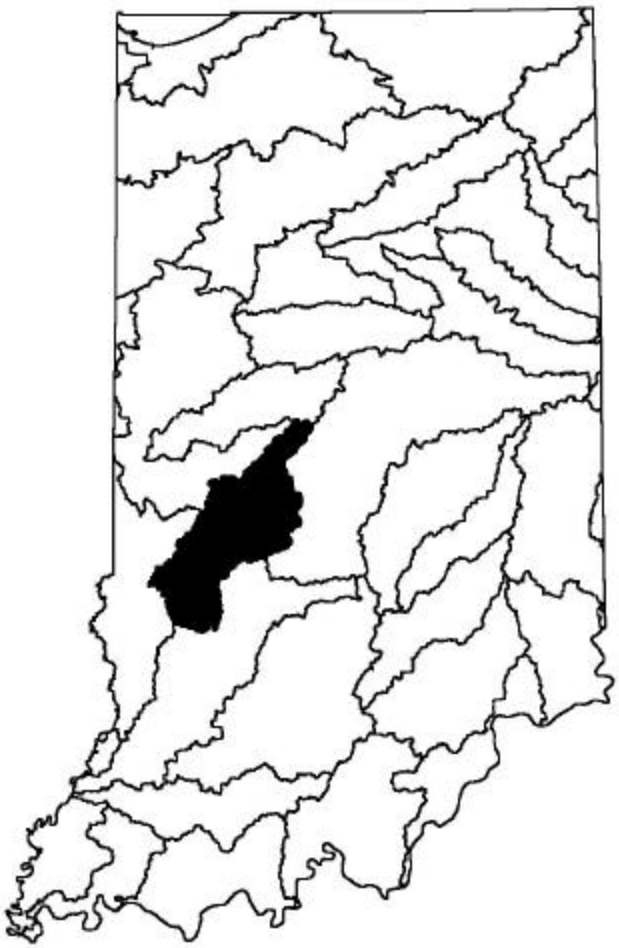
Eel-Big Walnut Watershed Restoration Action Strategy

Part I: Characterization and Responsibilities



Prepared by

Indiana Department of
Environmental Management
Office of Water Quality

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FOREWORD

The First Draft (October 1999) of the Watershed Restoration Action Strategy (WRAS) was reviewed internally by IDEM and revised accordingly. The Second Draft (Spring 2000) was reviewed by stakeholders and revised accordingly. This Third Draft (January 2001) is intended to be a living document to assist restoration and protection efforts of stakeholders in their sub-watersheds. As a "living document" information contained within the WRAS will need to be revised and updated periodically.

The WRAS is divided into two parts: Part I, Characterization and Responsibilities and Part II, Concerns and Recommendations.

James Dunaway, Resource Conservationist
IDEM Office of Water Quality
100 N. Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

jdunaway@dem.state.in.us

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EXECUTIVE SUMMARY

The overall goal and purpose of Part I of the Watershed Restoration Action Strategy (WRAS) is to provide a reference point and map to assist local citizens with improving water quality. The major water quality concerns and recommended management strategies will be addressed in Part II of the WRAS.

This Strategy broadly covers the entire watershed; therefore, it is intended to be an overall strategy and does not dictate management and activities at the stream site or segment level. Water quality management decisions and activities for individual portions of the watershed are most effective and efficient when managed through sub-watershed plans. However, these sub-watershed plans must also consider the impact on the watershed as a whole.

This Strategy is intended to be a fluid document in order to respond to the changing and dynamic quality of our environment. Therefore, this Strategy will require revision when updated information becomes available.

Overview of the Eel-Big Walnut Watershed

The Eel-Big Walnut watershed is located in west-central Indiana. The watershed covers portions of Boone, Clay, Greene, Hendricks, Morgan, Owen, Parke, Putnam, and Vigo counties. It encompasses 1,211 square miles and includes approximately 750 miles of perennial streams. The watershed system contains the following major streams: Eel River, Big Walnut Creek, Mill Creek, Deer Creek, and Clear Creek. The watershed contains many lakes. The largest lake is Cagles Mill/ Cataract Lake, located on Mill Creek, near the intersection of IN 243 and IN 42. Cagles Mill/ Cataract Lake is 1400 acres and spans the Putnam/ Owen county line. It is part of the Lieber State Recreation Area. The Eel-Big Walnut watershed drains into the lower reaches of the White River near the town of Worthington, in Greene County.

The land use in the watershed is predominantly agriculture, which represents approximately 72 percent of the land cover. Corn and soybeans comprise the majority of crops produced. Other land uses include forest, pasture, and urban areas. Development appears to be light to moderate in the watershed, with scattered residential development throughout the area. Industrial and commercial development is higher in the more populated areas within the watershed. Surface coal mining has impacted many acres in Clay, Owen, and Greene counties.

Greencastle, located between Big Walnut Creek and Deer Creek at the intersection of U.S. 231 and IN. 240, is the major urban area within the watershed. The second largest town within the watershed is Brazil, which sits on the divide between two watersheds. About half Brazil drains into Birch Creek, which flows to the Eel River. The Natural Resources Commission designates big Walnut Creek from the Putnam/ Hendricks county line to the city of Greencastle as an “Outstanding River” (see Section 2.4).

Current Status of Water Quality in the Eel-Big Walnut Watershed

Section 303(d) of the Clean Water Act requires states to identify waters that do not meet, or are not expected to meet, applicable water quality standards. The Clean Water Act Section 303(d) list for Indiana provides a basis for understanding the current status of water quality in the Eel-Big Walnut Watershed. The following waterbodies are on Indiana's 1998 Clean Water Act Section 303(d) list submitted to and approved by EPA:

Big Walnut Creek for Mercury fish consumption advisory
Cataract Lake / Cagles Mill Lake for Mercury fish consumption advisory
Conneley Ditch for E. coli violations
Eel River for E. coli violations, Mercury and PCB fish consumption advisory
Jones Creek for impaired biotic communities
Lick Creek for E. coli violations
Little Deer Creek for impaired biotic communities
Maiden Run for impaired biotic communities
Mill Creek for E. coli violations
Plum Creek for impaired biotic communities
Wabash and Erie Canal for E. coli violations

Water Quality Goal

The overall water quality goal for the Eel-Big Walnut Watershed is that all waterbodies meet the applicable water quality standards for their designated uses as determined by the State of Indiana, under the provisions of the Clean Water Act.

Eel-Big Walnut Watershed Restoration Action Strategy

Part I: Characterization and Responsibilities

1. Introduction

The Clean Water Action Plan states that "States and tribes should work with public agencies and private-sector organizations and citizens to develop, based on the initial schedule for the first two years, Watershed Restoration Action Strategies, for watersheds most in need of restoration." A WRAS is essentially a large-scale coordination plan for an eight-digit hydrologic unit watershed targeted by the Unified Watershed Assessment. In Indiana, 11 such units, including the Eel - Big Walnut watershed, were designated for restoration by the FFY 1999 Unified Watershed Assessment. Each year, the Assessment will be refined further as additional information becomes available, and targeted areas will become more specific. This will require amendments to the WRAS, which must be flexible and broad enough to accommodate change. The WRAS will also foster greater cooperation among State and Federal agencies, which should result in more effective use of personnel and resources.

The WRAS provides an opportunity to assemble, in one place, projects and monitoring that has been completed or is on going within a watershed. It also allows agencies and stakeholders to compare watershed goals and provides a guide for future work within a watershed.

The WRAS for the Eel - Big Walnut watershed contains two parts. Part I provides a characterization of water quality in the watershed and agency responsibilities. Part II provides a discussion of resource concerns and recommended strategies.

1.1 Purpose of This Document

The overall goal and purpose of the Watershed Restoration Action Strategy Part I is to provide a reference point and roadmap to assist with improving water quality. Part I is a compilation of information, facts, and local concerns in this watershed. It will serve as a reference document for watershed groups and others involved in the assessment and planning of watershed restoration activities.

Part I of the Strategy is intended to be a fluid document in order to respond to the changing and dynamic quality of our environment. Therefore, it will require revision when updated information becomes available.

1.2 Guide to the Use of This Document

Chapter 1: Introduction - This Chapter provides a non-technical description of the purpose of Part 1 of the Strategy. This Chapter also provides an overview of stakeholder groups in the Eel-Big Walnut watershed.

Chapter 2: General Watershed Description- Some of the specific topics covered in this chapter include:

An overview of the watershed

Hydrology of the watershed
A summary of land use within the watershed
Natural resources in the watershed
Population statistics
Major water uses in the watershed
Water quality classifications and standards.

Chapter 3: Causes and Sources of Water Pollution - This Chapter describes a number of important causes of water quality impacts including biochemical oxygen demand (BOD), toxic substances, nutrients, E. coli bacteria and others. This Chapter also describes both point and nonpoint sources of pollution.

Chapter 4: Water Quality and Use Support Ratings - This Chapter describes the various types of water quality monitoring conducted by IDEM. It summarizes water quality in the watershed based on Office of Water Quality data, and presents a summary of use support ratings for those surface waters that have been monitored or evaluated.

Chapter 5: State and Federal Water Quality Programs - Chapter 5 summarizes the existing State and Federal point and nonpoint source pollution control programs available to address water quality problems. These programs are management tools available for addressing the priority water quality concerns and issues that are discussed in Part II of the Strategy. Chapter 5 also describes the concept of Total Maximum Daily Loads (TMDLs). TMDLs represent management strategies aimed at controlling point and nonpoint source pollutants. IDEM's TMDL Strategy will also be discussed.

1.3 Stakeholder Groups in the Watershed

The Eel-Big Walnut watershed contains several stakeholder groups that have different missions (Appendix C). Many of these groups have a long history of conservation work in the Eel-Big Walnut watershed. The following discussions briefly describe some of the watershed groups.

Local Soil & Water Conservation Districts (SWCDs)

Soil and Water Conservation Districts are local sub-divisions of state government, charged with overseeing the protection of soil and water resources at the local level. Indiana has 92 SWCDs, one in each county. The SWCD is led by a board of supervisors, elected by local citizens. At the beginning of 1997, the local Soil & Water Conservation Districts in every county in Indiana convened meetings of local stakeholders as a part of their 'locally led conservation' program. The purpose of these meetings was to get public input on natural resource concerns within each county and to lay the groundwork for resource protection.

Resource Conservation & Development Councils (RC&Ds)

The Food and Agriculture Act of 1962 facilitated the development of RC&D councils as a U.S. Department of Agriculture (USDA) program. The USDA's Natural Resources Conservation Service (NRCS) administers the RC&D program.

The purpose of RC&D councils is to enable local leaders to develop and carry out a plan for the conservation and wise use of the natural and human resources available, and to improve the economic and social well being of all citizens within the RC&D area. The councils are volunteer organizations, which represent local people. RC&D councils are 501(c)(3) Not-for-Profit organizations working in partnership with local, state, and federal programs.

Three RC&D councils cover the Eel-Big Walnut watershed. The Sycamore Trails RC&D encompasses Putnam, Clay, Vigo and Owen counties. The Hoosier Heartland RC&D includes Boone, Hendricks, and Morgan counties. The Four Rivers RC&D covers the small portion of Greene county that is within the watershed.

Conservancy Districts

The development of conservancy districts is an increasingly active option for addressing a variety of land use issues at the local level. Freeholders within contiguous geographic areas may use a conservancy district to achieve a dependable drinking water supply, to provide for sewage collection and treatment, to improve flood control, to reduce soil erosion, or to achieve any of numerous other community goals, either singly or in combination (IC 14-33-1-1).

The determination whether to approve the establishment of a conservancy district and the primary responsibility for the oversight of an existing conservancy district rests with a circuit court where the district is located (IC 14-33-2-26). Management of the district itself is under the control of a board of directors, selected initially by the county commissioners and subsequently by the freeholders of the district (IC 14-33-5-11). (http://www.ai.org/nrc/procedur.htm)

The Eel-Big Walnut Watershed contains three Conservancy Districts, the Little Walnut Creek Conservancy District, the Clear Creek Conservancy District, and Van Bibber Lake Conservancy District. The Clear Creek Conservancy District was formed to address water supply, sewage and recreation. Little Walnut Creek Conservancy District was established to handle flood control, drainage, recreation, and soil erosion concerns. The Van Bibber Lake Conservancy District was created to provide sewage, water supply, and maintenance.

2 General Watershed Description

This Chapter provides a general description of Eel-Big Walnut and its watershed and includes the following:

Section 2.1 Eel-Big Walnut Watershed Overview
Section 2.2 Land Cover, Population, and Growth Trends
Section 2.3 Agricultural Activities in the Eel-Big Walnut Watershed
Section 2.4 Significant Natural Areas in the Eel-Big Walnut Watershed
Section 2.5 Surface Water Use Designations and Classifications
Section 2.6 US Geological Survey Water Use Information for the Eel-Big Walnut Watershed

2.1 Eel-Big Walnut Watershed Overview

The Eel-Big Walnut watershed is an 8 digit (05120203) hydrologic unit code (HUC) watershed located in west central Indiana (Figure 2-1). The watershed encompasses 1,211 square miles in nine different counties and approximately 750 miles of perennial streams. It is subdivided into 75 subbasins represented on the map by 14 digit HUCs (figure 2-2). The Eel-Big Walnut watershed is located in three ecoregions (USEPA/USGS, Ecoregions of Indiana and Ohio).

- The western most counties are in the Interior River Lowland ecoregion (72b), which is characterized by glaciated, undulating lowland plains with wide, shallow, low gradient valleys. The native vegetation was mostly Oak-Hickory forest and scattered prairies. Land use consists of cropland, scattered woodland, and surface coal mining.

- The eastern most counties are in the Interior Plateau ecoregion (71a), which is characterized by unglaciated heavily dissected hills with narrow valleys and high gradients. Terrain is rugged in the east. Native vegetation was mostly Oak-Hickory forest on the uplands, and a few barrens. Land use consists of mostly forest with some general farming in the west and in the valleys.

- The northern counties are in the Eastern Corn Belt Plains ecoregion (55b), which is characterized by glaciated level to rolling till plains with moraine and outwash land forms. Native vegetation was mostly Beech forest. Land use consists of extensive cropland, scattered woodland, and some urban development.

Geology and Soils

The Eel-Big Walnut basin is dominantly a nearly level and gently sloping highly productive till plain. Most soils have high water holding capacity and erosion is a moderate concern on gently sloping areas. The nearly level soils are very wet in the spring and have free water within a foot of the surface, or are ponded.

The soils in the northern part of the basin are underlain by Wisconson-age, calcareous, dense till at 2 to 5 feet. This till limits downward water movement.

The soils in the southern portion of the basin are from silty loess covered, older, deeper weathered, Illinoian-age till. In the eastern part of this area many soils have a brittle fragipan at a 2 to 3 foot

depth, which severely limits downward water movement and water holding capacity. These soils are moderately productive and erosion is a moderate concern.

Siltstone, sandstone and shale underlie most of the basin; however, there is a band of fractured limestone, which is subject to ground water contamination. This band is about 15 miles wide from Clinton Falls to Reesville and Cloverdale to Quincy. The area near Quincy is gently rolling and sinkholes are common. Generally, bedrock is a part of the soil only on the steeper slopes and may be exposed adjacent to major streams. On steeper soils, runoff is a hazard. Slope causes runoff and limits water infiltration. These soils are lower in productivity.

Generally, the flood plain soils have strata of highly permeable sands, which are easily contaminated. These soils are highly to moderately productive.

The erosion potential of the soils in the basin range from low through high. About 66% of the basin is in the high and very high erosion potential categories (IDNR, 1980) (Figure 2-3). Erosion may result in a significant impact to water quality due to nutrients and pesticides carried in the sediment loads from eroding areas.

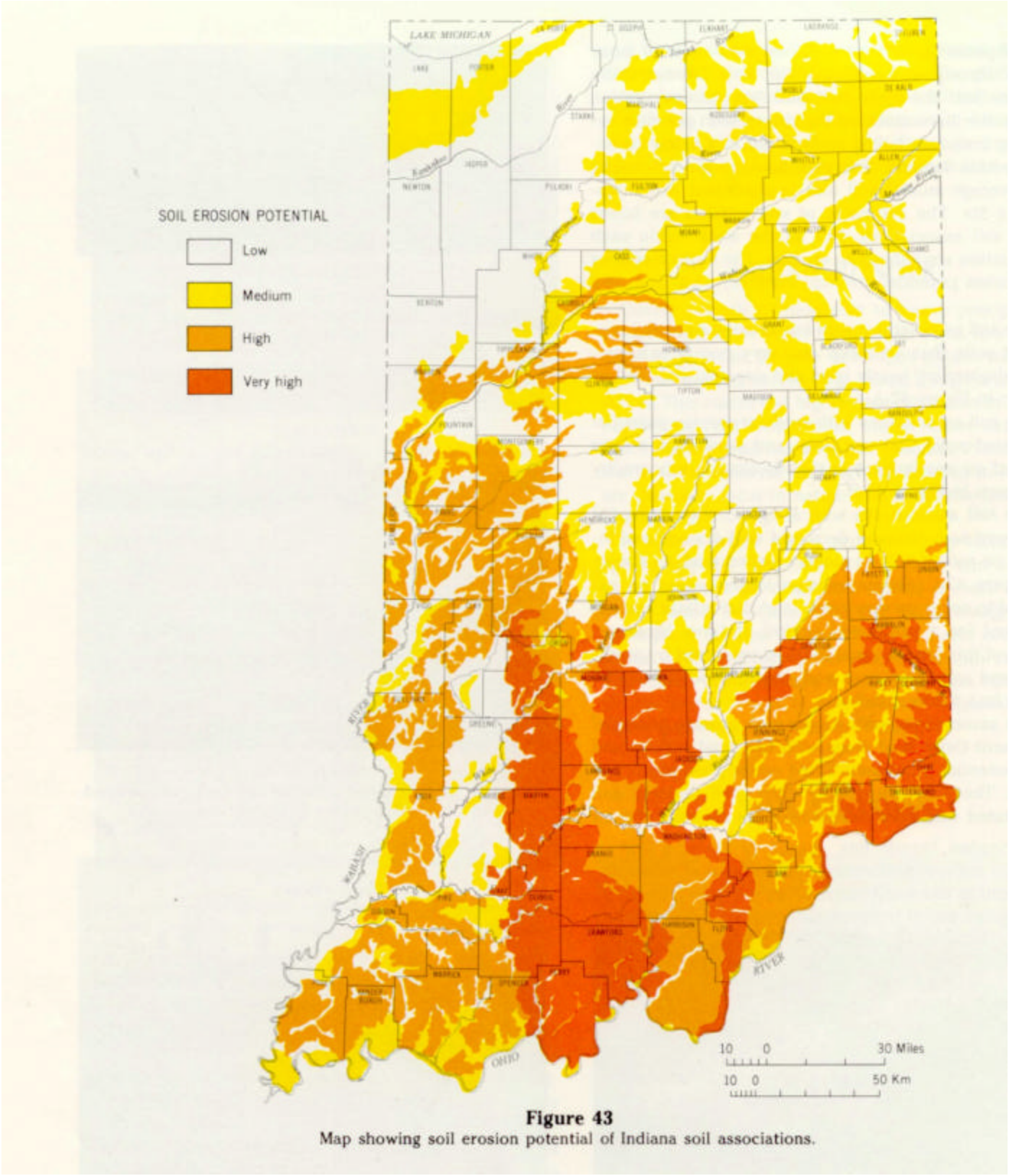


Figure 43
Map showing soil erosion potential of Indiana soil associations.

Figure 2-3 Erosion Potential *
** from The Indiana Water Resource, IDNR, 1980*

Climate

Climate in the Eel-Big Walnut watershed region is mid-continental, and temperatures fluctuate widely between seasons. Average yearly precipitation for the watershed is approximately 42 inches with an average yearly snowfall of approximately 29 inches (USDA, NRCS 1981). January average daily maximum and minimum temperatures are 36° F and 18° F, respectively, while July average daily maximum and minimum temperatures are 87° F and 64° F, respectively (USDA, NRCS 1981). Annual average precipitation runoff in the basin is 12 to 14 inches (IDNR 1980).

Eel River

The Eel River originates in southwestern Putnam County at the confluence of Mill Creek and Big Walnut Creek. It continues from this point in a southwesterly direction to the lower third of Clay County where it turns south, then easterly into Owen County. It then flows south into Green County and outlets into the White River near the town of Worthington.

Big Walnut Creek

Big Walnut Creek originates in south central Boone County as the West Fork Big Walnut, Middle Fork Big Walnut, and the East Fork Big Walnut. These three streams converge southwest of North Salem in Hendricks County to form Big Walnut Creek. Big Walnut flows southwest past Greencastle, then turns southward and flows to the southwest corner of Putnam County. Big Walnut ends at its confluence with Eel River and Mill Creek near Hoosier Highlands.

Deer Creek

Deer Creek begins and ends within Putnam County. Its headwaters originate near the town of Filmore. It then flows south-southwest past Putnamville to its confluence with Mill Creek near Hoosier Highlands.

Mill Creek

Mill Creek originates due west of Danville and flows southward past Amo and Stilesville. Just southwest of Stilesville the stream channel is the county line between Hendricks, Putnam, and Morgan counties. Mill Creek continues to flow southwest into Putnam County, and enters Owen County near Wallace Junction. There it flows southwest to Cataract where it makes a turn and flows northwest into Cagles Mill/ Cataract Lake. The outflow from the lake exits on the west- end of the lake, back into Mill Creek, where it continues westward to the confluence of Big Walnut Creek and Eel River.

Lakes

There are many lakes within the watershed. Most of the lakes are man-made impoundments, which outlet into surface waters. Many of the lakes were constructed for recreation, flood control, wildlife, or residential development. Lakes present special concerns to water quality, as they tend to trap sediments, nutrients, and other contaminants, and keep them in a closed system.

2.2 Land Cover, Population, and Growth Trends

2.2.1 General Land Cover

Native vegetation in the Eel-Big Walnut Watershed is an upland mixed hardwood forest in varied stages of succession. The U.S. Geological Survey - Biological Resources Division and the U.S. Fish and Wildlife Service are overseeing the National Gap Analysis Program. In Indiana, Indiana State University and Indiana University are carrying out the Indiana GAP Project which involves an analysis of current vegetative land cover through remote sensing (ISU 1999). This analysis provides vegetative land cover data in 30 x 30-meter grids (Figure 2-4). The following is a summary of vegetative cover in the watershed determined from the GAP image:

0.86%	Urban (impervious, low and high density)
72.12%	Agricultural vegetation (row crop and pasture)
24.52%	Forest vegetation (shrubland, woodland, forest)
1.9%	Wetland vegetation (Palustrine: forest, shrubland, herbaceous)
0.61%	Open Water

2.2.2 Population

The 1990 total population in the nine counties that have land portions in the watershed was 393,900 (IRBC 1993). Table 2-1 shows a break down of population by county and estimated population projections. It should be noted that these numbers do not reflect the actual population living in the Eel-Big Walnut watershed. For example, only a portion of Boone, Hendricks, Morgan, Vigo, and Greene counties are within the land area of the Eel-Big Walnut watershed (Figure 2-1). A better estimate of the population within the Eel-Big Walnut watershed may be the 1990 and 1995 US Geological Survey Water Use Reports, which show a total population in the watershed of 63,240 in 1990 and 72,840 in 1995 (Table 2-6). These reports indicate that the population in the watershed appears to have grown by about 15.18 % between 1990 and 1995.

The US Census and the Indiana Business Research Center also provide information about the population in cities and towns. Table 2-2 contains population estimates for various cities and towns located wholly within the watershed. Greencastle is the largest city located in the watershed in terms of population.

TABLE 2-1
EEL-BIG WALNUT COUNTY POPULATION PROJECTIONS 1990-2020*

County	1990	2000	2010	2020	Percent Change (1990 to 2020)
Boone	38,100	39,900	41,100	40,300	+5.7
Clay	24,700	24,500	24,800	25,100	+1.6
Greene	30,400	30,400	30,400	30,100	-0.98
Hendricks	75,700	80,100	82,700	83,200	+9.9
Morgan	55,900	59,400	61,700	62,700	+12.6
Owen	17,300	18,500	19,300	19,600	+13.29
Parke	15,400	15,100	14,900	14,600	-5.19
Putnam	30,300	31,400	31,700	31,200	+2.97
Vigo	106,100	103,800	102,900	101,700	-4.7
Totals	393,900	403,100	409,500	408,500	+3.7

* IBRC 1993

TABLE 2-2
EEL-BIG WALNUT CITY AND TOWN POPULATION ESTIMATES*

City/Town	Census 1990	Estimate 1996	Percent Change (1990 to 1996)
Amo	380	430	+13.2
Bainbridge	682	748	+9.7
Brazil	7,640	8,034	+5.2
Center Point	278	295	+6.1
Clay City	929	994	+7
Cloverdale	1,681	2,230	+32.7
Coatsville	469	546	+16.4
Greencastle	8,984	9,366	+4.3
Harmony	645	670	+9
Jamestown	864	901	+4.3
Jasonville	2,200	2,406	+9.4
Knightsville	740	798	+7.8
Lizton	410	444	+8.3
North Salem	499	569	+14
Stilesville	298	340	+14.1
Worthington	1,473	1,494	+1.4

* IBRC 1997

2.3 Agricultural Activities in the Eel-Big Walnut Watershed

Agriculture is the dominant land use in the Eel-Big Walnut Watershed. Section 2.2.1 shows that 72 percent of land cover in the watershed is agricultural vegetation. This section provides an overview of the agricultural activities in the watershed.

2.3.1 Livestock Operations

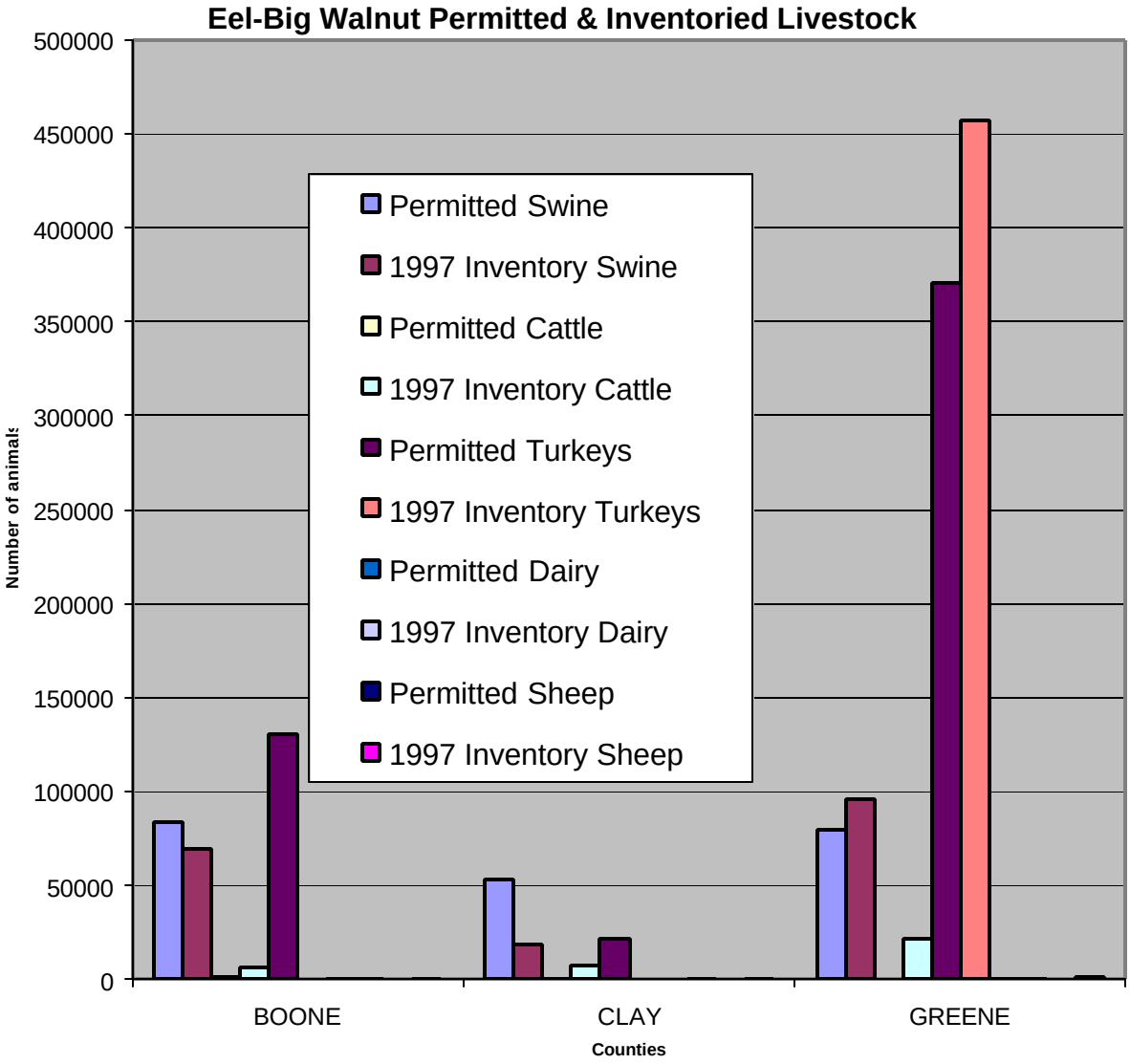
Livestock production within the watershed encompasses several species, and the overall composition changes from county to county. Hogs, cattle, and sheep are produced in every county, and five counties produce significant numbers of turkeys. See Table 2-3 for livestock inventory numbers. All of the turkey producing counties are within the top 25 counties for turkey production in Indiana. Some animals are raised in open lots or pastures and some are raised in confined feeding lots or buildings.

Confined feeding is the raising of animals for food, fur or recreation in lots, pens, ponds, sheds or buildings, where they are confined, fed and maintained for at least 45 days during any year, and where there is no ground cover or vegetation present over at least half of the animals' confinement area. Livestock markets and sale barns are generally excluded (IDEM 1999).

Indiana law defines a confined feeding operation as any livestock operation engaged in the confined feeding of at least 300 cattle, or 600 swine or sheep, or 30,000 fowl, such as chickens, ducks and other poultry. The IDEM regulates these confined feeding operations, as well as smaller livestock operations which have violated water pollution rules or laws, under IC 13-18-10.

As of October 1999, there were 199 livestock producers operating under the Confined Feeding Rules in the nine counties of the watershed (IDEM 1999). Figure 2-5 compares the animal numbers produced under Confined Feeding Permits to the USDA Agricultural Census (USDA-NASS 1997) “inventory” animals in each county.

The following factors affect the graphs in Figure 2-5:
Livestock operations that are smaller than the state regulated numbers may not require a permit from IDEM.
The permitted animal numbers represent the maximum facility capacity in any given 45-day period.
The USDA “inventory” number represents the number of animals on hand the day the inventory was done, and does NOT represent the total animals produced. The USDA category for “total animals sold” will more accurately reflect total animals produced.
Due to the various production cycles of the different species, the number of animals produced at any given permitted facility during the year may be higher or lower than the number of animals on the permit.
There is a time lag between USDA’s 1997 inventory and IDEM’s 1999 permit numbers.


Eel-Big Walnut Permitted & Inventoried Livestock
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450000
400000
350000
300000
250000
200000
150000
100000
50000
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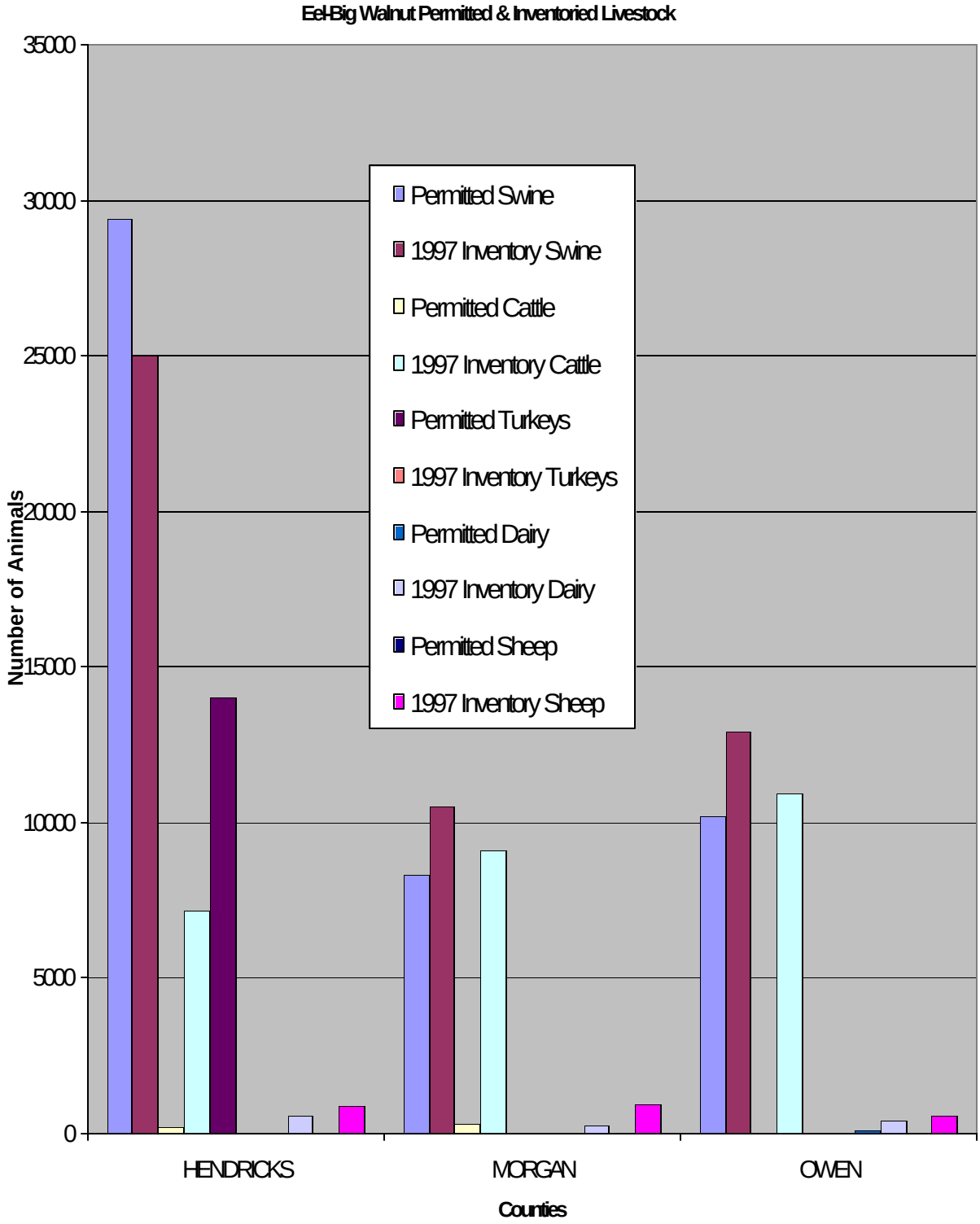
Number of animals
Permitted Swine
1997 Inventory Swine
Permitted Cattle
1997 Inventory Cattle
Permitted Turkeys
1997 Inventory Turkeys
Permitted Dairy
1997 Inventory Dairy
Permitted Sheep
1997 Inventory Sheep
BOONE
CLAY
GREENE
Counties


Eel-Big Walnut Permitted & Inventoried Livestock
35000
30000
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Number of Animals
Permitted Swine
1997 Inventory Swine
Permitted Cattle
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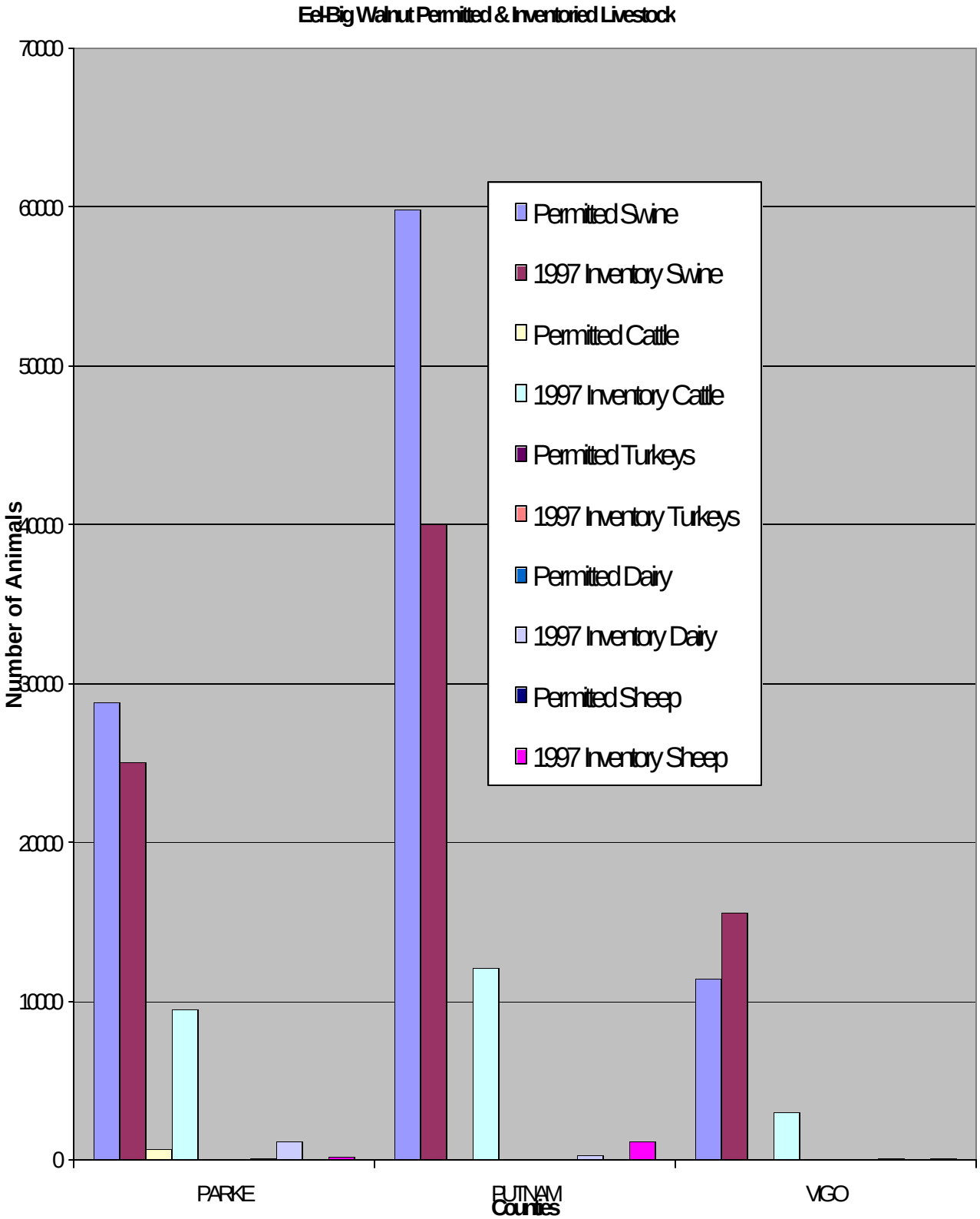
Permitted Dairy
1997 Inventory Dairy
Permitted Sheep
1997 Inventory Sheep
HENDRICKS
MORGAN
OWEN
Counties


Eel-Big Walnut Permitted & Inventoried Livestock
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60000
50000
40000
30000
20000
10000
0
Number of Animals
Permitted Swine
1997 Inventory Swine
Permitted Cattle
1997 Inventory Cattle
Permitted Turkeys
1997 Inventory Turkeys
Permitted Dairy
1997 Inventory Dairy
Permitted Sheep
1997 Inventory Sheep
PARKE
PUTNAM
VIGO
Counties

2.3.2 Crop Production

As discussed previously, the soils of the Eel-Big Walnut watershed are good for crop production. Table 2-4 lists the 1997 acres of the major crops produced in 1997 throughout the nine counties in the watershed. For 1997, total acres of corn for grain edged out total acres of soybeans as the number one crop produced in the nine counties. Corn for grain, and soybeans are clearly the primary crops produced in the watershed on basis of total acres.

The adoption of no-till crop production varies from county to county, and is estimated to be 10-20 % for corn, and 30% for soybeans on a watershed basis (NRCS, SWCD). Putnam County leads in no-till production with about 50% of corn and 85% of soybeans produced using no-till methods (Fisher, Barry. 1999). Hay is the third most significant crop produced in the watershed.

TABLE 2-3
LIVESTOCK IN THE EEL-BIG WALNUT WATERSHED

	1997 Livestock Inventory*							
	Hogs and pigs		Cattle and calves		Sheep and lamb		Turkeys	
County	Number	State Rank**	Number	State Rank**	Number	State Rank**	Number	State Rank**
Boone	69,682	19	6,292	62	608	38	(D)	18
Clay	18,415	59	7,421	54	278	60	(D)	19
Greene	96,385	12	21,561	10	1,820	3	457,100	3
Hendricks	25,011	51	7176	55	845	25	(D)	20
Morgan	10,515	73	9,063	43	927	17	@	@
Owen	12,934	69	10,917	32	551	44	@	@
Parke	25,025	50	9,518	39	183	76	@	@
Putnam	40,026	34	12,155	29	1163	11	(D)	23
Vigo	15,563	64	3,050	85	@	@	@	@

* USDA-NASS 1997

@ indicates specie is not in the top 4 for this county

** State Rank is out of a total of 92 counties in Indiana

(D) Numbers not disclosed by USDA-NASS

TABLE 2-4
CROPS PRODUCED IN THE EEL-BIG WALNUT WATERSHED

	1997 Crops*							
	Corn for grain		Soybeans for beans		Wheat		Hay crops	
County	Acres	State Rank**	Acres	State Rank**	Acres	State Rank**	Acres	State Rank**
Boone	98,481	12	98,462	8	4,109	51	5122	55
Clay	64,916	43	52,915	49	4,529	42	6,122	40
Greene	51,262	59	44,818	58	3,272	63	21,797	6
Hendricks	66,663	41	64,551	37	5,086	37	6,489	37
Morgan	50,799	60	39,978	62	3,969	55	7,085	32
Owen	20,534	77	18,068	81	2,414	75	11,652	13
Parke	66,914	40	55,717	44	8,599	15	6,085	41
Putnam	63,661	47	58,850	40	5,086	37	10,346	25
Vigo	42,440	59	43,874	59	3,365	62	3,488	72

* USDA-NASS 1997

** State Rank is out of a total of 92 counties in Indiana

2.4 Significant Natural Areas in the Eel-Big Walnut Watershed

In 1993, the Indiana Natural Resources Commission (NRC) adopted its “Outstanding Rivers” List for Indiana. This listing is referenced in the standards for utility line crossings within floodways, formerly governed by IC 14-28-2 and now controlled by 310 IAC 6-1-16 through 310 IAC 6-1-18. Except where incorporated into a statute or rule, the "Outstanding Rivers List" is intended to provide guidance rather than to have regulatory application (NRC 1997). To help identify the rivers and streams which have particular environmental or aesthetic interest, a special listing has been prepared by IDNR's Division of Outdoor Recreation. This listing is a corrected and condensed version of a list compiled by American Rivers and dated October 1990. The NRC has adopted the IDNR listing as an official recognition of the resource values of these waters. A river included in the "Outstanding Rivers List" qualifies under one or more of 22 categories. Table 2-5 presents the rivers in the Eel-Big Walnut watershed which are on the "Outstanding Rivers List" and their significance.

The upper portion of Big Walnut Creek is included in the Canoeing Guide published by IDNR, Division of Outdoor Recreation. “The upper most segment of the Big Walnut is a unique natural area which was identified by Alton A. Lindsey in *The Report of the Indiana Natural Areas Survey*, 1969. Here the stream flows through a deeply cut valley exhibiting a unique relic plant community which contains

hemlock and Canadian yew, characteristic of areas hundreds of miles further north. Several other rare plant species are found here with an abundance of wildlife." (IDNR-DOR, 1999)

All counties in the watershed are listed as potential habitat for the endangered Indiana bat (*Myotis sodalis*), and the threatened Bald eagle (*Haliaeetus leucocephalus*) (US F&WS, 1998).

State Parks, Forests, and Recreation Areas

The Eel-Big Walnut watershed contains three state property sites, which serve as natural or recreation areas. The Owen-Putnam State Forest is located in Owen County near Atkinsonville, and is comprised of 6,245 acres. This property consists of many scattered holdings in a north-south orientation. The Owen-Putnam State Forest provides 33 camp sites, hiking trails, horse trails, and hunting and fishing areas (IDNR, 1999). The Lieber State Recreation Area is located along the Owen/ Putnam county line. It covers 8,075 acres and includes the 1,400 acre Cagles Mill/ Cararact Lake, Cataract Falls State Recreation Area, and Cunot Ramp. The area provides camping, fishing, swimming, and boating opportunities (IDNR,1999).

TABLE 2-5
WATERS OF THE EEL-BIG WALNUT WATERSHED ON THE OUTSTANDING RIVERS LIST FOR INDIANA*

River Segment	County	Significance
Big Walnut Creek: From Hendricks/ Putnam Co. line to Greencastle	Putnam	5, 7, 11, 13, 19, 20

Significance of numbering system:

5. Nationwide Rivers Inventory Rivers. The 1,524 river segments identified by the National Park Service in its 1982 "Nationwide Rivers Inventory" as qualified for consideration for inclusion in the National Wild and Scenic Rivers System.
7. Rivers Identified in State Inventories or Assessments. Outstanding rivers from state inventories or assessments, i.e., rivers identified as having statewide or greater significance.
11. State Heritage Program Sites. Rivers identified by state natural heritage programs or similar state programs as having outstanding ecological importance.
13. Canoe Trails. State-designated canoe/boating routes.
19. National Natural Landmark Rivers. Rivers designated as, or included within, National Natural Landmarks.
20. State Study Rivers. Rivers that have been formally proposed for state protection or designation.

*NRC 1997

2.5 Surface Water Use Designations and Classifications

The following uses are designated by the Indiana Water Pollution Control Board (327 IAC 2-1-3):

- Surface waters of the state are designated for full-body contact recreation during the recreational season (April through October).
- All waters, except limited use waters, will be capable of supporting a well-balanced, warm water aquatic community.
- All waters, which are used for public or industrial water supply, must meet the standards for those uses at the point where water is withdrawn.
- All waters, which are used for agricultural purposes, must meet minimum surface water quality standards.
- All waters in which naturally poor physical characteristics (including lack of sufficient flow), naturally poor or reversible man-induced conditions, which came into existence prior to January 1, 1983, and having been established by use attainability analysis, public comment period, and hearing may qualify to be classified for limited use and must be evaluated for restoration and upgrading at each triennial review of this rule.
- All waters, which provide unusual aquatic habitat, which are an integral feature of an area of exceptional natural beauty or character, or which support unique assemblages of aquatic organisms may be classified for exceptional use.

All waters of the state, at all times and at all places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges:

- that will settle to form putrescent or otherwise objectionable deposits;
- that are in amounts sufficient to be unsightly or deleterious;
- that produce color, visible oil sheen, odor, or other conditions in such degree as to create a nuisance;
- which are in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill aquatic life, other animals, plants, or humans.
- which are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair designated uses.

2.5.1 Surface Water Classifications in the Eel-Big Walnut Watershed

The statewide classifications discussed in Section 2.5 apply to all stream segments in the Eel-Big Walnut watershed.

2.6 US Geological Survey Water Use Information for the Eel-Big Walnut Watershed

The U.S. Geological Survey's (USGS) National Water-Use Information Program is responsible for compiling and disseminating the nation's water-use data. The USGS works in cooperation with local, State, and Federal environmental agencies to collect water-use information at a site-specific level. USGS also compiles the data from hundreds of thousands of these sites to produce water-use information aggregated up to the county, state, and national levels. Every five years, data at the state and hydrologic region level are compiled into a national water-use data system. Table 2-6 shows the USGS Water-Use information for the Eel-Big Walnut Watershed for 1990 and 1995.

TABLE 2-6
1990 & 1995 Water Use Information for the Eel - Big Walnut Watershed

Population and Water Use totals	1990	1995
Total population in the watershed (thousands)	63.24	72.84
Public Water Supply	**1990**	**1995**
Population served by public groundwater supply (thousands)	35.08	42.5
Population served by surface water supply (thousands)	0.23	0
Total population served by public water supply (thousands)	35.31	42.5
Total groundwater withdrawals (mgd)	4.33	5.59
Total surface water withdrawals (mgd)	0	0
Total water withdrawals (mgd)	4.33	5.59
Total per capita withdrawal (gal/day)	122.63	131.53
Population self-supplied with water (thousands)	27.93	30.34
Commercial Water Use	**1990**	**1995**
Groundwater withdrawal for commercial use (mgd)	0.24	0.32
Surface water withdrawal for commercial use (mgd)	0.26	0.35
Deliveries from public water supplies for commercial use (mgd)	0.17	0.28
Total commercial water use (mgd)	0.67	0.95
Industrial Water Use	**1990**	**1995**
Groundwater withdrawal for industrial use (mgd)	0.26	0.58
Surface water withdrawals for industrial use (mgd)	0.3	0.33
Deliveries from public water suppliers for industrial use (mgd)	1.37	2.0
Total industrial water use (mgd)	1.93	2.91
Agricultural Water Use	**1990**	**1995**
Groundwater withdrawals for livestock use (mgd)	0.54	0.51
Surface water withdrawals for livestock use (mgd)	0.55	0.51
Total livestock water use (mgd)	1.09	1.02
Groundwater withdrawals for irrigation (mgd)	0	0
Surface water withdrawals for irrigation (mgd)	0	0
Total irrigation water use (mgd)	0	0
Mining Use	**1990**	**1995**
Groundwater withdrawals	0	0
Surface water withdrawals	1.44	1.13
Total withdrawals (mgd)	1.44	1.13

Notes:
mgd million gallon per day
gal/day gallon per day

- The water-use information presented in this table was compiled from information provided in the U.S. Geological Survey's National Water-Use Information Program data system for 1990 and 1995. The National Water-Use Information Program is responsible for compiling and disseminating the nation's water-use data. The U.S. Geological Survey works in cooperation with local, State, and Federal environmental agencies to collect water-use information at a site-specific level. Every five years, the U.S. Geological Survey compiles data at the state and hydrologic region level into a national water-use data system and are published in a national circular.

3 Causes and Sources of Water Pollution

A number of substances including nutrients, bacteria, oxygen-demanding wastes, metals, and toxic substances, cause water pollution. Sources of these pollution-causing substances are divided into two broad categories: point sources and nonpoint sources. Point sources are typically piped discharges from wastewater treatment plants, large urban and industrial stormwater systems, and other facilities. Nonpoint sources can include atmospheric deposition, groundwater inputs, and runoff from urban areas, agricultural lands and others. Chapter 3 includes the following:

Section 3.1 Causes of Pollution
Section 3.2 Point Sources of Pollution
Section 3.3 Nonpoint Sources of Pollution

3.1 Causes of Pollution

'Causes of pollution' refer to the substances which enter surface waters from point and nonpoint sources and result in water quality degradation and impairment. Major causes of water quality impairment include biochemical oxygen demand (BOD), nutrients, toxicants (such as heavy metals, polychlorinated biphenyls [PCBs], chlorine, pH and ammonia) and E. coli bacteria. Table 3-1 provides a general overview of causes of impairment and the activities that may lead to their introduction into surface waters. Each of these causes is discussed in the following sections.

TABLE 3-1
CAUSES OF WATER POLLUTION AND CONTRIBUTING ACTIVITIES

Cause	Activity associated with cause
Nutrients	Fertilizer on agricultural crops and residential/ commercial lawns, animal wastes, leaky sewers and septic tanks, direct septic discharge, atmospheric deposition, wastewater treatment plants
Toxic Chemicals	Pesticide applications, disinfectants, automobile fluids, accidental spills, illegal dumping, urban stormwater runoff, direct septic discharge, industrial effluent
Oxygen-Consuming Substances	Wastewater effluent, leaking sewers and septic tanks, direct septic discharge, animal waste
E. coli	Failing septic systems, direct septic discharge, animal waste (including runoff from livestock operations and impacts from wildlife), improperly disinfected wastewater treatment plant effluent

3.1.1 E. coli Bacteria

E. coli bacteria are associated with the intestinal tract of warm-blooded animals. They are widely used as an indicator of the potential presence of waterborne disease-causing (pathogenic) bacteria, protozoa, and viruses because they are easier and less costly to detect than the actual pathogenic organisms. The presence of waterborne disease-causing organisms can lead to outbreaks of such diseases as typhoid fever, dysentery, cholera, and cryptosporidiosis. The detection and identification of specific bacteria, viruses, and protozoa, (such as Giardia, Cryptosporidium, and Shigella) require special sampling protocols and very sophisticated laboratory techniques which are not commonly available.

E. coli water quality standards have been established in order to ensure safe use of waters for water supplies and recreation. 327 IAC 2-1-6 Section 6(d) states that E. coli bacteria, using membrane filter count (MF), shall not exceed 125 per 100 milliliters as a geometric mean based on not less than five samples equally spaced over a 30 day period nor exceed 235 per 100 milliliters in any one sample in a 30 day period.

E. coli bacteria may enter surface waters from nonpoint source runoff, but they also come from improperly treated discharges of domestic wastewater. Common potential sources of E. coli bacteria include leaking or failing septic systems, direct septic discharge, leaking sewer lines or pump station overflows, runoff from livestock operations, urban stormwater and wildlife. E. coli bacteria in treatment plant effluent are controlled through disinfection methods including chlorination (often followed by dechlorination), ozonation or ultraviolet light radiation.

3.1.2 Toxic Substances

327 IAC 2-1-9(45) defines toxic substances as substances, which are or may become harmful to plant or animal life, or to food chains when present in sufficient concentrations or combinations. Toxic substances include, but are not limited to, those pollutants identified as toxic under Section 307 (a)(1) of the Clean Water Act. Standards for individual toxic substances are listed 327 IAC 2-1-6. Toxic substances frequently encountered include chlorine, ammonia, organics (hydrocarbons and pesticides) heavy metals and pH. These materials are toxic to different organisms in varying amounts, and the effects may be evident immediately or may only be manifested after long-term exposure or accumulation in living tissue.

Whole effluent toxicity testing is required for major NPDES dischargers (discharge over 1 million gallons per day or population greater than 10,000). This test shows whether the effluent from a treatment plant is toxic, but it does not identify the specific cause of toxicity. If the effluent is found to be toxic, further testing is done to determine the specific cause. This follow-up testing is called a toxicity reduction evaluation. Other testing, or monitoring, done to detect aquatic toxicity problems include fish tissue analyses, chemical water quality sampling and assessment of fish community and bottom-dwelling organisms such as aquatic insect larvae. These monitoring programs are discussed in Chapter 4.

Each of the substances below can be toxic in sufficient quantity or concentration.

Metals

Municipal and industrial dischargers and urban runoff are the main sources of metal contamination in surface water. Indiana has stream standards for many heavy metals, but the most common ones in municipal permits are cadmium, chromium, copper, nickel, lead, mercury, and zinc. Standards are listed in 327 IAC 2-1-6. Point source discharges of metals are controlled through the National Pollution Discharge Elimination System (NPDES) permit process. Mass balance models are employed to

determine allowable concentrations for a permit limit. Municipalities with significant industrial users discharging wastes to their treatment facilities limit the heavy metals from these industries through a pretreatment program. Source reduction and wastewater recycling at waste water treatment plants (WWTP) also reduces the amount of metals being discharged to a stream. Nonpoint sources of pollution are controlled through best management practices.

In Indiana, as well as many other areas of the country, mercury contamination in fish has caused the need to post widespread fish consumption advisories. The source of the mercury is unclear; however, atmospheric sources are suspected and are currently being studied.

Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) were first created in 1881 and subsequently began to be commercially manufactured around 1929 (Bunce 1994). Because of their fire-resistant and insulating properties, PCBs were widely used in transformers, capacitors, and in hydraulic and heat transfer systems. In addition, PCBs were used in products such as plasticizers, rubber, ink, and wax. In 1966, PCBs were first detected in wildlife, and were soon found to be ubiquitous in the environment (Bunce 1994). PCBs entered the environment through unregulated disposal of products such as waste oils, transformers, capacitors, sealants, paints, and carbonless copy paper. In 1977, production of PCBs in North America was halted. Subsequently, the PCB contamination present in our surface waters and environment today is the result of historical waste disposal practices.

Ammonia (NH_3)

Point source dischargers are one of the major sources of ammonia. In addition, discharge of untreated septic effluent, decaying organisms which may come from nonpoint source runoff and bacterial decomposition of animal waste also contribute to the level of ammonia in a waterbody. Standards for ammonia are listed in 327 IAC 2-1-6.

3.1.3 Oxygen-Consuming Wastes

Oxygen-consuming wastes include decomposing organic matter or chemicals, which reduce dissolved oxygen in water through chemical reactions. Raw domestic wastewater contains high concentrations of oxygen-consuming wastes that need to be removed from the wastewater before it can be discharged into a waterway. Maintaining a sufficient level of dissolved oxygen in the water is critical to most forms of aquatic life.

The concentration of dissolved oxygen in a water body is one indicator of the general health of an aquatic ecosystem. 327 IAC Section 6 (b)(3) states that concentrations of dissolved oxygen shall average at least five milligrams per liter per calendar day and shall not be less than four milligrams per liter at any time. Dissolved oxygen concentrations are affected by a number of factors. Higher dissolved oxygen is produced by turbulent actions, such as waves, which mix air and water. Lower water temperatures also generally allows for retention of higher dissolved oxygen concentrations. Low dissolved oxygen levels tend to occur more often in warmer, slow-moving waters. In general, the lowest dissolved oxygen concentrations occur during the warmest summer months and particularly during low flow periods.

Sources of dissolved oxygen depletion include wastewater treatment plant effluent, the decomposition of organic matter (such as leaves, dead plants and animals) and organic waste matter that is washed or discharged into the water. Sewage from human and household wastes is high in organic waste matter. Bacterial decomposition can rapidly deplete dissolved oxygen levels unless these wastes are

adequately treated at a wastewater treatment plant. In addition, excess nutrients in a water body may lead to an over-abundance of algae and reduce dissolved oxygen in the water through algal respiration and decomposition of dead algae. Also, some chemicals may react with and bind up dissolved oxygen. Industrial discharges with oxygen consuming wasteflow may be resilient instream and continue to use oxygen for a long distance downstream.

3.1.4 Nutrients

The term "nutrients" in this Strategy refers to two major plant nutrients, phosphorus and nitrogen. These are common components of fertilizers, animal and human wastes, vegetation, and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources. Nutrients are beneficial to aquatic life in small amounts. However, in over-abundance and under favorable conditions, they can stimulate the occurrence of algal blooms and excessive plant growth in quiet waters or low flow conditions. The algal blooms and excessive plant growth often reduce the dissolved oxygen content of surface waters through plant respiration and decomposition of dead algae and other plants. This is accentuated in hot weather and low flow conditions because of the reduced capacity of the water to retain dissolved oxygen.

3.2 Point Sources of Pollution

As discussed previously, sources of these pollution-causing substances are divided into two broad categories: point sources and nonpoint sources. This section focuses on point sources. Section 3.3.1 defines point sources and Section 3.3.2 discusses point sources in the Eel-Big Walnut Watershed.

3.2.1 Defining Point Sources

Point sources refer to discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge. The term applies to wastewater and stormwater discharges from a variety of sources. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems that may serve schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for medium and large municipalities which serve populations greater than 100,000 and stormwater discharges associated with industrial activity as defined in the Code of Federal Regulations [40 CFR 122.26(a)(14)]. The primary pollutants associated with point source discharges are Oxygen demanding wastes, nutrients, sediment, color and toxic substances including chlorine, ammonia and metals.

Point source dischargers in Indiana must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state. Discharge permits are issued under the NPDES program, which is delegated to Indiana by the US Environmental Protection Agency (EPA). See Chapter 5 for a description of the NPDES program and permitting strategies.

3.2.2 Point Source Discharges in the Eel-Big Walnut Watershed

As of June 1999, there were 67 active NPDES permits within the Eel-Big Walnut watershed (Table 3-2, Figure 3-1). All 67 are considered minor dischargers. See Chapter 5 for definition of minor dischargers.

Another point source covered by NPDES permits is combined sewer overflows (CSO). A combined sewer system is a wastewater collection system that conveys sanitary wastewater (domestic, commercial and industrial wastewater) and storm water through a single-pipe system to a Publicly Owned Treatment Works. A CSO is the discharge from a combined sewer system at a point prior to the Publicly Owned Treatment Works. CSOs are point sources subject to NPDES permit requirements including both technology-based and water quality-based requirements of the Clean Water Act.

There are only two CSOs that discharge into the watershed. Both are in the city of Brazil, in Clay County. One discharges to Harms Run and one discharges to Birch Creek. Both are under an Agreed Order to be eliminated in 2000.

In addition to the NPDES permitted dischargers in the watershed, there may be many unpermitted, illegal discharges to the Eel-Big Walnut system. Illegal discharges of residential wastewater (septic tank effluent) to streams and ditches from straight pipe discharges and old inadequate systems are a problem within the watershed (Hale, 1999; Trinkle, 1999; Fisher, 1999).

Table 3-2
NPDES PERMITTED FACILITIES
EEL - BIG WALNUT WATERSHED

NPDES	Facility Name	Maj/Mi	City	County	Status
ING040015	Black Beauty Coal, Lick Creek	Minor	Coal City	Owen	Active
ING040021	Miller Mining Co., Arthur Mine	Minor	Switz City	Greene	Active
ING040059	Black Beauty Coal, Bridwell Mn	Minor	Switz City	Greene	Active
ING040061	Black Beauty Coal, White Oak M	Minor	Switz City	Owen	Active
ING040080	Little Sandy Coal, Brimar Mine	Minor		Clay	Active
ING040081	Little Sandy Coal, Pond Ck #1	Minor	Coal City	Owen	Active
ING040082	Little Sandy Coal, Kreden Mine	Minor	Coalmont	Clay	Inactive
ING040094	Black Beauty Coal, Eel Mine	Minor	Clay City	Clay	Active
ING040095	Black Beauty Coal, Rio Grande	Minor	Brazil	Clay	Active
ING040096	Black Beauty Coal, Sugar Ridge	Minor	Saline City	Clay	Active
ING040100	Black Beauty Coal, Ne Eel Mine	Minor	Clay City	Clay	Active
ING040105	Black Beauty Coal, Hornet Mine	Minor	Brazil	Clay	Active
ING040108	Black Beauty Coal, Lords 11 M.	Minor	Brazil	Clay	Active
ING040109	Haviland Brothers Coal, Pit #3	Minor	Coal City	Owen	Active
ING040110	Solar Sources, Lewis Mine	Minor	Lewis	Vigo	Active
ING040140	Little Sandy Coal, Pond Ck #2	Minor	Coal City	Owen	Inactive
ING040152	Little Sandy Coal, Pond Cr #2	Minor	Coal City	Owen	Active
ING040158	AML Site #1102, Hesco	Minor	Jasonville	Greene	Active
ING490011	American Agg. Cloverdale #524	Minor	Cloverdale	Putnam	Active
ING490025	Martin Marietta, Cloverdale Qu	Minor	Cloverdale	Putnam	Active
ING490065	Kentucky Stone, Putnamville Qu	Minor	Cloverdale	Putnam	Active
INP000012	North American Capacitor Co.	Minor	Greencastle	Putnam	Active
INP000037	Great Dane Trailers, Inc.	Minor	Brazil	Clay	Active
INP000156	Lobdell Emery Corporation	Minor	Greencastle	Putnam	Active
INP000171	Crown Equipment Corporation	Minor	Greencastle	Putnam	Active
INS700002	Milestone Contractors, L.P.	Minor	Cloverdale	Putnam	Inactive
IN0001279	Lone Star Industries, Inc.	Minor	Greencastle	Putnam	Active
IN0001848	Ibm Corporation	Minor	Greencastle	Putnam	Active
IN0003701	Bainbridge Municipal WWTP	Minor	Bainbridge	Putnam	Inactive
IN0003956	Brazil Water Treatment Plant	Minor	Brazil	Clay	Active
IN0004448	Marietta Corp-Stilesville Stone	Minor		Putnam	Inactive
IN0021008	Jasonville Municipal STP	Minor	Jasonville	Greene	Active
IN0021032	Greencastle Municipal STP	Major	Greencastle	Putnam	Active
IN0021211	Brazil Municipal STP	Major	Brazil	Clay	Active
IN0021318	Jamestown Municipal STP	Minor	Jamestown	Boone	Active
IN0021431	Clayton Municipal STP	Minor	Clayton	Hendricks	Active
IN0021938	Texaco Bulk Plant	Minor		Clay	Inactive
IN0022616	Cloverdale Municipal STP	Minor	Cloverdale	Putnam	Active
IN0023612	Loogootee City of	Minor		Putnam	Inactive
IN0025143	Little Point Auto/truck Stop	Minor		Morgan	Active
IN0025291	Lone Star Ind	Minor		Putnam	Inactive
IN0025844	Kentucky Stone Co, Sunset Hill	Minor	Cloverdale	Putnam	Inactive
IN0025879	I-70 Truck Stop	Minor		Morgan	Inactive
IN0030201	Mc Cormick's Creek State Park	Minor	Spencer	Owen	Active
IN0030279	Lieber State Recreation Area	Minor	Cloverdale	Putnam	Active
IN0030724	Patricksburg Elementary School	Minor	Patricksburg	Owen	Active
IN0030783	Jackson Twp. Elem. School	Minor	Brazil	Clay	Active

Table 3-2 (Continued)

NPDES	Facility Name	Maj/Mi	City	County	Status
IN0030791	Van Buren High and Elementary	Minor		Clay	Inactive
IN0031518	Lizton Rest Areas I-74	Minor	Lizton	Hendricks	Active
IN0031747	South Putnam High School	Minor	Greencastle	Putnam	Active
IN0032310	Eminence Elem School	Minor		Morgan	Inactive
IN0032611	Jasonville Wtr Trmt Plt	Minor		Greene	Inactive
IN0033707	Mallory P R & Co-mallory Capac	Minor		Putnam	Inactive
IN0034941	Staunton Town of	Minor		Clay	Inactive
IN0035076	Indiana State Farm	Minor		Putnam	Inactive
IN0035173	Lizton Municipal STP	Minor	Lizton	Hendricks	Active
IN0035220	Clear Creek Conservancy Dist	Minor		Putnam	Inactive
IN0036226	Cagles Millshop and Dwellings	Minor		Clay	Inactive
IN0036838	Center Point Town of	Minor		Clay	Inactive
IN0037401	Cascade Jr. Sr. H.S.	Minor	Clayton	Hendricks	Active
IN0039004	Indiana Baptist Assembly	Minor	Reelsville	Putnam	Active
IN0039161	Bainbridge Elementary School	Minor	Bainbridge	Putnam	Inactive
IN0039179	North Putnam Jr-sr High School	Minor	Roachdale	Putnam	Inactive
IN0039233	Brazil Coal and Clay Corp.-npr	Minor		Clay	Inactive
IN0039292	Center Point Town of	Minor	Centerpoint	Clay	Active
IN0039624	S & V Sewer Service Compamy	Minor	Greencastle	Putnam	Active
IN0039861	Clay City Municipal STP	Minor	Clay City	Clay	Active
IN0040436	North Salem Municipal STP	Minor	North Salem	Hendricks	Active
IN0040941	Bainbridge Municipal STP	Minor	Bainbridge	Putnam	Active
IN0040959	Coatesville Municipal STP	Minor		Hendricks	Inactive
IN0042668	Brazil Coal and Clay Corp.-npr	Minor		Clay	Inactive
IN0042960	Putnamville Correctional Facil	Minor	Greencastle	Putnam	Active
IN0043877	Amo-coatsville Municipal STP	Minor	Amo	Hendricks	Active
IN0044474	Eminence Consolidated School	Minor	Eminence	Morgan	Active
IN0045365	Harris Stone Service Inc	Minor		Putnam	Inactive
IN0045527	Clear Creek Conservancy Distri	Minor	Coatesville	Putnam	Active
IN0045594	E & E Clay Company	Minor		Parke	Inactive
IN0045896	Laswell Coal Co., Redbird Mine	Minor		Greene	Inactive
IN0045926	IDNR Site 271, Clay City	Minor	Clay City	Clay	Inactive
IN0046442	Jaeco, Inc., Eel River Mine	Minor	Carmel	Vigo	Inactive
IN0046795	Northern Coal, Coal City Pit 2	Minor	Coal City	Owen	Active
IN0047074	Reelsville Elementary School	Minor	Greencastle	Putnam	Active
IN0047244	Northern Coal-arthur Pit	Minor	Switz City	Greene	Inactive
IN0047571	Atlas Coal Co., Inc.	Minor	Worthington	Greene	Inactive
IN0047627	S & G Excavating, Inc.	Minor		Clay	Inactive
IN0047635	Northern Coal, Coal City Pit 1	Minor	Patricksburg	Owen	Active
IN0047961	IDNR Site 132, Staunton AML	Minor		Clay	Inactive
IN0048569	Haviland Brothers Coal, Pit #3	Minor	Coal City	Owen	Inactive
IN0049140	Phoenix Nr, Kirkling Mine	Minor	Cannelburg	Clay	Inactive
IN0049981	Brazil Coal & Clay Corp.	Minor	Centerpoint	Clay	Active
IN0050695	Wabash Park Campground	Minor	Clay City	Clay	Active
IN0052621	P-Burg Coal Co. NPR	Minor		Owen	Inactive
IN0053821	Shand Mining, Rio Grande Mine	Minor	Brazil	Clay	Inactive

Table 3-2 (Continued)

NPDES	Facility Name	Maj/Mi	City	County	Status
IN0054097	Beech Coal Co., Beech Mine	Minor	Clay City	Clay	Inactive
IN0054259	Northern Coal, Lap Corner Pit	Minor	Center Point	Clay	Active
IN0054267	Northern Coal-coal City Pit #3	Minor	Coal City	Owen	Inactive
IN0054526	Martin Marietta Agg, Cloverdal	Minor	Cloverdale	Putnam	Inactive
IN0054542	Little Sandy Coal, Kreden Mine	Minor	Jasonville	Greene	Inactive
IN0054577	Black Beauty Coal, White Oak M	Minor	Worthington	Clay	Inactive
IN0054585	Vigo Energy	Minor		Vigo	Inactive
IN0054631	B&Ls Contracting, Calcutta Rai	Minor	Brazil	Clay	Inactive
IN0054828	Northern Coal, Coal City Pit 4	Minor	Linton	Owen	Active
IN0055000	S & L Enterprise	Minor	Clayton	Hendricks	Active
IN0055182	Shand Mining, Hornet Mine	Minor	Brazil	Clay	Inactive
IN0055239	American Aggregates Corp. #524	Minor	Cloverdale	Putnam	Inactive
IN0055336	Shand Mining, Eel Mine	Minor	Clay City	Clay	Inactive
IN0055425	Kentucky Stone Co, Putnamville	Minor	Putnamville	Putnam	Inactive
IN0055450	Northern Coal, Hoosierville Mi	Minor	Brazil	Clay	Active
IN0055557	West Elem School	Minor		Hendricks	Inactive
IN0055964	Little Sandy Coal, Pond Ck #1	Minor	Coal City	Owen	Inactive
IN0056197	R & R Coal, Lords Pit No. 11	Minor	Stesrleyville	Clay	Inactive
IN0056791	IDNR Site 269, Peavey Mine AML	Minor		Clay	Inactive
IN0057312	Lewis Dock Corp., Inc.	Minor	Jasonville	Greene	Active
IN0057517	Heartland Coal, Dick Johnson M	Minor	Brazil	Clay	Inactive
IN0057533	Shand Mining, Sugar Ridge Mine	Minor	Brazil	Clay	Inactive
IN0057762	Shand Mining, N.e. Eel Mine	Minor	Clay City	Clay	Inactive
IN0058459	Greencastle Water Trmt. Plant	Minor		Putnam	Active
IN0059765	Camp Otto	Minor	Owen Cnty	Owen	Active
IN0059846	Cloverdale Water Dept., Town O	Minor	Cloverdale	Putnam	Active
IN0059871	Uplands Subdivision, the	Minor	Spencer	Owen	Active
IN0059986	Stilesville WWTP, Town of	Minor	Stilesville	Hendricks	Active
IN0109606	Signature Foods Indiana	Minor	Worthington	Greene	Active

3.3 Nonpoint Sources of Pollution

Nonpoint source pollution refers to runoff that enters surface waters through stormwater runoff, contaminated ground water, snowmelt or atmospheric deposition. There are many types of land use activities that can serve as sources of nonpoint source pollution including land development, construction, mining operations, crop production, animal feeding lots, timber harvesting, failing septic systems, landfills, roads and paved areas. Stormwater from large urban areas (>100,000 people) and from certain industrial and construction sites is technically considered a point source since NPDES permits are required for discharges of stormwater from these areas.

Sediment and nutrients are major pollution-causing substances associated with nonpoint source pollution. Others include E. coli bacteria, heavy metals, pesticides, oil and grease, and any other substance that may be washed off the ground or removed from the atmosphere and carried into surface waters. Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur at random time intervals depending on rainfall events. Below is a brief description of major areas of nonpoint sources of pollution in the Eel/ Big Walnut watershed.

3.3.1 Agriculture

There are a number of activities associated with agriculture that can serve as potential sources of water pollution. Land clearing and tilling make soils susceptible to erosion, which can then cause stream sedimentation. Pesticides and fertilizers (including synthetic fertilizers and animal wastes) can be washed from fields or improperly designed storage or disposal sites. Construction of drainage ditches on poorly drained soils enhances the movement of oxygen-consuming wastes, sediment and soluble nutrients into groundwater and surface waters.

Concentrated animal operations can be a significant source of nutrients, biochemical oxygen demand and E. coli bacteria if wastes are not properly managed. Impacts can result from over-application of wastes to fields, from leaking lagoons and from flows of lagoon liquids to surface waters due to improper waste lagoon management. Also there are potential concerns associated with nitrate-nitrogen movement through the soil from poorly constructed lagoons and from wastes applied to the soil surface.

Grassed waterways, conservation tillage, and no-till practices are several common practices used by many farmers to minimize soil loss. Maintaining a vegetated buffer between fields and streams is another excellent way to minimize sediment and nutrient loads to streams.

3.3.2 Urban/Residential

Runoff from urbanized areas, as a rule, is more localized and can often be more severe in magnitude than agricultural runoff. Any type of land-disturbing activity such as land clearing or excavation can result in soil loss and sedimentation. The rate and volume of runoff in urban areas is much greater due both to the high concentration of impervious surface areas and to storm drainage systems that rapidly transport stormwater to nearby surface waters. This increase in volume and rate of runoff can result in streambank erosion and sedimentation in surface waters.

Urban drainage systems, including curb and guttered roadways, also allow urban pollutants to reach surface waters quickly and with little or no filtering. Pollutants include lawn care pesticides and fertilizers;

automobile fluids; lawn and household wastes; road salts, and E. coli bacteria (from animals and failing septic systems). The diversity of these pollutants makes it very challenging to attribute water quality degradation to any one pollutant.

Replacement of natural vegetation with pavement and removal of buffers reduces the ability of the watershed to filter pollutants before they enter surface waters. The chronic introduction of these pollutants and increased flow and velocity into a stream results in degraded waters. Many waters adjacent to urban areas are rated as biologically poor. This degradation also exists in lakes, which have been heavily influenced by adjacent urban development.

The population figures discussed in Section 2.3.2 are good indicators of where urban development and potential urban water quality impacts are likely to occur. Concentrated areas where urban development is high may lead to further water quality problems associated with the addition of impervious surfaces next to surface waters.

3.3.3 Onsite Wastewater Disposal

Septic systems contain all of the wastewater from a household or business. A complete septic system consists of a septic tank and an absorption field to receive effluent from the septic tank. The septic tank removes some wastes, but the soil absorption field provides further absorption and treatment. Septic systems can be a safe and effective method for treating wastewater if they are sized, sited, and maintained properly. However, if the tank or absorption field malfunction or are improperly placed, constructed or maintained, nearby wells and surface waters may become contaminated.

Some of the potential problems from malfunctioning septic systems include:

- Polluted groundwater: Pollutants in septic effluent include bacteria, nutrients, toxic substances, and oxygen-consuming wastes. Nearby wells can become contaminated by failing septic systems.

- Polluted surface water: Groundwater often carries the pollutants mentioned above into surface waters, where they can cause serious harm to aquatic ecosystems. Leaking septic tanks can also leak into surface waters through or over the soil. In addition, some septic tanks may directly discharge to surface waters.

- Risks to human health: Septic system malfunctions can endanger human health when they contaminate nearby wells, drinking water supplies, and fishing and swimming areas.

Pollutants associated with onsite wastewater disposal may also be discharged directly to surface waters through direct pipe connections between the septic system and surface waters (straight pipe discharge). However, 327 IAC 5-1-1.5 specifically states that “point source discharge of sewage treated or untreated, from a dwelling or its associated residential sewage disposal system, to the waters of the state is prohibited”.

3.3.4 Construction

Construction activities that involve excavation, grading or filling can produce significant sedimentation if not properly controlled. Sedimentation from developing urban areas can be a major source of pollution due to the cumulative number of acres disturbed in a watershed. Construction of single

family homes in rural areas can also be a source of sedimentation when homes are placed in or near stream corridors.

As a pollution source, construction activities are typically temporary, but the impacts on water quality can be severe and long lasting. Construction activities tend to be concentrated in the more rapidly developing areas of the watershed.

4. Water Quality and Use Support Ratings in the Eel-Big Walnut Watershed

This section provides a detailed overview of water quality monitoring, water quality, and use support ratings in the Eel-Big Walnut watershed and includes the following:

4.1 Water Quality Monitoring Programs

This section discusses water quality monitoring programs. Specifically, Section 4.1.1 describes Office of Water Quality monitoring programs and Section 4.1.2 discusses other monitoring efforts in the watershed.

4.1.1 Office of Water Quality Programs

The Water Quality Assessment Branch of the Office of Water Quality is responsible for assessing the quality of water in Indiana's lakes, rivers and streams. This assessment is performed by field staff from the Survey Section and the Biological Studies Section. Virtually every element of IDEM's surface water quality management program of IDEM is directly or indirectly related to activities currently carried out by this Branch. The biological and surface water monitoring activities identify stream reaches, watersheds or segments where physical, chemical and/or biological quality has been or would be impaired by either point or nonpoint sources. This information is used to help allocate waste loads equitably among various sources in a way that would ensure that water quality standards are met along stream reaches in each of the nearly 100 stream segments in Indiana.

The purpose of the Surveys Section is to provide the water quality and hydrological data required for the assessment of Indiana's waters by conducting Watershed/Basin Surveys and Stream Reach Surveys. In 1996, the Section began a five-year synoptic study (Basin Monitoring Strategy) of the State's ten major watersheds. Information from these studies will be integrated with data from biological and nonpoint source studies as well as the Fixed Station Monitoring Program to make a major assessment of the State's waters. Such surveys determine the extent to which water quality standards are being met and whether the fishable, swimmable and water supply uses are being maintained.

Information derived from this strategy will contribute significantly to improved planning processes throughout the Office of Water Quality. This plan should initiate the development of interrelated action plans, which encompass the wide range of responsibilities, such as rule making, permitting, compliance, nonpoint source issues, and wastewater treatment facility oversight.

The Biological Studies Section conducts studies of fish and macroinvertebrate communities as well as stream habitats to establish biological conditions to which other streams may be compared in order to

identify impaired streams or watersheds. The Biological Studies Section also conducts fish tissue and sediment sampling to pinpoint sources of toxic and bioconcentrating substances. Fish tissue data serve as the basis for fish consumption advisories, which are issued, through the Indiana State Department of Health, to protect the health of Indiana citizens. This Section also participates in the development of site-specific water quality standards.

The Biological Studies Section relies on the Volunteer Water Quality Monitoring Programs to provide additional data on lakes and wetlands that may not be sampling sites in the Monitoring Strategy. Volunteer collected data provides IDEM scientists with an overall view of water quality trends and early warning of problems that may be occurring in a lake or wetland. If volunteers detect that a lake or wetland is severely degraded, professional IDEM scientists will conduct follow up investigation.

4.1.2 Other Monitoring Efforts

Extensive water quality monitoring, within the Eel-Big Walnut watershed was completed by Dr. James R. Gammon, Department of Biological Sciences, DePauw University. The monitoring projects were supported in part by Heritage Environmental Services, IDNR, PSI-Energy, and Eli Lilly Company (Gammon, 1995 and Gammon, 1997). The primary objective of these studies was to assess the effects of animal feedlots on water quality. The studies included water chemistry and biological sampling from 1993 to 1996.

4.2 Summary of Ambient Monitoring Data for the Eel-Big Walnut Watershed

The fixed station-monitoring program managed by IDEM's Office of Water Quality has been monitoring surface water chemistry throughout the state since 1957. The data set from 1986 to 1995 was analyzed using the Seasonal Kendall test. This test deduces if a statistical change in the surface water chemistry occurred over a time period. The results of the Seasonal Kendall analysis for stations located in the Eel-Big Walnut watershed are provided in Table 4-1. The data collected from 1991 to 1997 from this monitoring program was also analyzed to determine benchmark characteristics. The results of the benchmark characteristic analysis for stations located in the Eel-Big Walnut watershed are provided in Appendix B. For a more in depth discussion of this analysis, please refer to the Indiana Fixed Station Statistical Analysis 1997 (IDEM 32/02/005/1998), published in May 1998 by the Assessment Branch of the Office of Water Quality - IDEM.

TABLE 4-1
RESULTS OF SEASONAL KENDALL ANALYSIS FOR STATIONS LOCATED IN THE EEL-BIG WALNUT WATERSHED 1986 TO 1995

Parameter	EEL-1 Eel River S.R. 67 bridge, Worthington	MC-18 Mill Creek U.S. 231 bridge, Devore	MC-35 Mill Creek U.S. 40 bridge, Stilesville
Biological Oxygen Demand	↘	↘	«
Chemical Oxygen Demand	«	↓	↓
Dissolved Oxygen	«	↑	↗
E. coli	«	«	«
Ammonia	«	«	«
Nitrite + Nitrate	«	«	«
Total phosphorus	«	«	«
Total Residue	«	↓	«
Total Residue, Filterable	?	↗	↑
Total Residue, Nonfilterable	«	↓	«
Copper	?	?	?
Cyanide (total)	?	?	?

Notes

« No Statistical Change; significance < 80% or reported slope = 0.00000

↓ Statistically Decreasing; significance >95% with a negative slope

↘ Potentially Decreasing; significance >80% with a negative slope

↗ Potentially Increasing; significance >80% with a positive slope

↑ Statistically Increasing; significance >95 % with a positive slope

? Insufficient Data for analysis

4.3 Fish Consumption Advisories

Since 1972, the Indiana Department of Natural Resources, the IDEM, and the Indiana State Department of Health (ISDH) have worked together to create the Indiana Fish Consumption Advisory. Each year members from these three agencies meet to discuss the findings of recent fish monitoring data and to develop the new statewide fish consumption advisory.

The 1998 advisory is based on levels of PCBs and mercury found in fish tissue. Fish are tested regularly only in areas where there is suspected contamination. In each area, samples were taken of bottom-feeding fish, top-feeding fish, and fish feeding in between. Over 1,600 fish tissue samples collected throughout the state were analyzed for PCBs, pesticides, and heavy metals. Of those samples, 99% contained mercury. Criteria for placing fish on the 1996 Indiana Fish Consumption Advisory have changed from using the Food and Drug Administration guidelines to using the Great Lakes Task Force risk-based approach.

The ISDH defines the Advisory Groups as follows:

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

Carp generally are contaminated with both PCBs and mercury. Except as otherwise noted, carp in all Indiana rivers and streams fall under the following risk groups:

Carp, 15-20 inches - Group 3
Carp, 20-25 inches - Group 4
Carp over 25 inches - Group 5

In the Eel-Big Walnut Watershed, the following waterbodies are under the 1998 fish consumption advisory:

Waterbody/County	Species	Size	Contaminant	Group
Big Walnut Creek- Putnam County:	Black Redhorse	11-14”	Mercury	Group 2
		14+”	Mercury	Group 3

	River Carpsucker	9-14"	Mercury	Group 2
		14+"	Mercury	Group 3
	Spotted Bass	9-12"	Mercury	Group 2
		12+"	Mercury	Group 3
Eel River -Greene County:	Bigmouth Buffalo	18-20"	Mercury	Group 2
		20+"	Mercury	Group 3
	Channel Catfish	18+"	Mercury and PCBs	Group 2
	Freshwater Drum	14-16"	Mercury	Group 2
		16+"	Mercury	Group 3
	Sauger	18+"	PCBs	Group 3

4.4 Clean Water Act Section 305(b) Report

Section 305(b) of the Clean Water Act requires states to prepare and submit to the EPA a water quality assessment report of state water resources. A new surface water monitoring strategy for the Office of Water Quality was implemented in 1996 with the goal of monitoring all waters of the state by 2001 and reporting the assessments by 2003. Each year approximately 20 percent of the waterbodies in the state will be assessed and reported the following year. The methodology of the Clean Water Act Section 305(b) assessment and use support ratings are discussed in Section 4.5.

The Eel-Big Walnut assessment was updated during the summer of 1996 as part of the five year, rotating basin, monitoring strategy. The results of the 1996 assessment are reported in the 1998 305(b) report, titled *Indiana Water Quality Report 1998* (IDEM, 1998). The 1998 305(b) report is the most current and comprehensive assessment of the Eel-Big Walnut watershed.

Appendix C contains the listing of the Eel-Big Walnut watershed waterbodies assessed, status of designated use support, probable causes of impairment, and stream miles affected. This assessment was based on data collected during the summer of 1996. From examination of Appendix C, it is readily apparent that the majority of water quality impairments are because of E. coli water quality standard violations

4.5 Clean Water Act Section 305(b) Assessment and Use-Support: Methodology

The Office of Water Quality determines use support status for each stream and waterbody in accordance with the assessment guidelines provided by EPA (1997). Results from four monitoring programs are integrated to provide an assessment for each stream and waterbody:

Physical/chemical water column results;
Benthic aquatic macroinvertebrate community assessments;
Fish tissue and surficial aquatic sediment contaminant results;
E. coli monitoring results.

The assessment process was applied to each data sampling program. Then the individual assessments were integrated into an overall assessment for each waterbody by use designation: aquatic life support, fish consumption, and recreational use. River miles in a watershed appear as one waterbody while each lake in a watershed is reported as a separate waterbody.

Physical/chemical data for toxicants (total recoverable metals), conventional water chemistry parameters (dissolved oxygen, pH, and temperature), and bacteria (E. coli) were evaluated for

exceedance of the Indiana Water Quality Standards (327 IAC 2-1-6). U.S. EPA 305(b) Guidelines were applied to sample results as indicated in Table 4-3 (U.S. EPA 1997b).

4.6 Summary of Other Monitoring Efforts in the watershed

Dr. James R. Gammon, Department of Biological Sciences, DePauw University conducted studies on the effects of animal feedlots and pastures on water chemistry and fish communities. These studies were conducted from 1993 to 1996 on the mainstems and tributaries of three stream systems within Putnam County. Fish communities, habitat, and water chemistry were determined at 140 different sites. The effect of animal feedlots was determined by comparing sites downstream of animal feedlots to reference sites.

The studies indicate that waters downstream from feedlots and pastures generally had elevated levels of ammonia, pH, turbidity, and conductivity. Additionally, waters downstream of feedlots usually contained fewer numbers of fish and fewer species of fish.

The nitrates and phosphates associated with animal wastes stimulate algal growth, especially in areas where the riparian canopy has been removed and sunlight penetrates to the bottom of the stream. The algal growth and decomposition consumes oxygen and leaves the water deficient in dissolved oxygen.

The combination of low dissolved oxygen, high nutrient content, high water temperatures, and high turbidity have negative impacts on fish communities downstream of animal feedlots and pastures.

These studies suggest that the negative impacts of animal feedlots could be reduced by: fencing animals out of the streams, establishing wetlands for additional waste treatment, and establishing riparian buffers along the streams.

TABLE 4-2
CRITERIA FOR USE SUPPORT ASSESSMENT*

Parameter	Fully Supporting	Partially Supporting	Not Supporting
Aquatic Life Use Support			
Toxicants	Metals were evaluated on a site by site basis and judged according to magnitude of exceedance and the number of times exceedances occurred.		
Conventional inorganics	There were very few water quality violations, almost all of which were due to natural conditions.		
Benthic aquatic macroinvertebrate Index of Biotic Integrity (mIBI)	mIBI $\geq$ 4.	mIBI $<$ 4 and $\geq$ 2.	mIBI $<$ 2.
Qualitative habitat use evaluation (QHEI)	QHEI $\geq$ 64.	QHEI $<$ 64 and $\geq$ 51.	QHEI $<$ 51.
Fish community (fIBI) (Lower White River only)	IBI $\geq$ 44.	IBI $<$ 44 and $\geq$ 22	IBI $<$ 22.
Sediment (PAHs = polynuclear aromatic hydrocarbons. AVS/SEM = acid volatile sulfide/ simultaneously extracted metals.)	All PAHs $\leq$ 75th percentile. All AVS/SEMs $\leq$ 75th percentile. All other parameters $\leq$ 95th percentile.	PAHs or AVS/SEMs $>$ 75th percentile. (Includes Grand Calumet River and Indiana Harbor Canal sediment results, and so is a conservative number.)	Parameters $>$ 95thpercentile as derived from IDEM Sediment Contaminants Database.
Indiana Trophic State Index (lakes only)	Nutrients, dissolved oxygen, turbidity, algal growth, and sometimes pH were evaluated on a lake-by-lake basis. Each parameter judged according to magnitude.		
Fish Consumption			
Fish tissue	No specific Advisory*	Limited Group 2 - 4 Advisory*	Group 5 Advisory*
* Indiana Fish Consumption Advisory, 1997, includes a state wide advisory for carp consumption. This was not included in individual waterbody reports because it obscures the magnitude of impairment caused by other parameters.			
Recreational Use Support (Swimmable)			
Bacteria (cfu = colony forming units.)	No more than one grab sample slightly $>$ 235 cfu/100ml, and geometric mean not exceeded.	No samples in this classification.	One or more grab sample exceeded 235 cfu/100ml, and geometric mean exceeded.

*From Indiana Water Quality Report for 1998

5 State and Federal Water Programs

This Chapter summarizes the existing point and nonpoint source pollution control programs available for addressing water quality problems in the Eel-Big Walnut watershed. Chapter 5 includes:

Section 5.1 Indiana Department of Environmental Management Water Quality Programs
Section 5.2 Indiana Department of Natural Resources Water Programs
Section 5.3 USDA/Natural Resources Conservation Service Water Programs

5.1 Indiana Department of Environmental Management Water Quality Programs

This Section describes the water quality programs managed by the Office of Water Quality within IDEM and includes:

Section 5.1.1 State and Federal Legislative Authorities for Indiana's Water Quality Program
Section 5.1.2 Indiana's Point Source Control Program
Section 5.1.3 Nonpoint Source Control Programs
Section 5.1.4 Integrating Point and Nonpoint Source Pollution Control Strategies
Section 5.1.5 Potential Sources of Funding for Water Quality Projects

5.1.1 State and Federal Legislative Authorities for Indiana's Water Quality Program

Authorities for some of the programs and responsibilities carried out by the Office of Water Quality are derived from a number of federal and state legislative mandates outlined below. The major federal authorities for the state's water quality program are found in sections of the Clean Water Act. State authorities are from state statutes.

Federal Authorities for Indiana's Water Quality Program

- The Clean Water Act Section 301 - Prohibits the discharge of pollutants into surface waters unless permitted by EPA.
- The Clean Water Act Section 303(c) - States are responsible for reviewing, establishing and revising water quality standards for all surface waters.
- The Clean Water Act Section 303(d) - Each state shall identify waters within its boundaries for which the effluent limits required by 301(b)(1) A and B are not stringent enough to protect any water quality standards applicable to such waters.
- The Clean Water Act Section 305(b) - Each state is required to submit a biennial report to the EPA describing the status of surface waters in that state.
- The Clean Water Act Section 319 - Each state is required to develop and implement a nonpoint source pollution management program.

- The Clean Water Act Section 402 - Establishes the National Pollutant Discharge Elimination System (NPDES) permitting program. Allows for delegation of permitting authority to qualifying states (which Indiana has received).

- The Clean Water Act Section 404/401 - Section 404 regulates the discharge of dredge and fill materials into navigable waters and adjoining wetlands. Section 401 requires the Corps to receive a state Water Quality Certification prior to issuance a 404 permit.

State Authorities for Indiana's Water Quality Program

IC 13-13-5 Designation of Department for Purposes of Federal Law: Designates the Indiana Department of Environmental Management as the water pollution agency for Indiana for all purposes of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) effective January 1, 1988, and the federal Safe Drinking Water Act (42 U.S.C. 300f through 300j) effective January 1, 1988.

5.1.2 Indiana's Point Source Control Program

The State of Indiana's efforts to control the direct discharge of pollutants to waters of the State were inaugurated by the passage of the Stream Pollution Control Law of 1943. The vehicle currently used to control direct discharges to waters of the State is the NPDES (National Pollutant Discharge Elimination System) permit program. This was made possible by the passage of the Federal Water Pollution Control Act Amendments of 1972 (also referred to as the Clean Water Act). These permits place limits on the amount of pollutants that may be discharged to waters of the State by each discharger. These limits are set at levels protective of both the aquatic life in the waters which receive the discharge and human health.

The State of Indiana was granted primacy from U.S. EPA to issue NPDES permits on January 1, 1975 through a Memorandum of Agreement.

U.S. EPA, Region V, has oversight authority for the NPDES permits program. Under terms of the Memorandum of Agreement, Region V has the right to comment on all draft Major discharger permits. In addition to NPDES, the Office of Water Quality Permits Section has a pretreatment group which regulates municipalities in their development of municipal pretreatment programs and indirect discharges, or those discharges of process wastewater to municipal sewage treatment plants through Industrial Waste Pretreatment permits and regulation of Stormwater, CSO's, and variance requests through a special projects group currently known as the Urban Wet Weather Group. Land Application of waste treatment plant sludge is no longer a part of the Office of Water Quality but is now a part of the Office of Solid and Hazardous Waste.

The purpose of the NPDES permit is to control the point source discharge of pollutants into the waters of the State such that the quality of the water of the State is maintained in accordance with the standards contained in 327 IAC 2. The NPDES permit requirements must ensure that the minimum amount of control is imposed upon any new or existing point source through the application of technology-based treatment requirement contained in 327 IAC 5-5-2. According to 327 IAC 5-2-2, "Any discharge of pollutants into waters of the State as a point source discharge, except for exclusions made in 327 IAC 5-2-4 is prohibited unless in conformity with a valid NPDES permit obtained prior to discharge." This is the most basic principal of the NPDES permit program.

The majority of NPDES permits have existed since 1974. This means that most of the permit writing is for permit renewals. Approximately 10% of each year's workload is attributed to new permits, modifications and requests for estimated limits. NPDES permits are designed to be re-issued every five

years but are administratively extended in full force and effect indefinitely if the permittee applied for a renewal before the current permit expires.

There are several different types of permits that are issued in the NPDES permitting program. Table 5-1 lists and describes the various permits.

TABLE 5-1
TYPES OF PERMITS ISSUED UNDER THE NPDES PROGRAM

Type of Permit	Subtype	Comment
Municipal, Semi-Public or State (sanitary discharger)	Major	A facility owned by a municipality with a design flow Municipal of 1 MGD or greater (Cities, Towns, Regional Sewer Districts)
	Minor	Any municipally owned facility with a design flow of less than 1 MGD (Cities, Towns, Regional Sewer Districts)
	Semipublic	Any facility not municipally, State or Federally owned (i.e.- mobile home parks, schools, restaurants, etc.)
	State Owned	A facility owned or managed by a State agency (State parks, prisons, etc.)
	Federally	A facility owned by a federal agency (military Owned installation, national park, federal penitentiary, etc.)
Industrial (Wastewater generated in the process of producing a product)	Majors	Any point source discharger designated annually by agreement between the commissioner and EPA. Classification of discharger as a major involves consideration of factors relating to significance of impact on the environment, such as: Nature and quantity of pollutants discharged; Character and assimilative capacity of receiving waters; Presence of toxic pollutants in discharge; Compliance history of discharger.
	Minors	All dischargers which are not designated as major dischargers.
	Generals	General permit rule provides streamlined NPDES permitting process for certain categories of industrial point source discharges under requirements of the applicable general permit rule, rather than requirements of an individual permit specific to a single discharge. General permit rules: 327 IAC 15-7 Coal mining, coal processing, and reclamation activities; 327 IAC 15-8 Non-contact cooling water; 327 IAC 15-9 Petroleum product terminals; 327 IAC 15-10 Groundwater petroleum remediation systems; 327 IAC 15-11 Hydrostatic testing of commercial pipelines; 327 IAC 15-12 Sand, gravel, dimension stone or crushed stone operations.
	Cooling Water	Water which is used to remove heat from a product or process; the water may or may not come in contact with the product.
	Public Water Supply	Wastewater generated from the process of removing pollutants from ground or surface water for the purpose of producing drinking water.
Pretreatment Urban Wet Weather Group (Associated with NPDES but do not fall under same rule.)	Stormwater-related	Wastewater resulting from precipitation coming in contact with a substance which is dissolved or suspended in the water.
	Industrial Wastewater Pre-treatment	Processed wastewater generated by Industries that contribute to the overall wastewater received by the plant.
	Combined Sewer Overflows (CSOs)	Wastewater discharged from combined storm and sanitary sewers due to precipitation events. Municipal and Industrial Urban Wet Weather Programs

5.1.3 Nonpoint Source Control Programs

Nonpoint source (NPS) pollution is so named because the pollutants do not originate at single point sources, such as industrial and municipal waste discharge pipes. Instead, NPS pollutants are carried over fields, lawns, and streets by rainwater, wind, or snowmelt. This runoff may carry with it such things as fertilizer, road salt, sediment, motor oil, or pesticides. These pollutants either enter lakes and streams or seep into groundwater. While some NPS pollution is naturally occurring, most of it is a result of human activities.

Reducing NPS pollution requires careful attention to land use management and local geographic and economic conditions. The NPS Program was established to fully integrate methods for coping with the state's varied NPS water pollution problems. While a number of agencies and organizations currently have their own programs for addressing specific NPS issues, overall NPS coordination is being aided through the consolidated NPS Management Plan that was developed in the early stages of the Program's formation. Approximately 120 NPS-related projects have been funded and managed by the NPS Program since 1990. The NPS Management Plan was prepared in 1989, partially based on findings from the NPS Assessment Report, which was also completed that year. Some of the objectives of the Management Plan included the education of land users, the reduction and remediation of NPS pollution caused by erosion and sedimentation of forested and agricultural lands, and urban runoff. Other objectives addressed pesticide and fertilizer use, land application of sludge, animal waste practices, past and present mining practices, on-site sewage disposal, and atmospheric deposition. All of these objectives are being re-examined in an update and revision of the Management Plan.

The state's NPS Program, administered by the IDEM Office of Water Quality's Watershed Management Section, focuses on the assessment and prevention of NPS water pollution. The program also provides for the exchange of education and information in order to improve the way land is managed. Through the use of federal funding for the installation of best management practices (BMPs), the NPS Program effectively reaches out to citizens and assist in the development of BMPs to manage land in such a way that less pollution is generated. The NPS program promotes a non-regulatory, voluntary approach to solving water quality problems.

The many nonpoint source projects funded through the Office of Water Quality are a combination of local, regional, and statewide efforts sponsored by various public and not-for-profit organizations. The emphasis of these projects has been on the local, voluntary implementation of NPS water pollution controls. Since the inception of the program in the late 1980s, it has utilized over $8 million of federal funds for the development of over 120 projects.

The federal Clean Water Act contains nonpoint source provisions in several sections of the Act including the Section 319 Nonpoint Source Program, the Section 314 Clean Lakes Program (no longer funded), the Section 104(b)(3) Watershed Management Program, and the Section 205(j) Water Quality Planning Program. The Section 319 program provides for various voluntary projects throughout the state to prevent water pollution and also provides for assessment and management plans related to water bodies in Indiana impacted by NPS pollution. Section 314 has assessment provisions that assist in determining the nonpoint and point source water quality impacts on lakes and provides recommendations for improvements, but no longer receives funding. Section 104(b)(3) provides assistance in the development of watershed management planning efforts and education/information and implementation projects. Section 604(b) provides for planning activities relating to the improvement of water quality from nonpoint and point sources. The Watershed Management Section within the Planning Branch of the Office of Water Quality provides for the administration of the Section 319 funding source for the NPS-related projects. The Financial

Management Services Branch of the Office of Water Quality administers the Section 104(b)(3) and Section 604(b) grants.

Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies and organizations in the state that deal with NPS problems submit proposals to the Office of Water Quality each year for use of these funds in various projects.

One of the most important aspects of all NPS pollution prevention programs is the emphasis on the watershed approach to these programs. This calls for users in the watershed to become involved in the planning and implementation of practices, which are designed to prevent pollution. By looking at the watershed as a whole, all situations causing the degradation of water quality will be addressed, not just a few. Appendix C lists the conservation partners and local stakeholders located in the Eel-Big Walnut watershed.

5.1.4 Integrating Point and Nonpoint Source Pollution Control Strategies

Integrating point and nonpoint source pollution controls and determining the amount and location of the remaining assimilative capacity in a watershed are key long-term objectives of watershed management. The information is used for a number of purposes including: determining if and where new or expanded municipal or industrial wastewater treatment facilities can be allowed; setting the recommended treatment level at these facilities; and identifying where point and nonpoint source pollution controls must be implemented to restore capacity and maintain water quality standards.

Total Maximum Daily Loads

The Clean Water Act mandates an integrated point and nonpoint source pollution control approach. This approach, called a total maximum daily load (TMDL), uses the concept of determining the total pollutant loading from point and nonpoint sources that a waterbody can assimilate while still maintaining its designated use (maintaining water quality standards). EPA is responsible for ensuring that TMDLs are completed by States and for approving the completed TMDLs.

Under the TMDL approach, waterbodies that do not meet water quality standards are identified. States establish priorities for action, and then determine reductions in pollutant loads or other actions needed to meet water quality goals. The approach is flexible and promotes a watershed approach driven by local needs and directed by the State's list of priority waterbodies. The overall goal in establishing the TMDL is to establish the management actions on point and nonpoint sources of pollution necessary for a waterbody to meet water quality standards.

The Office of Water Quality at IDEM is in the process of reorganizing its work activities around a five year rotating basin schedule. The waters of the state have been grouped geographically into six major river basins, and water quality data and other information will be collected and analyzed from each basin, or group of basins, once every five years. The schedule for implementing the TMDL Strategy is proposed to follow this rotating basin plan to the extent possible. The TMDL Strategy discusses activities to be accomplished in three phases. Phase One involves planning, sampling and data collection and would take place the first year. Phase Two involves TMDL development and would occur in the second year, and Phase Three is the TMDL implementation and would occur the third year. It is expected that some phases, especially implementation of TMDLs (Phase Three) in the basin(s), may take more than one year to fully accomplish.

Initially, as part of the TMDL Strategy in a watershed, the IDEM TMDL Program Manager, in coordination with the IDEM Basin Coordinator of the target basin, will develop an activity reference

guide for each TMDL. This activity reference guide will provide: (1) a list of the necessary activities and tasks, (2) a schedule for completing activities and tasks associated with an individual TMDL, and (3) a roster that indicates which Section, staff, and /or contractor are responsible for completion of each activity/task.

In Phase Three, the TMDL scenario chosen in conjunction with watershed stakeholders during Phase Two will be used to develop a plan to implement the TMDL. During this process, stakeholder participation will be essential. The Basin Coordinator, in conjunction with the stakeholder groups, will develop a plan to implement the TMDL. Once the draft plan has been finalized through comments from stakeholder groups and IDEM, the plan becomes 'draft-final' and open public review. Public meetings will be held in areas affected to solicit comments.

5.1.5 Potential Sources of Funding for Water Quality Projects

There are numerous sources of funding for all types of water quality projects. The sources of funding include federal and state agencies, nonprofits, and private funding. Funds may be loans, cost-share projects, or grants. Section 319(h) grants and other funding sources are discussed below.

If a local government, environmental group, university researcher, or other individual or agency wants to find funding to address a local water quality problem, it is well worth the time to prepare a thorough but concise proposal and submit it to applicable funding agencies. Even if a project is not funded, persistence may be beneficial when funding agencies observe several consecutive proposals from the same group.

Section 319(h) Grants

EPA offers to the state Clean Water Act Section 319(h) grant moneys on an annual basis. These grants must be used to fund projects that address nonpoint source pollution issues. Some projects which the Office of Water Quality has funded with this money in the past include best management practice (BMP) demonstrations, watershed water quality improvements, data management, educational programs, modeling, stream restoration, and riparian buffer establishment. Agencies, environmental groups, university researchers, and others in the state that have expertise in nonpoint source pollution problems are invited to submit Section 319(h) proposals to the Office of Water Quality.

Office of Water Quality staff review proposals for minimum 319 eligibility criteria such as:

- Does it support the state NPS Management Program milestones?
- Does the project address targeted, high priority watersheds?
- Is there sufficient nonfederal cost-share match available (25% of project costs)?
- Are measurable outputs identified?
- Is monitoring required? Is there a Quality Assurance/Quality Control plan for monitoring?
- If a Geographical Information System is used, is it compatible with that of the state?
- Is there a commitment for educational activities and a final report?

Office of Water Quality staff separately review and rank each proposal which meets the minimum 319 eligibility criteria. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; degree of balance lent to the statewide NPS Program in terms of project type; and competence/reliability of contracting agency. They then convene to discuss individual projects merits, to pool all rankings and to arrive at final rankings for the projects. The Office of Water Quality seeks a balance between geographic regions of the state and types of projects. All

proposals that rank above the funding target are included in the annual grant application to EPA, with the Office of Water Quality reserving the right to make final changes to the list. Actual funding depends on approval from EPA and yearly congressional appropriations. There have been four 319 grants awarded within the watershed to address nonpoint source pollution. These grants are currently active in 1999. Figure 5-1 shows the relative location grant areas.

To obtain more information about applying for a Section 319(h) grant, contact:

Susan McLoud, Watershed Management Section Chief
IDEM Office of Water Quality
100 N. Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 232-0019

Other Sources of Funding

Besides Section 319(h) funding, there are numerous sources of funding for all types of water quality projects. The sources of funding include federal and state agencies, nonprofit, and private funding. Funds may be loans, cost-shares, or grants. Appendix D provides a summary list of agencies and funding opportunities.

5.2 Indiana Department of Natural Resources Water Programs

5.2.1 Division of Soil Conservation

The Division of Soil Conservation's mission is to ensure the protection, wise use, and enhancement of Indiana's soil and water resources. The Division's employees are part of Indiana's Conservation Partnership, which includes the 92 soil and water conservation districts (SWCDs), the USDA Natural Resources Conservation Service, and the Purdue University Cooperative Extension Service. Working together, the partnership provides technical, educational, and financial assistance to citizens to solve erosion and sediment-related problems occurring on the land or impacting public waters.

The Division administers the T-by-2000 soil conservation and water quality program under guidelines established by the State Soil Conservation Board, primarily through the SWCDs in direct service to landusers. The Division staff includes field-based resource specialists who work closely with landusers, assisting in the selection, design, and installation of practices to reduce soil erosion and sediment on their land. Regional urban conservation specialists work primarily with developers, contractors, and others to address erosion and sediment concerns in urban settings, developments under construction, and in landfills. The Lake and River Enhancement staff (LARE) oversee all administrative, operational, and technical aspects of the LARE program, which provides financial assistance to local entities concerned with improving and maintaining water quality in public-access lakes, rivers, and streams. There have been four LARE projects within the watershed to address soil and water conservation. Figure 5-1 shows the relative location of LARE projects.

5.2.2 Division of Water

The IDNR, Division of Water (DOW) is charged by the State of Indiana to maintain, regulate, collect data, and evaluate Indiana's surface and ground water resources.

The Engineering Branch of the DOW includes Dam and Levee Safety, Project Development, Surveying, Drafting, and Computer Services. The Dam and Levee Safety Section performs geotechnical and hydraulic evaluation on existing and proposed dams and levees throughout the State. The Project Development Section provides technical support to locally funded water resource projects along with engineering leadership and construction management to State funded water resource projects. The remaining sections provide support services to all Sections within the DOW such as reservoir depth mapping, topographic mapping, highwater marks, design of publications and brochures, and computer procurement and maintenance.

The Planning Branch of the DOW consists of Basin Studies, Coastal Coordination, Floodplain Management, Ground Water, Hydrology and Hydraulics, and Water Rights. Basin Studies are comprehensive reports on surface-and ground-water availability and use. Coastal Coordination is a communication vehicle to address Lake Michigan's diverse shoreline issues. Floodplain Management involves various floodplain management aspects including coordination with the National Flood Insurance Program and with State and Federal Emergency Management agencies during major flooding events. The Ground Water Section maintains the water-well record computer database and publishes reports and maps on the ground-water resource for the State. Hydrology and Hydraulics Section develops and reviews floodplain mapping and performs hydrologic studies and modeling. The Water Rights Section investigates and mediates groundwater/surface water rights issues, licenses water-well drillers, and develops well construction and abandonment procedures.

The Regulations Branch of DOW is made up of Stream Permits, Lake Permits, Permit Administration, Public Assistance, and Legal Counsel. The Stream Permits Section is responsible for reviewing permit applications for construction activity in the 100-year regulatory floodway along Indiana's waterways. The Lake Permits Section reviews construction projects at or below the legal lake level for all of Indiana's public freshwater lakes. Permit Administration Section provides administrative support to Branch staff, maintains the application database, and coordinates the application review process with other Divisions. The Public Assistance Section provides technical assistance on possible permit applications on proposed construction projects, investigates and mediates unpermitted construction activities and in some cases with the support of Legal Counsel pursues legal action for violation of State laws.

5.3 USDA/Natural Resources Conservation Service Water Quality Programs

While there are a variety of USDA programs available to assist people with their conservation needs. The following assistance programs are the principal programs available.

Conservation Technical Assistance (CTA)

The purpose of the program is to assist land-users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. The purpose of the conservation systems are to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

Objectives of the program are to: Assist individual landusers, communities, conservation districts, and other units of State and local government and Federal agencies to meet their goals for resource stewardship and assist individuals to comply with State and local requirements. NRCS assistance to individuals is provided through conservation districts in accordance with the Memorandum of Understanding signed by the Secretary of Agriculture, the Governor of the State, and the conservation district. Assistance is provided to land users voluntarily applying conservation and to those who must comply with local or State laws and regulations. Assistance is also provided to agricultural producers to comply with the highly erodible land (HEL) and wetland (Swampbuster) provisions of the 1985 Food Security Act as amended by the Food, Agriculture, Conservation and Trade Act of 1990 (16 U.S.C. 3801 et. seq.) and the Federal Agriculture Improvement and Reform Act of 1996, and wetlands requirements of Section 404 of the Clean Water Act. NRCS makes HEL and wetland determinations and helps land users develop and implement conservation plans to comply with the law. They also provide technical assistance to participants in USDA cost-share and conservation incentive programs. The Agency collects, analyzes, interprets, displays, and disseminates information about the condition and trends of the Nation's soil and other natural resources so that people can make good decisions about resource use and about public policies for resource conservation. They also develop effective science-based technologies for natural resource assessment, management, and conservation.

Conservation of Private Grazing Land Initiative (CPGL)

The Conservation of Private Grazing Land initiative will ensure that technical, educational, and related assistance is provided to those who own private grazing lands. It is not a cost share program. This technical assistance will offer opportunities for: better grazing land management; protecting soil from erosive wind and water; using more energy-efficient ways to produce food and fiber; conserving water; providing habitat for wildlife; sustaining forage and grazing plants; using plants to sequester greenhouse gases and increase soil organic matter; and using grazing lands as a source of biomass energy and raw materials for industrial products.

Conservation Reserve Program (CRP)

NRCS provides technical assistance to landowners interested in participating in the Conservation Reserve Program administered by the USDA Farm Service Agency. The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other

environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost-share funding is provided to establish the vegetative cover practices.

Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation. The purposes of the program are achieved through the implementation of a conservation plan, which includes structural, vegetative, and land management practices on eligible land. Five to ten year contracts are made with eligible producers. Cost-share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management, and grazing land management.

Fifty percent of the funding available for the program is targeted at natural resource concerns relating to livestock production. The program is carried-out primarily in priority areas that may be watersheds, regions, or multi-state areas, and for significant statewide natural resource concerns that are outside of geographic priority areas. There have been two EQIP priority areas within the watershed. The EQIP areas are shown in Figure 5-1.

Watershed Surveys and Planning

The Watershed and Flood Prevention Act, P.L. 83-566, August 4, 1954, (16 U.S.C. 1001-1008) authorized this program. Prior to fiscal year 1996, small watershed planning activities and the cooperative river basin surveys and investigations authorized by Section 6 of the Act were operated as separate programs. The 1996 appropriations act combined the activities into a single program entitled the Watershed Surveys and Planning program. Activities under both programs are continuing under this authority.

The purpose of the program is to assist Federal, State, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries.

Types of surveys and plans include watershed plans, river basin surveys and studies, flood hazard analyses, and flood plain management assistance. The focus of these plans is to identify solutions that use land treatment and nonstructural measures to solve resource problems. One small watershed project has been completed in the Little Walnut Creek watershed, under (PL-566), to address erosion control, flooding, and recreation. Figure 5-2 shows the location of PL-566 projects in the watershed.

Watershed Program and Flood Prevention Program (WF 08 or FP 03)

The Small Watershed Program works through local government sponsors and helps participants solve natural resource and related economic problems on a watershed basis. Projects include watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife

habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres. Both technical and financial assistance are available.

Wetlands Reserve Program (WRP)

The Wetlands Reserve Program is a voluntary program to restore wetlands. Participating landowners can establish conservation easements of either permanent or 30 year duration, or can enter into restoration cost-share agreements where no easement is involved. In exchange for establishing a permanent easement, the landowner receives payment up to the agricultural value of the land and 100 percent of the restoration costs for restoring the wetlands. The 30 year easement payment is 75 percent of what would be provided for a permanent easement on the same site and 75 percent of the restoration cost. The voluntary agreements are for a minimum 10 year duration and provide for 75 percent of the cost of restoring the involved wetlands. Easements and restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the easement or agreement. In all instances, landowners continue to control access to their land.

Wildlife Habitat Incentives Program (WHIP)

The Wildlife Habitat Incentives Program provides financial incentives to develop habitat for fish and wildlife on private lands. Participants agree to implement a wildlife habitat development plan and USDA agrees to provide cost-share assistance for the initial implementation of wildlife habitat development practices. USDA and program participants enter into a cost-share agreement for wildlife habitat development. This agreement generally lasts a minimum of 10 years from the date that the contract is signed.

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APPENDIX A

BENCHMARK CHARACTERISTIC ANALYSIS OF DATA FROM FIXED STATIONS IN THE EEL/ BIG WALNUT WATERSHED 1991 TO 1997

Station: EEL-1

	Valid N	Mean	Confid. -95.000%	Confid. +95.000%	Median	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Variance	Std.Dev.	Standard Error	Skewness	Std.Err. Skewness	Kurtosis	Std.Err. Kurtosis
Alkalinity (mg/l)	20	166.2	151.7735	180.6265	156	3324	125	212	141	203.5	87	62.5	950.1684	30.8248	6.892635	0.386273	0.512103	-1.4757	0.992384
Ammonia (mg/l as N)	21	0.188095	0.011373	0.364818	0.05	3.95	0.05	1.8	0.05	0.1	1.75	0.05	0.150726	0.388235	0.08472	3.948574	0.501195	16.60755	0.971941
BOD (mg/l)	18	1.288889	0.888547	1.689231	1.1	23.2	0.5	3	0.5	2.1	2.5	1.6	0.648105	0.805049	0.189752	0.798964	0.536278	-0.48226	1.037795
COD (mg/l)	21	15.77143	13.19501	18.34785	14.5	331.2	6.9	31	12	19.2	24.1	7.2	32.03614	5.660048	1.235124	0.958067	0.501195	1.319522	0.971941
Cyanide (mg/l)	20	0.00535	0.004719	0.005981	0.005	0.107	0.005	0.011	0.005	0.005	0.006	0	1.82E-06	0.001348	0.000302	4.289522	0.512103	18.73335	0.992384
Nitrate (mg/l as N)	21	1.971429	1.199187	2.74367	1.6	41.4	0.1	7.5	0.7	2.7	7.4	2	2.878143	1.696509	0.370209	1.752927	0.501195	4.59415	0.971941
Total Phosphorus (mg/l as P)	21	0.181429	0.055657	0.3072	0.12	3.81	0.03	1.36	0.07	0.16	1.33	0.09	0.076343	0.276302	0.060294	4.248512	0.501195	18.87398	0.971941
Total Solids (mg/l)	20	355	325.9748	384.0252	333.5	7100	274	500	321.5	387	226	65.5	3846.211	62.01782	13.86761	1.215672	0.512103	1.303178	0.992384
Suspended Solids (mg/l)	20	55.3	31.86034	78.73966	51	1106	2	210	24	59	208	35	2508.326	50.08319	11.19894	1.849716	0.512103	4.072329	0.992384
Dissolved Solids (mg/l)	7	260.4286	224.2575	296.5996	243	1823	223	334	233	286	111	53	1529.619	39.11034	14.78232	1.257618	0.793725	1.123241	1.587451
Sulfate (mg/l)	7	64.71429	-2.52379	131.9524	35	453	27	227	30	65	200	35	5285.571	72.70194	27.47875	2.485622	0.793725	6.288917	1.587451
TKN (mg/l as N)	7	0.642857	0.458992	0.826722	0.7	4.5	0.3	0.9	0.5	0.8	0.6	0.3	0.039524	0.198806	0.075142	-0.65451	0.793725	0.34812	1.587451
E. coli (CFU/100ml)	20	428	69.29271	786.7073	195	8560	10	3400	50	350	3390	300	587437.9	766.445	171.3823	3.429066	0.512103	12.92842	0.992384
TOC (mg/l)	7	3.2	2.588855	3.811145	3.2	22.4	2.1	4.1	2.7	3.7	2	1	0.436667	0.660808	0.249762	-0.46577	0.793725	0.114993	1.587451
Hardness (mg/l)	20	223.95	200.89	247.01	222	4479	122	300	181.5	269	178	87.5	2427.734	49.27204	11.01756	-0.19681	0.512103	-0.83317	0.992384
Chloride (mg/l)	7	16.28571	13.74089	18.83054	15	114	13	21	15	19	8	4	7.571429	2.751623	1.040016	0.92844	0.793725	0.078248	1.587451
Dissolved Oxygen (mg/l)	17	10.05706	9.006878	11.10724	10.4	170.97	6.33	12.64	7.97	11.66	6.31	3.69	4.171997	2.042547	0.49539	-0.45983	0.549747	-1.11237	1.063198
pH	17	7.977647	7.864672	8.090622	8	135.62	7.6	8.35	7.87	8.04	0.75	0.17	0.048282	0.219731	0.053293	0.044435	0.549747	-0.57524	1.063198
Copper (ug/l)	9	4.722222	2.069544	7.3749	2	42.5	2	10	2	8	8	6	11.90944	3.451006	1.150335	0.647455	0.717137	-1.67556	1.399708
Iron (ug/l)	8	1876.25	686.5803	3065.92	1600	15010	230	4500	940	2600	4270	1660	2024970	1423.014	503.1115	1.069023	0.752101	0.390549	1.48088
Zinc (ug/l)	9	104.4056	-113.425	322.2359	10	939.65	2.25	860	7.9	17	857.75	9.1	80308.07	283.3868	94.46226	2.998414	0.717137	8.992945	1.399708

Station: MC-18

	Valid N	Mean	Confid. -95.000%	Confid. +95.000%	Median	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Variance	Std.Dev.	Standard Error	Skewness	Std.Err. Skewness	Kurtosis	Std.Err. Kurtosis
Alkalinity (mg/l)	20	216.45	198.9079	233.9921	215.5	4329	116	291	207.5	234	175	26.5	1404.892	37.48189	8.381205	-0.69465	0.512103	2.067518	0.992384
Ammonia (mg/l as N)	20	0.065	0.043392	0.086608	0.05	1.3	0.05	0.2	0.05	0.05	0.15	0	0.002132	0.046169	0.010324	2.887939	0.512103	7.037037	0.992384
BOD (mg/l)	19	1.042105	0.628635	1.455576	0.5	19.8	0.5	3.4	0.5	1.7	2.9	1.2	0.735906	0.85785	0.196804	1.554543	0.523767	1.776239	1.01427
COD (mg/l)	19	11.32105	8.00809	14.63402	9	215.1	2.5	30.1	7	14	27.6	7	47.2462	6.873587	1.576909	1.682902	0.523767	2.71504	1.01427
Cyanide (mg/l)	0																		
Nitrate (mg/l as N)	20	2.5875	1.767196	3.407804	2.55	51.75	0.05	5.4	0.95	4.1	5.35	3.15	3.072072	1.752733	0.391923	-0.16277	0.512103	-1.35025	0.992384
Total Phosphorus (mg/l as P)	20	0.097	0.037034	0.156966	0.055	1.94	0.015	0.56	0.035	0.1	0.545	0.065	0.016417	0.128128	0.02865	2.941055	0.512103	9.396956	0.992384
Total Solids (mg/l)	20	380	337.2708	422.7292	355.5	7600	302	709	333	389.5	407	56.5	8335.474	91.29882	20.41504	2.891059	0.512103	9.272913	0.992384
Suspended Solids (mg/l)	20	18.35	3.213305	33.4867	9.5	367	2	150	5	17	148	12	1046.029	32.34237	7.231974	3.913066	0.512103	16.3304	0.992384
Dissolved Solids (mg/l)	19	338.8947	312.7983	364.9912	331	6439	244	468	305	354	224	49	2931.544	54.14373	12.42142	0.703954	0.523767	0.885653	1.01427
Sulfate (mg/l)	7	30	24.27392	35.72608	31	210	18	38	28	34	20	6	38.33333	6.191392	2.340126	-1.13847	0.793725	2.573172	1.587451
TKN (mg/l as N)	7	0.514286	0.146556	0.882015	0.4	3.6	0.3	1.4	0.3	0.5	1.1	0.2	0.158095	0.397612	0.150283	2.458503	0.793725	6.215104	1.587451
E. coli (CFU/100ml)	20	545.5	-355.026	1446.026	100	10910	5	8700	55	130	8695	75	3702318	1924.141	430.251	4.436477	0.512103	19.76854	0.992384
TOC (mg/l)	6	3.416667	0.696691	6.136642	2.5	20.5	1.8	8.6	2	3.1	6.8	1.1	6.717667	2.591846	1.058117	2.235455	0.845154	5.163217	1.740777
Hardness (mg/l)	20	272.95	251.0221	294.8779	275	5459	172	359	255.5	303	187	47.5	2195.208	46.85305	10.47666	-0.45092	0.512103	0.360151	0.992384
Chloride (mg/l)	7	22.14286	16.95414	27.33158	22	155	14	32	18	24	18	6	31.47619	5.610365	2.120518	0.473082	0.793725	1.268408	1.587451
Dissolved Oxygen (mg/l)	16	10.7725	9.575437	11.96956	10.51	172.36	7.18	14.6	8.825	12.41	7.42	3.585	5.04666	2.246477	0.561619	0.283712	0.564308	-0.80879	1.090774
pH	16	8.038125	7.903641	8.172609	8.03	128.61	7.48	8.5	7.895	8.22	1.02	0.325	0.063696	0.252381	0.063095	-0.26847	0.564308	0.320418	1.090774
Copper (ug/l)	7	2.785714	0.863141	4.708288	2	19.5	2	7.5	2	2	5.5	0	4.321429	2.078805	0.785714	2.645751	0.793725	7	1.587451
Iron (ug/l)	7	1074.286	-273.42	2421.991	410	7520	290	4300	310	1200	4010	890	2123495	1457.222	550.7781	2.407072	0.793725	5.927621	1.587451
Zinc (ug/l)	7	11.5	-0.64636	23.64636	5.9	80.5	2.25	37	2.25	22	34.75	19.75	172.4858	13.13339	4.963953	1.600563	0.793725	1.711074	1.587451

itation: MC-35

	Valid N	Mean	Confid -95.000%	Confid +95.000%	Median	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Variance	Std.Dev.	Standard Error	Skewness	Std.Err. Skewness	Kurtosis	Std.Err. Kurtosis
Alkalinity (mg/l)	21	233.1429	215.1449	251.1408	236	4896	104	289	224	249	185	25	1563.329	39.53895	8.628106	-1.71883	0.501195	5.13035	0.971941
Ammonia (mg/l as N)	21	0.064286	0.039206	0.089366	0.05	1.35	0.05	0.3	0.05	0.05	0.25	0	0.003036	0.055097	0.012023	4.3239	0.501195	19.13495	0.971941
BOD (mg/l)	19	1.147368	0.396309	1.898428	0.5	21.8	0.5	7.3	0.5	1.3	6.8	0.8	2.428187	1.558264	0.35749	3.776238	0.523767	15.32136	1.01427
COD (mg/l)	20	10.81	3.6558	17.9642	6.85	216.2	2.5	71.7	3.75	9.6	69.2	5.85	233.6704	15.28628	3.418117	3.674755	0.512103	14.71916	0.992384
Cyanide (mg/l)	0																		
Nitrate (mg/l as N)	21	2.171429	1.536943	2.805914	2.7	45.6	0.05	4.1	0.7	3	4.05	2.3	1.942893	1.393877	0.304169	-0.29855	0.501195	-1.40525	0.971941
Total Phosphorus (mg/l as P)	21	0.068333	-0.01078	0.147445	0.015	1.435	0.015	0.82	0.015	0.04	0.805	0.025	0.030206	0.173798	0.037926	4.451853	0.501195	20.13079	0.971941
Total Solids (mg/l)	21	415.381	351.0198	479.7421	384	8723	337	1006	350	419	669	69	19991.85	141.3925	30.85438	3.985914	0.501195	17.09578	0.971941
Suspended Solids (mg/l)	21	41.2381	-34.9909	117.4671	4	866	2	772	2	6	770	4	28044.39	167.4646	36.54377	4.580222	0.501195	20.98489	0.971941
Dissolved Solids (mg/l)	20	361.45	338.5203	384.3797	360.5	7229	230	447	338.5	384.5	217	46	2400.366	48.99353	10.95529	-0.53362	0.512103	1.808152	0.992384
Sulfate (mg/l)	7	36.85714	26.03963	47.67466	39	258	15	52	32	44	37	12	136.8095	11.69656	4.420884	-0.96197	0.793725	1.699881	1.587451
TKN (mg/l as N)	7	1.042857	-0.26601	2.35172	0.3	7.3	0.2	3.8	0.2	2.2	3.6	2	2.002857	1.415223	0.534904	1.653086	0.793725	1.754976	1.587451
E. coli (CFU/100ml)	21	1525.238	-1030.65	4081.13	220	32030	40	26000	100	460	25960	360	3.2E+07	5614.944	1225.281	4.56365	0.501195	20.87757	0.971941
TOC (mg/l)	6	3.116667	0.471409	5.761925	2.3	18.7	1.4	8.2	2	2.5	6.8	0.5	6.353667	2.520648	1.02905	2.313977	0.845154	5.525142	1.740777
Hardness (mg/l)	21	288.2857	263.8629	312.7086	298	6054	164	372	256	324	208	68	2878.714	53.65365	11.70819	-0.82801	0.501195	0.293534	0.971941
Chloride (mg/l)	7	21.57143	14.49052	28.65233	23	151	10	35	17	24	25	7	58.61905	7.656308	2.893812	0.405394	0.793725	1.52218	1.587451
Dissolved Oxygen (mg/l)	17	10.97235	10.07698	11.86772	11.1	186.53	8.05	13.64	9.72	12.52	5.59	2.8	3.032644	1.741449	0.422363	-0.25036	0.549747	-1.0727	1.063198
pH	17	7.982941	7.827993	8.13789	8.05	135.71	7.2	8.33	7.92	8.19	1.13	0.27	0.090822	0.301367	0.073092	-1.79025	0.549747	3.043653	1.063198
Copper (ug/l)	8	4.4	1.049056	7.750944	2	35.2	2	13	2	6.1	11	4.1	16.06571	4.008206	1.417115	1.765168	0.752101	2.709237	1.48088
Iron (ug/l)	8	2250.875	-2731.7	7233.453	140	18007	67	17000	110	220	16933	110	3.6E+07	5959.873	2107.133	2.82781	0.752101	7.997368	1.48088
Zinc (ug/l)	12	10.2125	-2.08073	22.50573	5	122.55	2.25	71	2.25	7.65	68.75	5.4	374.351	19.34815	5.58533	3.336882	0.637302	11.34525	1.232246

APPENDIX B

EEL/ BIG WALNUT WATERS ASSESSED IN THE CLEAN WATER ACT SECTION 305(B) REPORT 1996 TO 1998

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203010** Segment Number: 00
Waterbody Name: Big Walnut Creek Basin (headwaters to Putnam Co line)
Waterbody Type: River Size: 71.60 Miles
Basin: WHITE RIVER

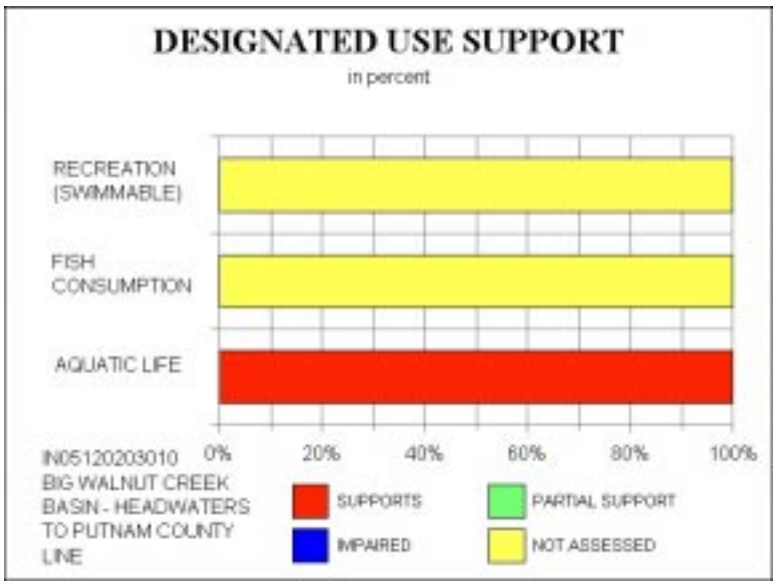
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	71.60	0.00	0.00	0.00	0.00	0.00
FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	71.60
SWIMMABLE	0.00	0.00	0.00	0.00	0.00	71.60



---------- Nonattainment Causes ----------

Cause Size Mag

No causes listed

---------- Nonattainment Sources ----------

Source Size Mag

No sources listed

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203020** Segment Number: 00
Waterbody Name: Big Walnut Creek (Putnam Co line to Eel R)
Waterbody Type: River Size: 103.60 Miles
Basin: WHITE RIVER

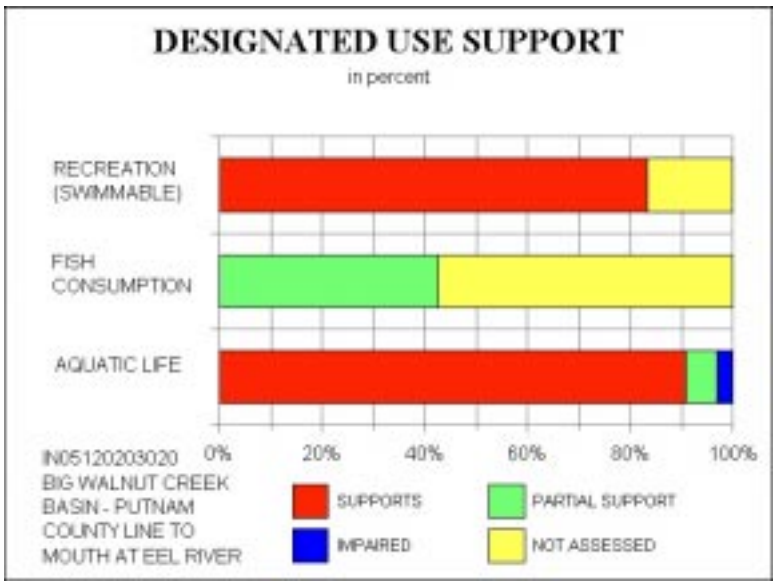
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	94.20	0.00	6.20	3.20	0.00	0.00
FISH CONSUMPTION	0.00	0.00	44.10	0.00	0.00	59.50
SWIMMABLE	86.40	0.00	0.00	0.00	0.00	17.20



---------- Nonattainment Causes ----------

Cause	Size	Mag
0500-METALS	44.10	M
0560-Mercury	44.10	M

---------- Nonattainment Sources ----------

Source	Size	Mag
9000-SOURCE UNKNOWN	44.10	M

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203030** Segment Number: 00
Waterbody Name: Little Walnut Creek Basin (incl. Glenn Flint Lake)
Waterbody Type: River Size: 47.30 Miles
Basin: WHITE RIVER

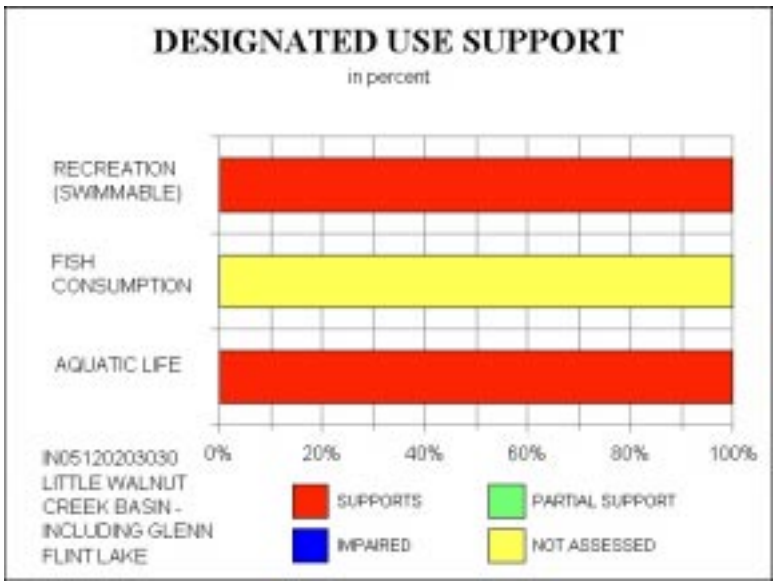
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	47.30	0.00	0.00	0.00	0.00	0.00
FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	47.30
SWIMMABLE	47.30	0.00	0.00	0.00	0.00	0.00



---------- Nonattainment Causes ----------

Cause Size Mag

No causes listed

---------- Nonattainment Sources ----------

Source Size Mag

No sources listed

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203040** Segment Number: 00
Waterbody Name: Deer Creek Basin (headwaters to Manhattan)
Waterbody Type: River Size: 62.60 Miles
Basin: WHITE RIVER

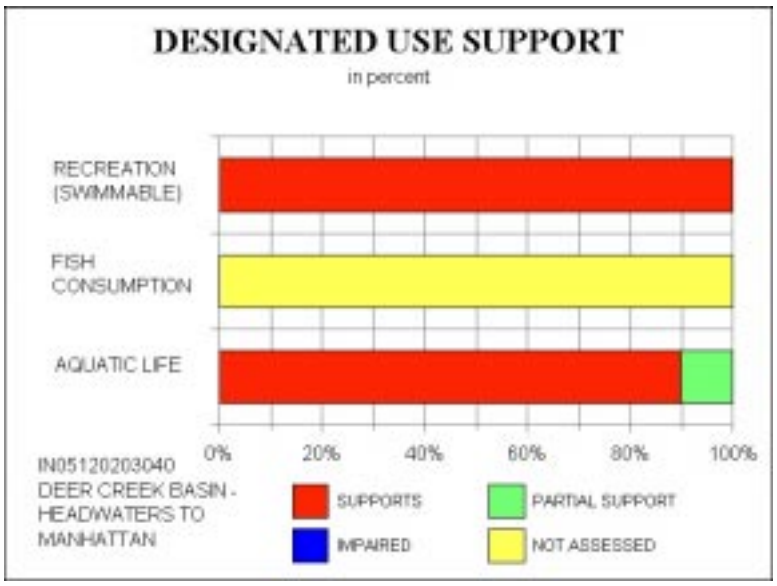
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	56.20	0.00	6.40	0.00	0.00	0.00
FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	62.60
SWIMMABLE	62.60	0.00	0.00	0.00	0.00	0.00



---------- Nonattainment Causes ----------

Cause Size Mag

No causes listed

---------- Nonattainment Sources ----------

Source Size Mag

No sources listed

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203050** Segment Number: 00
Waterbody Name: Mill Creek Basin
Waterbody Type: River Size: 174.40 Miles
Basin: WHITE RIVER

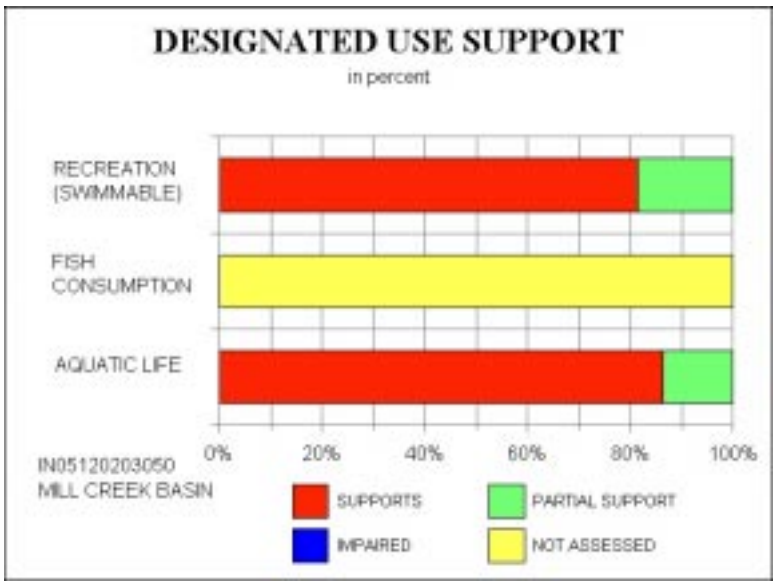
---------- Description of the Waterbody ----------

DOES NOT INCLUDE CATARACT LAKE.

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	152.40	0.00	24.00	0.00	0.00	0.00
FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	176.40
SWIMMABLE	143.60	0.00	32.80	0.00	0.00	0.00



---------- Nonattainment Causes ----------

Cause	Size	Mag
1700-PATHOGENS	32.80	S
0000-CAUSE UNKNOWN	24.00	S

---------- Nonattainment Sources ----------

Source	Size	Mag
9000-SOURCE UNKNOWN	32.80	S

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203060** Segment Number: 00
Waterbody Name: Eel River Basin (to Splunge Creek)
Waterbody Type: River Size: 145.40 Miles
Basin: WHITE RIVER

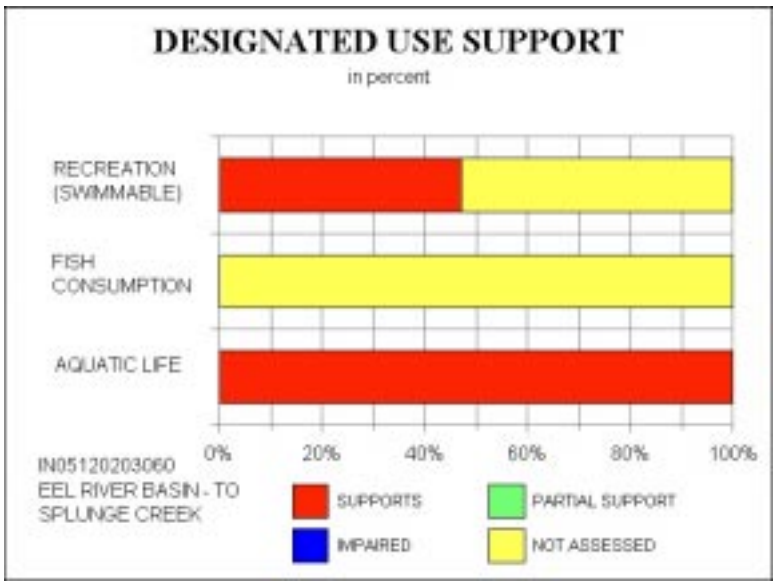
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	145.40	0.00	0.00	0.00	0.00	0.00
FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	145.40
SWIMMABLE	68.30	0.00	0.00	0.00	0.00	77.10



---------- Nonattainment Causes ----------

Cause Size Mag

No causes listed

---------- Nonattainment Sources ----------

Source Size Mag

No sources listed

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203070** Segment Number: 00
Waterbody Name: Jordon Creek Basin
Waterbody Type: River Size: 16.70 Miles
Basin: WHITE RIVER

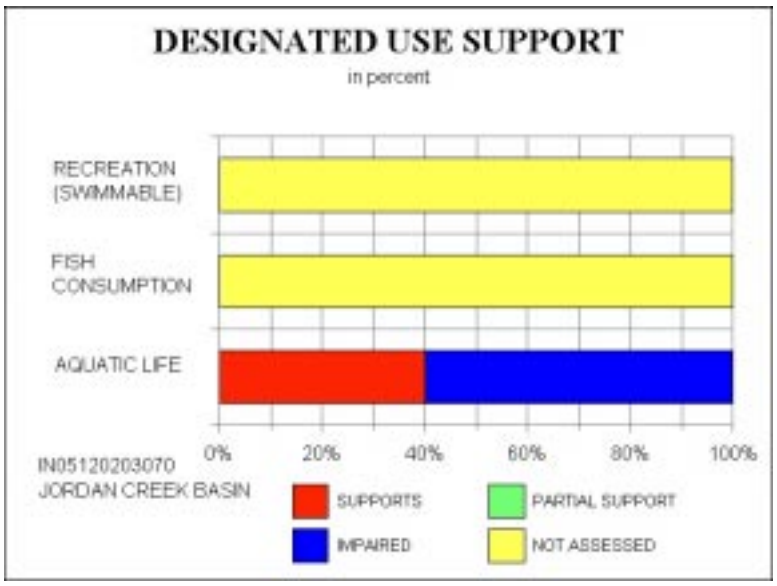
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	6.70	0.00	0.00	10.00	0.00	0.00
FISH CONSUMPTION	0.00	0.00	0.00	0.00	0.00	16.70
SWIMMABLE	0.00	0.00	0.00	0.00	0.00	16.70



---------- Nonattainment Causes ----------

Cause	Size	Mag
1600-HABITAT ALTER. (non-flow)	10.00	S

---------- Nonattainment Sources ----------

Source	Size	Mag
9000-SOURCE UNKNOWN	10.00	S

Overall Use Support Status Report
06-04-98

Waterbody ID : **IN05120203080** Segment Number: 00
Waterbody Name: Eel River (Splunge Cr to W F White River)
Waterbody Type: River Size: 170.80 Miles
Basin: WHITE RIVER

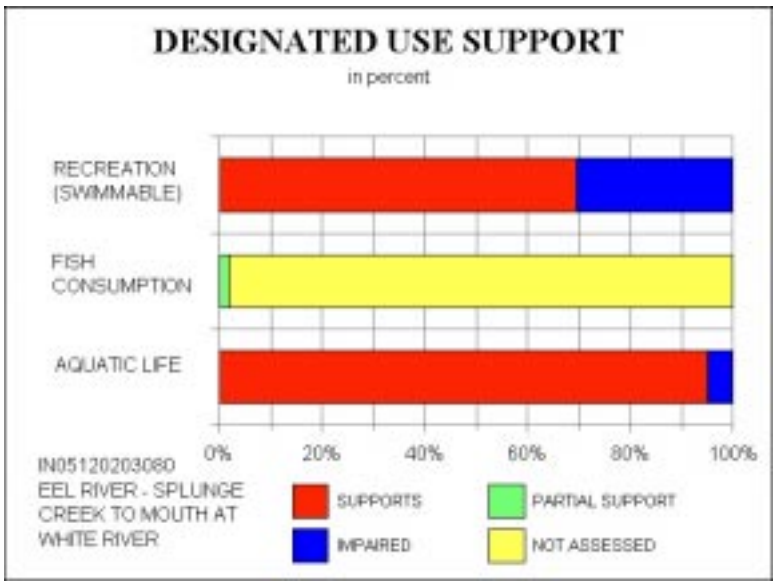
---------- Description of the Waterbody ----------

No description available

Assessment Date: 9804

---------- Use Support ----------

Designated Use	Fully Supp	Threat	Partial Supp	Not Supported	Not Attained	Not Assessed
AQUATIC LIFE SUPPORT	162.50	0.00	0.00	8.30	0.00	0.00
FISH CONSUMPTION	0.00	0.00	3.10	0.00	0.00	167.70
SWIMMABLE	118.90	0.00	0.00	51.90	0.00	0.00



---------- Nonattainment Causes ----------

Cause	Size	Mag
0410-PCBs	3.10	S
0500-METALS	3.10	S
0560-Mercury	3.10	S
1700-PATHOGENS	51.90	S

---------- Nonattainment Sources ----------

Source	Size	Mag
9000-SOURCE UNKNOWN	51.90	S

APPENDIX C

Potential Stakeholders in the Eel/ Big Walnut Watershed

Potential Stakeholders in the Eel/ Big Walnut Watershed

Boone County

Area Plan Commission
(765) 482-3821
B3 Courthouse Sq, Lebanon IN 46052

Boone County Building Inspctr
(765) 482-3821
B3 Courthouse Sq, Lebanon IN 46052

Boone County Soil & Water Conservation District
801 West Pearl St, Suite C, Lebanon IN 46052
(765) 482-6355

County Surveyor
102 Courthouse Sq, Lebanon IN 46052
(765) 483-4444

Purdue Cooperative Extension
1300 E 100 S, Lebanon IN 46052
(765) 482-0750

Boone County Solid Waste Dist
201 Courthouse Sq Lebanon, IN
(765) 483-0687

Mayors Office
201 E Main St Lebanon, IN
(765) 482-1201

Farm Service Agcy
803 W Pearl St # A Lebanon, IN
(765) 482-6355

Clay County

Clay County Commissioners
Brazil IN 47834
(812) 448-9008

Clay County Extension Office
609 E National Ave, Brazil IN 47834
(812) 448-9041

Clay County Surveyor
609 E National Ave, Brazil IN 47834
(812) 448-9017

Brazil City Mayor Ofc
203 E National Ave Brazil, IN
(812) 443-2221

Brazil Planning Adm
203 E National Ave Brazil, IN
(812) 446-0050

Brazil Treatment Plant
2205 E US Highway 40 Brazil, IN
(812) 448-1700

Brazil Water Works
203 E National Ave Brazil, IN
(812) 448-1539

Clay County Commissioners
609 E National Ave Brazil, IN
(812) 448-9008

Clay County Economic Develop
2 E National Ave Brazil, IN
(812) 448-8064

Clay County Health Dept
609 E National Ave # 203 Brazil, IN
(812) 448-9021

Clay County Soil & Water Conservation District
955 W. Craig Ave., Brazil, IN
(812) 446-8986

Greene County

Green County Farm Service Agency
30 W Indiana Ave Bloomfield, IN
(812) 384-4634

Greene County Surveyor
217 E Spring St # 2 Bloomfield, IN
(812) 384-2026

Linton Mayor's Office
86 Main St S Linton, IN
(812) 847-7754

Linton Water Dept Water Works
Buck Creek Rd S Linton, IN
(812) 847-4604

State Forest
2551 S State Road 159 Dugger, IN
(812) 648-2810

Greene County Solid Waste
Mgmt Rr 1 Switz City, IN
(812) 659-9955

Jasonville Mayor
145 S Lawton St Jasonville, IN
(812) 665-2266

Natural Resources Dept
State Road 48 Jasonville, IN
(812) 665-2207

Greene County Soil & Water Conservation District
30 W. Indiana Ave. Suite 2
Bloomfield, IN
(812) 384-4636

Hendricks County

Hendricks County Commissioner
355 S Washington St # 204
Danville, IN
(317) 745-9221

Hendricks County Bldg Permits
355 S Washington St # 212
Danville, IN
(317) 745-9255

Hendricks County Engineer
355 S Washington St # 209
Danville, IN
(317) 745-9236

Hendricks County Planning Comm
355 S Washington St # 212
Danville, IN
(317) 745-9254

Hendricks County Recorders Ofc
355 S Washington St # 213
Danville, IN
(317) 745-9224

Hendricks County Surveyor
355 S Washington St Danville, IN
(317) 745-9237

Hendricks County Soil & Water Conservation District
195 Meadow Drive, Suite 2, Danville, IN
(317) 745- 2555

Hendricks County Health Dept.
355 S. Washington St., Danville, IN
(317) 745-9217

Morgan County

County Commissioners
180 S Main St # 112 Martinsville, IN
(765) 342-1007

County Recorder
180 S Main St # 125 Martinsville, IN
(765) 342-1077

County Surveyor's Office
180 S Main St Martinsville, IN
(765) 342-1064

Morgan County Board Of Health
180 S Main St # 252 Martinsville, IN
(765) 342-6621

Morgan County contd.

Morgan County Office
5400 Blue Bluff Rd Martinsville, IN
(765) 349-6290

Morgan County Offices
1326 Morton Ave Martinsville, IN
(765) 349-9154

Morgan Monroe State Forest
6220 Forest Rd Martinsville, IN
(765) 342-4026

Morgan County Soil & Water Conservation District
1328 Morton Ave Martinsville, IN
(765) 342-5595

Purdue Extension
180 S Main St # 229 Martinsville, IN
(765) 342-1010

Farm Service Agency
1328 Morton Ave # 2 Martinsville, IN
(765) 342-5594

Morgan County Farmers Union
8515 SR 142
Martinsville, IN 46151
(765) 528-2513

Morgan County Farm Bureau
Otis Patrick
13869 SR 42
Cloverdale, IN 46120
(765) 528-2226

Owen County

Chamber Of Commerce
51 E Franklin St Spencer, IN
(812) 829-3245

Indiana State Owen-Putnam
Frst 400 West St Spencer, IN
(812) 829-2462

Owen County Soil & Water Conservation District
State Rd 46 Spencer, IN
(812) 829-2605

Owen County Adm
291 Vandalia Ave Spencer, IN
(812) 829-4412

Owen County Commissioner Ofc
Courthouse Spencer, IN
(812) 829-5058

Owen County Cooperative Ext
180 S Washington St Spencer, IN
(812) 829-5020

Parke County

County Zoning
116 W High St Rockville, IN
(765) 569-3394

Little Raccoon Conservancy
Courthouse Rockville, IN
(765) 569-6710

Parke County Soil & Water Conservation District
US Route 36 Rockville, IN
(765) 569-3551

Parke County Co-Op Extension
US Route 41 Rockville, IN
(765) 569-3176

Parke County Health Office
116 W High St # 10 Rockville, IN
(765) 569-6665

Parke County Plan Commission
116 W High St # 105 Rockville, IN
(765) 569-3394

Parke County Sanitarian
116 W High St # 10 Rockville, IN
(765) 569-6665

Parke County Surveyors Office
Courthouse Rockville, IN
(765) 569-4063

US Army Corps Of Engineers
Rr 1 Rockville, IN
(765) 344-1570

Farm Service Agcy
State Road 36 W Rockville, IN
(765) 569-2028
USDA Rural Development
US Route 36 Rockville, IN
(765) 569-2036

Putnam County

Building Commissioner
1 N. Locust Street
Greencastle, IN 46135
(765) 653-8522

Greencastle Mayor's Office
1 N. Locust Street
Greencastle, IN 46135
(765) 653-3100

Greencastle Wastewater Dept
PO Box 288
Greencastle, IN 46135
(765) 653-6830

Greencastle Dept. of Water Works
PO Box 288
Greencastle, IN 46135
(765) 653-3394

Putnam County Soil & Water Conservation District 5 Depot St Greencastle, IN
(765) 653-9785

Natural Resources Dept
64 N US Highway 231 # 3 Greencastle, IN
(765) 653-6615

Planning Commission & Zoning
1 Court House Square St Greencastle, IN
(765) 653-5727

Putnam County Board Of Health
1 Court House Square St Fl 4 Greencastle, IN
(765) 653-5210

Putnam County Coop Extension
64 N US Highway 231 Greencastle, IN
(765) 653-8411

Putnam County Surveyor's Ofc
1 Court House Square St Greencastle, IN
(765) 653-5603

Farm Service Agency
64 N US Highway 231 Greencastle, IN
(765) 653-5716

Vigo County

Terre Haute Chamber-Commerce
643 Wabash Ave Terre Haute, IN
(812) 232-2391

Terre Haute Mayor's Office
17 Harding Ave Terre Haute, IN
(812) 232-4132

Terre Haute Sewage Dept
17 Harding Ave Terre Haute, IN
(812) 235-8101

Terre Haute Treatment Plant
3200 S State Road 63 Terre Haute, IN
(812) 232-6564

Farm Service Agency
3229 S 3rd Pl Terre Haute, IN
(812) 232-0193

Vigo County Area Planning Dept
201 Cherry St Terre Haute, IN
(812) 462-3354

Vigo County Commissioner's Ofc
201 Cherry St Terre Haute, IN
(812) 462-3367

Vigo County Surveyor's Office
Vigo County CourtHouse # 9
Terre Haute, IN
(812) 462-3380

Vigo County Soil & Water Conservation
District
Honey Creek West, 3241 S. 3rd. Place
Terre Haute, IN
(812) 232-0193

Conservancy Districts

Little Walnut Creek
P.O. Box 543, Greencastle, IN
(765) 653-4904

Clear Creek
P.O. Box 134, Coatsville, IN
(765) 246-6752

Van Bibber Lake
3202 Van Bibber Lake Estates M-6
Greencastle, IN
(765) 739-6671

Resource Conservation & Development Councils

Sycamore Trails RC&D
5 Depot St. Greencastle, IN
(765) 653-9785

Hoosier Heartland RC&D
5995 Lakeside Blvd. Suite B
Indianapolis, IN (317) 290-3250

Four Rivers RC&D
715 S. 9th. St. Petersburg, IN
(812) 354-6808

STATE STAKEHOLDERS

Indiana Farm Bureau Inc.
225 S East St
Indianapolis, IN 46202
(317) 692-7851

Indiana Department of Environmental Management
100 N. Senate Ave
P.O. Box 6015
Indianapolis, IN 46206-6015

IDEM Switchboard
(317) 232-8603 or (800) 451-6027

Agricultural Liaison
(317) 232-8587

Air Management
(317) 233-0178

Community Relations
(317) 233-6648

Compliance and Technical Assistance
(317) 232-8172

Criminal Investigations
(317) 232-8128

Enforcement
(317) 233-5529

Environmental Response
(317) 308-3017

Legal Counsel
(317) 232-8493

Media and Communication Services
(317) 232-8560

Pollution Prevention and Technical Assistance
(317) 232-8172

Solid and Hazardous Waste Management
(317) 233-3656

Water Management
(317) 232-8670

Indiana Department of Natural Resources
402 West Washington Street
Indianapolis, IN 46204-2748

IDNR, Division of Soil Conservation, Field Representatives are generally located with the SWCD office in each county.

Division of Engineering
(317) 232-4150

Division of Entomology
and Plant Pathology
(317) 232-4120

Division of Fish & Wildlife
(317) 232-4080

Division of Forestry
(317)-232-4105

Division of Historic
Preservation & Archaeology
(317) 232-1646

Division of Law Enforcement
(317) 232-4010

Division of State
Parks and Reservoirs
(317)-232-4124

Division of Water
(317)-232-4160

Division of Public
Information and Education
(317) 232-4200

Division of Reclamation
(317)-232-1547

Division of Safety and Training
(317) 232-4145

Division of Soil Conservation
(317)-233-3870

Division of Oil and Gas
(317) 232-4055

Division of Outdoor Recreation
(317)-232-4070

Division of Nature Preserves
(317)-232-4052

Indiana State Department of Health
2 North Meridian St.
Indianapolis, IN 46204
(317) 233-1325

FEDERAL STAKEHOLDERS

Natural Resources Conservation Service
6013 Lakeside Blvd
Indianapolis, In 46278
(317) 290-3200

NRCS Field Representatives are generally located with the SWCD office in each county.

U.S. EPA Region 5
77 West Jackson Blvd
Chicago, IL 60604
(312) 353-2000
(800) 632-8431

U.S. Army Corps of Engineers Louisville District
Dr. Martin Luther King Jr. Place
Louisville, KY 40202

APPENDIX D

FUNDING SOURCES

FUNDING SOURCES

This listing of funding sources was derived from the November 1998 *Watershed Action Guide for Indiana*, which is available from the Watershed Management Section of IDEM.

FEDERAL CONSERVATION AND WATERSHED PROGRAMS

Environmental Protection Agency

Section 319, 604(b), and 104(b)3 Grants

Grants for conservation practices, water body assessment, watershed planning, and watershed projects. Available to non-profit or governmental entities. These monies, enabled by the Clean Water Act, are funneled through the Indiana Department of Environmental Management. *For details see IDEM below*.

U.S. Department of Agriculture (See county listings for local federal agency contacts.)

EQIP: Environmental Quality Incentive Program. Administered by the Natural Resources Conservation Service. Conservation cost-share program for implementing Best Management Practices, available to agricultural producers who agree to implement a whole-farm plan that addresses major resource concerns. Up to $50,000 over a 5- to 10-year period. Some parts of the state are designated Conservation Priority Areas and receive a larger funding allotments.

WRP: Wetland Reserve Program. Administered by the Natural Resources Conservation Service. Easement and restoration program to restore agricultural production land to wetland. Easements may be for 10 years, 30 years, or permanent. Longer easements are preferred. Partnerships with other acquisition programs are encouraged. Restoration and legal costs are paid by NRCS. Landowner retains ownership of the property and may use the land in ways that do not interfere with wetland function and habitat, such as hunting, recreational development, and timber harvesting.

CRP: Conservation Reserve Program. Administered by the Farm Service Agency with technical assistance from NRCS. Conservation easements in certain critical areas on private property. Agricultural producers are eligible. Easements are for 10 or 15 years, depending on vegetative cover, and compensation payments are made yearly to replace income lost through not farming the land. Cost share is available for planting vegetative cover on restored areas.

WHIP: Wildlife Habitat Incentive Program. Administered by the Natural Resources Conservation Service. Cost share to restore habitat on previously farmed land. Private landowners who are agricultural producers are eligible. Cost share up to 75%, and contracts are for 10 years.

FIP: Forestry Incentive Program. Administered by the Natural Resources Conservation Service. Cost-share to assist forest management on private lands. Funds may be limited.

U.S. Fish & Wildlife Service

Partners for Wildlife: assistance for habitat restoration.

STATE CONSERVATION AND WATERSHED PROGRAMS

IDNR Division of Soil Conservation

LARE: Lake & River Enhancement Program. Funds diagnostic and feasibility studies in selected watersheds and cost-share programs through local Soil & Water Conservation Districts. Project oversight provided through county-based Resource Specialists and Lake & River Enhancement Watershed Coordinators. Funding requests for Watershed Land Treatment projects must come from Soil & Water Conservation Districts. If a proposed project area includes more than one district, the affected SWCDs should work together to develop an implementation plan. The SWCDs should then apply for the funding necessary to administer the watershed project. Before applying for funding, the SWCDs should contact the Lake & River Enhancement Coordinators to determine (1) the appropriate watershed to include in the project, (2) if the proposed project meets the eligibility criteria, and (3) if funding is available.

IDNR Division of Fish & Wildlife

Classified Wildlife Habitat Program: Incentive program to foster private wildlife habitat management through tax reduction and technical assistance. Landowners need 15 or more acres of habitat to be eligible. IDNR provides management plans and assistance through District Wildlife Managers. See county listings.

Wildlife Habitat Cost-share Program: Similar to above.

IDNR Division of Forestry

Classified Forest Program: Incentive program to foster private forest management through tax reduction and technical assistance. Landowners need 10 or more acres of woods to be eligible. IDNR provides management plans and assistance through District Foresters. (See county listings.)

Classified Windbreak Act: Establishment of windbreaks at least 450 feet long adjacent to tillable land. Provides tax incentive, technical assistance through IDNR District Foresters.

Forest Stewardship Program & Stewardship Incentives Program: Cost share and technical assistance to encourage responsibly managed and productive private forests.

IDNR Division of Reclamation

Appalachian Clean Streams Initiative: Funds for acid mine drainage abatement.

IDNR Division of Nature Preserves

State Nature Preserve Dedication: Acquisition and management of threatened habitat.

IDEM Office of Water Quality

State Revolving Fund: Available to municipalities and counties for facilities development. Will be available in 1999 for nonpoint source projects as well. Funding is through very low-interest loans.

Section 319 Grants: Available to nonprofit groups, municipalities, counties, and institutions for implementing water quality improvement projects that address nonpoint source pollution concerns. Twenty-five percent match is required, which may be cash or in-kind. Maximum grant amount is $112,500. Projects are allowed two years for completion. Projects may be for land treatment through implementing Best Management Practices, for education, and for developing tools and applications for state-wide use.

Section 205(j) Grants, formerly called 604(b) Grants: Available to municipalities, counties, conservation districts, drainage districts. These are for water quality management projects such as studies of nonpoint pollution impacts, nonagricultural NPS mapping, and watershed management projects targeted to Northwest Indiana (including BMPs, wetland restoration, etc.)

Section 104(b)(3) Grants: These are watershed project grants for innovative demonstration projects to promote statewide watershed approaches for permitted discharges, development of storm water management plans by small municipalities, projects involving a watershed approach to municipal separate sewer systems, and projects that directly promote community based environmental protection. NOTE: the application time frame for IDEM grant programs is annually, by March 31st.

PRIVATE FUNDING SOURCES

National Fish and Wildlife Foundation

1120 Connecticut Avenue, NW Suite 900, Washington DC 20036. Nonprofit, established by Congress 1984, awards challenge grants for natural resource conservation. Federally appropriated funds are used to match private sector funds. Six program areas include wetland conservation, conservation education, fisheries, migratory bird conservation, conservation policy, and wildlife habitat.

Individual Utilities

Check local utilities such as IPALCO, CINergy, REMC, NIPSCO. Many have grants for educational and environmental purposes.

Indiana Hardwood Lumbermen's Association

Indiana Tree Farm Program

The Nature Conservancy

Land acquisition and restoration.

Southern Lake Michigan Conservation Initiative
Blue River Focus Area
Fish Creek Focus Area
Natural Areas Registry
Hoosier Landscapes Capitol Campaign

Conservation Technology Information Center (CTIC)

'Know Your Watershed' educational materials are available

Indiana Heritage Trust

Land acquisition programs

Ducks Unlimited

Land acquisition and habitat restoration assistance

Quail Unlimited

Pheasants Forever

Sycamore Land Trust

Acres Inc.

Land trust

Oxbow, Inc.

Land trust

SOURCES OF ADDITIONAL FUNDING OPPORTUNITIES

Catalog of Federal Funding Sources for Watershed Protection
EPA Office of Water (EPA841-B-97-008) September 1997

GrantsWeb: http://www.srainternational.org/cws/sra/resource.htm

Attachment 1
U.S. Geological Survey
National Water-Quality Assessment Program

Congress appropriated funds in 1986 for the U.S. Geological Survey (USGS) to begin a pilot program in seven project areas to develop and refine the National Water-Quality Assessment (NAWQA) Program. In 1991, the USGS began full implementation of the program. The NAWQA Program builds upon an existing base of water-quality studies of the USGS, as well as those of other Federal, State, and local agencies. The objectives of the NAWQA Program are to:

- Describe current water-quality conditions for a large part of the Nation's freshwater streams, rivers, and aquifers.
- Describe how water quality is changing over time.
- Improve understanding of the primary natural and human factors that affect water-quality conditions.

This information will help support the development and evaluation of management, regulatory, and monitoring decisions by other Federal, State, and local agencies to protect, use, and enhance water resources (Hirsch, 1997).

The NAWQA Program is assessing the water-quality conditions of more than 50 of the Nation's largest river basins and aquifers, known as Study Units. Collectively, these Study Units cover about one-half of the United States and include sources of drinking water used by about 70 percent of the U.S. population. Comprehensive assessments of about one-third of the Study Units are ongoing at a given time. Each Study Unit is scheduled to be revisited every decade to evaluate changes in water-quality conditions. NAWQA assessments rely heavily on existing information collected by the USGS and many other agencies as well as the use of nationally consistent study designs and methods of sampling and analysis. Such consistency simultaneously provides information about the status and trends in water quality conditions in a particular stream or aquifer and, more importantly, provides the basis to make comparisons among watersheds and improve our understanding of the factors that affect water-quality conditions regionally and nationally (Hirsch, 1998).

The White River Basin in Indiana was among the first 20 river basins to be studied as part of the NAWQA Program between 1992 and 1996. The USGS has published several reports and fact sheets, which address chemical, biological, and human factors within the watershed. The following is a partial listing of information available from the USGS NAWQA studies.

- Circular 1150, Water Quality in the White River Basin, Indiana, 1992-96.
- Report 94-4024, Water-Quality Assessment of the White River Basin, Indiana: Analysis of Available Information on Pesticides, 1972-92.
- Report 96-4192, Water-Quality Assessment of the White River Basin, Indiana: Analysis of Selected Information on Nutrients, 1980-92.
- Report 96-653A, Fish Communities and Habitat Data at Selected Sites in the White River Basin, Indiana, 1993-95.
- Report 97-4260, Environmental Setting and Natural Factors and Human Influences Affecting Water Quality in the White River Basin, Indiana.
- Fact Sheet 110-96, Occurrence of Nitrate in Ground Water in the White River Basin, Indiana, 1994-95.
- Fact Sheet 96-4232, Fishes of the White River Basin, Indiana.

- Fact Sheet 058-97, Trends in Acetochlor Concentrations in the Surface Waters of the White River Basin, Indiana, 1994-96.
- Fact Sheet 119-96, Influence of Natural and Human Factors on Pesticide Concentrations in Surface Waters of the White River Basin, Indiana.
- Fact Sheet 233-95, Occurrence of Pesticides in the White River, Indiana, 1991-95.
- Fact Sheet 209-96, Assessment of Water Quality at Selected Sites in the White River Basin, Indiana, 1993 and 1995 Using Biological Indices.
- Fact Sheet 124-96, Radon in the Fluvial Aquifers of the White River Basin, Indiana, 1995.
- Fact Sheet 138-96, Occurrence of Volatile Organic Compounds in Ground Water in the White River Basin, Indiana, 1994-95.
- Fact Sheet 084-96, Occurrence of Pesticides in Ground Water in the White River Basin, Indiana, 1994-95.

For additional information on the NAQWA Program, contact:
Project Chief
White River Basin Study
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46278-1996
317-290-3333
or visit, http://in.water.usgs.gov/

References

Hirsch, R.M. *in* Fenelon, J.M., 1998, Water quality in the White River basin, Indiana, 1992-96: U.S. Geological Survey Circular 1150, 1p.

Hirsch, R.M. *in* Baker, N.T. and Frey, J.W., 1997, Fish community and habitat data at selected sites in the White River basin, Indiana, 1993-95: U.S. Geological Survey Open File Report 96-653A, Forward.

Eel/ Big Walnut Watershed Restoration Action Strategy

Part II: Concerns and Recommendations

Prepared by

Indiana Department of
Environmental Management
Office of Water Quality

January 2001

Foreword

The First Draft (October 1999) of the Watershed Restoration Action Strategy (WRAS) was reviewed internally by IDEM and revised accordingly. The Second Draft (Spring 2000) was reviewed by stakeholders and revised accordingly. This Third Draft (January 2001) is intended to be a living document to assist restoration and protection efforts of stakeholders in their sub-watersheds. As a "living document" information contained within the WRAS will need to be revised and updated periodically.

The WRAS is divided into two parts: Part I, Characterization and Responsibilities and Part II, Concerns and Recommendations.

James Dunaway, Resource Conservationist
IDEM Office of Water Quality
100 N. Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

jdunaway@dem.state.in.us

Eel/ Big Walnut Watershed Restoration Action Strategy Part II: Concerns and Recommendations

Part II of the Watershed Restoration Action Strategy discusses the water quality concerns identified for the Eel/ Big Walnut Watershed and lists recommended management strategies to address these concerns.

Part II includes:

1 Water Quality Concerns and Priority Issues Identified by Stakeholder Groups

The Eel/ Big Walnut watershed contains potential stakeholder groups that have different missions. Many of these groups have a long history of working in the Eel/ Big Walnut watershed. The following discussion briefly describes some of the watershed groups and lists their priorities and concerns.

Local Soil & Water Conservation Districts

At the beginning of 1997, the local Soil & Water Conservation Districts in every county in Indiana convened meetings of local stakeholders as a part of their locally led conservation program. The purpose of these meetings was to get public input on natural resource concerns within each county and to lay the groundwork for resource protection. The resource concerns relative to water quality, identified by some of the SWCDs within the watershed, are listed below.

Clay County:

Clay County identified the following concerns:

- Drinking water
- Nutrients, nitrogen leaching
- Septic system failures
- Soil erosion

Hendricks County:

The concerns were combined into five broad topics, 1.) Water quality, 2.) Soil erosion/ Siltation/ Sedimentation, 3.) Drainage, 4.) Woodland management, and 5.) Landuse conversion. These five topics came from the following list of specific concerns:

- Soil water
- Soil structure/Compaction
- Drainage
- Landuse conversion
- Lack of riparian areas
- Water quality (septic/solid waste & public perception of water quality)
- Water availability
- Surface runoff facilities (retention/ detention basins & storage)
- Recreation use
- Maintenance of Court Drains
- Wetlands
- Animal wastes

Owen County:

The main concerns associated with water quality were identified as 1.) Sedimentation from soil erosion, 2.) Streambank erosion from flooding, and 3.) Waste disposal. These main concerns came from a listing of 30 identified resource concerns which included:

- Soil erosion
- Gullies
- Water retention in the uplands
- Need for surface water management
- Increase number of ponds and lakes
- Loss of productive farmland and forest
- Development in floodplains
- Sedimentation from developments
- Waste disposal (human and animal)
- Improper septic systems installed
- Dead animals
- Planning for development
- Groundwater
- Coal mines/ Quarries
- Need enforcement of the rules
- Dust, mud, erosion, sulfur
- Damage to ponds, wells and springs from blasting
- Surface water quality
- Nutrient loading

Putnam County:

Putnam County identified two concerns related to water quality they were 1.) Streambank stabilization, and 2.) Water quality.

Local Health Departments

The Health Departments in Clay, Hendricks, and Owen counties identified several concerns related to septic systems.

- Illegal discharges- straight pipe and field tile hook ups
- Failing Systems- older, inadequate systems- soil problems- water table problems
- Maintenance- lack of knowledge by homeowners on system maintenance
- Lack of area to expand septic systems in small lot subdivisions
- Existing package treatment systems that fail or overflow

Other Concerns Identified

In *An Environmental Assessment of the Streams of Putnam County, Indiana and Vicinity*, Dr. James Gammon identified many streams that were biologically impaired. The focus of this study was the impact of animal feedlots, however, other causes of impairment were referenced in the study. The potential causes of impairment gleaned from this study are listed below as concerns:

- Domestic animals in streams
- Confined feedlots near streams
- Lack of riparian buffers along streams
- Inadequate animal waste handling or storage practices
- Intensive row crop production

2 Water Quality Concerns and Priority Issues Identified by State and Federal Agencies

This section presents the combined efforts of state and federal agencies, and universities, such as IDEM, IDNR, USDA-Natural Resources Conservation Service, Ohio River Valley Water Sanitation Commission, Purdue University, Indiana University, Indiana Geologic Survey, and US Geological Survey, to assess water quality concerns and priority issues in the Eel/ Big Walnut Watershed. This multi-organization effort formed the basis of the Unified Watershed Assessment for Indiana.

Indiana's Unified Watershed Assessment (UWA)

The UWA workgroup gathered a wide range of water quality data that could be used to characterize Indiana's water resources. These data were used in 'layers' in order to sort the 8-digit HUC watersheds according to the present condition of the water in lakes, rivers, and streams. The workgroup used only those data which concerned the water column, organisms living in the water, or the suitability of the water for supporting aquatic ecosystems. Each 'layer' of information/data was partitioned by percentiles into scores. The scores ranged between 1 and 5, with a score of 1 indicative of good water quality or minimum impairment, and a score of 5 indicating heavily impacted or degraded water quality. The scoring derived through the UWA process is presented in Table 2-1.

The data layers listed in Table 2-1 can be defined as:

- Lake Fishery: Large mouth bass community information for lakes
- Stream Fishery: Small mouth bass community information for streams
- Aquatic Life Use Support: The 'livability' of the water column for aquatic life, determined from evaluation of chemical and physical water data, and assessment of aquatic life
- Fish Consumption Advisories: Site specific advisories based on current data
- Fish Index of Biotic Integrity: Based on fish community diversity and fish health
- Qualitative Habitat Evaluation Index: Measure of whether the aquatic habitat is suitable for diverse communities, based on visual observations
- Lake Trophic Scores: Indicator for the rate at which a lake is 'aging' due to inputs of nutrients and other factors
- Sediment Potential: Indicator of potential sediment input to waterbodies in the watershed

The sources and additional information for these data layers include:

- Lake Fishery: From IDNR fisheries surveys of lakes and reservoirs from 1972 to 1994. Raw scores were averaged for all lakes in the watershed.
- Stream Fishery: From IDNR fisheries surveys of streams from 1970 to 1994. Raw scores were averaged for all streams in the watershed.
- Aquatic Life Use Support: IDEM, Office of Water Quality, Assessment Branch
- Fish Consumption Advisories: ISDH and IDEM, Office of Water Quality, Assessment Branch
- Fish Index of Biotic Integrity: IDEM, Office of Water Quality, Assessment Branch
- Qualitative Habitat Evaluation Index: IDEM, Office of Water Quality, Assessment Branch
- Lake Trophic Scores: Indiana Clean Lakes Program through IDEM, Office of Water Quality, Assessment Branch. This score was based on information gathered from sampling conducted in the 1970's and 1980's.
- Sediment Potential: U.S. Geological Survey scored the population rate of change and the 1996 Conservation Tillage Transect data. The scores were then added and normalized to produce a sediment yield indicator for each watershed.

From this scoring, it is evident that sediment potential, fish consumption advisories, fish index of biotic integrity, and stream fishery on the Eel/ Big Walnut are key areas of concern. Lake fishery, aquatic life support, and lake trophic scores are secondary concerns within the Eel/ Big Walnut watershed.

TABLE 2-1
RESULTS OF THE UNIFIED WATERSHED ASSESSMENT FOR EEL/ BIG WALNUT

Data/Information Layer	Eel/ Big Walnut (05120203) Score
Lake Fishery	2
Stream Fishery	3
Aquatic Life Use Support	2
Fish Consumption Advisories	3
Fish Index of Biotic Integrity	3
Qualitative Habitat Evaluation Index	1
Lake Trophic Scores	2
Sediment Potential	5

Note:
The UWA scores range from 1 to 5, with a score of 1 indicating good water quality and a score of 5 indicating severe impairment.

Indiana's 2000-2001 Unified Watershed Assessment (UWA)

During summer 1999 the UWA workgroup used additional layers of information to identify the **resource concerns and stressors** for each of the 361 11-digit watersheds in Indiana. Examination of the human activities that have the potential to impact the ecosystem will help planners to focus on those areas where restoration may be most critical. Organizations can identify opportunities to use their programs and resources to address those areas.

This focusing process will illuminate areas where the interests of two or more partner agencies may converge. It is intended that this will lead to more effective allocation of resources for restoration and protection activities. At the local level, this information can assist groups to prioritize watershed activities and provide some discussion points for planning.

This amended assessment has the following benefits:

- Provides a logical process for targeting funds, which may be expanded or updated without changing the basic framework.
- Provides information at a finer resolution (11-digit hydrologic units) to agencies and local groups interested in watershed assessment.
- Identifies data gaps.
- Can be used as a compliment to other assessments, such as the 305(b) Report and 303(d) List.

Table 2-2 and Figure 2-1 show the results of the 2000-2001 UWA for the Eel-Big Walnut watershed.

3 Identification of Impaired Waters

Section 303(d) of the Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards with federal technology based standards alone. States are also required to develop a priority ranking for these waters taking into account the severity of the pollution and the designated uses of the waters. Indiana's 303(d) list was approved by EPA on February 16, 1999.

Once the Section 303(d) list and ranking of waters is completed, the states are required to develop Total Maximum Daily Loads (TMDLs) for these waters in order to achieve compliance with the water quality standards. The TMDL is an allocation that determines the point and nonpoint source (plus margin of safety) load reductions required in order for the waterbody to meet water quality standards. IDEM's Office of Water Quality has and continues to perform point source waste load allocations for receiving waters. Part I of the WRAS briefly outlines IDEM's strategy for developing TMDLs.

The following Eel/ Big Walnut Watershed waterbodies are on Indiana's 1998 Clean Water Act Section 303(d) list submitted and approved by EPA 303(d) list (Figure 3-1):

Big Walnut Creek for Mercury fish consumption advisory
Cataract Lake/ Cagles Mill Lake For Mercury fish consumption advisory
Conneley Ditch for E. coli violations
Eel River for E. coli violations, Mercury and PCB fish consumption advisory
Jones Creek for impaired biotic communities
Lick Creek for E. coli violations
Little Deer Creek for impaired biotic communities
Maiden Run for impaired biotic communities
Mill Creek for E. coli violations
Plum Creek for impaired biotic communities
Wabash and Erie Canal for E. coli violations

4 Priority Issues and Recommended Management Strategies

Part I provided the existing water quality information for the Eel/ Big Walnut watershed and Part II lists priority issues and concerns from local, state, and federal stakeholders in the watershed. This section pulls together the priority issues and concerns held by all stakeholders and recommends management strategies. Underlying all discussions of priority issues and concerns is the fact that improving water quality in the Eel/ Big Walnut Watershed will also enhance the natural and recreational values of Eel/ Big Walnut. Each subsection below focuses on a single priority issue.

4.1 Data/ Information and Targeting

Local stakeholders did not identify the need for additional data or information. However, the success in restoring water quality in the Eel/ Big Walnut Watershed is fundamentally based on identifying the specific geographic problem areas; identifying all sources contributing to the impairment of the waterbody; and quantifying the contribution of a pollutant by each source.

Recommended Management Strategy 1: Data and assessments from the 1996 sampling performed by the Office of Water Quality is complete and is included in the 1998 305(b) report

(Appendix B of Part I). This information was used in writing this Watershed Restoration Action Strategy, and will provide guidance in the future in order to better prioritize and target specific areas in the Eel/ Big Walnut Watershed. The scale at which targeting and prioritization should occur is the 14 digit HUC watershed area (Figure 2-2 of Part I). Targeting and prioritization will require input from stakeholders living in those geographic areas. The purpose of prioritization and targeting is to enhance allocation of resources in the effort of improving water quality.

Recommended Management Strategy 2: Through the development of Total Maximum Daily Loads (TMDLs) for impaired waterbodies in the Eel/ Big Walnut Watershed, all sources contributing to the impairment of a waterbody will be identified and quantified in terms of their contribution to the waterbody. This includes gathering more data and information on nonpoint sources of water pollution. Throughout the TMDL process, information and feedback from watershed stakeholders will be required in order to generate appropriate allocation scenarios. The result of developing TMDLs will be an understanding of the impact of nonpoint sources on water quality in the watershed.

4.2 Streambank Erosion and Stabilization

The cutting and erosion of streambanks within the Eel/ Big Walnut Watershed was identified by many local stakeholders as a major concern. This cutting and erosion increases the sediment load in waterbodies and directly impacts the scenic and recreational values of waterbodies in the Eel/ Big Walnut Watershed. Streambank cutting and erosion is often a function of many factors that include: stream energy and velocity, flooding, and land management. Increased drainage in headwater streams and ditches increases stream energies during rainfall events and often leads to increased streambank cutting and erosion downstream. Land clearing and urban development also impact volume and velocity of runoff. Hence, this problem is not easily solved.

Recommended Management Strategy 1: IDEM's Office of Water Quality offers their active support to the primary agency that has jurisdiction over this problem in order to facilitate the development of solutions.

Recommended Management Strategy 2: Structural stabilization of specific streambank areas in the Eel/ Big Walnut watershed may solve problems on a temporary basis. However, a comprehensive understanding of drainage, stream flows and energies, and land management practices is required to adequately approach this problem. Conservation partners (local, state, and federal) are actively working within their specific geographic areas (typically at the county level); however, this may not facilitate solving the streambank cutting and erosion problems because efforts may not be coordinated between headwater and downstream areas. For example, work in Hendricks County, which contains many of the headwaters of Eel/ Big Walnut Creek, to increase drainage should take into account the work and efforts of downstream partners to reduce flooding and streambank cutting. Conservation efforts should be in the context of watersheds and span county boundaries in order to account for downstream impacts. Local Drainage Boards, Planning and Zoning Boards, and County Commissioners could effectively address this issue by involving local stakeholders in the decision making process and approaching the issue on a watershed basis.

4.3 Failing Septic Systems and Straight Pipe Discharges

Local county health departments and other stakeholders have identified failing septic systems and straight pipe discharge from septic tanks as significant sources of water pollution in the Eel/ Big Walnut watershed. Straight pipe discharges from septic tanks and septic tanks connected to drainage tiles are illegal (327 IAC 5-1-1.5); however, these practices still exist in the Eel/ Big Walnut watershed.

Recommended Management Strategy 1: The direct impact of communities discharging their septic tank effluent to waterbodies needs to be adequately characterized. This will involve coordination between the Office of Water Quality, local health departments, Indiana State Department of Health, and other stakeholders. During generation of the Clean Water Act Section 303(d) list for 2000 and completion of subsequent TMDLs, illegal straight pipe discharges will be targeted for characterization and elimination. The option of choice to eliminate the illegal discharges will be a cooperative effort between homeowners and local, state, and federal stakeholders.

Recommended Management Strategy 2: Local planning, zoning, and health ordinances could be adopted or strengthened to address this problem during new development. Existing local ordinances could be enforced more vigorously to correct problems with existing systems. Both of these strategies will require input from local stakeholders.

Recommended Management Strategy 3: An education/ outreach program on the health and environmental risks of septic system discharges, system maintenance, and system function would provide homeowners and others with basic information to better understand the impacts of inadequate systems. This kind of education effort would involve local health departments, Indiana State Department of Health, IDEM, and other stakeholders.

4.4 Water Quality - General

The Clean Water Act Section 303(d) list presented in Section 3 lists impaired waterbodies for the Eel/ Big Walnut watershed. This list will be revised in 2000.

Recommended Management Strategy: The Clean Water Act requires states to complete TMDLs for waterbodies listed on the Section 303(d) list. The Office of Water Quality is currently evaluating and exploring the modeling process and data needs required to complete TMDLs for the Section 303(d) listed waterbodies. Completion of a TMDL will involve loading allocations of a pollutant to both point and nonpoint sources. The Office of Water Quality is currently drafting a TMDL strategy that involves stakeholder input throughout the process. The TMDL development process is currently scheduled to occur from 2001 through 2008 for waterbodies in the Eel/ Big Walnut watershed. The development of TMDLs will involve meetings with stakeholder groups linked to the Section 303(d) waterbodies. As TMDLs are developed, this Watershed Restoration Action Strategy will be amended to incorporate the final TMDLs.

4.5 Fish Consumption Advisories

As noted in Part I and Part II, fish consumption advisories are concerns within the Eel/ Big Walnut watershed. Three of the eleven 303(d) listed waterbodies in the Eel/ Big Walnut watershed are for fish consumption advisories.

Recommended Management Strategy 1: The three fish consumption advisories are for mercury contamination. One also includes PCB contamination. The source of the contamination is unknown and may be from atmospheric deposition or some unknown discharge. To address this concern, the cause or source must be identified. Until that is accomplished, the fish consumption advisories should be followed.

4.6 Nonpoint Source Pollution - General

Nonpoint source pollution contributions are often difficult to assess or quantify. They can include sediment deposition from soil erosion, nutrient runoff from animal wastes and commercial fertilizer, herbicide and insecticide runoff, and oil or fuel waste runoff. Nonpoint pollution can emanate from agricultural as well as urban lands. Currently, loadings of nonpoint source pollutants to water are often inferred by examination of land use practices, without actual measurements. In addition, the actual water quality impairments related to nonpoint source pollutants have not been well characterized in the Eel/ Big Walnut watershed. Finally, very few regulatory control mechanisms exist to control nonpoint source pollution.

Recommended Management Strategy 1: Through the TMDL development process, the Office of Water Quality will identify, assess, and quantify nonpoint source pollutant loadings to impaired waterbodies. In order to accomplish this task, the Office of Water Quality will work closely with local, state, and federal stakeholders at the watershed and subwatershed level. Loading scenarios for nonpoint source pollutants will be developed by the Office of Water Quality and reviewed by local, state, and federal stakeholders. Implementation of nonpoint source controls will involve a blend of funding assistance and regulatory action, where applicable.

Recommended Management Strategy 2: Numerous funding mechanisms, such as Conservation Reserve Program, Environmental Quality Incentive Program, Lake and River Enhancement program, and 319(h) grants, exist to promote practices to reduce nonpoint source pollution in the watershed. To more efficiently and effectively address nonpoint source pollution in the watershed, the prioritization and targeting discussed previously in Part II should be used to allocate further application of resources.

Recommended Management Strategy 3: The management of urban nonpoint sources can be addressed through effective land use planning and site design. Designs that incorporate less impervious area and more natural infiltration areas have proven effective in reducing urban nonpoint pollution. Local stakeholders working with local planning and zoning authorities, and developers, should implement more stringent site design requirements to reduce nonpoint source contaminants. This effort would be supported by the state and federal stakeholders.

Nonpoint Source Pollution- Lack of riparian corridors/ filter strips

The lack of riparian habitat and corridors along stream channels allows pollutants unrestricted flow into waterbodies. Sediments, pesticides, and nutrients will settle out of flow when there is an adequate time delay through grasses, shrubs, and trees, which are components of desirable riparian corridors. These corridors serve as buffers to agricultural and urban influences, provide wildlife habitat, affect flood flows, stabilize channel banks, and provide shading of the channel which reduces water temperature.

Recommended Management Strategy: Several programs, such as the Conservation Reserve Program, Environmental Quality Incentive Program, Lake and River Enhancement, and 319(h) grants exist to address riparian zones. To effectively address lack of riparian areas within the watershed, prioritization and targeting must be used to identify areas for improvement and to allocate financial resources.

Nonpoint Source Pollution- Education and Outreach

This Watershed Restoration Action Strategy is a beginning point for education and outreach efforts. It compiles existing knowledge about the water resource in this watershed and presents it to the stakeholders who live in the Eel/ Big Walnut. It brings to a public forum the available information and local concerns. However, the education process does not stop with the publication of this document.

Recommended Management Strategy: Local stakeholders, in cooperation with state and federal agencies, need to seek additional information on water quality concerns and issues addressed in this document and make that information available to the public. Additionally, the problems associated with septic failures, soil erosion, land use issues, and riparian zones can be emphasized through meetings, training sessions, and stakeholder group discussions. Field days are excellent ways to present information and encourage discussion. Use of experts with strong background knowledge coupled with local sponsors is an effective method to convey solutions to these problems.

4.7 Point Sources - General

There are 67 NPDES permitted dischargers, and two CSO discharge points in the Eel/ big Walnut watershed. Additionally there are illegal point source discharges, such as tiles discharging septic tank effluent that exist in the watershed.

Recommended Management Strategy: The Permitting and Compliance Branch of the Office of Water Quality is responsible for issuing and monitoring compliance of NPDES permit holders. Clearly, more emphasis and resources are needed to identify and correct illegal point sources and noncomplying point sources. Improving compliance of NPDES dischargers and identifying illegal dischargers will involve fostering a working relationship with other local, state, and federal stakeholders to monitor compliance and report unusual discharges or stream appearance. In regards to illegal discharges, the Office of Water Quality will work with local, state, and federal stakeholders to identify and eliminate these sources of water pollution.

5 Future Expectations and Actions

As discussed in Part I, this Watershed Restoration Action Strategy is intended to be fluid document that will be revised or amended as new information becomes available. Section 5.1 discusses expectations derived from the Strategy and how progress will be measured. Specific revisions and amendments to the Watershed Restoration Action Strategy are discussed in Section 5.2. Finally, the

Watershed Restoration Action Strategy will be reviewed by all stakeholders before it becomes final, as described in Section 5.3.

5.1 Expectations and Measuring Progress

The Eel/ Big Walnut Strategy provides a starting point to address water quality concerns held by local, state, and federal stakeholders. Part II provides recommended management strategies to address these concerns. Through cooperative efforts with stakeholders, all of the recommended management strategies listed will begin implementation by the summer of 2000.

Measurement of progress is critical to the success of any plan. Water quality improvements will not take place overnight. Measuring of progress in terms of water quality will be provided through the Office of Water Quality Assessment Branch's rotating basin monitoring strategy. Specifically, they will be conducting sampling again in the Lower White River basin, which includes the Eel/ Big Walnut watershed, in the year 2001. This will allow an assessment of progress in improving water quality.

5.2 Expected Revisions and Amendments

This Watershed Restoration Action Strategy is intended to provide a starting point to improve water quality and measure the improvement. Hence, this document will require revisions and amendments as new information becomes available. The future revisions and amendments have been divided into those that are expected within the next year (Section 5.2.1) and those that will occur over a long-term basis (Section 5.2.2).

5.2.1 Short Term Revisions and Amendments

The most significant revisions and amendments will likely occur during 2001 and after, as a result of the rotating basin assessments to be completed during 2001. The Section 305(b) assessments will be completed by late 1999 or early 2000. Local, state, and federal stakeholder comments regarding the Watershed Restoration Action Strategy will be addressed in future revisions of the document.

5.2.2 Long Term Revisions and Amendments

The Office of Water Quality is moving toward adopting a watershed management approach to solve water quality problems. Part of the watershed approach is the use of a rotating basin management cycle. The Assessment Branch of the Office of Water Quality has already adopted this rotating basin cycle in its intensive monitoring and assessment of Indiana waterbodies (this is in addition to the already established fixed monitoring station monitoring which occurs on a monthly basis). Based on the cycle the Assessment Branch is using, the next intensive monitoring of the Eel/ Big Walnut watershed will occur during the sampling season of 2001. The information from the 2001 monitoring effort will be incorporated into the Watershed Restoration Action Strategy.

In addition, the Watershed Restoration Action Strategy may be revised or amended prior to 2001, if sufficient information becomes available.

5.3 Review of the Watershed Restoration Action Strategy

Before this Watershed Restoration Action Strategy becomes final, it will undergo rigorous review. The first stage of review will be performed internally by the Office of Water Quality. Once the Watershed Restoration Action Strategy has been revised to address internal Office of Water Quality comments, it will be circulated to local, state, and federal stakeholders in the watershed and meetings within the

watershed will be held to discuss the document. Written comments from local, state, and federal stakeholders will be addressed and the Watershed Restoration Action Strategy will again be revised to incorporate applicable comments. Once internal and external comments have been addressed, the final version of the Watershed Restoration Action Strategy will be released.

Table 2-2

HYDROLOGIC UNIT SCORES for Each Parameter Used in the Unified Watershed Assessment [2000-2001]

11 Digit Hydrologic Unit		Mussel Diversity and Occurrence	Aquatic Life Use Support	Recreational Use Attainment	Stream Fishery	Lake Fishery	Eurasian Milfoil Infestation Status	Lake Trophic Status	Critical Biodiversity Resource	Aquifer Vulnerability	Population Using Surface Water for Drinking Water	Residential Septic System Density	Degree of Urbanization	Density of Livestock	% Cropland	Mineral Extraction Activities
Eel-Big Walnut	05120203010	nd	1	nd	nd	nd	nd	nd	2	4	1	2	1	3	4	1
	05120203020	nd	3	1	4	1	nd	nd	3	5	1	3	2	3	2	1
	05120203030	nd	1	1	nd	1	nd	nd	1	4	1	1	1	3	2	1
	05120203040	nd	3	1	2	nd	nd	nd	2	3	1	2	1	3	2	1
	05120203050	nd	3	3	nd	nd	nd	2	2	5	1	3	2	3	2	1
	05120203060	nd	1	1	3	2	nd	nd	3	3	1	3	2	3	2	1
	05120203070	nd	4	nd	nd	nd	nd	nd	2	4	1	3	2	2	2	2
	05120203080	nd	2	3	5	nd	nd	4	2	4	1	2	2	2	3	3
	05120203090	nd	nd	nd	nd	nd	nd	nd	2	4	2	2	2	3	2	3

Note:
The UWA scores range from 1 to 5, with a score of 1 indicating good water quality and a score of 5 indicating severe impairment.
Nd = No data

Figure 2-1

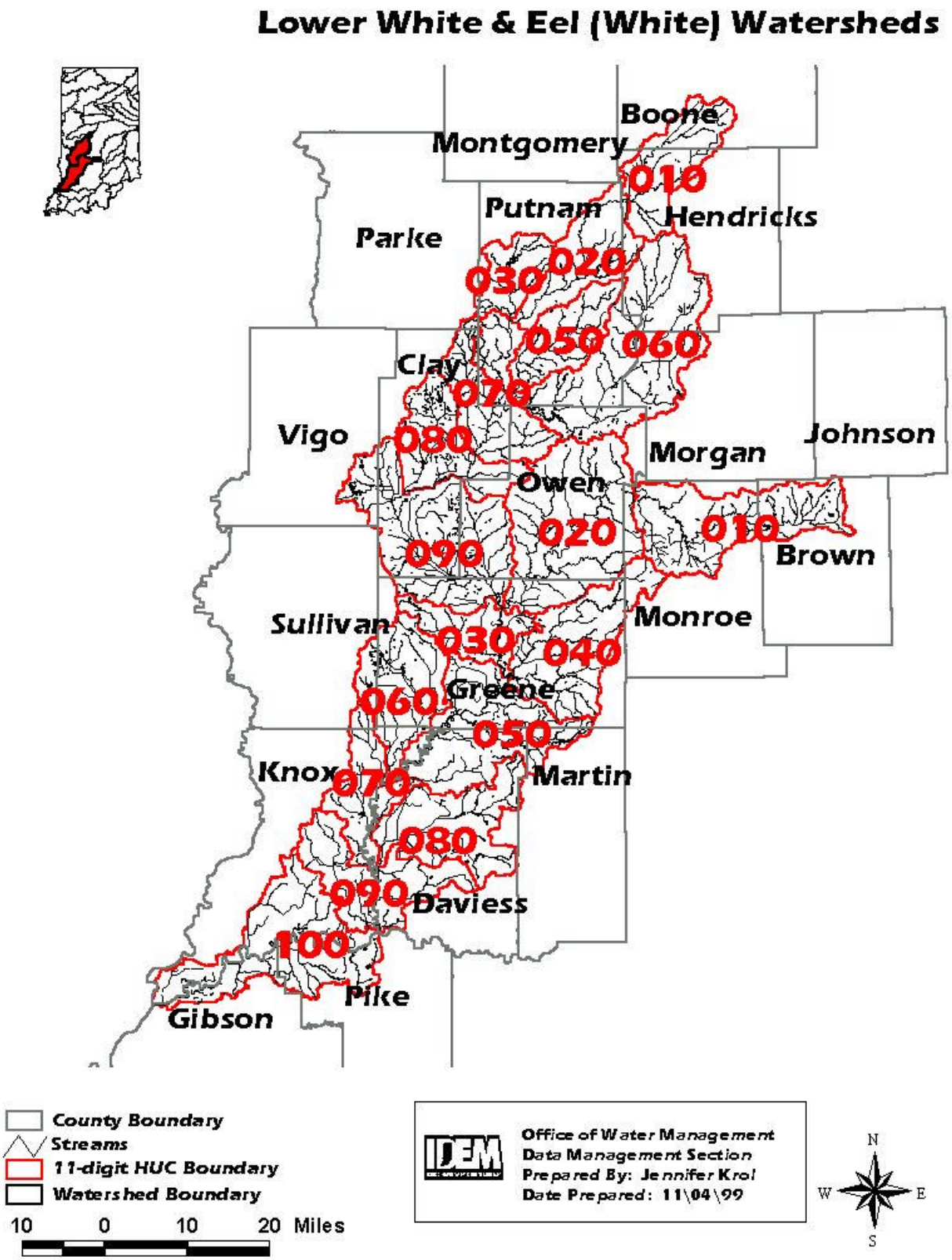

Lower White & Eel (White) Watersheds
Boone
Montgomery
010
Putnam
Hendricks
Parke
030
020
050
060
Clay
070
Vigo
080
Morgan
Johnson
Owen
020
010
090
Brown
Sullivan
Monroe
030
040
Greene
060
050
Knox
070
Martin
080
090
Daviess
100
Pike
Gibson
County Boundary
Streams
11-digit HUC Boundary
Watershed Boundary
10 0 10 20 Miles
IDEM
Office of Water Management
Data Management Section
Prepared By: Jennifer Krol
Date Prepared: 11\04\99
N
W
E
S

FIGURE 2-1
EEL RIVER WATERSHED

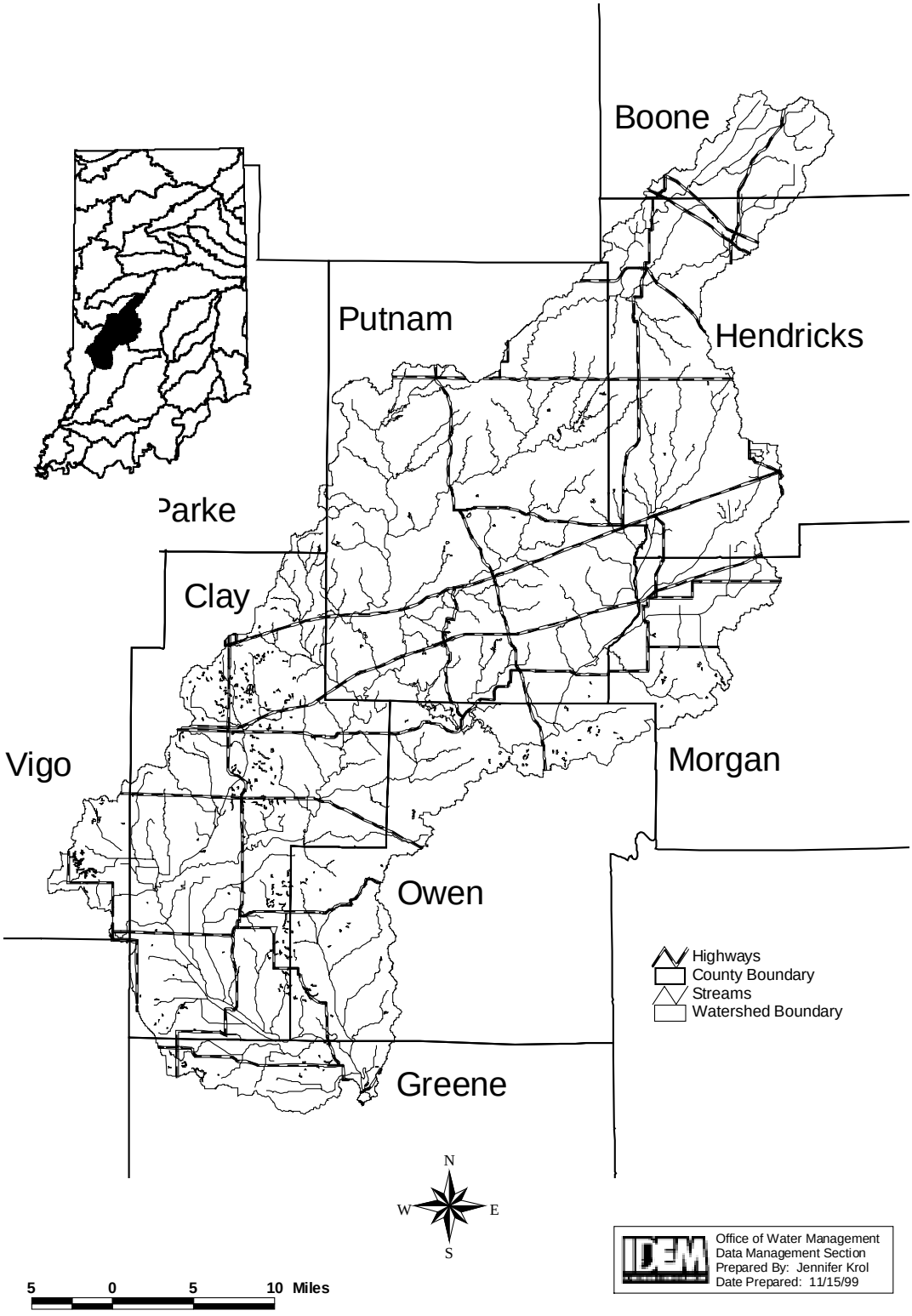
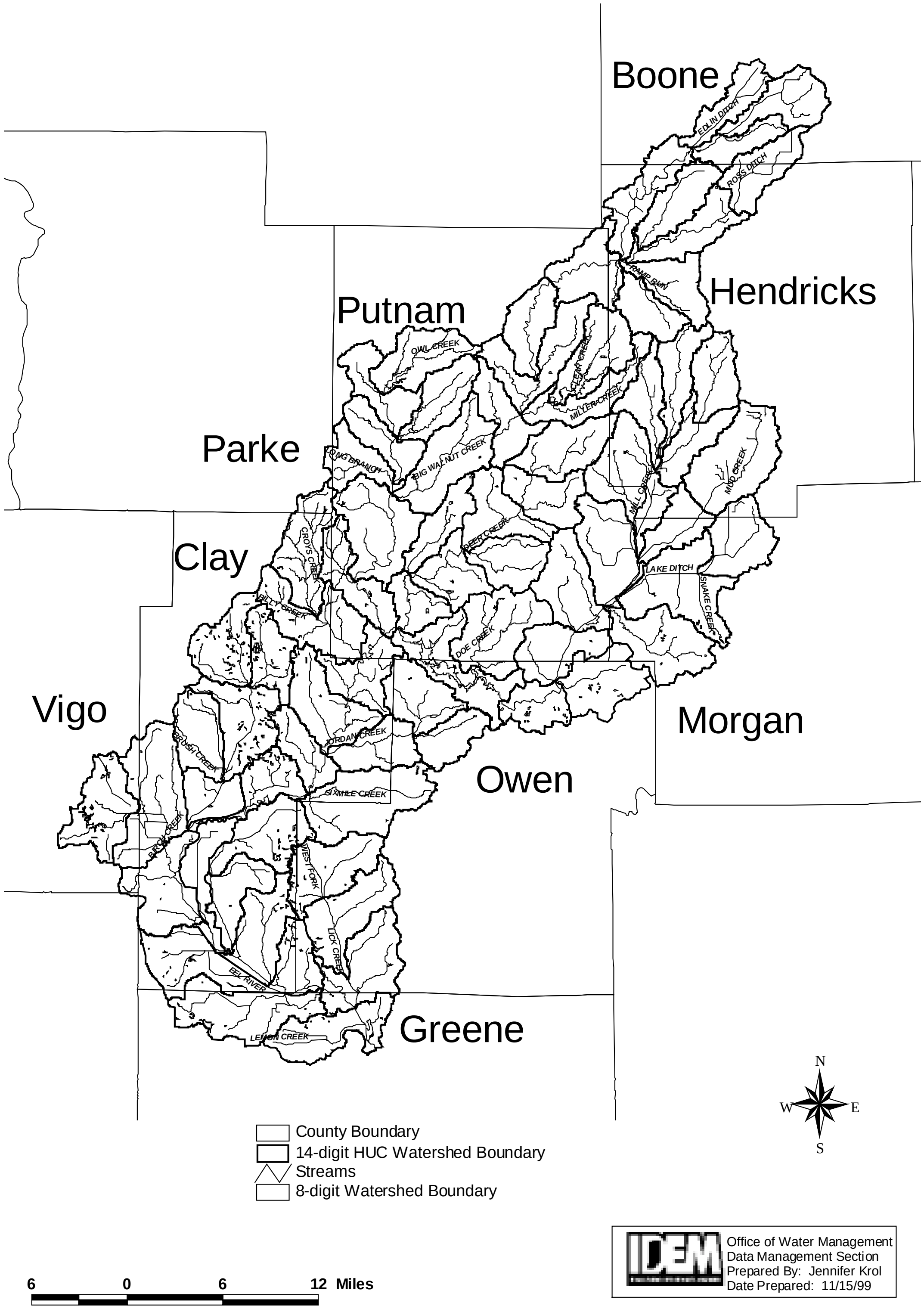


FIGURE 2-2
14-DIGIT HYDROLOGIC UNIT CODE WATERSHEDS
EEL RIVER WATERSHED



IDEM
Office of Water Management
Data Management Section
Prepared By: Jennifer Krol
Date Prepared: 11/15/99

FIGURE 2-4
VEGETATIVE LAND COVER
EEL RIVER WATERSHED

FIGURE 3-1
NPDES DISCHARGES
EEL RIVER WATERSHED

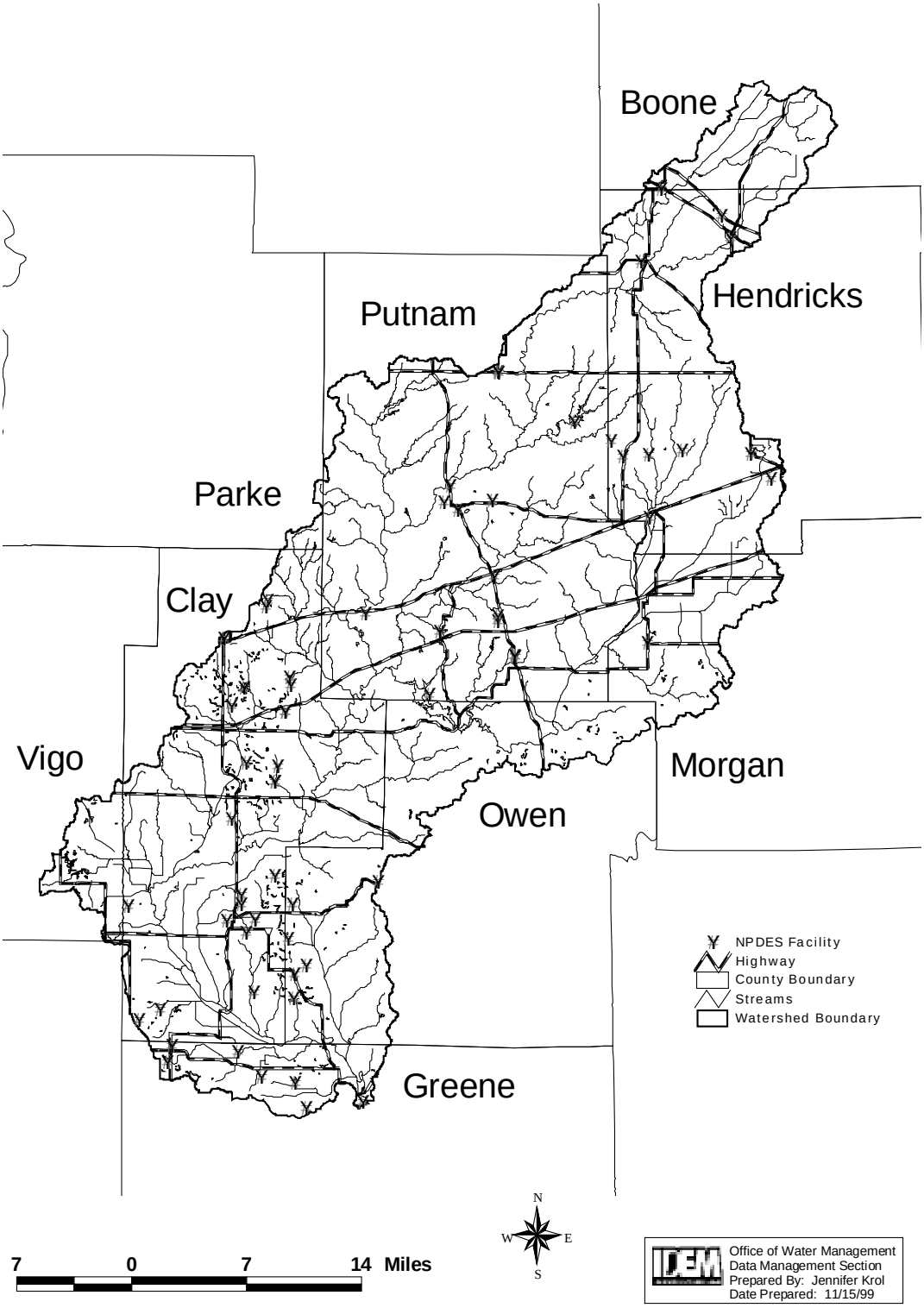


FIGURE 3-1
CLEAN WATER ACT SECTION 303(d) LISTED STREAMS
EEL RIVER WATERSHED

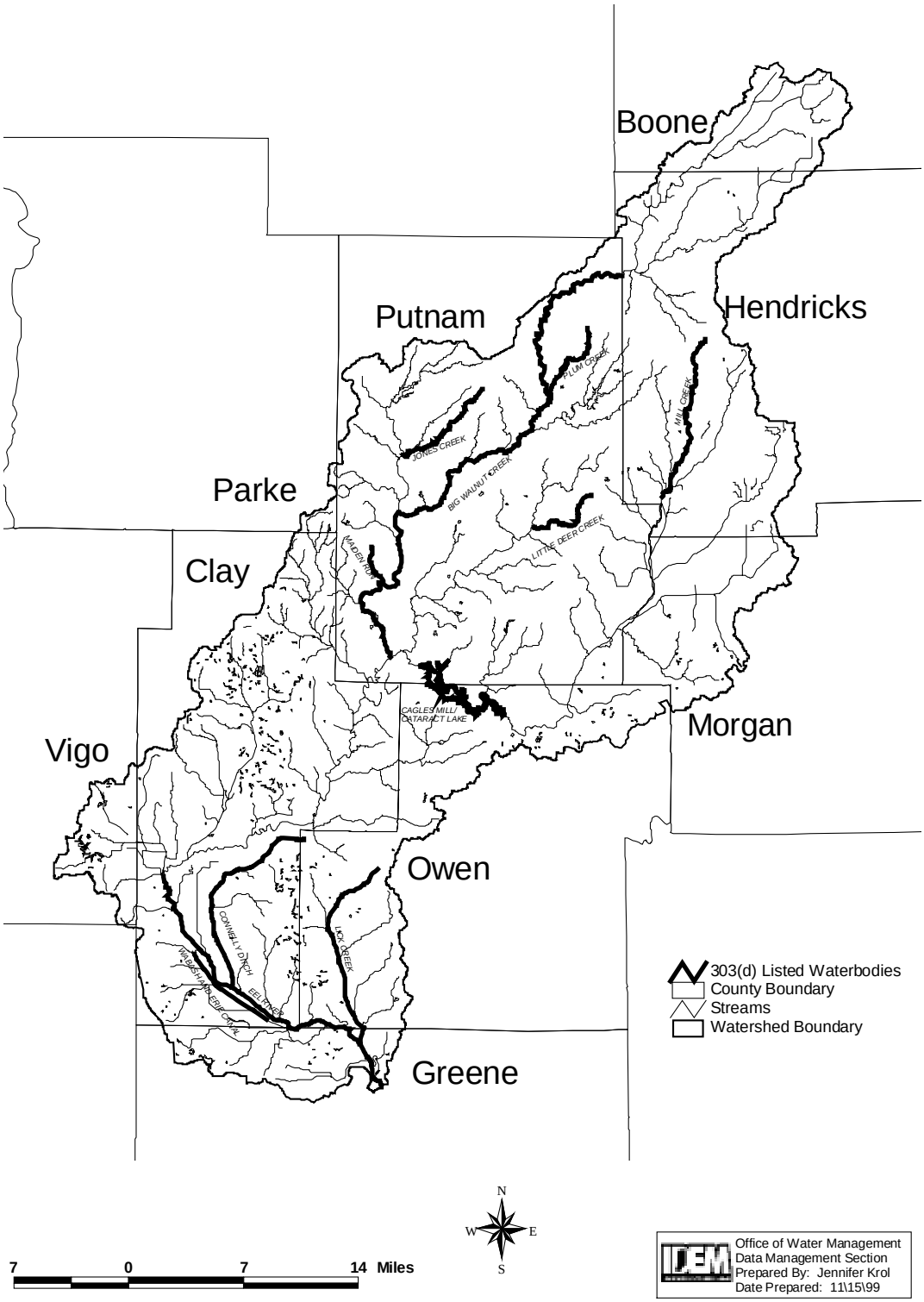


FIGURE 5-1
LARE, S319, EQUIP 97 & 98 AREAS
EEL RIVER WATERSHED

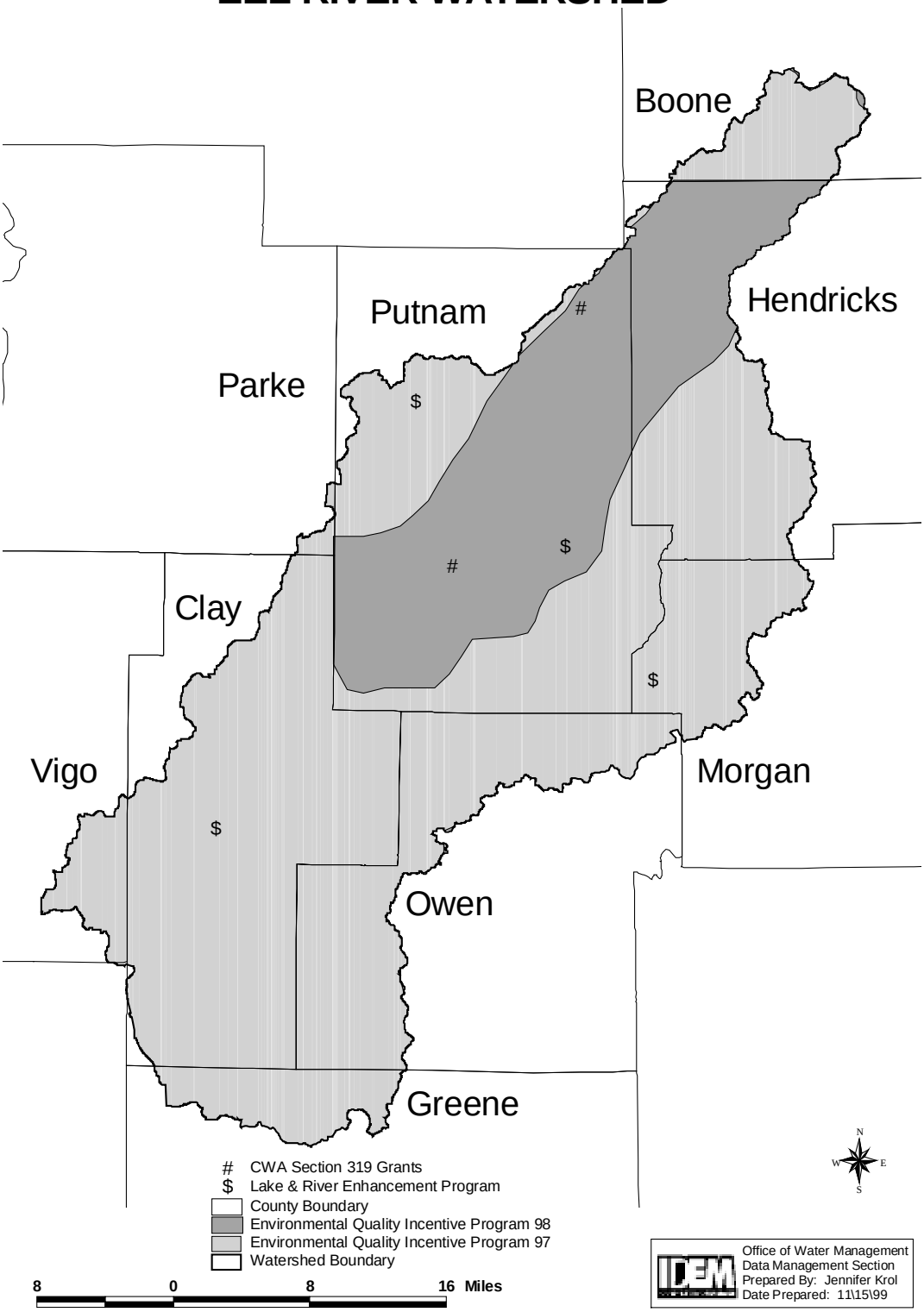
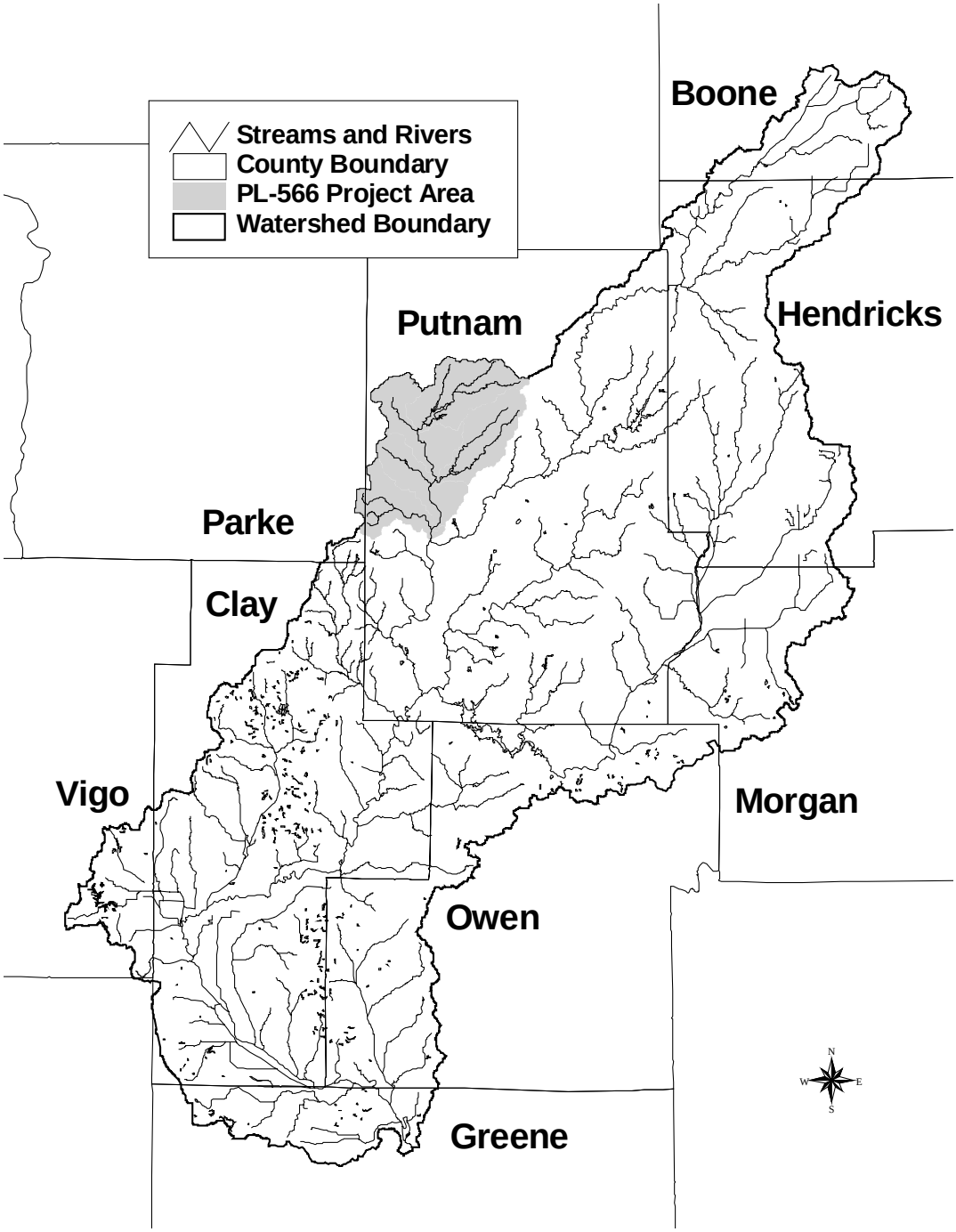


FIGURE 5-2
PL-566 WATERSHED PROJECTS
EEL RIVER WATERSHED



Office of Water Management
Watershed Management Section
Prepared By: Wes Stone
Date Prepared: 12\30\99