impaired for *E.coli* from just downstream of Geist Reservoir to the confluence of the White River. In addition, water quality data collected in Hamilton County indicates that portions of Mud Creek, a tributary to Fall Creek, are also being impacted by the presence of *E.coli*. As with land uses, the sources of pollution associated with these water quality problems include both urban and agricultural sources, such as land application of manure, inadequately functioning septic systems, stormwater runoff, and combined sewer overflows.

The socioeconomic status of the Lower Fall Creek Watershed is equally diverse. Median household income in the southern portion of the watershed is less than $35,000, while median household income in the Hamilton County portion of the watershed exceeds $50,000.

In recognition of the unique challenges that such diversity presents, a Steering Committee has been established to guide the planning process. The Steering Committee is made of representatives from all four counties and includes representatives from municipalities, counties, economic development organizations, neighborhood associations, universities, and environmental groups. The Steering Committee conducted its Kick-Off Meeting on May 31, 2007 and will meet on a quarterly basis for the duration of the project.

A public meeting to announce the project is currently being planned and will likely be held in July. The meeting will introduce the project to the public and will solicit participation in one of three working groups that will focus on water quality, land use, and public education in the watershed.

Once completed, the Lower Fall Creek Watershed Management Plan will identify and prioritize water quality problems and will establish an action plan to improve water quality and public awareness in the Lower Fall Creek Watershed.

For additional information, please contact Ron Lauster from the Marion County SWCD at 317-780-1765 or ron-lauster@iaswcd.org or Sheila McKinley from CBBEL at 317-266-8000 or smckinley@cbbel-in.com.

---- End ----

LOWER FALL CREEK WATERSHED PLANNING
NEWSLETTER INFORMATION
07-06-07

Marion County SWCD Begins Lower Fall Creek Watershed Improvement Project

In the fall of 2006, the Marion County Soil & Water Conservation District (SWCD) submitted a Section 319 Non Point Source Program grant application to the Indiana Department of Environmental Management (IDEM) to develop a WMP for the Lower Fall Creek Watershed. The grant funds were awarded in March of 2007 and the Marion County SWCD retained the professional services of Christopher B. Burke Engineering, Ltd. (CBBEL) located in Indianapolis. CBBEL will assist in the development of the watershed plan steering committee, facilitate stakeholder discussions, collect and analyze water quality data, and serve as the primary author of the Watershed Management Plan.

A Watershed Management Plan (WMP) is a guiding document that examines the historical and existing water resource issues in a particular watershed and presents specific actions to address those water resource issues based on the values and needs of the community. The intent of the WMP is to provide better living conditions, economic viability, and environmental health benefits for those that reside in the watershed and for communities downstream. Developers of the WMP are interested stakeholders that investigate prior and existing watershed conditions, identify watershed priority areas, and formulate strategies for implementing specific actions. The WMP document represents the earnest efforts of the community to understand, analyze, and be an integral part of the solution to improve impaired water quality in the watershed. Furthermore, active community involvement in the development of the WMP helps to ensure that there is future commitment by the community to implement projects identified in the WMP.

Partnerships among water resource professionals and interested citizens are essential to the successful development and implementation of the Lower Fall Creek WMP. In recognition of the social, physical, and economic diversity that is present in the watershed a Steering Committee of local water resource experts was established to guide the development of the plan. The Lower Fall Creek Watershed Steering Committee will be the primary committee utilized to steer the overall direction of the Lower Fall Creek WMP. The Steering Committee will meet on a quarterly basis from May of 2007 through September of 2009 and include the following individuals and groups representing municipalities, counties, economic development organizations, neighborhood associations, universities, and environmental groups.

- **Chris Barnett**, Near North Development Corporation
- **Cindy Beckner,** Hancock SWCD
- **Crist Blassaras**, Madison SWCD
- **Victoria Cluck**, Indianapolis DPW
- **Angie Dye,** Veolia Water
- **Josh Goode**, Watershed Resident
- **Tina Jones**, Indy Parks
- **Lori Kaplan**, City of Lawrence DPW
- **Joe King,** Dirty Dozen Hunting & Fishing Club
- **Ron Lauster**, Marion SWCD
- **Bob Masbaum**, Indianapolis DPW
- **Donna Price**, Indianapolis DMD
- **John South**, Hamilton SWCD
- **Pam Thevenow**, Marion County Health Department
- **Kelly Wood,** Neighborhood Liaison

In addition to the Steering Committee, three Working Committees focusing on Public Education & Outreach, Water Quality, and Land Use and Economic Development will be established. Participation in the Working Committees will be open to any stakeholder with expertise and interest in one or more of the 3 topics. The intent will be to thoroughly discuss each topic, identify critical areas in the Lower Fall Creek Watershed, and recommend programs, policies, and projects to improve water quality.

It is hoped that the successful completion of the Lower Fall Creek Watershed Improvement Project will serve as a benchmark for all future urban watershed efforts in the State of Indiana. Fall Creek is a highly recognizable recreational and drinking water supply resources and traverses a varied landscape socially, economically, and geographically.

Lower Fall Creek Watershed Management Plan
Newsletter update
November 17, 2008

Activities continue in the Lower Fall Creek Watershed.

- The Backyard Conservation workshop held on November 12, 2008 was well attended and positive comments were received as workshop attendees learned how to construct a rain barrel, how to attract wildlife to their backyards, and how to have their backyards certified as a Backyard Wildlife Habitat by the Indiana Wildlife Federation. One workshop remains for this phase of Lower Fall Creek Watershed project: Regulated Drains and Natural Waterways. This workshop will be held in early 2009 and will involve presentations and discussions on the differences between natural channels and regulated drains, what can be done and what should not be done along these types of water systems, and how actions in and around natural streams and regulated drains affect water quality downstream. More information will be provided through the Lower Fall Creek Watershed Alliance's website (www.lowerfallcreek.org) as this workshop is developed.

- As a part of the planning phase, the Marion SWCD was provided funding to install water quality demonstration projects throughout the watershed. Project ideas have included rain gardens, bio-filtration areas, and critical area plantings all designed to filter pollutants from the water prior to reaching Lower Fall Creek, its tributary streams, or the groundwater. Project locations are still being determined as the Marion SWCD continues to work with local partners to identify highly visible areas where residents can view the projects and learn how water quality is being protected.

- The first Social Indicators survey, designed to identify the needs and concerns of the watershed regarding water quality and the Lower Fall Creek, has been conducted. The Lower Fall Creek Watershed Alliance has partnered with Purdue University to complete this confidential survey of watershed residents. Over 1,000 randomly selected residents within the Lower Fall Creek Watershed received a several page survey with questions assessing:
    - Types of pollutants in Lower Fall Creek;
    - Consequences of poor water quality in Lower Fall Creek; and
    - Practices to improve water quality in Lower Fall Creek;

  Results from this survey will be compiled and presented to the public and the Lower Fall Creek WMP Steering Committee in early 2009.

- A public meeting to present the full Draft Watershed Management Plan (WMP) will be held on January 15, 2009 at the Lawrence Government Center. Over the last months, Steering Committee members and IDEM have reviewed the WMP and provided their comments. These comments will be incorporated and the Draft WMP will be discussed at the public meeting along with information on how the public can review and comment on the plan prior to submission to IDEM.

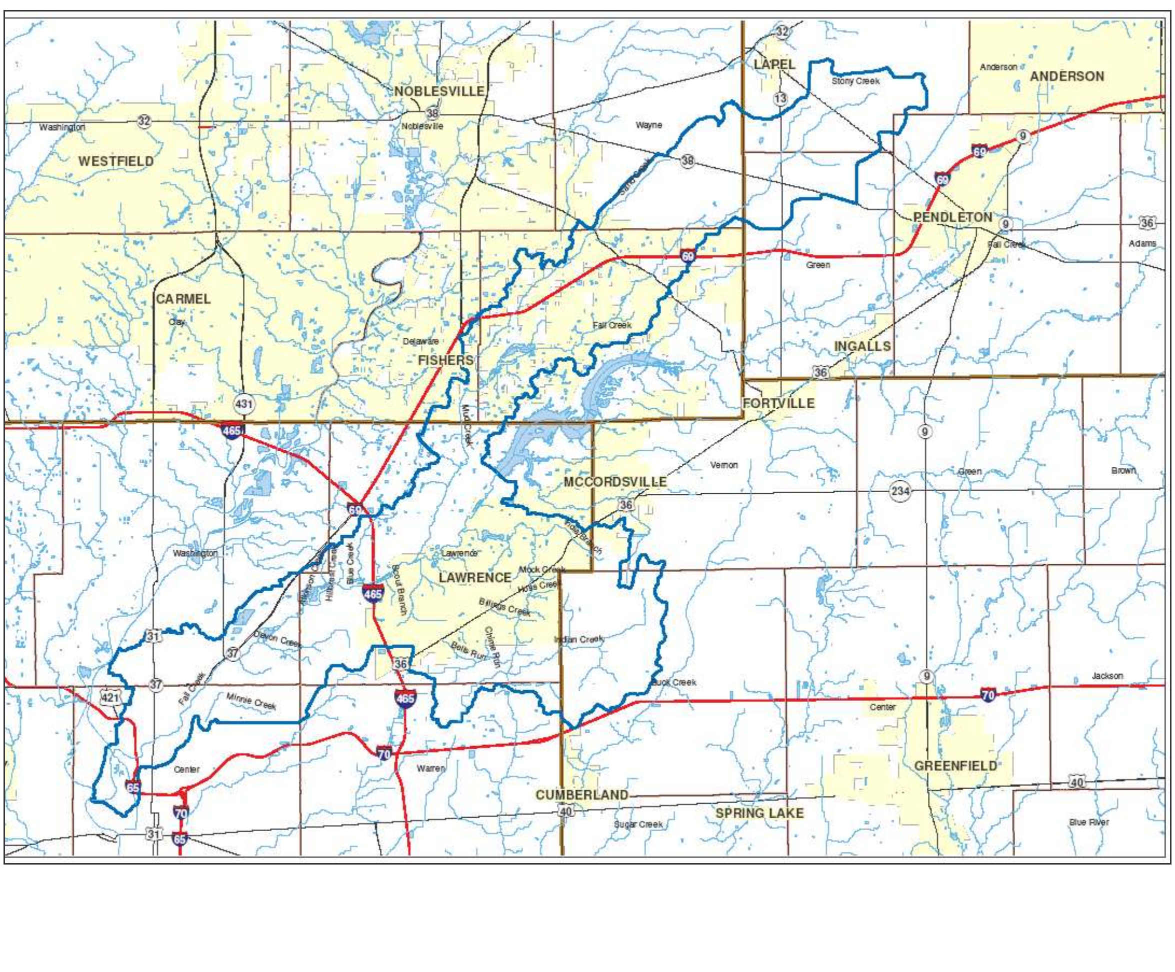
- The final Steering Committee meeting will be held on January 29, 2008 and will involve discussion of overall project results, accomplishments, and next steps. The Marion SWCD has applied for funding to implement the Lower Fall Creek WMP and hopes to hear soon if that funding will be provided to continue the hard work of the Steering Committee will increasing the number of “in the ground” projects throughout the Lower Fall Creek Watershed.

Lower Fall Creek Watershed Management Plan
Newsletter update
December 19, 2008

- The final DRAFT of the Lower Fall Creek Watershed Management Plan (WMP) was submitted to the Indiana Department of Environmental Management (IDEM) for review and comment on December 1, 2008. The purpose of developing the WMP was to gain a greater understanding of the water quality impairments in the Lower Fall Creek Watershed and engage the diverse stakeholders to identify and implement sustainable and local solutions.

  The Marion County SWCD believes that a WMP is a guiding document that examines the historical and existing water resource issues in a particular watershed and presents specific actions to address those water resource issues based on the values and needs of the community. The SWCD hopes that the successful completion of the Lower Fall Creek WMP will serve as a benchmark for all future urban watershed efforts in the State of Indiana. Fall Creek is a highly recognizable recreational and drinking water supply resource which traverses a varied landscape socially, economically, and geographically.

  While IDEM is completing their review of the WMP, there is still an opportunity for public review and comment. The report, including exhibits and appendices, can be found at the Lower Fall Creek Watershed Alliance's website: www.lowerfallcreek.org. If you would like to provide any comments or suggestions regarding the WMP, please forward those to Ron Lauster, Director of the Marion County Soil & Water Conservation District (ron.lauster@iaswcd.org).



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  Results from this survey will be compiled and presented to the public and the Lower Fall Creek WMP Steering Committee in early 2009.

- A public meeting to present the full Draft Watershed Management Plan (WMP) will be held on January 15, 2009 at 7:00 pm in the Lawrence Government Center. Over the last months, Steering Committee members and IDEM have reviewed the WMP and provided their comments. These comments will be incorporated and the Draft WMP will be discussed at the public meeting along with information on how the public can review and comment on the plan prior to submission to IDEM.

- The final Steering Committee meeting will be held on January 29, 2008 at 2:00 pm and will involve discussion of overall project results, accomplishments, and next steps. The Marion SWCD has applied for funding to implement the Lower Fall Creek WMP and hopes to hear soon if that funding will be provided to continue the hard work of the Steering Committee will increasing the number of “in the ground” projects throughout the Lower Fall Creek Watershed.

Lower Fall Creek Watershed Management Plan
Newsletter update
March 5, 2009

Regulated Drains and Natural Waterways

On Wednesday, March 25, 2009 the Lower Fall Creek Watershed Alliance will present Regulated Drains and Natural Waterways, the final in a series of workshops offered as a part of the Indiana Department of Environmental Management (IDEM) 319 grant awarded to the Marion County Soil and Water Conservation District. This grant provides funding for the development of a Watershed Management Plan (WMP) for the Lower Fall Creek Watershed covering portions of Hamilton, Hancock, Madison, and Marion Counties; education and outreach efforts; and macro-invertebrate sampling within Fall Creek and tributary streams.

Debris causing a log jam

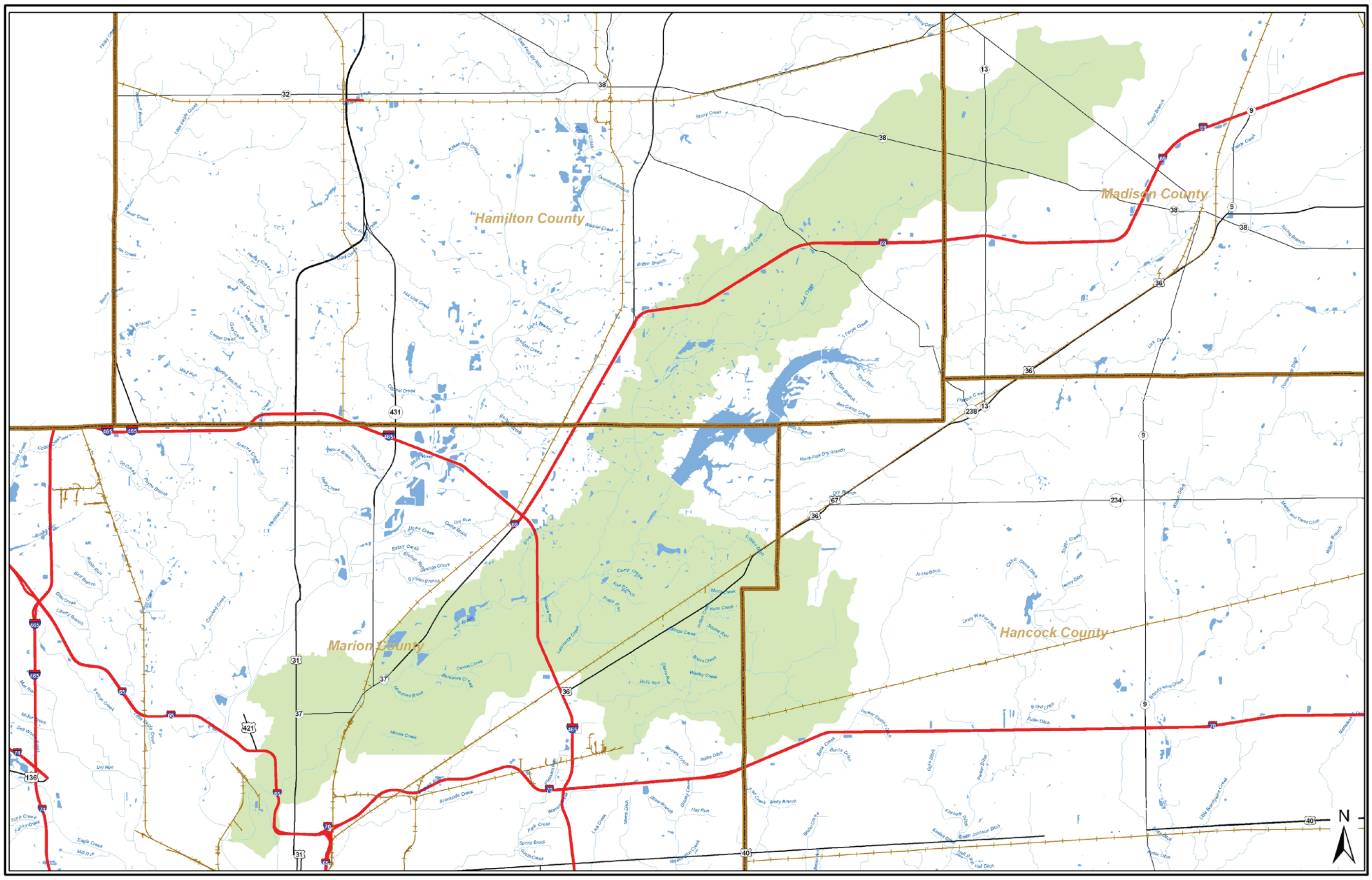
The Regulated Drains and Natural Waterways workshop will be held at the Lapel Public Library, 610 Main Street in Lapel, Indiana and is set to begin at 6:30pm. During this workshop, landowners will learn more about regulated drains, the maintenance associated with regulated drains and how they can find out if the stream or creek on their property is a regulated drain. In addition, a representative from the Indiana Department of Natural Resources (IDNR) Division of Water will be on hand to provide information on log jams and any permitting requirements for log jam removal.

Newly Constructed 2-Stage Ditch

Brief overviews will also be provided regarding available USDA funding for conservation projects in the Lower Fall Creek Watershed through the Natural Resource Conservation Service or the Farm Service Agency and the concept of 2-Stage Ditch Design and its applications in the agricultural setting.

For more information on the Regulated Drains and Natural Waterways workshop, please contact the Marion County Soil and Water Conservation District at (317) 786-1776.

Your Views on
Lower Fall Creek Water Resources



Your local watershed project is conducting this survey in coordination with Purdue University. The purpose of this survey is to identify the needs and concerns in your community regarding water quality.

We ask that this survey be completed by the person in your household that makes most of the lawn and garden decisions and is at least 18 years old. Your participation in this survey is completely voluntary. Your answers will be kept confidential and will be released only as summaries where individual answers cannot be identified.

Unless otherwise instructed, please check the box that corresponds to the answer category that best describes you and your situation or opinion. The survey should take approximately 20-30 minutes to complete. Please read each question carefully.

Lower Fall Creek Water Resources

Your Watershed

PLEASE READ BEFORE BEGINNING THIS SURVEY:

The survey must be completed by an adult member of your household 18 years of age or older. Please mark all answers clearly, in pen or pencil, as indicated below.

Example "A" ☐ ☐ ☒ Example "B" ☐ ☐ ☑

Overall, *how would you rate the quality of water* in your area?

	Poor	Okay	Good	Don't Know
1. For canoeing/kayaking/boating	☐	☐	☐	☐
2. For eating fish caught in the water	☐	☐	☐	☐
3. For swimming	☐	☐	☐	☐
4. For picnicking/family activities	☐	☐	☐	☐
5. For fish habitat	☐	☐	☐	☐
6. For scenic beauty	☐	☐	☐	☐

Do you live in a watershed?

- ☐ Yes
- ☐ No
- ☐ Don't know

Do you know where the water goes when it runs off of your property?

- ☐ No, I don't know
- ☐ Yes, it goes to: ______________________________

Please indicate your level of agreement or disagreement with the statements below.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. The economic stability of my community depends upon good water quality.	☐	☐	☐	☐	☐
2. The way that I care for my lawn and yard can influence water quality in local streams and lakes.	☐	☐	☐	☐	☐
3. It is my personal responsibility to help protect water quality.	☐	☐	☐	☐	☐
4. It is important to protect water quality even if it slows economic development.	☐	☐	☐	☐	☐
5. What I do on my land doesn't make much difference in overall water quality.	☐	☐	☐	☐	☐
6. Lawn and yard-care practices (on individual lots) do not have an impact on local water quality.	☐	☐	☐	☐	☐
7. My actions have an impact on water quality.	☐	☐	☐	☐	☐
8. Taking action to improve water quality is too expensive for me.	☐	☐	☐	☐	☐
9. It is okay to reduce water quality to promote economic development.	☐	☐	☐	☐	☐
10. It is important to protect water quality even if it costs me more.	☐	☐	☐	☐	☐
11. I would be willing to pay more to improve water quality (for example: through local taxes or fees).	☐	☐	☐	☐	☐
12. I would be willing to change the way I care for my lawn and yard to improve water quality.	☐	☐	☐	☐	☐
13. The quality of life in my community depends on good water quality in local streams, rivers and lakes.	☐	☐	☐	☐	☐
14. Developers in my community follow current regulations.	☐	☐	☐	☐	☐
15. Construction in my community should use practices that minimize soil erosion.	☐	☐	☐	☐	☐
16. I would choose to purchase a home in a neighborhood that uses water quality conservation measures.	☐	☐	☐	☐	☐

Lower Fall Creek Water Resources

Water Impairments

Below is a list of water pollutants that are generally present in water bodies to some extent. The pollutants and conditions become a problem when present in excessive amounts. In your opinion, *how much of a problem are the following pollutants in your area*?

		Not a Problem	Slight Problem	Moderate Problem	Severe Problem	Don't know
1.	Sediments	☐	☐	☐	☐	☐
2.	Nitrates/nitrogen	☐	☐	☐	☐	☐
3.	Phosphate/phosphorus	☐	☐	☐	☐	☐
4.	*E.coli*	☐	☐	☐	☐	☐
5.	Trash and debris	☐	☐	☐	☐	☐
6.	Salt (i.e. road salt)	☐	☐	☐	☐	☐
7.	Automotive fluids (e.g. MTBE, oil & grease, antifreeze)	☐	☐	☐	☐	☐
8.	Blue-green algae	☐	☐	☐	☐	☐
9.	Exotic or invasive aquatic plants	☐	☐	☐	☐	☐
10.	Flow alteration (e.g. large discharges from Geist Reservoir)	☐	☐	☐	☐	☐
11.	Habitat alteration (e.g. land use change)	☐	☐	☐	☐	☐

The items listed below are sources of water quality pollution across the country. In your opinion, *how much of a problem are the following sources in your area*?

		Not a Problem	Slight Problem	Moderate Problem	Severe Problem	Don't know
1.	Soil erosion from construction sites	☐	☐	☐	☐	☐
2.	Excessive use of lawn fertilizers and/or pesticides (from golf courses, sports fields, homes)	☐	☐	☐	☐	☐
3.	Improper disposal of used motor oil and/or antifreeze	☐	☐	☐	☐	☐
4.	Sewage from combined sewer overflows or failing septic tanks	☐	☐	☐	☐	☐
5.	Stormwater runoff (e.g. roofs, driveways, streets)	☐	☐	☐	☐	☐
6.	Droppings from wildlife and pets	☐	☐	☐	☐	☐
7.	Littering/illegal dumping of trash	☐	☐	☐	☐	☐
8.	Streambank or shoreline modification/destabilization	☐	☐	☐	☐	☐
9.	Conversion of forest land and wetlands to urban use	☐	☐	☐	☐	☐
10.	Discarded medications	☐	☐	☐	☐	☐

Poor water quality can lead to a variety of consequences for communities. In your opinion, *how much of a problem are the following issues in your area*?

		Not a Problem	Slight Problem	Moderate Problem	Severe Problem	Don't know
1.	Contaminated fish resulting in Fish Consumption Advisories	☐	☐	☐	☐	☐
2.	High drinking water treatment costs	☐	☐	☐	☐	☐
3.	Reduced beauty of lakes or streams	☐	☐	☐	☐	☐
4.	Reduced opportunities for water recreation (e.g. swimming and boating)	☐	☐	☐	☐	☐
5.	Fish kills	☐	☐	☐	☐	☐
6.	Decreased property value	☐	☐	☐	☐	☐
7.	Decrease in fish and wildlife populations due to exposure to hormone-mimics (from improperly disposed of medications)	☐	☐	☐	☐	☐

Each set of 4 questions on these pages refers to a specific practice that can address water quality issues. Please follow directions within each shaded box and answer the appropriate questions.

Controlling erosion

Controlling erosion along streambanks and shorelines with vegetation and other practices.

1. Do you use or have you ever used erosion controls?

- ☐ Currently use (go directly to table below)
- ☐ Don't currently use (go to question 3)
- ☐ Never used (go to question 2)

2. How familiar are you with erosion controls?

- ☐ Never heard of it
- ☐ Somewhat familiar with
- ☐ Know how to use; not using

3. Are you willing to try erosion controls?

- ☐ Yes
- ☐ Maybe
- ☐ No

4. On a scale of 1-5, which of the following factors would prevent you from using erosion controls?

Not a problem ⟷ Major problem

	1	2	3	4	5
Lack of skills	☐	☐	☐	☐	☐
Lack of equipment	☐	☐	☐	☐	☐
Doesn't fit with current practices	☐	☐	☐	☐	☐
Too much time required	☐	☐	☐	☐	☐
My views about yard maintenance	☐	☐	☐	☐	☐
Prior personal experience	☐	☐	☐	☐	☐
Does not apply to my home	☐	☐	☐	☐	☐

Follow manufacturer guidelines

Following pesticide application instructions for lawn and garden.

1. Do you now or have you ever followed manufacturer guidelines?

- ☐ Currently use (go directly to table below)
- ☐ Don't currently use (go to question 3)
- ☐ Never used (go to question 2)

2. How familiar are you with following manufacturer guidelines?

- ☐ Never heard of it
- ☐ Somewhat familiar with
- ☐ Know how to use; not using

3. Are you willing to try following manufacturer guidelines?

- ☐ Yes
- ☐ Maybe
- ☐ No

4. On a scale of 1-5, which of the following factors would prevent you from using pesticides?

Not a problem ⟷ Major problem

	1	2	3	4	5
Lack of skills	☐	☐	☐	☐	☐
Lack of equipment	☐	☐	☐	☐	☐
Doesn't fit with current practices	☐	☐	☐	☐	☐
Too much time required	☐	☐	☐	☐	☐
My views about yard care	☐	☐	☐	☐	☐
Prior personal experience	☐	☐	☐	☐	☐
Does not apply to my home	☐	☐	☐	☐	☐

Low-phosphate fertilizers

Using low-phosphate fertilizers for lawn and garden.

1. **Do you use or have you ever used low-phosphate fertilizers?**
   - ☐ Currently use (go directly to table below)
   - ☐ Don't currently use (go to question 3)
   - ☐ Never used (go to question 2)

2. **How familiar are you with low-phosphate fertilizers?**
   - ☐ Never heard of it
   - ☐ Somewhat familiar with
   - ☐ Know how to use; not using

3. **Are you willing to try low-phosphate fertilizers?**
   - ☐ Yes
   - ☐ Maybe
   - ☐ No

4. **On a scale of 1-5, which of the following factors would prevent you from using low-phosphate fertilizers?**

Not a problem ⟷ **Major problem**

	1	2	3	4	5
Lack of skills	☐	☐	☐	☐	☐
Lack of equipment	☐	☐	☐	☐	☐
Doesn't fit with current practices	☐	☐	☐	☐	☐
Too much time required	☐	☐	☐	☐	☐
My views about yard care	☐	☐	☐	☐	☐
Prior personal experience	☐	☐	☐	☐	☐
Does not apply to my lawn	☐	☐	☐	☐	☐

Rain barrels and rain gardens

Rain barrels are above ground water storage vessels that capture rain. Rain gardens are designed to absorb and filter stormwater. They are usually designed to collect stormwater from a house.

1. **Do you use or have you ever used rain barrels or rain gardens?**
   - ☐ Currently use (go directly to table below)
   - ☐ Don't currently use (go to question 3)
   - ☐ Never used (go to question 2)

2. **How familiar are you with rain barrels or rain gardens?**
   - ☐ Never heard of it
   - ☐ Somewhat familiar with
   - ☐ Know how to use; not using

3. **Are you willing to try rain barrels or rain gardens?**
   - ☐ Yes
   - ☐ Maybe
   - ☐ No

4. **On a scale of 1-5, which of the following factors would prevent you from using rain barrels or rain gardens?**

Not a problem ⟷ **Major problem**

	1	2	3	4	5
Lack of skills	☐	☐	☐	☐	☐
Lack of equipment	☐	☐	☐	☐	☐
Doesn't fit with current practices	☐	☐	☐	☐	☐
Too much time required	☐	☐	☐	☐	☐
My views about yard care	☐	☐	☐	☐	☐
Prior personal experience	☐	☐	☐	☐	☐
Does not apply to my home	☐	☐	☐	☐	☐

Lower Fall Creek Water Resources

Please indicate which statement most accurately *describes your level of experience with each practice*.

		Never heard of it	Somewhat familiar with it	Know how to use; not using	Currently use it
1.	Restoring native plant communities and planting trees	☐	☐	☐	☐
2.	Keeping grass clippings and trash out of storm drains, roads, ditches, and gutters	☐	☐	☐	☐
3.	Properly disposing of household wastes (such as batteries, medicines, cleaners)	☐	☐	☐	☐
4.	Not putting chemicals down sewers	☐	☐	☐	☐
5.	Disconnecting downspouts from direct access to storm drains	☐	☐	☐	☐
6.	Reporting suspected violations of water quality regulations (e.g. contact neighborhood association, call TIP-line)	☐	☐	☐	☐
7.	Participating in environmental education outreach with neighborhood groups	☐	☐	☐	☐

When you make decisions about changing your lawn care and/or stormwater practices, *how important is each of the following*?

		Not at all important	Somewhat important	Undecided	Important	Very important
1.	Personal out-of-pocket expense	☐	☐	☐	☐	☐
2.	My own physical abilities	☐	☐	☐	☐	☐
3.	Lack of available information about a practice	☐	☐	☐	☐	☐
4.	No one else I know is implementing the practice	☐	☐	☐	☐	☐
5.	Approval of my neighbors	☐	☐	☐	☐	☐
6.	Restrictive covenants in my subdivision	☐	☐	☐	☐	☐
7.	Don't know where to get information and/or assistance about the practice	☐	☐	☐	☐	☐
8.	Environmental damage caused by practice	☐	☐	☐	☐	☐
9.	Environmental benefit of practice	☐	☐	☐	☐	☐
10.	Concerns about resale value	☐	☐	☐	☐	☐
11.	I do not own my own property	☐	☐	☐	☐	☐

People get information about water quality from a number of different sources. To what extent *do you trust the organizations list below as a source of information about water quality*?

	Not at all	Slightly	Moderately	Very much	Am not familiar
1. Lower Fall Creek Watershed Alliance	☐	☐	☐	☐	☐
2. Soil and Water Conservation District (SWCD)	☐	☐	☐	☐	☐
3. Natural Resources Conservation Service (NRCS)	☐	☐	☐	☐	☐
4. Indiana Department of Natural Resources (IDNR)	☐	☐	☐	☐	☐
5. Indiana Department of Environmental Management (IDEM)	☐	☐	☐	☐	☐
6. Citizen action groups	☐	☐	☐	☐	☐
7. Local landowners/friends	☐	☐	☐	☐	☐
8. Universities	☐	☐	☐	☐	☐
9. Community service groups	☐	☐	☐	☐	☐
10. Gardening and recreational clubs	☐	☐	☐	☐	☐
11. Land Trusts (e.g. TNC, CILTI)	☐	☐	☐	☐	☐
12. Local government	☐	☐	☐	☐	☐
13. Community Development Corporations (CDCs)	☐	☐	☐	☐	☐
14. Neighborhood associations	☐	☐	☐	☐	☐
15. Religious organizations	☐	☐	☐	☐	☐
16. Youth organizations	☐	☐	☐	☐	☐
17. Local access television stations	☐	☐	☐	☐	☐

1. **Do you know how to contact a local government representative?**
   - ☐ Yes
   - ☐ No

2. **How many times in the last year have you called a local government representative?**
   - ☐ Never
   - ☐ Once
   - ☐ 2 - 5 times
   - ☐ More than 5 times

3. **Do you know how zoning works?**
   - ☐ Yes
   - ☐ No

4. **How many times in the last year have you attended a local government meeting?**
   - ☐ Never
   - ☐ Once
   - ☐ 2 - 5 times
   - ☐ More than 5 times

Lower Fall Creek Water Resources

About You

1. **Do you live in close proximity to a lake or stream?**
   - ☐ Waterfront property
   - ☐ Within 1/4 mile
   - ☐ Within 1/2 mile
   - ☐ Within a mile
   - ☐ Further

2. **Do you participate in any of the following water-based recreation activities in this area? (check all that apply)**
   - ☐ Boating
   - ☐ Swimming
   - ☐ Fishing
   - ☐ None of the above

3. **Do you live in a place adversely affected by poor water quality?**
   - ☐ Yes
   - ☐ No

4. **Does poor water quality impact your activities?**
   - ☐ Yes
   - ☐ No

5. **Does poor water quality impact your property values?**
   - ☐ Yes
   - ☐ No

6. **Which of the following do you do on a regular basis? (check all that apply)**
   - ☐ Drive a hybrid vehicle
   - ☐ Recycle
   - ☐ Take public transportation
   - ☐ Walk/bike to work/school
   - ☐ Use compact fluorescent light bulbs
   - ☐ Other (specify) ____________________

7. **Do you make the home and lawn care decisions in your household?**
   - ☐ Yes
   - ☐ No

8. **What is your gender?**
   - ☐ Male
   - ☐ Female

9. **In what year were you born?** __________

10. **What is the highest grade in school that you have completed?**
    - ☐ Some formal schooling
    - ☐ High school diploma/GED
    - ☐ Some college
    - ☐ 2 year college degree
    - ☐ 4 year college degree
    - ☐ Post-graduate degree

11. **What is the approximate size of your residential lot?**
    - ☐ 1/4 acre or less
    - ☐ More than 1/4 acre but less than 1 acre
    - ☐ 1 acre to less than 5 acres
    - ☐ 5 acres or more

12. **Do you own or rent your home?**

- [ ] Own
- [ ] Rent

13. **How long have you lived at your current residence? ________________ years**

14. **What is the source of your drinking water?**

- [ ] Individual well
- [ ] Municipal well
- [ ] Fall Creek
- [ ] Eagle Creek

15. **What is your zip code? ______________**

16. **In addition to your residence, which of the following do you own or manage? (check all that apply)**

- [ ] An agricultural operation
- [ ] Forested land
- [ ] Rural recreational property
- [ ] None of these

17. **Do you use a professional lawn care service?**

- [ ] Yes, just for mowing
- [ ] Yes, for mowing and fertilizing
- [ ] Yes, just for fertilizing and pest control
- [ ] Yes, for mowing, fertilizing and pest control
- [ ] No

18. **In the past three years, have you heard about water quality issues in any of the following? (check all that apply)**

- [ ] Newsletters/brochures/fact sheets
- [ ] Internet
- [ ] Workshops/demonstrations/meetings
- [ ] Radio - Station name: _____________
- [ ] Newspapers - Name publication: ______________________________
- [ ] Television - Station name: ______________________________
- [ ] Water bill - Name provider: ______________________________
- [ ] Notices posted at local businesses
- [ ] Notices posted on community bulletin boards
- [ ] Billboards
- [ ] Conversations with others
- [ ] Other (please specify) ______________
- [ ] None of the above

19. **What is your ethnicity?**

- [ ] African American
- [ ] American Indian
- [ ] Asian/Asian American/Pacific Islander
- [ ] Hispanic/Latino
- [ ] White/Caucasian
- [ ] Multi-racial
- [ ] Other

20. **What is your occupation? (please be as specific as possible)**

____

____

Thank You

Thank you for your time and assistance!

Please return your completed questionnaire in the postage-paid envelope provided. Please use the space below for any additional comments about this survey or water resources in your community.

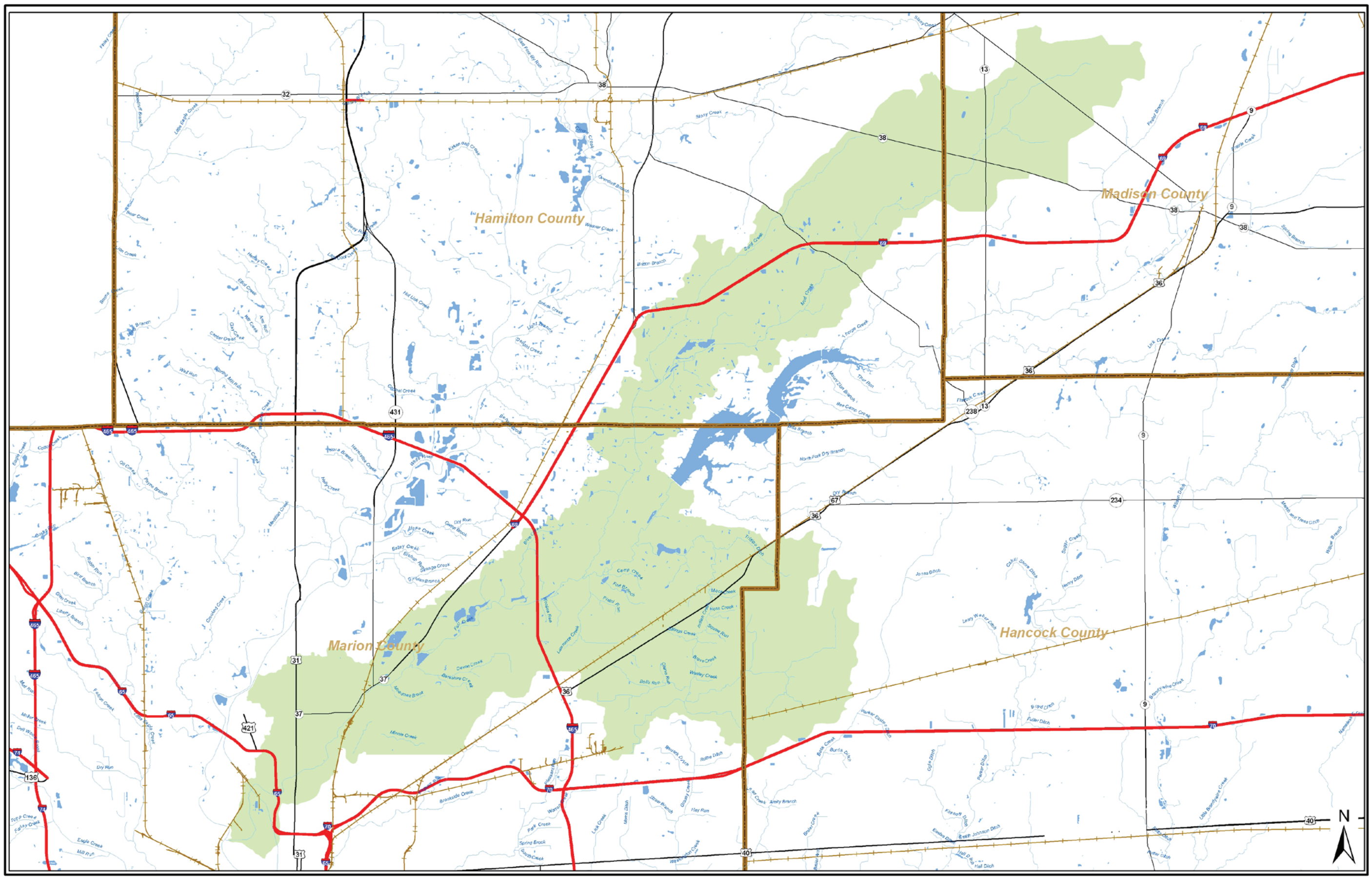
For more information about the Lower Fall Creek Watershed Alliance, please see www.lowerfallcreek.org or contact Ron Lauster at (317) 786-1776.

For more information about this survey, please call Linda Prokopy at (765) 496-2221.

Survey results will be available February 2009 at www.lowerfallcreek.org.

Printed on 30% post-consumer content paper

Su punto de vista acerca de los recursos de agua de la cuenca Lower Fall Creek



El proyecto local de cuencas está llevando a cabo esta encuesta en colaboración con la Universidad de Purdue. El propósito de esta encuesta es identificar las necesidades y preocupaciones de la comunidad respecto a la calidad del agua.

Solicitamos que esta encuesta la complete el miembro del hogar que se encarga de las decisiones de jardinería y sea mayor de 18 años. Su participación en la encuesta es totalmente voluntaria. Sus respuestas son confidenciales y se divulgarán únicamente en forma de resúmenes, en los que no se identifican respuestas individuales.

A menos que se le indique lo contrario, marque la casilla que corresponde a la categoría de respuesta que mejor lo describe a usted y su situación u opinión. La encuesta toma entre 20 y 30 minutos aproximadamente para completarla. Lea detenidamente cada una de las preguntas.

Recursos de agua de Lower Fall Creek

Acerca de la cuenca

POR FAVOR LEA ESTO ANTES DE COMPLETAR LA ENCUESTA:

La encuesta debe completarla un adulto del hogar de 18 años o mayor. Por favor marque todas las respuestas claramente, en bolígrafo o lápiz, como se indica a continuación.

Ejemplo "A" ☐ ☐ ☒   Ejemplo "B" ☐ ☐ ☑

En general, ***¿cómo calificaría la calidad del agua en su área?***

	Deficiente	Bastante buena	Buena	No sé
1. Para canotaje/practicar kayak/paseos en bote	☐	☐	☐	☐
2. Para comer pescados extraídos del agua	☐	☐	☐	☐
3. Para nadar	☐	☐	☐	☐
4. Para hacer picnic/actividades familiares	☐	☐	☐	☐
5. Para el hábitat de peces	☐	☐	☐	☐
6. Como escenario pintoresco	☐	☐	☐	☐

¿Vive en una cuenca?

☐ Sí

☐ No

☐ No sé

¿Sabe hacia dónde se dirige el agua cuando sale de su propiedad?

☐ No, no lo sé

☐ Sí, se dirige a: ______________________________

Sus Opiniones

Por favor indique el nivel de acuerdo o desacuerdo con las siguientes afirmaciones.

	En total desacuerdo	En desacuerdo	No estoy de acuerdo ni en desacuerdo	Estoy de acuerdo	Estoy totalmente de acuerdo
1. La estabilidad económica de mi comunidad depende de una buena calidad de agua.	☐	☐	☐	☐	☐
2. La forma en que cuido el césped y el jardín puede afectar la calidad del agua en los arroyos y lagos.	☐	☐	☐	☐	☐
3. Es mi responsabilidad ayudar a proteger la calidad del agua.	☐	☐	☐	☐	☐
4. Es importante proteger la calidad del agua, incluso si desacelera el desarrollo económico.	☐	☐	☐	☐	☐
5. Lo que hago en mi tierra no crea una gran diferencia en la calidad del agua total.	☐	☐	☐	☐	☐
6. Las prácticas de cuidado de césped y jardín (en lotes individuales) no afectan la calidad del agua local.	☐	☐	☐	☐	☐
7. Mis actos afectan la calidad del agua.	☐	☐	☐	☐	☐
8. Tomar medidas para mejorar la calidad del agua es demasiado costoso para mí.	☐	☐	☐	☐	☐
9. Está bien reducir la calidad del agua para promover el desarrollo económico.	☐	☐	☐	☐	☐
10. Es importante proteger la calidad del agua, incluso si me genera un gasto mayor.	☐	☐	☐	☐	☐
11. Estaría dispuesto a pagar más para mejorar la calidad del agua (por ejemplo: a través de impuestos o tarifas locales)	☐	☐	☐	☐	☐
12. Estaría dispuesto a cambiar la forma en que cuido mi césped y jardín para mejorar la calidad del agua.	☐	☐	☐	☐	☐
13. La calidad de vida en la comunidad depende de una buena calidad del agua en los arroyos, ríos y lagos locales.	☐	☐	☐	☐	☐
14. Los promotores inmobiliarios de mi comunidad cumplen las normas actuales.	☐	☐	☐	☐	☐
15. La construcción en mi comunidad debería utilizar prácticas que minimicen la erosión del suelo.	☐	☐	☐	☐	☐
16. Elegiría comprar una vivienda en un vecindario que implemente medidas de conservación de la calidad del agua.	☐	☐	☐	☐	☐

Recursos de agua de Lower Fall Creek

Degradación del agua

A continuación encontrará una lista con los contaminantes del agua que por lo general están presentes en masas de agua. Los contaminantes y las condiciones se tornan problemáticos si se encuentran en cantidades excesivas. De acuerdo con su opinión, *¿en qué medida los siguientes contaminantes constituyen un problema en su área?*

	No es un problema	Problema leve	Problema moderado	Problema grave	No sé
1. Sedimentos	☐	☐	☐	☐	☐
2. Nitratos/nitrógeno	☐	☐	☐	☐	☐
3. Fosfatos/fósforo	☐	☐	☐	☐	☐
4. *E.coli*	☐	☐	☐	☐	☐
5. Basura y escombros	☐	☐	☐	☐	☐
6. Sales (es decir, sales del suelo)	☐	☐	☐	☐	☐
7. Líquidos vehiculares (por ejemplo: éter metil tert-butílico, aceite y grasa, anticongelantes)	☐	☐	☐	☐	☐
8. Algas verdeazuladas	☐	☐	☐	☐	☐
9. Plantas acuáticas exóticas o invasivas	☐	☐	☐	☐	☐
10. Alteración de caudal	☐	☐	☐	☐	☐
11. Alteración del hábitat	☐	☐	☐	☐	☐

Fuentes de contaminación del agua

Los puntos enumerados a continuación son fuentes de contaminación de la calidad del agua en todo el país. De acuerdo con su opinión, *¿en qué medida las siguientes fuentes constituyen un problema en su área?*

	No es un problema	Problema leve	Problema moderado	Problema grave	No sé
1. Erosión del suelo por los sitios de construcción	☐	☐	☐	☐	☐
2. Uso excesivo de fertilizantes o pesticidas para césped (desde campos de golf, campos de deportes, hogares)	☐	☐	☐	☐	☐
3. Eliminación incorrecta de aceites o anticongelantes para motor usados	☐	☐	☐	☐	☐
4. Aguas residuales de rebosaderos de cloacas combinados o tanques sépticos defectuosos	☐	☐	☐	☐	☐
5. Escorrentía pluvial (por ejemplo: techos, entrada de autos, calles)	☐	☐	☐	☐	☐
6. Excrementos de animales salvajes y mascotas	☐	☐	☐	☐	☐
7. Arrojar basura/vertederos de basura ilegales	☐	☐	☐	☐	☐
8. Modificación/desestabilización de la ribera o costa	☐	☐	☐	☐	☐
9. Conversión de tierras forestales y humedales para uso urbano	☐	☐	☐	☐	☐
10. Medicamentos desechados	☐	☐	☐	☐	☐

La deficiente calidad del agua puede traer aparejadas múltiples consecuencias para las comunidades. De acuerdo con su opinión, *¿en qué medida las siguientes cuestiones constituyen un problema en su área?*

	No es un problema	Problema leve	Problema moderado	Problema grave	No sé
1. Peces contaminados (lo cual ocasiona notificaciones de consumo de pescado)	☐	☐	☐	☐	☐
2. Costos elevados de tratamiento de agua potable	☐	☐	☐	☐	☐
3. Belleza reducida de lagos y arroyos	☐	☐	☐	☐	☐
4. Menos posibilidades de recreación acuática (por ejemplo: natación y paseos en bote)	☐	☐	☐	☐	☐
5. Mortandad de peces	☐	☐	☐	☐	☐
6. Valor de propiedad reducido	☐	☐	☐	☐	☐
7. Disminución en las poblaciones de peces y flora y fauna debido a la exposición a mímicos hormonales (a causa de medicamentos desechados incorrectamente)	☐	☐	☐	☐	☐

Prácticas para mejorar la calidad del agua

Cada serie de 4 preguntas en estas páginas hace referencia a prácticas específicas que pueden abordar las cuestiones relacionadas con la calidad del agua. Por favor siga las instrucciones en cada casilla sombreada y responda las preguntas correspondientes..

Control de la erosión

Controlar la erosión a lo largo de las riberas y costas con vegetación y otras prácticas.

1. **¿Usa actualmente o usó alguna vez controles de erosión?**
   - ☐ Actualmente en práctica (dirigirse diréctamente a la tabla siguiente)
   - ☐ No está en práctica actualmente (ir a 3)
   - ☐ Nunca se puso en práctica (ir a 2)

2. **¿Qué sabe acerca de los controles de erosión?**
   - ☐ Nunca escuché hablar sobre esto
   - ☐ Estoy algo familiarizado
   - ☐ Sé como usarla, pero no la usamos

3. **¿Está dispuesto a poner en práctica los controles de erosión?**
   - ☐ Sí
   - ☐ Quizás
   - ☐ No

4. **En una escala de 1 a 5, ¿cuál de los siguientes factores le impediría implementar los controles de erosión?**

No es un problema ⟷ Problema serio

	1	2	3	4	5
Falta de conocimiento	☐	☐	☐	☐	☐
Falta de equipo	☐	☐	☐	☐	☐
No se ajusta a las prácticas actuales	☐	☐	☐	☐	☐
Se requiere demasiado tiempo	☐	☐	☐	☐	☐
Mis opiniones sobre cuidado de la yarda	☐	☐	☐	☐	☐
Experiencia personal previa	☐	☐	☐	☐	☐
No se aplica a mi hogar	☐	☐	☐	☐	☐

Seguir las pautas del fabricante

Seguir las instrucciones de uso de pesticidas para césped y jardines.

1. **¿Sigue actualmente las pautas del fabricante o las siguió alguna vez?**
   - ☐ Actualmente en práctica (dirigirse diréctamente a la tabla siguiente)
   - ☐ No está en práctica actualmente (ir a 3)
   - ☐ Nunca se puso en práctica (ir a 2)

2. **¿Qué sabe acerca de seguir las pautas del fabricante?**
   - ☐ Nunca escuché hablar sobre esto
   - ☐ Estoy algo familiarizado
   - ☐ Sé como usarla, pero no la usamos

3. **¿Está dispuesto a intentar seguir las pautas del fabricante?**
   - ☐ Sí
   - ☐ Quizás
   - ☐ No

4. **En una escala de 1 a 5, ¿cuál de los siguientes factores le impediría seguir las pautas del fabricante?**

No es un problema ⟷ Problema serio

	1	2	3	4	5
Falta de conocimiento	☐	☐	☐	☐	☐
Falta de equipo	☐	☐	☐	☐	☐
No se ajusta a las prácticas actuales	☐	☐	☐	☐	☐
Se requiere demasiado tiempo	☐	☐	☐	☐	☐
Mis opiniones sobre cuidado de la yarda	☐	☐	☐	☐	☐
Experiencia personal previa	☐	☐	☐	☐	☐
No se aplica a mi hogar	☐	☐	☐	☐	☐

Fertilizantes con bajo contenido fosfórico

Utilizar fertilizantes con bajo contenido de fósforo para césped y jardines

1. **¿Usa actualmente fertilizantes con bajo contenido fosfórico o los utilizó alguna vez?**
   - ☐ Actualmente en práctica (dirigirse diréctamente a la tabla siguiente)
   - ☐ No está en práctica actualmente (ir a 3)
   - ☐ Nunca se puso en práctica (ir a 2)

2. **¿Qué sabe acerca de los fertilizantes con bajo contenido fosfórico?**
   - ☐ Nunca escuché hablar sobre esto
   - ☐ Estoy algo familiarizado
   - ☐ Sé como usarla, pero no la usamos

3. **¿Está dispuesto a probar los fertilizantes de bajo contenido fosfórico?**
   - ☐ Sí
   - ☐ Quizás
   - ☐ No

4. **En una escala de 1 a 5, ¿cuál de los siguientes factores le impediría utilizar fertilizantes con bajo contenido fosfórico?**

No es un problema ⟷ Problema serio

	1	2	3	4	5
Falta de conocimiento	☐	☐	☐	☐	☐
Falta de equipo	☐	☐	☐	☐	☐
No se ajusta a las prácticas actuales	☐	☐	☐	☐	☐
Se requiere demasiado tiempo	☐	☐	☐	☐	☐
Mis opiniones sobre cuidado de la yarda	☐	☐	☐	☐	☐
Experiencia personal previa	☐	☐	☐	☐	☐
No se aplica a mi hogar	☐	☐	☐	☐	☐

Barriles para agua de lluvia y jardines de lluvia

Los barriles para agua de lluvia son recipientes de almacenamiento sobre nivel que capturan el agua de lluvia proveniente de bocas de descarga. Un jardín de lluvia es un jardín diseñado para absorber y filtrar el agua pluvial. Por lo general se diseñan para recolectar el agua pluvial de una vivienda.

1. **¿Usa actualmente barriles para agua de lluvia o jardines de lluvia o los usó alguna vez?**
   - ☐ Actualmente en práctica (dirigirse diréctamente a la tabla siguiente)
   - ☐ No está en práctica actualmente (ir a 3)
   - ☐ Nunca se puso en práctica (ir a 2)

2. **¿Qué sabe acerca de los barriles para agua de lluvia o jardines de lluvia?**
   - ☐ Nunca escuché hablar sobre esto
   - ☐ Estoy algo familiarizado
   - ☐ Sé como usarla, pero no la usamos

3. **¿Está dispuesto a probar los barriles para agua de lluvia o jardines de lluvia?**
   - ☐ Sí
   - ☐ Quizás
   - ☐ No

4. **En una escala de 1 a 5, ¿cuál de los siguientes factores le impediría utilizar barriles para agua de lluvia y jardines de lluvia**

No es un problema ⟷ Problema serio

	1	2	3	4	5
Falta de conocimiento	☐	☐	☐	☐	☐
Falta de equipo	☐	☐	☐	☐	☐
No se ajusta a las prácticas actuales	☐	☐	☐	☐	☐
Se requiere demasiado tiempo	☐	☐	☐	☐	☐
Mis opiniones sobre cuidado de la yarda	☐	☐	☐	☐	☐
Experiencia personal previa	☐	☐	☐	☐	☐
No se aplica a mi hogar	☐	☐	☐	☐	☐

Prácticas para mejorar la calidad del agua

Recursos de agua de Lower Fall Creek

Toma de decisiones para mi Propiedad

Por favor indique la afirmación que *describe con mayor precisión su nivel de experiencia con cada práctica*.

	Nunca escuché hablar sobre esto	Estoy algo familiarizado	Sé cómo usarla, pero no la usamos	La usamos en la actualidad
1. Restablecer las comunidades de plantas autóctonas y plantar árboles	☐	☐	☐	☐
2. Mantener los recortes de pasto y basura lejos de sumideros pluviales, caminos, cunetas y alcantarillas	☐	☐	☐	☐
3. Desechar correctamente los residuos del hogar (tales como pilas, medicamentos, productos de limpieza)	☐	☐	☐	☐
4. No tirar productos químicos en los sumideros	☐	☐	☐	☐
5. Desconectar los bajantes (tuberías de desagüe) del acceso directo a sumideros pluviales	☐	☐	☐	☐
6. Informar supuestas infracciones a las normas de calidad del agua (por ejemplo: comunicarse con asociaciones vecinales, llamar a TIP-line (línea de sugerencias)	☐	☐	☐	☐
7. Participar en educación ambiental con los grupos vecinales	☐	☐	☐	☐

Cuando toma decisiones acerca de cambiar las prácticas correspondientes al cuidado del césped o aguas pluviales, *¿qué importancia tienen cada uno de los siguientes puntos?*

	No son importantes	Poco importantes	Indefinido	Importantes	Muy importantes
1. Gastos menores personales	☐	☐	☐	☐	☐
2. Mis propias habilidades físicas	☐	☐	☐	☐	☐
3. Falta de información disponible sobre las prácticas	☐	☐	☐	☐	☐
4. Ninguno de mis conocidos implementa la práctica	☐	☐	☐	☐	☐
5. Aprobación de mis vecinos	☐	☐	☐	☐	☐
6. Convenios restrictivos en mi subdivisión	☐	☐	☐	☐	☐
7. No sé donde conseguir información o ayuda acerca de las prácticas	☐	☐	☐	☐	☐
8. Daño ambiental por causa de la práctica	☐	☐	☐	☐	☐
9. Beneficio ambiental por causa de la práctica	☐	☐	☐	☐	☐
10. Preocupación acerca del valor de reventa	☐	☐	☐	☐	☐
11. No soy propietario de la vivienda	☐	☐	☐	☐	☐

Fuentes de información

Las personas obtienen información sobre la calidad del agua de una cantidad de fuentes diferentes. *¿En qué medida confía en las organizaciones enumeradas a continuación como fuente de información sobre la calidad del agua?*

	Nada	Muy poco	En forma moderada	Mucho	No estoy al tanto
1. Lower Fall Creek Watershed Alliance	☐	☐	☐	☐	☐
2. Distrito de preservación del agua y de los suelos (SWCD)	☐	☐	☐	☐	☐
3. Servicio de preservación de los recursos naturales (NRCS)	☐	☐	☐	☐	☐
4. Departamento de recursos naturales de Indiana (IDNR)	☐	☐	☐	☐	☐
5. Departamento de administración de protección ambiental de Indiana (IDEM)	☐	☐	☐	☐	☐
6. Grupos de acción ciudadana	☐	☐	☐	☐	☐
7. Terratenientes/amigos locales	☐	☐	☐	☐	☐
8. Universidades	☐	☐	☐	☐	☐
9. Grupos de servicio a la comunidad	☐	☐	☐	☐	☐
10. Jardinería y clubes recreativos	☐	☐	☐	☐	☐
11. Fideicomiso de propiedades (por ejemplo: TNC, CILTI)	☐	☐	☐	☐	☐
12. Gobierno local	☐	☐	☐	☐	☐
13. Empresas de desarrollo comunitario (CDC)	☐	☐	☐	☐	☐
14. Asociaciones vecinales	☐	☐	☐	☐	☐
15. Organizaciones religiosas	☐	☐	☐	☐	☐
16. Organizaciones juveniles	☐	☐	☐	☐	☐
17. Emisoras de televisión de alcance local	☐	☐	☐	☐	☐

1. **¿Usted sabe cómo contactarse con un representante del gobierno local?**
   - ☐ Sí
   - ☐ No

2. **¿Cuántas veces en el último año ha llamado a un representante del gobierno local?**
   - ☐ Nunca
   - ☐ Una vez
   - ☐ 2 a 5 veces
   - ☐ Más de 5 veces

3. **¿Usted sabe cómo funciona la urbanización?**
   - ☐ Sí
   - ☐ No

4. **¿Cuántas veces en el último año ha asistido a una reunión del gobierno local?**
   - ☐ Nunca
   - ☐ Una vez
   - ☐ 2 a 5 veces
   - ☐ Más de 5 veces

Recursos de agua de Lower Fall Creek

Acerca de usted

1. **¿Vive cerca de un lago o arroyo?**
   - ☐ Propiedad en la zona ribereña
   - ☐ A ¼ de milla
   - ☐ A ½ milla
   - ☐ A 1 milla
   - ☐ Más lejos

2. **¿Participa en alguna de las siguientes actividades de recreación acuáticas en esta área? (marque las que correspondan)**
   - ☐ Paseos en bote
   - ☐ Natación
   - ☐ Pesca
   - ☐ Ninguna

3. **¿Usted vive en un lugar afectado negativamente por la calidad de agua deficiente?**
   - ☐ Sí
   - ☐ No

4. **¿La calidad del agua deficiente afecta sus actividades?**
   - ☐ Sí
   - ☐ No

5. **¿La calidad del agua deficiente afecta el valor de su propiedad?**
   - ☐ Sí
   - ☐ No

6. **¿Cuál de los siguientes puntos realiza en forma regular? (marque las que correspondan)**
   - ☐ Conduce un vehículo híbrido
   - ☐ Recicla
   - ☐ Viaja en transporte público
   - ☐ Va caminando o en bicicleta al trabajo/escuela
   - ☐ Utiliza bombillas fluorescentes compactas
   - ☐ Otra (especificar)________________

7. **¿Usted toma las decisiones de cuidado del hogar y césped en su núcleo familiar?**
   - ☐ Sí
   - ☐ No

8. **¿Cuál es su sexo?**
   - ☐ Masculino
   - ☐ Femenino

9. **¿En qué año nació?** __________

10. **¿Cuál es el grado de estudio superior que completó?**
    - ☐ Algún grado de escuela secundaria
    - ☐ Título de escuela secundaria (GED)
    - ☐ Universitario
    - ☐ Título universitario de dos años
    - ☐ Título universitario de 4 años
    - ☐ Título de postgrado

11. **¿Cuál es el tamaño aproximado de su lote de vivienda (residencial)?**
    - ☐ ¼ de acre o menos
    - ☐ Más de ¼ de acre pero menos de 1 acre
    - ☐ 1 acre a menos de 5 acres
    - ☐ 5 acres o más

12. **¿Es propietario o inquilino?**
    - ☐ Propietario
    - ☐ Inquilino

13. **¿Por cuánto tiempo ha vivido en su residencia actual?** ______________ **años**

14. **¿Cuál es su fuente de agua potable?**
    - ☐ Pozo individual
    - ☐ Pozo municipal
    - ☐ Fall Creek
    - ☐ Eagle Creek

15. **¿Cuál es su código postal?** ____________

16. **Además de su residencia, ¿cuál de las siguientes administra o de cuál es propietario? (marque las que correspondan)**
    - ☐ Una operación agrícola
    - ☐ Tierra forestada
    - ☐ Propiedad rural recreativa
    - ☐ Ninguna

17. **¿Utiliza un servicio profesional de cuidado de césped?**
    - ☐ Sí, sólo para cortar el césped
    - ☐ Sí, para cortar el césped y fertilizar
    - ☐ Sí, sólo para la fertilización y control de pestes
    - ☐ Sí, para cortar el césped, fertilizar y controlar pestes
    - ☐ No

18. **En los últimos tres años, ¿ha escuchado hablar sobre cuestiones de calidad del agua en alguno de los siguientes? (marque las que correspondan)**
    - ☐ Boletines/folletos/hojas de datos
    - ☐ Internet
    - ☐ Talleres/demostraciones/reuniones
    - ☐ Radio – Nombre de la emisora: _______
    - ☐ Periódicos – Nombre de la publicación: ______________
    - ☐ Televisión – Nombre de la emisora: ______________
    - ☐ Boleta del agua – Nombre del proveedor: ______________
    - ☐ Avisos en negocios locales
    - ☐ Avisos publicados en el tablón de anuncios de la comunidad
    - ☐ Carteleras
    - ☐ Conversaciones con otras personas
    - ☐ Otro (especificar) ______________
    - ☐ Ninguno

19. **¿Cuál es su origen étnico?**
    - ☐ Afroamericano
    - ☐ Indígena de Estados Unidos
    - ☐ Isleño asiático/asiático americano/del Pacífico
    - ☐ Hispano/Latino
    - ☐ Blanco/Caucásico
    - ☐ Mestizo
    - ☐ Otro

20. **¿Cuál es su ocupación? (por favor, sea lo más específico posible)**

    ____

    ____

Acerca de usted

Recursos de agua de Lower Fall Creek

Gracias

¡*Gracias* por su tiempo y colaboración!

Por favor envíe el cuestionario completo en el sobre con franqueo prepago provisto. Utilice el espacio a continuación para comentarios adicionales sobre esta encuesta o recursos del agua en su comunidad.

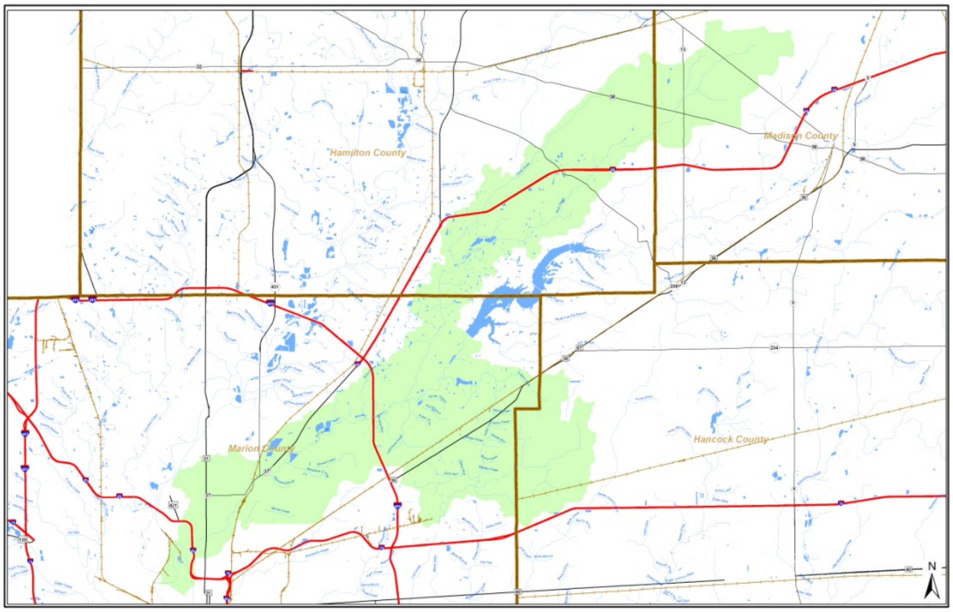
Para más información sobre Lower Fall Creek Watershed Alliance, visite www.lowerfallcreek.org o comuníquese con Ron Lauster al (317) 786-1776.

Para más información acerca de esta encuesta, comuníquese con Linda Prokopy al (765) 496-2221.

Los resultados de la encuesta estarán disponibles en febrero de 2009, en www.lowerfallcreek.org.

Printed on 30% post-consumer content paper

Results: Your Views on Lower Fall Creek Water Resources



The purpose of this study was to collect social indicators data from residents of the Lower Fall Creek watershed to inform the Project's planning and implementation activities. The results of this survey also provide baseline social indicator information that may be used for comparison with a follow up survey in order to examine changes that occurred in the watershed over the project's lifetime.

The questions in the survey were developed by a regional team of researchers for utilization in nonpoint source pollution (NPS) projects. More information about this regional project can be found at: http://www.uwex.edu/ces/regionalwaterquality/flagships/indicators.htm Social indicators data collected include awareness of water quality issues, sources, and practices for improvement; general water quality attitudes and attitudes toward implementation of practices; and behavior. In Fall of 2008, a survey was mailed to residents of Marion County using a stratified sampling approach in which census tracts with high percentages of African Americans and Latinos were oversampled to ensure their representation in the final dataset. The survey covered the social indicators developed for use in 319 funded watershed projects. The survey was mailed to over 1000 residents but only 692 addresses were valid (i.e. mailings were not returned as undeliverable). Only 187 people completed the survey leading to a very low response rate of only 27%. A follow-up focus group was held to get a better sense of residents' awareness, attitudes, and practices related to water quality in the watershed.

In the survey results, you will find that the number of people answering each question is different. This is a result of all respondents not answering every question. The total in each table is the total number of people answering that question. The numbers in the columns represent the percentage of respondents who chose that response. The results have not been weighted.

This report was prepared for the Lower Fall Creek Watershed Project by:

Natural Resource Social Science Lab
Department of Forestry and Natural Resources
Purdue University
(765) 496-2221

Your Watershed:

Overall, *how would you rate the quality of water* in your area?

	Poor (1)	Okay (2)	Good (3)	Don't Know	Mean (n)
1. For canoeing/kayaking/boating	13.3	26.5	10.8	49.4	1.95 (166)
2. For eating fish caught in the water	45.5	12.6	4.2	37.7	1.34 (167)
3. For swimming	50.6	13.3	5.4	30.7	1.35 (166)
4. For picnicking/family activities	17.6	46.1	16.4	20.0	1.98 (165)
5. For fish habitat	26.5	25.3	12.7	35.5	1.79 (166)
6. For scenic beauty	13.1	47.6	31.0	8.3	2.19 (168)

Do you live in a watershed? n=175
31.4% -Yes
20.6% -No
48.0% -Don't know

Do you know where the water goes when it runs off your property? n=166
56.0% - No, I don't know
44.0 % - Yes, it goes to: (see appendix A)

Your Opinions:

Please indicate your level of agreement or disagreement with the statements below.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean (n)
1. The economic stability of my community depends upon good water quality.	1.7	6.7	17.4	47.8	26.4	3.90 (178)
2. The way that I care for my lawn and yard can influence water qulity in local streams and lakes.	2.2	7.8	13.9	50.6	25.6	3.89 (180)
3. It is my personal responsibility to help protect water quality.	2.2	3.4	12.4	53.9	28.1	4.02 (178)
4. It is important to protect water quality even if it slows economic development.	1.7	4.5	18.4	52.5	22.9	3.91 (179)
5. What I do on my land doesn't make much difference in overall water quality.	25.8	44.4	15.2	12.4	2.2	2.21 (178)
6. Lawn and yard-care practices (on individual lots) do not have an impact on local water quality.	29.2	44.9	16.3	8.4	1.1	2.07 (178

7. My actions have an impact on water quality.	2.2	3.3	16.7	56.1	21.7	3.92 (180)
8. Taking action to improve water quality is too expensive for me.	8.5	31.1	44.6	13.6	2.3	2.70 (177)
9. It is okay to reduce water quality to promote economic development.	39.8	38.6	14.8	5.1	1.7	1.90 (176)
10. It is important to protect water quality even if it costs me more.	3.4	8.4	28.7	48.9	10.7	3.55 (178)
11. I would be willing to pay more to improve water quality (for example: through local taxes or fees).	7.3	13.5	31.5	41.6	6.2	3.26 (178)
12. I would be willing to change the way I care for my lawn and yard to improve water quality.	1.1	5.0	19.4	57.8	16.7	3.84 (180)
13. The quality of life in my community depends on good water quality in local streams, rivers and lakes.	1.7	7.3	15.2	53.4	22.5	3.88 (178)
14. Developers in my community follow current regulations.	2.8	10.2	68.2	14.8	4.0	3.07 (176)
15. Construction in my community should use practices that minimize soil erosion.	1.1	2.8	12.8	53.6	29.6	4.08 (179)
16. I would choose to purchase a home in a neighborhood that uses water quality conservation measures.	0.6	1.1	27.7	49.2	21.5	3.90 (177)

Water Impairments:

Below is a list of water pollutants that are generally present in water bodies to some extent. The pollutants and conditions become a problem when present in excessive amounts. In your opinion, *how much of a problem are the following pollutants in your area*?

	Not a Problem	Slight Problem	Moderate Problem	Severe Problem	Don't Know	Mean (n)
1. Sediments	12.2	5.2	18.0	9.3	55.2	2.55 (172)
2. Nitrates/nitrogen	9.2	5.8	12.7	5.8	66.5	2.45 (173)
3. Phosphate/phosphorus	7.1	3.5	13.5	7.1	68.8	2.66 (170)
4. *E.coli*	12.9	6.4	8.2	9.9	62.6	2.41 (171)
5. Trash and debris	8.6	18.4	22.4	23.0	27.6	2.83 (174)
6. Salt (i.e. road salt)	8.8	10.5	21.1	8.8	50.9	2.61 (171)
7. Automotive fluids (e.g. MTBE, oil & grease, antifreeze)	12.6	9.8	13.2	12.6	51.7	2.54 (174)
8. Blue-green algae	9.7	5.7	20.6	12.6	51.4	2.74 (175)

9. Exotic or invasive aquatic plants	14.9	8.6	11.5	5.2	59.8	2.17 (174)
10. Flow alteration (e.g. large discharges from Geist Reservoir)	14.9	7.5	7.5	2.9	67.2	1.95 (174)
11. Habitat alteration (e.g. land use change)	12.1	9.2	12.1	11.5	55.2	2.51 (174)

Sources of Pollutants:

The items listed below are sources of water quality pollution across the country. In your opinion, *how much of a problem are the following sources in your area*?

	Not a Problem	Slight Problem	Moderate Problem	Severe Problem	Don't Know	Mean (n)
1. Soil erosion from construction sites	16.9	16.3	21.5	7.6	37.8	2.32 (172)
2. Excessive use of lawn fertilizers and/or pesticides (from golf courses, sports fields, homes)	14.0	17.4	20.9	17.4	30.2	2.60 (172)
3. Improper disposal of used motor oil and/or antifreeze	11.0	18.0	15.1	11.0	44.8	2.47 (172)
4. Sewage from combined sewer overflows or failing septic tanks	15.3	10.8	15.3	23.3	35.2	2.72 (176)
5. Stormwater runoff (e.g. roofs, driveways, streets)	13.3	22.5	26.0	15.6	22.5	2.57 (173)
6. Droppings from wildlife and pets	18.9	26.3	13.7	8.0	33.1	2.16 (175)
7. Littering/illegal dumping of trash	12.8	23.8	22.1	21.5	19.8	2.65 (172)
8. Streambank or shoreline modification/destabilization	16.0	9.1	15.4	7.4	52.0	2.30 (175)
9. Conversion of forest land and wetlands to urban use	14.9	10.3	18.3	20.0	36.6	2.68 (175)
10. Discarded medications	13.9	13.9	12.1	11.0	49.1	2.40 (173)

Consequences of Poor Water Quality:

Poor water quality can lead to a variety of consequences for communities. In your opinion, *how much of a problem are the following issues in your area*?

	Not a Problem	Slight Problem	Moderate Problem	Severe Problem	Don't Know	Mean (n)
1. Contaminated fish resulting in Fish Consumption Advisories	13.4	12.2	17.4	12.8	44.2	2.53 (172)
2. High drinking water treatment costs	9.2	13.3	20.2	19.1	38.2	2.79 (173)
3. Reduced beauty of lakes or streams	14.6	20.5	21.1	18.7	25.1	2.59 (171)

4. Reduced opportunities for water recreation (e.g. swimming and boating)	12.8	13.4	22.1	22.1	29.7	2.76 (172)
5. Fish kills	12.8	14.5	21.5	18.0	33.1	2.67 (172)
6. Decreased property value	16.5	12.4	14.7	15.9	40.6	2.50 (170)
7. Decrease in fish and wildlife populations due to exposure to hormone-mimics (from improperly disposed of medications)	12.8	7.6	13.4	11.6	54.7	2.53 (172)

Practices to Improve Water Quality:

Controlling erosion: Controlling erosion along streambanks and shorelines with vegetation and other practices.

1. Do you use or have you ever used erosion controls? n=174
10.3% -Currently use (go directly to table below)
10.3% -Don't currently use (go to question 3)
79.3% -Never used (go to question 2)

2. How familiar are you with erosion controls? n=154
39.6% -Never heard of it
52.6% -Somewhat familiar with
7.8% -Know how to use it; not using

3. Are you willing to try erosion controls? n=157
29.9% -Yes
52.9% -Maybe
17.2% -No

4. On a scale of 1-5, which of the following factors would prevent you from using erosion controls?

Not a problem ----------------------------Major problem

	1	2	3	4	5	Mean (n)
Lack of skills	24.8	9.0	30.3	19.3	16.6	2.94 (145)
Lack of equipment	16.4	5.5	24.0	26.0	28.1	3.44 (146)
Doesn't fit with current practices	31.9	8.5	31.9	17.0	10.6	2.66 (141)
Too much time required	25.7	13.9	35.4	14.6	10.4	2.70 (144)
My views about home management	36.4	16.4	30.0	10.7	6.4	2.34 (140)

Prior personal experience	34.0	16.3	26.2	13.5	9.9	2.49 (141)
Does not apply to my home	39.0	10.4	29.3	9.8	11.6	2.45 (164)

Follow manufacturer guidelines: Following pesticide application instructions for lawn and garden.

1. Do you now or have you ever followed manufacturer guidelines? n=163

40.5% -Currently use (go directly to table below)
30.7% -Don't currently use (go to question 3)
28.8% -Never used (go to question 2)

2. How familiar are you with following manufacturer guidelines? n=94
29.8% -Never heard of it
41.5% -Somewhat familiar with
28.7% -Know how to use it; not using

3. Are you willing to try following manufacturer guidelines? n=111
51.4% -Yes
36.9% -Maybe
11.7% -No

4. On a scale of 1-5, which of the following factors would prevent you from using pesticides?

Not a problem ---Major problem

	1	2	3	4	5	Mean (n)
Lack of skills	40.0	15.6	20.7	8.1	15.6	2.44 (135)
Lack of equipment	31.7	16.5	23.0	12.9	15.8	2.65 (139)
Doesn't fit with current practices	36.8	12.0	28.6	7.5	15.0	2.52 (133)
Too much time required	38.6	18.9	27.3	7.6	7.6	2.27 (132)
My views about home management	39.1	17.4	23.9	7.2	12.3	2.36 (138)
Prior personal experience	43.5	13.0	28.2	5.3	9.9	2.25 (131)
Does not apply to my home	46.1	11.3	28.4	4.3	9.9	2.21 (141)

Low-phosphate fertilizers: **Using low-phosphate fertilizers for lawn and garden.**

1. Do you use or have you ever used low-phosphate fertilizers? n=173
16.2% -Currently use (go directly to table below)
28.3% -Don't currently use (go to question 3)
55.5% -Never used (go to question 2)

2. How familiar are you with low-phosphate fertilizers? n=131
51.1% -Never heard of it
34.4% -Somewhat familiar with
14.5% -Know how to use it; not using

3. Are you willing to try low-phosphate fertilizers? n=146
25.3% -Yes
54.1% -Maybe
20.5% -No

4. On a scale of 1-5, which of the following factors would prevent you from using low-phosphate fertilizers?

Not a problem --Major problem

	1	2	3	4	5	Mean (n)
Lack of skills	39.4	8.0	26.3	6.6	19.7	2.59 (137)
Lack of equipment	32.6	10.6	25.5	12.8	18.4	2.74 (141)
Doesn't fit with current practices	37.3	9.7	34.3	7.5	11.2	2.46 (134)
Too much time required	37.3	12.7	33.6	6.7	9.7	2.39 (134)
My views about home management	38.1	14.4	28.8	7.9	10.8	2.39 (139)
Prior personal experience	43.6	9.8	30.1	6.0	10.5	2.30 (133)
Does not apply to my home	47.9	7.0	26.8	6.3	12.0	2.27 (142)

Rain barrels and rain gardens: Rain barrels are above ground water storage vessels that capture rain. Rain gardens are designed to absorb and filter stormwater. They are usually designed to collect stormwater from a house.

1. Do you use or have you ever used rain barrels or rain gardens? n=178
6.2% -Currently use (go directly to table below)
15.2% -Don't currently use (go to question 3)
78.7% -Never used (go to question 2)

2. How familiar are you with rain barrels or rain gardens? n=157
33.1% -Never heard of it
44.6% -Somewhat familiar with
22.3% -Know how to use it; not using

3. Are you willing to try rain barrels or rain gardens? n=164
32.3% -Yes
46.3% -Maybe
21.3% -No

4. On a scale of 1-5, which of the following factors would prevent you from using rain barrels or rain gardens?

Not a problem --Major problem

	1	2	3	4	5	Mean (n)
Lack of skills	36.6	13.1	21.4	10.3	18.6	2.61 (145)
Lack of equipment	22.3	8.8	25.7	14.2	29.1	3.19 (148)
Doesn't fit with current practices	37.9	6.9	29.7	12.4	13.1	2.56 (145)
Too much time required	35.9	13.1	31.7	6.2	13.1	2.48 (145)
My views about home management	40.8	16.2	28.9	6.3	7.7	2.24 (142)
Prior personal experience	39.9	14.7	23.8	6.3	15.4	2.43 (143)
Does not apply to my home	45.0	11.9	25.2	5.3	12.6	2.28 (151)

Making Decisions for My Property:

Please indicate which statement *most accurately describes your level of experience with each practice*.

	Never heard of it	Somewhat familiar with it	Know how to use; not using	Currently use it	Mean (n)
1. Restoring native plant communities and planting trees	20.2	50.3	16.8	12.7	2.22 (173)
2. Keeping grass clippings and leaves out of the roads, ditches and gutters	7.0	33.1	5.8	54.1	3.07 (172)
3. Properly disposing of household wastes (such as batteries, medicines, cleaners)	6.4	23.4	10.5	59.6	3.23 (171)
4. Not putting chemicals down sewers	4.1	18.6	12.2	65.1	3.38 (172)
5. Disconnecting downspouts from direct access to storm drains	24.7	25.9	10.0	39.4	2.64 (170)
6. Reporting suspected violations of water quality regulations (e.g. contact neighborhood association, call TIP-line)	45.6	31.2	13.5	8.8	1.85 (170)
7. Participating in environmental education outreach with neighborhood groups	47.4	33.5	13.9	5.2	1.77 (173)

When you make decisions about changing your lawn care and/or stormwater practices, *how important is each of the following*?

	Not at all important	Somewhat important	Undecided	Important	Very important	Mean (n)
1. Personal out-of-pocket expense	1.1	14.4	16.7	31.6	36.2	3.87 (174)
2. My own physical abilities	7.5	13.8	13.2	37.4	28.2	3.65 (174)
3. Lack of available information about a practice	3.0	14.5	22.4	41.8	18.2	3.58 (165)
4. No one else I know is implementing the practice	31.5	11.3	31.5	13.1	12.5	2.64 (168)
5. Approval of my neighbors	38.0	14.0	25.7	13.5	8.8	2.41 (171)
6. Restrictive covenants in my subdivision	35.7	8.9	30.4	12.5	12.5	2.57 (168)
7. Don't know where to get information and/or assistance about the practice	8.8	15.2	22.2	32.7	21.1	3.42 (171)

8. Environmental damage caused by practice	2.9	7.6	22.4	38.8	28.2	3.82 (170)
9. Environmental benefit of practice	2.4	3.6	20.2	39.9	33.9	3.99 (168)
10. Concerns about resale value	7.1	10.6	18.8	34.1	29.4	3.68 (170)
11. I do not own my own property	45.3	4.7	14.0	18.7	17.3	2.58 (150)

Information Sources

People get information about water quality from a number of different sources. To what extent *do you trust the organizations list below as a source of information about water quality*?

	Not at all	Slightly	Moderately	Very much	Am not familiar	Mean (n)
1. Lower Fall Creek Watershed Alliance	5.2	5.7	20.1	10.9	58.0	2.88 (174)
2. Soil and Water Conservation District (SWCD)	3.5	5.3	20.5	15.2	55.6	3.07 (171)
3. Natural Resources Conservation Service (NRCS)	3.0	7.8	22.8	13.8	52.7	3.00 (167)
4. Indiana Department of Natural Resources (IDNR)	1.8	8.8	36.3	25.7	27.5	3.19 (171)
5. Indiana Department of Environmental Management (IDEM)	2.9	8.2	29.8	25.1	33.9	3.17 (171)
6. Citizen action groups	5.9	15.3	28.2	12.9	37.6	2.77 (170)
7. Local landowners/friends	4.1	27.6	27.1	9.4	31.8	2.61 (170)
8. Universities	5.3	14.1	28.2	25.3	27.1	3.01 (170)
9. Community service groups	7.1	16.5	31.2	8.8	36.5	2.66 (170)
10. Gardening and recreational clubs	7.7	18.9	23.7	10.7	39.1	2.61 (169)
11. Land Trusts (e.g. TNC, CILTI)	8.9	10.1	16.0	7.7	54.7	2.53 (169)
12. Local government	11.8	23.5	31.2	10.0	23.5	2.52 (170)
13. Community Development Corporations (CDCs)	12.4	15.9	17.1	5.9	48.8	2.32 (170)
14. Neighborhood associations	9.8	20.8	25.4	16.2	27.7	2.66 (173)
15. Religious organizations	23.5	16.5	22.9	7.1	30.0	2.19 (170)

16. Youth organizations	22.8	13.5	22.8	7.0	33.9	2.21 (171)
17. Local access television stations	8.8	25.1	33.3	9.9	22.8	2.58 (171)

1. Do you know how to contact a local government representative? n=179
64.2% -Yes
35.8% -No

2. How many times in the last year have you called a local government representative?
n=179
70.9% -Never
14.0% -Once
12.3% -2 – 5 times
2.8% -More than 5 times

3. Do you know how zoning works? n=176
41.5%-Yes
58.5% -No

4. How many times in the last year have you attended a local government meeting? n=178
80.3% -Never
12.4% -Once
5.6% -2 – 5 times
1.7% -More than 5 times

About You:

1. Do you live in close proximity to a lake or stream? n=174
4.6% -Waterfront property
13.2% -Within ¼ mile
12.1% -Within ½ mile
27.0% -Within a mile
43.1% -Further

2. Do you participate in any of the following water-based recreation activities in this area? (check all that apply) n=185
11.4% -Boating
9.2% -Swimming
14.1% -Fishing
73.5% -None of the above

3. Do you live in a place adversely affected by poor water quality? n=168
30.4% -Yes
69.6% -No

4. Does poor water quality impact your activities? n=172
33.7% -Yes
66.3% -No

5. Does poor water quality impact your property values?
32.9% -Yes
67.1% -No

6. Which of the following do you do on a regular basis? (check all that apply) n=185
3.2% -Drive a hybrid vehicle
51.9% -Recycle
5.9% -Take public transportation
11.4% -Walk/bike to work/school
60.5% -Use compact fluorescent light bulbs
8.6% -Other (specify: see appendix B)

7. Do you make the home and lawn care decisions in your household? n=173
9.2% -No
90.8% -Yes

8. What is your gender? n=175
49.7% -Male
50.3% -Female

9. In what year were you born? n=161
range = 1918-1987 mean=1950.88

10. What is the highest grade in school you have completed? n=170
3.5% - Some formal schooling
22.9% - High school diploma/GED
22.4% - Some college
11.8% - 2 year college degree
28.8% - 4 year college degree
10.6% - Post-graduate

11. What is the approximate size of your residential lot? n=168
47.0% - ¼ acre or less
33.3% - more than ¼ acre but less than 1 acre
16.7% - 1 acre to less than 5 acres
3.0% - 5 acres or more

12. Do you own or rent your home? n=172
89.5% - Own
10.5% - Rent

13. How long have you lived at your current residence? n=171
range=0.08-64 years mean=17.85

14. What is the source of your drinking water? n=138
4.3% -Individual well
39.9% -Municipal well
55.1% -Fall Creek
0.7% -Eagle Creek

15. What is your zip code? n=174
(See appendix D)

16. In addition to your residence, which of the following do you own or manage? (check all that apply) n=184
0.5% - An agricultural operation
1.6% - Forested land
3.3% - Rural recreational property
88.0% - None of these

17. Do you use a professional lawn care service? n=175
5.7% - Yes, just for mowing
7.4% - Yes, for mowing and fertilizing
9.7% - Yes, just for fertilizing and pest control
2.9% - Yes, for mowing, fertilizing, and pest control
74.3% - No

18. In the past three years, have you heard about water quality issues in any of the following? (check all that apply) n=185

31.9% -Newsletters/brochures/fact sheets
13.5% -Internet
3.2% -Workshops/demonstrations/meetings
9.7% -Radio – Station name: (see appendix C)
31.9% -Newspapers – Name of publication: (see appendix C)
29.2% -Television – Station name: (see appendix C)
31.4% -Water bill – Name provider: (see appendix C)
2.7% -Notices posted at local businesses
2.7% -Notices posted on community bulletin boards
2.7% -Billboards
22.2% **-**Conversations with others
2.2% **-**Other (please specify: see appendix C)
21.1% -None of the above

19. What is your ethnicity? n=171

39.2% -African American
0.6% -American Indian
2.3% -Asian/Asian American/Pacific Islander
0.6% -Hispanic/Latino
51.5% -White/Caucasian
1.2% -Multi-racial
4.7% -Other

20. What is your occupation? (please be as specific as possible)

(see appendix E)

Appendix A:

Do you know where the water goes when it runs off your property? Yes it goes to:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		108	58.7	58.7	58.7
	a sewer system	1	.5	.5	59.2
	Butler Canal	1	.5	.5	59.8
	city sewer	2	1.1	1.1	60.9
	city sewer system	1	.5	.5	61.4
	creek - feed to Fall Creek	1	.5	.5	62.0
	creek across the street	1	.5	.5	62.5
	creek below the house to Fall Creek	1	.5	.5	63.0
	Devon Creek into Fall Creek	1	.5	.5	63.6
	Devon Lake > Berkshire Creek > Fall Creek	1	.5	.5	64.1
	disch	1	.5	.5	64.7
	down the drain on the street	1	.5	.5	65.2
	evaporation	1	.5	.5	65.8
	eventually into Fall Creek	1	.5	.5	66.3
	Fall Creek	13	7.1	7.1	73.4
	Fall Creek and my septic tank	1	.5	.5	73.9
	in the man holes	1	.5	.5	74.5
	in the sewer	1	.5	.5	75.0
	Indian Creek	1	.5	.5	75.5
	Indian Lake, Fall Creek, White River	1	.5	.5	76.1
	into a sewer line	1	.5	.5	76.6
	into the city sewer system	1	.5	.5	77.2
	into the ground	1	.5	.5	77.7
	into the Lawrence storm-sewer system in our street	1	.5	.5	78.3
	Kesslerwood East Lake and Fall Creek	1	.5	.5	78.8
	Lake Maxinhall	1	.5	.5	79.3
	Mud Creek	2	1.1	1.1	80.4

Mud Creek???	1	.5	.5	81.0
Pouque Run	1	.5	.5	81.5
retension pond	1	.5	.5	82.1
sewer	13	7.1	7.1	89.1
sewer drain	1	.5	.5	89.7
sewer in backyard	1	.5	.5	90.2
sewers	1	.5	.5	90.8
Sewers and settles in some backyards	1	.5	.5	91.3
sits in the street until it evaporates	1	.5	.5	91.8
small streams --> Fall Creek	1	.5	.5	92.4
soil	1	.5	.5	92.9
storm sewer	3	1.6	1.6	94.6
storm sewer in street	1	.5	.5	95.1
storm sewers in the street	1	.5	.5	95.7
the Crooked Creek	1	.5	.5	96.2
the lot to the north of me	1	.5	.5	96.7
the river	1	.5	.5	97.3
the sewer	1	.5	.5	97.8
west on Pleasant Woods to drain to pond by VFW	1	.5	.5	98.4
white river	1	.5	.5	98.9
woods behind house	1	.5	.5	99.5
ditch in front of my yard - neighborhood creek - Fall Creek	1	.5	.5	100.0
Total	184	100.0	100.0	

Appendix B:

Which of the following do you do on a regular basis?:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		165	89.2	89.2	89.2
	buy environmetlal safe products	1	.5	.5	89.7
	buy water (distilled) to drink	1	.5	.5	90.3
	car	1	.5	.5	90.8
	car pool	1	.5	.5	91.4
	carpool	1	.5	.5	91.9
	compost yard debris and vegetable food waste	1	.5	.5	92.4
	compost, don't water lawn	1	.5	.5	93.0
	Conserve water, don't water lawn, conserve electicity, now hanging laundry to dry	1	.5	.5	93.5
	don't mow or use -icides	1	.5	.5	94.1
	drive as little as possible	1	.5	.5	94.6
	feed nature's animals, birds, squirrels	1	.5	.5	95.1
	high efficiency appliance	1	.5	.5	95.7
	no	1	.5	.5	96.2
	none	2	1.1	1.1	97.3
	organic fertilizer, reel(manual) lawnmower	1	.5	.5	97.8
	rain barrel, clothes line use, composting	1	.5	.5	98.4
	Rain recycle	1	.5	.5	98.9
	Runner	1	.5	.5	99.5
	shut off water while taking a shower and brushing teeth	1	.5	.5	100.0
	Total	185	100.0	100.0	

Appendix C:

Radio Station:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		176	95.1	95.1	95.1
	106.7 FM	1	.5	.5	95.7
	NPR	4	2.2	2.2	97.8
	PBS	1	.5	.5	98.4
	WFYI	1	.5	.5	98.9
	WIBC	1	.5	.5	99.5
	WTLC	1	.5	.5	100.0
	Total	185	100.0	100.0	

Newspaper Publication:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		142	76.8	76.8	76.8
	Indianapolis News	1	.5	.5	77.3
	Indianapolis Star	26	14.1	14.1	91.4
	Indianapolis Star & News	1	.5	.5	91.9
	Indianapolis Star News	1	.5	.5	92.4
	Indpls. Star	1	.5	.5	93.0
	Indy Star	6	3.2	3.2	96.2
	star	1	.5	.5	96.8
	Star	6	3.2	3.2	100.0
	Total	185	100.0	100.0	

Television Stations:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		153	82.7	82.7	82.7
	#59	1	.5	.5	83.2
	13-59	1	.5	.5	83.8

	6,8,13	1	.5	.5	84.3
	All	1	.5	.5	84.9
	all stations	1	.5	.5	85.4
	All stations news	1	.5	.5	85.9
	CBS	2	1.1	1.1	87.0
	CBS NBC ABC	1	.5	.5	87.6
	CBS News	1	.5	.5	88.1
	Ch 8 & 13	1	.5	.5	88.6
	Channel 6 evening news	1	.5	.5	89.2
	Indianapolis Stations	1	.5	.5	89.7
	NBC	1	.5	.5	90.3
	NBC, WTHR	1	.5	.5	90.8
	NBS, CBS, ABC, Fox News	1	.5	.5	91.4
	several	1	.5	.5	91.9
	WFYI	1	.5	.5	92.4
	WHTR	1	.5	.5	93.0
	WHTR, WTTV	1	.5	.5	93.5
	WISH	1	.5	.5	94.1
	WISH Ch 8	1	.5	.5	94.6
	Wish TV	1	.5	.5	95.1
	WISH TV 8	1	.5	.5	95.7
	WISH, WTHR	1	.5	.5	96.2
	WISH, WTHR, WRTV	1	.5	.5	96.8
	WRTV6	2	1.1	1.1	97.8
	WRTV6, WISH8, WTHR13	1	.5	.5	98.4
	WTHR	2	1.1	1.1	99.5
	WTHR, WRTV, WISH	1	.5	.5	100.0
	Total	185	100.0	100.0	

Water Provider:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		142	76.8	76.8	76.8
	Indianapolis Water	9	4.9	4.9	81.6
	Indianapolis Water - Veolia	1	.5	.5	82.2

Indianapolis Water Co.	6	3.2	3.2	85.4
Indianapolis Water Company	1	.5	.5	85.9
Indianpolis Water	1	.5	.5	86.5
Indianpolis water co	1	.5	.5	87.0
Indpls. Water	1	.5	.5	87.6
IPL	1	.5	.5	88.1
Lawrence	1	.5	.5	88.6
Lawrence Utilities	9	4.9	4.9	93.5
Lawrence Water	1	.5	.5	94.1
Lawrence Water Co.	1	.5	.5	94.6
super markets	1	.5	.5	95.1
Veola	3	1.6	1.6	96.8
VEOLA	1	.5	.5	97.3
Veolia	4	2.2	2.2	99.5
Veolia Water	1	.5	.5	100.0
Total	185	100.0	100.0	

Other:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		181	97.8	97.8	97.8
	barber shop	1	.5	.5	98.4
	home owners association	1	.5	.5	98.9
	IDEM	1	.5	.5	99.5
	red signs at river	1	.5	.5	100.0
	Total	185	100.0	100.0	

Appendix D:

What is your zip code?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	8	1	.5	.6	.6
	46055	1	.5	.6	1.1
	46202	1	.5	.6	1.7
	46205	22	11.9	12.6	14.4
	46206	1	.5	.6	14.9
	46208	17	9.2	9.8	24.7
	46218	23	12.4	13.2	37.9
	46220	5	2.7	2.9	40.8
	46226	59	31.9	33.9	74.7
	46228	1	.5	.6	75.3
	46235	5	2.7	2.9	78.2
	46236	16	8.6	9.2	87.4
	46239	1	.5	.6	87.9
	46250	1	.5	.6	88.5
	46256	17	9.2	9.8	98.3
	46308	1	.5	.6	98.9
	462051031	1	.5	.6	99.4
	462085452	1	.5	.6	100.0
	Total	174	94.1	100.0	
Missing	System	11	5.9		
Total		185	100.0		

Appendix E:

What is your occupation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		22	11.9	11.9	11.9
	401(K) Plan Administrator	1	.5	.5	12.4
	Account manager for audio visual rental company	1	.5	.5	13.0
	Accounting Technician	1	.5	.5	13.5
	Admin assistant	1	.5	.5	14.1
	Admininstrative Assistant	1	.5	.5	14.6
	Architect	1	.5	.5	15.1
	Art Director	1	.5	.5	15.7
	Assembly	1	.5	.5	16.2
	baby day care	1	.5	.5	16.8
	Barber	1	.5	.5	17.3
	Bartender	1	.5	.5	17.8
	Business Manager	1	.5	.5	18.4
	CAN	1	.5	.5	18.9
	car wash owner/operator. RV Park & Pier Rental Lake Wawasee. Home remodeler.	1	.5	.5	19.5
	Cashier	1	.5	.5	20.0
	Chef De Cuisine @ popular restaurant in downtown area	1	.5	.5	20.5
	Claim Handler	1	.5	.5	21.1
	College Educational Sales & retention	1	.5	.5	21.6
	Commercial Driver	1	.5	.5	22.2
	computer repairs	1	.5	.5	22.7
	Courier	1	.5	.5	23.2
	Creative director	1	.5	.5	23.8
	CSR	2	1.1	1.1	24.9
	Customer service rep	1	.5	.5	25.4
	Customer Service Supervisor	1	.5	.5	25.9
	Delivery contractor	1	.5	.5	26.5
	Disabled	1	.5	.5	27.0

Dog Groomer	1	.5	.5	27.6
driver for furniture company	1	.5	.5	28.1
Engineer	1	.5	.5	28.6
Executive Assistant	1	.5	.5	29.2
Factory Worker	2	1.1	1.1	30.3
Flow- unload trucks	1	.5	.5	30.8
Fund raiser State museum	1	.5	.5	31.4
General Management	1	.5	.5	31.9
Graphic Designer	1	.5	.5	32.4
High school shop teacher	1	.5	.5	33.0
Home repairs spcialist for nonprofit CDC	1	.5	.5	33.5
Homemaker	2	1.1	1.1	34.6
Homemaker - Widow	1	.5	.5	35.1
House mother	1	.5	.5	35.7
Housekeeping	2	1.1	1.1	36.8
housewife	1	.5	.5	37.3
HVAC/Mechanical Engineer	1	.5	.5	37.8
INDOT crew leader	1	.5	.5	38.4
Insurance agent	1	.5	.5	38.9
Insurance underwriter	1	.5	.5	39.5
IT Professional	1	.5	.5	40.0
Letter carrier	1	.5	.5	40.5
LSS, Childcare, CRS.	1	.5	.5	41.1
Mail Carrier (USPS)	1	.5	.5	41.6
Manager local business	1	.5	.5	42.2
Manufacturing/Purchasing Agent	1	.5	.5	42.7
Marketing/Communications Director	1	.5	.5	43.2
Medical technologist/customer service	1	.5	.5	43.8
Merchandising Manager	1	.5	.5	44.3
Mortician	1	.5	.5	44.9
Newspaper copy editor	1	.5	.5	45.4
Night sup at Marsh	1	.5	.5	45.9

none	1	.5	.5	46.5
NONE	1	.5	.5	47.0
Nurse	3	1.6	1.6	48.6
Nursing	1	.5	.5	49.2
Optician	1	.5	.5	49.7
Outside Sales Representative	1	.5	.5	50.3
Philosophy Professor	1	.5	.5	50.8
Physician (MD)	1	.5	.5	51.4
Police Officer	1	.5	.5	51.9
Postal Worker	2	1.1	1.1	53.0
process control engineer	1	.5	.5	53.5
Proctor at Ivy Tech Community College	1	.5	.5	54.1
Procurement	1	.5	.5	54.6
Professional Services - Architectual/Engineering	1	.5	.5	55.1
Public Safety Dispatcher	1	.5	.5	55.7
realter, Broker,Author, Minister, Student	1	.5	.5	56.2
Receptionist at Direct Buy Indianapolis	1	.5	.5	56.8
Respitory Therapist	1	.5	.5	57.3
Retail Service Manager	1	.5	.5	57.8
retired	1	.5	.5	58.4
Retired	40	21.6	21.6	80.0
Retired - Disability	1	.5	.5	80.5
Retired (Insurance underwriter)	1	.5	.5	81.1
Retired Engineer	1	.5	.5	81.6
Retired Fire Fighter	1	.5	.5	82.2
Retired for INDOT	1	.5	.5	82.7
Retired from Marsh as a back door receiver	1	.5	.5	83.2
Retired from mental health field and artist	1	.5	.5	83.8
Retired GM employee	1	.5	.5	84.3
Retired Millwright	1	.5	.5	84.9

retired minister	1	.5	.5	85.4
Retired RCA recorder	1	.5	.5	85.9
retired social work	1	.5	.5	86.5
Retired system analyst	1	.5	.5	87.0
Retired teacher	5	2.7	2.7	89.7
Retired teacher - Chicago Public Schools	1	.5	.5	90.3
retirement	1	.5	.5	90.8
RN	1	.5	.5	91.4
self employed	1	.5	.5	91.9
Stay at home mom and full time student	1	.5	.5	92.4
Student - Pharmacy at Butler University	1	.5	.5	93.0
student full time	1	.5	.5	93.5
Teacher	2	1.1	1.1	94.6
Technician	1	.5	.5	95.1
Truck Driver	1	.5	.5	95.7
Tutor for K-8	1	.5	.5	96.2
unemployed	3	1.6	1.6	97.8
US Navy (Retired)	1	.5	.5	98.4
waiter	1	.5	.5	98.9
Warehouse Manager	1	.5	.5	99.5
Warehouse Worker	1	.5	.5	100.0
Total	185	100.0	100.0	

APPENDIX 4

Endangered, Threatened, and Rare Species

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11/22/2005

Indiana County Endangered, Threatened and Rare Species List

County: Hamilton

Species Name	Common Name	FED	STATE	GRANK	SRANK
Mollusk: Bivalvia (Mussels)					
Epioblasma torulosa rangiana	Northern Riffleshell	LE	SE	G2T2	S1
Epioblasma triquetra	Snuffbox		SE	G3	S1
Lampsilis fasciola	Wavyrayed Lampmussel		SSC	G4	S2
Ligumia recta	Black Sandshell			G5	S2
Obovaria subrotunda	Round Hickorynut		SSC	G4	S2
Plethobasus cyphyus	Sheepnose	C	SE	G3	S1
Pleurobema clava	Clubshell	LE	SE	G2	S1
Ptychobranchus fasciolaris	Kidneyshell		SSC	G4G5	S2
Quadrula cylindrica cylindrica	Rabbitsfoot		SE	G3T3	S1
Toxolasma lividus	Purple Lilliput		SSC	G2	S2
Toxolasma parvum	Lilliput			G5	S2
Villosa fabalis	Rayed Bean	C	SSC	G1G2	S1
Villosa lienosa	Little Spectaclecase		SSC	G5	S2
Fish					
Ammocrypta pellucida	Eastern Sand Darter			G3	S2
Amphibian					
Necturus maculosus	Common mudpuppy		SSC	G5	S2
Reptile					
Clemmys guttata	Spotted Turtle		SE	G5	S2
Sistrurus catenatus catenatus	Eastern Massasauga	C	SE	G3G4T3T4	S2
Bird					
Bartramia longicauda	Upland Sandpiper		SE	G5	S3B
Buteo lineatus	Red-shouldered Hawk		SSC	G5	S3
Certhia americana	Brown Creeper			G5	S2B
Dendroica cerulea	Cerulean Warbler		SSC	G4	S3B
Ixobrychus exilis	Least Bittern		SE	G5	S3B
Nycticorax nycticorax	Black-crowned Night-heron		SE	G5	S1B
Thryomanes bewickii	Bewick's Wren			G5	S1B
Mammal					
Lynx rufus	Bobcat	No Status		G5	S1
Taxidea taxus	American Badger			G5	S2
Vascular Plant					
Armoracia aquatica	Lake Cress		SE	G4?	S1
Chelone obliqua var. speciosa	Rose Turtlehead		WL	G4T3	S3
Drosera intermedia	Spoon-leaved Sundew		SR	G5	S2
Platanthera leucophaea	Prairie White-fringed Orchid	LT	SE	G3	S1
High Quality Natural Community					
Forest - floodplain wet-mesic	Wet-mesic Floodplain Forest		SG	G3?	S3
Forest - upland mesic	Mesic Upland Forest		SG	G3?	S3

Indiana Natural Heritage Data Center
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Indiana Department of Natural Resources
This data is not the result of comprehensive county surveys.

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GRANK: Global Heritage Rank: G1 = critically imperiled globally; G2 = imperiled globally; G3 = rare or uncommon globally; G4 = widespread and abundant globally but with long term concerns; G5 = widespread and abundant globally; G? = unranked; GX = extinct; Q = uncertain rank; T = taxonomic subunit rank

SRANK: State Heritage Rank: S1 = critically imperiled in state; S2 = imperiled in state; S3 = rare or uncommon in state; G4 = widespread and abundant in state but with long term concern; SG = state significant; SH = historical in state; SX = state extirpated; B = breeding status; S? = unranked; SNR = unranked; SNA = nonbreeding status unranked

Indiana County Endangered, Threatened and Rare Species List

County: Hancock

Species Name	Common Name	FED	STATE	GRANK	SRANK
Mollusk: Bivalvia (Mussels)					
Alasmidonta viridis	Slippershell Mussel			G4G5	S2
Epioblasma triquetra	Snuffbox		SE	G3	S1
Lampsilis fasciola	Wavyrayed Lampmussel		SSC	G4	S2
Pleurobema clava	Clubshell	LE	SE	G2	S1
Ptychobranchus fasciolaris	Kidneyshell		SSC	G4G5	S2
Toxolasma lividus	Purple Lilliput		SSC	G2	S2
Toxolasma parvum	Lilliput			G5	S2
Villosa lienosa	Little Spectaclecase		SSC	G5	S2
Bird					
Ardea herodias	Great Blue Heron			G5	S4B
Bartramia longicauda	Upland Sandpiper		SE	G5	S3B
Lanius ludovicianus	Loggerhead Shrike	No Status	SE	G4	S3B
Nycticorax nycticorax	Black-crowned Night-heron		SE	G5	S1B
Mammal					
Mustela nivalis	Least Weasel		SSC	G5	S2?
Myotis sodalis	Indiana Bat or Social Myotis	LE	SE	G2	S1
Taxidea taxus	American Badger			G5	S2
Vascular Plant					
Magnolia acuminata	Cucumber Magnolia		SE	G5	S1

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Indiana County Endangered, Threatened and Rare Species List

County: Madison

Species Name	Common Name	FED	STATE	GRANK	SRANK
Mollusk: Bivalvia (Mussels)					
Epioblasma torulosa rangiana	Northern Riffleshell	LE	SE	G2T2	S1
Lampsilis fasciola	Wavyrayed Lampmussel		SSC	G4	S2
Plethobasus cyphyus	Sheepnose	C	SE	G3	S1
Pleurobema clava	Clubshell	LE	SE	G2	S1
Ptychobranchus fasciolaris	Kidneyshell		SSC	G4G5	S2
Quadrula cylindrica cylindrica	Rabbitsfoot		SE	G3T3	S1
Toxolasma lividus	Purple Lilliput		SSC	G2	S2
Toxolasma parvum	Lilliput			G5	S2
Villosa lienosa	Little Spectaclecase		SSC	G5	S2
Insect: Odonata (Dragonflies & Damselflies)					
Cordulegaster bilineata	Brown Spiketail		SE	G5	S1
Bird					
Ardea herodias	Great Blue Heron			G5	S4B
Lanius ludovicianus	Loggerhead Shrike	No Status	SE	G4	S3B
Nycticorax nycticorax	Black-crowned Night-heron		SE	G5	S1B
Rallus elegans	King Rail		SE	G4	S1B
Mammal					
Taxidea taxus	American Badger			G5	S2
Vascular Plant					
Deschampsia cespitosa	Tufted Hairgrass		SR	G5	S2
Hypericum pyramidatum	Great St. John's-wort		ST	G4	S1
Juglans cinerea	Butternut		WL	G3G4	S3
Onosmodium hispidissimum	Shaggy False-gromwell		SE	G4	S1
Poa paludigena	Bog Bluegrass		WL	G3	S3
Selaginella apoda	Meadow Spike-moss		WL	G5	S1
Spiranthes lucida	Shining Ladies'-tresses		SR	G5	S2
Valerianella chenopodiifolia	Goose-foot Corn-salad		SE	G5	S1
High Quality Natural Community					
Forest - upland mesic	Mesic Upland Forest		SG	G3?	S3
Wetland - fen	Fen		SG	G3	S3
Wetland - marsh	Marsh		SG	GU	S4

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Indiana County Endangered, Threatened and Rare Species List

County: Marion

Species Name	Common Name	FED	STATE	GRANK	SRANK
Mollusk: Bivalvia (Mussels)					
Alasmidonta viridis	Slippershell Mussel			G4G5	S2
Epioblasma torulosa rangiana	Northern Riffleshell	LE	SE	G2T2	S1
Epioblasma triquetra	Snuffbox		SE	G3	S1
Obovaria subrotunda	Round Hickorynut		SSC	G4	S2
Plethobasus cyphyus	Sheepnose	C	SE	G3	S1
Pleurobema clava	Clubshell	LE	SE	G2	S1
Ptychobranchus fasciolaris	Kidneyshell		SSC	G4G5	S2
Quadrula cylindrica cylindrica	Rabbitsfoot		SE	G3T3	S1
Toxolasma parvum	Lilliput			G5	S2
Venustaconcha ellipsiformis	Ellipse		SSC	G3G4	S2
Villosa lienosa	Little Spectaclecase		SSC	G5	S2
Insect: Neuroptera					
Sisyra sp. 1	Indiana Spongilla Fly		ST	GNR	S2
Fish					
Ammocrypta pellucida	Eastern Sand Darter			G3	S2
Percina evides	Gilt Darter		SE	G4	S1
Amphibian					
Rana pipiens	Northern Leopard Frog		SSC	G5	S2
Reptile					
Clemmys guttata	Spotted Turtle		SE	G5	S2
Clonophis kirtlandii	Kirtland's Snake		SE	G2	S2
Emydoidea blandingii	Blanding's Turtle		SE	G4	S2
Thamnophis butleri	Butler's Garter Snake		SE	G4	S1
Bird					
Aimophila aestivalis	Bachman's Sparrow			G3	SXB
Ardea alba	Great Egret		SSC	G5	S1B
Ardea herodias	Great Blue Heron			G5	S4B
Bartramia longicauda	Upland Sandpiper		SE	G5	S3B
Botaurus lentiginosus	American Bittern		SE	G4	S2B
Buteo lineatus	Red-shouldered Hawk		SSC	G5	S3
Buteo platypterus	Broad-winged Hawk	No Status	SSC	G5	S3B
Certhia americana	Brown Creeper			G5	S2B
Dendroica cerulea	Cerulean Warbler		SSC	G4	S3B
Falco peregrinus	Peregrine Falcon	No Status	SE	G4	S2B
Haliaeetus leucocephalus	Bald Eagle	LT,PDL	SE	G5	S2
Helmitheros vermivorus	Worm-eating Warbler		SSC	G5	S3B
Ixobrychus exilis	Least Bittern		SE	G5	S3B
Lanius ludovicianus	Loggerhead Shrike	No Status	SE	G4	S3B
Mniotilta varia	Black-and-white Warbler		SSC	G5	S1S2B
Nycticorax nycticorax	Black-crowned Night-heron		SE	G5	S1B
Pandion haliaetus	Osprey		SE	G5	S1B
Rallus elegans	King Rail		SE	G4	S1B
Sitta canadensis	Red-breasted Nuthatch			G5	S1B
Wilsonia citrina	Hooded Warbler		SSC	G5	S3B
Mammal					
Lutra canadensis	Northern River Otter			G5	S2
Lynx rufus	Bobcat	No Status		G5	S1
Myotis sodalis	Indiana Bat or Social Myotis	LE	SE	G2	S1
Taxidea taxus	American Badger			G5	S2
Vascular Plant					
Chelone obliqua var. speciosa	Rose Turtlehead		WL	G4T3	S3
Deschampsia cespitosa	Tufted Hairgrass		SR	G5	S2
Hydrastis canadensis	Golden Seal		WL	G4	S3

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Indiana County Endangered, Threatened and Rare Species List

County: Marion

Species Name	Common Name	FED	STATE	GRANK	SRANK
Juglans cinerea	Butternut		WL	G3G4	S3
Melanthium virginicum	Virginia Bunchflower		SE	G5	S1
Panax quinquefolius	American Ginseng		WL	G3G4	S3
Poa wolfii	Wolf Bluegrass		SR	G4	S2
Rubus odoratus	Purple Flowering Raspberry		ST	G5	S2
Trifolium stoloniferum	Running Buffalo Clover	LE	SE	G3	S1
High Quality Natural Community					
Forest - flatwoods central till plain	Central Till Plain Flatwoods		SG	G3	S2
Forest - floodplain mesic	Mesic Floodplain Forest		SG	G3?	S1
Forest - floodplain wet	Wet Floodplain Forest		SG	G3?	S3
Forest - floodplain wet-mesic	Wet-mesic Floodplain Forest		SG	G3?	S3
Forest - upland dry-mesic	Dry-mesic Upland Forest		SG	G4	S4
Forest - upland mesic	Mesic Upland Forest		SG	G3?	S3
Wetland - fen	Fen		SG	G3	S3

APPENDIX 5

Demographic Data

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STATS Indiana

about the profile | release calendar | a to z | hoosiers by the numbers

Select County

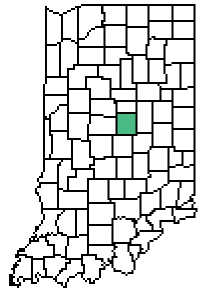
Indiana GO

Select Region

IEDC NW GO

Create a Region

Custom Region



Hamilton County IN Depth Profile

County Seat: Noblesville

Hamilton County, Indiana

Organized in 1823 and named for Alexander Hamilton, first secretary of the treasury

Largest City: Fishers (pop in 2006: 61,840

Population per Sq. Mile: 630.8 Sq. Miles: 397.9

Link to County's in.gov Site

Population Over Time	Number	Rank in State	Percent of State	Indiana
Yesterday(1990)	108,936	12	2.0%	5,544,156
Today(2006)	250,979	5	4.0%	6,313,520
Tomorrow(2010 proj.)	298,642	4	4.7%	6,417,198
Percent Change 1990 to 2000	67.7%	1		9.7%

Sources: US Census Bureau; Indiana Business Research Center

Components of Population Change in 2006	Number	Rank in State	Percent of State	Indiana
Net Domestic Migration 2005 to 2006	7,531	1		5,011
Net International Migration 2005 to 2006	303	8		10,419
Natural Increase (births minus deaths)	2,481	3	7.9%	31,308

Source: US Census Bureau

Population Estimates by Age in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Preschool (0 to 4)	18,767	5	7.5%	6.8%
School Age (5 to 17)	52,462	4	20.9%	18.2%
College Age (18 to 24)	20,957	7	8.4%	9.8%
Young Adult (25 to 44)	80,171	4	31.9%	27.6%
Older Adult (45 to 64)	59,566	5	23.7%	25.2%
Older (65 plus)	19,056	8	7.6%	12.4%
Median Age	33.9			Median Age = 36.3

Sources: US Census Bureau; Indiana Business Research Center

Population Estimates by Race or Hispanic Origin in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
American Indian or Alaska Native Alone	425	7	0.2%	0.3%
Asian Alone	9,543	2	3.8%	1.3%
Black Alone	8,629	9	3.4%	8.9%
Native Hawaiian and Other Pac. Isl. Alone	72	8	0.0%	0.0%
White Alone	229,920	4	91.6%	88.3%
Two or More Race Groups	2,390	6	1.0%	1.1%
Hispanic or Latino(can be of any race)				
Non-Hispanic or Latino	244,297	5	97.3%	95.2%
Hispanic or Latino	6,682	8	2.7%	4.8%

Source: US Census Bureau

Household Types	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Households in 2000 (Includes detail not shown below)	65,933	7	100.0%	100.0%
Married With Children	24,585	4	37.3%	23.8%

Married Without Children	19,922	6	30.2%	29.8%
Single Parents	4,209	8	6.4%	9.1%
Living Alone	12,259	12	18.6%	25.9%

Source: US Census Bureau

Housing	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Total Housing Units in 2006 (estimate)	95,690	5	100.0%	100.0%
Total Housing Units in 2000 (includes vacant units)	69,478	7	100.0%	100.0%
Owner Occupied (Pct. distribution based on all housing units) Median Value (2000)	53,369 $166,300	5 1	76.8% --	65.9% --
Renter Occupied (Pct. distribution based on all housing units) Median Rent (2000)	12,564 $709	13 1	18.1% --	26.3% --

Source: US Census Bureau

Education	Number	Rank in State	Percent of State	Indiana
School Enrollment (2006/2007 Total Reported)	48,376	4	4.2%	1,154,826
Public	47,424	4	4.5%	1,045,702
Private	952	93	0.9%	109,124
High School Graduates (2005/2006)	2,490	6	4.0%	62,296
Going on to Higher Education	2,303	5	4.4%	51,976
4-year	1,970	5	5.1%	38,334
2-year	269	10	3.0%	8,991
Voc/tech.	64	16	1.4%	4,651
Adults (25+ in 2000 Census)	116,457	5	3.0%	3,893,278
with High School diploma or higher	94.2%	1		82.1%
with B.A. or higher degree	48.9%	1		19.4%

Sources: Indiana Department of Education; US Census Bureau
Notes: 1) School enrollment figures for 2006/2007 are preliminary. 2) Private enrollment includes home schools. 3) County rankings for high-school graduates continuing to higher education are subject to revision. Data from the Indiana Department of Education for Vigo County appear to include an erroneous entry. Until the data has been corrected by IDOE, Vigo will be removed from the rankings.

Income and Poverty	Number	Rank in State	Percent of State	Indiana
Per Capita Personal Income (annual) in 2005	$44,354	1	142.3%	$31,173
Median Household Income in 2004	$82,196	1	190.2%	$43,217
Poverty Rate in 2004	3.9%	92	35.1%	11.1%
Poverty Rate among Children under 18	4.5%	92	28.7%	15.7%
Welfare (TANF) Monthly Average Families in 2006	204	1		
Foodstamp Recipients in 2006	4,246	1		
Free and Reduced Fee Lunch Recipients in 2006	4,123	20	1.1%	374,221

Sources: U.S. Bureau of Economic Analysis; US Census Bureau; Indiana Family Social Services Administration; Indiana Department of Education

Health and Vital Statistics in 2005	Number	Rank in State	Percent of State	Indiana
Births	3,693	5	4.2%	87,088
Births to Teens	117	20	1.2%	9,604
Deaths	1,023	14	1.8%	55,623

Source: Indiana State Department of Health

Labor Force in 2006	Number	Rank in State	Percent of State	Indiana
Total Resident Labor Force	134,885	5	4.1%	3,271,496
Employed	130,502	4	4.2%	3,108,806
Unemployed	4,383	7	2.7%	162,690
Unemployment Rate	3.2	92	64.0%	5.0
November 2007 Unemployment Rate	**3.0**	**90**	**68.2%**	**4.4**

Source: Bureau of Labor Statistics; Indiana Department of Workforce Development

Employment and Earnings by Industry in 2005 (NAICS)	Employment	Pct Dist. in County	Earnings ($000)	Pct Dist. In County	Avg. Earnings Per Job
Total by place of work	146,696	100.0%	$6,184,898	100.0%	$42,161

Wage and Salary	104,938	71.5%	$4,263,701	68.9%	$40,631
Farm Proprietors	597	0.4%	$350	0.0%	$586
Nonfarm Proprietors	41,161	28.1%	$1,002,121	16.2%	$24,346
Farm	754	0.5%	$9,626	0.2%	$12,767
Nonfarm	145,942	99.5%	$6,175,272	99.8%	$42,313
Private	135,036	92.1%	$5,666,323	91.6%	$41,962
Accommodation, Food Serv.	9,106	6.2%	$160,734	2.6%	$17,651
Arts, Ent., Recreation	4,468	3.0%	$64,986	1.1%	$14,545
Construction	10,379	7.1%	$531,187	8.6%	$51,179
Health Care, Social Serv.	11,742	8.0%	$469,336	7.6%	$39,971
Information	3,891	2.7%	$212,135	3.4%	$54,519
Manufacturing	6,642	4.5%	$426,607	6.9%	$64,229
Professional, Tech. Serv.	12,767	8.7%	$607,576	9.8%	$47,590
Retail Trade	17,382	11.8%	$548,503	8.9%	$31,556
Trans., Warehousing	1,225	0.8%	$32,629	0.5%	$26,636
Wholesale Trade	7,639	5.2%	$541,703	8.8%	$70,913
Other Private (not above)	48,782*	33.3%*	$2,032,963*	32.9%*	$41,674*
Government	10,906	7.4%	$508,949	8.2%	$46,667

Source: US Bureau of Economic Analysis

* These totals do not include county data that are not available due to BEA non-disclosure requirements.

Assessed Property Value in 1999 (for taxes payable in 2000)	Value	Rank in State	Pct Dist. in County	Pct Dist. in State
Assessed Value by Property Class	$2,666,509,670	4	100.0%	100.0%
Commercial & Industrial	$636,326,690	9	23.9%	43.2%
Residential	$1,865,515,830	2	70.0%	41.5%
Agricultural	$82,673,070	13	3.1%	9.6%
Utilities	$81,994,080	9	3.1%	5.6%
Total Assesed Value Per Capita	$16,382	2		

Source: The State Board of Tax Commissioners

Residential Building Permits in 2006	Units	Pct Dist. in County	Pct Dist. in State	Cost ($000)	State Cost ($000)
Total Permits Filed	3,895	100.0%	100.0%	$686,436	$4,687,933
Single Family	3,030	77.8%	84.1%	$629,800	$4,343,823
Two Family	116	3.0%	3.5%	$11,301	$103,869
Three & Four Family	113	2.9%	2.0%	$9,002	$41,336
Five families and More	636	16.3%	10.4%	$36,333	$198,905

Source: US Census Bureau (Greene County totals are not included as it does not currently issue building permits.) Note: Detail cost may not sum to total due to rounding.

Commuting Patterns - Top 5 in 2005					
Into Hamilton FROM	Number	Percent	Out of Hamilton TO	Number	Percent
All Areas	27,421	22.9%	All Areas	61,340	39.9%
Marion County	11,861	9.9%	Marion County	51,703	33.7%
Madison County	4,449	3.7%	Howard County	2,420	1.6%
Boone County	1,772	1.5%	Madison County	1,530	1.0%
Hancock County	1,463	1.2%	Boone County	841	0.5%
Hendricks County	1,378	1.2%	Hancock County	581	0.4%

Source: Indiana Department of Revenue

Cities and Towns in Hamilton County

	Population in 2006	% of County
Arcadia	1,820	0.7%
Atlanta	838	0.3%
Carmel	60,570	24.1%
Cicero	4,400	1.8%
Fishers	61,840	24.6%
Noblesville	40,115	16.0%

Order by Size

Sheridan	2,779	1.1%	**Arcadia**
Westfield	13,444	5.4%	**Atlanta**

Links to Maps:
Census Tract Boundary Map of Hamilton county
Tiger Mapping Service Map of Area
Top of page

County Profiles is a component of **STATS Indiana**, a web-based information service of the State of Indiana and the Indiana Department of Workforce Development, developed and maintained by the Indiana Business Research Center at Indiana University's Kelley School of Business.
Updated: December 21, 2007 at 20:03

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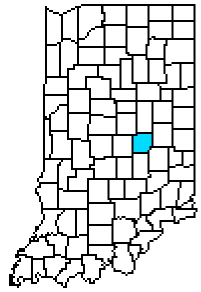


Hancock County IN Depth Profile

County Seat: Greenfield

Hancock County, Indiana

Named in 1828 for John Hancock, signer of the Declaration of Independence

Largest City: Greenfield (pop in 2006: 17,453

Population per Sq. Mile: 212.5 Sq. Miles: 306.1

Link to County's in.gov Site

Population Over Time	Number	Rank in State	Percent of State	Indiana
Yesterday(1990)	45,527	26	0.8%	5,544,156
Today(2006)	65,050	25	1.0%	6,313,520
Tomorrow(2010 proj.)	67,426	25	1.1%	6,417,198
Percent Change 1990 to 2000	21.7%	6		9.7%

Sources: US Census Bureau; Indiana Business Research Center

Components of Population Change in 2006	Number	Rank in State	Percent of State	Indiana
Net Domestic Migration 2005 to 2006	1,784	5		5,011
Net International Migration 2005 to 2006	6	63		10,419
Natural Increase (births minus deaths)	307	20	1.0%	31,308

Source: US Census Bureau

Population Estimates by Age in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Preschool (0 to 4)	4,185	24	6.4%	6.8%
School Age (5 to 17)	11,618	24	17.9%	18.2%
College Age (18 to 24)	5,858	23	9.0%	9.8%
Young Adult (25 to 44)	18,392	23	28.3%	27.6%
Older Adult (45 to 64)	17,263	25	26.5%	25.2%
Older (65 plus)	7,734	25	11.9%	12.4%
Median Age	37.3			Median Age = 36.3

Sources: US Census Bureau; Indiana Business Research Center

Population Estimates by Race or Hispanic Origin in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
American Indian or Alaska Native Alone	109	37	0.2%	0.3%
Asian Alone	492	24	0.8%	1.3%
Black Alone	1,271	23	2.0%	8.9%
Native Hawaiian and Other Pac. Isl. Alone	13	38	0.0%	0.0%
White Alone	62,733	25	96.4%	88.3%
Two or More Race Groups	432	27	0.7%	1.1%
Hispanic or Latino(can be of any race)				
Non-Hispanic or Latino	64,268	25	98.8%	95.2%
Hispanic or Latino	782	41	1.2%	4.8%

Source: US Census Bureau

Household Types	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Households in 2000 (Includes detail not shown below)	20,718	25	100.0%	100.0%
Married With Children	6,294	23	30.4%	23.8%

Married Without Children	7,696	25	37.1%	29.8%
Single Parents	1,304	31	6.3%	9.1%
Living Alone	3,891	29	18.8%	25.9%

Source: US Census Bureau

Housing	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Total Housing Units in 2006 (estimate)	26,947	25	100.0%	100.0%
Total Housing Units in 2000 (includes vacant units)	21,750	25	100.0%	100.0%
Owner Occupied (Pct. distribution based on all housing units) Median Value (2000)	16,872 $129,700	25 4	77.6% --	65.9% --
Renter Occupied (Pct. distribution based on all housing units) Median Rent (2000)	3,846 $571	32 5	17.7% --	26.3% --

Source: US Census Bureau

Education	Number	Rank in State	Percent of State	Indiana
School Enrollment (2006/2007 Total Reported)	12,677	21	1.1%	1,154,826
Public	12,677	20	1.2%	1,045,702
Private	N/R			109,124
High School Graduates (2005/2006)	747	25	1.2%	62,296
Going on to Higher Education	643	27	1.2%	51,976
4-year	393	26	1.0%	38,334
2-year	128	50	1.4%	8,991
Voc/tech.	122	23	2.6%	4,651
Adults (25+ in 2000 Census)	37,073	25	1.0%	3,893,278
with High School diploma or higher	87.8%	6		82.1%
with B.A. or higher degree	22.2%	11		19.4%

Sources: Indiana Department of Education; US Census Bureau
Notes: 1) School enrollment figures for 2006/2007 are preliminary. 2) Private enrollment includes home schools. 3) County rankings for high-school graduates continuing to higher education are subject to revision. Data from the Indiana Department of Education for Vigo County appear to include an erroneous entry. Until the data has been corrected by IDOE, Vigo will be removed from the rankings.

Income and Poverty	Number	Rank in State	Percent of State	Indiana
Per Capita Personal Income (annual) in 2005	$36,466	4	117.0%	$31,173
Median Household Income in 2004	$62,657	3	145.0%	$43,217
Poverty Rate in 2004	5.4%	90	48.6%	11.1%
Poverty Rate among Children under 18	6.9%	90	43.9%	15.7%
Welfare (TANF) Monthly Average Families in 2006	134	1		
Foodstamp Recipients in 2006	2,802	1		
Free and Reduced Fee Lunch Recipients in 2006	1,425	61	0.4%	374,221

Sources: U.S. Bureau of Economic Analysis; US Census Bureau; Indiana Family Social Services Administration; Indiana Department of Education

Health and Vital Statistics in 2005	Number	Rank in State	Percent of State	Indiana
Births	888	23	1.0%	87,088
Births to Teens	61	37	0.6%	9,604
Deaths	503	27	0.9%	55,623

Source: Indiana State Department of Health

Labor Force in 2006	Number	Rank in State	Percent of State	Indiana
Total Resident Labor Force	35,526	23	1.1%	3,271,496
Employed	34,086	23	1.1%	3,108,806
Unemployed	1,440	27	0.9%	162,690
Unemployment Rate	4.1	83	82.0%	5.0
November 2007 Unemployment Rate	**3.6**	**82**	**81.8%**	**4.4**

Source: Bureau of Labor Statistics; Indiana Department of Workforce Development

Employment and Earnings by Industry in 2005 (NAICS)	Employment	Pct Dist. in County	Earnings ($000)	Pct Dist. In County	Avg. Earnings Per Job
Total by place of work	35,349	100.0%	$1,065,943	100.0%	$30,155

Wage and Salary	20,358	57.6%	$690,547	64.8%	$33,920
Farm Proprietors	554	1.6%	$1,884	0.2%	$3,401
Nonfarm Proprietors	14,437	40.8%	$197,138	18.5%	$13,655
Farm	643	1.8%	$4,680	0.4%	$7,278
Nonfarm	34,706	98.2%	$1,061,263	99.6%	$30,579
Private	30,585	86.5%	$882,758	82.8%	$28,862
Accommodation, Food Serv.	2,018	5.7%	$25,211	2.4%	$12,493
Arts, Ent., Recreation	732	2.1%	$10,007	0.9%	$13,671
Construction	3,627	10.3%	$124,613	11.7%	$34,357
Health Care, Social Serv.	1,966	5.6%	$56,513	5.3%	$28,745
Information	488	1.4%	$14,829	1.4%	$30,387
Manufacturing	2,917	8.3%	$179,619	16.9%	$61,577
Professional, Tech. Serv.	3,025	8.6%	$146,881	13.8%	$48,556
Retail Trade	4,070	11.5%	$70,873	6.6%	$17,414
Trans., Warehousing	1,186	3.4%	$29,788	2.8%	$25,116
Wholesale Trade	1,173	3.3%	$73,879	6.9%	$62,983
Other Private (not above)	9,248*	26.2%*	$142,089*	13.3%*	$15,364*
Government	4,121	11.7%	$178,505	16.7%	$43,316

Source: US Bureau of Economic Analysis

* These totals do not include county data that are not available due to BEA non-disclosure requirements.

Assessed Property Value in 1999 (for taxes payable in 2000)	Value	Rank in State	Pct Dist. in County	Pct Dist. in State
Assessed Value by Property Class	$513,414,590	25	100.0%	100.0%
Commercial & Industrial	$130,805,970	35	25.5%	43.2%
Residential	$276,399,810	24	53.8%	41.5%
Agricultural	$85,178,610	11	16.6%	9.6%
Utilities	$21,030,210	37	4.1%	5.6%
Total Assesed Value Per Capita	$9,421	39		

Source: The State Board of Tax Commissioners

Residential Building Permits in 2006	Units	Pct Dist. in County	Pct Dist. in State	Cost ($000)	State Cost ($000)
Total Permits Filed	594	100.0%	100.0%	$103,572	$4,687,933
Single Family	564	94.9%	84.1%	$100,927	$4,343,823
Two Family	30	5.1%	3.5%	$2,645	$103,869
Three & Four Family	0	0.0%	2.0%	$0	$41,336
Five families and More	0	0.0%	10.4%	$0	$198,905

Source: US Census Bureau (Greene County totals are not included as it does not currently issue building permits.) Note: Detail cost may not sum to total due to rounding.

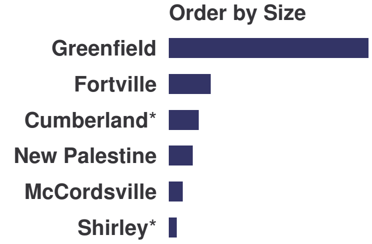
Commuting Patterns - Top 5 in 2005					
Into Hancock FROM	Number	Percent	Out of Hancock TO	Number	Percent
All Areas	6,023	20.4%	All Areas	20,661	46.8%
Marion County	1,573	5.3%	Marion County	16,600	37.6%
Henry County	1,317	4.5%	Hamilton County	1,463	3.3%
Madison County	693	2.4%	Shelby County	615	1.4%
Shelby County	596	2.0%	Madison County	484	1.1%
Hamilton County	581	2.0%	Henry County	283	0.6%

Source: Indiana Department of Revenue

Cities and Towns in Hancock County

	Population in 2006	% of County
Cumberland	2,660	4.1%*
Fortville	3,691	5.7%
Greenfield	17,453	26.8%
McCordsville	1,289	2.0%
New Palestine	2,014	3.1%
Shirley	713	1.1%*

Order by Size



Spring Lake	276	0.4%
Wilkinson	353	0.5%

* Population in this county is shown, this city or town crosses county lines.

Links to Maps:
Census Tract Boundary Map of Hancock county
Tiger Mapping Service Map of Area
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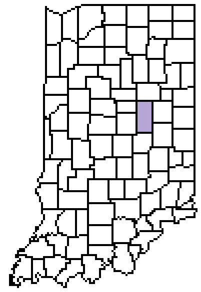

Madison County IN Depth Profile

County Seat: Anderson

Madison County, Indiana

Formed in 1823 and named in honor of President James Madison

Largest City: Anderson (pop in 2006: 57,496

Population per Sq. Mile: 288.8 Sq. Miles: 452.1

Link to County's in.gov Site

Population Over Time	Number	Rank in State	Percent of State	Indiana
Yesterday(1990)	130,669	7	2.4%	5,544,156
Today(2006)	130,575	12	2.1%	6,313,520
Tomorrow(2010 proj.)	129,019	13	2.0%	6,417,198
Percent Change 1990 to 2000	2.1%	72		9.7%

Sources: US Census Bureau; Indiana Business Research Center

Components of Population Change in 2006	Number	Rank in State	Percent of State	Indiana
Net Domestic Migration 2005 to 2006	57	23		5,011
Net International Migration 2005 to 2006	91	23		10,419
Natural Increase (births minus deaths)	9	83	0.0%	31,308

Source: US Census Bureau

Population Estimates by Age in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Preschool (0 to 4)	8,002	11	6.1%	6.8%
School Age (5 to 17)	22,049	12	16.9%	18.2%
College Age (18 to 24)	10,977	15	8.4%	9.8%
Young Adult (25 to 44)	34,995	12	26.8%	27.6%
Older Adult (45 to 64)	34,387	9	26.3%	25.2%
Older (65 plus)	20,165	7	15.4%	12.4%
Median Age	39.3			Median Age = 36.3

Sources: US Census Bureau; Indiana Business Research Center

Population Estimates by Race or Hispanic Origin in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
American Indian or Alaska Native Alone	330	14	0.3%	0.3%
Asian Alone	593	20	0.5%	1.3%
Black Alone	10,623	8	8.1%	8.9%
Native Hawaiian and Other Pac. Isl. Alone	23	25	0.0%	0.0%
White Alone	117,715	12	90.2%	88.3%
Two or More Race Groups	1,291	16	1.0%	1.1%
Hispanic or Latino(can be of any race)				
Non-Hispanic or Latino	127,705	12	97.8%	95.2%
Hispanic or Latino	2,870	15	2.2%	4.8%

Source: US Census Bureau

Household Types	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Households in 2000 (Includes detail not shown below)	53,052	10	100.0%	100.0%
Married With Children	10,780	12	20.3%	23.8%

Married Without Children	17,055	9	32.1%	29.8%
Single Parents	5,098	7	9.6%	9.1%
Living Alone	14,421	9	27.2%	25.9%

Source: US Census Bureau

Housing	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Total Housing Units in 2006 (estimate)	59,245	10	100.0%	100.0%
Total Housing Units in 2000 (includes vacant units)	56,939	10	100.0%	100.0%
Owner Occupied (Pct. distribution based on all housing units) Median Value (2000)	39,358 $81,600	9 57	69.1% --	65.9% --
Renter Occupied (Pct. distribution based on all housing units) Median Rent (2000)	13,694 $490	10 29	24.1% --	26.3% --

Source: US Census Bureau

Education	Number	Rank in State	Percent of State	Indiana
School Enrollment (2006/2007 Total Reported)	21,244	12	1.8%	1,154,826
Public	20,080	12	1.9%	1,045,702
Private	1,164	92	1.1%	109,124
High School Graduates (2005/2006)	1,109	14	1.8%	62,296
Going on to Higher Education	948	14	1.8%	51,976
4-year	633	14	1.7%	38,334
2-year	198	14	2.2%	8,991
Voc/tech.	117	8	2.5%	4,651
Adults (25+ in 2000 Census)	89,458	9	2.3%	3,893,278
with High School diploma or higher	80.1%	55		82.1%
with B.A. or higher degree	14.4%	30		19.4%

Sources: Indiana Department of Education; US Census Bureau
Notes: 1) School enrollment figures for 2006/2007 are preliminary. 2) Private enrollment includes home schools. 3) County rankings for high-school graduates continuing to higher education are subject to revision. Data from the Indiana Department of Education for Vigo County appear to include an erroneous entry. Until the data has been corrected by IDOE, Vigo will be removed from the rankings.

Income and Poverty	Number	Rank in State	Percent of State	Indiana
Per Capita Personal Income (annual) in 2005	$28,688	31	92.0%	$31,173
Median Household Income in 2004	$40,480	61	93.7%	$43,217
Poverty Rate in 2004	12.1%	20	109.0%	11.1%
Poverty Rate among Children under 18	18.2%	17	115.9%	15.7%
Welfare (TANF) Monthly Average Families in 2006	1,151	1		
Foodstamp Recipients in 2006	15,414	1		
Free and Reduced Fee Lunch Recipients in 2006	8,141	7	2.2%	374,221

Sources: U.S. Bureau of Economic Analysis; US Census Bureau; Indiana Family Social Services Administration; Indiana Department of Education

Health and Vital Statistics in 2005	Number	Rank in State	Percent of State	Indiana
Births	1,650	11	1.9%	87,088
Births to Teens	222	7	2.3%	9,604
Deaths	1,406	6	2.5%	55,623

Source: Indiana State Department of Health

Labor Force in 2006	Number	Rank in State	Percent of State	Indiana
Total Resident Labor Force	63,189	13	1.9%	3,271,496
Employed	59,385	13	1.9%	3,108,806
Unemployed	3,804	8	2.3%	162,690
Unemployment Rate	6.0	17	120.0%	5.0
November 2007 Unemployment Rate	**5.6**	**4**	**127.3%**	**4.4**

Source: Bureau of Labor Statistics; Indiana Department of Workforce Development

Employment and Earnings by Industry in 2005 (NAICS)	Employment	Pct Dist. in County	Earnings ($000)	Pct Dist. In County	Avg. Earnings Per Job
Total by place of work	56,491	100.0%	$2,173,002	100.0%	$38,466

Wage and Salary	46,429	82.2%	$1,438,361	66.2%	$30,980
Farm Proprietors	734	1.3%	$422	0.0%	$575
Nonfarm Proprietors	9,328	16.5%	$346,014	15.9%	$37,094
Farm	1,002	1.8%	$7,372	0.3%	$7,357
Nonfarm	55,489	98.2%	$2,165,630	99.7%	$39,028
Private	48,343	85.6%	$1,816,914	83.6%	$37,584
Accommodation, Food Serv.	4,364	7.7%	$57,397	2.6%	$13,152
Arts, Ent., Recreation	1,354	2.4%	$40,464	1.9%	$29,885
Construction	3,076	5.4%	$95,537	4.4%	$31,059
Health Care, Social Serv.	7,581	13.4%	$278,968	12.8%	$36,798
Information	691	1.2%	$25,939	1.2%	$37,538
Manufacturing	6,699	11.9%	$671,388	30.9%	$100,222
Professional, Tech. Serv.	1,923	3.4%	$59,615	2.7%	$31,001
Retail Trade	7,162	12.7%	$147,938	6.8%	$20,656
Trans., Warehousing	2,115	3.7%	$85,016	3.9%	$40,197
Wholesale Trade	1,598	2.8%	$79,261	3.6%	$49,600
Other Private (not above)	11,661*	20.6%*	$271,027*	12.5%*	$23,242*
Government	7,146	12.6%	$348,716	16.0%	$48,799

Source: US Bureau of Economic Analysis

* These totals do not include county data that are not available due to BEA non-disclosure requirements.

Assessed Property Value in 1999 (for taxes payable in 2000)	Value	Rank in State	Pct Dist. in County	Pct Dist. in State
Assessed Value by Property Class	$888,010,630	15	100.0%	100.0%
Commercial & Industrial	$344,820,600	17	38.8%	43.2%
Residential	$421,010,600	13	47.4%	41.5%
Agricultural	$90,067,280	8	10.1%	9.6%
Utilities	$32,112,160	31	3.6%	5.6%
Total Assesed Value Per Capita	$6,767	84		

Source: The State Board of Tax Commissioners

Residential Building Permits in 2006	Units	Pct Dist. in County	Pct Dist. in State	Cost ($000)	State Cost ($000)
Total Permits Filed	328	100.0%	100.0%	$56,216	$4,687,933
Single Family	314	95.7%	84.1%	$54,012	$4,343,823
Two Family	14	4.3%	3.5%	$2,204	$103,869
Three & Four Family	0	0.0%	2.0%	$0	$41,336
Five families and More	0	0.0%	10.4%	$0	$198,905

Source: US Census Bureau (Greene County totals are not included as it does not currently issue building permits.) Note: Detail cost may not sum to total due to rounding.

Commuting Patterns - Top 5 in 2005

Into Madison FROM	Number	Percent	Out of Madison TO	Number	Percent
All Areas	8,289	11.1%	All Areas	16,816	20.2%
Delaware County	2,060	2.8%	Marion County	6,830	8.2%
Hamilton County	1,530	2.1%	Hamilton County	4,449	5.4%
Henry County	1,392	1.9%	Delaware County	1,633	2.0%
Marion County	782	1.0%	Grant County	830	1.0%
Grant County	488	0.7%	Howard County	704	0.8%

Source: Indiana Department of Revenue

Cities and Towns in Madison County

	Population in 2006	% of County
Alexandria	5,888	4.5%
Anderson	57,496	44.0%
Chesterfield	2,773	2.1%*
Country Club Heights	87	0.1%
Edgewood	1,872	1.4%
Elwood	9,089	7.0%*

Frankton	1,866	1.4%
Ingalls	1,585	1.2%
Lapel	1,859	1.4%
Markleville	384	0.3%
Orestes	324	0.2%
Pendleton	3,919	3.0%
River Forest	27	0.0%
Summitville	1,048	0.8%
Woodlawn Heights	71	0.1%

* Population in this county is shown, this city or town crosses county lines.

Links to Maps:
Census Tract Boundary Map of Madison county
Tiger Mapping Service Map of Area
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Updated: December 21, 2007 at 20:04

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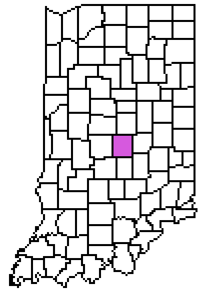


Marion County IN Depth Profile

County Seat: Indianapolis

Marion County, Indiana

Named in 1821 for Revolutionary War General Francis Marion

Largest City: Indianapolis Consolidated (pop in 2006: 767,255)

Population per Sq. Mile: 2,184.5 Sq. Miles: 396.2

Link to County's in.gov Site

Population Over Time	Number	Rank in State	Percent of State	Indiana
Yesterday(1990)	797,159	1	14.4%	5,544,156
Today(2006)	865,504	1	13.7%	6,313,520
Tomorrow(2010 proj.)	866,409	1	13.5%	6,417,198
Percent Change 1990 to 2000	7.9%	44		9.7%

Sources: US Census Bureau; Indiana Business Research Center

Components of Population Change in 2006	Number	Rank in State	Percent of State	Indiana
Net Domestic Migration 2005 to 2006	-6,122	92		5,011
Net International Migration 2005 to 2006	2,486	1		10,419
Natural Increase (births minus deaths)	7,282	1	23.3%	31,308

Source: US Census Bureau

Population Estimates by Age in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Preschool (0 to 4)	72,464	1	8.4%	6.8%
School Age (5 to 17)	160,143	1	18.5%	18.2%
College Age (18 to 24)	70,032	1	8.1%	9.8%
Young Adult (25 to 44)	260,402	1	30.1%	27.6%
Older Adult (45 to 64)	208,200	1	24.1%	25.2%
Older (65 plus)	94,263	1	10.9%	12.4%
Median Age	35.3			Median Age = 36.3

Sources: US Census Bureau; Indiana Business Research Center

Population Estimates by Race or Hispanic Origin in 2006	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
American Indian or Alaska Native Alone	2,967	1	0.3%	0.3%
Asian Alone	13,935	1	1.6%	1.3%
Black Alone	226,050	1	26.1%	8.9%
Native Hawaiian and Other Pac. Isl. Alone	654	1	0.1%	0.0%
White Alone	608,734	1	70.3%	88.3%
Two or More Race Groups	13,164	1	1.5%	1.1%
Hispanic or Latino(can be of any race)				
Non-Hispanic or Latino	808,693	1	93.4%	95.2%
Hispanic or Latino	56,811	2	6.6%	4.8%

Source: US Census Bureau

Household Types	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Households in 2000 (Includes detail not shown below)	352,164	1	100.0%	100.0%
Married With Children	64,880	1	18.4%	23.8%

Married Without Children	80,281	1	22.8%	29.8%
Single Parents	41,470	1	11.8%	9.1%
Living Alone	111,990	1	31.8%	25.9%

Source: US Census Bureau

Housing	Number	Rank in State	Pct Dist. in County	Pct Dist. in State
Total Housing Units in 2006 (estimate)	416,045	1	100.0%	100.0%
Total Housing Units in 2000 (includes vacant units)	387,183	1	100.0%	100.0%
Owner Occupied (Pct. distribution based on all housing units) Median Value (2000)	208,957 $99,000	1 19	54.0% --	65.9% --
Renter Occupied (Pct. distribution based on all housing units) Median Rent (2000)	143,207 $567	1 8	37.0% --	26.3% --

Source: US Census Bureau

Education	Number	Rank in State	Percent of State	Indiana
School Enrollment (2006/2007 Total Reported)	171,295	1	14.8%	1,154,826
Public	139,029	1	13.3%	1,045,702
Private	32,266	7	29.6%	109,124
High School Graduates (2005/2006)	7,743	2	12.4%	62,296
Going on to Higher Education	6,689	2	12.9%	51,976
4-year	5,179	2	13.5%	38,334
2-year	1,051	2	11.7%	8,991
Voc/tech.	459	2	9.9%	4,651
Adults (25+ in 2000 Census)	553,459	1	14.2%	3,893,278
with High School diploma or higher	81.6%	36		82.1%
with B.A. or higher degree	25.4%	5		19.4%

Sources: Indiana Department of Education; US Census Bureau
Notes: 1) School enrollment figures for 2006/2007 are preliminary. 2) Private enrollment includes home schools. 3) County rankings for high-school graduates continuing to higher education are subject to revision. Data from the Indiana Department of Education for Vigo County appear to include an erroneous entry. Until the data has been corrected by IDOE, Vigo will be removed from the rankings.

Income and Poverty	Number	Rank in State	Percent of State	Indiana
Per Capita Personal Income (annual) in 2005	$36,286	5	116.4%	$31,173
Median Household Income in 2004	$42,702	45	98.8%	$43,217
Poverty Rate in 2004	14.1%	6	127.0%	11.1%
Poverty Rate among Children under 18	21.1%	4	134.4%	15.7%
Welfare (TANF) Monthly Average Families in 2006	9,858	1		
Foodstamp Recipients in 2006	116,272	1		
Free and Reduced Fee Lunch Recipients in 2006	75,981	1	20.3%	374,221

Sources: U.S. Bureau of Economic Analysis; US Census Bureau; Indiana Family Social Services Administration; Indiana Department of Education

Health and Vital Statistics in 2005	Number	Rank in State	Percent of State	Indiana
Births	14,653	1	16.8%	87,088
Births to Teens	1,823	1	19.0%	9,604
Deaths	7,526	1	13.5%	55,623

Source: Indiana State Department of Health

Labor Force in 2006	Number	Rank in State	Percent of State	Indiana
Total Resident Labor Force	471,981	1	14.4%	3,271,496
Employed	449,005	1	14.4%	3,108,806
Unemployed	22,976	1	14.1%	162,690
Unemployment Rate	4.9	48	98.0%	5.0
November 2007 Unemployment Rate	**4.4**	**44**	**100.0%**	**4.4**

Source: Bureau of Labor Statistics; Indiana Department of Workforce Development

Employment and Earnings by Industry in 2005 (NAICS)	Employment	Pct Dist. in County	Earnings ($000)	Pct Dist. In County	Avg. Earnings Per Job
Total by place of work	677,633	100.0%	$36,401,765	100.0%	$53,719

Wage and Salary	632,031	93.3%	$26,412,019	72.6%	$41,789
Farm Proprietors	211	0.0%	$1,163	0.0%	$5,512
Nonfarm Proprietors	45,391	6.7%	$3,348,789	9.2%	$73,776
Farm	508	0.1%	$10,521	0.0%	$20,711
Nonfarm	677,125	99.9%	$36,391,244	100.0%	$53,744
Private	597,723	88.2%	$31,635,841	86.9%	$52,927
Accommodation, Food Serv.	48,507	7.2%	$891,937	2.5%	$18,388
Arts, Ent., Recreation	11,622	1.7%	$555,941	1.5%	$47,835
Construction	36,555	5.4%	$2,413,972	6.6%	$66,037
Health Care, Social Serv.	72,701	10.7%	$3,682,501	10.1%	$50,653
Information	12,594	1.9%	$850,662	2.3%	$67,545
Manufacturing	72,587	10.7%	$6,957,494	19.1%	$95,850
Professional, Tech. Serv.	38,483	5.7%	$2,894,435	8.0%	$75,213
Retail Trade	66,396	9.8%	$1,981,131	5.4%	$29,838
Trans., Warehousing	37,141	5.5%	$1,642,907	4.5%	$44,234
Wholesale Trade	33,493	4.9%	$2,188,288	6.0%	$65,336
Other Private (not above)	167,644	24.7%	$7,576,573	20.8%	$45,194
Government	79,402	11.7%	$4,755,403	13.1%	$59,890

Source: US Bureau of Economic Analysis

Assessed Property Value in 1999 (for taxes payable in 2000)	Value	Rank in State	Pct Dist. in County	Pct Dist. in State
Assessed Value by Property Class	$9,598,695,170	1	100.0%	100.0%
Commercial & Industrial	$5,483,077,030	1	57.1%	43.2%
Residential	$3,678,313,170	1	38.3%	41.5%
Agricultural	$24,252,960	89	0.3%	9.6%
Utilities	$413,052,010	1	4.3%	5.6%
Total Assesed Value Per Capita	$11,811	16		

Source: The State Board of Tax Commissioners

Residential Building Permits in 2006	Units	Pct Dist. in County	Pct Dist. in State	Cost ($000)	State Cost ($000)
Total Permits Filed	2,891	100.0%	100.0%	$431,067	$4,687,933
Single Family	2,145	74.2%	84.1%	$354,218	$4,343,823
Two Family	148	5.1%	3.5%	$17,312	$103,869
Three & Four Family	124	4.3%	2.0%	$10,009	$41,336
Five families and More	474	16.4%	10.4%	$49,529	$198,905

Source: US Census Bureau (Greene County totals are not included as it does not currently issue building permits.) Note: Detail cost may not sum to total due to rounding.

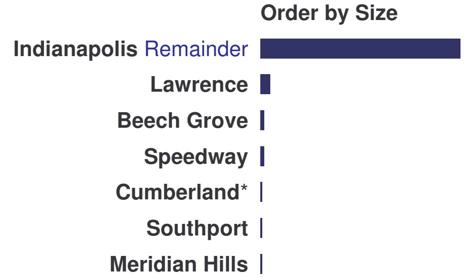
Commuting Patterns - Top 5 in 2005					
Into Marion FROM	Number	Percent	Out of Marion TO	Number	Percent
All Areas	198,507	28.7%	All Areas	34,151	6.5%
Hamilton County	51,703	7.5%	Hamilton County	11,861	2.3%
Hendricks County	35,182	5.1%	Hendricks County	5,933	1.1%
Johnson County	29,583	4.3%	Johnson County	5,318	1.0%
Hancock County	16,600	2.4%	Hancock County	1,573	0.3%
Morgan County	15,099	2.2%	Boone County	1,161	0.2%

Source: Indiana Department of Revenue

Cities and Towns in Marion County

	Population in 2006	% of County
Beech Grove	14,082	1.6%
Clermont	1,465	0.2%
Crows Nest	105	0.0%
Cumberland	2,738	0.3%*
Homecroft	733	0.1%
Indianapolis Remainder	785,597	90.8%
Lawrence	41,791	4.8%

Order by Size



Meridian Hills	1,708	0.2%
North Crows Nest	42	0.0%
Rocky Ripple	698	0.1%
Southport	1,731	0.2%
Speedway	12,416	1.4%
Spring Hill	97	0.0%
Warren Park	1,619	0.2%
Williams Creek	410	0.0%
Wynnedale	272	0.0%

* Population in this county is shown, this city or town crosses county lines.

Warren Park |
Clermont |
Homecroft |
Rocky Ripple |
Williams Creek |
Wynnedale |
Crows Nest |
Spring Hill |
North Crows Nest |

Links to Maps:
Census Tract Boundary Map of Marion county
Tiger Mapping Service Map of Area
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Updated: December 21, 2007 at 20:04

APPENDIX 6

BMP Report

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Introduction

In the fall of 2006, the Marion County Soil and Water Conservation District (SWCD) was awarded funding through the Section 319 Non Point Source Program grant of the Indiana Department of Environmental Management (IDEM) to develop a Watershed Management Plan (WMP) for the Lower Fall Creek Watershed. The SWCD retained the professional services of Christopher B. Burke Engineering, Ltd. (CBBEL) to serve as the Watershed Coordinator for the development of the WMP. As a part of this planning effort, CBBEL was also tasked with developing a short report identifying potential best management practices (BMPs) within the critical areas determined by the Steering Committee and the Working Groups.

Critical areas are specific areas or activities in the watershed that are suspected of degrading water quality. Implementation of management measures for these specific areas or activities in the watershed should have the greatest impact on water quality. Focusing on a few specific areas or activities should be more effective at improving water quality than a generalized watershed-based program. For this reason the Steering Committee and Working Groups have identified the following critical areas within the Lower Fall Creek Watershed:

- Sediment and erosion control from active construction sites.
- Indian Lake Watershed in regard to the documented sedimentation issues as well as input from local representatives.
- Golf Courses (8) in regard to the potentially excessive application of nutrients, potential lack of riparian corridors along Fall Creek and tributary streams, and the potential pollutant loadings from on site detention ponds during high water events.
- Lakes larger than 50 acres and surrounded by residential land use (4) in regard to the potentially excessive application of nutrients, potential pathogen loadings from wildlife and improperly treated household wastewater, and potential destabilization of shorelines.
- Indiana State Fairgrounds in regard to the elevated *E. coli* levels downstream of the Fairgrounds suspected to be as a result of the stormwater runoff from the livestock barns.
- Wellfield Protection Areas within the Lower Fall Creek Watershed in regard to the need for increased efforts to protect drinking water from contamination.
- Septic Tank Elimination Program (STEP) areas prioritized by the Marion County Department of Health and the City of Indianapolis Department of Public Works.
- Areas in need of water related recreation

The critical areas mentioned above may or may not be suitable for implementation of a BMP demonstration project within this particular planning effort. Items such as erosion & sediment control, the Indiana State Fairgrounds, the areas in need of water related recreation, and the STEP areas will need to have working relationships established and long-term partnerships developed prior to implementation of projects. Therefore, for the purposes of this document the 8 golf courses and 4 lakes larger than 50 acres will be highlighted for potential BMP implementation. Also there are numerous schools within the Lower Fall Creek that are located within sensitive Wellfield Protection Areas and these properties may be highly visible with accessibility to the BMP demonstration sites.

Based on the analysis of water quality studies completed by the Marion County Health Department, IDEM, and the City of Indianapolis Department of Public Works the following quality conclusions have been drawn:

- Bacteria concentrations exceed EPA recommended thresholds and Water Quality Standards throughout the Lower Fall Creek Watershed.
- Phosphorus levels are exceeding EPA recommended thresholds throughout the Lower Fall Creek Watershed.
- Total nitrogen concentrations are exceeding EPA recommended thresholds in the Mud Creek - Sand Creek and Mud Creek Headwaters Subwatersheds.
- Biological communities are stressed throughout the Lower Fall Creek Watershed.
- Habitat is degraded within the Mud Creek - Sand Creek and Mud Creek Headwaters Subwatersheds.

By implementing BMPs such as those described in the following sections, pollutant sediment, nutrient, and pathogen loadings are expected to be reduced addressing the impairments listed above. Once the demonstration projects have been installed, pollutant load reductions will be calculated and provided as an addendum to this document. As these projects are demonstrations, it can be anticipated that future projects will be implemented throughout the watershed as stakeholders are able to see the success of these individual projects.

Golf Courses

Why Many golf courses in the watershed lie adjacent to or cross over streams and tributaries to Fall Creek. These courses are utilized by thousands of stakeholders and can serve as high profile, high visibility demonstration areas. The common pollutant associated with golf courses is excess nutrients from fertilizer and chemical application

Where The following is a list of golf courses within the Lower Fall Creek Watershed and any special considerations regarding water quality.

Ironwood Golf Club
- Borders the northeastern shoreline of Stonebridge Lake
- Several residential properties abut golf course detention ponds:
  - approximately 26 homes along Brixton Lane
  - approximately 10 homes along Midnight Pass
  - approximately 11 homes along Knightsridge Lane
  - approximately 13 homes along Burning Ridge Lane
- 10 detention ponds
- Approximately 1 stream mile of Mud Creek passes through Ironwood golf course with sparse and disconnected riparian corridor

Gray Eagle Golf Course
- Approximately 1.5 stream miles of Mud Creek passes through Gray Eagle Golf Course
- Majority of riparian corridor > 30 feet of each streambank
- Several residential properties abut golf course detention ponds:
  - Approximately 4 homes along unnamed road off of Gray Eagle Drive
  - Approximately 10 homes along Duval Drive
  - Approximately 13 homes along Largo Drive
- 5 detention ponds

Indian Lake Golf Course
- Lies completely within the Lawrence Wellfield Protection Area
- 1 detention pond

Brendonwood Golf Club
- Abuts Fall Creek along approximately 2 stream miles
- Majority of riparian corridor >30 feet on each streambank
- No detention ponds

Hillcrest County Club
- Direct discharge to Fall Creek via large detention pond draining to Hillcrest Creek

Old Oakland Golf Club

- Approximately 0.5 mile of India Branch and 1 mile of Indian Creek passes through Old Oakland Golf Course
- This course has completed streambank restoration/stabilization projects
- Majority of riparian corridor >30 feet each streambank
- 7 detention ponds

Fort Golf Course

- Approximately 0.5 stream mile of Fort Branch and approximately 0.25 stream mile of Camp Creek passes through Fort Golf Course
- This course is in the process of achieving certification through the Audubon International's Cooperative Sanctuary Program for Golf Courses
- A small portion of the course lies within the Geist Wellfield Protection Area as Fort Branch exits the course.
- Majority of Fort Branch riparian corridor >50 feet each streambank
- No riparian corridor present along Camp Creek as it passes through course

The Hawthorns Golf Club

- Only the northern portion of the golf course is within the Lower Fall Creek watershed
- Approximately 1 stream mile of Mud Creek is the northern border of the golf course.
- Approximately 50% of the riparian corridor is >30 feet on each bank
- 3 detention ponds

Who

Indian Lake Country Club
David Sherry
Superintendant
10502 E. 75th Street
Indianapolis, IN 46236
317-823-6552

Brendonwood Golf Club:
Tom Smith
Superintendant
5925 Braewick Rd
Indianapolis, IN 46226
317-547-8717

Hillcrest Country Club:
Robert Reynolds
Club Manager
6098 Fall Creek Road
Indianapolis, IN 46220
317-251-1425

Ironwood Golf Club:
Michael Jordan
General Superintendant
10955 Fall Road
Fishers, IN 46037
317-842-0551

Gray Eagle Golf Course
Frank Bayon
General Manager
12500 Brooks School Road
Fishers, IN 46037
317-845-2900

The Hawthorns Golf Club
Jeff Buttitta
Director of Golf
12255 Club Pointe
Fishers, IN 46037
317-845-9100

Old Oakland Golf Club	**Fort Golf Course**
Chase Waldon	Jon Chapple
Golf Course Superintendant	Head Golf Professional
11611 E 75th Street	6002 N Post Road
Indianapolis, IN 46236	Indianapolis, IN 46216
317-823-4791	317-543-9597

How

Contact Owners/operators of golf courses within the Lower Fall Creek Watershed to determine willingness to participate in a demonstration project.

Schedule a site visit to complete assessment of streambanks, detention ponds, drainage outlets, common areas such as the parking areas or Club House, etc.

Rank potential projects according to:

- potential load reductions
- visibility of the project site
- access to the project site
- ability to provide required in-kind or cash match contribution.
- willingness to complete long-term monitoring and maintenance of project area

What

Potential BMPs suitable for golf courses include:

- Rain gardens, rain barrels, porous pavement in common areas, parking lots or near Club House
- Vegetated swales at inlets and/or outlets to detention ponds or streams
- Soil sampling to determine fertilizer/chemical needs
- Pond or streambank stabilization on needed segments
- Pond or streambank filter strips or “no mow” zones
- Establish or enhance riparian corridors along streams
- Participation in Audubon International’s Cooperative Sanctuary Program for Golf Courses
- Participation in Groundwater Foundation’s Groundwater Guardian Green Site program

Residential Lakes

Why Inland lakes surrounded by residential land use may be severely impacted due to excess lawn fertilizers, pet & wildlife waste, and even failing residential septic systems. As the lake systems are impacted by increased sediment, bacteria and nutrient loadings human health issues, aesthetic value, and property values may also be negatively impacted as a result.

Where The following is a listing of those lakes larger than 50 acres, surrounded by residential land use, and special considerations if applicable.

Lake Maxinhall

- Approximately 74.5 acres surrounded by approximately 80 residential properties close to the shoreline
- Approximately 60% of the lake lies with the Fall Creek Wellfield Protection Area
- Allisonville Road separates Lake Maxinhall from an area identified by the Marion County Health Department as a low priority Septic Tank Elimination Program (STEP) area
- Redi-mix concrete facility drains to Lake Maxinhall under 56th Street
- Active participation in controlling Canada Goose population in accordance with IDNR regulations
- The active Homeowner's Association has expressed an interest in partnering to install a demonstration project.

Indian Lake

- Approximately 54 acres with heavily wooded shoreline with approximately 30 residential properties set back from shoreline
- Approximately 75% of the lake lies within the Fall Creek Wellfield Protection Area
- Known sedimentation and bank destabilization issues
- Owns and operates private dredge to remove excess sediment from May to October
- An Indian Lake representative has expressed an interest in partnering to install a demonstration project.

Lake Kesslerwood (East & West)

- Approximately 94 acres surrounded by approximately 125 single family and 22 multi-family residences close to the shoreline
- Fall Creek Parkway North Drive separates Lake Kesslerwood from Fall Creek along the southern boundary

Stonebridge Lake

- Approximately 75 acres surrounded by approximately 150 residential properties close to the shoreline
- The eastern portion of Stonebridge Lake is bordered by Ironwood Golf Course along the un-buffered southern shoreline.
- Mud Creek passes between this shoreline and Hamilton Pass

Who

Lake Maxinhall
Eric Becker
317-896-5452

Indian Lake
Mark Rumreich
317-587-4623

Kesslerwood East
Mac Martin
317-259-6600

Kesslerwood West
No contact information available

Stonebridge Lake
No contact information available

How

Contact representatives from each lake to inquire about willingness to participate in a demonstration project. Representatives from Lake Maxinhall and Indian Lake have expressed interest in this program.

Schedule a site visit to complete assessment of shoreline, inlets and outlets to the lake, common areas around the lake, and individual residential lots as interested.

Rank potential projects according to:

- potential load reductions
- visibility of the project site
- access to the project site
- ability to provide required in-kind or cash match contribution
- willingness of landowner or association to complete long-term monitoring and maintenance of project area

What

Potential BMPs suitable for residential lakes include:

- Rain gardens, rain barrels, porous pavement, etc. in common areas or on individual lots
- Vegetated swales at inlets to lake or outlets from lake
- Soil sampling to determine fertilizer/chemical needs
- Shoreline stabilization on needed segments
- Shoreline filter strips or “no mow” zones

Schools

Why There are 78 schools within the Lower Fall Creek Watershed which increases the potential for willing partners. Further, many school properties allow for high visibility, accessibility, and also opportunities for other programs such as learning labs, outdoor classrooms, wildlife habitat and food plots, etc.

Where Exhibit 1 indicates the location and names of the schools within the Lower Fall Creek Watershed.

Who Table 1 identifies the Name, Contact (if available), and Address for each of the schools within a Wellfield Protection Area (WFPA). Information is also provided to indicate which Wellfield and the time of travel area (either 1-yr or 5-yr). No schools within the Lower Fall Creek Watershed were identified as located within the regulated Floodplains.

How **Contact** Principals from each school, beginning with those located in the 1-yr time of travel, to inquire about willingness to participate in a demonstration project.

Schedule a site visit to complete assessment of the school properties.

Develop listing of potential projects for each site.

Rank potential projects according to:

- potential load reductions
- willingness of school administration to complete long-term monitoring and maintenance of project area
- visibility of the project site
- access to the project site
- ability to provide required in-kind or cash match contribution.

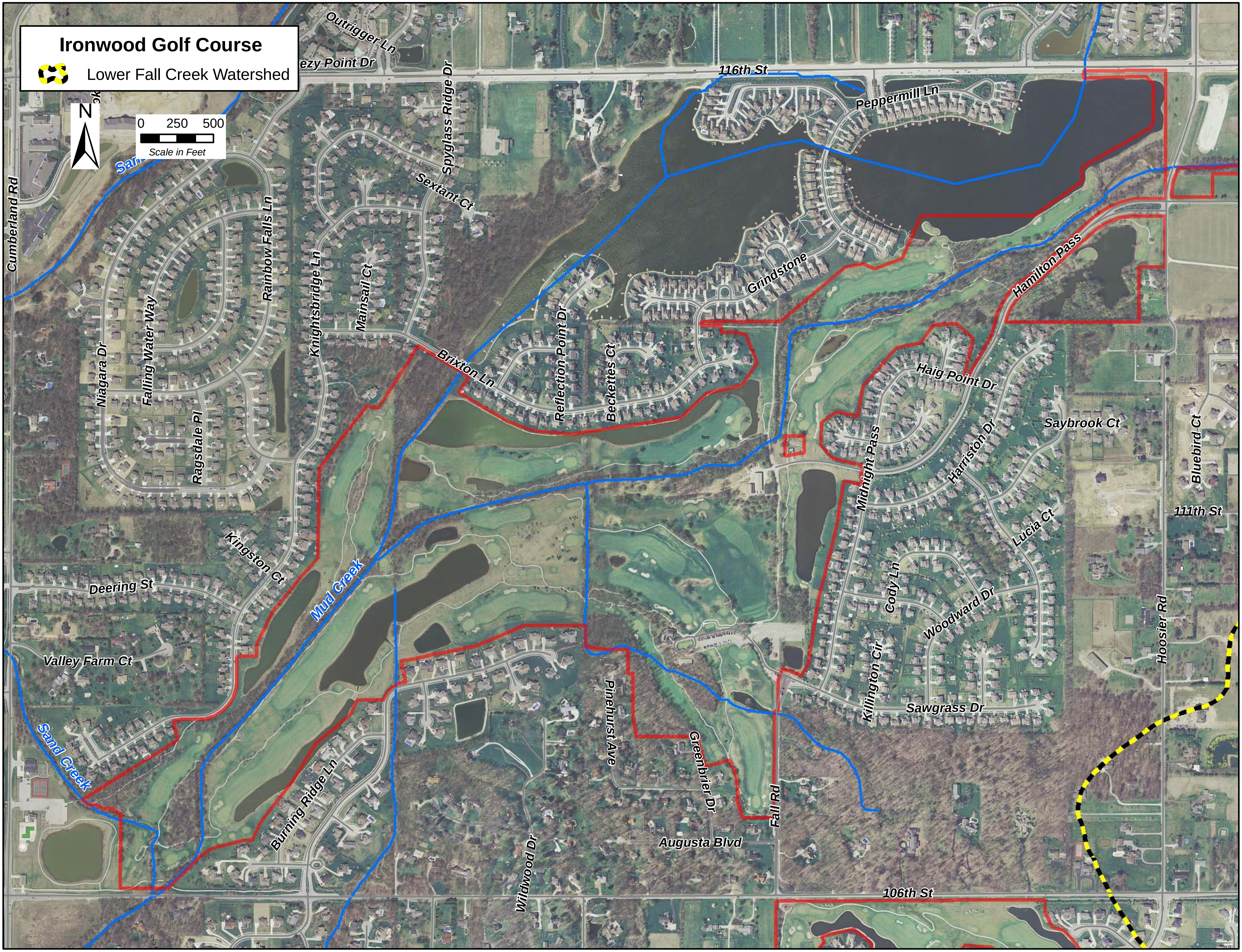
What Potential BMPs suitable for school properties include:

- Rain gardens and rain barrels in common areas or individual lots
- Vegetated swales along drainage routes
- Soil sampling to determine fertilizer/chemical needs
- “No mow” zones
- Tree plantings
- Critical area seeding/planting

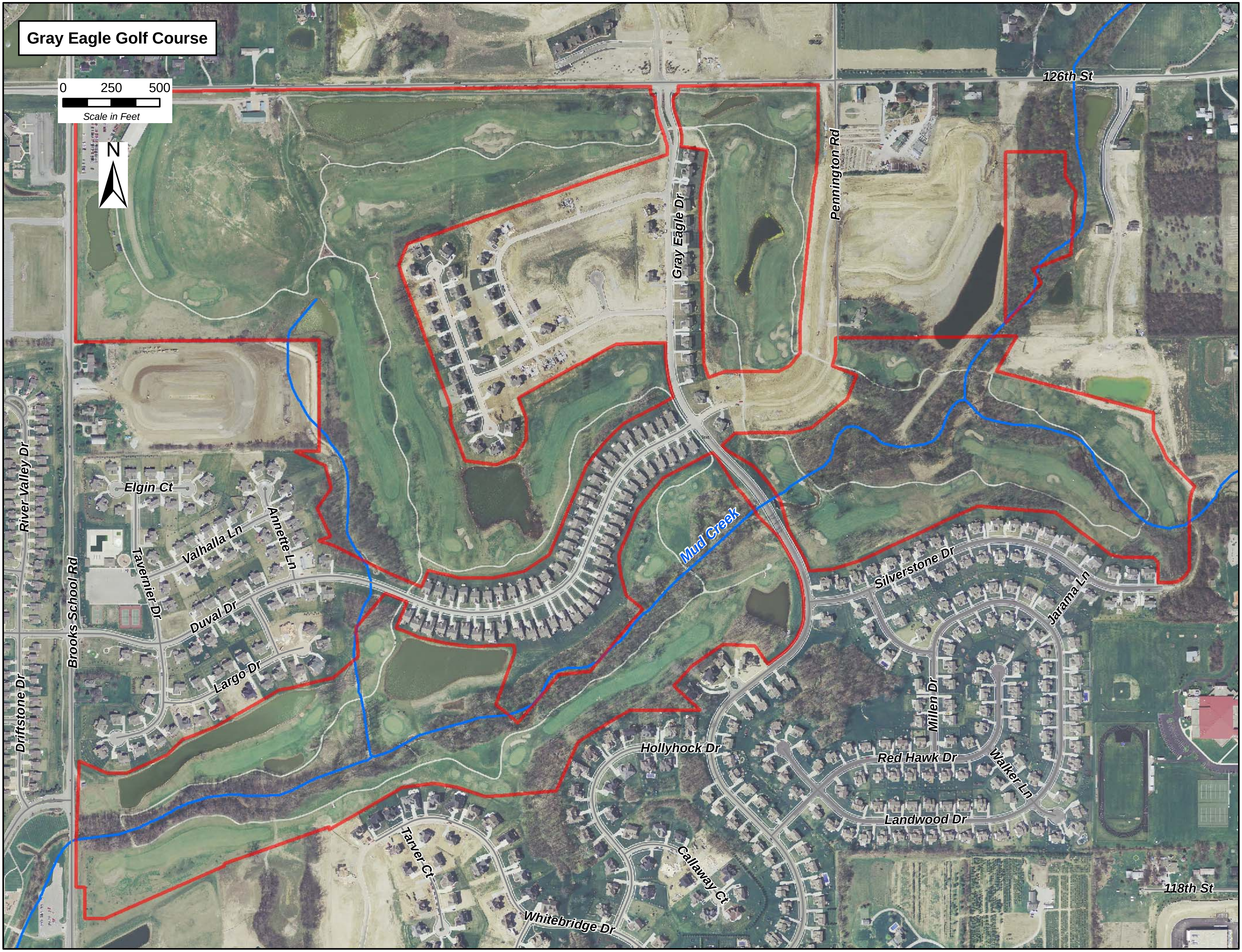
*For those areas located within the 1-yr time of travel interested in establishing stormwater infiltration areas such as vegetated swales of parking lot runoff bio-retention areas, pre-treatment should be required to further reduce the potential for groundwater pollution.

Table 1: Lower Fall Creek Schools in Wellfield Protection Areas

SCHOOL	ADDRESS	City	ZIP	PRINCIPAL	PHONE (317)	Time of Travel	Wellfield
Compassion Christian Child Care	1710 E 49th St	Indianapolis	46205	Samuels Wynn	251-0052	1yr	Fall Creek
Crossroads Rehabilitation Ctr	4740 Kingsway Dr	Indianapolis	46205		466-2010	1yr	Fall Creek
Day Nursery Assn Indpls Med Ctr	1001 W 10th St	Indianapolis	46204	Deborah Green	630-6200	1yr	Riverside
Horizon Christian School	7702 Indian Lake Rd	Indianapolis	46236	Frank Onorio	823-4533	1yr	Geist
Indiana School For The Deaf	1200 E 42nd St	Indianapolis	46205	Bob Kovatch	924-4374	1yr	Fall Creek
Vincennes University Extension	1200 E 42 St	Indianapolis	46205		923-2305	1yr	Fall Creek
Belzer Middle School	7555 E 56th St	Indianapolis	46226	Ron Davie	545-7411	5yr	Lawrence
Brook Park Elementary	5259 David St	Indianapolis	46226	Barbara Stryker	546-4988	5yr	Lawrence
Capitol City SDA School	2143 Boulevard Pl	Indianapolis	46202		926-0058	5yr	Riverside
Centralized Kindergarten-South	7300 E 56th St	Indianapolis	46226	Denna Renbarger	545-2614	5yr	Lawrence
Flanner House Elementary	2424 Dr M L King Jr St	Indianapolis	46208	Cynthia Diamond	925-4231	5yr	Riverside
Harrison Hill Elementary	7510 E 53rd St	Indianapolis	46226	Sharon Smith	546-2488	5yr	Lawrence
IPS #011 Edgar H. Evans	3202 E 42nd St	Indianapolis	46205	Cheryl Murray	226-4211	5yr	Fall Creek
IPS #069 Joyce Kilmer	3421 N Keystone Ave	Indianapolis	46218	Judie Williams	226-4269	5yr	Fall Creek
IPS #070 Mary E. Nicholson	510 E 46th St	Indianapolis	46205	Joyce Akridge	226-4270	5yr	Fall Creek
IPS #087 George Washington Carver	2411 Indianapolis Ave	Indianapolis	46208	Paula Corley	226-4287	5yr	Riverside
IPS Crispus Attucks	1140 Dr M L King Jr St	Indianapolis	46202	Annjo Glenn	226-4007	5yr	Riverside
Julian Center	2011 N Meridian St	Indianapolis	46202	Carlene Richardson	920-9320	5yr	Riverside
Lawrence Central High School	7300 E 56th St	Indianapolis	46226	Caroline Hanna	545-5301	5yr	Lawrence
Lawrence Christian School	5450 Boy Scout Rd	Indianapolis	46226		545-5595	5yr	Lawrence
Our Savior Lutheran Academy	261 W 25th St	Indianapolis	46208	Felix Renteria	925-3737	5yr	Riverside
St Joan Of Arc School	500 E 42nd St	Indianapolis	46205	Diane Cole	283-1518	5yr	Fall Creek

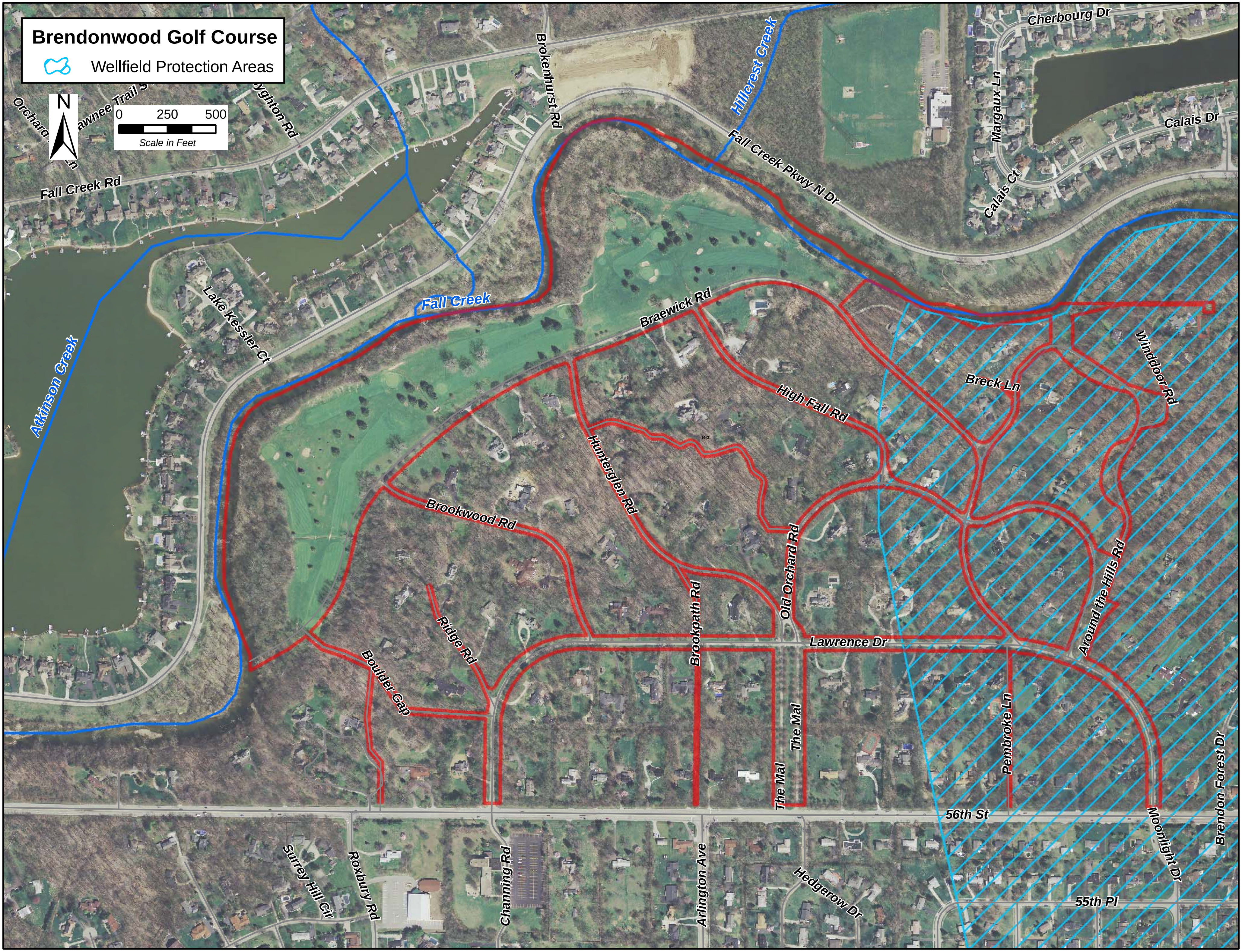


Ironwood Golf Course
Lower Fall Creek Watershed
N
0 250 500
Scale in Feet
Outrigger Ln
116th St
Peppermill Ln
Spyglass Ridge Dr
Sextant Ct
Cumberland Rd
Rainbow Falls Ln
Knightsbridge Ln
Mainsail Ct
Grindstone
Hamilton Pass
Brixton Ln
Reflection Point Dr
Beckettes Ct
Niagara Dr
Falling Water Way
Ragsdale Pl
Haig Point Dr
Saybrook Ct
Harriston Dr
Midnight Pass
Bluebird Ct
111th St
Lucia Ct
Kingston Ct
Deering St
Mud Creek
Cody Ln
Woodward Dr
Valley Farm Ct
Hoosier Rd
Pinehurst Ave
Killington Cir
Sawgrass Dr
Sand Creek
Greenbrier Dr
Burning Ridge Ln
Fall Rd
Augusta Blvd
Wildwood Dr
106th St



Gray Eagle Golf Course
0 250 500
Scale in Feet
N
126th St
Gray Eagle Dr
Pennington Rd
Elgin Ct
River Valley Dr
Valhalla Ln
Annette Ln
Taverneir Dr
Mud Creek
Silverstone Dr
Jarama Ln
Duval Dr
Brooks School Rd
Largo Dr
Driftstone Dr
Millen Dr
Hollyhock Dr
Red Hawk Dr
Walker Ln
Landwood Dr
Tarver Ct
Callaway Ct
118th St
Whitebridge Dr

Indian Lake Golf Course
Lower Fall Creek Watershed
Wellfield Protection Areas
N
0
250
500
Scale in Feet
Chesapeake Dr S
Potomac Dr
Chesapeake Dr W
Seaview Ln
77th St
Pennycroft Dr
Limbach Ct
75th St
Sunnyside Rd
Rainbow Ln N
River Birch Ln
Elm Ridge Dr
Campfire Run
Elm Ridge Ct

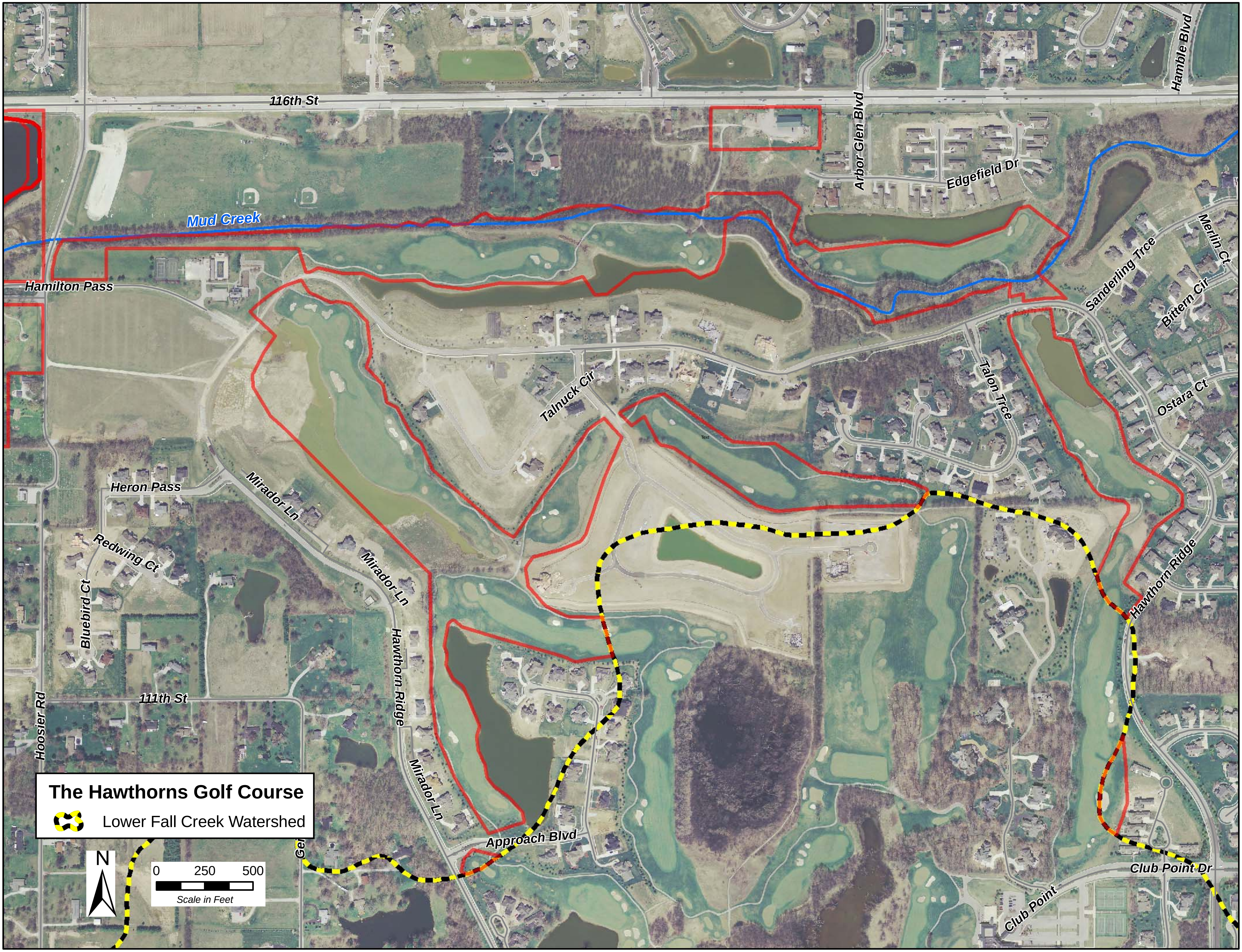


Brendonwood Golf Course
Wellfield Protection Areas
N
0 250 500
Scale in Feet
Fall Creek Rd
Brokenhurst Rd
Hillcrest Creek
Cherbourg Dr
Margaux Ln
Calais Dr
Calais Ct
Fall Creek Pkwy N Dr
Fall Creek
Atkinson Creek
Lake Kessler Ct
Braewick Rd
High Fall Rd
Breck Ln
Windloor Rd
Hunterglen Rd
Brookwood Rd
Old Orchard Rd
Around the Hills Rd
Ridge Rd
Boulder Gap
Brookpath Rd
Lawrence Dr
The Mal
The Mal
Pembroke Ln
Brendon Forest Dr
56th St
Moonlight Dr
Surrey Hill Cir
Roxbury Rd
Channing Rd
Arlington Ave
Hedgerow Dr
55th Pl

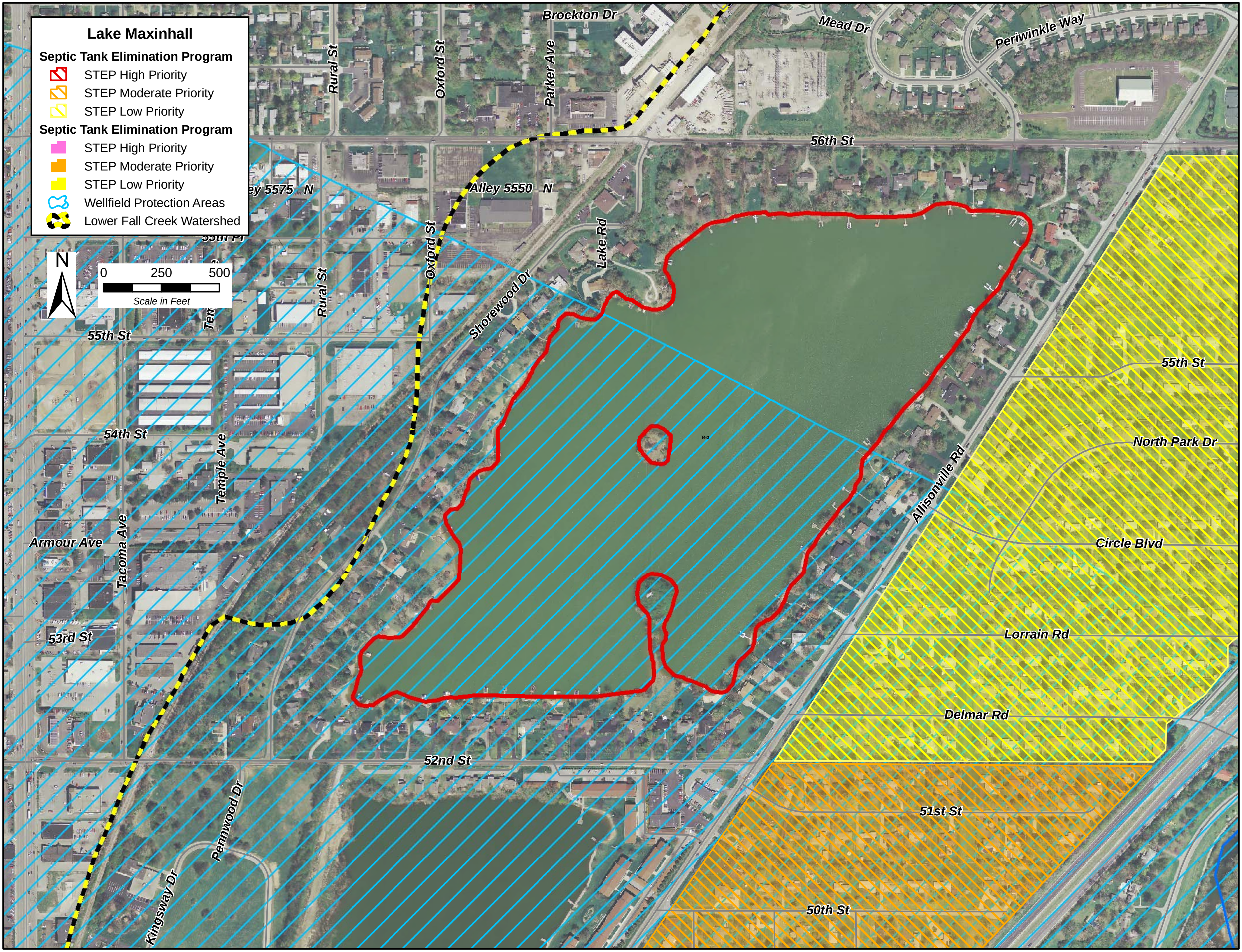

Halfmoon Ln
Winnock Dr
Lakeknoll Dr
Cricklewood Rd
Farmleigh Dr
Grosvenor Pl
Graham Rd
Lands End Ln
Lowanna Way
Lakeland Dr
Landborough S Dr
65th Pl
65th St
Ashurst St
Harbridge Rd
Breamore Rd
Avalon Lane East Dr
Creekside Ln
Blue Creek
Cardinal Ln
Hillcrest Creek
Johnson Rd
Macatuck Dr
Sycamore Hill Dr
Brokenhurst Rd
Myrtle Ln
Hillcrest Ln
62nd Pl
Avalon Ln
Autumn Ln
Azure Ln
Fall Creek Rd
62nd Pl
Hillcrest Ln
Hillcrest Golf Course
Lower Fall Creek Watershed
N
0 250 500
Scale in Feet

Old Oakland Golf Course
Lower Fall Creek Watershed
Wellfield Protection Areas
N
0 250 500
Scale in Feet
Bayridge Cir E
75th St
Oakland Hills Cir
Oakland Hills Ct
Oakland Hills Dr
Royal Oakland Dr
Royal Oakland Ct
Golf Course Dr
Geist Valley Blvd
Fairway Ct
Pebblebrook W Dr
Laurel Oak Dr
Rossi Dr
River Birch Ln
Indian Creek
India Branch
Elm Ridge Dr
Ravenna Way
71st St
Cable Dr
Old Orchard Dr
Meadow Ln
Turfgrass Way
Indian Lake Blvd S
Meadowgreen Dr
Palatka Ct
Brave Ct
Silver Tree Dr
Brandon St
Trolley Rd
Rairoad
Olvey St
Verdin St
Sunnyside Rd
Royal Oakland Pl
Breckenridge Ct
Oaklandon Rd
Railroad St
Broadway St
Paradise Dr
65th St
65th St
Teeter Ln
Smith Rd
64th St
Ruby St
Nogales St
Titania Dr
36
Blakeview Dr
Ware St
Maple St
63rd St
Teetor Ct

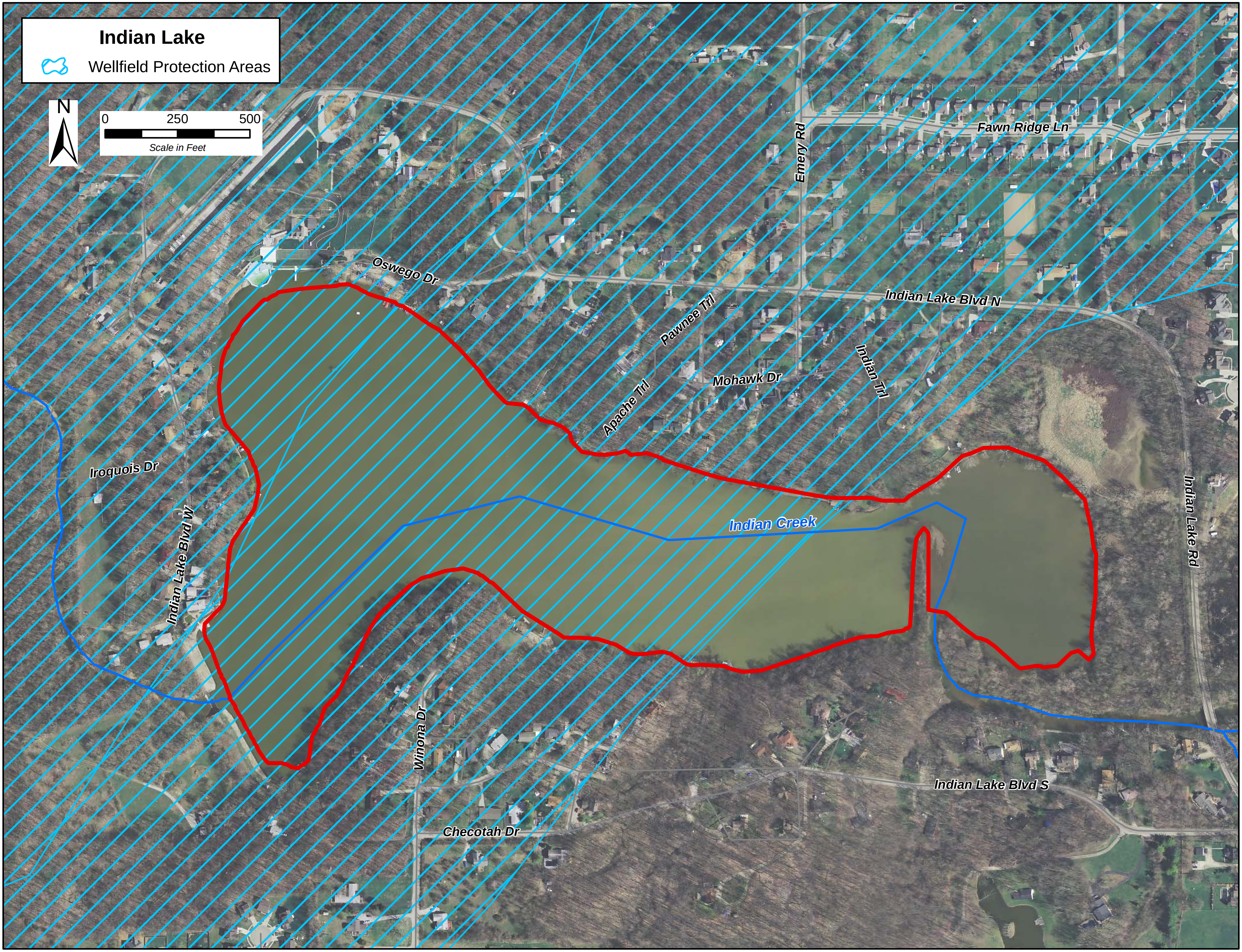
Fort Golf Course
Wellfield Protection Areas
0 250 500
Scale in Feet
N
Camp Creek
Lee Rd
63rd St
Fort Branch
Schoen Creek
Shafter Rd
Pistol Run
Post Rd
Wood Rd
East 59th St
School Rd
Lawton Loop W Dr
Hess Ct



The Hawthorns Golf Course
Lower Fall Creek Watershed
116th St
Arbor Glen Blvd
Hamble Blvd
Edgefield Dr
Mud Creek
Hamilton Pass
Merlin Ct
Sanderling Trce
Bittern Cir
Talon Trce
Talnuck Cir
Ostara Ct
Heron Pass
Mirador Ln
Redwing Ct
Bluebird Ct
Hawthorn Ridge
111th St
Hoosier Rd
Approach Blvd
Club Point Dr
Club Point
N
0
250
500
Scale in Feet

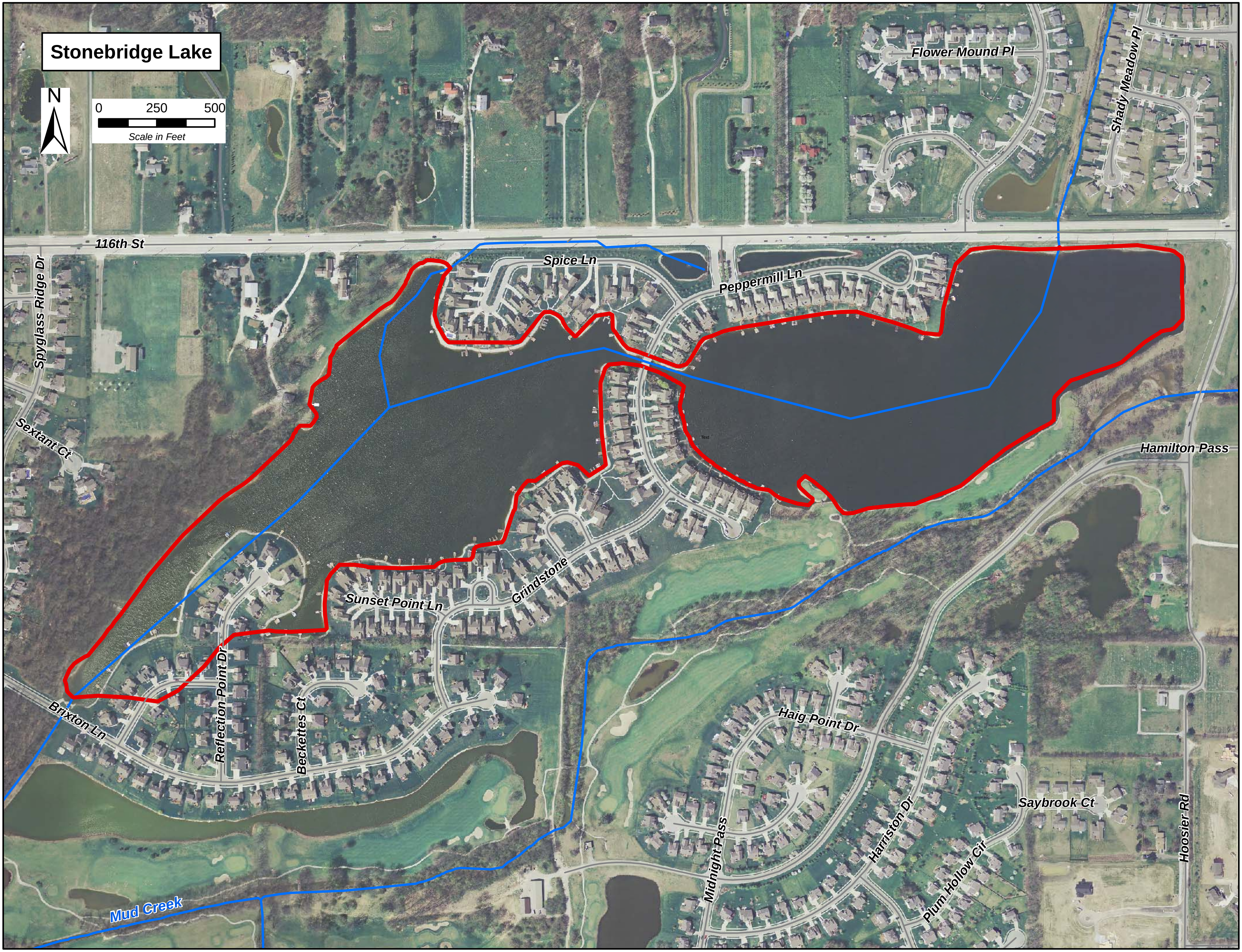


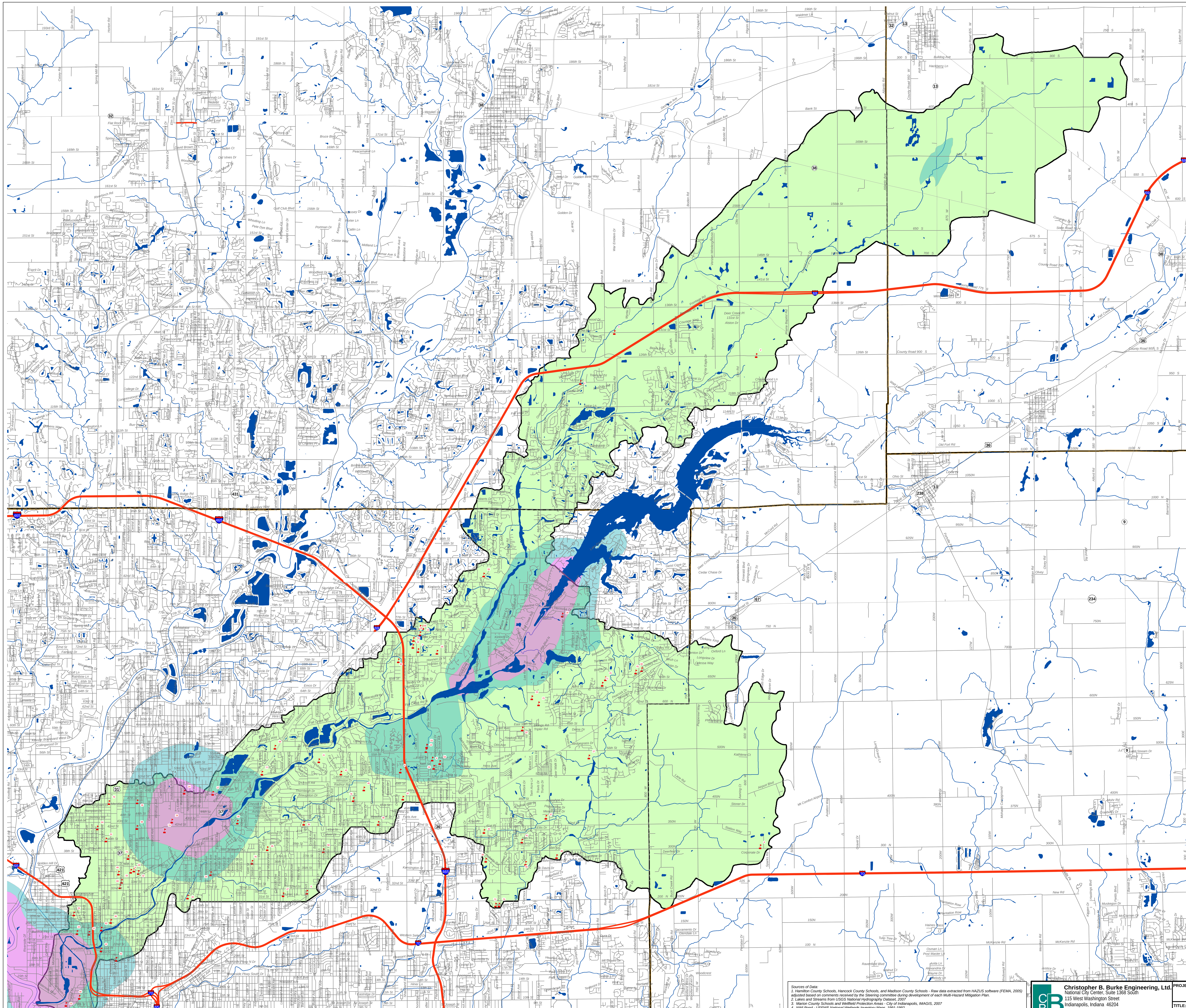
Lake Maxinhall
Septic Tank Elimination Program
STEP High Priority
STEP Moderate Priority
STEP Low Priority
Septic Tank Elimination Program
STEP High Priority
STEP Moderate Priority
STEP Low Priority
Wellfield Protection Areas
Lower Fall Creek Watershed
N
0
250
500
Scale in Feet
Brockton Dr
Mead Dr
Periwinkle Way
Rural St
Oxford St
Parker Ave
56th St
ey 5575 N
Alley 5550 N
Lake Rd
Shorewood Dr
Oxford St
Rural St
55th St
Temple Ave
54th St
Armour Ave
Tacoma Ave
53rd St
55th St
North Park Dr
Allisonville Rd
Circle Blvd
Lorrain Rd
Delmar Rd
52nd St
51st St
50th St
Pennwood Dr
Kingsway Dr



Indian Lake
Wellfield Protection Areas
N
0
250
500
Scale in Feet
Fawn Ridge Ln
Emery Rd
Oswego Dr
Indian Lake Blvd N
Pawnee Trl
Indian Trl
Mohawk Dr
Apache Trl
Iroquois Dr
Indian Lake Blvd W
Indian Creek
Indian Lake Rd
Winona Dr
Indian Lake Blvd S
Checotah Dr

Lake Kesslerwood
N
0
250
500
Scale in Feet
Linton Ln
Andover Rd
Wexford Rd
Wycombe Ln
Rucker Rd
Knyghton Rd
Brokenhurst Rd
Fall Creek Rd
Atkinson Creek
Lake Kessler Ct
Fall Creek Pkwy N Dr
Hunterglen Rd
Braewick Rd
Brookwood Rd
Boardwalk Pl
Kessler Blvd East Dr
Ridge Rd
Guard Hill Ln
Boulder Gap
Lawrence Dr
Fall Creek
56th St


Stonebridge Lake
N
0
250
500
Scale in Feet
Flower Mound Pl
Shady Meadow Pl
116th St
Spice Ln
Peppermill Ln
Spyglass Ridge Dr
Sextant Ct
Hamilton Pass
Grindstone
Sunset Point Ln
Reflection Point Dr
Beckettes Ct
Brixton Ln
Haig Point Dr
Saybrook Ct
Midnight Pass
Harriston Dr
Plum Hollow Cir
Hoosier Rd
Mud Creek



Lower Fall Creek Watershed Schools

Wellhead Protection Areas

- 1 Year Time of Travel
- 5 Year Time of Travel
- Streams & Rivers
- Lower Fall Creek Watershed

Hamilton

Map ID	SCHOOL
1	Hoosier Road Elementary
2	Hamilton Southeastern HS
3	Sand Creek Intermediate School

Hancock

Map ID	School
4	Mt Comfort Elementary

Marion

Map ID	School
5	Auntie Mame's Child Dev Ctr
6	*Belzer Middle School* *
7	Bradford Schools Inc.
8	*Brook Park Elementary* *
9	Building Blocks Academy
10	*Capitol City SDA School* *
11	Cathedral High School
12	Centralized Kindergarten-North
13	*Centralized Kindergarten-South* *
14	*Compassion Christian Child Care* **
15	Craig Middle School
16	Crestview Elementary
17	*Crossroads Rehabilitation Ctr* **
18	Day Nursery Assn Indpls Lilly Br
19	*Day Nursery Assn Indpls Med Ctr* **
20	Divine Savior Evangelical Lutheran
21	Fall Creek Valley Middle School
22	*Flanner House Elementary* *
23	Forest Glen Elementary
24	*Harrison Hill Elementary* *
25	Holy Angels Catholic School
26	*Horizon Christian School* **
27	Indian Creek Elementary
28	*Indiana School For The Deaf* **
29	International Business College
30	*IPS #011 Edgar H. Evans* *
31	IPS #043 James Whitcomb Riley
32	IPS #048 Louis B. Russell
33	IPS #060 William A. Bell
34	*IPS #069 Joyce Kilmer* *
35	*IPS #070 Mary E. Nicholson* *
36	IPS #083 Floro Torrence
37	*IPS #087 George Washington Carver* *
38	IPS #092 Booth Tarkington
39	IPS #098 T.C. Steele
40	IPS #102 Francis Bellamy
41	IPS #103 Francis Scott Key
42	IPS #105 Charles Warren Fairbanks
43	IPS #106 Robert Lee Frost
44	IPS #110 Julian D Coleman
45	IPS Arlington
46	*IPS Crispus Attucks* *
47	IPS Forest Manor
48	IPS John Marshall
49	IPS Shortridge
50	Ivy Tech State College
51	*Julian Center* *
52	KIND Alternative Program
53	*Lawrence Central High School* *
54	*Lawrence Christian School* *
55	Mary Evelyn Castle Elementary
56	McKenzie Career Center
57	Mt Carmel Christian Academy
58	North Star Christian Academy
59	Northwood University
60	Oaklandon Christian School
61	Oaklandon Elementary
62	*Our Savior Lutheran Academy* *
63	Skiles Test Elementary
64	Smarts Starts Here
65	St Andrew The Apostle/St Rita Cath
66	*St Joan Of Arc School* *
67	St Lawrence School
68	St Matthew School
69	St Richard School
70	St Thomas Aquinas School
71	Sunnyside Elementary
72	The Renaissance School
73	The Villages of Indiana
74	*Vincennes University Extension* **
75	Warren Early Childhood Ctr
76	Witness Christ Christian School
77	Worthmore Academy Inc
78	Zion Hope Christian School

Wellfield Protection Areas
* *5 yr Time of Travel*
** *1 yr Time of Travel*

0 0.5 1 2 Miles

N

Sources of Data:
1. Hamilton County Schools, Hancock County Schools, and Madison County Schools - Raw data extracted from HAZUS software (FEMA, 2005) adjusted based on comments received by the Steering committee during development of each Multi-Hazard Mitigation Plan.
2. Lakes and Streams from USGS National Hydrography Dataset, 2007
3. Marion County Schools and Wellfield Protection Areas - City of Indianapolis, IMAGIS, 2007
4. NWI Pond - USFWS National Wetlands Inventory Maps, 1991-1992

CBB
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National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: Lower Fall Creek Watershed Management Plan	PROJECT NO. 07-0116	APPROX. SCALE As Shown
TITLE: Lower Fall Creek Watershed Schools		DATE: 05/08
		EXHIBIT 1

APPENDIX 7

Stream Assessments

Macroinvertebrate Collection

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Introduction

Macroinvertebrate monitoring is a valuable tool to measure the ecological health of a stream. Because they are considered to be more sensitive to local conditions and respond relatively rapidly to change, benthic (bottom-dwelling) organisms are considered to be the primary tool to document the biological condition of the streams. The numbers and kinds of animals present at a study site can be compared to an unimpacted reference site. For example, the presence of mayflies, stoneflies, and caddisflies (also called "EPT taxa") are indicators of good biological integrity, while many midge species are considered to be tolerant of degraded conditions. A stream with good biological integrity will have a good diversity of organisms present and not be dominated by one or two kinds of animals. This bioassessment technique results in a biological integrity value; the higher the value, the more ecologically healthy the stream.

Methods

Study Sites

1. Sand Creek at Brooks School Road
2. Sand Creek at 116th Street
3. Mud Creek at Madison/Hamilton County Line
4. Mud Creek at 116th Street
5. Mud Creek at 75th Street
6. Indian Creek at Marion/Hancock County Line
7. Indian Creek at 52nd Street
8. Indian Creek at Sunnyside Drive
9. Indian Creek below Indian Lake
10. Fall Creek below Geist Dam
11. Fall Creek at Emerson Avenue
12. Fall Creek at Meridian Street

Habitat Evaluation

The aquatic habitat at each study site was evaluated according to the method described by Ohio EPA [2]. This method results in values being assigned to various habitat parameters (e.g. substrate quality, riparian vegetation, channel morphology, etc.) and results in a numerical score for each site. Higher scores indicate higher aquatic habitat value. The maximum value for habitat using this assessment technique is 100. For quality control purposed, a duplicate assessment was conducted by a second person at site 3.

Sample Collection

Macroinvertebrate samples in this study were collected by dipnet in riffle areas where current speed approached 30 cm/sec. All samples were preserved in the field with 70% isopropanol and returned to the lab for sorting and analysis. Spring samples were collected on April 24 and 25, 2008. Fall samples were collected on October 15 and 20, 2008. A duplicate sample for quality control was collected at site 3 during the spring collections.

Laboratory Analysis

In the laboratory, a 100 organism subsample was prepared from each site by evenly distributing the animals collected in a white, gridded pan. Grids were randomly selected and all organisms within grids were removed until 100 organisms had been selected from the entire sample.

Each animal was identified to the lowest practical taxon (usually genus or species) using standard taxonomic references [4,5,6]. As each new taxon was identified, a representative specimen was preserved as a "voucher." All voucher specimens will ultimately be deposited in the Purdue University Department of Entomology collection. The list of animals found at each site number for both spring and fall collections may be found in the appendix.

Data Analysis (Macroinvertebrates)

Following identification of the animals in the sample, "metrics" were calculated for each site. These metrics are based on knowledge about the sensitivity of each species to changes in environmental conditions. The macroinvertebrate data from this study were analyzed by two different sets of metrics. Data were analyzed with the mIBI protocol developed by the Indiana Department of Environmental Management [3], which is based on taxonomic identification to the family level, and an adaptation of the Ohio EPA protocol [2], which is based on taxonomic identifications to the genus and species level. The maximum possible score with the Ohio EPA method is 60, while the mIBI has a maximum possible score of 8. To facilitate comparisons to habitat values, both biotic indices are also expressed as a percentage of the maximum possible score

Results

During spring collections, 41 macroinvertebrate genera belonging to 24 families were identified. Predominant families were Chironomidae (midges) and Elmidae (riffle beetles). The sediment-tolerant midge species *Orthocladius obumbratus* was the dominant organism at all but two sites (sites 10 and 11).

During fall collections, 63 macronvertebrate genera belonging to 27 families were collected. Predominant families were Chironomidae (midges), Hydropsychidae (net-spinning caddisflies), especially *Cheumatopsyche* spp., and Heptageniidae (flatheaded mayflies). Macroinvertebrate raw data are listed in the appendix.

Table 1. Results for habitat (QHEI) and macroinvertebrate (Ohio EPA and IDEM mIBI) assessments. Macroinvertebrate scores are expressed as a percentage of the total possible score. Derivation of scores is listed in the appendix.

Site Number	QHEI	Ohio EPA (spring)	Ohio EPA (fall)	IDEM mIBI (spring)	IDEM mIBI (fall)
1	28	23	47	18	30
2	50	20	57	23	55
3	53	28	47	32	68
3 duplicate	56	20	*	20	*
4	50	37	53	38	68
5	67	37	30	28	38
6	31	23	50	28	50
7	58	20	43	18	30
8	59	47	60	18	65
9	70	33	37	28	40
10	73	17	37	23	53
11	76	33	67	33	70
12	54	33	47	23	50

* not applicable

Diagnosis

<u>Comparison of habitat quality and biotic integrity</u>

One of the most useful aspects of biological monitoring is the ability to use information about the way aquatic animals respond to different types of stress to diagnose a problem. For example, when aquatic habitat and biotic integrity are graphed in relation to each other, they form a straight line unless water quality is degraded [1]. Plus or minus 10% can be added to the graph to allow for a certain degree of measurement error. When values fall outside this range, water quality problems are suspected. A comparison of biotic integrity to habitat for this study is shown in Figures 1 and 2.

Figure 1. Comparison of Ohio EPA biotic index values to habitat values. Biotic index values are an average of spring and fall data and are expressed as a percentage of the total possible value.

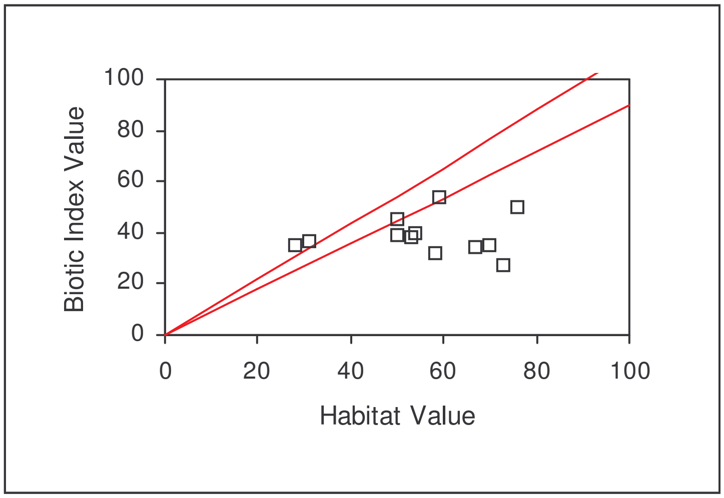
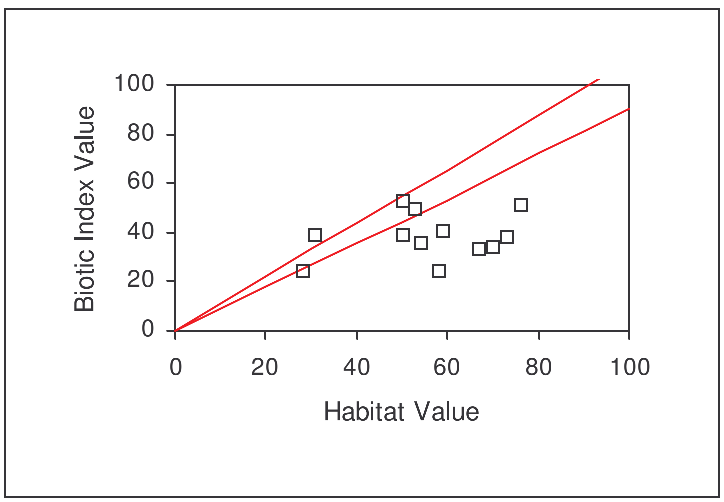


Figure 2. Comparison of IDEM macroinvertebrate biotic index values and habitat values. Biotic index values are an average of spring and fall data and are expressed as a percentage of the total possible value.



Examination of both graphs show similar patterns. Sites 5, 7, 9, 10, and 11 fall the farthest from the expected range in both graphs, which is likely the result of degraded water quality. When looking at the graph of Ohio EPA scores, sites 2, 3 and 12 group together moderately below the expected range, while on the graph of IDEM mIBI scores, sites 2, 8 and 12 are grouped together. These sites also have impaired water quality. The biotic integrity values at sites 1, 4 and 6 are within the range predicted by their habitat scores.

Primary water quality problem

The primary water quality problem in the study area appears to be silt. Extensive silt deposits were noted at several sites. Table 2 lists the silt tolerances of selected organisms collected during the study. Although some silt intolerant organisms were present, the dominant forms were more frequently silt tolerant.

Table 2. Silt tolerances of selected organisms collected during 2008 study. [7]

Organism	Silt Tolerance
Stenacron interpuctatum	Tolerant
Baetis intercalaris	Tolerant
Caenis spp.	Tolerant
Cheumatopsyche spp.	Tolerant
Hydropsyche betteni	Tolerant
Ceratopsyche bifida	Intolerant
Ceratopsyche sparna	Intolerant
Chimarra obscura	Intolerant
Orthocladius obumbratus	Tolerant

Prioritization of sub-watersheds

1. Indian Creek (sites 6, 7, 8, and 9). Heavy silt deposits were observed at all sites in the Indian Creek subwatershed. Habitat at the most upstream site (6) was poor and was limited by lack of instream cover and riparian vegetation. Site 7 had the highest percentage (90%) of the sediment-tolerant midge *Orthocladius obumbratus* of any site during spring sampling. Site 8 had unstable riffle substrates that were embedded from silt deposits. Site 9 had few mayflies, was dominated by the planarian flatworm *Dugesia* in the fall collection, and had the most extensive silt deposits of any site in the study.

2. Fall Creek (sites 10, 11, and 12): Despite having a habitat score of 73, Site 10 had few mayflies, and was dominated by midges in the spring and the caddisfly *Cheumatopsyche* and blackfly larve (*Simulium* spp.) in the fall. This site is immediately below Geist Dam and may be affected by water quality problems within the reservoir, such as periodic dissolved oxygen deficits. Site 11 had the best habitat score (76) of all the study sites, but only had only fair biotic integrity, with one mayfly in the spring sample. The fall sample had good biotic integrity, with four mayfly species and three caddisfly species represented. Site 12 had few mayflies present, primarily *Stenacron interpuctatum*. Dominant organisms were the midge species *Orthocladius obumbratus* in the spring and the caddisfly genus *Cheumatopsyche* in the fall. Habitat quality was limited by a lack of in-stream cover and riparian vegetation.

3. Mud Creek (sites 3, 4, and 5): Habitat at the Mud Creek sites was good (QHEI scores of 50 to 67). The most downstream site (5) was observed to have moderate silt deposits and had impaired biotic integrity. The spring sample was dominated (50%) by *Orthocladius obumbratus* but had few mayflies, while the fall sample had no mayflies. Sites 3 and 4 had biotic integrity values closer to what would be expected based on the available habitat. Habitat quality at these sites was reduced by past channelization.

4. Sand Creek (sites 1 and 2). Site 1 had the poorest habitat (QHEI score of 28) of any of the study sites. There were heavy silt deposits, unstable substrates and evidence of recent channelization. Biotic integrity scores were close to what would be expected based on

available habitat. Site 2 had much better habitat (QHEI score of 50) with moderate levels of silt observed, but had very few mayflies in either the spring or fall collections. Both sites 1 and 2 were dominated by the midge *Orthocladius obumbratus* in the spring.

Recommendations

1. Control inflow of sediment and silt into streams throughout the Fall Creek watershed. Special emphasis should be placed on sediment control within the Indian Creek subwatershed.

2. Investigate the status of water quality in Geist Reservoir. Water quality problems within Geist Reservoir may be affecting biotic integrity downstream in Fall Creek.

3. Enhance habitat by planting riparian vegetation at sites where it is sparse or absent, for example, at the upstream site (6) of Indian Creek and the downstream site (12) of Fall Creek.

4. Avoid future channelization of streams. Sites 3 and 4 on Mud Creek are in the process of natural recovery from past channelization. Site 1 on Sand Creek showed evidence of recent channelization but also of a two-stage ditch construction project which holds the potential to improve habitat and water quality in the future.

References

1. Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid Bioassessment Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. US Environmental Protection Agency, Office of Water, Washington, D.C. EPA/444/4-89-001.

2. Ohio EPA. 1987. Biological criteria for the protection of aquatic life: Vol. II. Users manual for biological field assessment of Ohio surface waters. Div. of Water Quality Monitoring and Assessment, Columbus, OH.

3. Indiana Department of Environmental Management, 1999. Metrics for analysis of benthic macroinvertebrate samples collected from artificial substrates. PowerPoint Presentation to the Ohio Valley Chapter of SETAC. Office of Water Management, Biological Studies Section, Indianapolis, IN.

4. Simpson, K.W. and R.W. Bode. 1980. Common Larvae of Chironomidae (Diptera) from New York State Streams and Rivers. Bull. No. 439. NY State Museum, Albany, NY.   105 pp.

5. Schuster, G.A. and D.A. Etnier. 1978. A manual for the identification of the larvae of the caddisfly genera Hydropsyche and Symphitopsyche in Eastern and Central North America. U.S. EPA Environmental Support Laboratory, Cincinnati, OH (EPA-600/4-78-060.

6. Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. Third Edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 pp.

7. Roback, S.S. 1974. Insecta (Arthropoda: Insecta), in Hart, C.W. and S.L.H. Fuller, eds. Pollution Ecology of Freshwater Invertebrates. Academic Press, New York. 389 pp.

APPENDIX

Macroinvertebrate Site Data

Macroinvetebrate Metrics Data and Scoring

Qualitative Habitat Evaluation Index (QHEI) Data

Spring macroinvertebrate data

			1	2	3	3 dpl.	4	5	6
Ephemeroptera	Baetidae	Baetis amplus			1		2	2	
	Heptagenidae	Stenacrom interpunctatum					3	2	
		Stenonema femoratum							
		S. terminatum							
	Caenidae	Caenis spp.	1						
Trichoptera	Hydropsychidae	Hydropsyche betteni	1	1			19	1	
		Ceratopsyche bifida	1					1	
		Cheumatopsyche spp.		3	3		7	1	
	Hydroptilidae	Ochotrichia spp.			1	1			
	Philopotamidae	Chimarra obscura						2	
	Polycentropidae	Neureclpsis spp.							3
	Lepidostomatidae								
Plecoptera	Perlodidae	Isoperla spp.							6
Coleoptera	Elmidae	Stenelmis spp.	1	3	20	10	1	9	17
		Optioservus fastiditus		14			2	7	
		Macronychus glabratus			2				
	Psenpenidae	Psephenus herricki			11	7			
Odonata	Calopyterydae	Argia spp.				1			
	Coenagrioniidae	Hetaerina spp.							
Diptera	Simuliidae	Simulium spp.		8			10	3	8
	Tipulidae	Hexatoma spp.			1				
	Ceratopogonidae		1						
	Chironomidae	Thienemannimyia spp.			6			3	
		Orthocladius obumbratus	73	69	51	73	47	50	21
		Parametriocnemus lundbecki	20						
		Cricotopus bicinctus							3
		C. tremulus				4	2	11	
		Eukiefferiella claripennis						4	2
		Polypedilum convictum			3	3	7		
		P. fallax							
		Dicrotendipes spp.						4	
		Paratendipes albimanus							
		Glyptotendipes lobiferus							
		Cryptochironomus fulvus							
		Parachironomus frequens							
		Rheotanytarus spp.							
Crustacea		Decapoda							
Isopoda		Caecodotea spp.	1						
		Lirceus spp.							40
Amphipoda									
Annelida		Oligochaeta	1	2	1	1			
		Hirudinea							
Bivalvia		Corbicula fluminea							
Platyhelminthes		Dugesia spp.							
total			100	100	100	100	100	100	100

Spring macroinvertebrate data, con't.

			7	8	9	10	11	12
Ephemeroptera	Baetidae	Baetis amplus						
	Heptagenidae	Stenacrom interpunctatum	2	1	2		1	9
		Stenonema femoratum		15				
		S. terminatum						4
	Caenidae	Caenis spp.	4	3	4			
Trichoptera	Hydropsychidae	Hydropsyche betteni						
		Ceratopsyche bifida					8	2
		Cheumatopsyche spp.			1	7	4	10
	Hydroptilidae	Ochotrichia spp.				1		
	Philopotamidae	Chimarra obscura						
	Polycentropidae	Neureclpsis spp.						
	Lepidostomatidae						1	
Plecoptera	Perlodidae	Isoperla spp.						
Coleoptera	Elmidae	Stenelmis spp.		2	2	1	24	
		Optioservus fastiditus		2	1			
		Macronychus glabratus						
	Psenpenidae	Psephenus herricki		8				
Odonata	Calopyterydae	Argia spp.	1					
	Coenagrioniidae	Hetaerina spp.						1
Diptera	Simuliidae	Simulium spp.		10	32	14	46	
	Tipulidae	Hexatoma spp.					1	
	Ceratopogonidae							
	Chironomidae	Thienemannimyia spp.			14			6
		Orthocladius obumbratus	90	19	12	5	9	53
		Parametriocnemus lundbecki						
		Cricotopus bicinctus			2	5	4	12
		C. tremulus						
		Eukiefferiella claripennis		7	19			
		Polypedilum convictum		2	4	33	2	
		P. fallax		5				
		Dicrotendipes spp.		2		5		
		Paratendipes albimanus		17				
		Glyptotendipes lobiferus			7	24		
		Cryptochironomus fulvus		2				
		Parachironomus frequens						3
		Rheotanytarus spp.		2				
Crustacea		Decapoda	1					
Isopoda		Caecodotea spp.						
		Lirceus spp.		1				
Amphipoda			1			1		
Annelida		Oligochaeta		2		1		
		Hirudinea				1		
Bivalvia		Corbicula fluminea	1					
Platyhelminthes		Dugesia spp.				2		
total			100	100	100	100	100	100

Fall Macroinvertebrate Data

			1	2	3	4	5	6
Ephemeroptera	Baetidae	Baetis flavistrigia		1				
		B. hageni				3		
	Heptageniidae	Stenacrom interpunctatum	3	1		1		1
		Stenonema femoratum	4					
	Caenidae	Caenis spp.	46					
Trichoptera	Hydropsychidae	Hydropsyche betteni		12	4	43	2	8
		Ceratopsyche bifida		2	1	8	2	
		C. sparna		4	8	11		
		Cheumatopsyche spp.	3	37	43	9	12	12
	Philopotamidae	Chimarra obscura			6			
Plecoptera	Perlidae	Perlinella spp.						
	Perlodidae						2	
Coleoptera	Elmidae	Stenelmis spp.			13	8		26
		Optioservus fastiditus		11		4	4	15
		Dubiraphia spp.	1					
	Psephenidae	Psephenus herricki			12			
	Hydrophilidae	Berosus spp.						3
	Heliodidae							1
Odonata	Coenagrioniidae	Argia spp.	3		1			1
	Aeshnidae	Boyeria spp.			1			
Diptera	Simuliidae	Simulium spp.		5		6	60	
	Tipulidae	Tipula spp.		1	5	1	2	6
		Antocha spp.		3	1	1	1	
	Chironomidae	Ablabesmyia mallochi	4					
		Thienemannimyia spp.		4	2	1		6
		Orthocladius obumbratus		4		2	9	
		Parametriocnemus lundbecki		1			1	1
		Cricotopus bicinctus		2				1
		Eukiefferiella bavarica			2		3	
		Thienemanniella xena		2				
		Polypedilum convictum		2		1	1	7
		Dicrotendipes spp.	4					
		Glyptotendipes lobiferus	3					
		Cryptochironomus fulvus	2					
		Endochironomus nigricans	4					
		Microtendipes caelum		5				
		Rheotanytarus spp.	4					
Crustacea	Isopoda	Caecodotea spp.						2
		Lirceus spp.	11					
	Amphipoda			2		1		
Annelida	Oligochaeta		3				1	
	Hirudinea		3	1				
Bivalvia	Sphaeridae		1					
Gastropoda	Ancylidae	Ferrissia spp.						
	Physidae	Physella spp.	1					
Platyhelminthes		Dugesia spp.			1			10
total			100	100	100	100	100	100

Fall Macroinvertebrate Data, con’t.

			7	8	9	10	11	12
Ephemeroptera	Baetidae	B. intercalaris		1	2		18	6
	Heptageniidae	Stenacrom interpunctatum	53					
		Stenonema femoratum	5	5				
		S. terminatum					22	
		S. pulchellum					2	2
	Caenidae	Caenis spp.	1					
	Tricoryhidae	Tricorythodes spp.				4	5	
Trichoptera	Hydropsychidae	Hydropsyche betteni		14				
		H. orris					4	
		Ceratopsyche bifida		5			17	9
		C. sparna		9				
		Cheumatopsyche spp.		35	11	47	9	39
	Philopotamidae	Chimarra obscura		1	1			
Plecoptera	Perlidae	Perlinella spp.					1	
Coleoptera	Elmidae	Stenelmis spp.	2	6	17			9
		Macronychus glabratus					1	
	Psephenidae	Psephenus herricki		9				
Odonata	Coenagrioniidae	Argia spp.	4					
Megaloptera	Corydalidae	Corydalus cornutus					2	
Lepidoptera	Pyralidae						4	
Diptera	Simuliidae	Simulium spp.		2	6	26		11
	Tipulidae	Tipula spp.		4				
	Chironomidae	Thienemannimyia spp.	2		4			4
		Orthocladius obumbratus	3	1			2	4
		Parametriocnemus lundbecki	1					
		Cricotopus bicinctus		1		7	5	13
		C. trifascia						1
		Rheocricotopus robacki						1
		Thienemanniella xena		1	3			
		Polypedilum convictum		4	10	8		
		Phaenopsectra spp.	2					
		Dicrotendipes spp.	3		2		1	
		Chironomus spp.	5					
		Glyptotendipes lobiferus	3		12	1	1	
		Microtendipes caelum	3	1	1		6	
		Rheotanytarus spp.	2					1
Crustacea	Isopoda	Caecodotea spp.		1				
		Lirceus spp.	2					
Annelida	Oligochaeta		1			1		
	Hirudinea		1		1	1		
Bivalvia	Sphaeridae				3			
Gastropoda	Ancylidae	Ferrissia spp.	7					
Platyhelminthes		Dugesia spp.			27	5		
total			100	100	100	100	100	100

Qualitative Habitat Evaluation Index (QHEI) site data

Site	1	2	3	3 dpl	4	5	6
Substrate	6	12	16	16	14	15	5
Cover	3	7	7	10	7	11	4
Channel	3	11	9	10	9	14	7
Riparian	4	6	6	3	6	7	3
Pool/Current	4	5	5	4	5	8	4
Riffle/Rum	2	3	6	5	3	6	2
Gradient	6	6	6	8	6	6	6
Total QHEI	28	50	53	56	50	67	31

Qualitative Habitat Evaluation Index (QHEI) site data

Site	7	8	9	10	11	12
Substrate	10	10	14	14	18	12
Cover	12	12	12	14	14	5
Channel	12	14	16	14	14	12
Riparian	8	8	9	10	8	3
Pool/Current	7	8	8	10	11	11
Riffle/Rum	3	1	3	5	5	5
Gradient	6	6	8	6	6	6
Total QHEI	58	59	70	73	76	54

Ohio EPA metrics data (spring)

Site	**1**	**2**	**3**	**3 dpl.**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
# genera	9	7	11	8	10	14	8	7	16	12	13	10	9
# mayfly taxa	1	0	1	0	2	2	0	2	3	2	0	1	2
# caddisfly taxa	2	2	2	1	2	4	1	0	0	1	2	3	2
#diptera taxa	3	2	4	3	4	6	4	1	8	7	6	5	4
% tanitarsini	0	0	0	0	0	0	0	0	2	0	0	0	0
% mayflies	1	0	1	0	5	4	0	6	19	6	0	1	13
% caddisflies	2	4	4	1	26	5	3	0	0	1	8	13	12
% tolerant	1	2	1	1	0	4	3	0	9	9	35	4	12
%nontanytarsids & non-insects	96	79	62	81	66	75	74	93	67	90	91	62	74
% dominant	73	69	51	73	47	50	40	90	19	32	33	46	53

Ohio EPA metrics scoring (spring)

Site	1	2	3	3 dupl	4	5	6	7	8	9	10	11	12
# genera	2	2	2	2	2	4	2	2	4	2	2	2	2
# mayfly taxa	0	0	0	0	2	2	0	2	2	2	0	0	2
# caddisfly taxa	2	2	2	2	2	4	2	0	0	2	2	2	2
#diptera taxa	0	0	2	0	2	2	2	0	4	2	2	2	2
% tanitarsini	0	0	0	0	0	0	0	0	2	0	0	0	0
% mayflies	2	0	1	0	2	2	0	2	4	2	0	2	4
% caddisflies	2	2	2	2	6	2	2	0	0	2	2	4	4
% tolerant	6	6	6	6	6	6	6	6	6	6	0	6	4
%nontanytarsids & non-insects	0	0	2	0	0	0	0	0	0	0	0	2	0
% dominant	0	0	0	0	0	0	0	0	6	2	2	0	0
Ohio EPA score	14	12	17	12	22	22	14	12	28	20	10	20	20
standardized score	23	20	28.3	20	37	37	23	20	47	33	17	33	33

Ohio EPA metrics data (fall)

Site	1	2	3	4	5	6	7	8	9	10	11	12
# genera	17	18	13	14	13	15	18	16	14	9	15	11
# mayfly taxa	3	2	0	2	0	1	3	2	1	1	4	2
# caddisfly taxa	1	4	5	4	3	2	0	5	2	1	3	2
#diptera taxa	6	10	4	6	7	5	9	7	7	4	5	7
% tanitarsini	4	0	0	0	0	0	2	0	0	0	0	1
% mayflies	53	2	0	4	0	1	59	6	2	4	47	8
% caddisflies	3	55	62	71	16	20	0	64	12	47	30	48
% tolerant	11	2	0	0	1	1	19	1	14	9	7	13
%nontanytarsids & non-insects	36	32	11	13	78	33	33	15	69	49	15	34
% dominant	46	37	43	43	60	26	53	35	27	47	22	39

Ohio EPA metrics scoring (fall)

Site	1	2	3	4	5	6	7	8	9	10	11	12
# genera	4	4	2	4	2	4	4	4	4	2	4	2
# mayfly taxa	2	2	0	2	0	0	2	2	0	0	2	2
# caddisfly taxa	2	4	6	4	4	2	0	6	2	2	4	2
#diptera taxa	2	4	2	2	2	2	4	2	2	2	2	2
% tanitarsini	2	0	0	0	0	0	2	0	0	0	0	2
% mayflies	6	2	0	2	0	2	6	2	2	2	6	2
% caddisflies	2	6	6	6	4	6	0	6	4	6	6	6
% tolerant	4	6	6	6	6	6	4	6	4	6	6	4
%nontanytarsids & non-insects	4	4	6	6	0	4	4	6	0	2	6	4
% dominant	0	2	0	0	0	4	0	2	4	0	4	2
Ohio EPA score	28	34	28	32	18	30	26	36	22	22	40	28
Standardized score	47	57	47	53	30	50	43	60	37	37	67	47

IDEM mIBI metrics data (spring)

Site	1	2	3	3 dpl	4	5	6	7	8	9	10	11	12
Family HBI	6.01	5.66	5.29	5.7	5.48	5.52	6.22	5.97	5.57	5.9	5.86	5.19	5.69
No. of taxa	7	5	8	6	6	7	6	7	8	6	9	7	4
no. of individuals	200	>350	>350	>350	>350	200	>350	150	110	>350	200	160	150
% dominant	93	69	60	80	56	72	40	90	56	58	72	46	74
EPT index	2	1	3	1	3	4	2	2	2	3	2	3	2
ept count	6	20	25	5	155	18	31.5	9	22	25	16	22.4	37.5
ept count/total count	0.03	0.04	0.05	0.01	0.31	0.09	0.09	0.06	0.2	0.1	0.08	0.14	0.25
ept/chironomids	0.03	0.06	0.08	0.01	0.06	0.12	0.346	0.07	0.36	0.1	0.11	0.93	0.34
chironomid count	>146	>146	>146	>146	>146	144	>146	135	62	>149	144	24	111
ind/squares	>410	>410	>410	>410	>410	>410	>410	>410	<30	>410	>410	>410	>410

IDEM mIBI metrics scoring (spring)

Site	1	2	3	3 dpl	4	5	6	7	8	9	10	11	12
Family HBI	0	0	2	0	2	2	0	0	2	0	0	2	0
No. of taxa	0	0	2	0	0	0	0	0	2	0	2	0	0
no. of individuals	6	8	8	8	8	6	8	4	2	8	6	4	4
% dominant	0	0	2	0	2	0	4	0	2	2	0	2	0
EPT index	0	0	2	0	2	4	0	0	0	2	0	2	0
ept count	0	2	2	0	6	0	2	0	2	2	0	2	2
ept count/total count	0	0	0	0	2	0	0	0	2	0	0	2	2
ept/chironomids	0	0	0	0	0	0	0	0	0	0	0	0	0
chironomid count	0	0	0	0	0	2	0	2	2	0	2	4	2
ind/squares	8	8	8	8	8	8	8	8	0	8	8	8	8
mIBI	1.4	1.8	2.6	1.6	3	2.2	2.2	1.4	1.4	2.2	1.8	2.6	1.8
% of total possible	17.5	22.5	32.5	20	37.5	27.5	27.5	17.5	17.5	28	22.5	32.5	22.5

IDEM mIBI metrics data (fall)

Site	1	2	3	4	5	6	7	8	9	10	11	12
Family HBI	7.01	4.5	4.01	4.18	5.41	4.6	5.32	4.21	5.99	5.06	4.45	4.7
No. of taxa	11	9	9	8	7	10	9	11	9	7	9	6
no. of individuals	100	>350	>350	>350	>350	>350	120	>350	>350	>350	>350	>350
% dominant	46	55	56	71	60	41	58	63	32	47	30	48
EPT index	3	3	2	3	2	2	2	4	3	2	5	3
ept count	56	57	62	75	18	21	59	70	14	51	78	56
ept count/total count	0.56	0.57	0.62	0.75	0.18	0.21	0.59	0.7	0.14	0.51	0.78	0.56
ept/chironomids	2.667	2.85	15.5	18.75	1.286	1.4	2.46	10	0.438	3.188	5.2	2.33
chironomid count	21	20	4	4	14	15	24	7	32	16	15	24
ind/squares	<30	>410	>410	>410	>410	>410	<30	>410	>410	>410	>410	>410

IDEM mIBI metrics scoring (fall)

Site	1	2	3	4	5	6	7	8	9	10	11	12
Family HBI	0	6	8	6	2	6	2	6	0	4	6	4
No. of taxa	4	2	2	2	0	2	2	4	2	0	2	0
no. of individuals	2	8	8	8	8	8	2	8	8	8	8	8
% dominant	2	2	2	0	2	4	2	0	4	2	6	2
EPT index	2	2	0	2	0	0	0	4	2	0	4	2
ept count	4	4	4	4	0	2	4	4	0	4	4	4
ept count/total count	4	6	6	8	2	2	6	6	4	6	8	6
ept/chironomids	2	2	8	8	2	2	2	6	0	4	4	2
chironomid count	4	4	8	8	6	6	4	6	4	6	6	4
ind/squares	0	8	8	8	8	8	0	8	8	8	8	8
mIBI	2.4	4.4	5.4	5.4	3	4	2.4	5.2	3.2	4.2	5.6	4
% of total possible	30	55	68	67.5	38	50	30	65	40	52.5	70	50

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 28

River Code: 01 **RM:** **Stream:** ~~Fox~~ Sand Creek
Date: 4/25/08 **Location:** ~~79th~~ Brooks School Rd
Scorers Full Name: GRB **Affiliation:**

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE POOL RIFFLE
- BLDR /SLBS[10]
- BOULDER [9]
- COBBLE [8]
- HARDPAN [4]
- MUCK [2]
- SILT [2] X
- GRAVEL [7]
- SAND [6] X
- BEDROCK[5]
- DETRITUS[3]
- ARTIFICIAL[0]

NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)
- LIMESTONE [1]
- TILLS [1]
- WETLANDS[0]
- HARDPAN [0]
- SANDSTONE [0]
- X RIP/RAP [0]
- LACUSTRINE [0]
- SHALE [-1]
- COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)

SILT:
- X SILT HEAVY [-2]
- SILT MODERATE [-1]
- SILT NORMAL [0]
- SILT FREE [1]

EMBEDDEDNESS:
- EXTENSIVE [-2]
- MODERATE [-1]
- X NORMAL [0]
- NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
- 4 or More [2]
- X 3 or Less [0]

COMMENTS

Substrate: 6 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)

TYPE: Score All That Occur
- ___UNDERCUT BANKS [1]
- ___OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- ___ROOTMATS [1]
- ___POOLS> 70 cm [2]
- ___ROOTWADS [1]
- ___BOULDERS [1]
- ___OXBOWS, BACKWATERS [1]
- ___AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- EXTENSIVE > 75% [11]
- MODERATE 25-75% [7]
- SPARSE 5-25% [3]
- X NEARLY ABSENT < 5%[1]

Cover: 3 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY
- HIGH [4]
- MODERATE [3]
- LOW [2]
- X NONE [1]

DEVELOPMENT
- EXCELLENT [7]
- GOOD [5]
- FAIR [3]
- X POOR [1]

CHANNELIZATION
- NONE [6]
- RECOVERED [4]
- RECOVERING [3]
- X RECENT OR NO RECOVERY [1]

STABILITY
- HIGH [3]
- MODERATE [2]
- X LOW [1]

MODIFICATIONS/OTHER
- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEED
- X BANK SHAPING

COMMENTS:

Channel: 3 (Max 20)

recen 2-sta ditch constr

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH — L R (Per Bank)
- WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2]
- X X VERY NARROW <5 m[1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) — L R (Most Predominant Per Bank)
- FOREST, SWAMP [3]
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL,PARK,NEW FIELD [1]
- FENCED PASTURE [1]
- X X CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE,ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION — L R (Per Bank)
- NONE/LITTLE [3]
- X X MODERATE [2]
- HEAVY/SEVERE[1]

COMMENTS:

Riparian: 4 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- >1m [6]
- 0.7-1m [4]
- 0.4-0.7m [2]
- X 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2]
- X POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES[1]
- FAST[1]
- X MODERATE [1]
- X SLOW [1]
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

COMMENTS:

Pool/Current: 4 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- Best Areas >10 cm [2]
- X Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- MAX > 50 [2]
- X MAX < 50[1]

RIFFLE/RUN SUBSTRATE
- STABLE (e.g.,Cobble, Boulder) [2]
- MOD. STABLE (e.g.,Large Gravel) [1]
- X UNSTABLE (Fine Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- LOW [1]
- X MODERATE [0]
- EXTENSIVE [-1]

COMMENTS:
- NO RIFFLE [Metric=0]

Riffle/Run: 2 (Max 8)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: ___ %GLIDE: ___
%RIFFLE: ___ %RUN: ___

Gradient: 6 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 50

River Code: 2 RM: Stream: Sand Cr.
Date: 4/25/08 Location: 116th St
Scorers Full Name: GRB Affiliation:

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE))	SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
BLDR /SLBS[10]			GRAVEL [7]	X		LIMESTONE [1]	SILT: SILT HEAVY [-2]
BOULDER [9]			SAND [6]	X		X TILLS [1]	X SILT MODERATE [-1]
COBBLE [8]			BEDROCK[5]			WETLANDS[0]	SILT NORMAL [0]
HARDPAN [4]			DETRITUS[3]			HARDPAN [0]	SILT FREE [1]
MUCK [2]			ARTIFICIAL[0]			SANDSTONE [0]	EMBEDDEDNESS: EXTENSIVE [-2]
SILT [2]			NOTE: Ignore Sludge Originating From Point Sources			RIP/RAP [0]	X MODERATE [-1]
						LACUSTRINE [0]	NORMAL [0]
						SHALE [-1]	NONE [1]
						COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☐ 4 or More [2] ☒ 3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS

Substrate: 12 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) TYPE: Score All That Occur

- ___ UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- ___ POOLS> 70 cm [2]
- ___ ROOTWADS [1]
- ___ BOULDERS [1]
- ___ OXBOWS, BACKWATERS [1]
- ___ AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- ☐ EXTENSIVE > 75% [11]
- ☐ MODERATE 25-75% [7]
- ☒ SPARSE 5-25% [3]
- ☐ NEARLY ABSENT < 5%[1]

Cover: 7 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]	☐ SNAGGING	☐ IMPOUND.
☐ MODERATE [3]	☐ GOOD [5]	☒ RECOVERED [4]	☒ MODERATE [2]	☐ RELOCATION	☐ ISLANDS
☒ LOW [2]	☒ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]	☐ CANOPY REMOVAL	☐ LEVEED
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]		☐ DREDGING	☐ BANK SHAPING
				☐ ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS:

Channel: 11 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐ WIDE > 50m [4]	☐☒ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]	☐☐ NONE/LITTLE [3]
☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]	☐☒ MODERATE [2]
☐☐ NARROW 5-10 m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ OPEN PASTURE, ROWCROP [0]	☐☐ HEAVY/SEVERE[1]
☒☒ VERY NARROW <5 m[1]	☐☐ FENCED PASTURE [1]	☐☐ MINING/CONSTRUCTION [0]	
☐☐ NONE [0]			

COMMENTS:

Riparian: 6 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY (Check 1 or 2 & AVERAGE)	CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)	
☐ >1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ EDDIES[1]	☐ TORRENTIAL[-1]
☐ 0.7-1m [4]	☒ POOL WIDTH = RIFFLE WIDTH [1]	☐ FAST[1]	☐ INTERSTITIAL[-1]
☒ 0.4-0.7m [2]	☐ POOL WIDTH < RIFFLE W. [0]	☒ MODERATE [1]	☐ INTERMITTENT[-2]
☐ 0.2- 0.4m [1]		☒ SLOW [1]	☐ VERY FAST[1]
☐ < 0.2m [POOL=0]	COMMENTS:		

Pool/Current: 5 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ Best Areas >10 cm [2]	☐ MAX > 50 [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☒ Best Areas 5-10 cm[1]	☒ MAX < 50[1]	☒ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ Best Areas < 5 cm [RIFFLE=0]		☒ UNSTABLE (Fine Gravel, Sand) [0]	☒ MODERATE [0]
			☐ EXTENSIVE [-1]

COMMENTS: ☐ NO RIFFLE [Metric=0]

Riffle/Run: 3 (Max 8)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: %GLIDE:
%RIFFLE: %RUN:

Gradient: 6 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

EPA 4520 06/24/01

plankton growth thick on rocks

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 53

River Code: 3 **RM:** **Stream:** Mud Creek
Date: 4/25/08 **Location:** Madison / Hamilton Co. Line
Scorers Full Name: GRB **Affiliation:**

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE — POOL RIFFLE

- BLDR /SLBS [10]
- BOULDER [9]
- COBBLE [8]
- HARDPAN [4]
- MUCK [2]
- SILT [2]
- GRAVEL [7] X
- SAND [6] X
- BEDROCK [5]
- DETRITUS [3]
- ARTIFICIAL [0]

NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)
- LIMESTONE [1]
- X TILLS [1]
- WETLANDS [0]
- HARDPAN [0]
- SANDSTONE [0]
- RIP/RAP [0]
- LACUSTRINE [0]
- SHALE [-1]
- COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)

SILT:
- SILT HEAVY [-2]
- SILT MODERATE [-1]
- X SILT NORMAL [0]
- SILT FREE [1]

EMBEDDEDNESS:
- EXTENSIVE [-2]
- MODERATE [-1]
- X NORMAL [0]
- NONE [1]

NUMBER OF SUBSTRATE TYPES: 4 or More [2]; X 3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS

Substrate: 14 Max 20

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)
TYPE: Score All That Occur

- UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- POOLS > 70 cm [2]
- ROOTWADS [1]
- X BOULDERS [1]
- OXBOWS, BACKWATERS [1]
- AQUATIC MACROPHYTES [1]
- LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- EXTENSIVE > 75% [11]
- MODERATE 25-75% [7]
- X SPARSE 5-25% [3]
- NEARLY ABSENT < 5% [1]

Cover: 7 Max 20

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY
- HIGH [4]
- MODERATE [3]
- X LOW [2]
- NONE [1]

DEVELOPMENT
- EXCELLENT [7]
- GOOD [5]
- X FAIR [3]
- POOR [1]

CHANNELIZATION
- NONE [6]
- X RECOVERED [4]
- RECOVERING [3]
- RECENT OR NO RECOVERY [1]

STABILITY
- HIGH [3]
- MODERATE [2]
- LOW [1]

MODIFICATIONS/OTHER
- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEED
- BANK SHAPING

COMMENTS:

Channel: 9 Max 20

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH — L R (Per Bank)
- WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2]
- X VERY NARROW < 5 m [1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) — L R (Most Predominant Per Bank)
- FOREST, SWAMP [3]
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL, PARK, NEW FIELD [1]
- FENCED PASTURE [1]
- X CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE, ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION — L R (Per Bank)
- X NONE/LITTLE [3]
- MODERATE [2]
- HEAVY/SEVERE [1]

COMMENTS:

Riparian: 6 Max 10

5.] POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- \>1m [6]
- 0.7-1m [4]
- X 0.4-0.7m [2]
- 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2]
- X POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES [1]
- FAST [1]
- X MODERATE [1]
- X SLOW [1]
- TORRENTIAL [-1]
- INTERSTITIAL [-1]
- INTERMITTENT [-2]
- VERY FAST [1]

COMMENTS:

Pool/Current: 5 Max 12

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- X Best Areas > 10 cm [2]
- Best Areas 5-10 cm [1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- MAX > 50 [2]
- X MAX < 50 [1]

RIFFLE/RUN SUBSTRATE
- X STABLE (e.g., Cobble, Boulder) [2]
- MOD. STABLE (e.g., Large Gravel) [1]
- UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- X LOW [1]
- MODERATE [0]
- EXTENSIVE [-1]

COMMENTS: NO RIFFLE [Metric=0]

Riffle/Run: 6 Max 8

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.): ______

%POOL: %GLIDE: %RIFFLE: %RUN:

Gradient: 6 Max 10

OhioEPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 56

River Code: 3 RM: Stream: Mud Creek
Date: 4/25/08 Location: Madison/ Hamilton Co. Line
Scorers Full Name: MMK Affiliation:

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE POOL RIFFLE | POOL RIFFLE | SUBSTRATE ORIGIN | SUBSTRATE QUALITY

- BLDR /SLBS[10] ___ ___
- BOULDER [9] ___ ___
- COBBLE [8] 1 2
- HARDPAN [4] ___ ___
- MUCK [2] ___ ___
- SILT [2] ___ ___
- GRAVEL [7] X ✓
- SAND [6] ___ ___
- BEDROCK[5] ___ ___
- DETRITUS[3] ___ ___
- ARTIFICIAL[0] ___ ___

NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)
- LIMESTONE [1]
- ☒ TILLS [1]
- WETLANDS[0]
- HARDPAN [0]
- SANDSTONE [0]
- RIP/RAP [0]
- LACUSTRINE [0]
- SHALE [-1]
- COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)

SILT:
- SILT HEAVY [-2]
- SILT MODERATE [-1]
- ☒ SILT NORMAL [0]
- SILT FREE [1]

EMBEDDEDNESS:
- EXTENSIVE [-2]
- MODERATE [-1]
- ☒ NORMAL [0]
- NONE [1]

Substrate: 16 Max 20

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
- 4 or More [2]
- ☒ 3 or Less [0]

COMMENTS

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)
TYPE: Score All That Occur

- ___ UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- ___ SHALLOWS (IN SLOW WATER) [1]
- ___ ROOTMATS [1]
- ___ POOLS> 70 cm [2]
- X ROOTWADS [1]
- ___ BOULDERS [1]
- ___ OXBOWS, BACKWATERS [1]
- ___ AQUATIC MACROPHYTES [1]
- ✓ LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- EXTENSIVE > 75% [11]
- ☒ MODERATE 25-75% [7]
- SPARSE 5-25% [3]
- NEARLY ABSENT < 5%[1]

Cover: 10 Max 20

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY
- HIGH [4]
- MODERATE [3]
- ☒ LOW [2]
- NONE [1]

DEVELOPMENT
- EXCELLENT [7]
- GOOD [5]
- ☒ FAIR [3]
- POOR [1]

CHANNELIZATION
- NONE [6]
- RECOVERED [4]
- ☒ RECOVERING [3]
- RECENT OR NO RECOVERY [1]

STABILITY
- HIGH [3]
- ☒ MODERATE [2]
- LOW [1]

MODIFICATIONS/OTHER
- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEED
- BANK SHAPING

Channel: 10 Max 20

COMMENTS:

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH — L R (Per Bank)
- WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2]
- ☒☒ VERY NARROW <5 m[1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) — L R (Most Predominant Per Bank)
- FOREST, SWAMP [3]
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL,PARK,NEW FIELD [1]
- FENCED PASTURE [1]

L R
- CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- ☒☒ OPEN PASTURE,ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION — L R (Per Bank)
- NONE/LITTLE [3]
- ☒☒ MODERATE [2]
- HEAVY/SEVERE[1]

Riparian: 3 Max 10

COMMENTS:

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- >1m [6]
- 0.7-1m [4]
- 0.4-0.7m [2]
- ☒ 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2]
- ☒ POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES[1]
- ☒ FAST[1]
- ☒ MODERATE [1]
- SLOW [1]
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

Pool/ Current: 4 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- Best Areas >10 cm [2]
- ☒ Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- MAX > 50 [2]
- ☒ MAX < 50[1]

RIFFLE/RUN SUBSTRATE
- ☒ STABLE (e.g.,Cobble, Boulder) [2]
- MOD. STABLE (e.g.,Large Gravel) [1]
- UNSTABLE (Fine Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- ☒ LOW [1]
- MODERATE [0]
- EXTENSIVE [-1]

Riffle/Run: 5 Max 8

COMMENTS: - NO RIFFLE [Metric=0]

Gradient: 8 Max 10

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: ____ %GLIDE: ____
%RIFFLE: ____ %RUN: ____

** Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 50

River Code: 4 **RM:** **Stream:** Mud Creek
Date: 4/25/08 **Location:** 116th St.
Scorers Full Name: GRB **Affiliation:**

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present)

TYPE POOL RIFFLE / POOL RIFFLE / SUBSTRATE ORIGIN / SUBSTRATE QUALITY

- BLDR /SLBS[10] ___ ___ / GRAVEL [7] X ___ / Check ONE (OR 2 & AVERAGE) / Check ONE (OR 2 & AVERAGE)
- BOULDER [9] ___ ___ / SAND [6] X ___ / LIMESTONE [1] / SILT: SILT HEAVY [-2]
- COBBLE [8] ___ ___ / BEDROCK [5] ___ ___ / X TILLS [1] / SILT MODERATE [-1]
- HARDPAN [4] ___ ___ / DETRITUS [3] ___ ___ / WETLANDS [0] / X SILT NORMAL [0]
- MUCK [2] ___ ___ / ARTIFICIAL [0] ___ ___ / HARDPAN [0] / SILT FREE [1]
- SILT [2] ___ ___ / NOTE: Ignore Sludge Originating From Point Sources / SANDSTONE [0] / EMBEDDEDNESS: EXTENSIVE [-2]
- RIP/RAP [0] / MODERATE [-1]

NUMBER OF SUBSTRATE TYPES: 4 or More [2]; X 3 or Less [0] (High Quality Only, Score 5 or >)
- LACUSTRINE [0] / X NORMAL [0]
- SHALE [-1] / NONE [1]
- COAL FINES [-2]

COMMENTS

Substrate: 14 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)
TYPE: Score All That Occur

- ___ UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- ___ POOLS> 70 cm [2]
- ___ ROOTWADS [1]
- ___ BOULDERS [1]
- ___ OXBOWS, BACKWATERS [1]
- ___ AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- EXTENSIVE > 75% [11]
- MODERATE 25-75% [7]
- X SPARSE 5-25% [3]
- NEARLY ABSENT < 5%[1]

Cover: 7 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
HIGH [4]	EXCELLENT [7]	NONE [6]	HIGH [3]	SNAGGING	IMPOUND.
MODERATE [3]	GOOD [5]	X RECOVERED [4]	MODERATE [2]	RELOCATION	ISLANDS
X LOW [2]	X FAIR [3]	RECOVERING [3]	LOW [1]	CANOPY REMOVAL	LEVEED
NONE [1]	POOR [1]	RECENT OR NO RECOVERY [1]		DREDGING	BANK SHAPING
				ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS:

Channel: 9 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH — L R (Per Bank)
- WIDE > 50m [4]
- MODERATE 10-50m [3]
- X (L) NARROW 5-10 m [2]
- VERY NARROW <5 m[1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) — L R (Most Predominant Per Bank)
- FOREST, SWAMP [3]
- X (R) SHRUB OR OLD FIELD [2]
- RESIDENTIAL, PARK, NEW FIELD [1]
- FENCED PASTURE [1]
- CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE, ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION — L R (Per Bank)
- NONE/LITTLE [3]
- X (R) MODERATE [2]
- HEAVY/SEVERE[1]

COMMENTS:

Riparian: 6 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- >1m [6]
- 0.7-1m [4]
- X 0.4-0.7m [2]
- 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2]
- X POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES[1]
- FAST[1]
- X MODERATE [1]
- X SLOW [1]
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

COMMENTS:

Pool/Current: 5 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- Best Areas >10 cm [2]
- X Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- MAX > 50 [2]
- X MAX < 50[1]

RIFFLE/RUN SUBSTRATE
- STABLE (e.g., Cobble, Boulder) [2]
- X MOD. STABLE (e.g., Large Gravel) [1]
- UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- LOW [1]
- X MODERATE [0]
- EXTENSIVE [-1]

COMMENTS: NO RIFFLE [Metric=0]

Riffle/Run: 3 (Max 8)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: ___ %GLIDE: ___
%RIFFLE: ___ %RUN: ___

Gradient: 6 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

OhioEPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 67

River Code: 5 **RM:** ______ **Stream:** Mud Creek
Date: 4/24/08 **Location:** Fall Cr. Parkway
Scorers Full Name: GRB **Affiliation:** ______

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE	POOL RIFFLE		POOL RIFFLE	SUBSTRATE ORIGIN Check ONE (OR 2 & AVERAGE)	SUBSTRATE QUALITY Check ONE (OR 2 & AVERAGE)
☐☐-BLDR /SLBS[10]		☐☐-GRAVEL [7]	X	☐ -LIMESTONE [1]	SILT: ☐- SILT HEAVY [-2]
☐☐-BOULDER [9]		☐☐-SAND [6]	X	☒-TILLS [1]	☒-SILT MODERATE [-1]
☐☐-COBBLE [8]		☐☐-BEDROCK[5]		☐ -WETLANDS[0]	☐-SILT NORMAL [0]
☐☐-HARDPAN [4]		☐☐-DETRITUS[3]		☐-HARDPAN [0]	☐-SILT FREE [1]
☐☐-MUCK [2]		☐☐-ARTIFICIAL[0]		☐ -SANDSTONE [0]	EMBEDDEDNESS: ☐-EXTENSIVE [-2]
☐☐-SILT [2]		NOTE: Ignore Sludge Originating From Point Sources		☐-RIP/RAP [0]	☐ -MODERATE [-1]
				☐ -LACUSTRINE [0]	☒-NORMAL [0]
				☐ -SHALE [-1]	☐ -NONE [1]
				☐-COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☒-4 or More [2] ☐-3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS ______

Substrate: 15 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)

TYPE: Score All That Occur

___UNDERCUT BANKS [1]	___POOLS> 70 cm [2]	___OXBOWS, BACKWATERS [1]
X OVERHANGING VEGETATION [1]	___ROOTWADS [1]	___AQUATIC MACROPHYTES [1]
X SHALLOWS (IN SLOW WATER) [1]	___BOULDERS [1]	X LOGS OR WOODY DEBRIS [1]
X ROOTMATS [1]		

COMMENTS: ______

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- ☐ - EXTENSIVE > 75% [11]
- ☒ - MODERATE 25-75% [7]
- ☐ - SPARSE 5-25% [3]
- ☐ - NEARLY ABSENT < 5%[1]

Cover: 11 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐- HIGH [4]	☐- EXCELLENT [7]	☒- NONE [6]	☐- HIGH [3]	☐- SNAGGING	☐ - IMPOUND.
☒- MODERATE [3]	☐- GOOD [5]	☐- RECOVERED [4]	☒- MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☐ - LOW [2]	☒- FAIR [3]	☐- RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐- NONE [1]	☐- POOR [1]	☐- RECENT OR NO RECOVERY [1]		☐- DREDGING	☐- BANK SHAPING
				☐-ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ______

Channel: 14 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐- WIDE > 50m [4]	☐☒-FOREST, SWAMP [3]	☐☐-CONSERVATION TILLAGE [1]	☐☐-NONE/LITTLE [3]
☐☐- MODERATE 10-50m [3]	☐☐-SHRUB OR OLD FIELD [2]	☐☐-URBAN OR INDUSTRIAL [0]	☐☒-MODERATE [2]
☐☒- NARROW 5-10 m [2]	☐☐-RESIDENTIAL,PARK,NEW FIELD [1]	☐☐-OPEN PASTURE,ROWCROP [0]	☐☐-HEAVY/SEVERE[1]
☒☐- VERY NARROW <5 m[1]	☐☐-FENCED PASTURE [1]	☐☐-MINING/CONSTRUCTION [0]	
☐☐- NONE [0]			

COMMENTS: ______

Riparian: 7 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY (Check 1 or 2 & AVERAGE)	CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)	
☐- >1m [6]	☒-POOL WIDTH > RIFFLE WIDTH [2]	☐-EDDIES[1]	☐-TORRENTIAL[-1]
☒- 0.7-1m [4]	☐-POOL WIDTH = RIFFLE WIDTH [1]	☐-FAST[1]	☐-INTERSTITIAL[-1]
☐- 0.4-0.7m [2]	☐-POOL WIDTH < RIFFLE W. [0]	☒-MODERATE [1]	☐-INTERMITTENT[-2]
☐- 0.2- 0.4m [1]		☒-SLOW [1]	☐-VERY FAST[1]
☐- < 0.2m [POOL=0]			

COMMENTS: ______

Pool/Current: 8 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☒- Best Areas >10 cm [2]	☒- MAX > 50 [2]	☒-STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
☐- Best Areas 5-10 cm[1]	☐ -MAX < 50[1]	☐-MOD. STABLE (e.g.,Large Gravel) [1]	☐ - LOW [1]
☐- Best Areas < 5 cm [RIFFLE=0]		☐-UNSTABLE (Fine Gravel,Sand) [0]	☒- MODERATE [0]
			☐- EXTENSIVE [-1]

COMMENTS: ______ ☐ - NO RIFFLE [Metric=0]

Riffle/Run: 6 (Max 8)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.): ______

%POOL: ______ %GLIDE: ______
%RIFFLE: ______ %RUN: ______

Gradient: 6 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

EPA 4520 06/24/01

fat mucket (w.d.) (clam)
typical

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 31

River Code: 6 RM: Stream: Indian Creek
Date: 4/25/08 Location: County Line
Scorers Full Name: GRB Affiliation:

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE POOL RIFFLE
- BLDR /SLBS[10]
- BOULDER [9]
- COBBLE [8]
- HARDPAN [4]
- MUCK [2]
- SILT [2] X

POOL RIFFLE
- GRAVEL [7]
- SAND [6] X
- BEDROCK[5]
- DETRITUS[3]
- ARTIFICIAL[0]

NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN
Check ONE (OR 2 & AVERAGE)
- LIMESTONE [1]
- X TILLS [1]
- WETLANDS[0]
- HARDPAN [0]
- SANDSTONE [0]
- RIP/RAP [0]
- LACUSTRINE [0]
- SHALE [-1]
- COAL FINES [-2]

SUBSTRATE QUALITY
Check ONE (OR 2 & AVERAGE)
SILT:
- X SILT HEAVY [-2]
- SILT MODERATE [-1]
- SILT NORMAL [0]
- SILT FREE [1]

EMBEDDEDNESS:
- X EXTENSIVE [-2]
- MODERATE [-1]
- NORMAL [0]
- NONE [1]

NUMBER OF SUBSTRATE TYPES: 4 or More [2] / X 3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS

Substrate: 5 Max 20

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) TYPE: Score All That Occur

- ___UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- ___ROOTMATS [1]
- ___POOLS> 70 cm [2]
- ___ROOTWADS [1]
- ___BOULDERS [1]
- ___OXBOWS, BACKWATERS [1]
- ___AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- EXTENSIVE > 75% [11]
- MODERATE 25-75% [7]
- SPARSE 5-25% [3]
- X NEARLY ABSENT < 5%[1]

Cover: 4 Max 20

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY
- HIGH [4]
- MODERATE [3]
- X LOW [2]
- NONE [1]

DEVELOPMENT
- EXCELLENT [7]
- GOOD [5]
- FAIR [3]
- X POOR [1]

CHANNELIZATION
- NONE [6]
- X RECOVERED [4]
- RECOVERING [3]
- RECENT OR NO RECOVERY [1]

STABILITY
- HIGH [3]
- MODERATE [2]
- X LOW [1]

MODIFICATIONS/OTHER
- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEED
- BANK SHAPING

COMMENTS:

Channel: 7 Max 20

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH
L R (Per Bank)
- WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2]
- VERY NARROW <5 m[1]
- X NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN)
L R (Most Predominant Per Bank)
- FOREST, SWAMP [3]
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL,PARK,NEW FIELD [1]
- FENCED PASTURE [1]

L R
- X CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE,ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION
L R (Per Bank)
- NONE/LITTLE [3]
- X MODERATE [2]
- HEAVY/SEVERE[1]

COMMENTS:

Riparian: 3 Max 10

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- >1m [6]
- 0.7-1m [4]
- 0.4-0.7m [2]
- X 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2]
- X POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES[1]
- FAST[1]
- X MODERATE [1]
- X SLOW [1]
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

COMMENTS:

Pool/Current: 4 Max 12

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- Best Areas >10 cm [2]
- X Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- MAX > 50 [2]
- X MAX < 50[1]

RIFFLE/RUN SUBSTRATE
- STABLE (e.g.,Cobble, Boulder) [2]
- MOD. STABLE (e.g.,Large Gravel) [1]
- X UNSTABLE (Fine Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- LOW [1]
- MODERATE [0]
- X EXTENSIVE [-1]

COMMENTS:
- NO RIFFLE [Metric=0]

Riffle/Run: 2 Max 8

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: %GLIDE:
%RIFFLE: %RUN:

Gradient: 6 Max 10

** Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA **Qualitative Habitat Evaluation Index Field Sheet** QHEI Score: 58

River Code: 7 **RM:** ______ **Stream:** Indian Creek

Date: 4/24/08 **Location:** 52nd St.

Scorers Full Name: GRB **Affiliation:** ______

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	SUBSTRATE ORIGIN	SUBSTRATE QUALITY
						Check ONE (OR 2 & AVERAGE)	Check ONE (OR 2 & AVERAGE)
BLDR /SLBS[10]			GRAVEL [7]	X			
BOULDER [9]			SAND [6]	X		LIMESTONE [1]	SILT: X SILT HEAVY [-2]
COBBLE [8]			BEDROCK[5]			X TILLS [1]	SILT MODERATE [-1]
HARDPAN [4]			DETRITUS[3]			WETLANDS[0]	SILT NORMAL [0]
MUCK [2]			ARTIFICIAL[0]			HARDPAN [0]	SILT FREE [1]
SILT [2]			NOTE: Ignore Sludge Originating From Point Sources			SANDSTONE [0]	EMBEDDEDNESS: X EXTENSIVE [-2]
						RIP/RAP [0]	MODERATE [-1]
						LACUSTRINE [0]	NORMAL [0]
						SHALE [-1]	NONE [1]
						COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☐ 4 or More [2] X 3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS ______

Substrate: 10 Max 20

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) TYPE: Score All That Occur

___ UNDERCUT BANKS [1]
X OVERHANGING VEGETATION [1]
X SHALLOWS (IN SLOW WATER) [1]
X ROOTMATS [1]
___ POOLS> 70 cm [2]
X ROOTWADS [1]
___ BOULDERS [1]
___ OXBOWS, BACKWATERS [1]
___ AQUATIC MACROPHYTES [1]
X LOGS OR WOODY DEBRIS [1]

COMMENTS: ______

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
☐ - EXTENSIVE > 75% [11]
X - MODERATE 25-75% [7]
☐ - SPARSE 5-25% [3]
☐ - NEARLY ABSENT < 5%[1]

Cover: 12 Max 20

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	X - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☐ - GOOD [5]	☐ - RECOVERED [4]	☐ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
X - LOW [2]	X - FAIR [3]	☐ - RECOVERING [3]	X - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ______

Channel: 12 Max 20

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐ - WIDE > 50m [4]	☐X - FOREST, SWAMP [3]	☐☐ - CONSERVATION TILLAGE [1]	☐☐ - NONE/LITTLE [3]
☐X - MODERATE 10-50m [3]	☐☐ - SHRUB OR OLD FIELD [2]	☐☐ - URBAN OR INDUSTRIAL [0]	☐X - MODERATE [2]
☐☐ - NARROW 5-10 m [2]	☐☐ - RESIDENTIAL,PARK,NEW FIELD [1]	☐☐ - OPEN PASTURE,ROWCROP [0]	☐☐ - HEAVY/SEVERE[1]
☐☐ - VERY NARROW <5 m[1]	☐☐ - FENCED PASTURE [1]	☐☐ - MINING/CONSTRUCTION [0]	
☐☐ - NONE [0]			

COMMENTS: ______

Riparian: 8 Max 10

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY (Check 1 or 2 & AVERAGE)	CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)	
☐ - >1m [6]	☐ - POOL WIDTH > RIFFLE WIDTH [2]	☐ - EDDIES[1]	☐ - TORRENTIAL[-1]
X - 0.7-1m [4]	X - POOL WIDTH = RIFFLE WIDTH [1]	☐ - FAST[1]	☐ - INTERSTITIAL[-1]
☐ - 0.4-0.7m [2]	☐ - POOL WIDTH < RIFFLE W. [0]	X - MODERATE [1]	☐ - INTERMITTENT[-2]
☐ - 0.2- 0.4m [1]		X - SLOW [1]	☐ - VERY FAST[1]
☐ - < 0.2m [POOL=0]			

COMMENTS: ______

Pool/Current: 7 Max 12

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ - Best Areas >10 cm [2]	☐ - MAX > 50 [2]	X STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
X - Best Areas 5-10 cm[1]	X - MAX < 50[1]	☐ MOD. STABLE (e.g.,Large Gravel) [1]	☐ - LOW [1]
☐ - Best Areas < 5 cm [RIFFLE=0]		☐ UNSTABLE (Fine Gravel,Sand) [0]	☐ - MODERATE [0]
			X - EXTENSIVE [-1]

COMMENTS: ______ ☐ - NO RIFFLE [Metric=0]

Riffle/Run: 3 Max 8

Gradient: 6 Max 10

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: ______ %GLIDE: ______
%RIFFLE: ______ %RUN: ______

** Best areas must be large enough to support a population of riffle-obligate species

OhioEPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 60 59

River Code: 8 **RM:** **Stream:** Indian Creek
Date: 4/24/08 **Location:** Sunnyside
Scorers Full Name: GRB **Affiliation:**

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE POOL RIFFLE | POOL RIFFLE | SUBSTRATE ORIGIN Check ONE (OR 2 & AVERAGE) | SUBSTRATE QUALITY Check ONE (OR 2 & AVERAGE)

- BLDR /SLBS[10]
- BOULDER [9]
- COBBLE [8]
- HARDPAN [4]
- MUCK [2]
- SILT [2]
- GRAVEL [7] X
- SAND [6] X
- BEDROCK[5]
- DETRITUS[3]
- ARTIFICIAL[0]

NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN: LIMESTONE [1]; X TILLS [1]; WETLANDS[0]; HARDPAN [0]; SANDSTONE [0]; RIP/RAP [0]; LACUSTRINE [0]; SHALE [-1]; COAL FINES [-2]

SILT: X SILT HEAVY [-2]; SILT MODERATE [-1]; SILT NORMAL [0]; SILT FREE [1]

EMBEDDEDNESS: X EXTENSIVE [-2]; MODERATE [-1]; NORMAL [0]; NONE [1]

Substrate: 10 Max 20

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >) 4 or More [2]; X 3 or Less [0]

COMMENTS

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

TYPE: Score All That Occur (Structure)

- UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- POOLS> 70 cm [2]
- X ROOTWADS [1]
- BOULDERS [1]
- OXBOWS, BACKWATERS [1]
- AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE) EXTENSIVE > 75% [11]; X MODERATE 25-75% [7]; X SPARSE 5-25% [3]; NEARLY ABSENT < 5%[1]

Cover: 8 Max 20

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY: HIGH [4]; X MODERATE [3]; LOW [2]; NONE [1]

DEVELOPMENT: EXCELLENT [7]; GOOD [5]; X FAIR [3]; POOR [1]

CHANNELIZATION: X NONE [6]; RECOVERED [4]; RECOVERING [3]; RECENT OR NO RECOVERY [1]

STABILITY: HIGH [3]; X MODERATE [2]; LOW [1]

MODIFICATIONS/OTHER: SNAGGING; RELOCATION; CANOPY REMOVAL; DREDGING; ONE SIDE CHANNEL MODIFICATIONS; IMPOUND.; ISLANDS; LEVEED; BANK SHAPING

Channel: 14 Max 20

COMMENTS:

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank): WIDE > 50m [4]; X MODERATE 10-50m [3]; NARROW 5-10 m [2]; VERY NARROW <5 m[1]; NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank): X FOREST, SWAMP [3]; SHRUB OR OLD FIELD [2]; RESIDENTIAL, PARK, NEW FIELD [1]; FENCED PASTURE [1]; CONSERVATION TILLAGE [1]; URBAN OR INDUSTRIAL [0]; OPEN PASTURE, ROWCROP [0]; MINING/CONSTRUCTION [0]

BANK EROSION L R (Per Bank): NONE/LITTLE [3]; X MODERATE [2]; HEAVY/SEVERE[1]

Riparian: 8 Max 10

COMMENTS:

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!): >1m [6]; X 0.7-1m [4]; 0.4-0.7m [2]; 0.2- 0.4m [1]; < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE): X POOL WIDTH > RIFFLE WIDTH [2]; POOL WIDTH = RIFFLE WIDTH [1]; POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply): EDDIES[1]; FAST[1]; X MODERATE [1]; X SLOW [1]; TORRENTIAL[-1]; INTERSTITIAL[-1]; INTERMITTENT[-2]; VERY FAST[1]

Pool/Current: 8 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH: Best Areas >10 cm [2]; X Best Areas 5-10 cm[1]; Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH: MAX > 50 [2]; X MAX < 50[1]

RIFFLE/RUN SUBSTRATE: STABLE (e.g.,Cobble, Boulder) [2]; MOD. STABLE (e.g.,Large Gravel) [1]; X UNSTABLE (Fine Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS: NONE [2]; LOW [1]; MODERATE [0]; X EXTENSIVE [-1]

Riffle/Run: 1 Max 8

COMMENTS: NO RIFFLE [Metric=0]

Gradient: 6 Max 10

6] GRADIENT (ft/mi): DRAINAGE AREA (sq.mi.): %POOL: %GLIDE: %RIFFLE: %RUN:

** Best areas must be large enough to support a population of riffle-obligate species

EPA 4520 06/24/01

fat mucket (w. d.)

OhioEPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 70

River Code: 9 RM: Stream: Indian Creek
Date: 4/24/08 Location: D/S Indian Lake
Scorers Full Name: GRB Affiliation:

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present)

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
BLDR /SLBS[10]			GRAVEL [7]	X	
BOULDER [9]			SAND [6]		
COBBLE [8]	X		BEDROCK[5]		
HARDPAN [4]			DETRITUS[3]		
MUCK [2]			ARTIFICIAL[0]		
SILT [2]			NOTE: Ignore Sludge Originating From Point Sources		

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE): LIMESTONE [1]; X TILLS [1]; WETLANDS[0]; HARDPAN [0]; SANDSTONE [0]; RIP/RAP [0]; LACUSTRINE [0]; SHALE [-1]; COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE):
SILT: X SILT HEAVY [-2]; SILT MODERATE [-1]; SILT NORMAL [0]; SILT FREE [1]
EMBEDDEDNESS: X EXTENSIVE [-2]; MODERATE [-1]; NORMAL [0]; NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >) X 4 or More [2]; 3 or Less [0]

COMMENTS

Substrate: 14 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure) TYPE: Score All That Occur

- UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- POOLS> 70 cm [2]
- X ROOTWADS [1]
- BOULDERS [1]
- OXBOWS, BACKWATERS [1]
- AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE) EXTENSIVE > 75% [11]; X MODERATE 25-75% [7]; SPARSE 5-25% [3]; NEARLY ABSENT < 5%[1]

Cover: 12 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
HIGH [4]	EXCELLENT [7]	X NONE [6]	HIGH [3]
X MODERATE [3]	X GOOD [5]	RECOVERED [4]	X MODERATE [2]
LOW [2]	FAIR [3]	RECOVERING [3]	LOW [1]
NONE [1]	POOR [1]	RECENT OR NO RECOVERY [1]	

MODIFICATIONS/OTHER: SNAGGING; RELOCATION; CANOPY REMOVAL; DREDGING; ONE SIDE CHANNEL MODIFICATIONS; IMPOUND.; ISLANDS; LEVEED; BANK SHAPING

COMMENTS:

Channel: 16 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank): WIDE > 50m [4]; MODERATE 10-50m [3] (R checked); NARROW 5-10 m [2]; VERY NARROW <5 m[1]; NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank): FOREST, SWAMP [3] (R checked); SHRUB OR OLD FIELD [2]; RESIDENTIAL, PARK, NEW FIELD [1]; FENCED PASTURE [1]; CONSERVATION TILLAGE [1]; URBAN OR INDUSTRIAL [0]; OPEN PASTURE, ROWCROP [0]; MINING/CONSTRUCTION [0]

BANK EROSION L R (Per Bank): NONE/LITTLE [3] (R checked); MODERATE [2]; HEAVY/SEVERE[1]

COMMENTS:

Riparian: 9 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!): >1m [6]; X 0.7-1m [4]; 0.4-0.7m [2]; 0.2- 0.4m [1]; < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE): X POOL WIDTH > RIFFLE WIDTH [2]; POOL WIDTH = RIFFLE WIDTH [1]; POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply): EDDIES[1]; FAST[1]; X MODERATE [1]; X SLOW [1]; TORRENTIAL[-1]; INTERSTITIAL[-1]; INTERMITTENT[-2]; VERY FAST[1]

COMMENTS:

Pool/Current: 8 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH: Best Areas >10 cm [2]; X Best Areas 5-10 cm[1]; Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH: MAX > 50 [2]; X MAX < 50[1]

RIFFLE/RUN SUBSTRATE: X STABLE (e.g., Cobble, Boulder) [2]; MOD. STABLE (e.g., Large Gravel) [1]; UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS: NONE [2]; LOW [1]; MODERATE [0]; X EXTENSIVE [-1]

NO RIFFLE [Metric=0]

COMMENTS:

Riffle/Run: 3 (Max 8)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______ %POOL: %GLIDE: %RIFFLE: %RUN:

Gradient: 8 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

EPA 4520 06/24/01

fat mucket (w.d.)
paper shell (f.d.)

extensive silt deposits

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 73

River Code: 10 **RM:** ____ **Stream:** Fall Creek
Date: 4/25/08 **Location:** Geist Dam
Scorers Full Name: GRB **Affiliation:** ____

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present)

TYPE — POOL RIFFLE

- BLDR /SLBS[10]
- BOULDER [9]
- COBBLE [8]
- HARDPAN [4]
- MUCK [2]
- SILT [2]
- GRAVEL [7] — X
- SAND [6] — X
- BEDROCK[5]
- DETRITUS[3]
- ARTIFICIAL[0]

NOTE: Ignore Sludge Originating From Point Sources

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
- 4 or More [2]
- X 3 or Less [0]

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)
- LIMESTONE [1]
- X TILLS [1]
- WETLANDS[0]
- HARDPAN [0]
- SANDSTONE [0]
- RIP/RAP [0]
- LACUSTRINE [0]
- SHALE [-1]
- COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)

SILT:
- SILT HEAVY [-2]
- SILT MODERATE [-1]
- X SILT NORMAL [0]
- SILT FREE [1]

EMBEDDEDNESS:
- EXTENSIVE [-2]
- MODERATE [-1]
- X NORMAL [0]
- NONE [1]

Substrate: 14 (Max 20)

COMMENTS ____

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure) TYPE: Score All That Occur

- UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- X POOLS> 70 cm [2]
- X ROOTWADS [1]
- BOULDERS [1]
- OXBOWS, BACKWATERS [1]
- AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS: ____

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- X EXTENSIVE > 75% [11]
- X MODERATE 25-75% [7]
- SPARSE 5-25% [3]
- NEARLY ABSENT < 5%[1]

Cover: 14 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY
- HIGH [4]
- X MODERATE [3]
- LOW [2]
- NONE [1]

DEVELOPMENT
- EXCELLENT [7]
- GOOD [5]
- X FAIR [3]
- POOR [1]

CHANNELIZATION
- X NONE [6]
- RECOVERED [4]
- RECOVERING [3]
- RECENT OR NO RECOVERY [1]

STABILITY
- HIGH [3]
- X MODERATE [2]
- LOW [1]

MODIFICATIONS/OTHER
- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEED
- BANK SHAPING

Channel: 14 (Max 20)

COMMENTS: ____

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH — L R (Per Bank)
- X X WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2]
- VERY NARROW <5 m[1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) — L R (Most Predominant Per Bank)
- X FOREST, SWAMP [3]
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL, PARK, NEW FIELD [1]
- FENCED PASTURE [1]
- CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE, ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION — L R (Per Bank)
- X NONE/LITTLE [3]
- MODERATE [2]
- HEAVY/SEVERE[1]

Riparian: 10 (Max 10)

COMMENTS: ____

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- X >1m [6]
- 0.7-1m [4]
- 0.4-0.7m [2]
- 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2]
- X POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES[1]
- X FAST[1]
- X MODERATE [1]
- X SLOW [1]
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

Pool/Current: 10 (Max 12)

COMMENTS: ____

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- X Best Areas >10 cm [2]
- Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- X MAX > 50 [2]
- MAX < 50[1]

RIFFLE/RUN SUBSTRATE
- STABLE (e.g.,Cobble, Boulder) [2]
- MOD. STABLE (e.g.,Large Gravel) [1]
- X UNSTABLE (Fine Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- X LOW [1]
- MODERATE [0]
- EXTENSIVE [-1]
- NO RIFFLE [Metric=0]

Riffle/Run: 5 (Max 8)

COMMENTS: ____

6] GRADIENT (ft/mi): ____ DRAINAGE AREA (sq.mi.) : ____

%POOL: ____ %GLIDE: ____
%RIFFLE: ____ %RUN: ____

Gradient: 6 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 76

River Code: 11 **RM:** **Stream:** Fall Creek
Date: 4/24/08 **Location:** Emerson St.
Scorers Full Name: GRB **Affiliation:**

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE POOL RIFFLE
- BLDR /SLBS[10]
- BOULDER [9]
- COBBLE [8] X
- HARDPAN [4]
- MUCK [2]
- SILT [2]
- GRAVEL [7] X
- SAND [6]
- BEDROCK[5]
- DETRITUS[3]
- ARTIFICIAL[0]

NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN Check ONE (OR 2 & AVERAGE)
- LIMESTONE [1]
- TILLS [1] X
- WETLANDS[0]
- HARDPAN [0]
- SANDSTONE [0]
- RIP/RAP [0]
- LACUSTRINE [0]
- SHALE [-1]
- COAL FINES [-2]

SUBSTRATE QUALITY Check ONE (OR 2 & AVERAGE)
SILT:
- SILT HEAVY [-2]
- SILT MODERATE [-1]
- SILT NORMAL [0] X
- SILT FREE [1]

EMBEDDEDNESS:
- EXTENSIVE [-2]
- MODERATE [-1]
- NORMAL [0] X
- NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
- 4 or More [2] X
- 3 or Less [0]

COMMENTS

Substrate: 18 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)
TYPE: Score All That Occur
- UNDERCUT BANKS [1]
- X OVERHANGING VEGETATION [1]
- X SHALLOWS (IN SLOW WATER) [1]
- X ROOTMATS [1]
- X POOLS> 70 cm [2]
- X ROOTWADS [1]
- BOULDERS [1]
- OXBOWS, BACKWATERS [1]
- AQUATIC MACROPHYTES [1]
- X LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- EXTENSIVE > 75% [11]
- MODERATE 25-75% [7] X
- SPARSE 5-25% [3]
- NEARLY ABSENT < 5%[1]

Cover: 14 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY
- HIGH [4]
- MODERATE [3] X
- LOW [2]
- NONE [1]

DEVELOPMENT
- EXCELLENT [7]
- GOOD [5] X
- FAIR [3] X
- POOR [1]

CHANNELIZATION
- NONE [6] X
- RECOVERED [4]
- RECOVERING [3]
- RECENT OR NO RECOVERY [1]

STABILITY
- HIGH [3]
- MODERATE [2] X
- LOW [1]

MODIFICATIONS/OTHER
- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEED
- BANK SHAPING

COMMENTS:

Channel: 14 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)
- WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2] X X
- VERY NARROW <5 m[1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)
- FOREST, SWAMP [3] X
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL, PARK, NEW FIELD [1] X
- FENCED PASTURE [1]
- CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE, ROWCROP [0]
- MINING/CONSTRUCTION [0]

BANK EROSION L R (Per Bank)
- NONE/LITTLE [3] X X
- MODERATE [2]
- HEAVY/SEVERE[1]

COMMENTS:

Riparian: 8 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- >1m [6] X
- 0.7-1m [4]
- 0.4-0.7m [2]
- 0.2- 0.4m [1]
- < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- POOL WIDTH > RIFFLE WIDTH [2] X
- POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
- EDDIES[1]
- FAST[1] X
- MODERATE [1] X
- SLOW [1] X
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

COMMENTS:

Pool/Current: 11 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH
- Best Areas >10 cm [2] X
- Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH
- MAX > 50 [2] X
- MAX < 50[1]

RIFFLE/RUN SUBSTRATE
- STABLE (e.g., Cobble, Boulder) [2] X
- MOD. STABLE (e.g., Large Gravel) [1] X
- UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- NONE [2]
- LOW [1]
- MODERATE [0] X
- EXTENSIVE [-1]

COMMENTS:
- NO RIFFLE [Metric=0]

Riffle/Run: 5 (Max 8)

6] GRADIENT (ft/mi): DRAINAGE AREA (sq.mi.) :

%POOL: %GLIDE:
%RIFFLE: %RUN:

Gradient: 6 (Max 10)

** Best areas must be large enough to support a population of riffle-obligate species

EPA 4520 06/24/01

mucket (live)
white heelsplitter (f.d.)
Wabash pigtoe
fat mucket
creeper
} (w.d)

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 54

River Code: 12 **RM:** **Stream:** Fall Creek
Date: 4/24/08 **Location:** Meridian St., Indpls
Scorers Full Name: GRB **Affiliation:**

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE	POOL RIFFLE	TYPE	POOL RIFFLE	SUBSTRATE ORIGIN	SUBSTRATE QUALITY
☐☐-BLDR/SLBS[10]		☐☐-GRAVEL [7]	X	Check ONE (OR 2 & AVERAGE)	Check ONE (OR 2 & AVERAGE)
☐☐-BOULDER [9]		☐☐-SAND [6]	X	☐-LIMESTONE [1]	SILT: ☐-SILT HEAVY [-2]
☐☐-COBBLE [8]		☐☐-BEDROCK[5]		☒-TILLS [1]	☒-SILT MODERATE [-1]
☐☐-HARDPAN [4]		☐☐-DETRITUS[3]		☐-WETLANDS[0]	☐-SILT NORMAL [0]
☐☐-MUCK [2]		☐☐-ARTIFICIAL[0]		☐-HARDPAN [0]	☐-SILT FREE [1]
☐☐-SILT [2]		NOTE: Ignore Sludge Originating From Point Sources		☐-SANDSTONE [0]	EMBEDDEDNESS: ☐-EXTENSIVE [-2]
				☐-RIP/RAP [0]	☒-MODERATE [-1]
				☐-LACUSTRINE [0]	☐-NORMAL [0]
				☐-SHALE [-1]	☐-NONE [1]
				☐-COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☐-4 or More [2] ☐-3 or Less [0]
(High Quality Only, Scored 5 or >)

COMMENTS

Substrate: 12 Max 20

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) TYPE: Score All That Occur

___UNDERCUT BANKS [1] X POOLS> 70 cm [2] ___OXBOWS, BACKWATERS [1]
___OVERHANGING VEGETATION [1] ___ROOTWADS [1] ___AQUATIC MACROPHYTES [1]
___SHALLOWS (IN SLOW WATER) [1] ___BOULDERS [1] ___LOGS OR WOODY DEBRIS [1]
___ROOTMATS [1] COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
☐ - EXTENSIVE > 75% [11]
☐ - MODERATE 25-75% [7]
☒ - SPARSE 5-25% [3]
☐ - NEARLY ABSENT < 5%[1]

Cover: 5 Max 20

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☒ - MODERATE [3]	☐ - GOOD [5]	☒ - RECOVERED [4]	☒ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☐ - LOW [2]	☒ - FAIR [3]	☐ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS:

Channel: 12 Max 20

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐ - WIDE > 50m [4]	☐☐-FOREST, SWAMP [3]	☐☐-CONSERVATION TILLAGE [1]	☐☒-NONE/LITTLE [3]
☐☐ - MODERATE 10-50m [3]	☐☐-SHRUB OR OLD FIELD [2]	☐☒-URBAN OR INDUSTRIAL [0]	☐☐-MODERATE [2]
☐☐ - NARROW 5-10 m [2]	☐☐-RESIDENTIAL,PARK,NEW FIELD [1]	☐☐-OPEN PASTURE,ROWCROP [0]	☐☐-HEAVY/SEVERE[1]
☐☐ - VERY NARROW < 5 m[1]	☐☐-FENCED PASTURE [1]	☐☐-MINING/CONSTRUCTION [0]	
☒☒ - NONE [0]			

COMMENTS:

Riparian: 3 Max 10

5.] POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☒ - >1m [6]
☐ - 0.7-1m [4]
☐ - 0.4-0.7m [2]
☐ - 0.2- 0.4m [1]
☐ - < 0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☒-POOL WIDTH > RIFFLE WIDTH [2]
☐-POOL WIDTH = RIFFLE WIDTH [1]
☐-POOL WIDTH < RIFFLE W. [0]

COMMENTS:

CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)
☐-EDDIES[1] ☐-TORRENTIAL[-1]
☐-FAST[1] ☐-INTERSTITIAL[-1]
☒-MODERATE [1] ☐-INTERMITTENT[-2]
☒-SLOW [1] ☐-VERY FAST[1]

Pool/Current: 11 Max 12

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☒ - Best Areas >10 cm [2]	☒ - MAX > 50 [2]	☐-STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
☐ - Best Areas 5-10 cm[1]	☐ - MAX < 50[1]	☒-MOD. STABLE (e.g.,Large Gravel) [1]	☐ - LOW [1]
☐ - Best Areas < 5 cm [RIFFLE=0]		☐-UNSTABLE (Fine Gravel,Sand) [0]	☐ - MODERATE [0]
			☐ - EXTENSIVE [-1]

COMMENTS: ☐ - NO RIFFLE [Metric=0]

Riffle/Run: 5 Max 8

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ______

%POOL: %GLIDE:
%RIFFLE: %RUN:

Gradient: 6 Max

* Best areas must be large enough to support a population of riffle-obligate species

Rapid Stream Assessment Field Notes

Stream Name: Sand ~~Fall~~ Creek
Location: ~~79th St.~~ Brooks School Rd

Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D.: 1
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 500 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep	x-steep steep
Roads			moderate gentle	moderate gentle
Railroads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Improved Paths			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Development			Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width
Valley Width: ☐ Gorge

Narrowly Confined (1-2)
Semi-confined (>2-4)
Narrow (>4-6)
Broad (>6-10)
Very Broad (>10)

1.6 Grade Controls (circle one)
Location in Reach (record locations on field map)
Fill out height fields for grade control with greatest total height

	Location in Reach				Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 100 ft. **2.2 Max. Bankfull Depth:** 5 ft. **2.3 Mean Bankfull Depth:** 4 ft

2.4 ~~Floodprone~~ Stream Width: 8 ft. **2.5 Low Bank Height:** 3 ft. **2.6 Ratio W/d$_{mean}$:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous NA **2.11 Riffle/Step Spacing:** ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
						<1	<1	Y / N	Bed: sand Bar: sand circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

2- stage ditch construction (photo)

Rapid Stream Assessment Field Notes

Stream Name: Sand Creek
Location: 116th St

Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D.: 2
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 500 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right
Berms		
Roads		
Railroads		
Improved Paths		✓
Development		

1.4 Adjacent Side Slopes

Left Corridor	Right Corridor
x-steep steep moderate gentle	x-steep steep moderate gentle
Continuous w/bank A / S / N	Continuous w/bank A / S / N
Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width

Valley Width: ☑ Gorge

Narrowly Confined	(1-2)
Semi-confined	(>2-4)
Narrow	(>4-6)
Broad	(>6-10)
Very Broad	(>10)

1.6 Grade Controls (circle one)
Location in Reach (record locations on field map)
Fill out height fields for grade control with greatest total height

	Location in Reach				Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 20 ft. **2.2 Max. Bankfull Depth:** 8 ft. **2.3 Mean Bankfull Depth:** 6 ft.

2.4 ~~Floodprone~~ Stream Width: 15 ft. **2.5 Low Bank Height:** 5 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)
			30	30	40	<1	<1	Y / N

2.13 Avg. Size of Largest Particles on:
Bed: Sand Bar: sand
circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

riffles only at bridge crossing (rip rap)

Rapid Stream Assessment Field Notes

Stream Name: Mud Cr.
Location: Madison/Hamilton Co. Line

Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D: 3
Date: 4/25/08
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 500 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None	None	x-steep steep moderate gentle	x-steep steep moderate gentle
Roads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Railroads			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Improved Paths			Texture of Exposed Slope	Texture of Exposed Slope
Development			till boulder/cobble gravel sand silt clay bedrock other NE	till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width

Valley Width: ☑ Gorge

Narrowly Confined	(1-2)
Semi-confined	(>2-4)
Narrow	(>4-6)
Broad	(>6-10)
Very Broad	(>10)

1.6 Grade Controls (circle one) Location in Reach (record locations on field map)				Fill out height fields for grade control with greatest total height	Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 20 ft. **2.2 Max. Bankfull Depth:** 8 ft. **2.3 Mean Bankfull Depth:** 6 ft.

2.4 ~~Floodprone~~ stream Width: 10 ft. **2.5 Low Bank Height:** 6 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 100 ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
								Y / N	Bed: Bar: circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Rapid Stream Assessment Field Notes

Stream Name: Mud Creek
Location: 116 th St.
Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D: 4
Date: 4/25/08
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 500 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep	x-steep steep
Roads			moderate gentle	moderate gentle
Railroads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Improved Paths			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Development			Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement *Valley width / Channel width*

Valley Width: ~~☐~~ Gorge

1.5 Confinement		1.6 Grade Controls (circle one) Location in Reach (record locations on field map)				Fill out height fields for grade control with greatest total height	Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Narrowly Confined	(1-2)	Waterfall	upstream	downstream	both	none				
Semi-confined	(>2-4)	Ledge	upstream	downstream	both	none				
Narrow	(>4-6)	Dam	upstream	downstream	both	none				
Broad	(>6-10)	Weir	upstream	downstream	both	none				
Very Broad	(>10)	Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 25 ft. **2.2 Max. Bankfull Depth:** 10 ft. **2.3 Mean Bankfull Depth:** 8 ft.

2.4 ~~Floodprone~~ stream **Width:** 20 ft. **2.5 Low Bank Height:** 8 ft. **2.6 Ratio W/d$_{mean}$:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
		5	30	20	45	<1	<1	Y / N	Bed: sand Bar: gravel circle: inches or millimeters

2.14 Stream Type: A G F ~~B~~ ~~E~~ C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

riffle at bridge (rip rap)

Rapid Stream Assessment Field Notes

Stream Name: Mud Creek
Location: Fall Creek Pkwy

Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D: 5
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep	x-steep steep
Roads			moderate gentle	moderate gentle
Railroads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Improved Paths			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Development			Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width

Valley Width: ☐ Gorge

- Narrowly Confined (1-2)
- Semi-confined (>2-4)
- Narrow (>4-6)
- Broad (>6-10)
- Very Broad (>10)

1.6 Grade Controls (circle one) Location in Reach (record locations on field map)					Fill out height fields for grade control with greatest total height	Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none					
Ledge	upstream	downstream	both	none					
Dam	upstream	downstream	both	none					
Weir	upstream	downstream	both	none					
Culverts	upstream	downstream	both	none					

2. Stream Channel

2.1 Bankfull Width: 30 ft. **2.2 Max. Bankfull Depth:** 4 ft. **2.3 Mean Bankfull Depth:** 3 ft.

2.4 ~~Floodprone~~ Stream Width: 20 ft. **2.5 Low Bank Height:** 2 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 100 ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
		10	20	20	50	1	1	Y / N	Bed: gravel Bar: gravel circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Rapid Stream Assessment Field Notes

Stream Name: Indian Creek
Location: County Line

Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather: Sunny 70° F
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D.: 6
Date: 4/25/08
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 500 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length		1.4 Adjacent Side Slopes	
	Left	Right	Left Corridor	Right Corridor
Berms	None		x-steep steep moderate gentle	x-steep steep moderate gentle
Roads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Railroads			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Improved Paths			Texture of Exposed Slope	Texture of Exposed Slope
Development			till boulder/cobble gravel sand silt clay bedrock other NE	till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement *Valley width / Channel width* Valley Width: ☑ Gorge	1.6 Grade Controls (circle one) Location in Reach (record locations on field map)				Fill out height fields for grade control with greatest total height	Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Narrowly Confined (1-2)	Waterfall	upstream	downstream	both	none				
Semi-confined (>2-4)	Ledge	upstream	downstream	both	none				
Narrow (>4-6)	Dam	upstream	downstream	both	none				
Broad (>6-10)	Weir	upstream	downstream	both	none				
Very Broad (>10)	Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 30 ft. **2.2 Max. Bankfull Depth:** 8 ft. **2.3 Mean Bankfull Depth:** 8 ft

2.4 ~~Floodprone~~ Stream Width: 8 ft. **2.5 Low Bank Height:** 8 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
			25	5	70	<1	<1	Y / N	Bed: sand Bar: sand circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Rapid Stream Assessment Field Notes

Stream Name: Indian Creek
Location: 52 nd St.

Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D: 7
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep	x-steep steep
Roads			moderate gentle	moderate gentle
Railroads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Improved Paths			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Development			Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width
Valley Width: ☐ Gorge

Narrowly Confined	(1-2)
Semi-confined	(>2-4)
Narrow	(>4-6)
Broad	(>6-10)
Very Broad	(>10)

1.6 Grade Controls (circle one)
Location in Reach (record locations on field map)
Fill out height fields for grade control with greatest total height

					Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 25 ft. **2.2 Max. Bankfull Depth:** 7 ft. **2.3 Mean Bankfull Depth:** 6 ft

2.4 ~~Floodprone~~ stream Width: 20 ft. **2.5 Low Bank Height:** 6 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 100 ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)
		5	15	10	70	<1	<1	Y / N

2.13 Avg. Size of Largest Particles on:
Bed: Bar:
circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

impounded by beavers u/s

Rapid Stream Assessment Field Notes

Stream Name: Indian Creek
Location: Sunnyside
U/S Indian Lake
Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D.: 8
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep moderate gentle	x-steep steep moderate gentle
Roads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Railroads			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Improved Paths			Texture of Exposed Slope: till boulder/cobble gravel sand	Texture of Exposed Slope: till boulder/cobble gravel sand
Development			silt clay bedrock other NE	silt clay bedrock other NE

1.5 Confinement *Valley width / Channel width*

Valley Width: ☐ Gorge

- Narrowly Confined (1-2)
- Semi-confined (>2-4)
- Narrow (>4-6)
- Broad (>6-10)
- Very Broad (>10)

1.6 Grade Controls (circle one) **Location in Reach** (record locations on field map). Fill out height fields for grade control with greatest total height

	Location in Reach				Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 30 ft. **2.2 Max. Bankfull Depth:** ~~8~~ 6 ft. **2.3 Mean Bankfull Depth:** 4 ft

2.4 ~~Floodprone~~ stream **Width:** 15 ft. **2.5 Low Bank Height:** 4 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 100 ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)
		5	30	15	50	<1	<1	Y / N

2.13 Avg. Size of Largest Particles on:
Bed: sand Bar: gravel
circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Rapid Stream Assessment Field Notes

Stream Name: Indian Creek
Location: D/S Indian Lake
Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D.: 9
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 500 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep moderate gentle	x-steep steep moderate gentle
Roads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Railroads			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Improved Paths			Texture of Exposed Slope: till boulder/cobble gravel sand	Texture of Exposed Slope: till boulder/cobble gravel sand
Development			silt clay bedrock other NE	silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width

Valley Width: ☐ Gorge

Narrowly Confined (1-2)
Semi-confined (>2-4)
Narrow (>4-6)
Broad (>6-10)
Very Broad (>10)

1.6 Grade Controls (circle one)

Location in Reach (record locations on field map)					Fill out height fields for grade control with greatest total height: Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 30 ft. **2.2 Max. Bankfull Depth:** 7 ft. **2.3 Mean Bankfull Depth:** 4 ft.

2.4 ~~Floodprone~~ stream Width: 20 ft. **2.5 Low Bank Height:** 3 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 100 ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
		30	20	30	20	<1	<1	Y / N	Bed: Bar: circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Rapid Stream Assessment Field Notes

Stream Name: Fall Creek
Location: Geist Dam
Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D: 10
Date: 4/25/08
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 1000 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep	x-steep steep
Roads			moderate gentle	moderate gentle
Railroads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Improved Paths			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Development			Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement *Valley width / Channel width*

Valley Width: ☐ Gorge

- Narrowly Confined (1-2)
- Semi-confined (>2-4)
- Narrow (>4-6)
- Broad (>6-10)
- Very Broad (>10)

1.6 Grade Controls (circle one)

Location in Reach (record locations on field map)

Fill out height fields for grade control with greatest total height

					Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 100 ft. **2.2 Max. Bankfull Depth:** 6 ft. **2.3 Mean Bankfull Depth:** 5 ft

2.4 ~~Floodprone~~ stream **Width:** 100 ft. **2.5 Low Bank Height:** 4 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
			20	10	70	<1	<1	Y / N	Bed: sand Bar: sand circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

No riffles except those at base of dam

Rapid Stream Assessment Field Notes

Stream Name: Fall Creek
Location: Emerson st Indpls
Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather:
Rain Storm within past 7 days: Y / N ☐Flood history known

Segment I.D.: 11
Date:
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right	1.4 Adjacent Side Slopes: Left Corridor	1.4 Adjacent Side Slopes: Right Corridor
Berms	None		x-steep steep moderate gentle	x-steep steep moderate gentle
Roads			Continuous w/bank A / S / N	Continuous w/bank A / S / N
Railroads			Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Improved Paths			Texture of Exposed Slope: till boulder/cobble gravel sand	Texture of Exposed Slope: till boulder/cobble gravel sand
Development			silt clay bedrock other NE	silt clay bedrock other NE

1.5 Confinement *Valley width / Channel width*	1.6 Grade Controls (circle one) Location in Reach (record locations on field map)					Fill out height fields for grade control with greatest total height	Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Valley Width: ☐ Gorge										
Narrowly Confined (1-2)	Waterfall	upstream	downstream	both	none					
Semi-confined (>2-4)	Ledge	upstream	downstream	both	none					
Narrow (>4-6)	Dam	upstream	downstream	both	none					
Broad (>6-10)	Weir	upstream	downstream	both	none					
Very Broad (>10)	Culverts	upstream	downstream	both	none					

2. Stream Channel

2.1 Bankfull Width: 90 ft. **2.2 Max. Bankfull Depth:** 7 ft. **2.3 Mean Bankfull Depth:** 5 ft.

2.4 ~~Floodprone~~ Stream Width: 90 ft. **2.5 Low Bank Height:** 4 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8 Incision Ratio:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 500 ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)	2.13 Avg. Size of Largest Particles on:
		10	30	30	30	<1	<1	Y / N	Bed: gravel Bar: sand circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Rapid Stream Assessment Field Notes

Stream Name: Fall Creek
Location: Meridian Street
Indianapolis
Observers: GRB
Organization /Agency:
USGS Map Name(s):
Weather: Sunny 70°F
Rain Storm within past 7 days: Y / N ☑Flood history known

Segment I.D.: 12
Date: 4/24/08
Town:
Elevation: ft.
Latitude (N/S):
Longitude (E/W):
Drainage Area: sq. mi.
Segment Length: 600 ft.

1. Valley and River Corridor

1.1 Watershed Zone:

1.2 Alluvial Fan: Yes / No

1.3 River Corridor Encroachments	Corridor Length Left	Corridor Length Right
Berms		
Roads	✓	✓
Railroads		
Improved Paths	✓	✓
Development	✓	✓

1.4 Adjacent Side Slopes

Left Corridor	Right Corridor
x-steep steep moderate gentle	x-steep steep moderate gentle
Continuous w/bank A / S / N	Continuous w/bank A / S / N
Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE	Texture of Exposed Slope: till boulder/cobble gravel sand silt clay bedrock other NE

1.5 Confinement
Valley width / Channel width

Valley Width: ☐ Gorge

Narrowly Confined (1-2)
Semi-confined (>2-4)
Narrow (>4-6)
Broad (>6-10)
Very Broad (>10)

1.6 Grade Controls (circle one)

Location in Reach (record locations on field map)

Fill out height fields for grade control with greatest total height

Type					Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photos taken? Y/N	GPS Y/N
Waterfall	upstream	downstream	both	none				
Ledge	upstream	downstream	both	none				
Dam	upstream	downstream	both	none				
Weir	upstream	downstream	both	none				
Culverts	upstream	downstream	both	none				

2. Stream Channel

2.1 Bankfull Width: 250 ft. **2.2 Max. Bankfull Depth:** 10 ft. **2.3 Mean Bankfull Depth:** 10 ft.

2.4 stream ~~**Floodprone**~~ **Width:** 130 ft. **2.5 Low Bank Height:** 2 ft. **2.6 Ratio W/d_{mean}:**

2.7 Entrenchment: **2.8** ~~**Incision Ratio**~~**:** **2.9 Sinuosity:**

2.10 Riffles/Steps: complete / partial / diagonal / continuous / NA **2.11 Riffle/Step Spacing:** 500' ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64 - 256 mm	4 Gravel Fine 0.1-0.6in 2-16 mm	4 Gravel Coarse 0.6-2.5in 16-64 mm	5 Sand < 0.1 in < 2 mm	% Detritus	Large Woody Debris (# pieces)	Silt or Clay (present)
		~~20~~ 10	20	20	40	<5	0	Y / N

2.13 Avg. Size of Largest Particles on:
Bed: gravel Bar: Sand
circle: inches or millimeters

2.14 Stream Type: A G F B E C D 1 2 3 4 5 a b c
rip cap

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

~~35~~ 34
CQHEI Total

Vol ID:

Site ID: #1

River and Watershed: N39°50,426 W85°56,070 EL 253

I. Substrate (Bottom Type)

Score: 0

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [x] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] ~~NO 5 pt~~
- [x] YES 0 pt

0

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present

Score: 4

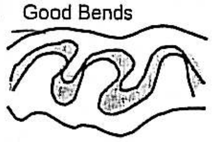
- [ ] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Boulders
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [ ] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Deep Areas (Chest Deep)
- [ ] 2 pt — Undercut Banks
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

III. Stream Shape and Human Alterations

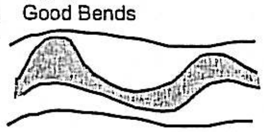
Score: 8

a) "Curviness" or "Sinuousity" of Channel

- [x] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [ ] 12 pt — Mostly Natural
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [x] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion

Score: ~~14~~ 13

a) Width of Riparian Forest & Wetland - Mostly:

- [ ] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [x] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 4 pt — Shrubs
- [ ] 3 pt — Overgrown Fields
- [ ] 2 pt — Fenced Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 2 pt — Conservation Tillage
- [ ] 1 pt — Suburban
- [x] 1 pt — Row Crop
- [ ] 0 pt — Open Pasture
- [x] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [x] 4 pt — Stable Hard or Well-Vegetated Banks
- [ ] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity

Score: 5

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [ ] 6 pt — Waist Deep
- [x] 4 pt — Knee Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent
- [ ] 0 pt — None

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken)

Score: 4

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 4 pt — Ankle Deep or Less & Slow
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail
- [x] 0 pt — Smaller Than Your Fingernails or Do Not Exist

#1 PICTURE OF 6' GALV CULVERT UNDER 700 W

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

48
CQHEI Total

Vol ID:
Site ID: #2
River and Watershed: N 39°50.467 W 85°58.507 EL 200 M

I. Substrate (Bottom Type) Score: 0

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [x] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

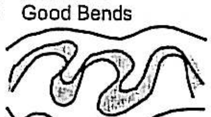
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present Score: 10

- [ ] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [x] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

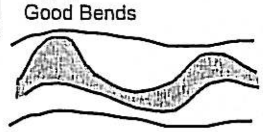
III. Stream Shape and Human Alterations Score: 12

a) "Curviness" or "Sinuousity" of Channel

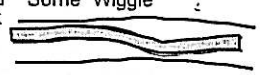
- [ ] 8 pt — 2 or More Good Bends



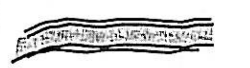
- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"



- [x] 0 pt — Very Straight



b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion Score: 13

a) Width of Riparian Forest & Wetland - Mostly:

- [ ] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [x] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [x] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [x] 4 pt — Stable Hard or Well-Vegetated Banks
- [ ] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity Score: 9

a) Deepest Pool is At Least:

- [x] 8 pt — Chest Deep
- [ ] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) Score: 4

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [x] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [x] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#2 PICTURE SHOWS SILT / SANDBAR W/ TRASH & DEBRIS

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

CQHEI Total: 62

Vol ID:

Site ID: #3

River and Watershed: N39° 51.358 W85° 58.204 EL 285.4m

I. Substrate (Bottom Type) — Score: 15

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [x] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [x] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

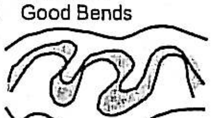
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: –

- [ ] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [ ] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [ ] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [ ] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

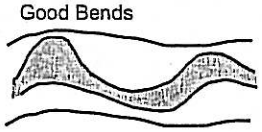
III. Stream Shape and Human Alterations — Score: 20

a) "Curviness" or "Sinuousity" of Channel

- [x] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 14

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [x] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 5

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 8

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [x] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [x] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#3 PICTURE OF BANKS + TREES OVERHANG + ROOTS

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

43
CQHEI Total

Vol ID: | Site ID: #4 | River and Watershed: N 39° 52.879 W 85° 58.837 EL 242.8

I. Substrate (Bottom Type) Score:

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [x] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

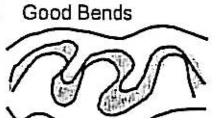
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present Score: 8

- [x] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [ ] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

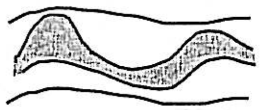
III. Stream Shape and Human Alterations Score: 12

a) "Curviness" or "Sinuousity" of Channel

- [ ] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [x] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion Score: 18

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [x] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity Score: 5

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) Score: 0

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#4 PICTURE OF CULVERT ON S. BANK + SMALL WATERCRAFT

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

77
CQHEI Total

Vol ID:

Site ID: #5

River and Watershed: N 39° 53.027 W 86° 00.291 EL 237.9m

I. Substrate (Bottom Type) — Score: 19

a) Size

- [x] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [x] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

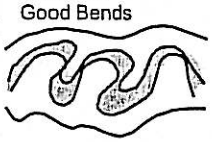
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 12

- [x] 2 pt — Underwater Tree Roots (Large)
- [x] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [x] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

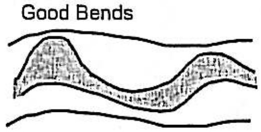
III. Stream Shape and Human Alterations — Score: 18

a) "Curviness" or "Sinuousity" of Channel

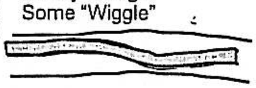
- [ ] 8 pt — 2 or More Good Bends



- [x] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"



- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 17

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [x] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [x] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 11

a) Deepest Pool is At Least:

- [x] 8 pt — Chest Deep
- [ ] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [x] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [ ] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score:

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#8 PICTURE UNDER BRIDGE SHOWING GRAVELLY SAND BAR

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

85 CQHEI Total

Vol ID:

Site ID: #6

River and Watershed: N39°53.894 W85°59.448 EL 232.8m

I. Substrate (Bottom Type) — Score: 14

a) Size

- [x] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

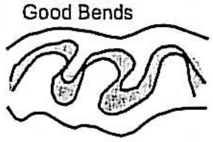
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 16

- [x] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [x] 2 pt — Boulders
- [x] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [x] 2 pt — Water Plants
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Undercut Banks
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

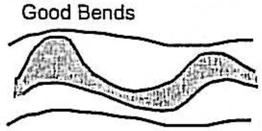
III. Stream Shape and Human Alterations — Score: 18

a) "Curviness" or "Sinuousity" of Channel

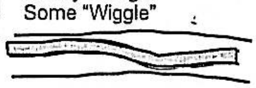
- [ ] 8 pt — 2 or More Good Bends



- [x] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"



- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 15

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 4 pt — Shrubs
- [ ] 3 pt — Overgrown Fields
- [ ] 2 pt — Fenced Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 2 pt — Conservation Tillage
- [x] 1 pt — Suburban
- [ ] 1 pt — Row Crop
- [ ] 0 pt — Open Pasture
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [x] 4 pt — Stable Hard or Well-Vegetated Banks
- [ ] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [ ] 3 pt — Mostly
- [x] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 9

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [ ] 4 pt — Knee Deep
- [x] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [x] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent
- [ ] 0 pt — None

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 13

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [x] 6 pt — Ankle/Calf Deep & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [x] 7 pt — Fist Size or Larger
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist

#5 PICTURE SHOWS FALLING TREES & OVERHANG

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

69
CQHEI Total

Vol ID:

Site ID: #8

River and Watershed: N 39° 54.140 W 86° 00.602 EL 231.5 m

I. Substrate (Bottom Type) — Score: 20

a) Size
- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [x] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"
Are Fist Size and Larger Pieces Smothered By Sands/Silts?
- [x] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"
Are Silts and Clays Distributed Throughout Stream?
- [x] NO 5 pt
- [ ] YES 0 pt

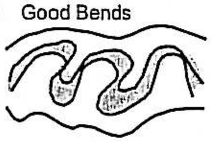
Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 8

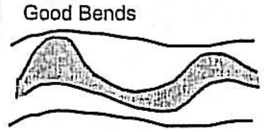
- [x] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

III. Stream Shape and Human Alterations — Score: 18

a) "Curviness" or "Sinuousity" of Channel
- [ ] 8 pt — 2 or More Good Bends



- [x] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?
- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 18

a) Width of Riparian Forest & Wetland - Mostly:
- [x] 8 pt — Wide (Can't Throw A Rock Through/Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:
- [x] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [x] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/Industrial

c) Bank Erosion - Typically:
- [x] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?
- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 5

a) Deepest Pool is At Least:
- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):
- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [ ] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 0

a) Riffles/Runs Are:
- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:
- [ ] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#6 PICTURE FROM BRIDGE SHOWS OVERHANG OF TREES + BANKS

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

CQHEI Total: 51

Vol ID:

Site ID: #8

River and Watershed: N 39° 54.747 W86.00.053 EL 250.8m

I. Substrate (Bottom Type) — Score: 0

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [x] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

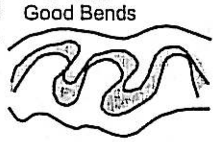
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 8

- [x] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

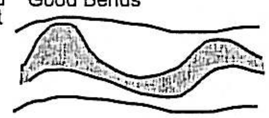
III. Stream Shape and Human Alterations — Score: 20

a) "Curviness" or "Sinuousity" of Channel

- [x] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 18

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [x] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 5

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 0

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#7 PICTURE OF UNDERWATER 12" GALV CULVERT

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

60
CQHEI Total

Vol ID:

Site ID: #9

River and Watershed: N39°55.633 W86°.00.201 EL 239.3

I. Substrate (Bottom Type) — Score: 14

a) Size
- [x] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"
Are Fist Size and Larger Pieces Smothered By Sands/Silts?
- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"
Are Silts and Clays Distributed Throughout Stream?
- [ ] NO 5 pt
- [x] YES 0 pt

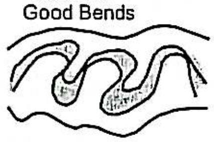
Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 8

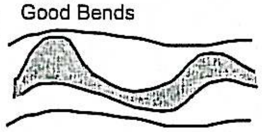
- [x] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

III. Stream Shape and Human Alterations — Score: 15

a) "Curviness" or "Sinuousity" of Channel
- [ ] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [x] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?
- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 17

a) Width of Riparian Forest & Wetland - Mostly:
- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:
- [x] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:
- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?
- [ ] 3 pt — Mostly
- [x] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 6

a) Deepest Pool is At Least:
- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):
- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 0

a) Riffles/Runs Are:
- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:
- [ ] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#9 PICTURE FROM UNDER BRIDGE SHOWS DEER CARCUS & WEST BANK TREES & ROOT

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

68
CQHEI Total

Vol ID:

Site ID: #10

River and Watershed: N 39° 57.694 W 85° 56.543 EL 243.6m

I. Substrate (Bottom Type) — Score: 14

a) Size

- [x] Mostly Large (Fist Size or Bigger) — 14 pt
- [ ] Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock) — 6 pt
- [ ] Mostly Medium (Smaller than Fist, but Bigger than Fingernail) — 10 pt
- [ ] Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky) — 0 pt

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO — 5 pt
- [x] YES — 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO — 5 pt
- [x] YES — 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

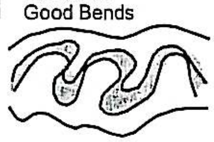
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 10

- [ ] Underwater Tree Roots (Large) — 2 pt
- [x] Underwater Tree Rootlets (Fine) — 2 pt
- [x] Boulders — 2 pt
- [ ] Backwaters, Oxbows or Side Channels — 2 pt
- [x] Downed Trees, Logs, Branches — 2 pt
- [x] Shallow, Slow Areas for Small Fish — 2 pt
- [ ] Water Plants — 2 pt
- [ ] Deep Areas (Chest Deep) — 2 pt
- [ ] Undercut Banks — 2 pt
- [x] Shrubs, Small Trees that Hang Close Over the Bank — 2 pt

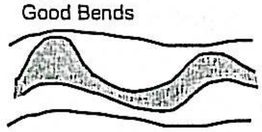
III. Stream Shape and Human Alterations — Score: 12

a) "Curviness" or "Sinuousity" of Channel

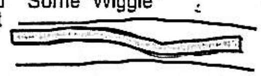
- [ ] 2 or More Good Bends — 8 pt



- [x] 1 or 2 Good Bends — 6 pt



- [ ] Mostly Straight Some "Wiggle" — 3 pt



- [ ] Very Straight — 0 pt

b) How Natural Is The Site?

- [ ] Mostly Natural — 12 pt
- [x] Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders) — 6 pt
- [ ] A Few Minor Man-made Changes (e.g., a bridge, some streambank changes) — 9 pt
- [ ] Heavy, Man-made Changes (e.g., leveed or channelized) — 0 pt

PARK

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 11

a) Width of Riparian Forest & Wetland - Mostly:

- [ ] Wide (Can't Throw A Rock Through/Across It) — 8 pt
- [x] Narrow (Can Throw A Rock Through/Across It) — 5 pt
- [ ] None — 0 pt

b) Land Use - Mostly:

- [ ] Forest/Wetland — 5 pt
- [ ] Shrubs — 4 pt
- [ ] Overgrown Fields — 3 pt
- [ ] Fenced Pasture — 2 pt
- [ ] Park (Grass) — 2 pt
- [ ] Conservation Tillage — 2 pt
- [x] Suburban — 1 pt
- [ ] Row Crop — 1 pt
- [ ] Open Pasture — 0 pt
- [ ] Urban/Industrial — 0 pt

c) Bank Erosion - Typically:

- [ ] Stable Hard or Well-Vegetated Banks — 4 pt
- [x] Combination of Stable and Eroding Banks — 2 pt
- [ ] Raw, Collapsing Banks — 0 pt

d) How Much of Stream is Shaded?

- [x] Mostly — 3 pt
- [ ] Partly — 2 pt
- [ ] None — 0 pt

V. Depth & Velocity — Score: 8

a) Deepest Pool is At Least:

- [ ] Chest Deep — 8 pt
- [ ] Waist Deep — 6 pt
- [x] Knee Deep — 4 pt
- [ ] Ankle Deep — 0 pt

b) Check ALL The Flow Types That You See (Add Points):

- [x] Very Fast: Hard to Stand in the Current — 2 pt
- [ ] Fast: Quickly Takes Objects Downstream — 3 pt
- [x] Moderate: Slowly Takes Objects Downstream — 1 pt
- [x] Slow: Flow Nearly Absent — 1 pt
- [ ] None — 0 pt

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 13

a) Riffles/Runs Are:

- [ ] Knee Deep or Deeper & Fast — 8 pt
- [x] Ankle/Calf Deep & Fast — 6 pt
- [ ] Ankle Deep or Less & Slow — 4 pt
- [ ] Do Not Exist — 0 pt

b) Riffle/Run Substrates Are:

- [x] Fist Size or Larger — 7 pt
- [ ] Smaller Than Fist Size, but Larger Than Fingernail — 4 pt
- [ ] Smaller Than Your Fingernails or Do Not Exist — 0 pt

#10 PICTURE LOOKING AT RIFFLE UNDER BRIDGE + DOWNED TREES ACCROSS CREEK

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

58

CQHEI Total

Vol ID:

Site ID: #11

River and Watershed: N 39°58.626 W 85°55.144 EL 248.2

I. Substrate (Bottom Type) — Score: 0

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [x] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

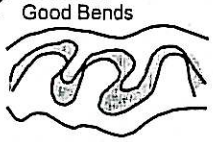
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 8

- [ ] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

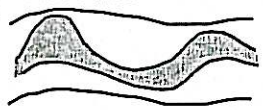
III. Stream Shape and Human Alterations — Score: 20

a) "Curviness" or "Sinuousity" of Channel

- [x] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: ~~13~~ 12

a) Width of Riparian Forest & Wetland - Mostly:

- [ ] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [x] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [x] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [x] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [x] 3 pt — Mostly
- [ ] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 5

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [ ] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 13

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [x] 4 pt — Ankle Deep or Less & Slow
- [x] 6 pt — Ankle/Calf Deep & Fast
- [x] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [x] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#11 PICTURE FROM UNDER BRIDGE SHOWS NARROWING & CURVING OF CREEK

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

20
CQHEI Total

Vol ID:

Site ID: #12 Alt

River and Watershed: N40°00.020 N85°56.279 EL 239.2

I. Substrate (Bottom Type) — Score: 0

a) Size

- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [x] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [ ] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

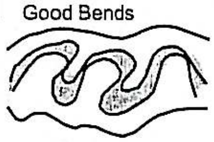
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: Ø

- [ ] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Boulders
- [ ] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [ ] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [ ] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [ ] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

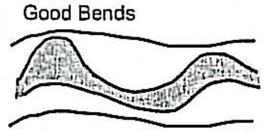
III. Stream Shape and Human Alterations — Score: 6

a) "Curviness" or "Sinuousity" of Channel

- [ ] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [x] 0 pt — Very Straight

b) How Natural Is The Site?

- [ ] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [x] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 9

a) Width of Riparian Forest & Wetland - Mostly:

- [ ] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [x] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [x] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [x] 4 pt — Stable Hard or Well-Vegetated Banks
- [ ] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [ ] 3 pt — Mostly
- [ ] 2 pt — Partly
- [x] 0 pt — None

V. Depth & Velocity — Score: 5

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [x] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [ ] 2 pt — Very Fast: Hard to Stand in the Current
- [ ] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [ ] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score:

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [ ] 7 pt — Fist Size or Larger
- [x] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#12 PICTURE EAST OF BRIDGE SHOWS AS MUCH AS KNEE DEEP 10' WIDE
#13 PICTURE DRY CREEK BED GRASS W STANDING POOL

Date: 11-3-07

Citizens Qualitative Habitat Evaluation Index

83
CQHEI Total

Vol ID: Site ID: #13   River and Watershed: N39°51.908 W 86°02.803 EL 272.1

I. Substrate (Bottom Type) — Score: 14

a) Size

- [x] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

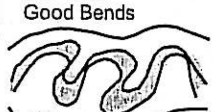
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 10

- [ ] 2 pt — Underwater Tree Roots (Large)
- [x] 2 pt — Boulders
- [x] 2 pt — Downed Trees, Logs, Branches
- [ ] 2 pt — Water Plants
- [x] 2 pt — Undercut Banks
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [ ] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

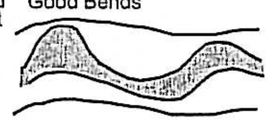
III. Stream Shape and Human Alterations — Score: 12

a) "Curviness" or "Sinuousity" of Channel

- [ ] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [ ] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 19

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [x] 5 pt — Forest/Wetland
- [ ] 2 pt — Conservation Tillage
- [ ] 4 pt — Shrubs
- [ ] 1 pt — Suburban
- [ ] 3 pt — Overgrown Fields
- [ ] 1 pt — Row Crop
- [ ] 2 pt — Fenced Pasture
- [ ] 0 pt — Open Pasture
- [ ] 2 pt — Park (Grass)
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [x] 4 pt — Stable Hard or Well-Vegetated Banks
- [ ] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [ ] 3 pt — Mostly
- [x] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 15

a) Deepest Pool is At Least:

- [x] 8 pt — Chest Deep
- [ ] 4 pt — Knee Deep
- [ ] 6 pt — Waist Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [x] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [ ] 0 pt — None
- [x] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 13

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [x] 6 pt — Ankle/Calf Deep & Fast
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [x] 7 pt — Fist Size or Larger
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

#14 PICTURE UNDER 465 BRIDGE LOOKING EAST TO RIFFLE RUN

Date: 10/27/2007

Citizens Qualitative Habitat Evaluation Index

86
CQHEI Total

Vol ID:

Site ID: 14A

River and Watershed: FALL CREEK - DOWNSTREAM 56th St. EL. 718 m N 39 51.167 W 086 04.968

I. Substrate (Bottom Type) — Score: 14

a) Size

- [x] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [ ] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] NO 5 pt
- [x] YES 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

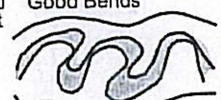
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 16

- [x] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [x] 2 pt — Boulders
- [x] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [x] 2 pt — Water Plants
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Undercut Banks
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

III. Stream Shape and Human Alterations — Score: 18.

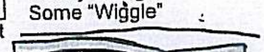
a) "Curviness" or "Sinuousity" of Channel

- [ ] 8 pt — 2 or More Good Bends

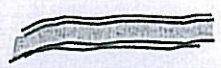


- [x] 6 pt — 1 or 2 Good Bends

- [ ] 3 pt — Mostly Straight Some "Wiggle"



- [ ] 0 pt — Very Straight



b) How Natural Is The Site?

- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 14.

a) Width of Riparian Forest & Wetland - Mostly:

- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:

- [ ] 5 pt — Forest/Wetland
- [ ] 4 pt — Shrubs
- [ ] 3 pt — Overgrown Fields
- [ ] 2 pt — Fenced Pasture
- [x] 2 pt — Park (Grass)
- [ ] 2 pt — Conservation Tillage
- [ ] 1 pt — Suburban
- [ ] 1 pt — Row Crop
- [ ] 0 pt — Open Pasture
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- [ ] 3 pt — Mostly
- [x] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 13

a) Deepest Pool is At Least:

- [ ] 8 pt — Chest Deep
- [x] 6 pt — Waist Deep
- [ ] 4 pt — Knee Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- [x] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent
- [ ] 0 pt — None

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 11

a) Riffles/Runs Are:

- [ ] 8 pt — Knee Deep or Deeper & Fast
- [ ] 6 pt — Ankle/Calf Deep & Fast
- [x] 4 pt — Ankle Deep or Less & Slow
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- [x] 7 pt — Fist Size or Larger
- [ ] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist

Date: 10-27-07

Citizens Qualitative Habitat Evaluation Index

CQHEI Total: 57

Vol ID:

Site ID: 15

River and Watershed: FALL CREEK N 39.51.118 W 86.05.213 EL 220.4

PICTURES 10 + 11

I. Substrate (Bottom Type) — Score: 14

a) Size

- ☑ Mostly Large (Fist Size or Bigger) — 14 pt
- ☐ Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock) — 6 pt
- ☐ Mostly Medium (Smaller than Fist, but Bigger than Fingernail) — 10 pt
- ☐ Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky) — 0 pt

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- ☐ NO — 5 pt
- ☑ YES — 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- ☐ NO — 5 pt
- ☑ YES — 0 pt

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

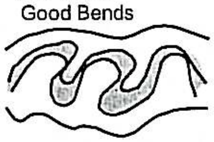
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 12

- ☑ Underwater Tree Roots (Large) — 2 pt
- ☑ Boulders — 2 pt
- ☑ Downed Trees, Logs, Branches — 2 pt
- ☐ Water Plants — 2 pt
- ☑ Undercut Banks — 2 pt
- ☐ Underwater Tree Rootlets (Fine) — 2 pt
- ☐ Backwaters, Oxbows or Side Channels — 2 pt
- ☑ Shallow, Slow Areas for Small Fish — 2 pt
- ☐ Deep Areas (Chest Deep) — 2 pt
- ☑ Shrubs, Small Trees that Hang Close Over the Bank — 2 pt

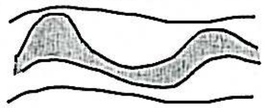
III. Stream Shape and Human Alterations — Score: 9

a) "Curviness" or "Sinuousity" of Channel

- ☐ 2 or More Good Bends — 8 pt

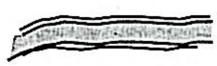


- ☐ 1 or 2 Good Bends — 6 pt



- ☐ Mostly Straight Some "Wiggle" — 3 pt

- ☑ Very Straight — 0 pt



b) How Natural Is The Site?

- ☐ Mostly Natural — 12 pt
- ☐ Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders) — 6 pt
- ☑ A Few Minor Man-made Changes (e.g., a bridge, some streambank changes) — 9 pt
- ☐ Heavy, Man-made Changes (e.g., leveed or channelized) — 0 pt

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 14

a) Width of Riparian Forest & Wetland - Mostly:

- ☑ Wide (Can't Throw A Rock Through/ Across It) — 8 pt
- ☐ Narrow (Can Throw A Rock Through/ Across It) — 5 pt
- ☐ None — 0 pt

b) Land Use - Mostly:

- ☐ Forest/Wetland — 5 pt
- ☐ Conservation Tillage — 2 pt
- ☐ Shrubs — 4 pt
- ☐ Suburban — 1 pt
- ☐ Overgrown Fields — 3 pt
- ☐ Row Crop — 1 pt
- ☐ Fenced Pasture — 2 pt
- ☐ Open Pasture — 0 pt
- ☑ Park (Grass) — 2 pt
- ☐ Urban/ Industrial — 0 pt

c) Bank Erosion - Typically:

- ☐ Stable Hard or Well-Vegetated Banks — 4 pt
- ☑ Combination of Stable and Eroding Banks — 2 pt
- ☐ Raw, Collapsing Banks — 0 pt

d) How Much of Stream is Shaded?

- ☐ Mostly — 3 pt
- ☑ Partly — 2 pt
- ☐ None — 0 pt

V. Depth & Velocity — Score: 8

a) Deepest Pool is At Least:

- ☐ Chest Deep — 8 pt
- ☐ Knee Deep — 4 pt
- ☑ Waist Deep — 6 pt
- ☐ Ankle Deep — 0 pt

b) Check ALL The Flow Types That You See (Add Points):

- ☐ Very Fast: Hard to Stand in the Current — 2 pt
- ☑ Moderate: Slowly Takes Objects Downstream — 1 pt
- ☐ None — 0 pt
- ☐ Fast: Quickly Takes Objects Downstream — 3 pt
- ☑ Slow: Flow Nearly Absent — 1 pt

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 0

a) Riffles/Runs Are:

- ☐ Knee Deep or Deeper & Fast — 8 pt
- ☐ Ankle Deep or Less & Slow — 4 pt
- ☐ Ankle/Calf Deep & Fast — 6 pt
- ☑ Do Not Exist — 0 pt

b) Riffle/Run Substrates Are:

- ☐ Fist Size or Larger — 7 pt
- ☐ Smaller Than Your Fingernails or Do Not Exist — 0 pt
- ☐ Smaller Than Fist Size, but Larger Than Fingernail — 4 pt

DNA

Citizens Qualitative Habitat Evaluation Index

Date: |

Vol ID: | Site ID: 16 | River and Watershed: FALL CREEK N 39 50.829 W 86 06.024 EL 222.6

CQHEI Total: 87

I. Substrate (Bottom Type) — Score: 20

a) Size
- [ ] 14 pt — Mostly Large (Fist Size or Bigger)
- [ ] 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- [x] 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- [ ] 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"
Are Fist Size and Larger Pieces Smothered By Sands/Silts?
- [x] NO 5 pt
- [ ] YES 0 pt

Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"
Are Silts and Clays Distributed Throughout Stream?
- [x] NO 5 pt
- [ ] YES 0 pt

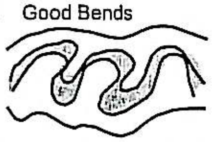
Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: 14

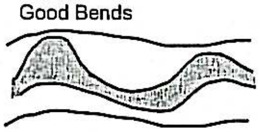
- [ ] 2 pt — Underwater Tree Roots (Large)
- [ ] 2 pt — Underwater Tree Rootlets (Fine)
- [x] 2 pt — Boulders
- [x] 2 pt — Backwaters, Oxbows or Side Channels
- [x] 2 pt — Downed Trees, Logs, Branches
- [x] 2 pt — Shallow, Slow Areas for Small Fish
- [x] 2 pt — Water Plants
- [ ] 2 pt — Deep Areas (Chest Deep)
- [x] 2 pt — Undercut Banks
- [x] 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

III. Stream Shape and Human Alterations — Score: 15

a) "Curviness" or "Sinuousity" of Channel
- [ ] 8 pt — 2 or More Good Bends



- [ ] 6 pt — 1 or 2 Good Bends



- [x] 3 pt — Mostly Straight Some "Wiggle"

- [ ] 0 pt — Very Straight

b) How Natural Is The Site?
- [x] 12 pt — Mostly Natural
- [ ] 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- [ ] 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- [ ] 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: 17

a) Width of Riparian Forest & Wetland - Mostly:
- [x] 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- [ ] 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- [ ] 0 pt — None

b) Land Use - Mostly:
- [x] 5 pt — Forest/Wetland
- [ ] 4 pt — Shrubs
- [ ] 3 pt — Overgrown Fields
- [ ] 2 pt — Fenced Pasture
- [x] 2 pt — Park (Grass)
- [ ] 2 pt — Conservation Tillage
- [ ] 1 pt — Suburban
- [ ] 1 pt — Row Crop
- [ ] 0 pt — Open Pasture
- [ ] 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:
- [ ] 4 pt — Stable Hard or Well-Vegetated Banks
- [x] 2 pt — Combination of Stable and Eroding Banks
- [ ] 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?
- [ ] 3 pt — Mostly
- [x] 2 pt — Partly
- [ ] 0 pt — None

V. Depth & Velocity — Score: 11

a) Deepest Pool is At Least:
- [ ] 8 pt — Chest Deep
- [ ] 6 pt — Waist Deep
- [x] 4 pt — Knee Deep
- [ ] 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):
- [x] 2 pt — Very Fast: Hard to Stand in the Current
- [x] 3 pt — Fast: Quickly Takes Objects Downstream
- [x] 1 pt — Moderate: Slowly Takes Objects Downstream
- [x] 1 pt — Slow: Flow Nearly Absent
- [x] 0 pt — None

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: 10

a) Riffles/Runs Are:
- [ ] 8 pt — Knee Deep or Deeper & Fast
- [x] 6 pt — Ankle/Calf Deep & Fast
- [ ] 4 pt — Ankle Deep or Less & Slow
- [ ] 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:
- [ ] 7 pt — Fist Size or Larger
- [x] 4 pt — Smaller Than Fist Size, but Larger Than Fingernail
- [ ] 0 pt — Smaller Than Your Fingernails or Do Not Exist