SECTION 1: INTRODUCE WATERSHED

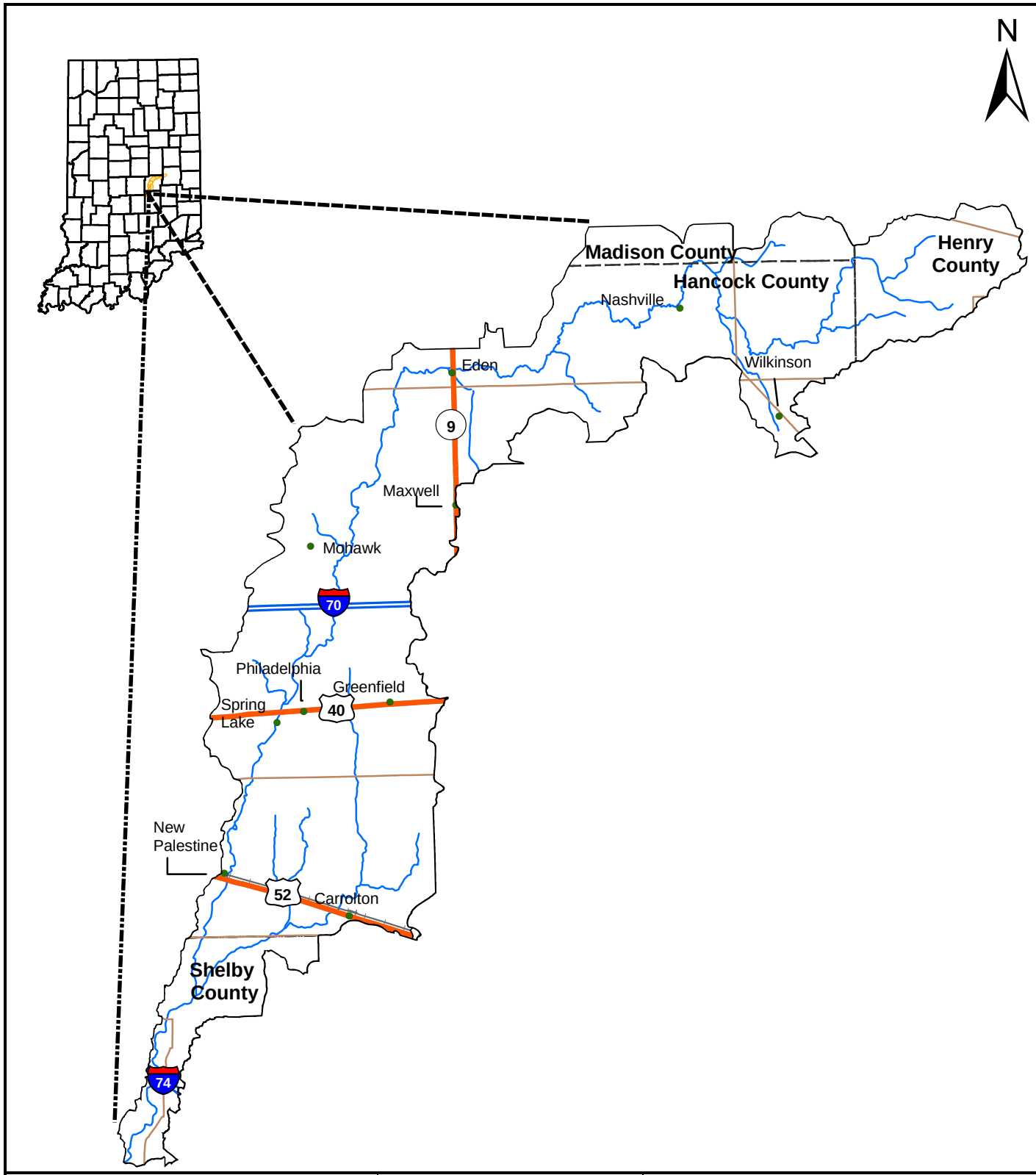
Location, Characteristics and Size of the Sugar Creek Watershed

Watershed and Watershed Health

A watershed is an area of land from which water drains to a single point in a natural basin and contributes flow (i.e., water) to a place or point on a body of water. Watershed health references the overall rating of a watershed based on the presence, condition, and numbers of different biological indicators. Some of these biological indicators include the different types of fish, insects, algae, plants and other aquatic life that are present or not present within the body or bodies of water within the watershed. These biological factors can provide accurate information about the health of a specific waterbody such as a river, stream, lake, or wetland. Water quality parameters also indicate the watershed health based on the quality of water entering and exiting the watershed. Some of these water quality parameters include temperature, pH, dissolved oxygen (DO), nitrates, nitrites, salinity, and total phosphate.

Location

Sugar Creek has its origins in west central Henry County and flows west into Madison and Hancock Counties (Exhibit 1). Sugar Creek then turns south and flows through Hancock County into Shelby County where it is joined by Buck Creek. The watershed encompasses approximately 84,750 acres of mixed land use consisting mainly of row crop agriculture and pasture. Approximately 92 linear miles of cumulative waterways are contained in the Sugar Creek Watershed. Some of the cities and towns located in the Sugar Creek Watershed include: Greenfield, New Palestine, Eden, Philadelphia, Spring Lake, Carrolton, Wilkinson, Mohawk, Maxwell and Nashville (Exhibit 1).



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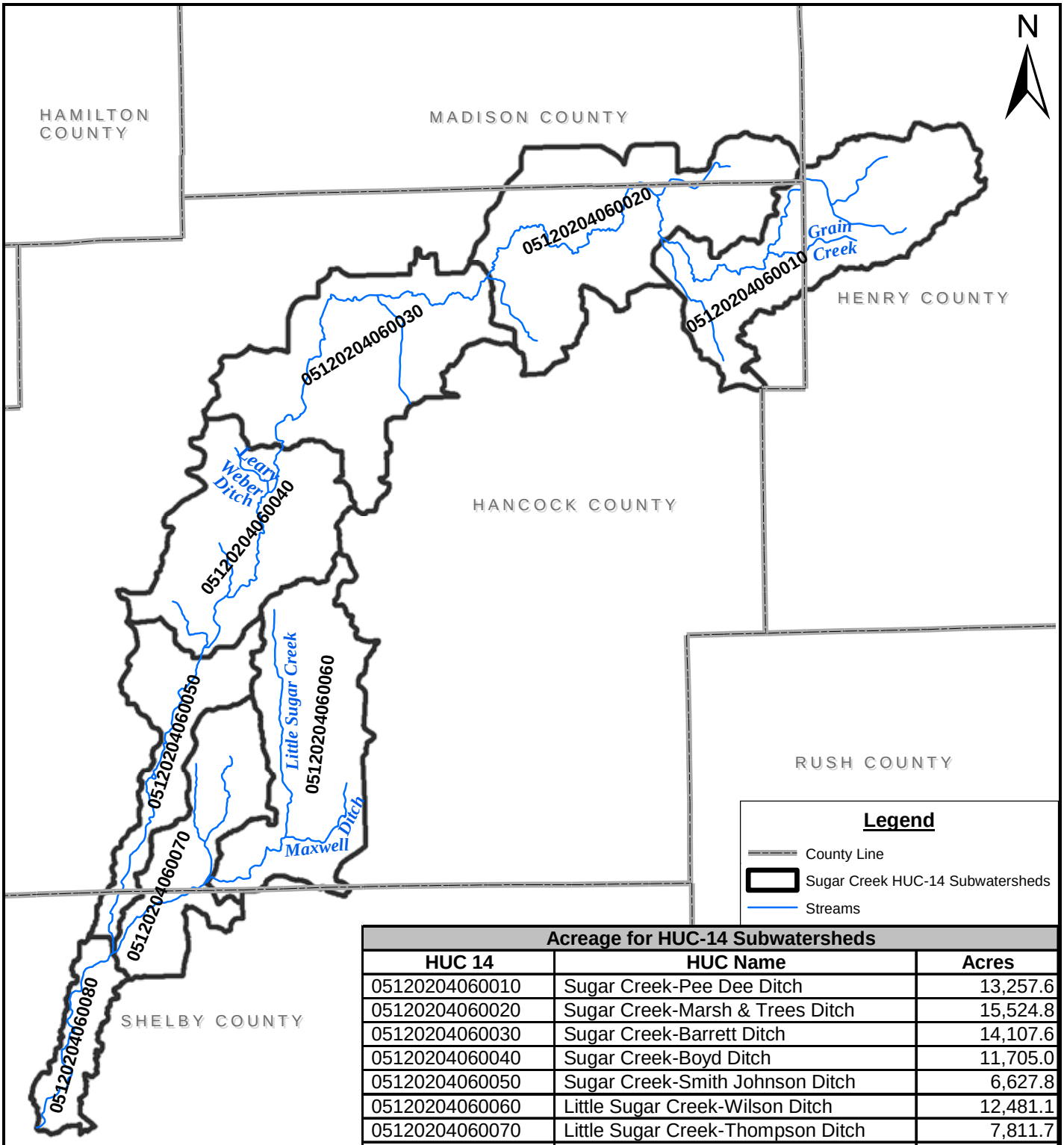
TITLE: **Sugar Creek Watershed Location Map**		PROJECT: **Sugar Creek Watershed Project**	
BASE LAYER: N/A		PROJECT NO. 07065	EXHIBIT: 1	SHEET: 1 OF: 1
CLIENT: Hancock County SWCD 1101 West Main St., Ste. N Greenfield, IN 46140		QUADRANGLE: N/A	DATE: 4/9/08	SCALE: NTS

The US Geological Survey (USGS) created the Hydrologic Unit Code (HUC) system to classify the nation's watersheds and sub-watersheds. At the time the Sugar Creek Watershed Management Plan was awarded and contracted, 14-digit HUCs were being used. All of the mapping analysis through August 2008 was based on 14-digit HUCs (Exhibit 2a). In an effort to position the Sugar Creek Watershed for additional funding, much of the watershed management plan has been converted into 12-digit HUCs so that the presentation and report could more easily apply for and receive funding while abiding by the 12-digit HUC requirements. The study area acreage remained 84,750 and the boundaries of the Sugar Creek Watershed did not change during the transition from 14-digit HUCs to 12-digit HUCs (Exhibit 2a and 2b, Table 1). The subwatershed boundaries within the Sugar Creek Watershed changed with the HUC code transition. The 14-digit subwatersheds with the code of 05120204060060 and 05120204060070 combined to form the 12-digit subwatershed with the code of 051202040404. The 14-digit subwatersheds with the code of 05120204060040, 05120204060050, and 05120204060080 combined to form the 12-digit subwatershed with the code of 051202040405.

The Sugar Creek Watershed consists of five (5) 12-digit Hydrologic Unit Codes or HUCs (Exhibit 2b). Some of the major tributaries include Little Sugar Creek, Maxwell Ditch, Grain Creek, and Leary Weber Ditch (Exhibit 2b). Hydrologic unit codes were developed by the USGS in cooperation with the US Water Resource Council and the USDA Natural Resources Conservation Service (NRCS). Most federal and state agencies use this coding system. HUCs are a way of cataloguing portions of the landscape according to their drainage. Landscape units are nested within each other and described as successively smaller units. The hydrologic code attached to a specific watershed is unique, enabling different agencies to have common terms of reference and agree on the boundaries of the watershed. These commonly understood boundaries foster understanding of how landscapes function, where water quality problems should be addressed, and who needs to be involved in the planning process.

Table 1. Sugar Creek Subwatershed Comparative Acreages of HUC 12 and HUC 14

HUC 12	HUC 14	HUC Name	HUC 12 Acres	HUC 14 Acres
051202040401	05120204060010	Sugar Creek - Pee Dee Ditch	13,257	13,257.6
051202040402	05120204060020	Sugar Creek - Marsh and Trees Ditch	15,541	15,524
051202040403	05120204060030	Sugar Creek - Barrett Ditch	14,091	14,107.6
051202040404	05120204060060	Little Sugar Creek - Wilson Ditch	20,290	12,481.1
-	05120204060070	Little Sugar Creek – Thompson Ditch	-	7,811.7
051202040405	05120204060040	Sugar Creek - Boyd Ditch	21,571	11,705
-	05120204060050	Sugar Creek – Smith Johnson Ditch	-	6,627.8
-	05120204060080	Sugar Creek – Sugar Creek (town)	-	3,234.4
		Total Acres	**84,750**	**84,750**



Acreage for HUC-14 Subwatersheds

HUC 14	HUC Name	Acres
05120204060010	Sugar Creek-Pee Dee Ditch	13,257.6
05120204060020	Sugar Creek-Marsh & Trees Ditch	15,524.8
05120204060030	Sugar Creek-Barrett Ditch	14,107.6
05120204060040	Sugar Creek-Boyd Ditch	11,705.0
05120204060050	Sugar Creek-Smith Johnson Ditch	6,627.8
05120204060060	Little Sugar Creek-Wilson Ditch	12,481.1
05120204060070	Little Sugar Creek-Thompson Ditch	7,811.7
05120204060080	Sugar Creek-Sugar Creek (town)	3,234.4
	Total Acres	**84,750**

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TITLE: **HUC- 14 Watershed Map**

PROJECT: **Sugar Creek Watershed Project**

BASE LAYER: N/A

CLIENT: Hancock County SWCD
1101 W. Main Street, Ste N
Greenfield, IN 46140

PROJECT NO. 07065

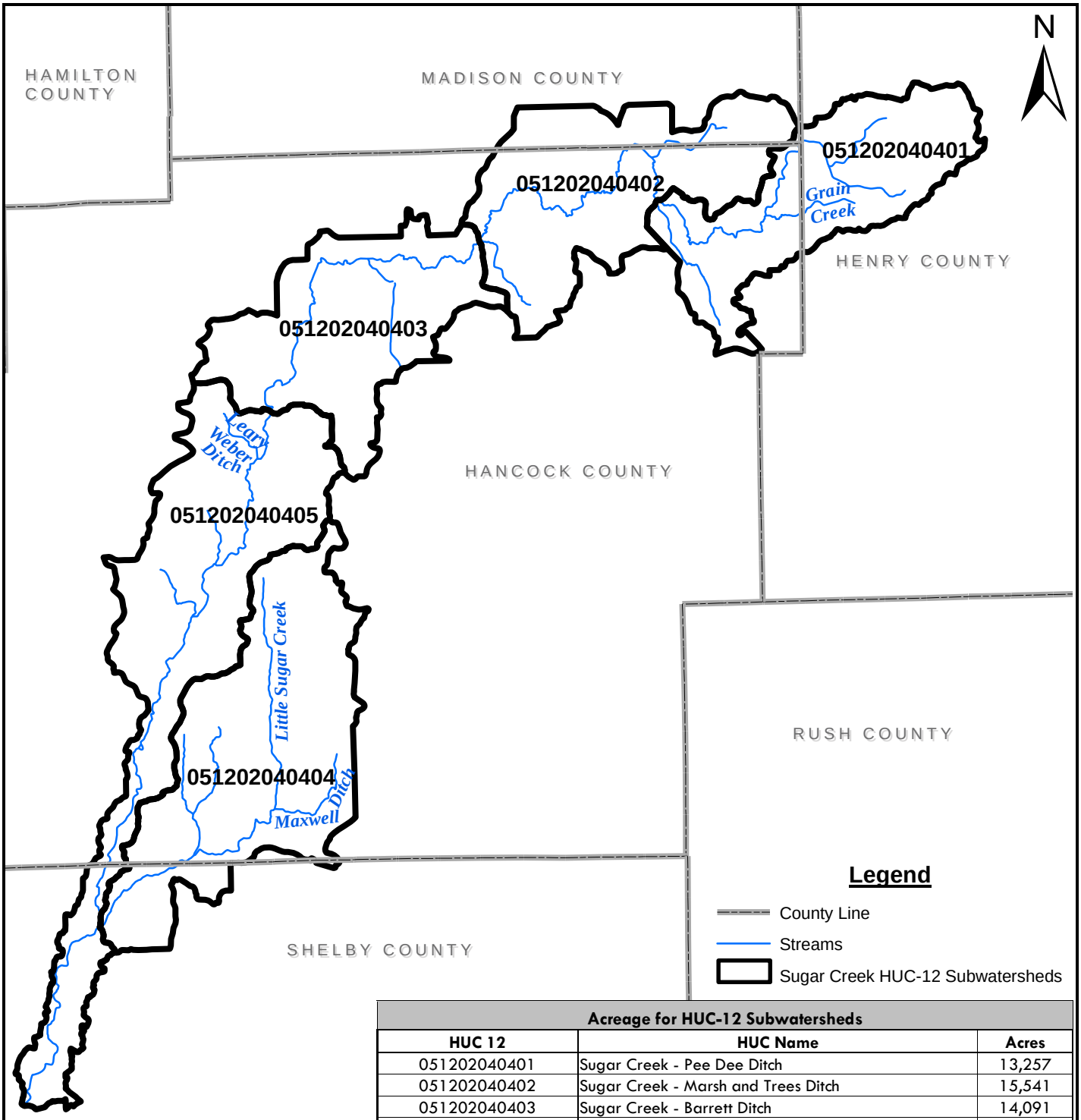
EXHIBIT: 2a

SHEET: 1 OF: 1

QUADRANGLE: N/A

DATE: 10/29/08

SCALE: NTS



Acreage for HUC-12 Subwatersheds

HUC 12	HUC Name	Acres
051202040401	Sugar Creek - Pee Dee Ditch	13,257
051202040402	Sugar Creek - Marsh and Trees Ditch	15,541
051202040403	Sugar Creek - Barrett Ditch	14,091
051202040404	Little Sugar Creek - Wilson Ditch	20,290
051202040405	Sugar Creek - Boyd Ditch	21,571
	Total Acres	**84,750**

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PROJECT: **Sugar Creek Watershed Project**

BASE LAYER: N/A

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PROJECT NO. 07065

EXHIBIT: 2b

SHEET: 1 OF: 1

QUADRANGLE: N/A

DATE: 10/29/08

SCALE: NTS

Climate

The surface water and groundwater resources in the Sugar Creek Watershed provide critical support for both human and natural systems. Surface water from Sugar Creek, its tributaries, and local diversion and irrigation canals, is the primary source of water for human needs in the Watershed; including water for irrigation, livestock watering, industry and commerce, recreation, and waste assimilation. Rural domestic water users rely on both surface water and groundwater to supply their needs. Human demands for water must be balanced with the water requirements of terrestrial and aquatic ecosystems. Balancing these demands involves recognition of a myriad of values, both human and ecological, and presents significant challenges, particularly when considered in the context of climatic variability and change. Changes in air temperature, precipitation, and the frequency and severity of drought events related to climate change could adversely affect agriculture and other sectors in the Sugar Creek Watershed.

The average daily maximum temperature in July is 85.4°F, and the average daily minimum in January is 16.8°F. Using climate data from Greenfield, Indiana from 1971 – 2000, the lowest temperature on record occurred on January 1, 1985 and was -24°F. The highest temperature on record occurred on July 11, 1936 and was 109 °F. Typical relative humidity is about 58% - 68% in the mid-afternoon. Humidity is higher in the evening and averages around 90% at dawn. On average, 25 inches of moisture a year move into the atmosphere due to evapotranspiration (Lathrop, 2006). Winds are most often from the southwest, although in winter the dominant direction is from the northwest. Average velocities range from 7 miles per hour (mph) in September to 11mph in March and April.

Precipitation and temperature data can be found in Table 2 (as follows). Rainfall is moderately heavy and averages around 43.43 inches annually. Rainfall is generally well distributed throughout the year, but is slightly lower in mid to late winter. The record rainfall based on data from 1903 – 2000 occurred on August 10, 1968 and totaled 5.2 inches. The heaviest snowfall occurred on December 20, 1973 and totaled 10.8 inches. Average annual snowfall is 13.6 inches.

Table 2 Historical Climate Data, 1971- 2000

Month	Maximum Temperature (°F)	Minimum Temperature (°F)	Mean Temperature (°F)	Mean Precipitation (in.)	Mean Snowfall (in.)
January	33.6	16.8	25.2	2.47	5.6
February	38.8	20.2	29.5	2.37	2.2
March	49.9	29.9	39.9	3.33	1.5
April	61.8	40.4	51.1	4.07	0.2
May	72.9	51.4	62.2	4.69	0.0
June	81.8	60.5	71.2	4.48	0.0
July	85.4	64.4	74.9	4.85	0.0
August	83.6	62.2	72.9	4.01	0.0
September	77.5	54.6	66.1	3.16	0.0
October	65.4	42.5	54.0	3.05	0.1
November	51.1	32.9	42.0	3.88	0.7
December	38.6	22.6	30.6	3.07	3.3
Monthly Mean	61.7	41.5	51.6	na	na
Annual Total	na	na	na	43.43	13.6

Source: NCDS Normals, Station 123527, Greenfield, Indiana, Midwest Regional Climate Center, 2007

Indiana has a varying climate with strongly marked seasons. The transition from cold to hot weather can produce an active spring with thunderstorms and tornadoes. Oppressive humidity and high temperatures arrive in summer. Autumn is favored with lower humidity than the other seasons, and mostly sunny skies. Indiana's location within the continent highly determines its climate. The Gulf of Mexico is a major player in Indiana's climate. Southerly winds from the Gulf of Mexico region readily transport warm, moisture-laden air into the State. The warm, moist air collides with continental polar air brought southward by the jet stream from central and western Canada.

Local climate variations within the State of Indiana are caused by differences of latitude, terrain, soil type and lakes. The State's record maximum temperature of 116 degrees Fahrenheit (° F) was set at Collegeville on July 14, 1936. The record minimum temperature is -36° F observed on January 19, 1994 at New Whiteland.

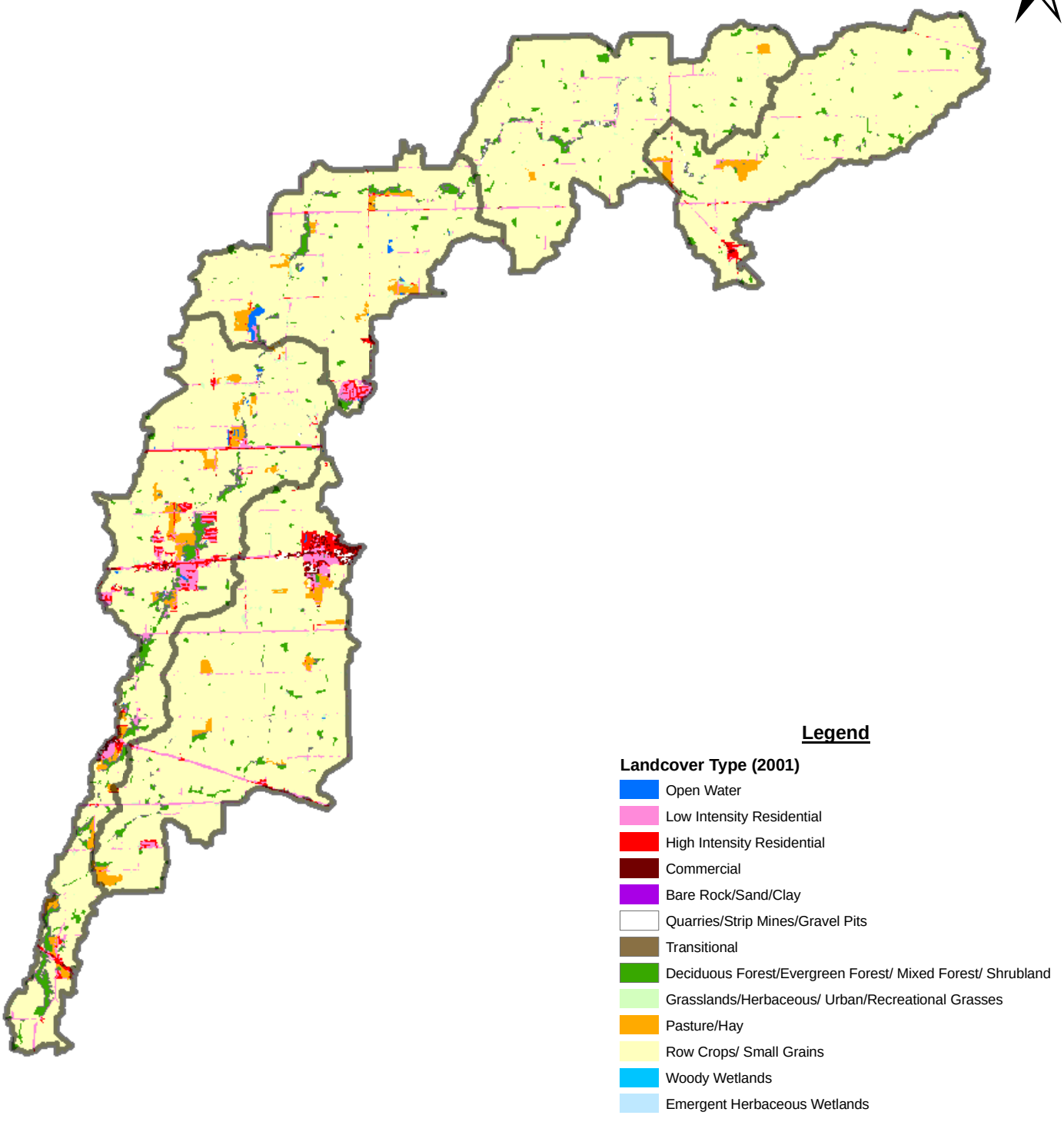
Trends in Land Development

Land Use and Population

The Sugar Creek Watershed consists of approximately 84,750 acres of mixed land use, according to the 2001 National Land Cover Data (NLCD) published by the USGS (Exhibit 3; Table 3). This watershed has historically been dominated by agricultural land and currently comprises 83.9% of its area. Additionally, forests and wetlands comprise 5.8%, and urban and residential lands comprise 8.6% of the Watershed. As urban development increases within the watershed, it should be considered when evaluating and protecting the natural resources within the basin.

Table 3 Land use in the Sugar Creek Watershed

GRIDCODE	Land Cover Type	Acres
11	Open Water	204
21	Low Intensity Residential	5,373
22	High Intensity Residential	1,451
23	Commercial/Industrial/Transportation	330
24	Developed High Intensity	115
41	Deciduous Forest	4,513
42	Evergreen Forest	8
52	Shrub/Scrub	89
71	Grassland/Herbaceous	1,215
81	Pasture/Hay	2,292
82	Row Crops	68,789
90	Woody Wetlands	298
95	Emergent Herbaceous Wetlands	72
	Other	1
	Grand Total Land Use	**Approx. 84,750**



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TITLE: **Land Use NLCD (2001)**	PROJECT: **Sugar Creek Watershed Project**		
BASE LAYER: N/A	PROJECT NO. 07065	EXHIBIT: 3	SHEET: 1 OF: 1
CLIENT: Hancock County SWCD 1101 West Main St., Ste. N Greenfield, IN 46140	QUADRANGLE: N/A	DATE: 10/29/08	SCALE: NTS

Agricultural Land Use

Agricultural production is a large component of the counties within the Watershed. A summary showing the 2006 – 2007 agricultural statistics for Hancock, Henry, Madison, and Shelby counties is presented in Table 4 (published by the USDA). A ranking is given to each county based on the amount of crop harvested or livestock produced and is used as a comparison to all of the 92 counties of Indiana. Over the years a switch between conventional farming to no-till conservation practices has been made. Conventional farming practices typicaly involve regular tilling that agitates the soil in various ways, usually with tractor-drawn implements. Tilling is used to remove weeds, to mix in soil amendments such as fertilizers, to shape the soil into rows for crop plants and furrows for irrigation, and to prepare the surface for seeding. This can lead to unfavorable effects which include soil compaction; loss of organic matter; degradation of soil aggregates; disruption of soil microbes, arthropods, and earthworms; and soil erosion. No-till farming avoids these unfavorable effects by reducing or excluding the use of conventional tillage. No-till farming practices provides additional benefit through the presence of plant stems and residual plant materials left on the soils surface, known as residue. The amount or percent of soil covered by residue is variable based on field topography, precipitation events causing runoff to move residue off the fields towards surface water drainage features and by wind intensities. Benefits associated with the use of no-till practices include the reduction of soil loss by up to 90% in comparison to conventional tillage (USEPA 2002). This reduction of erosion benefits Sugar Creek Watershed as it protects the streambeds from sedimentation and improves water quality through reducing the particulates suspended in the water column.

Based on the 2007 Indiana Cropland Tillage Transect Survey, no-till corn increased from 19% (2004) to 27% (2007) and soybeans went from 61% (2004) to 69% (2007). In Hancock County, no-till corn practices increased from 2% (2004) to 38% (2007), while no-till soybean practices increased from 47% (2004) to 95% (2007), based on percentage. In 2007, the state of Indiana ordered counties within Indiana by agricultural best management practices categories, Hancock County was ranked first of all Indiana counties in the use of no-till for soybean crop production. Best management practices are actions that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources to water bodies. Non-point source pollution consists of pollutants that cannot be measured from a single source. Non point source pollutants are moved over land through runoff.

Table 4 Agricultural Statistics of Counties within the Watershed				
Hancock County				
2006 Crops	**Planted (acres)**	**Yield per acre**	**Produced**	**Rank**
Corn	67,900	155 Bu	10,505,000 Bu	36
Soybeans	82,500	50 Bu	4,088,600 Bu	32
Wheat	4,500	65 Bu	293,700 Bu	31
Hay	---	4.14 Ton	14,900 Ton	60
Livestock	**Number Head**	**Rank**		
All Cattle (2007)	3,300	79		
All Hogs (2002)	37,082	29		
All Sheep (2002)	1,941	6		
Chickens (2002)	1,141	18		
Henry County				
2006 Crops	**Planted (acres)**	**Yield per acre**	**Produced**	**Rank**
Corn	71,400	157 Bu	11,080,600 Bu	31
Soybeans	87,100	53 Bu	4,565,400 Bu	22
Wheat	4,200	66 Bu	277,000 Bu	35
Hay	---	4.38 Ton	25,400 Ton	33
Livestock	**Number Head**	**Rank**		
All Cattle (2007)	12,700	22		
All Hogs (2002)	11,457	56		
All Sheep (2002)	935	25		
Chickens (2002)	395	44		
Madison County				
2006 Crops	**Planted (acres)**	**Yield per acre**	**Produced**	**Rank**
Corn	80,500	163 Bu	12,945,100 Bu	23
Soybeans	98,600	54 Bu	5,300,100 Bu	11
Wheat	2,900	72 Bu	207,500 Bu	48
Hay	---	3.40 Ton	16,300 Ton	56
Livestock	**Number Head**	**Rank**		
All Cattle (2007)	6,400	57		
All Hogs (2002)	26,875	42		
All Sheep (2002)	655	39		
Chickens (2002)	348	48		
Shelby County				
2006 Crops	**Planted (acres)**	**Yield per acre**	**Produced**	**Rank**
Corn	97,000	150 Bu	14,482,400 Bu	19
Soybeans	96,400	52 Bu	5,028,600 Bu	15
Wheat	4,300	65 Bu	278,900 Bu	34
Hay	---	3.47 Ton	11,100 Ton	71
Livestock	**Number Head**	**Rank**		
All Cattle (2007)	4,500	68		
All Hogs (2002)	25,471	44		
All Sheep (2002)	685	38		
Chickens (2002)	216	57		
**Note: Bu= Bushel*				

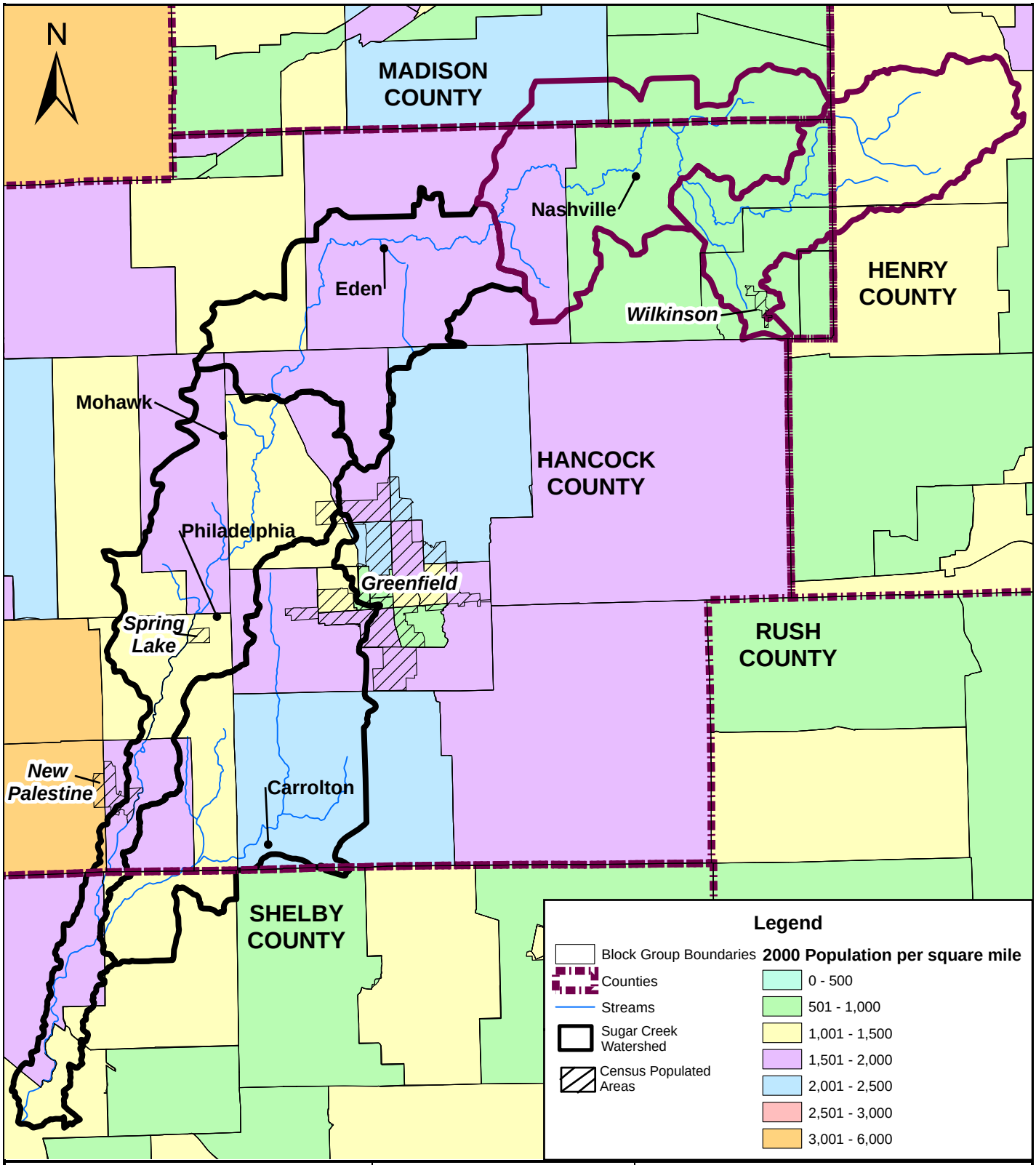
Population Changes within the Watershed

A sub-category related to trends in land development includes population estimates of the Watershed. The majority of the Watershed (79%) is located within Hancock County. Between 2000 and 2006, the population in Hancock County increased 17.40% (Table 5). It is the third fastest growing county in the State. The increase in population growth of Hancock County is attributed to the development of business and infrastructure as well as its proximity to the Indianapolis metropolitan area which is desirable to commuters. This exponential growth rate is having an impact on the Sugar Creek Watershed, which has traditionally been almost exclusively an agricultural watershed. Henry, Madison, and Shelby counties have experienced either slow growth or negative growth between 2000 and 2006. Henry County's population decreased by 3.22% and Madison County's by 2.09% during this time frame. Shelby County experienced slow growth during this period increasing by only 1.54%; well below the state average of 3.8%.

As the Watershed changes from a largely rural setting to one that is increasingly more urban and residential, water quality and other natural resources in the basin have become an issue of concern. Sugar Creek Watershed is also experiencing changes from larger farms to smaller hobby farms. All of these land use changes have the potential to negatively impact the Watershed if they are not addressed in appropriate ways. Exhibit 4 demonstrates the population in the Sugar Creek Watershed in 2000. US Census populated areas were included to demonstrate major population centers. Change in population density trends from 1970 to 2000 are demonstrated in Exhibit 5. Most of the growth is occurring in the central portions of the Watershed in Hancock County. Areas in the northern portions of the basin in Hancock and Henry County seem to be growing at a slower rate with even some losses between 1980 and 1990. The highest population concentrations in 2000 within the Sugar Creek Watershed were in Hancock County east of New Palestine.

Growth in the basin must be sustainable for the protection and improvement of rivers and streams water quality as well as the protection of high-quality farmland and other valuable natural resources. Therefore, the implementation of this plan will have a focus both on the urban and rural areas of the Watershed.

Table 5 Trends in Land Development: 2006 Population Estimates for Sugar Creek Watershed Counties									
Population Estimates and Counts								**Change July 1, 2000 to July 1, 2006**	
	July 1, 2000	**July 1, 2001**	**July 1, 2002**	**July 1, 2003**	**July 1, 2004**	**July 1, 2005**	**June 1, 2006**	**Number**	**Percent**
Indiana	**6,091,955**	**6,125,677**	**6,154,739**	**6,196,269**	**6,226,537**	**6,271,973**	**6,324,990**	**233,035**	**3.80%**
Hancock	55,660	56,699	58,249	59,644	60,965	63,138	65,050	9,659	17.40%
Henry	48,469	48,353	48,056	47,770	47,662	47,244	46,947	-1,561	-3.20%
Madison	133,299	132,404	131,922	130,982	130,482	130,412	130,575	-2,783	-2.10%
Shelby	43,610	43,910	43,770	43,599	43,711	43,766	44,114	669	1.50%
Population Size Rank									
	July 1, 2000	**July 1, 2001**	**July 1, 2002**	**July 1, 2003**	**July 1, 2004**	**July 1, 2005**	**July 1, 2006**		
Hancock	25	25	25	25	25	25	25		
Henry	27	27	28	29	29	30	31		
Madison	10	10	10	10	10	10	12		
Shelby	33	33	33	33	33	33	33		



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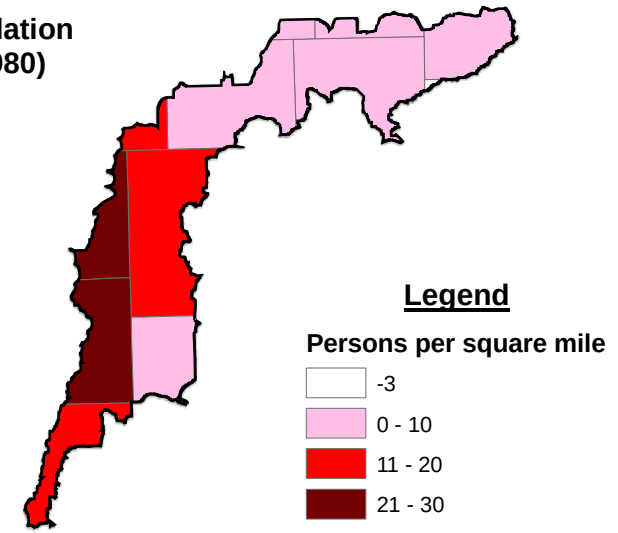
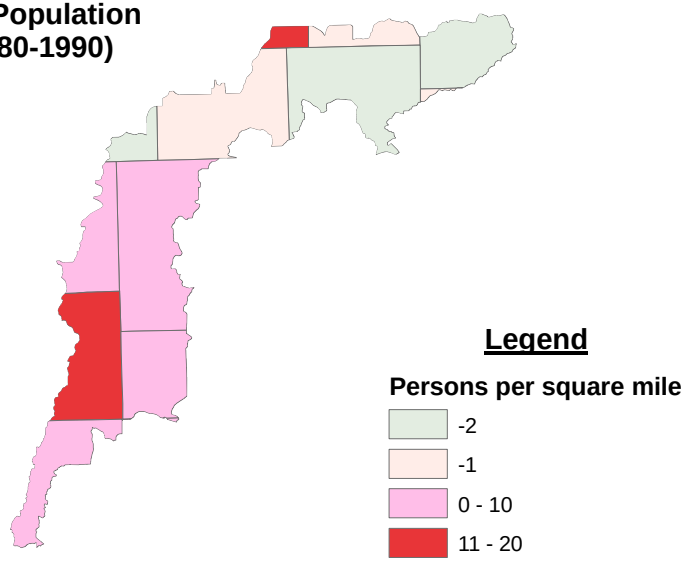
TITLE: 2000 Population Estimate	PROJECT: Sugar Creek Watershed Project			
BASE LAYER: United States Census Bureau	PROJECT NO. 07065	EXHIBIT: 4	SHEET: 1 OF: 1	
CLIENT: Hancock County SWCD 1101 West Main St., Ste. N Greenfield, IN 46140	QUADRANGLE: N/A	DATE: 10/29/08	SCALE: NTS	

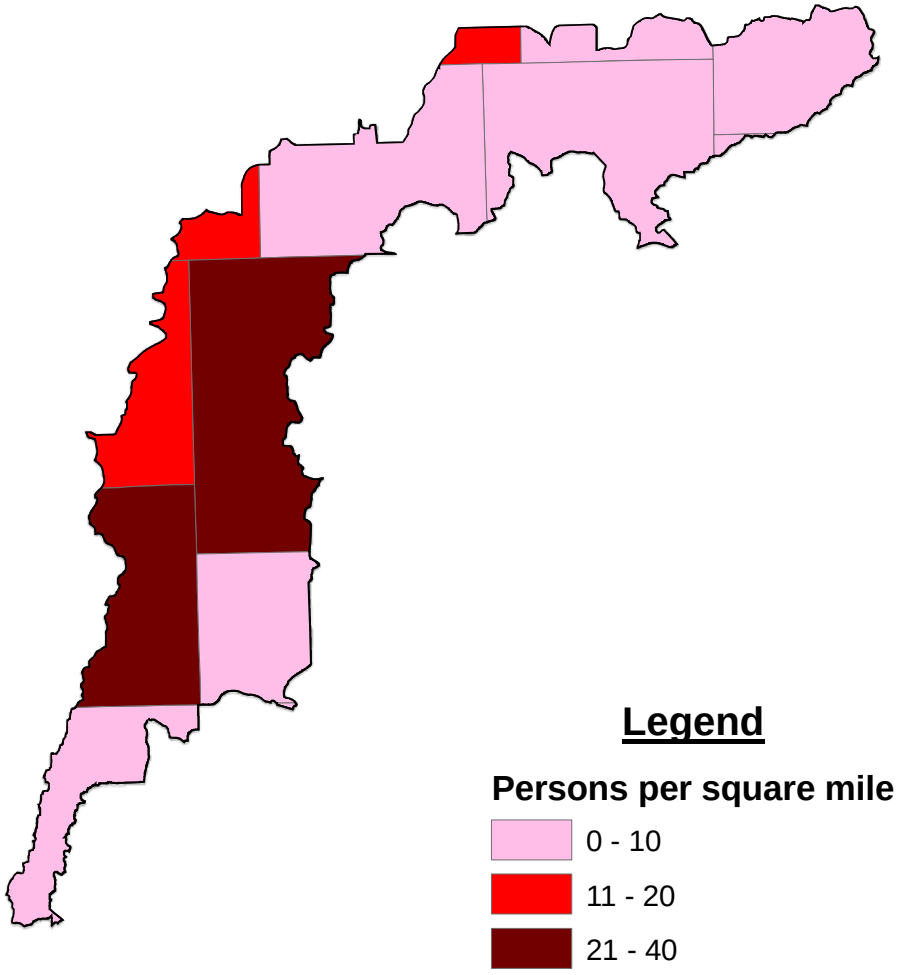
Change in Population Density (1970-1980)



Change in Population Density (1980-1990)



Change in Population Density (1990-2000)



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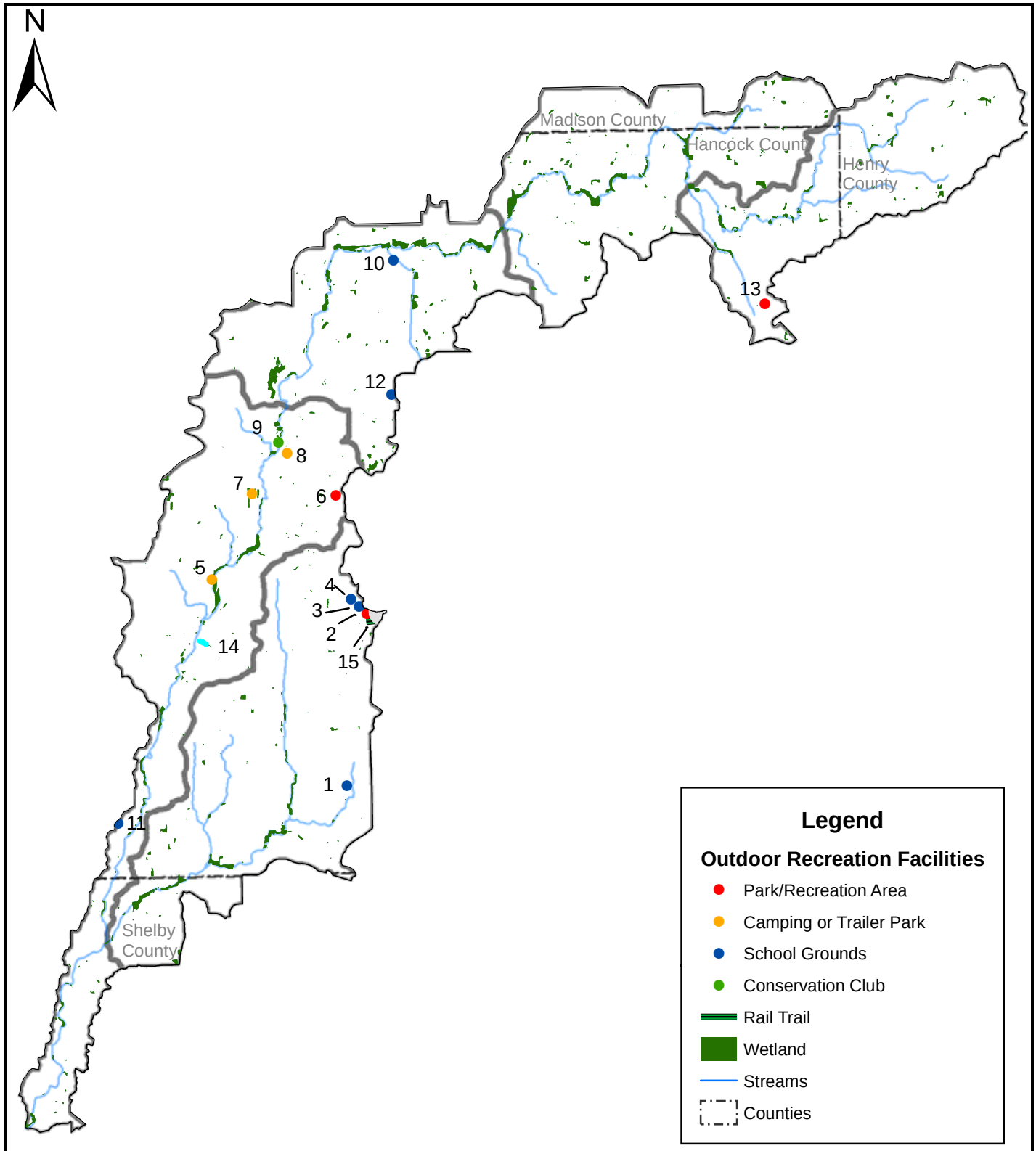
TITLE: Change in Population Density		PROJECT: Sugar Creek Watershed Project	
BASE LAYER: United States Census Bureau		PROJECT NO.: 07065	EXHIBIT: 5
CLIENT: Hancock County SWCD 1101 West Main St., Ste. N Greenfield, IN 46140		QUADRANGLE: N/A	DATE: 10/29/08
		SHEET: 1 OF: 1	SCALE: NTS

Recreational Resources and Significant Natural Areas

A number of recreational opportunities are scattered throughout the Sugar Creek Watershed. The recreational facilities, parks, and trails within the Sugar Creek Watershed serve as an opportunity for the public to enjoy the natural landscape within their community as well as learn about valuable natural resources within the Sugar Creek Watershed. Activities such as walking, canoeing and driving the Watershed create educational outreach opportunities to teach stakeholders and children of all ages about the dynamic aquatic system within their community. They range from parks and conservation clubs to camping and activities on school grounds (Exhibit 6, and Table 6). Wetlands within the Sugar Creek Watershed provide important filtration functions as well as serve as a productive habitat for many species. Sugar Creek is a unique surface-water resource that is home to several endangered species and species of special concern (see section entitled Threatened and Endangered Species on page 41 of this plan). Many portions of Sugar Creek still have natural riparian zones adjacent to the river which provide habitat for a variety of wildlife and offer opportunities for wildlife viewing and enjoyment.

Table 6 Unique Recreational Resources: Outdoor Recreational Facilities and Trails

Site	City	Type of Facility	Number in Exhibit 6
Brandywine Elementary School	Greenfield	School Grounds	1
Commons Park	Greenfield	Park/Recreation Area	2
Weston Elementary School	Greenfield	School Grounds	3
St Michael's School	Greenfield	School Grounds	4
S & H Campground	Greenfield	Camping or Trailer Park	5
Beckenholdt Park	Greenfield	Park/Recreation Area	6
Heartland Resort (Sugar Creek Resort Club)	Greenfield	Camping or Trailer Park	7
Mohawk Campground	Greenfield	Camping or Trailer Park	8
Greenfield Conservation Club	Greenfield	Conservation Club	9
Eden Elementary School	Greenfield	School Grounds	10
New Palestine Elementary School	New Palestine	School Grounds	11
Maxwell Middle School	Maxwell	School Grounds	12
Wilkinson City Park (War Memorial)	Wilkinson	Park/Recreation Area	13
Spring Lake	Spring Lake	Park/Recreation Area	14
Trails	**County**	**Type of Trail**	
Pennsy Trail	Hancock	Hiking/biking	15



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TITLE: **Unique Recreational Resources**	PROJECT: **Sugar Creek Watershed Project**			
BASE LAYER: Indiana Geological Survey	PROJECT NO. 07065	EXHIBIT: 6	SHEET: 1 OF: 1	
CLIENT: Hancock County SWCD 1101 West Main St., Ste. N Greenfield, IN 46140	QUADRANGLE: N/A	DATE: 10/29/08	SCALE: NTS	