

# Watershed Inventory Workbook for Indiana

A guide for watershed partnerships



Do you know what goes on in your watershed? Completing a **watershed inventory** can help you discover major land uses in your watershed, and possible impacts on water quality from each land use

This guide is designed for volunteers. You don't need to be an expert! All you need is time, willingness to explore, persistence, and a way to keep track of your discoveries.

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**Watershed delineation:** Manual for Conducting a Watershed Land Use Survey by the Texas Natural Resource Commission, 1997, and Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds by Caraco et. al., 1998.

**Logging site observations:** *Logging and Forestry BMP's for Water Quality in Indiana, Field Guide* by Forest Practices Working Group, 1998.

**Impervious fractions:** *Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds* by Caraco et. al., 1998, and *Urban Hydrology for Small Watersheds. Tech. Release 55*, by U.S. Department of Agriculture, Soil Conservation Service, 1986.

**Stream observations:** *Stream Visual Assessment Protocol*. USDA-NRCS Technical Note 99-1, by U. S. Department of Agriculture – NRCS, 1998.

**Residential and Urban:** *Manual for Conducting a Watershed Land Use Survey* by TNRCC-Nonpoint Source Program, GI-232. Texas Natural Resource Conservation Commission, 1997, and *A Citizen's Guide to Lake Watershed Surveys, How to Conduct a Nonpoint Source Phosphorus Survey* by Maine Department of Environmental Protection, 1997.

**Mining Observations:** *Citizens Guide to Indiana's Abandoned Mine Lands Program and Citizens Guide to Coal Mining and Reclamation in Indiana* by Indiana Department of Natural Resources, Division of Reclamation

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# Introduction

This Watershed Inventory Workbook for Indiana is designed for groups who are beginning to develop watershed management plans. A watershed inventory can help you identify potential concerns in your watershed by assisting you in observing and evaluating how various land uses can affect water quality. You will contact state, county, and city government agencies to learn how they are involved in the current and future planning of your watershed, and you'll drive or bike your watershed's roads making firsthand observations. All you need is the enthusiasm to explore and a few sharp pencils!

## Why do a watershed inventory?

- Completing the inventory will help educate the group about activities in the watershed that could be affecting the overall water quality of your streams and lakes.
- Once you have done the applicable parts of this workbook, you will have a better understanding of how land use and landscape features affect water resources in your watershed.
- An inventory can help in developing a monitoring strategy to collect baseline data or monitor the progress of your restoration efforts.
- You can use the material from the inventory at public meetings, to educate residents about your project.
- Your inquiries will help you meet knowledgeable people and locate valuable information sources in the area, and alert you to interest groups that may have been left out of the group.
- Finally, your inventory is a detailed record of current conditions and characteristics of this unique watershed, serving as a benchmark to measure future changes against.

finished. It should be done early in the planning process, right after developing goals and objectives. Share the information you are gathering with the larger group frequently (at least monthly) in order to make sure your efforts mesh with the others in the group, and to establish whether you are on track with the group's objectives and needs. Finally, present the information you gathered in a clear, organized way so everyone can understand it.

There are two levels or tiers to most sections of the Workbook. **Tier One** can be completed at home or in the office, using published material, the various Web sites, or contacting local governments. Since many useful sources of environmental data are available on the Web, we suggest that you use it to answer certain questions. If you do not have Internet access, check your local library. Most local libraries provide free Internet access.

**Tier Two** usually involves traveling around the watershed making direct observations. You can learn many things from looking at maps of the area, but there is no substitute for seeing it yourself. By driving, biking, canoeing, and hiking around your watershed you will gain first hand knowledge of potential problem areas as well as places where water is well protected. Photos, either digital or on paper, are valuable additions to your records. Take pictures of

**Tier One** can be completed at home or in the office by using published materials, searching Web sites, and making telephone calls. **Tier Two** gets you out of the office, directly observing the watershed.

sites you observe in the field, problem areas, people involved in watershed group activities, etc. Remember to mark which pictures go with which sites!

The two tiers are separate because they do not need to be done at once, and they do not need to be done by the same person.

## How do you do it?

Depending on the nature of your watershed, you may not need every section or table presented here. Pick and choose what's vital to you. At a minimum, complete the "Getting to know your watershed area" and "Land use overview" sections, then evaluate which other sections you need to explore in order to meet your group's goals. Before you start, identify who will do the inventory (perhaps the planning or technical subcommittees) and when the group expects it to be

You can complete the ten inventory sections one at a time or all at once. How long it takes depends on the size of your watershed and the level of detail you want; most sections can be completed in a few days. No formal training is required.

**Geographic Information Systems (GIS)** can be used to make many of the analyses easier. However, instructions are also provided for doing the assessments without the use of GIS.

## Recording Information

You can record the information from your inventory in at least three formats: text, tables (worksheets), and maps.

Just writing down what you do and what you find is the simplest way to keep track of information. Be sure to keep good notes – you can't always imagine what will be useful later.

Many of the sections in this Inventory have tables or worksheets for you to fill out. In each case, worksheet examples are included in the text, while blank worksheets (without the examples) are included at the end of each section so you can fill them out. Copy them as often as needed

Each workbook section will ask you to mark locations of certain features on a map, and then to fill out tables where information about the sites is recorded. You need at least four copies of a good map of the watershed area. If several groups work on the inventory, which would be the case in a large watershed, each group should have their own set of maps. Designate a record keeper and a good location for all of the information to be collated and stored as the project proceeds.

A particularly good map to work with is a U.S. Geological Survey (USGS) 7 ½ minute topographic map. These maps show elevation, major roads, streams, lakes, buildings, and other features. Each map is referred to as a *quadrant* or “quad” and has a distinctive name. Many sporting goods stores and bookstores sell them, and they can also be obtained through a USGS map dealer (see Table I.3) for \$4 each. You can find which quadrant you need at various Web sites such as <http://www.topozone.com>. Topographic maps are also available for your personal computer from many hiking/camping software packages, and on CD-ROM from the USGS office in Indianapolis.

TABLE 1: U.S. GEOLOGICAL SURVEY MAP DEALERS IN INDIANA

Map Dealers	City	Phone Number
Indiana Dunes Eastern National Bookstore	Beverly Shores	
Howards Bookstore	Bloomington	812-336-7662
Odyssey Map Store	Indianapolis	317-635-3837
Indiana Geological Survey	Bloomington	812-855-6560
J. L. Waters Co. Inc.	Bloomington	812-334-1845
Ball State Bookstore	Muncie	317-285-8080
Bearfoot Outfitters, Inc.	Clarksville	512-284-2327
Backcountry Outfitters	Evansville	812-946-1339
Salem Title Company	Salem	812-883-3605

Evansville Blueprint Company	Evansville	812-424-2484
Riegels, Inc.	Fort Wayne	219-424-1429
Blueprint Specialties, Inc.	Lafayette	317-742-6976
City of Fort Wayne Technical Service	Fort Wayne	219-427-1166
Highland Blueprint	Highland	219-838-8097
Indiana Dunes National Park	Porter	219-926-7561
Bicycle Garage of Indy, Inc.	Indianapolis	317-842-4140
Indiana DNR	Indianapolis	317-232-4180
Griffon Bookstore	South Bend	219-287-5533
Purdue University, LARS	West Lafayette	765-494-6305

Some groups have found that marking everything on a single map is difficult. You may want to have several copies, and use them for different sections of the inventory. For example, you may want to have three copies of your map to record observations and locations, and record features as follows:

- Map 1.** Agriculture Land Use, Wetlands, and Forest
- Map 2.** Urban and Residential, Regulated Pollutants
- Map 3.** Streams & Lakes, Recreation, and Mines and Wells

Table 1.4 is a symbol key you can use to mark special features on your maps. You may not need to use all of them in your watershed. Each symbol would be followed by a unique number, so that you can organize and retrieve all the information you gather about each site. Each section will discuss in greater detail how to use these symbols. An example of how they would look on a map can be seen in Figures 1 and 2.

TABLE 2: MAP SYMBOL KEY

	Survey Title	Topic	Symbol
1	Agriculture	Fields	A
		Wetland	W
		Forest	L
2	Residential and Urban	Subdivisions & Groups of Homes	H
		Construction	C
		Large Impervious Areas	I
		Golf Courses & other grass (turf) areas	R
	Regulated Pollutant Sources	NPDES (Regulated discharges)	REG
		Superfund	SUPER
		Landfills (Solid Waste)	SW
		Combined Sewer Overflows	CSO
		Unknown Pipes	UP

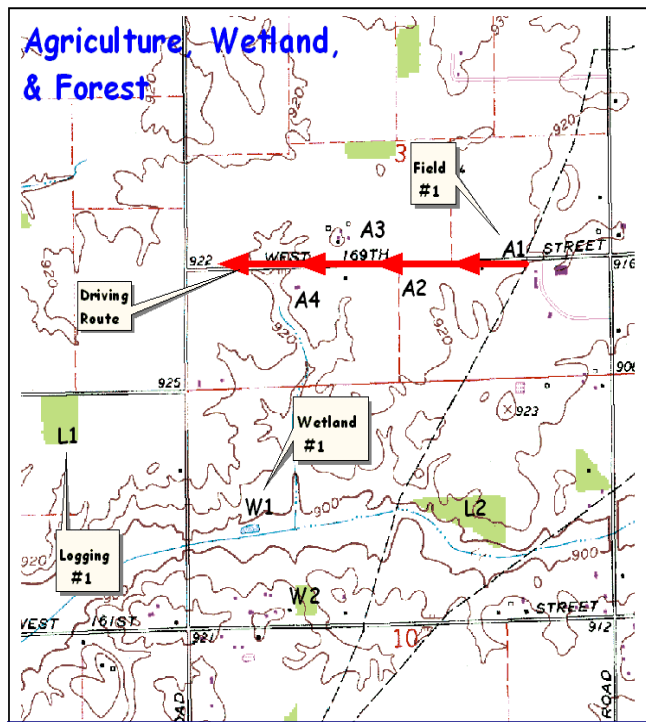


Figure 1: Example of the **Agriculture, Wetland and Forest Map**

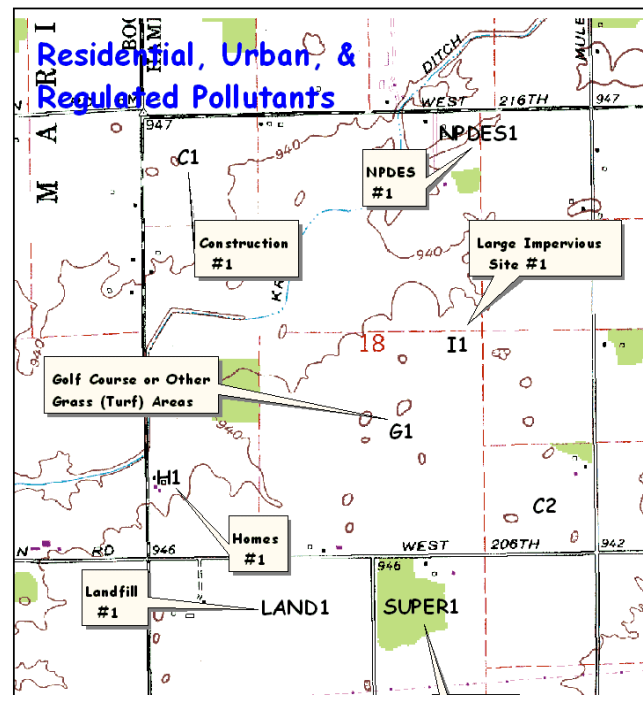


Figure 2: Example of the **Residential, Urban, and Regulated Pollutant Sources Map**

## Studies and Reports

There may already be assessments, reports, or studies that have been published on your watershed or some portion of it. Even if they are out of date, they are very valuable as background information. (Data more than five years old is generally considered to be less useful in making decisions.) To find studies, check with:

- IDNR Division of Soil Conservation. Ask for LARE diagnostic and feasibility studies and pre-assessment reports.
- IDNR Fish & Wildlife Division. Ask for fish population studies.
- IDEM Watershed Management Section. Ask for final reports of Section 319 or other grants.
- IDEM Assessment Branch. Ask for synoptic studies, old Section 208 studies, or any other information they can give you, including water quality data from at least the last 10 years.
- US Geological Survey. Ask for water quality or water availability studies.
- In addition to IDEM and USGS, many schools, water utilities, or local governments have monitored water quality in streams and lakes. Your local SWCD and local government should be able to help you determine if there is any water quality information for the streams and lakes in your watershed. .

Maintain copies of studies, reports, and data in a central location, along with copies of all the information you gather during your inventory. Decide who is responsible for keeping all of the information organized and accessible. After you've worked this hard, you don't want to lose any of it!

## Sources of Information

Many sources of information will be used throughout the inventory, and it's a good idea to start pulling them together right away. These sources might include

- Contacts for any watershed groups, associations, projects or studies going on in watershed or nearby now or in the past

- Soil Surveys for the counties in your watershed
- Topographic maps and aerial photos of the watershed
- Any reports, studies, monitoring data, or plans developed in the watershed by others
- County road maps and plat books, if available
- Aerial photographs can be an excellent source of information for your group. Your county Farm Service Agency office has paper aerial photos from the 1950's on, and the Natural Resources Conservation Service office has digital aerial photos flown in 1998. These 1998 photos have been rectified so that they have the properties of a map. They can be used in GIS software applications or certain free software packages. Some can be viewed on the Web at <http://www.terraserver.com>. They are also available on CD-ROM from Purdue Extension (\$15 per CD-ROM, which includes 3 or 4 counties). See <http://www.ecn.purdue.edu/~safewater/orthophoto> for more information.

Table 1 includes some of the sources of information that you will need throughout the assessment tool. Some sections may list more sources that may help you to answer the questions about the watershed.

**TABLE 3: MAPS YOU SHOULD COLLECT, AND WHERE IN THE INVENTORY THEY WILL BE USED**

	1. Determining Watershed Boundaries	2. Physical Features of the Land	3. Land Use	4. Streams, Lakes, Wetlands	5. Residential and Urban	6. Regulated Pollutant Sources	7. Agriculture	8. Forests	9. Mines and Oil or Gas Wells	10. Social and Economic Factors
Topographic Map	x	x		x	x			x	x	
Soil Survey		x					x			
Aerial Photos		x		x	x		x	x	x	
National Wetlands Inventory				x						
Current Land Use			x		x		x	x		
Zoning Maps			x							
Floodplain Maps		x								

TABLE 4: SOURCES OF INFORMATION

Title of Publication or Government Agency	How to Obtain/Contact	Information Available
Indiana Agricultural Statistics publication	Call 1-800-363-0469 or view at your Purdue Extension county office or on the Web at <a href="http://www.aes.purdue.edu/agstat/nass.html">http://www.aes.purdue.edu/agstat/nass.html</a>	Crop acres, forest acres, animal numbers, county area, pesticide and fertilizer usage
Indiana Fertilizer Tonnage Report	Office of the Indiana State Chemist (765) 494-1192	Fertilizer sales information by county, for each 6-month period
Fish Consumption Advisory	Indiana State Department of Health ( <a href="http://www.IN.gov/isdh/">http://www.IN.gov/isdh/</a> )	Streams and rivers where fish have been found to be a health risk
Purdue Extension Service	Look under your local government offices in the phone book or <a href="http://www.ces.purdue.edu">http://www.ces.purdue.edu</a>	Pesticide and fertilizer usage
Natural Resources Conservation Service (NRCS)	Find your county's office under "U.S. Dept. of Agriculture" in the phone book or <a href="http://offices.usda.gov">http://offices.usda.gov</a>	Conservation programs, technical assistance, soil information, aerial photos
Soil and Water Conservation Districts (SWCD)	Find your county's office under the local government offices in the phone book or go to <a href="http://www.ai.org/dnr/soilcons/swcd.htm">http://www.ai.org/dnr/soilcons/swcd.htm</a>	Soil Survey, conservation programs, aerial photographs
Indiana Department of Environmental Management (IDEM)	Call 317-232-8476 or go to <a href="http://www.IN.gov/idem/water/">http://www.IN.gov/idem/water/</a>	NPDES permits; 303(d) lists
U.S. Geological Survey (USGS)	<a href="http://in.water.usgs.gov">http://in.water.usgs.gov</a>	National Water Quality (NAWQA) and other monitoring information; numerous reports and streamflow data
USGS - Hydrologic Unit Areas for Indiana	<a href="http://in.water.usgs.gov/cdfactsheet/index.shtml">http://in.water.usgs.gov/cdfactsheet/index.shtml</a>	Factsheet and digital HUC information
Purdue Extension "Safe Water for the Future" Web site	<a href="http://www.ecn.purdue.edu/safewater">http://www.ecn.purdue.edu/safewater</a>	Watersheds for drinking water systems; watershed information
Planning departments	Look under your local government offices in the phone book	Zoning maps, subdivision info. and aerial photographs
U.S. EPA "Envirofacts" Database	<a href="http://www.epa.gov/enviro">http://www.epa.gov/enviro</a>	Superfund and water discharge (NPDES) permits,
U.S. Fish and Wildlife Service	<a href="http://www.nwi.fws.gov">http://www.nwi.fws.gov</a>	Wetlands
Indiana Department of Natural Resources (IDNR)	<a href="http://www.state.in.us/dnr/">http://www.state.in.us/dnr/</a>	Div. of Reclamation: Active and abandoned mines Div. of Recreation: Outstanding Resource Waters Div. of Soil Conservation: LARE information Div. of Natural Preserves: Critical Biological Resources



# Section One: Determine Watershed Boundaries

Before you can learn what is happening in a watershed, you need to know where the boundaries are and how large the watershed is. **If you already know your watershed boundaries and size, you can skip this section and go directly to Section Two.** If not, this section will help you determine them.

**In this section you will gather:**

- Watershed boundaries and watershed area
- Hydrologic unit codes
- Area of watershed in each county, if more than one county
- Percentage of the county in the watershed, for one or more counties

A watershed is an area of land from which all water drains to a common outlet. There are two options for determining your watershed boundaries. You can use the **hydrologic unit area code** boundaries that have been developed by the U.S. Geological Survey (USGS) or you can map the watershed yourself using a **topographic map**.

## Hydrologic Unit Area Codes

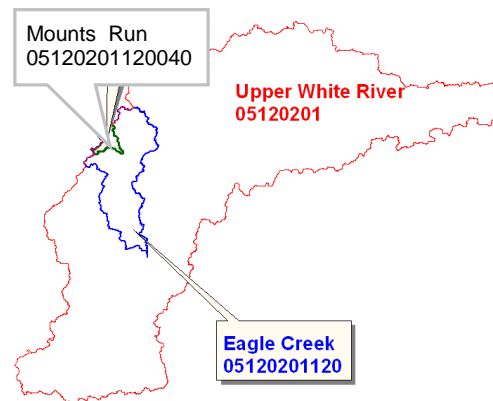
Hydrologic unit codes (HUCs) are “addresses” for segments of the landscape that drain to a common receiving stream or lake. The three codes that you may hear quite often are 8, 11, or 14-digit. *The smaller the code, the larger the watershed.* For example, the 8-digit code 05120201 is for the Upper White River (2720 mi<sup>2</sup>), while the 11-digit code 05120201120 is for Eagle Creek (164 mi<sup>2</sup>) which is in the Upper White River basin. The Mounts Run basin (19 mi<sup>2</sup>) which is inside the Eagle Creek basin has a 14-digit address of 05120201120040. Because so many government agencies, consultants, and planners use the hydrologic unit boundaries, they are useful as well for local groups.

The local NRCS office will be able to supply you with a map of the 14 or 11-digit watersheds in your county. If you have GIS, the HUC boundaries are available from USGS or NRCS as a shape file. Draw or overlay the boundaries of the

watershed onto a USGS topographic map and make several copies of the map to use as you carry out your inventory.

Note: In the future you may hear reference to 10 and 12 digit codes. There is discussion of dropping off the zeroes at the beginning of the 11-digit and the beginning and end of the 14-digit codes to make them shorter and easier to enter into databases. The landscape boundaries will remain the same as they are now.

**Note:** Not every HUC is a ‘watershed’ in the pure sense, since longer streams are divided along their length. The downstream HUCs do not include the entire upstream area, so they are not complete watersheds. However, each tributary that is included has a watershed.



**Figure 1.1: Example of an 8, 11, and 14-Digit Hydrologic Unit**

Because watershed protection efforts are usually most effective when the project area is modest, we recommend that your project focus on a 14-digit watershed, or break your project into 14-digit sub watersheds during the inventory process.

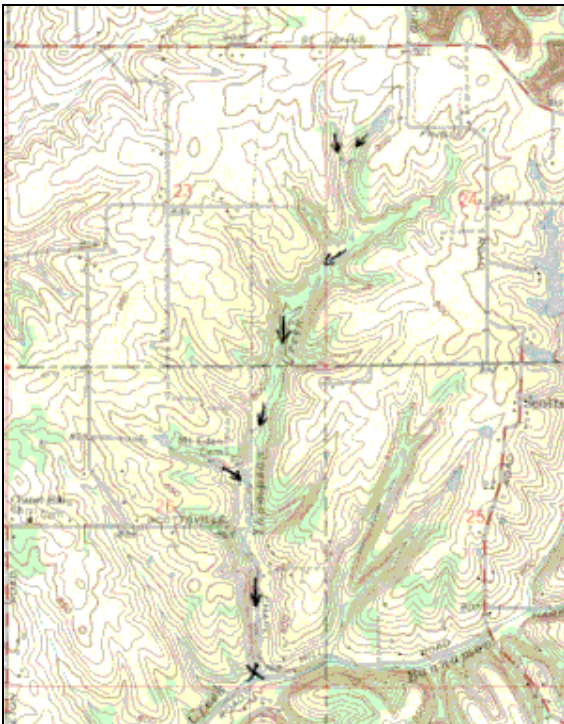
## Delineate the Watershed Using a Topographic Map

The second option is to delineate the watershed boundaries yourself. Once you’ve obtained the topographic maps for your area, the following steps will help you locate the boundaries of the watershed.

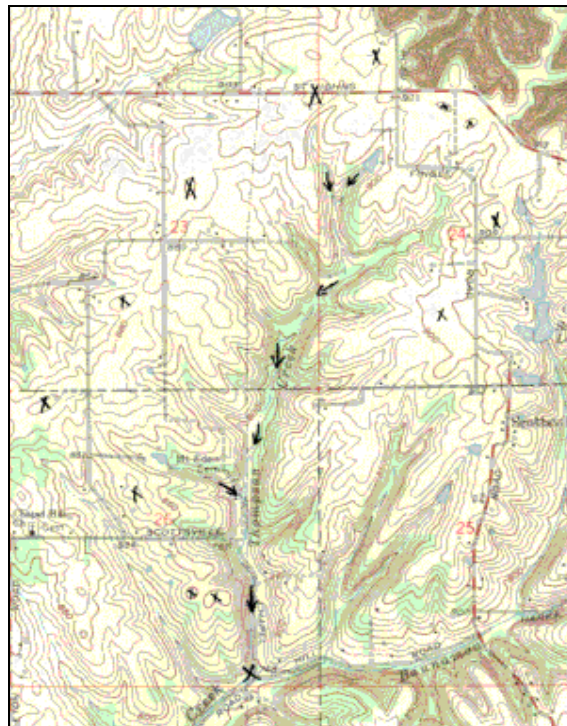
1. Mark the downstream outlet of your watershed (marked with an X in Figure 1.2). The farther

downstream from the headwaters of the river your outlet is, the larger your watershed will be. The smaller your watershed is, the easier it will be to obtain the information for the inventory.

1.4). You should not cross any water features except at the outlet. Follow ridges and cross slopes at *right angles* to the contour lines. If you have doubts about a certain area, refer to the soil maps in your county soil survey; often the direction of drainage and the location of ridges and low spots is easier to see by comparing two maps.

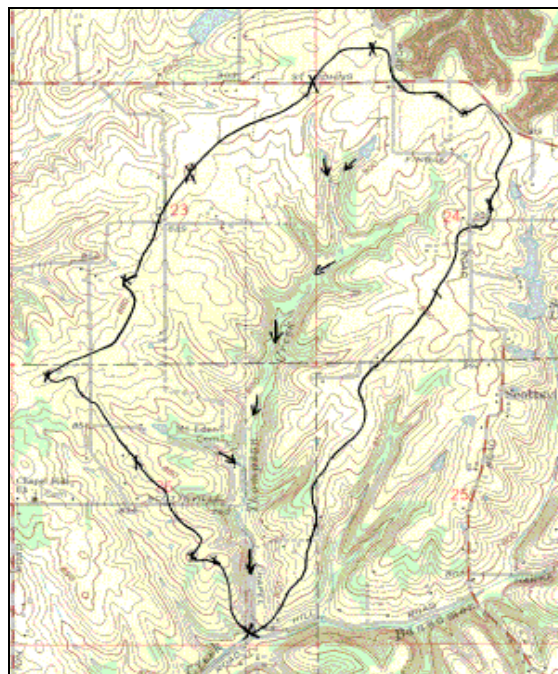


**Figure 1.2: Outlet Location and Flow Arrows**



**Figure 1.3: High Points and Flow Direction**

2. Locate all water features that flow to the outlet. Trace the water from its source to the outlet and then back again to make sure you don't miss any tributaries. Use arrows to mark the directions of the streams (Figure 1.2). To determine which direction a stream is flowing, compare the elevations of the land around the stream to the stream. [The brown lines on the topographic map are contour lines. These lines connect all points of equal elevation. The thick dark lines will have a number associated with them showing the elevation. The thin lines change in 10 ft increments and the dark lines change in 50 ft increments.]
3. Find and mark the highpoints on the map surrounding the streams you've marked (Figure 1.3). The high points will often appear on the map as closed areas.
4. Connect the highpoints, starting and returning to the outlet, to form the boundaries (Figure



**Figure 1.4: Delineated Watershed**

- Once the boundaries are drawn, imagine a bucket of water poured on the surface. Make sure it flows from the boundary to the outlet.

Once you've determined the boundaries of the watershed, make several copies of the map. You will use these maps to determine the area, mark important features, and keep as back up information. Five or six copies should suffice.

## Watershed Area

The watershed area is needed throughout the inventory

You can estimate the areas using your topographic map. One method to find the area is to count squares using a grid (See box at right.) You can also use a tool called a "planimeter" to trace the boundary of the watershed (it will calculate the area within the boundary), or a dot or grid counter to determine the area. If you do not have these tools, check with your local NRCS or SWCD office. [If you have the watershed boundaries in GIS, use your GIS software to identify the area in acres or square miles. Acres are most commonly used for

### Estimating Area Using a Grid

Use graph paper or draw a grid of equally spaced lines in both directions (for example, each grid line could be ¼ inch apart). Photocopy this onto a transparency. Then overlay the transparency on the watershed map and count the number of squares that are in the watershed within each county. Using the scale of the map you can get the area of the watershed. For example, if the scale is 1 inch = 2,000 ft, you can convert the number of squares into feet by taking the side length, 1/4 inch, times 2,000 ft which equals 500 ft. Each square represents 250,000 sq. ft. or 5.74 acres. One square inch would equal 91.8 acres at the same scale. To convert square feet to acres use the conversion 1 acre = 43,560 ft<sup>2</sup>. This area will only be an estimate due to the irregularities of the watershed boundary.

watershed and county data.] **Record the total area of the watershed on the worksheet at the end of this section: 'Worksheet 1.1: Watershed Boundaries'.**

Since watersheds can vary in size from a few acres to several hundred thousand acres, your watershed may lie in one or more counties. Some of the data you will want to collect are only reported at the county level (Example: 1,527 beef cows in Muskrat County). To determine values for your watershed you will be asked to estimate

the value from county numbers. Therefore, you will need to know the area and percentage of the watershed in each county. **Record the areas on Worksheet 1.1.**

Divide the watershed area in each county by the county's area. This will give you the fraction, or percentage, of each county that is in the watershed. **Record this on the worksheet.**

**Note:** Worksheet examples are included in the text. Blank worksheets [without the examples] are included at the end of each section so you can fill them out. Copy them as often as needed.

### WORKSHEET 1.1 (EXAMPLE): WATERSHED AREA

HUC and Watershed Name		Total Area of Watershed	
05120201-150-170; Orchard Creek		Acres	Sq. Miles
		8547.6	13.36
County	Area of watershed in the county	Total county area	Percentage of county within the watershed
MORGAN	All of it	262,751 Acres	3.25%

### Blank worksheet for your use

HUC and Watershed Name		Total Area of Watershed	
		Acres	Sq. Miles
County	Area of watershed in the county	Total county area	Percentage of county within the watershed

# Section Two: Physical Features of the Watershed

The physical characteristics of the watershed can have an important impact on water quality.

In this section you will examine the natural physical features of the land in your watershed.

- Soils
- Floodplains & floodways
- Topography of the watershed
- Geology
- Karst (sinkhole) areas

## Soils

Soil influences water quality in many ways. A good inventory should include at least a basic understanding of the soils in the watershed. Obtain a copy of the *Soil Survey* for your county from the SWCD office (For contact information, see Table I.3). Also request a set of loose soil survey map sheets for the watershed, from the SWCD office. Draw the watershed onto the loose soil maps. (It does not have to be absolutely accurate). List the soil mapping units you see within the watershed, and look up their characteristics in the survey. (Note: If you have access to GIS and digital county soil data, it will save a lot of time in determining the soil types in your watershed. NRCS is digitizing soil surveys, and more will be available in coming years. Check with NRCS to find out when your will be available.)

Record soil mapping units in your watershed in the first column of Worksheet 2.1. To estimate the area of each soil type, you can either approximate it visually by estimating the percentage of the watershed that they take up, or use a grid counter to estimate acreage. You do not need to know the exact acreage; the point of estimating area is to identify which mapping units are the most common in the watershed. If you want to interpret it visually, you might color each

major soil type a different color and ask others to help estimate the percentage of each color. You should be able to come within about 10% using this method. Notice which soil types occur with each land use, such as residential, farming, and industrial. Pay particular attention to whether the soils are suitable for septic systems, prone to flooding or high water tables, or have other attributes that generate concern about the land uses and zoning in the watershed. The NRCS personnel in the county field office can assist you with interpreting soils data.

For each soil, the Soil Survey provides information about many properties that are useful to understand in watershed management, such as flooding occurrence, high water table depth, and suitability for septic systems. Water-related features can be found in the “Soil and Water Features” (or “Water Features” in older Surveys) table of the Soil Survey, and are explained below. Other characteristics may also be of interest to your group.

### *Flooding*

Flooding carries many pollutants into streams and rivers, and dictates what land uses will be appropriate. Write down the flooding frequency category. Soils that are flooded “occasionally,” “frequently,” and “very frequently” have the possibility of being flooded.

### *High Water Table Depth*

Many soils in Indiana have a high water table and need to be artificially drained for optimal crop production or for development. Soils that have high water table depths of less than 2.0 feet are usually drained by perforated tubing commonly called “tiles”. This tile drainage is not directly visible, but can have an important impact on water quality. Nitrate can easily leach with the drained water, which is channeled directly into ditches and streams.

### *Suitability for Septic Systems*

Septic systems rely on the soil to treat wastewater. Many soils are not suitable for this treatment system, and therefore special measures are required if houses are to be built in these areas. It is helpful to understand this characteristic of soils in your watershed.

## WORKSHEET 2.1 EXAMPLE: SOIL INFORMATION

Soil type	Area or % (estimate)	Flooding	High water table depth	Suitable for septic systems	Other characteristics	Comments
<i>Bowes Silt Loam</i>	<i>About 15%</i>	<i>frequent</i>	<i>2-3 ft</i>	<i>No; severe limitation</i>	<i>This soil type is often severely eroded</i>	<i>New subdivision on Bogbottom Road has a lot of this soil. Find out if they are on sewer; and do the houses all have sump pumps?</i>

### Floodplains

IDNR Division of Water determines floodway boundaries in developing areas. The SWCD office, County Planning office, and some realtors will have copies of the Federal Emergency Management Agency (FEMA) floodplain maps that identify areas where flood insurance is available. These will tell you where flooding occurs within certain frequencies. In some counties, the floodplain map is available at the Web site

<<http://www.esri.com/hazards/makemap.html>>. In areas where the FEMA maps are not available, the Soil Survey can provide information on flooding. Look for soil types that are frequently or occasionally flooded. **Roughly delineate these areas on your map or obtain copies of the FEMA maps.** Also note land use in the flood plain areas.

### Topography

Use your topographic map, combined with driving around the watershed, to get a sense of the topography. Where are the steeper slopes? Where are the flatter valleys? You can also use the Soil Survey to obtain information about topography in the watershed. The average slope is given for each soil type, which you can use to estimate slopes in different parts of your watershed.

### Geology

The Soil Survey (printed version) is also a good source of information about geology of the area. You don't need to understand the geology in great detail to develop a watershed plan, but it is a good idea to know whether or not the area was glaciated, and what kind of deep subsurface layers might be present, for example. There may be local people that you can talk with who are very interested in the geology of the area, and can contribute a great deal to your watershed group's work.

### Karst Areas

In south central Indiana, limestone near the surface has been worn away by millennia of rain, forming caves and sinkholes. This type of landscape is called "karst", after the area in central Europe where this geology was first studied. In karst landscapes, there is little surface water since streams often sink out of site except during the wettest weather. Since the rock underlying the earth is essentially limestone Swiss cheese, it is very vulnerable to contamination from pollutants on the surface. Springs are likely to emerge to the surface during rainy weather, and it can be very difficult to identify where water is flowing underground. In these areas, human and animal waste management, nutrient and pesticide management, and sediment control are absolutely critical. **If there are areas in your watershed that are karst landscapes, mark their boundaries on the topo map with a highlighter.** The local planning and health departments, as well as the soil survey, can help you identify these areas.

### Blank worksheet for your use

(following page)

WORKSHEET 2.1: SOIL INFORMATION

Soil type	Area or % (estimate)	Flooding	High water table depth	Suitable for septic systems	Suitability for foundations	Comments
<b>Information about Flood plains</b>				<b>Topography</b>		
<b>Information about Geology</b>				<b>Karst areas</b>		

# Section Three: Land Use Overview

Knowing how land is used in your watershed can help you determine possible pollutant sources or problem areas in your watershed. Land use changes through time, which is different than many of the physical features you noted in the previous section. Therefore in this section you will note current land use, then try to get an idea about future land use by looking at zoning maps.

In this section you will examine how the land in the watershed is being used, and how it may be used in the future (based on zoning plans).

- **Tier 1:** Find maps of current and zoned land uses. Calculate impervious areas under each of the land uses.
- **Tier 2:** Drive around the watershed, seeing what might be different than on your map or photo. Adjust maps based on your observations and any other information.

## Current Land Use

Unfortunately, printed maps of land use are not widely available for most areas in Indiana. The best ways to determine the current land uses are GIS data, recent aerial photographs, topographic maps, Indiana Agriculture Statistics publications, or conducting a “windshield survey.”

**GIS:** If you have GIS, or can ask an agency or organization with GIS to assist you, the task is much easier and your results will be more accurate. The GAP data, developed by the U.S. Fish & Wildlife Service using satellite imagery from 1992, is considered an appropriate coverage for watershed assessment. If you use it, you can easily calculate the area of each land use in your watershed. Another coverage is the “National Land Cover Database”, developed by USGS (<http://landcover.usgs.gov/>).

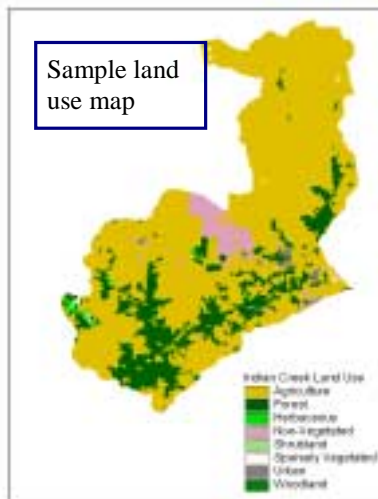
**Aerial Photos:** (See information on obtaining aerial photos in the Introduction.) Photocopy the needed maps and identify the various land uses in the watershed. If you have GIS, you may want to digitize the

different land uses right on the ortho aerial photo and derive your areas that way. This is particularly useful if the watershed is developing rapidly, and you are aware of tracts that have changed hands or are slated for development that has not yet begun.

**Topographic maps:** Topographic maps show forested areas, towns, high-density areas, and all buildings in rural areas are marked on them. By using the map, you can estimate the percent of the total watershed area that each land use covers. Note the year that the map was updated so you will know how old your information is.

**Indiana Agricultural Statistics publication:** Using the County Highlights Section, you can estimate the acres of woodland and agriculture in your county (or counties) and use that to estimate the percentage in your watershed. (Caution: keep in mind that when using county data and extrapolating it to your watershed, you are making an assumption that the features or characteristics are evenly distributed in the county. Since in reality this is rarely the case, the figures you get using this method should be suspect until confirmed with additional information. For example, if the county data says there are 500 acres of dense development in the county, and your watershed occupies 50% of the county area, you will conclude that there are 250 acres of dense development in your watershed. However, all of those development acres may be in one corner of the county -- maybe in your watershed, and maybe not. Try to use more than one source of data when making this sort of estimate.)

Record the percentage or acres of land uses in your watershed in **Worksheet 3.1**. The categories in the worksheet are typical identifiers of land use. If needed, adjust the categories to better represent your watershed and the methods you are using. For instance, if there is little industrial and commercial land in the watershed, they could be combined. If it is a rural area, you may want to identify concentrated residential areas (subdivisions and strip development) and include isolated houses in the agricultural coverage if they are difficult to distinguish from farms. The main thing is for the group to understand and agree on the



categories that you use.

## Zoned (Potential) Land Uses

Most counties have planning departments and/or Plan Commissions that create maps to show how each parcel is zoned determine how land can be used in the future (zoning). Although zoning maps are not usually representative of *current* land uses, they do show what *potentially* could be built in each area. You should be aware of these to plan for future impacts on your watershed. These maps vary in size, scale, and detail from county to county and possibly from township to township within a county.

You can usually look at these maps at the planning department. Many of the maps can be photocopied, but some planning departments may charge you a small fee to copy them.

First, draw the boundaries of the watershed on the zoning map. Then observe the different types of zoned land uses within the watershed. To make it easier to distinguish each, you may want to color code corresponding land uses. Next, estimate the area of each land use, using the same methods you have in previous sections.

There is no universal legend for zoning maps, so you may have to adjust the entries on the worksheet to better match the categories your county uses. The difference between low density (LD) and high density (HD) housing is particularly variable. You may need to adjust the size of the lots based on what your local zoning board uses. Many zoning boards consider agricultural land and forest together, so you may not be able to distinguish each.

Some counties may only have maps by townships. In that case, make a separate worksheet column for each township. **Record your findings on Worksheet 3.1.**

## Calculating Impervious Area

Impervious surfaces in a watershed can have significant impacts on the quality of streams. In a forested or natural setting, most rainfall soaks (infiltrates) into the ground. When the ground is paved for roads and parking lots, or buildings are constructed

and roofed, the water can no longer infiltrate and therefore it runs off directly into the stream. Rainfall collects and flows into the stream much more quickly and in larger volumes than before. This hydrologic change results in stream bank erosion, sandbars, and silt deposits on the stream bed. In addition the runoff carries increased quantities of pollutants from the landscape into the water. There may also be less water in the stream during dry periods due to a decrease in groundwater flow. These changes degrade aquatic habitat and can cause maintenance problems for the community.

Using the areas you estimated for the various land uses in the watershed, estimate the amount of “imperviousness” that is in your watershed for both current and future (zoned) land uses. The values in the worksheet are approximate. They are intended to give you an idea of the percent impervious area usually found in certain land uses. **Record your results in Worksheet 3.2.**

## Public & Private Land

Indiana has very little public land compared to a state like Utah, but many watersheds will still have areas managed by public or non-profit entities. These could be Federal or State forests, reservoir boundaries, nature preserves, land trust holdings, or county parks. Some may show on your topo maps; or you can obtain a GIS coverage of public and managed lands. You can also peruse tax maps in the County Assessor’s office. The purpose of collecting this information is to identify stakeholders who may have a keen interest in your watershed project, and may have a lot to contribute.

### TIER 2

## Windshield survey:

Drive through the watershed and observe what is there. It is a good idea to have at least three people participate. One person will drive, another will observe the landscape, and the third will record the observations on a topographic map or road map. Don’t try to write and drive if there is only one person making observations! Pull over as often as you can safely do so and write down your observations.



**Worksheet 3.1 Example : Land Use Overview**

<b>Current Land Use</b> <i>NOTE: Your categories may be different than the examples below</i>	<b>County 1</b>	<b>County 2</b>	<b>Total for Watershed (acres &amp; %)</b>
Concentrated Residential [Subdivisions and strip development]	1800 acres		19%
Rural Residential [isolated houses and farmsteads]	800 acres		9%
Commercial & Industrial	600 acres		6%
Working Agricultural Land [Cropland and pasture]	4200 acres		45%
Forest	1900 acres		21%
<b>Total</b>	<b>9,300 acres</b>		<b>100%</b>
<b>Zoned or Proposed Land Use</b> <i>NOTE: Your categories may be different than the examples below</i>	<b>County 1</b>	<b>County 2</b>	<b>Total for Watershed(acres or %)</b>
Concentrated Residential [Subdivisions and strip development]	3100 acres		33%
Rural Residential [isolated houses and farmsteads]	500 acres		5%
Commercial & Industrial	1500 acres		16%
Working Agricultural Land [Cropland and pasture]	2300 acres		25%
Forest	1900 acres		21%
<b>Total</b>	<b>9300 acres</b>		<b>100%</b>

**Worksheet 3.2 Example: Impervious Area in Your Watershed**

<b>Current Land Use</b> Note: Use the same categories as in Worksheet 4.1	<b>Area or % (from Worksheet 4.1)</b>	<b>Typical Impervious Fraction</b>	<b>Impervious Area or % in Watershed</b>
Concentrated Residential [Subdivisions and strip development]	19%	<b>0.4</b>	7.6%
Rural Residential [isolated houses and farmsteads]	9%	<b>0.3</b>	2.7%
Commercial & Industrial	6%	<b>0.85</b>	5.1%
Working Agricultural Land [Cropland and pasture]	45%	<b>0.01</b>	.5%
Forest	21%	<b>0.01</b>	.2%
<b>Total</b>	<b>100%</b>		<b>16.1%</b>
<b>Proposed or Zoned Land Use</b>		<b>Typical Impervious Fraction</b>	<b>Impervious Area or % in Watershed</b>
Concentrated Residential [Subdivisions and strip development]	33%	<b>0.4</b>	13.2%
Rural Residential [isolated houses and farmsteads]	5%	<b>0.3</b>	1.5%
Commercial & Industrial	16%	<b>0.85</b>	13.6%
Working Agricultural Land [Cropland and pasture]	25%	<b>0.01</b>	.3%
Forest	21%	<b>0.01</b>	.2%
<b>Total</b>	<b>100%</b>		<b>28.8%</b>

## Blank worksheets for your use

### Worksheet 3.1: Land Use Overview

<b>Current Land Use</b> <i>NOTE: Your categories may be different than the examples below</i>	<b>County 1</b>	<b>County 2</b>	<b>Total for Watershed (acres &amp; %)</b>
Concentrated Residential [Subdivisions and strip development]			
Rural Residential [isolated houses and farmsteads]			
Commercial & Industrial			
Working Agricultural Land [Cropland and pasture]			
Forest			
Total			100%
<b>Zoned or Proposed Land Use</b> <i>NOTE: Your categories may be different than the examples below</i>	<b>County 1</b>	<b>County 2</b>	<b>Total for Watershed (acres or %)</b>
Concentrated Residential [Subdivisions and strip development]			
Rural Residential [isolated houses and farmsteads]			
Commercial & Industrial			
Working Agricultural Land [Cropland and pasture]			
Forest			
Total			100%

### Worksheet 3.2: Impervious Area in Your Watershed

<b>Current Land Use</b> Note: Use the same categories as in Worksheet 4.1	<b>Area or % (from Worksheet 4.1)</b>	<b>Typical Impervious Fraction</b>	<b>Impervious Area in Watershed</b>
Concentrated Residential [Subdivisions and strip development]		<b>0.4</b>	
Rural Residential [isolated houses and farmsteads]		<b>0.3</b>	
Commercial & Industrial		<b>0.85</b>	
Working Agricultural Land [Cropland and pasture]		<b>0.01</b>	
Forest		<b>0.01</b>	
Total			
<b>Proposed or Zoned Land Use</b>		<b>Typical Impervious Fraction</b>	<b>Impervious Area in Watershed</b>
Concentrated Residential [Subdivisions and strip development]		<b>0.4</b>	
Rural Residential [isolated houses and farmsteads]		<b>0.3</b>	
Commercial & Industrial		<b>0.85</b>	
Working Agricultural Land [Cropland and pasture]		<b>0.01</b>	
Forest		<b>0.01</b>	
Total			

# Section Four: Streams, Lakes, & Wetlands

Understanding the streams and lakes that drain your watershed is a very important part of understanding your watershed. Streams, lakes, and other waterbodies are the central focus of any watershed. By observing the landscape around the water bodies, you can learn what could potentially affect their ecosystems, and by observing the water body itself, you can learn its current condition. Wetlands are valuable because they help to regulate water levels, can reduce flooding, provide wildlife habitat, and can improve water quality

**Tier 1:** Locate streams, lakes, and wetlands in the watershed and use published sources to identify any known water quality concerns or problems.

**Tier 2:** Observe the streams, lakes, and wetlands to see their current condition, and how adjacent land uses may be affecting them.

## Tier 1

### Stream Locations

Locate all streams in the watershed using your maps, photos, or local knowledge. The term “streams” includes streams, rivers, ditches, legal drains, and channeled waterways. **Write the name of each stream in the worksheet at the end of this section: “Worksheet 4.1: Streams”.** Note: Some streams on the topo map may not have names. You might be able to find names from local residents, county maps, or other sources; or you may choose to create an identifying name or number yourselves. Keep track of which names are “official” and “unofficial”!

### Legal Drains

In Indiana, many streams are considered “legal drains.” Legal drainage systems were established to remove excess water from agricultural land to improve crop production. These drains are dredged periodically to make sure the flow of water is unobstructed.

Visit your County Surveyor’s office to determine which streams in your watershed are legal drains, and find out about their maintenance schedules. The Surveyor has jurisdiction over legal drains and will have maps you can look at. **Record this information on Worksheet 4.1.**

## Impaired Streams

Section 303(d) of the Clean Water Act requires Indiana to identify waters that do not meet water quality standards. The 303(d) list identifies streams that do not meet the standards, contaminants of concern, and the severity of the impairment. This information is published by the Indiana Department of Environmental Management (IDEM) and can be found at the Web site <http://www.IN.gov/idem/water/planbr/wqs/303d.html> Streams that are not on the list may be unimpaired, or may not yet have been assessed. The 2002 draft list is currently open for public comment.

**Complete the “impaired streams” section of Worksheet 4.1** by marking streams that are on the 303(d) List, what contaminants are of concern, the severity ranking, and whether a TMDL (Total Maximum Daily Load calculation for the contaminant of concern) has been scheduled or completed.

## Fish Consumption Advisory

Each year the Indiana State Department of Health (ISDH), in cooperation with IDNR and IDEM develops a Fish Consumption Advisory list for the state. The advisory is based on levels of polychlorinated biphenyls (PCBs) and mercury found in fish tissue. This list can be accessed at ISDH Web site (<http://www.state.in.us/isdh/>) under “Data and Statistics”.

Determine if any fish consumption advisories are in effect for the streams you identified in Worksheet 4.1. **Add Fish Consumption Advisory information to Worksheet 4.1.**

## Lakes

Identify lakes and large ponds on the topographic map or aerial photo. For public lakes or any others you will include in the watershed plan, note what stream feeds the lake and what water receives the lake outflow. If there are no public lakes in the watershed, you may choose to simply locate the private lakes and ponds and move on.

### For large or public access lakes:

- Using the same method as for the area of your watershed, estimate the area of the lake watershed and the lake itself.
- Note whether they have swimming or boating, who manages the lake, and a contact person for further information.
- If there is a lake association, find out who a contact person is.
- Contact the Indiana Clean Lakes Program at IDEM and ask for the trophic scores for each public access lake. The trophic score is an index of lake ecology that tells whether the lake is likely to have an excess of nutrients flowing into it.
- Ask your local water utility whether the lake is used as a drinking water source for any customers.

## Beach Closings

Beaches are sometimes closed due to high levels of *E. Coli*. Although *E. Coli* bacteria themselves are usually harmless, they are monitored as indicators of unsanitary conditions, and other more dangerous pathogens may be present where large numbers of *E. coli* are found.

If any beaches are located in your watershed, determine if they have been closed during the most recent operating season and if closings occurred in previous years. Your county health department should be able to help you determine this. **Add this information to the Worksheet 4.4.**

## Wetlands



“Wetlands” is a collective term for marshes, swamps, and bogs. Wetlands are areas of land that lie in flat vegetated areas and sometimes are hard to identify because while some are wet most or all of the time, others are actually dry much of the year. In Indiana, the most common types are forested wetlands and small temporarily flooded wetlands in farm fields. Wetlands are valuable because they help to regulate water levels, reduce flooding, recharge aquifers, provide wildlife habitat, and improve water quality.

The U.S. Fish and Wildlife Service developed the National Wetlands Inventory (NWI) in the 1980s to provide information on characteristics, size, and status of the nation’s wetlands. Information on wetlands in your watershed can be obtained on the Web by using an interactive mapping tool. You can access this site at

<http://www.nwi.fws.gov>. Choose the “Wetlands Interactive Mapper” to determine the wetlands in your watershed and their size. This data can also be downloaded and used with GIS. (Note: The NWI Web site was shut down in December 2001, and has not reopened as of March 2002.)

An additional source of information about wetlands is the Natural Resources Conservation Service (NRCS). NRCS may have copies of the US Fish and Wildlife Service National Wetlands Inventory maps, and can supply Soil Surveys.

Wetlands are also shown on the topographic map that you are using to mark locations and the Soil Survey map used in the agricultural section. Your local NRCS office may also know of other wetlands in the watershed.

- USGS map symbol for wetlands 
- Soil Survey map symbol for wetlands 

Once you have located the wetlands, mark them on the copy of your map labeled “Agriculture, Forest, and Wetlands.” **Label each site with a “W” and the site number. Record the site numbers, a location description, and area of the sites on Worksheet 4.4.**

### Tier 2

## Stream Observations in the Field

Choose sites along the streams that have easy access without trespassing on someone’s property. Good locations are usually bridges where you can gain access to the stream from the road. Mark the location of sites on the copy of your map labeled “Streams & Lakes”, assigning a different number for each site. Describe each site on the top portion of **Worksheet 4.2**. If you cannot measure the depth and width of the stream, try to estimate them. Next, enter your comments on the site. For example, look for erosion or scouring around bridges, culverts, or any other engineering structure you see. Erosion could indicate increased stream flow due to human influences in the watershed. Structures that need to be replaced because of erosion or scour represent a potential economic impact on the community.

### Instructions for Recording Observations

The bottom portion of **Worksheet 4.2** contains columns to record characteristics of the streambank, riparian area, and in-stream habitat. The following list describes the topics covered in the worksheet for the sites you described above.

NOTE: A streambank is defined as the area of the bank from the water's edge up to bank full stage. Bank full stage is the point of highest flow before the water spills into the floodplain. The riparian area is the land running alongside the stream, including a portion of the floodplain.

- **Channel Modified:** Modification can consist of vegetation being removed, very straight channels, rip rap on the banks, or concrete banks (urban areas).
- **Pipes:** If you see a pipe at the site, indicate yes. Pipes can be tile drains from agricultural fields, industrial discharge, or stormwater runoff.
- **Trash:** Indicate if you see a lot of trash at the site. This may come from runoff from urban or impervious areas.
- **Streambank Erosion:** Indicate if the streambanks look stable or show signs of sloughing or washing out.
- **Streambank Cover:** Streambank vegetation should be a dense cover of trees, shrubs, or unmowed grasses (not field crops or lawns). Observe the vegetation and indicate whether or not there is good cover.
- **Riparian Cover:** Good riparian cover consists of trees and/or unmowed grasses. Lawns, crops, and bare soil are not adequate cover for riparian areas.
- **Riparian buffer width:** The wider the vegetated riparian area is, the better for stream habitat. Trees or unmowed grasses in the riparian area form a "riparian buffer." If there is such an area, indicate its width.
- **Fish hangouts:** Good fish habitat includes areas where deep pools, root wads, fallen trees, dense plant beds and overhanging vegetation provide

sheltered areas for fish to feed, breed, and lurk during daylight. Indicate if you see any of these areas.

- **Insect hangouts:** Aquatic insects (macroinvertebrates) prefer areas of fine woody debris, submerged logs, leaf packs, undercut banks, cobbles, boulders, and coarse gravel. All of these provide habitat for feeding, breeding, and sheltering. Indicate if you see any of these areas.

**When you have completed your observations for all selected sites, tally your results on Worksheet 4.3, Stream Observation Summary Table.**

## Lake Observations

If you can access the public lakes, or any of the larger private lakes, go out and make observations. Mark your observation locations on your map (L1, L2, etc.) For each location, note whether there is a riparian buffer along the shore, plain mowed grass, a seawall, or rip-rap. Also note the presence of large numbers of waterfowl if you see them. If boating, fishing, or swimming are permitted, ask the contact person for the lake if there are any concerns such as shoreline erosion, turbidity from boat traffic, violation of no-wake zones, complaints about the quality of fishing, aquatic weed problems, or other water-related concerns. Note the information on **Worksheet 4.4: Lake Observations.**

## Wetland Observations

When you are driving the watershed to make visual observations for other sections, note any activity adjacent to the wetland that you think may have a negative impact, and record your observation in the **Worksheet 4.5 Wetland Observations.**

WORKSHEET 4.1 EXAMPLE: STREAMS

Stream	Upstream tributaries	Downstream receiving water	Legal Drain ?	Lakes & Ponds	Comments
Orchard Creek	North, Middle & South Forks	White Lick Creek	No	Arens Lk + 17 ponds	3 <sup>rd</sup> order
Webb Ditch	None	Donkey Creek	Yes	2 hdwtr ponds	No planned dredging
Donkey Creek	Webb Ditch	White Lick Creek	No	4 hdwtr ponds	1 <sup>st</sup> order
Impaired Streams					
Streams on the 303(d) List of Impaired Waters	Contaminants of concern	Severity ranking			Is a TMDL scheduled or completed?
White Lick Creek	FCA	Medium			2011
Streams with Fish Consumption Advisories	Species	Size			Group
White Lick Creek	All species for mercury, carp for both mercury and PCBs, consumption limits on all species	(see page 20, table 3 of 2000 Fish Consumption Guide for details)			
Streams that have been monitored					
Monitoring History	Who Monitored	What Parameters	Which Years	Where can we get the data?	
White Lick Creek	IDEM	Full spectrum	1996, 2001	IDEM	
White River	USGS NWQA Report	numerous	early 90's	USGS	

**WORKSHEET 4.2 EXAMPLE: STREAM OBSERVATIONS**

Site ID #	Stream	Location	Date	Weather	Stream Depth	Stream Width	Site Comments																
ST1	Hub's Cr	Watson, just after Horse & Hub come together, near White Lick	7/20	Hot, overcast, no recent rain	Almost dry, but would normally be 10-12"	Normally 6-8 feet	Bottom silty, some gravel, looks like lots of stuff gets washed down. Bridge scoured on one side & rip-rap & gabions installed in vain attempt to stop erosion. Woods both sides.																
ST2	Hub's Cr	Pennington, flow from new pond into Crouse Lk	7/13	Hot, sunny, recent rain	Just a few inches normally	Pipe is about 30"	Just runs from one side of road, from pond outlet, into other pond on other side of road. Residential.																
Site ID #	Channel Modified		Pipes		Erosion		Bank Cover		Trash		Riparian Cover				Riparian Buffer Width			Fish Hangouts		Insect Hangouts			
	Y	N	Y	N	Y	N	Y	N	Y	N	Trees	Grass	Crops	Poor	None	1-30 ft	30-100 ft	over 100 ft	Yes	No	Yes	No	
ST1		X		X	X		X			X	X				X	X				X		X	
ST2	X		X		X			X		X				X					X		X		

**WORKSHEET 4.3 EXAMPLE: STREAM OBSERVATION SUMMARY TABLE**

After you have completed Worksheet 4.2, enter total number of sites with that observation in first row. Enter any comments in second row.

Channel Modification	Pipes	Erosion	Bare Banks	Riparian Vegetation				Buffer Width			
				Trees	Grass	Crops	Bare	None	1-30	30-100	100+
3	4	2	3	4	6	8	4	12	6	4	0
<b>What was the TOTAL number of sites you observed?</b>				<b>22</b>							
Were you able to draw any conclusions or make any general observations about streams in the watershed? <i>Many go dry in hot summers. While banks and riparian zones are pretty well protected now, if development continues to accelerate the changes in hydrology could be detrimental to streams. Most streams have silty or sandy bottoms.</i>											

WORKSHEET 4.4 EXAMPLE: PUBLIC ACCESS LAKE OBSERVATIONS

Lake Name (if any)		Private or Public?	Boating	Swimming	Fishing	Trophic Score	Management/Association & Contacts
Goose Lake		Public	yes	yes	yes		Friends of Goose Lake
Lake Observations							
Lake ID#	Drinking Water Source	Waterfowl	Riparian Zone Vegetation	Shoreline Erosion	Turbidity	Monitoring Data or Data Sources	
GL-1							
Beach		Closing History		Comments			
No public beaches in the watershed							

WORKSHEET 4.5 EXAMPLE: WETLANDS OBSERVATIONS

Site ID #	Location	Area (acres)	Construction nearby?		Farming nearby?		Comments
<b>Total number of wetlands identified:</b>		<b>Percentage of wetlands with construction nearby:</b>				<b>Percentage of wetlands with farming nearby:</b>	

**Blank worksheets for your use**

Following page



WORKSHEET 4.1: STREAMS

Stream	Upstream tributaries	Downstream receiving water	Legal Drain ?	Lakes & Ponds	Comments
Streams on the 303(d) List of Impaired Waters	Contaminants of concern	Severity ranking			Is a TMDL scheduled or completed?
Streams with Fish Consumption Advisories	Species	Size			Group
Monitoring History	Who Monitored	What Parameters		Which Years	Where can we get the data?

WORKSHEET 4.2: STREAM OBSERVATIONS

Site ID #	Stream	Location	Date	Weather	Stream Depth	Stream Width	Site Comments
ST1							
ST2							
ST3							
ST4							
ST5							
ST6							
ST7							
ST8							
ST9							
ST10							
ST11							
ST12							
ST13							
ST14							
ST15							
ST16							
ST17							
ST18							
ST19							
ST20							
ST21							
ST22							
ST23							
ST24							
ST25							
ST26							

Site ID #	Channel Modified		Pipes		Erosion		Bank Cover		Trash		Riparian Cover				Riparian Buffer Width				Fish Hangouts		Insect Hangouts		
	Y	N	Y	N	Y	N	Y	N	Y	N	Trees	Grass	Crops	Poor	None	1 - 30 ft	30 - 100 ft	over 100 ft	Yes	No	Yes	No	
ST1																							
ST2																							
ST3																							
ST4																							
ST5																							
ST6																							
ST7																							
ST8																							
ST9																							
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ST20																							
ST21																							
ST22																							
ST23																							
ST24																							
ST25																							
ST26																							

**WORKSHEET 4.4: PUBLIC ACCESS LAKE OBSERVATIONS**

Lake Name (if any)		Private or Public?	Boating	Swimming	Fishing	Trophic Score	Management/Association & Contacts
Lake Observations							
Lake D#		Drinking Water Source	Waterfowl	Riparian Zone Vegetation	Shoreline Erosion	Turbidity	Monitoring Data or Data Sources
Beach		Closing History		Comments			

**WORKSHEET 4.5: WETLANDS OBSERVATIONS**

Site ID #	Location	Area (acres)	Construction nearby?		Farming nearby?		Comments
<b>Total number of wetlands identified:</b>		<b>Percentage of wetlands with construction nearby:</b>				<b>Percentage of wetlands with farming nearby:</b>	

# Section Five: Residential and Urban Areas

Residential and urban activities in a watershed can greatly affect water quality. Potential sources of pollution include septic systems, impervious area runoff, construction erosion, and lawn chemicals. In Tier 1 you will identify areas you should visit in Tier 2. *Tier 2* includes field observation of homes, construction sites, and large impervious areas, which may require a little more effort. You will need to visually observe the sites to answer some questions, and you may need to contact someone to answer the rest.

## Subdivisions and Other Residential Areas

Major water quality concerns in residential areas

In this section, collect information on “built up” areas where people live and work.

- Map where these uses are
- Locate subdivisions, and observe which subdivisions have detention ponds
- Map sewerred and non-sewerred residential areas
- Observe sediment from construction areas
- Locate large impervious areas, and observe runoff management from impervious areas
- Locate large turfed areas; observe management
- Locate bridges and evaluate roads

are septic systems, lawn chemicals, runoff from impervious areas, and erosion. In this section, questions related to these areas can be answered through observations (a windshield survey), talking with residents, and maps.

Many counties mark subdivisions on their zoning maps. You may be able to identify subdivisions from aerial photographs as well. To answer the questions about residences in the watershed that are not in subdivisions, it may be easiest to group them

and then answer the questions for each grouping. An example of a grouping would be “all homes on 600 E between 200 N and 300 N.”

Using the copy of the watershed map that you marked “Residential, Urban and Regulated Pollutants,” mark the location of subdivisions or groupings of homes. For each one, mark H and the site number; for example the first group of homes would be labeled “H1.”

Tier 2:

Go to each subdivision or group of houses you have identified on your maps, and observe any impact they may be having on water quality. Talking to the homeowners would be the most direct method of obtaining answers to the various topics, however some may not feel comfortable answering the questions.

**Sewage:** The homes either have **septic systems** (also called on-site waste disposal) or are connected to a **sewer system**. Failing septic systems can release nutrients and pathogens into the watershed. Planning departments, local contractors, health departments, or realtors should know if the homes are on septic or sewer systems. The health department is probably the best source for information on failing septic systems. Another source of information would be to contact your local sewer company to determine where their pipelines are located. Check which system you believe the homes are using or, if unsure, check “don’t know.” (Sewer systems are included in the *Regulated Pollutant Sources* section.)

**Stormwater Control:** Wet or dry detention ponds collect runoff and allow some sediment to settle out. They are designed to release water more slowly than it runs off, modifying the peak storm discharges to streams. Determine if a detention pond or some other storm water control structure is located in the subdivision. If there are storm drains at the curbs, the water is going somewhere.... but check to be sure it is collected in a pond rather than being discharged directly to the stream.

## WORKSHEET 5.1 EXAMPLE: RESIDENTIAL AREAS

Site	Name or Description	Location	Area	Age	Sewage			Ponds		Buffers			Unusually green lawns	
					Septic	Sewer	Don't know	Yes	No	Yes	No	N/A	Yes	No
H1	Red River Subdivision	On 600 N along Red River	25	0-10		✓		✓			✓		✓	

### Communities in the Watershed

Find out what incorporated communities are in the watershed. This information is usually available on maps.

**Water Sources:** Where does each community get its water? Find out where the local water utility draws its raw water supply; it may be surface water, groundwater, or a mix. Have there been any problems with this raw water, such as high atrazine levels, taste and odor problems, nitrates, etc? Identify rural water systems, and a contact person for each. These are stakeholders with a serious interest in water quality. If you can, find out from the health department or other sources whether private wells in the watershed have had water quality problems.

**Wellhead Protection:** Ask the water utility if any areas in the watershed have been designated as wellhead protection areas; has a protection plan been developed yet?

**Water Usage:** The IDNR Division of Water publishes reports of water usage in each river basin. It may surprise you to find out how much water is used by industrial or commercial customers in your watershed. River Basin Water Supply summaries are available for some river systems at <http://www.IN.gov/dnr/water/basinsums/index.html>. Water Use trends by county for the years 1986 to 1997 are shown as graphs at <http://www.IN.gov/dnr/water/pdf/k-m.pdf>. Printed water resource assessments can be obtained in libraries or by calling the Division of Water.

**Stormwater:** Ask your county planning office if there are communities in your watershed that will be required to develop stormwater management

plans. These plans need to be completed by 2003. The regulation only applies to communities of a certain size. If there are such communities in your watershed, develop a relationship with the people who will be working on the plan, since you will be able to share information with each other. Some elements of a stormwater management plan are similar to parts of a watershed plan.

### Construction Sites

Sediment from a construction site can be much greater than erosion from a farm field. Sediment reduces stream capacity, interferes with fish life cycles, and can carry unwanted nutrients. In Indiana, a state rule commonly called "Rule 5" (327 IAC 15-5) regulates construction sites. The purpose of Rule 5 is to reduce the sediment leaving the sites. It has only applied to areas that are 5 acres or larger in size, but will cover those down to 1 acre after 2003. However, if the land area being disturbed is less than 5 acres, but is part of a larger plan of development (for example a subdivision or industrial park), it is still covered by the rule.

The Soil and Water Conservation District (SWCD) office in each county is responsible for approving and maintaining erosion control plans for each site. The plans detail what measures the construction firm will use to prevent sediment laden water from running off the site, sediment from entering roadways, and sediment from entering on-site storm drains. However many counties have limited resources and are unable to make sure the construction firms are following the plans once they have been approved. Ask the SWCD personnel how they think the Rule 5 program is progressing in your watershed. Do they find that contractors and developers are trying to do a good job? Does the county government work with them to cure violations?

Tier 2: Once you have identified the sites, drive by and see if they are using appropriate practices. You should see

erosion control practices in place and not see any sediment leaving the site. Possible erosion control practices that you may see are straw bales, sediment (silt)fences, and sediment basins. Indicate whether or not these practices are in place and if they seem to be working properly.

**Runoff:** Sediment-laden water should not flow from the site. It should be detained by erosion control structures. Observe the area and see if muddy water is allowed to flow from the site. Answer “yes” if it is and “no” if not.

**Waste:** Construction material should not be carried away from the site by runoff. This includes

garbage, debris, oil, or cleaning wastes. Answer “yes” if waste is leaving the site and “no” if not.

**Buffers:** A strip of existing vegetation left around the site helps to reduce off-site erosion and sedimentation. Indicate “yes” or “no” if you see this or not. This is especially important if the site is next to a stream.

**Other Comments:** Write down any observations that you feel may have an adverse impact on water quality. This could include sediment leaving a site, silt fence falling over due to too much sediment, or unprotected storm drain inlets. You should also record the types of erosion control practices that are seen. This could include a silt fence (properly installed, with its bottom buried) surrounding the site, existing grass strip around the site, or runoff channeled into a sediment basin.

### WORKSHEET 5.2: CONSTRUCTION SITES

Name	Location	Runoff		Waste		Buffers		Comments
		Yes	No	Yes	No	Yes	No	
<i>New hotel</i>	<i>SR 25</i>	x			x		x	<i>Silt fences have fallen down</i>

## Large Impervious Areas

Sites with a large area of pavement or roof, such as industrial complexes or shopping malls, may impact water quality in your watershed. If your watershed is small or mostly rural, then a church or school parking lot may be of concern. If your watershed is large or urban, then perhaps only a large industrial plant may need to be noted (for example, an automobile manufacturing plant).

These sites are of concern because they produce large amounts of runoff, which may be contaminated with heavy metals, nutrients, oil and gasoline, and salts. Observe the sites to see where the runoff is going and if there are any management practices such as buffer strips or constructed wetlands installed to reduce runoff. You can obtain their locations before driving around by looking at an aerial photograph.

Mark the location on your “Residential, Urban and Regulated Pollutants” map. Mark the location using “I” and the site number. For example site 2 would be marked, “I2.”

Tier 2: The following descriptions will help you determine the condition of runoff leaving the site,

and where it goes. On the worksheet, check all that apply for each topic.

**Runoff:** Look around the site to see how runoff is conducted off the site. Indicate “sewer” if the runoff goes directly into a pipe or storm sewer grate. “Ditch” indicates the runoff is channeled into a ditch without passing through any grassy area. “Buffer” is for runoff that you can see passing through a grassy area or other area that will improve water quality such as a constructed wetland.

**Appearance:** If the runoff can be seen, look to see if you can tell if any pollutants are visible. “Sheen” is a shiny or iridescent appearance on the surface that is caused by oil and gas. “Scum” is any greenish or yellowish growth you can see. This is usually caused by excess nutrients in the water. Indicate “Trash” if you see any floating in the runoff or deposited in surrounding ditches.

**Clean:** Indicate “yes” if it appears that the area is cleaned periodically. This would include trash being picked up around the area or parking lot sweepers being used.

**Comments:** List any other items that you see that you feel may be a possible water quality concern.

WORKSHEET 5.3 EXAMPLE: LARGE IMPERVIOUS AREAS

Site ID #	Name	Location	Runoff goes to			Appearance			Clean		Comments
			Sewer	Ditch	Buffer	Sheen	Scum	Trash	Yes	No	
11	Wal*Mart	On Hwy 665			x	x			x		Runoff goes to a constructed wetland.

**Recreational Facilities and Other Large Grassed Areas**

Golf courses, cemeteries, parks, and sports fields can benefit the environment by reducing stormwater and providing wildlife habitat. However, inappropriate management of these facilities can result in water quality problems.

Aerial photographs, maps, or observations can be used to locate these facilities in the watershed and to estimate their areas. **Mark their locations on the map labeled “Residential, Urban, and Regulated Pollutants”.**

Tier 2: The following topics can best be answered by interviewing the facility superintendent or maintenance workers.

**Chemical Storage**

Pesticides and fertilizers need to be stored properly. The Office of the Indiana State Chemist (OISC) can provide information on chemical storage. The storage, use, and disposal of all pesticides must be in accordance with the EPA label, and OISC has established rules for application, storage, and record keeping that must be met by golf courses.

Containers should not be leaking, stored near a waterbody, be out in the open, or stored in groups. Ask the superintendents how they store their chemicals and observe them if possible.

**Integrated Pest Management**

One way that some intensively managed areas lessen their use of pesticides is through Integrated Pest Management or IPM. IPM relies on a combination of common sense practices of preventing and controlling pests such as weeds, diseases, and insects. Monitoring is used to identify the pests and the amount of damage they cause, then all possible management options are evaluated and the most environmentally-friendly control is implemented. Ask the superintendents if their courses use IPM and to what extent it is used.

**Rinsing of Equipment**

After applying chemicals, the machinery used is usually washed. This rinsate can contain small amounts of the chemicals used. It should not be discharged into any nearby streams or sensitive areas due to the possibility for water pollution. Even if a concrete pad is used, the water must still drain someplace. Ask where the rinse water goes.

**Grass Clippings**

Golf courses cut their grass frequently. Many remove the clippings from the landscape instead of leaving them in place. The best way to dispose of these clippings is to compost them. The worst way is to dump them into streams or ponds! Ask the supervisor or maintenance worker what they do with the clippings.

WORKSHEET 5.4: RECREATIONAL FACILITIES AND OTHER LARGE GRASSED AREAS

Areas	Name	Location	Area	Comments
G1	Eagle Pines Golf Course	Country Club Rd S	~ 350??	Looks pretty well maintained. This is the only big recreational facility in the watershed.
C1	Lakeview Cemetery	450 N at 200 W	80 acres	



## Roads, Culverts, and Bridges

Mark the location of bridges and culverts on your topographic map, if you observe erosion problems around them when you are driving the watershed. Also mark bridge locations that would be useful sample points for a monitoring program.

Roads are not inherently a problem, but in some cases road management can be a concern. Talk to the County Highway Department to find out what sort of de-icing compounds they use in winter. If they are

using salt, find out where it is stored. Observe how roadside ditches are managed; is there serious erosion in some? Are there places where the road frequently floods during storms? Are roads washing out where they are adjacent to streams? Are there culverts that are frequently choked with sediment?

Record your observations either in a table or in brief notes on the maps.

## Blank Worksheets for Your Use

WORKSHEET 5.1 EXAMPLE: RESIDENTIAL AREAS

Site	Name or Description	Location	Area	Age	Sewage				Ponds		Buffers			Overly green lawns	
					Septic	Sewer	Don't know	Yes	No	Yes	No	N/A	Yes	No	

**WORKSHEET 5.2: CONSTRUCTION SITES**

Name	Location	Runoff		Waste		Buffers		Comments
		Yes	No	Yes	No	Yes	No	

**WORKSHEET 5.3: LARGE IMPERVIOUS AREAS**

Name	Location	Runoff goes to			Appearance			Clean		Comments
		Sewer	Ditch	Buffer	Sheen	Scum	Trash	Yes	No	

**WORKSHEET 5.5: RECREATIONAL FACILITIES AND OTHER LARGE GRASSED AREAS**

Grass Areas	Name	Location	Area (acres)	Comments

# Section Six: Regulated Pollutant Sources

In this section, identify the location of wastewater treatment plants, industries, and other types of regulated facilities.

Regulated pollutant sources (also called *point sources*) in your watershed are businesses and facilities that require discharge permits from a federal or state government agency.

Permits dictate the amount of a pollutant that can be safely discharged without degrading designated uses in a stream or lake.

It is useful to know the location of point sources because of the potential for accidental discharges that exceed allowable levels. Also, many wastewater treatment plants discharge raw sewage during storm events because of combined sewer overflows (CSOs) in the community they serve. Such discharges could be detrimental to drinking water quality or aquatic species in streams, rivers, or lakes. You also need to take point sources into account when assessing the impact of nonpoint source pollution from runoff.

The following questions will help you to better understand the facilities in your watershed that have permits to discharge into the environment. Sources of information include the U.S. EPA and the Indiana Department of Environmental Management (IDEM).

## Tier 1

### NPDES Permits

The **National Pollution Discharge Elimination System (NPDES)** is the system the government has developed to regulate facilities that discharge into waterbodies. To identify the facilities in your watershed, search EPA's "Envirofacts" Website (<http://www.epa.gov/enviro>). Use the "water discharge permits (PCS)" link. You can search based on county, city, or zip code; this will give you

a table of all the facilities within a certain area. You may need to compare the addresses to a map (you can use the "Enviomapper" interactive map program at this site) to determine if the facilities are actually within your watershed. Note that in some cases the address listed is the mailing address of the company, not the location of the discharge. It is best to combine this search with local information.

Another way to determine which facilities are in your watershed is to contact IDEM's Office of Water Management Permitting Branch Programs at 317-232-8476, or search at the Web site <http://www.IN.gov/idem/water/fasb/NPDESfacilitiesmap.html>

Mark the sites on your watershed map labeled "Urban, Residential, and Regulated Pollutants." You might use "PS" (for point source) and the site number, or develop your own numbering system.

### Combined Sewer Overflows

A combined sewer system is a single pipe that conveys both wastewater (domestic, commercial, and industrial) and storm water to a sewage treatment plant. A combined sewer overflow (CSO) is the discharge from this system at a point before the water gets to the sewage treatment plant. Overflows usually occur during or after large storm events, when the volume of flow overloads the sewage treatment plant causing it to divert the flow directly (untreated) into the receiving water. Indiana has more combined sewer overflows than any other state.

Determine whether or not any of the communities in your watershed have CSOs. A list of towns with CSOs can be found at <http://www.IN.gov/idem/water/data/#cso>. For any communities that have CSOs, contact the local sewage treatment plant to determine where the outlet is located, how often discharges occur, and any plans to eliminate them. Mark the outlet locations on your watershed map labeled "Urban, Residential, and Regulated Pollutants." Use "CSO" and the site number.

WORKSHEET 6.1: REGULATED DISCHARGERS AND COMBINED SEWER OVERFLOWS

Site	NPDES number (for reference)	Facility name	Location	Receiving waters
PS1	IN0025987	Joe's Garage	Corner of 7 <sup>th</sup> and Main	Little Blue River
CSO1		Prairieville sewage treatment plant	Near Main St. bridge	Dirty River

**Superfund Sites**

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), more commonly known as Superfund, appropriates money to clean up abandoned toxic and hazardous waste sites throughout the United States. The National Priorities List (NPL) was developed to rank the sites based on a series of factors that assess the potential to cause harm. Sites on this list are “first in line” to be cleaned up.

Determine whether there are any Superfund sites within your watershed by searching the EPA’s Superfund Website (<http://www.epa.gov/superfund/sites/index.htm>). Use the “CERCLIS Sites by State” to determine if a site is located in your watershed. There are few of these, so it is unlikely that you will have more than one in your watershed. You can read about the site’s history, how it was contaminated, and current cleanup actions.

Mark the sites on your watershed map labeled “Urban, Residential, and Regulated Pollutants” and record them on **Worksheet 6.2**.

**Landfills**

To find the landfills in your watershed go to <http://www.IN.gov/idem/land/sw/index.html>, where you can open (municipal, non-municipal, construction-demolition sites, and restricted waste) and closed landfills. Active landfills follow strict environmental procedures. Many closed landfills, however, were in place before environmental protection laws were enacted and therefore may pose a risk to ground and surface water. Once you determine if a landfill is located in your watershed you can talk to solid waste collectors, longtime residents of the area, or your Solid Waste Management District to find out more about the operation of the facility. Mark the sites on your watershed map labeled “Urban, Residential, and Regulated Pollutants” and record them on **Worksheet 6.2**.

WORKSHEET 6.2: POTENTIAL HAZARDS ON THE LAND: LANDFILLS AND SUPERFUND SITES

Site	Facility Name	Facility Location	Comments
SUPE R1	Temple's Waste Storage	East of 1100 N & 900 E	
LND1	City Dump	West of Old School Rd.	Cleaned up superfund site

**Tier 2**

**Unpermitted or Unknown Pipes**

While you are driving through the watershed or walking along streams, you may discover pipes (other than field tile drains) not identified on the worksheets so far. This would include any pipes

leading into a stream, river, or ditch, *especially if they are flowing during dry weather*. Note their location on your watershed map labeled “Urban, Residential, and Regulated Pollutants.” Use “UP” and the site number.

**WORKSHEET 6.3 EXAMPLE: UNKNOWN PIPES**

Site	Name (if known)	Location	Size & Type of Pipe	Receiving waters
UP1	Next to ACME Metals	On 45 <sup>th</sup> Street	18" corrugated metal	Green River

**Blank Worksheets for Your Use**

**WORKSHEET 6.1: REGULATED DISCHARGERS AND COMBINED SEWER OVERFLOWS**

Site	NPDES number (for reference)	Facility name	Location	Receiving waters

**WORKSHEET 6.2: POTENTIAL HAZARDS ON THE LAND: LANDFILLS AND SUPERFUND SITES**

Site	Facility Name	Facility Location	Comments

**WORKSHEET 6.5: UNKNOWN PIPES**

Site	Name (if known)	Location	Size & Type of Pipe	Receiving waters

# Section Seven: Agriculture

Characterize the farming activities in the watershed; identify where pesticides, fertilizers, and animal waste are stored and used, and where erosion potential is present.

About two-thirds of land in Indiana is used for agricultural production or is part of a farm operation. If your watershed is typical, agriculture is probably a major land use. Farming can benefit the environment by providing habitat for wildlife, large permeable areas where rainfall can soak into the ground, a desirable landscape appearance, and vegetation that protects water resources and air quality. However agricultural activities, like any other human activity, can also have adverse impacts on water quality. Inappropriate management of crops and livestock can cause manure, pesticides, fertilizers, and soil to enter streams and lakes, which can be harmful to aquatic and human health.

The most common field crops in Indiana are corn, soybeans, and wheat. Livestock production is diverse, including swine, dairy cattle, beef cattle, and poultry

This assessment helps you identify potential impacts from agricultural land use in your watershed. Tier 1 helps you identify where the agricultural operations are and what crops or livestock are raised. Tier 2 requires using more detailed information including Soil Surveys, interviews, and a “windshield survey” which helps you know your watershed better.

The following sources of information may help you in this section:

- Natural Resources Conservation Service (NRCS): Tillage practices, conservation programs
- Purdue Extension offices: Animal numbers, manure amounts
- Soil and Water Conservation Districts (SWCD)
- Indiana Agricultural Statistics: Crop acres, animal numbers, pesticides, fertilizers
- Office of Indiana State Chemist: Fertilizer

## Tier 1

### Cropland, Pasture, and Other Agricultural Lands

In Section 3, you mapped the land uses in your watershed, including agricultural land. Using whatever methods (GIS or hand mapping on aerial photos) you used before, revisit the agricultural land use and separate out cropland, pasture, and farmsteads. If you are not using GIS, this may take some visual observation, since it is not easy to tell pasture from cropland on aerial photos. Use highlighters to mark the fields and estimate their cumulative area with a grid counter. It is far more important to know *where* in the watershed agriculture is occurring than to know *exactly how many acres* of corn or wheat are planted, or how many cows there are.

### Pesticides

Pesticides stop or limit insects and weeds from damaging crops. Ideally, they remain in the environment long enough to control the pests and then break down into harmless compounds. However, due to weather, application methods, or location, they may be transported into water supplies before they have enough time to break down.

About 1% of all applied pesticides end up in Indiana’s surface water. If you are conducting water quality monitoring in your watershed, and you decide to test for commonly used pesticides such as atrazine, it is important to gauge the flow of the stream at each sample point. The amount of pesticide in the water sample is the concentration, but without flow data, you will not know the actual load being transported from that stream into the main stem. Concentration alone can be misleading. Comparing loads from different tributaries could help you decide where an integrated crop management program, or other practices, would be effective. Farmers and dealers will know what compounds are widely used in your area..

Work with the Purdue Cooperative Extension Educator in your county for assistance with correct application rates, common and chemical names of pesticides, and pesticide label information.

## Fertilizers

Fertilizers provide vital nutrients for crop growth. These nutrients, however, can also cause water quality problems if the nutrient load delivered to water bodies is more than the ecosystem can absorb. The two nutrients that are of most concern are nitrogen (N) and phosphorus (P). **Nitrogen** breaks down into the nitrate form, which can cause health concerns in ground water and contributes to a low oxygen zone toxic to fish in the salt water of the Gulf of Mexico (the 'Dead Zone'). If soil moisture in a crop field is controlled with tile drainage, as is about 50% of Indiana farmland, highly soluble nitrates can move into the soil along with rainwater, and then enter tile drains, which flow directly into ditches and streams. **Phosphorus** usually travels in surface runoff by attaching to fine soil particles. When soil erodes from fields it takes phosphorus with it. Too much phosphorus in lakes can cause overgrowth of algae and aquatic plants, which can suffocate the lake. Excess phosphorus can also disrupt stream ecology; it is the limiting plant nutrient in freshwater systems. Where phosphorus applications to soil have been excessive over long periods, phosphorus may also be discharged through tile drains.

## Livestock

Livestock production has the potential to impact the environment in several ways. When animals are kept in confinement for some portion of their life cycle, as with poultry houses, dairy barns, and feedlots, the manure they produce has to be stored and handled properly. Manure, along with processing and washing wastes, carcasses, etc. is collectively referred to as 'animal waste'. This is usually disposed of by land application to crop land, since it contains valuable crop nutrients. Like any crop amendment, if it is carried into surface or groundwater, it can be a pollutant. Animal wastes may contain nutrients, pathogens, salts, and undecomposed organic matter. Livestock on pasture can also cause erosion, and if allowed free access to streams, can degrade aquatic habitat.

Estimating the number of livestock in a watershed can be very difficult, for several reasons: livestock numbers change seasonally and as animals are sold;

information on some livestock numbers is considered proprietary (not available to the public); operations fluctuate due to economic impacts, changes in ownership, and changes in management.

What is more feasible is to **record on your maps the location of different types of livestock operations, and note the ones that are large or otherwise of interest.** Drive through the areas on your map that have been designated 'agricultural land use' and mark the location of dairy operations, beef operations, poultry and swine houses, and where livestock are on pasture. Note any locations where you see livestock having free access to streams or lakes. Don't forget horses and unusual species such as ostrich or llama, which are also livestock, and often have insufficient pasture for their numbers. If you need to, develop codes for 'hobby farm', 'confined feeding operation', and so forth. **Record locations and characteristics for livestock operations by subwatershed.**

## Tillage Practices

Since 1989, conservation partners in all counties in Indiana have conducted Tillage Transects on a regular basis to gather information on crop production practices and erosion in the county. Participants include NRCS, Cooperative Extension, IDNR, and FSA. The same route is driven each year, and the same points are observed for crop, tillage type, changes in land use, etc. This information is used to analyze trends in tillage, cropping, and loss of farmland. In recent years, the 14-digit watershed has been recorded for each point. This information is available in electronic form through the Purdue Department of Agronomy, or from the SWCD in each county.

Conservation tillage is a cropping system with 30% or more residue remaining on the soil surface after planting, to reduce soil erosion by water and wind. This includes no-till, ridge-till, mulch-till, etc.

The "T" value is the "tolerable" soil loss, which is the rate at which new soil is formed to replace what is eroded. Cropland eroding below "T" is farmed sustainably. However, even at this rate it could cause a water quality concern if excess amounts of nutrients or pesticides are applied.

The following questions can be answered using Tillage Transect data.

## WORKSHEET 7.1 EXAMPLE: TILLAGE PRACTICES

County or watershed	The amount of conservation tillage occurring in the watershed (percentage)	Amount of cropland eroding above "T" value (percentage)	Major type of tillage practices in watershed
<i>Tippecanoe</i>	<i>65%</i>	<i>About 6%</i>	<i>No-till</i>

### Tier 2

The following exercises will increase your understanding of agricultural activities that may affect water resources in the watershed.

### Windshield Survey

You can learn many things from looking at maps of the area, but there is no substitute for seeing it yourself. By driving, biking, canoeing, and hiking around your watershed you will gain first hand knowledge of potential problem areas as well as places where water is well protected..

On the map labeled "Agriculture, Wetlands, and Forest," plan the routes you will take. You can then use this map while traveling to mark locations. Avoid heavily traveled roads when possible, as you will frequently be slowing down or stopping. Depending on the age of the topographical map, some road names may have changed. The work will be much easier if at least two people drive or bike together. In a car, one drives while the other observes and records observations. Mark agricultural fields you observe as "AC" for crop, "AP" for pasture, and "AX" for other uses (such as farmsteads or orchards). (See Figure 1 in the Introduction (p. 6) for an example.)

The following steps will help you to complete the Tier 2 work sheets:

1. Mark your route with highlighter on a map, circling or putting a symbol in places where you recorded information.
2. Look at each field and determine whether it is crop, pasture, or other. Then answer the

questions. If a stream runs next to or through the field also complete Worksheet 4.2.

The more fields you observe, the more objective and fair your assessment will be.

## Cropland Management

What to look for:

**Crop status:** Indicate the most recent crop if you can identify it, or just enter 'crop'. If no crop residue, or very little, is on the surface indicate 'exposed soil', 'plowed', or 'bare' (whatever seems the most appropriate) under Surface Cover. If there is a substantial amount of residue on the surface, enter that on the worksheet.

**Tillage:** Conservation tillage is any tillage or planting system with 30% or more residue remaining on the soil surface after planting which reduces soil erosion by water. This includes no-till, ridge-till, mulch-till, etc. Conventional tillage leaves less residue on the surface and usually includes several passes with an implement. The local NRCS staff can supply you with brochures that show what different percents of residue look like for different crops. If you feel comfortable doing so, indicate the type of tillage.

**Signs of erosion:** Erosion indicators include bare soil with rills or gullies forming in it. Rills are small channels that have been carved out by the water and gullies are channels a foot or more across. Note them where you see them. Also note any stream bank erosion where streams and ditches cross crop fields.



## WORKSHEET 7.2 EXAMPLE: CROP MANAGEMENT

	<b>Crop management</b> [Crop, residue, bare soil]	<b>Tillage</b> [No-till, conservation tillage (30% or more), conventional tillage (less than 30%), or can't tell.]	<b>Signs of erosion</b> [None, Rills, Gully, or Can't See.]	<b>Comments</b> [Filter strips, buffers, other comments]
<i>AC1</i>	<i>Corn</i>	<i>No-tilled into corn residue</i>	<i>Can't see</i>	<i>Large flock of geese.</i>
<i>AC2</i>	<i>Wheat stubble</i>	<i>Conventional</i>	<i>Few small rills</i>	<i>Filter strip ~ 30' along ditch on south side; ditch bank is sloughed off in a few places</i>

## Pasture

Fill out Worksheet 7.3 for each pasture you see.

**Livestock:** If any animals are present, indicate what kind and roughly estimate how many.

**Pasture management:** Overgrazing can cause severe erosion in a field. Look for trampled vegetation or bare spots, which may indicate overgrazing.

**Signs of erosion:** Gullies, eroded streambanks, soil deposits in low spots.

**Access to streams:** Note if you see livestock in streams or on banks. Electric fences can be hard to see, so look closely before making a judgement.

## WORKSHEET 7.3 EXAMPLE: PASTURE MANAGEMENT

<b>Field</b>	<b>Livestock</b>	<b>Pasture Management</b>	<b>Erosion</b>	<b>Access to streams</b>
<i>AP2</i>	<i>About 30 beef cows &amp; calves</i>	<i>Grass looks pretty lush, few weeds</i>	<i>None observed</i>	<i>Saw fence along stream and watering troughs in field</i>
<i>AP16</i>	<i>10 horses</i>	<i>Pasture only about 2 acres, no vegetation except a few weeds</i>	<i>Stream banks and sloped areas eroded from horse traffic</i>	<i>Small stream runs right through pasture, no fencing. Banks are bare. Big pile of manure next to stream.</i>

## Other Uses

Use the following worksheet to write down what you see that doesn't fall into the cropland or pasture categories. Note the presence of poultry or swine houses, orchards, feedlots, dairy barns, or other land uses you are interested in.

## WORKSHEET 7.4 EXAMPLE: OTHER AGRICULTURAL AREAS

<b>Field number</b>	<b>Other Uses</b>
<i>AX3</i>	<i>3 large turkey barns</i>
<i>AX7</i>	<i>Looks like an old apple orchard...possibly commercial?</i>





# Section Eight: Forest Land

Characterize the forest land in the watershed, find out which is public and which is private, and observe any logging.

Forested land in a watershed protects water quality in many ways. Tree canopies absorb rainfall energy and slow runoff, allowing more time for infiltration to occur.

The roots of the trees and forest litter on the soil surface help to hold soil in place, reducing erosion. Overall, areas that are forested usually have better water quality than agricultural and urban land. Knowing the amount and location of forested land in a watershed will help you determine where land is protected by this low-impact land use.

While forest cover protects water quality, timber harvesting has the potential to damage stream habitat through erosion, riparian forest removal, and vehicle traffic. Improperly-sited roads, large clearings, and machinery driving through streams result in sedimentation, destruction of aquatic habitat, and changes in hydrology.

Forest land also provides wildlife habitat, which is important to your inventory for two reasons: Land dedicated to wildlife is likely to also promote good water quality, since it will have good vegetative

cover; and those interested in wildlife are often good water quality partners as well.

## Tier 1

In **Section Three: Land Use Overview** you estimated the amount of forested land in the watershed. Now, try to determine how much of this is public land. The topographic map on which you have delineated your watershed should have public land marked. If you are using GIS, obtain a coverage for ‘managed lands’ or ‘public lands’. The remainder of forested land in the watershed is likely to be private. Note the forested areas in Worksheet 8.1.

Publicly-owned forest land is less likely to be disturbed by practices such as logging than privately-owned land, although state and federal forests may have logging as part of their management plan. Managed land may include both public and private lands: national and state forests, local parks, recreation areas, nature preserves, and land trusts.

Develop a list of people who can provide you with information about forest and wildlife resources in your watershed, starting with the IDNR District Forester and District Wildlife Biologist for your county.

WORKSHEET 8.1 EXAMPLE: PUBLIC AND PRIVATE FOREST LAND

Public Forested Properties	Acres	Forested Private Land	Acres
<i>Happy City Park</i>	<i>185</i>	<i>Albemarle County</i>	<i>570</i>
<i>Buffalo Wallow State Game Lands</i>	<i>372</i>	<i>Hunt County</i>	<i>1250</i>

## Special Features

- Note on your topo map where **riparian forest** (forests along the borders of streams and lakes) exists, and whether it is on public or managed land, or ordinary private land.
- From County Assessor’s records, identify the larger tracts of **Classified Forest** and **Classified Wildlife Habitat** (these are lands less likely to be developed.)
- Note **threatened and endangered species** for your county (see Checklist for website). Some species may be aquatic or need wetland habitat to survive.

## Tier 2

Tier 2 addresses logging that may be occurring in your watershed. In most counties logging operators are not required to report activities; if that’s the case in your watershed, the amount of logging can only be estimated by observation. Record the location of logging operations that you see during your road trips. Use the copy of your topographic map labeled “Agriculture, Wetlands, and Forest” and label the logging sites on the map.

**WORKSHEET 8.2 EXAMPLE: LOGGING AND OTHER OBSERVATIONS**

<b>Site</b>	<b>Location</b>	<b>Comments</b>
L1	Corner of 350 W and 600 N	Log landing along the road; Several skidsteers parked. They have been cutting back in there for months; small operation.
L2	South side of Wolf Road 100 yards East of Prairie Creek crossing	Saw log trucks pulling out & looks like a road has been cut back into the woods. This would be private land. Looks like they are just taking out big logs.

**Blank worksheets for your use**

**WORKSHEET 8.1: PUBLIC AND PRIVATE FOREST LAND**

<b>Public Forested Properties</b>	<b>Acres</b>	<b>Forested Private Land</b>	<b>Acres</b>

**WORKSHEET 8.2: LOGGING AND OTHER OBSERVATIONS**

<b>Location</b>	<b>Comments</b>

# Section Nine: Mines & Oil or Gas Wells

I identify locations where mineral resource extraction has occurred and may be affecting water resources.

Coal mining is a large part of the economy in Southwest Indiana. Most abandoned and un-reclaimed mines were in operation before laws were

in effect to treat runoff and restore the land's surface after mining. Newer mines can also adversely affect water quality in a watershed if the operators do not follow current state laws. Runoff from the exposed soil can carry sediment into streams and lakes. Runoff or drainage exposed to coal-bearing rock can be acidic, and deposit iron and manganese compounds on the streambed as well as lowering the pH of the water to levels uninhabitable by aquatic organisms.

Extraction of other minerals, including gypsum, limestone, aggregate, or sand & gravel, is less problematic than coal mining but still has the potential for sediment pollution, impacts on groundwater and wetlands, and tracking soil onto roads.

There are at least a few gas or oil wells in every county in Indiana, many of them abandoned or plugged; most wells are located in the southwestern quarter of the state. Abandoned or poorly managed wells may contaminate surrounding soil with brine, making reclamation difficult. Improperly plugged or abandoned wells may contaminate groundwater as well.

## Active Mines

If mining is common in your watershed your local SWCD and the IDNR Division of Reclamation can help you to identify the active mining operations. Using the map labeled "Streams & Mining," mark their locations. Label the sites using AM; C [coal], L [limestone], G [aggregate], SG [sand & gravel]; and the site number. For example for active coal mining site 3, label it "AMC3."

### WORKSHEET 9.1: ACTIVE MINES

Site	Name & Company	Location	Estimated Area
AMC1	Blackheart Mine -- AMAX	Both sides Hwy 335 North of Mudeye	300 Acres
AMS G1	Sand & gravel pit, new this year; Consolidated Aggregates Inc.	East side of Mann Road south of Landersdale; Hobbs farm former cropground.	30 acres

## Abandoned and Un-reclaimed Mines

Unfortunately, some mining practices of the past created persistent and damaging conditions. Reclaiming these sites is often complex and expensive. Problems associated with abandoned coal mines include acid drainage, sinkholes, toxic waste materials, unsafe mine entrances, pools of acidified

water, and erosion. Abandoned quarries or sand & gravel operations may not generate pollution, but the sites may be unsafe.

Using your map labeled "Streams & Mining," mark their locations. Label the sites using AUM and the site number.

### WORKSHEET 9.2 EXAMPLE: ABANDONED AND UNRECLAIMED MINES

Site	Name	Location	Type	Area (acres)	Comments
AUM1	Unknown	Along 350 N	Coal	150	Spoil piles never revegetated and are eroding into creek.

## Reclaimed Mines

The Indiana Department of Natural Resource’s Division of Reclamation is working to reclaim abandoned coal mines (and some oil and gas wells) in Indiana. In the last 2 decades, the NRCS RAMP program has also reclaimed numerous sites. However, while mines are being reclaimed, they still

have the possibility to affect the watershed; and the years of damage that they caused still affect the environment.

Using your map labeled “Streams & Mining” mark their locations. Label the sites using RM and the site number.

### WORKSHEET 9.3: RECLAIMED MINES

Site	Project	Location	Type	Area (acres)	Comments
<i>RM1</i>	<i>Rock Island Mine</i>	<i>North of Happy Park</i>	<i>Coal</i>	<i>75</i>	<i>I DNR reclamation project; graded &amp; seeded last year.</i>

## Blank worksheets for your use

### WORKSHEET 9.1: ACTIVE MINES

Site	Name & Company	Location	Estimated Area

### WORKSHEET 9.2 EXAMPLE: ABANDONED AND UNRECLAIMED MINES

Site	Name	Location	Type	Area (acres)	Comments

### WORKSHEET 9.3: RECLAIMED MINES

Site	Project	Location	Type	Area (acres)	Comments

# Section Ten: Social & Economic Factors

Identify social, economic, and historic features of your watershed that might help you understand it and build a solid watershed management plan.

Some of the things that impact your watershed don't show on a map. Economic trends, demographic trends, and the rise and fall of industries all play a part in what happens on the land. Following are

suggestions for additional information you may want to gather in order to better understand what's going on in your project area.

## Watershed Projects or Other Conservation Programs

Watershed projects throughout the State are developing strategies for protecting natural resources. Conservation programs by state and federal agencies play an important role in reducing pollution, primarily from agricultural land. Find out if any watershed projects or other conservation programs are going on in the watershed; who was involved, what funding sources were available, and what was accomplished. Sources of information include the local Soil and Water Conservation District, NRCS staff, IDNR staff,

Center for Technology Information's (CTIC) Know Your Watershed Website (<http://www.ctic.purdue.edu/KYW/>), and lists of watershed projects and coordinators on the IDEM Watershed Management Section Web site <<http://www.IN.gov/idem/water/planbr/wsm/>>

Ask at the SWCD office about these programs, which provide technical and financial assistance for agriculture:

- **Lake and River Enhancement (LARE):** This program is funded by the IDNR's Division of Soil Conservation to support projects that reduce or prevent sedimentation in streams or lakes.
- **Environmental Quality Incentive Program (EQIP):** This U.S. Department of Agriculture (NRCS) program provides technical, financial, and educational assistance to farmers to address natural resource concerns.
- **Section 319 Grants:** Distributed by IDEM's Office of Water Management. They provide funding for implementing water quality improvement projects that address nonpoint source pollution.

WORKSHEET 10.1 EXAMPLE: CONSERVATION PROGRAMS IN THE WATERSHED

Project name	Location	Funding source	Project goals	What was accomplished
Goodwin Creek Watershed Project	Southern half of the Watershed	EQIP	Nutrient and pesticide management plan for 8 farms. 3 miles of buffer strips installed.	Reduced amount of pesticide applied to fields and amount entering creek.

## Business & Industry

**New business:** Check with the Chamber of Commerce and County Planning Department to find out if any new industries or industrial development is coming to your area, or if existing industry or business is planning to expand. New industry need not be actually in the watershed to affect it; if there will also be new housing to accommodate additional workforce, or changes in transportation routes, these can affect you too. Another source is the IDEM Compliance site,

where you can look for pending permits (see Checklist).

**Census data:** You collected census data for the Land Use Section. Take another look at that information for what it says about your community's economic well-being; are unemployment rates higher or lower than surrounding counties? Do most workers stay in the county, or go outside to work? If the population is expanding, what part of the county are they moving to?



**Agricultural change:** If there is a large agricultural presence in your area, also look again at the economic indicators in the Agriculture Statistics publication; are farms consolidating? Is there a definite trend one way or another in farm revenue?

**Housing:** Check with the County Planning office to find out how many building permits were granted in the last year and if they have seen any trends in the number of permits. Check with the local realtor's association for trends in housing sales.

**Water-related infrastructure:** Do residents pay for the water they drink? Are rates going up? Do they pay for sewerage? Are new water treatment or sewage treatment facilities being built? Are there water infrastructure investments (such as new plants, reservoirs, wellheads) that need to be protected? Often people who have no deep interest in the environment are galvanized by economic factors. If protecting water quality in a reservoir, aquifer, or river will save them money in the future, they may become ardent supporters of your project.

## Population

While it is useful to know the number of people in the watershed (and to be able to reach them through a mailing list), it is particularly important to the planning process to know if the population is growing or declining and at what rate. Census information is readily available on the web, usually back to the turn of the century. Start with the State Library website, or go to the national site at [www.census.gov](http://www.census.gov) and select the Indiana contact point. In addition to the number of persons, you can find out age distribution, how many are employed, how many commute out of the county, ethnic distribution, projected future population estimates, and so forth. The shaded box below shows the kind of data you might find out about your watershed.

- **Total Current Watershed Population:** About 2170 based on 3.25% of total county population. Probably higher, since housing is more dense in this part of the county than in the south.
- **Population Changes:**
  - 51,999 – 1980
  - 55,920 – 1990
  - 66,689 – 2000
  - 81,716 -- projected 2020

- Growth from 1990 to 2000: 19.3% Growth from 1980 to 2000 – 28.3% Projected growth from 2000 to 2020 – 22.5%
- 2000 Census facts: In-migration about 1,032 per year; births (minus deaths) 387. 4<sup>th</sup> largest in-migration rate in the state.
- School-age population (0-17) 27% & retired population (65+) 11% Median age 36.
- The unemployment rate is 2.1% (May 2001).
- In 1999, 96.2% of labor worked off the farm; 23.8% in services and 21.2% in retail. In 1995, there were 91 people in the county employed in agriculture (less by 1999 but the number wasn't specified.)
- Daily, about 2800 people commute into Morgan county to work, and about 20,000 commute out of the county to somewhere else, mostly Marion County.
- Martinsville is the biggest town at 11,698 and Mooresville second at 9,273. Brooklyn/Bethany has 1639.
- In 1999 601 residential building permits were filed. There are almost 26,000 housing units in the county. There are 164 people per square mile.

## Nuts & Bolts

**Mailing lists:** Either as part of the inventory or under the heading of “outreach”, someone needs to develop a mailing list of all the residents in the watershed and all the stakeholders in the community. This will be one instrument used to disseminate information, invite people to meetings and events, and let landowners know about new programs.

**Meeting places:** On one of your maps, note the location of all the places that the group could hold a meeting, along with contact person and phone number, how many people can be accommodated, and whether there are services (like electricity, heat, and chairs!) This information is really useful when a gathering place is needed to organize volunteers, promote new programs, canvas the residents for their concerns, etc.

**Schools:** Make a list of schools in and near the watershed; find out who the science teachers are, along

## Your Watershed's Past

If your group is very fortunate, one of the members will be a local history buff. Delving into the landscape's past can illuminate processes occurring in the present, and help you understand what you see.

Some of what you find will give you an essential sense of place, like knowing that native Americans hunted deer on a certain hill, and where early settlers laid their families to rest. Other information will help make sense of your water quality assessments; for example, knowing where large livestock operations used to exist during recent decades may help explain streambank erosion, nutrient imbalances, or aquatic habitat degradation. Knowing where old quarrying operations occurred, or where the local limekiln was built, or

whether hills were logged and overgrazed, may explain other findings.

While this information is gathered a little differently than what you have worked on so far, it's well worth devoting some time and energy to developing a brief history for your watershed plan. The community will feel a deeper sense of ownership, and be more engaged in the project, if you acknowledge and honor the past before starting to change things!

## Blank Worksheets

WORKSHEET 10.1: CONSERVATION PROGRAMS IN THE WATERSHED

Project Name	Location	Funding source	Project Goals	What was accomplished

# Pulling It All Together

Use what you learned to create a watershed plan by

- Summarizing your findings from each of these sections
- Reviewing what you've learned, and
- Using your findings to develop problem statements

Now that you have completed your inventory of the watershed, what do you do with the mountain of information you've accumulated? Some questions follow to help you make sense of what you gathered. They are organized by section.

At this point, if the inventory has mostly been conducted by a subcommittee or coordinator, you may want to draw in the people who have been working on other aspects of your watershed plan; monitoring, outreach, or problem identification, for instance. You need to work together to fit these puzzle pieces into a clear picture of the project.

*In evaluating what you have learned, be very careful to be objective and non-judgmental. It is easy to point fingers and much harder to come up with constructive solutions. Finger pointing and stereotyping will only create adversaries where you need partners.*

## For each section, ask yourselves:

1. What have we learned about this part of the landscape that we think is a problem?
2. What have we learned that is positive and needs to be maintained or protected?
3. Do we know enough to reach a decision about what needs to change?
4. If not, what else do we need to find out?
5. Who could help us bring about change?
6. What's the priority for this activity, land use, or feature...is it an emergency, a serious but long-term problem, a minor issue, or something that just needs to be watched?
7. If we think we have identified a problem, is it one we should address as a group or should we turn it over to somebody else?

## Sifting Through Your Inventory

### Section Two: Land Use

1. Study the major land uses in the watershed and where they are located. Identify the primary land use in the headwaters and along the main stem of each subwatershed. Depending on the water quality problems your teams have been able to identify, these land uses should tell you who the audiences are for your project. For example, if the primary land use in the headwaters of a subwatershed is crop production, then you need to develop a way to contact that audience (crop producers in that subwatershed) in order to work with them to address water quality concerns.  
**CAUTION:** Just because there is a predominant land use does NOT mean that those folks are “culprits” or “the problem”. The water quality problem you may be addressing could have been caused by anything from natural background conditions, to activities that took place twenty years ago, to a single discharge pipe or an isolated spill. You don't yet know enough to associate cause and effect. You only know which audience controls the present-day land use.
2. Study the present land use and compare it to the zoned or proposed land use. Take into account what you learned about impervious area, population changes, soils, flooding, and drinking water sources. Which audiences will change? Will some land uses be eliminated? Different land uses have different potential for affecting the environment. What water quality risks might increase? Decrease?

### Section Three: Streams & Lakes

1. Study your map of streams and lakes, looking at the location of streams or lakes that you know or suspect are impaired. Can you relate any impacts of the land uses with known or suspected impairments?
2. Are there streams that you feel may be threatened by existing or changing land uses?
3. If your project has been monitoring water quality, can you relate what you know from your inventory to the results so far?

4. Do any sample sites need to be added, based on what you now know about the watershed?

#### **Section Four: Wetlands**

1. Looking at your map of wetlands, does it appear that many wetland locations have the potential to be affected by land use change?
2. Are there areas that used to be wetlands, that may have been drained, that you think might be suitable for restoration?

#### **Section Five: Residential and Urban Areas**

1. Examine the maps of residential areas that are sewer or served by septic systems. Based on what you have learned and on conversations with the County Health Department, do you think that there are areas that need to be served by new sewers? That need improvements or maintenance to existing septic systems?
2. If there are numerous construction sites in the watershed, or areas that are developing rapidly, do you feel that there is a need to promote compliance with Rule 5? Do you see a need for changes in the way new homes are sited, for example a set-back from streams and lakes or avoiding steep slopes? Has this need been discussed with the County Planning Department?
3. If you have calculated the impervious area in sub-watersheds, note whether any areas are approaching or have exceeded 15% impervious area. Some research suggests that above 15%, the aquatic habitat in streams is degraded by changes in hydrology. A comprehensive stormwater management policy in the county can help to reduce this impact, but it becomes increasingly difficult to “fix” as the percentage of concrete, asphalt, and roofing increases. Retrofitting existing subdivisions and commercial developments is possible, but planning for stormwater management in new construction is much easier. If this looms as a problem in your watershed, discuss it with the County Planning and County Engineering departments.

#### **Section Six: Regulated Pollutant Sources**

1. Point source pollution isn't usually addressed by local groups, since there is a regulatory agency (IDEM) to oversee it. However, if you feel that there are problems with certain discharges, request assistance from IDEM in assessing whether the facilities are in compliance with their permits.

You may want to stay in contact with IDEM to be sure that complaints or concerns are followed up.

#### **Section Seven: Agriculture**

1. By now you have probably considered agriculture during your assessment of land use impacts. Revisit what you know about this land use, and identify any continuing concerns about crop or livestock production. Discuss these with the members of your group that represent agriculture.
2. Are there cost share programs or education programs that would help to change some management practices that you think may have adverse impacts on water quality? Who could bring these programs to the watershed?

#### **Section Eight: Forests & Wildlife**

1. If there are public or managed lands in your watershed, have you asked the managers to participate in your project? You may want to meet with them as a focus group to discuss wildlife habitat, endangered species protection, or other issues rather than expecting them to participate regularly in your group's activities.
2. If there is a large amount of woodland in the watershed in private ownership, is there a need for landowner education, cost share programs, or logging contractor education? The IDNR Division of Forestry may be able to assist you.

#### **Section Nine: Mines & Wells**

1. If mining or oil & gas are issues in your watershed, is the Appropriate IDNR Division represented in your group? Are there issues that you can refer to them, or programs you can promote to address adverse impacts?

#### **Section Ten: Social & Economic Factors**

1. You've probably already taken what you learned into account while discussing the various land uses. Review what you gathered in these sections to be sure you haven't missed anything important. Think about the implications of what you learned when reviewing your problem statements.

## Problem Statements

If you feel you have enough information, try to develop one or more **problem statements** for each section. A problem statement specifies what, where, and why. Problem statements state only what you know, and do not make judgements.

Examples:

- “There’s a visible plume of sediment going into Lick Creek north of Centenary Road when it rains; from our field observations, it appears to be due to the lack of erosion and sediment control practices in the new Country Corner subdivision.”
- “Streambank erosion was noted at 60% of stream observation points, and we know that impervious area in the watershed has increased from 8% to 15% over the last five years. The county presently has no stormwater management ordinance in place, and 75% of subdivisions do not have any provision for retarding stormwater. It appears that increased impervious area may be changing the hydrology of the streams.”
- Possum Creek, which is on the 1998 303(d) list for “impaired biotic community”, runs through three farms where beef cattle have free access to the stream. The stream banks in these areas are eroded and bare of vegetation. Habitat assessments by the monitoring team show that habitat is poor at both sample sites on this creek.; it appears that livestock access to the streambed is degrading aquatic habitat on this stream.”

List all the problem statements you have developed from this assessment exercise, and prioritize them based on:

- Urgency...what will happen if the problem isn’t fixed?
- Feasibility....is it something that the group can fix or influence? Does it need to be turned over to someone else?
- Location... does the problem occur all over the watershed or only in certain areas? Can you map it or associate it with something on the map?

**You may go through this exercise several times as you learn more, incorporate monitoring data into your decisions, and decide as a group what you are prepared to act on.**

## What’s Next?

Completing the Watershed Inventory should have helped your group become better educated about the watershed and what might be impacting it.

The next step is to prioritize the problems statements. Your final list of prioritized problem statements will evolve into goals, objectives, and actions that the group resolves to implement, and will form the backbone of your watershed plan.

Consult the *Watershed Action Guide for Indiana* for more information on how to complete a watershed plan.