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Pete's Run Watershed Management Plan

Howard County, Indiana

HUC #05120107020070

IDEM Contract No. ARN A305-3-669

February 2005

Prepared by the Howard County Soil and Water Conservation District in cooperation with stakeholders of the Pete's Run Watershed

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INTRODUCTION

Purpose

The purpose of this project is to investigate land use and water quality issues within the Pete's Run 205j project area (Figure 1), identify potential water quality problems, and develop strategies for solving these problems.

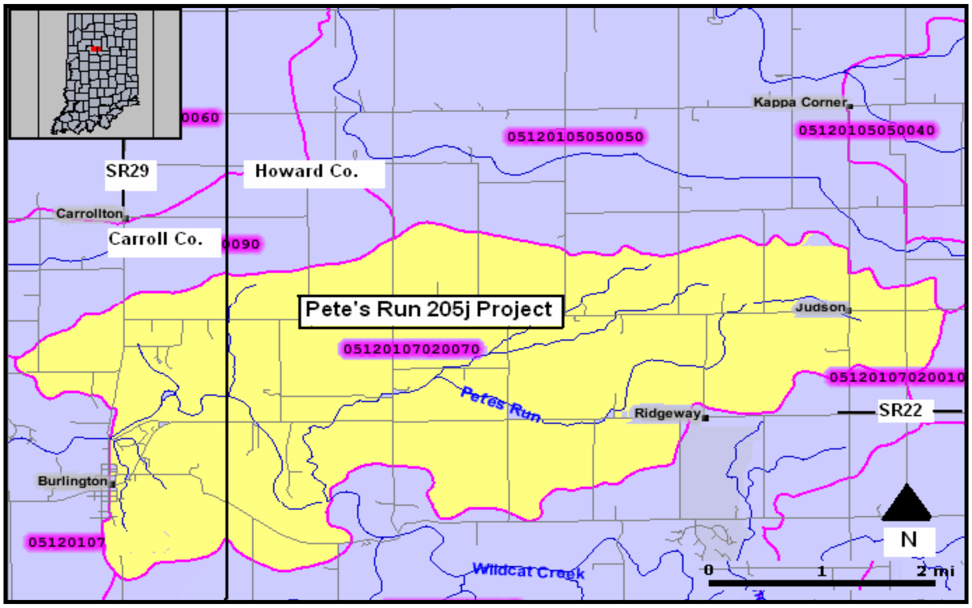

Figure 1. Location of Pete's Run 205j Project (HUC #05120107020070) in Howard County, Indiana.

Project Origin

In 2001, the Howard County Soil and Water Conservation District (SWCD) identified the Pete's Run watershed as an area for study of potential water quality problems. This area has high numbers of livestock, soil tests that reflect concentrated manure applications, slightly rolling topography, and a large amount of cropland. The SWCD was concerned about nonpoint source pollution from these land uses and the impact of the Pete's Run area on downstream water quality problems. Pete's Run empties into the Wildcat Creek which is listed by the Indiana Department of Environmental Management (IDEM) as an impaired waterbody (*2004 Integrated Water Quality Monitoring and Assessment Report*, IDEM, Indianapolis, IN.

Plan Development

The SWCD received a 205j watershed planning grant from IDEM and the U.S. Environmental Protection Agency (USEPA) in January, 2003. This grant was concurrent with a watershed planning grant for the Little Deer Creek Headwaters watershed also in Howard, County. The SWCD board assumed the role of steering committee for the project. They were responsible for overall management of the project (hiring a watershed coordinator, budgeting, monitoring progress, assisting with contacts and meetings). The steering committee met each month.

In April 2003, the SWCD formed a stakeholder advisory committee. This committee had representation from farm operators, rural residents not on farms, and interested citizens, including the Wildcat Guardians, a local not-for-profit group dedicated to protecting Wildcat Creek. The role of the stakeholder committee was to help identify land use and water quality concerns in the project area. A series of meetings was planned to provide several opportunities for local citizens to voice concerns and learn more about the watershed. At the initial stakeholder meeting, participants agreed to a vision statement as follows: *To maintain a level of stewardship that allows waterways to be used for their intended purpose including drainage and human contact.*

The stakeholder committee met eight times over the course of the project. Meeting attendance averaged 10 to 12 citizens. At the first meeting, participants listed these concerns for the watershed:

- drainage
- ditch maintenance
- soil erosion
- development
- chemicals from farms and homes
- drinking water
- septic systems
- dumping
- education
- storm runoff from farms, homes and roads
- economics
- wildlife habitat

Some of these concerns were also expressed directly to the watershed coordinator and in written responses to a survey mailed to 208 residents of the project area (Appendix A). At each stakeholder meeting, a selected topic was discussed along with possible solutions to potential water quality problems. A list of meeting dates and topics is in Appendix B.

The following entities assisted in the development of this plan:

- Local citizens assisted with the land inventory of the watershed and attended meetings to develop the watershed management plan.
- The Natural Resources Conservation Service in Howard County provided information about land use.
- The Howard County Health Department assisted in coordinating surface water testing.
- The Indiana State Department of Health analyzed surface water samples.
- The Indiana-American Water Company, Inc., Kokomo, tested for Atrazine in surface water samples.
- Commonwealth Biomonitoring, Indianapolis, conducted the biological monitoring.
- The Indiana Department of Environmental Management provided grant funding, water quality information, land use data.
- Purdue University Extension provided Confined Animal Feed Operation information.
- The Indiana Department of Natural Resources provided information.

WATERSHED DESCRIPTION

The Pete's Run 205j project area is about 10,283 acres of land. It is located in western Howard County and encompasses a portion of eastern Carroll County including part of the town of Burlington. Pete's Run watershed is one of forty-four 14 digit hydrologic unit code (HUC#05120107020070) sub-watersheds that make up the larger Wildcat Creek watershed. Approximately 300 people live in this watershed. The project area has about 4.4 miles of open waterway. The watershed also includes a 3.2 mile segment of Wildcat Creek from the outlet of Pete's Run in Howard County to the state road 29 bridge in the town of Burlington in Carroll County. Overall, approximately 6,528 acres of the watershed drains into Pete's Run and 3,755 acres drain directly into Wildcat Creek.

Federal and state laws broadly define designated uses of these waterways for aquatic life support, fishing, and primary contact recreation (swimming). Pete's Run, McDowell Ditch, Moore Ditch, and Burchard-Davison Ditch originally were natural, perennial streams; however, these streams have been altered to improve agricultural drainage. All of the waterways in the watershed are considered legal drains and have a 75 foot drainage easement on either side.

Pete's Run watershed is a headwaters area emptying into Wildcat Creek in Howard County, which drains into the Wabash River at Lafayette, Indiana. Wildcat Creek is on the IDEM 303(d) List of Impaired Waterbodies due to high levels of PCBs and pathogens (Appendix C). There is also a Level 5 (most restrictive) fish consumption advisory for sections of the Wildcat Creek due to the presence of polychlorinated biphenyls (Appendix D).

While there are no plans to complete a Total Maximum Daily Load Study (TMDL) on Pete's Run, IDEM is currently developing a TMDL for the main branch of the Wildcat Creek Watershed. This includes the area where Pete's Run empties into Wildcat Creek.

Geology

The landscape of Howard County was shaped by several glaciations. Most recently, from about 10,000 to 15,000 years ago, the Wisconsin Glacier deposited parent material for soils in the Pete's Run watershed. The ground was scoured and leveled as the glaciers retreated through the northern half of Indiana. Glacial till (ground up rock and soil) was deposited over the limestone bedrock of Howard County. The till deposited over western Howard County was loam-textured and of mixed origin. As the ice melted and receded, melt water formed creeks such as Wildcat Creek and Pete's Run. Outwash (sand and gravel) was deposited along the streambeds. Wind blown silt (loess) covered all parts of the county.

Soils

Glaciation and loess deposits resulted in three major areas of soil formation: upland till plains (silt over glacial till), outwash terraces (sand and gravel along drainages), and bottom lands (flood plains receiving alluvium eroded from upland areas). The Pete's Run watershed is an average of 820 feet above sea level. The landform is flat to gently rolling on the upland till plain with slopes of 0 to 2%. Soils formed in outwash terraces have slopes ranging between 2 and 18%. Bottom land soils are flat with slopes of 0 to 2%.

Most of the watershed (about 85%) in Howard County consists of soils in the Fincastle-Brookston association (deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level and gently sloping, on uplands). Minor soils in terms of area are those along drainages and the bottom lands. These soils include the Miami-Russell-Morley association (deep, well drained, medium-textured and moderately fine textured, gently to strongly sloping, on uplands) and the Genesee-Shoals association (deep, well drained and somewhat poorly drained, medium textured, nearly level, on alluvial bottoms). In the Carroll County portion of the watershed, upland soils are the Cyclone-Fincastle-Starks association (deep, nearly level and gently sloping, poorly drained and somewhat poorly drained, moderately fine textured and medium textured, on till plains and outwash plains) and soils along drainages are the Rockfield-Fincastle-Starks association (deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained, medium textured, on till plains). Moundhaven-Landes-Ockley association soils make up the floodplains and streambeds of the watershed in Carroll County. These soils are deep, nearly level and well drained.

The Fincastle (silt loam) and Brookston (silty clay loam) soils have a seasonal high water table and slow permeability. On these soils, tile drainage is necessary for successful crop growth and on-site wastewater disposal (septic systems). Ponded water is common on upland soils after heavy rainfall. Flooding is a potential hazard in winter or early in spring for soils along drainages and in the bottom lands.

A small part (less than 50 acres) of the project area has highly erodible soils. Brookston silty clay loam is the only soil considered a hydric soil; however, the majority of this soil no longer supports hydrophytic vegetation due to tile drainage.

Upland soils are moderately acidic, which is a limitation for agriculture typically overcome with lime and fertilizer.

Climate

Howard and Carroll Counties has a temperate climate with an average temperature of 30^0 F in the winter and 75^0 F in the summer. Low-pressure and high-pressure fronts pass through the area frequently. Precipitation averages around 37 inches per year. Sixty percent of precipitation falls from April to September. Precipitation is adequate for crop growth, but there are periods with low rainfall in the summer that can cause mild drought conditions. Relative humidity in the region varies from 45% to 100%. Prevailing winds are from the southwest, except in the winter when winds come from the northwest.

Severe thunderstorms and tornadoes have the potential to occur in the area and cause localized damage. An estimated one-third of the county's total precipitation enters surface waters and flows out of the county. Wildcat Creek drains approximately 60 percent of the county including the Pete's Run watershed.

Land Use

The original local landscape was a mixture of wet, swampy areas and dense stands of hardwood trees. The federal government purchased the area from the Miami Indians and organized Richardville County in 1844. The name was changed to Howard County in 1846. Early settlers used the creeks to transport goods. Farming spread slowly across the area as trees were cleared and wetlands were drained. Industry expanded rapidly in Howard County when natural gas was discovered in 1886. Many factories located in Kokomo to take advantage of the inexpensive natural gas.

Most (95%) of the Pete's Run watershed is used for agriculture. Less than 1% of the area has an "urban" use (residences, churches, schools). The remaining 4% of the land is grassland, forest, wetland, and open water. All of the land in the watershed is privately owned. Table 1 shows land use data for the Pete's Run 205j Project.

Table 1. Land Use Data for Pete's Run Watershed (GAP Data from IDEM, 1992-93).

Land Use	Area (acres)	Percent of Watershed
Developed: Agricultural, Pasture/Grassland	198.58	1.93%
Developed: Agricultural, Row Crop	9,583.63	93.20%
Developed: Agricultural, Wet Areas	3.33	0.03%
Developed: High Density Urban	3.71	0.04%
Developed: Low Density Urban	36.73	0.36%
Palustrine: Forest, Deciduous	111.06	1.08%
Palustrine: Herbaceous, Deciduous	103.41	1.01%
Palustrine: Shrubland, Deciduous	35.75	0.35%
Terrestrial: Forest, Deciduous	184.50	1.79%
Terrestrial: Shrubland, Deciduous	4.75	0.05%
Terrestrial: Woodland, Deciduous	12.04	0.12%
Water	5.59	0.05%
Total	10,283.06	100%

The land along Wildcat Creek is zoned as floodplain and A1 for agriculture (Kokomo-Howard County Plan Commission). This designation includes the land along the first half mile of Pete's Run from its confluence with Wildcat Creek upstream almost to County Road 100N. The rest of the watershed is zoned for agriculture and residences. Minimum lot size for development recently increased from 20,000 to 30,000 square feet.

BASELINE ASSESSMENT

The baseline assessment includes results from a windshield survey and information from records and staff of the Howard Count SWCD, IDEM, and IDNR. The watershed coordinator organized the information to provide a picture of current land use and water quality within the Pete's Run project.

Land Use

Windshield Survey

A windshield survey of current conditions in the watershed was conducted using volunteers in the summer of 2003. The method used was adapted from the "Watershed Inventory Workbook for Indiana" (Frankenberger et. al., Purdue Cooperative Extension Service, 2002). Volunteers were given a driving route and a series of worksheets to record observations about streams, residential and urban areas (homes, construction sites, impervious areas, recreational facilities, unrecorded discharge pipes), pasture, cropland, and forested land.

Residential and Urban Areas

There are small clusters of homes throughout the watershed. All of these homes use on-site wastewater disposal and private drinking water wells. The east half of the town of Burlington is located within this project area. With a population of 444 in 2000, Burlington is the only area considered urban. The town of Burlington has a wastewater treatment plant, which discharges downstream of state road 29, below the point designated as the Pete's Run project terminus. This treatment plant is the only regulated point pollution source (NPDES permitted) located in the 205j project area.

Roads, residential, commercial and farm buildings, driveways and parking lots make up the impervious area of the watershed. Outside the town of Burlington, the amount of impervious area in the watershed is small. Stormwater control for this area consists of the drainage ditches and streams in the watershed. There are also several small residential and farm ponds that serve as retention basins. There is a commercial gravel pit in the watershed. There is a public park in the town of Burlington. No new construction was observed during the windshield survey, but scattered lots for sale appear regularly throughout the year.

Agriculture

Cropland covers 93 percent of the Pete's Run watershed. The dominant crop rotation is corn and soybeans. Tillage practices range from conventional (moldboard plow) to no-till. No tillage for soybeans has been increasing over the last ten years in both Howard and Carroll Counties. No-till was used on less than 5 percent of soybeans in 1990. In 2000, no-till was used on 39 percent of soybeans in Howard County and 23 percent of soybeans in Carroll County (Conservation Technology Information Center, 2002). Some of this increase is likely happening within the Pete's Run watershed. The acreage of corn in conservation tillage has also increased in both counties, but this tillage is reduced tillage, not no-till. According to some farmers who have attended stakeholder meetings and a local crop consultant, certain crop management issues, such as planting time, soil temperature and weed pressure, are compatible with no-till soybeans but not corn.

A record search of the Farm Service Agency maps in Howard County showed that six different landowners in the Pete's Run watershed are currently involved with federal conservation programs. The following practices are currently under federal contract: 34.1 acres of filter strips on 12 tracts of land, and 1.2 acres of grassed waterways on 2 tracts of land.

There are approximately 4,000 animal units within the Pete's Run watershed, mostly hogs in confinement. These operations store hog waste in pits under the building. Pits are pumped out and the waste is spread on available cropland. Much of the spreading is by injection under the soil surface, which is presumed preferable to surface spreading for several reasons (less runoff potential, greater capture of nutrients, less odor). The crop consultant, farmers, and the NRCS staff note that levels of phosphorus are extremely high in some fields close to hog barns indicating that these fields have historically received most of the animal waste, a common situation in Indiana. Four of the hog operations are permitted Confined Animal Feeding Operations (CAFOs)(Appendix E). There are a few small herds of pastured cattle, horses, and hogs. In some locations the pasture is eroding and stock have unlimited access to a perennial stream or ephemeral drainage.

Forested Land

The hardwood forests that originally covered this area have been reduced to scattered, small wooded parcels. There are several wooded parcels ranging in size from very small to about 20 acres. Many of these parcels have been used for pasture.

Natural Areas and Endangered Species

In 1980, the main stem of the Wildcat Creek was designated a State Natural and Scenic River Segment beginning at state road 29 in Burlington downstream to 4.8 miles upstream of the confluence with the Wabash River at Lafayette. This designation does not apply to Pete's Run or the Wildcat Creek in Howard County; however, as headwaters areas, these streams significantly impact the downstream environment by contributing point and nonpoint pollutants.

The DNR maintains a list of endangered, threatened, and rare species for the state. Listings for Howard County are in Appendix F. It is possible that some listings may apply to the Pete's Run watershed; however, detailed studies have not been done to document specific locations of endangered, threatened, or rare species within the watershed.

Stream Observations

Almost all local streams have been altered in some way to improve drainage. This includes straightening, filling, and dredging. Some stream banks are quite steep as a result of repeated dredging. The windshield surveyors recorded a wide range of conditions from wooded or grassed, stable banks to eroding banks caused by livestock accessing the stream. At the time of the windshield survey, stream flow was typically low, estimated at less than 10 cubic feet per second. Almost all streams have some type of vegetation buffer and in some places the buffer is greater than 30 feet wide on both sides of the stream. In a few locations, tillage is very close to the stream bank and there is no vegetative buffer.

Water Quality

Existing Data

No previous water quality studies have been conducted specifically for surface water in the Pete's Run watershed; however, several studies have been made of the Wildcat Creek. The water quality of Wildcat Creek downstream of Kokomo is severely impacted by the Continental Steel Superfund Site (US EPA CERCLIS). IDEM studies show PCB contamination in both sediment and fish tissue downstream of Kokomo. A level 5 (Do Not Eat – all species) fish consumption advisory is in place for Wildcat Creek beginning at the waterworks dam near U.S. 31 in Howard County and extending the entire length of Wildcat Creek in Carroll County. The advisory is less restrictive in Tippecanoe County.

An IDEM study of pesticides in surface waters of the Upper Wabash River Basin, including the Pete's Run watershed, was published in 2001 (McDuffee, R. 2001. *An Assessment of Pesticide Concentrations in the Upper Wabash River Basin*. IDEM, Office of Water Quality, Assessment Branch, Surveys Section, Indianapolis, IN. IDEM 032/02/024/2001). The closest downstream sampling point to the Pete's Run watershed outlet is at Owasco in Carroll County, several miles downstream of Pete's Run. Water samples from this site contained concentrations of the commonly used agricultural herbicide Atrazine above drinking water standards in 4 out of 15 samples. The four samples were collected following elevated stream discharge during the period of the year when agricultural herbicides are most commonly applied.

In the early 1990s, the Indiana Farm Bureau coordinated a county-based, volunteer well water testing program. Samples were tested for nitrate, Acetanilide, and Atrazine. In Howard County, 74 well samples were tested and none contained concentrations above drinking water standards (*Well Testing Program*, Indiana Farm Bureau, 1994.).

Surface Water Monitoring

A water quality monitoring program was approved for the Pete's Run watershed project. The program followed procedures according to the Quality Assurance Project Plan (QAPP) developed for this project. In June 2004, the QAPP was revised to provide for DNA testing of E. coliform bacteria. The QAPP is on file with the Howard County SWCD.

The sampling design was to conduct two rounds of sampling in 2003 - spring sampling to represent high flow conditions followed by fall sampling to represent low flow conditions. The spring sampling took place on June 21, within 24 hours of at 0.5 inches of rainfall. The fall sampling took place on October 21, prior to which no significant rainfall had occurred. Sample locations are shown in Figure 2. Latitude and longitude coordinates for these sampling sites are in Appendix G. Sites were selected for the project terminus and bridge access to lower Pete's Run and perennial feeder streams.

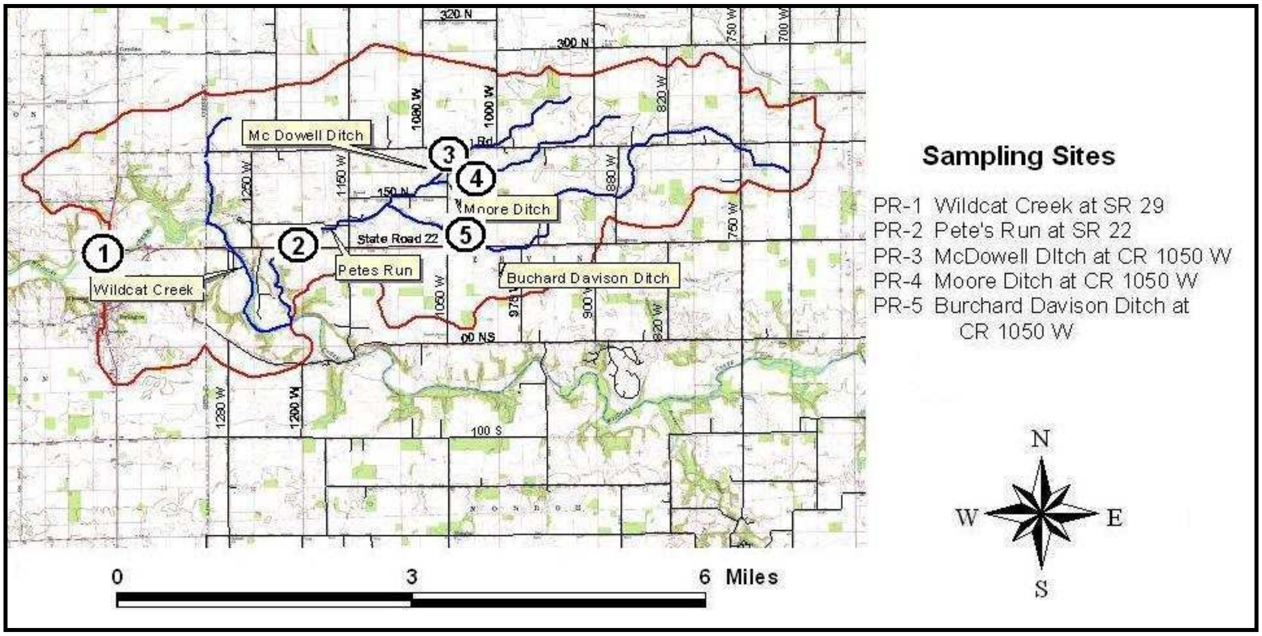

Figure 2. Water sampling locations in the Pete's Run watershed project.

Stream discharge was calculated manually in the field by observing stream width, depth, and rate of flow at three locations approximately 20 feet apart. Water quality analysis was conducted in the field using a Hach Surface Waters testing kit. The variables tested were: water temperature, pH, and dissolved oxygen. Turbidity was determined by using a turbidity tube. The remaining water quality variables were analyzed in the laboratory by two cooperators: the Indiana State Department of Health Environmental Laboratory in Indianapolis (ammonia, total Kjeldahl nitrogen, nitrate+nitrite, total phosphorus, E. coliform bacteria, and conductivity) and the Indiana-American Water Company office in Kokomo, Indiana (Atrazine). Results of the water analysis are in Table 2.

Table 2 . Results of Water Analysis in the Pete's Run Watershed.

Spring sampling: 6/12/04 (within 12 hours of 0.5" rainfall)

Fall sampling: 10/21/04 (no recent rainfall / partly cloudy / crop harvest underway)

SITE	TIME (a.m.) Spring	TIME (a.m.) Fall	WATER TEMP. C (F) Spring	WATER TEMP. C (F) Fall	pH Spring	pH Fall	TURBIDITY (NTUs) Spring	TURBIDITY (NTUs) Fall	DISCHARGE (cfs) Spring	DISCHARGE (cfs) Fall
PR 1	8:45	8:00	17.8 (64)	14.44 (58)	8.3	8.5	200	≤ 10	200*	296.03
PR 2	9:30	9:00	16.7 (62)	13.33 (56)	8.0	8.4	225	≤ 10	36.60	12.68
PR 3A	9:45	9:30	15.5 (60)	13.33 (56)	7.8	8.3	800	≤ 10	5.79	0.55
PR 3B	9:45	9:30	15.5 (60)	13.33 (56)	7.8	8.3	800	≤ 10	4.83	0.55
PR 4	10:10	10:15	15.5 (60)	13.33 (56)	7.9	8.3	250	≤ 10	9.60	1.20
PR 5	10:25	10:40	16.7 (62)	13.89 (57)	8.0	8.3	300	≤ 10	22.75	4.62

*estimated

SITE	DISSOLVED OXYGEN (mg/L) Spring	DISSOLVED OXYGEN (mg/L) Fall	AMMONIA (mg/L) Spring	AMMONIA (mg/L) Fall	TKN (mg/L) Spring	TKN (mg/L) Fall	NITRATE + NITRITE (mg/L) Spring	NITRATE + NITRITE (mg/L) Fall	TOTAL PHOSPHORUS (mg/L) Spring	TOTAL PHOSPHORUS (mg/L) Fall
PR 1	7	9	<0.1	<0.1	1.5	0.6	3.2	3.7	0.36	0.06
PR 2	8	8	0.30	<0.1	2.0	0.3	11.0	7.5	0.46	0.04
PR 3A	7	8	0.30	<0.1	1.2	0.5	16.0	5.5	0.22	0.04
PR 3B	7	8	0.30	<0.1	1.4	0.3	16.0	4.6	0.26	0.04
PR 4	7	9	<0.1	<0.1	1.7	<0.1	19.0	11.0	0.52	0.07
PR 5	8	8	0.10	<0.1	1.5	0.7	12.0	7.8	0.33	0.10

SITE	ATRAZINE (ug/L) Spring	ATRAZINE (ug/L) Fall	E. COLI (cfu/100 ml) Spring	E. COLI (cfu/100 ml) Fall	CONDUCTIVITY (umho/cm) Spring	CONDUCTIVITY (umho/cm) Fall
PR 1	0.44	0.26	20,000	190	564	728
PR 2	5.66	0.29	17,000	390	460	723
PR 3A	3.10	0.15	8,700	47	613	706
PR 3B	6.63	0.13	13,000	54	624	709
PR 4	3.52	0.27	6,100	150	546	713
PR 5	3.76	0.42	11,000	410	550	741

The testing results clearly show that elevated stream discharge after a spring rain carries higher pollutant loads than low stream flow on a typical fall day. This is true for all of the nonpoint pollutants of concern in this watershed: sediment, ammonia, nitrogen, phosphorus, Atrazine, and E. coliform bacteria. Spring water samples at all sites contain levels of nitrate+nitrite, Atrazine, and E. coli above state standards for drinking water. E. Coli levels are also above the state standard for primary contact recreation (swimming). Pollutants in fall samples are below standards with some exceptions. E. coli levels at PR-2 and PR-5 exceed the standard for primary contact recreation. Nitrate+nitrite at PR-4 exceeds the standard for drinking water.

Sampling site PR-1 at the State Road 29 bridge over the Wildcat Creek is affected by a much larger watershed than the actual Pete's Run drainage. Sampling was done at this site because it is the terminus of the 14 digit hydrologic unit; however, testing results here reflect point and nonpoint pollution impacts from the City of Kokomo, Greentown, and many thousands of acres of agricultural land upstream of the Pete's Run 205j project area.

None of the streams in this project area are drinking water sources. Wildcat Creek is used for recreation including boating, fishing, wading, and swimming. Wading in smaller streams is a potential use in warmer months.

A DNA matching technique was used to identify the source of E. coli as either human or other animal. This technique is expensive; therefore, only five samples could be analyzed with the remaining water testing budget. One site (PR-B3 - Pete's Run at SR 22) was selected for one time analysis. Two other sites (PR-B1 and PR-B2) were sampled on two occasions after rainfall events of 0.5 inches or more. See Figure 3 for a map showing the location of these sampling sites.

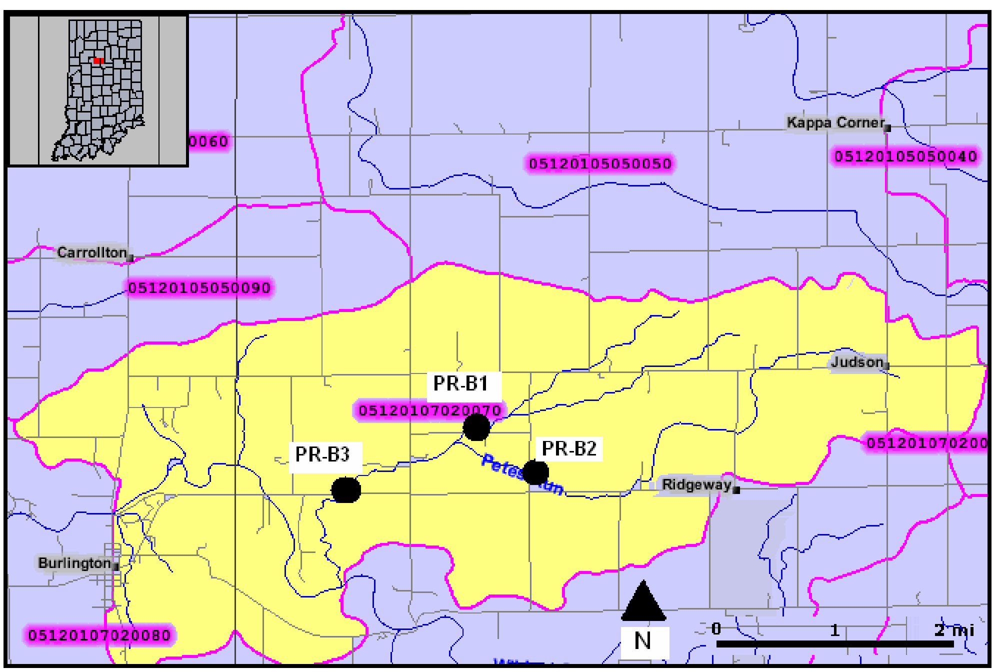

Figure 3. Water sampling sites for E. coli DNA source matching.

The first sampling was on June 17, 2004 (PR-B1, PR-B2, PR-B3). The second sampling was on July 7, 2004 (PR-B2, PR-B3). The total number of samples analyzed was five. For each sample, five isolates are examined for DNA matching to human or animal sources. Results are shown in Table 3. The laboratory employed for this analysis was Source Molecular Corporation (telephone: 786-268-8363 / www.sourcemolecular.com).

Table 3. E. Coliform Bacteria DNA Matching Analysis.

	June 17, 2004			July 7, 2004		
Sampling Site	Fecal Coliform (mpn/100ml)	E. coli Isolate #	Probable Source	Fecal Coliform (mpn/100ml)	E. coli Isolate #	Probable Source
PR-B1 Pete's Run @ CR 150N	> 2,400	1	Animal	>2,400	1	Animal
		2	Animal		2	Animal
		3	Animal		3	Animal
		4	Animal		4	Animal
		5	Animal		5	Animal
PR-B2 Burchard-Davison @ CR 1050 W	> 2,400	1	Animal	>2,400	1	Animal
		2	Animal		2	Animal
		3	Animal		3	Animal
		4	Animal		4	Animal
		5	Animal		5	Animal
PR-B3 Pete's Run @ SR 22	>2,400	1	Animal			
		2	Animal			
		3	Animal			
		4	Animal			
		5	Animal			

Initially, stakeholders and project staff believed that malfunctioning or incorrectly installed septic systems would be a significant source of human E. coli during high stream flows. This belief was not supported by the DNA matching analysis. Results clearly show that animals, including livestock, were the primary sources of fecal waste contamination on both sampling dates. This does not rule out the likelihood that failing septic systems are also a source of contamination, although it may be minor in comparison to livestock sources.

In addition to impacts on human health and recreation, water quality was evaluated for support of aquatic life (animal and plant communities living in surface waters). Atrazine levels measured in both spring and fall water samples were below both chronic (long-term exposure) and acute (one-time exposure) standards set to protect aquatic life. As expected, turbidity (water clarity) is high during high flows due to suspended particles, such as sediment, which can impact aquatic life by interfering with breathing, nesting, and food gathering. Dissolved oxygen levels are adequate in both spring and fall samples to support aquatic life. The pH levels are within the acceptable range for state surface waters.

Spring water samples contain nutrient concentrations known to cause over-enrichment (or eutrophication) of the aquatic environment. Excess nutrients stimulate algae and plant growth in the stream. During daylight hours when photosynthesis occurs, plants introduce oxygen to the stream; however, the opposite occurs at night when plants require oxygen. When algae and plants are over-abundant, there are wide swings in available oxygen (from plenty to not enough) for aquatic animals such as fish and insects. Also, the decomposition of large amounts of dead algae and plants consumes much oxygen which can drastically reduce the amount available to aquatic animals. Locally, these impacts are noticeable but may not be dramatic; however, there are serious national concerns about the impacts of persistent loads of excess nutrients on the health of larger water bodies downstream such as the Wabash, Ohio, and Mississippi Rivers, and the Gulf of Mexico.

Indiana does not yet have water quality standards for nutrients, including ammonia, nitrogen and phosphorus. The USEPA has issued nutrient criteria to guide states in the process of establishing standards. The objective is to reduce over-enrichment of surface waters caused by excess nutrient loads in runoff. Excess nutrients contribute to chronic conditions such as low dissolved oxygen, fish kills, cloudy water, and loss of desirable aquatic animals and plants. The USEPA criteria are set for ecoregions (areas of similar geology, climate and soil type) and are representative numerical values modeled from a data base of several thousand field observations. The Pete's Run project is in the Eastern Corn Belt Plains ecoregion that includes central Indiana and west central Ohio.

<u>Ammonia</u>: Ammonia levels measured in spring and fall do not exceed the USEPA acute and chronic criteria needed to support aquatic life.

<u>Nitrogen</u>: Nitrate-nitrogen concentrations in spring flows are in violation of the drinking water quality standard of 10 mg/l. Concentrations in fall samples are not in violation. Total nitrogen concentrations in both spring and fall samples exceed the nutrient criteria to prevent eutrophication.

<u>Phosphorus</u>: Spring water samples have concentrations well above the USEPA nutrient criteria to prevent eutrophication. Fall samples are below the criteria. Spring stream flow carries excessively high levels of phosphorus. Total phosphorus (TP) concentrations of 0.03 mg/l are known to cause algal blooms. Spring water samples from all five sampling sites contained TP concentrations ranging from 7 to 17 times greater than 0.03 mg/l. Fall samples were at or near this threshold level.

Biological Monitoring

The Howard County SWCD subcontracted with Commonwealth Biomonitoring to perform biological testing of aquatic habitat and aquatic organisms (macroinvertebrate communities) according to the QAPP. Similar to the water testing, the subcontractor conducted two rounds of sampling in 2003, one in the spring (May) and one in the fall (October). This testing was conducted at three sites in the Pete's Run watershed (Figure 4).

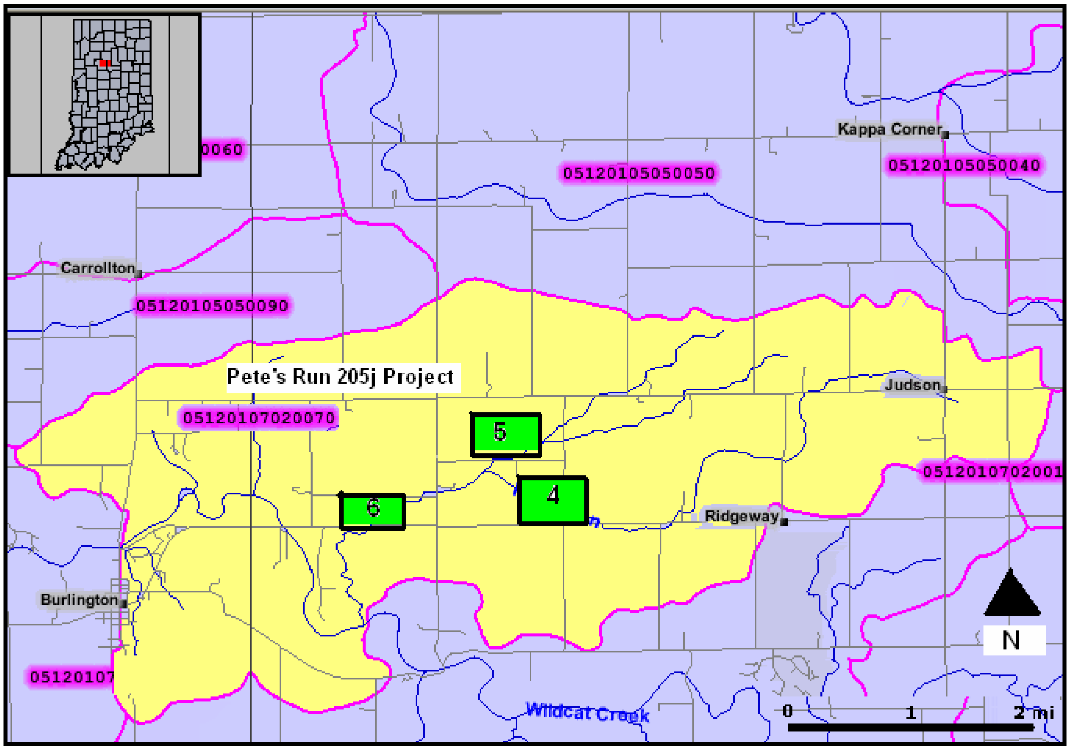

Figure 4. Biological sampling locations for the Pete's Run 205j project.

The subcontractor used a series of tests, or indices, to rate stream habitat and in-stream biotic health. Scores on these tests were compiled and normalized based on the reference site. That is, the reference site represents a "perfect" score of 100 for comparison against scores from the other two sites. There are two evaluations to make. First, both habitat and biota can be assessed as "poor, fair, good, or excellent" by direct comparison with the reference site. Second, the difference between the habitat and biotic index for each site may indicate some type of water quality impairment. If the difference is significant (either negative or positive) then habitat and biota scores do not correlate well, indicating an external impact is affecting the score.

Table 4. Results of Biological Monitoring for Pete's Run Watershed, May 2003 (Commonwealth Biomonitoring).

Sampling Site (map #)	Habitat Index	Biotic Index	Difference	Level of Water Quality Impairment
Reference 6	96	100	+ 4	none
5	58	68	+10	none
4	64	45	-19	moderate
Index scores are normalized based on the reference site #6.				

Results (Table 4) show that sample site 6 (Pete's Run at SR22) has good aquatic habitat, while sites 5 and 4 have only fair habitat "due to artificial channelization and the lack of riparian vegetation or shading canopy" (*Watershed Bioassessment Report: Headwaters of Little Deer Creek and Pete's Run*. Commonwealth Biomonitoring. May and October, 2003).

The biological community was excellent at site 6, and only fair at sites 4 and 5. The biotic index value at site 4 differs significantly from the value predicted by the habitat score. This indicates moderate water quality impairment above site 4, the Burchard-Davison drainage. The macroinvertebrate sample from this site was dominated by algae scrapers, although the habitat score indicates that a more well rounded macroinvertebrate community, including other types of feeders, should be present. This suggests excessive nutrient inputs from land use in this sub-watershed.

Another measure of water quality using macroinvertebrates, the Hilsenhoff Index, indicates the Burchard-Davison sub-watershed is also impacted by low dissolved oxygen levels. The chemical water sampling results show adequate dissolved oxygen levels for the spring and fall testing; however, these were single tests taken in the morning. Dissolved oxygen levels may vary widely during a 24 hour period, especially when excessive nutrients are present to stimulate the growth of aquatic algae and other plants. The full report for this 205j project by Commonwealth Biomonitoring is on file at the Howard County Soil and Water Conservation District.

PROBABLE WATER QUALITY PROBLEMS and SOURCES

The following is a list of water quality problem statements for the Pete's Run 205j project area. These statements are based on information gathered at stakeholder meetings, from the windshield survey of the watershed, and from local agriculture and natural resource professionals.

- <u>Herbicide and Nutrient Movement Off-Site to Surface Waters</u>
  - <u>Causes/Sources</u>:
    - timing of chemical application
    - drainage tiles and tile risers in crop fields
    - possible surface runoff – stream buffers not adequate to slow runoff
  - <u>Location</u>:
    - cropland
  - <u>Extent</u>:
    - 60% of cropland

- <u>Fecal Waste Contamination of Surface Water</u>
  - <u>Causes/Sources</u>:
    - livestock waste storage and disposal
    - septic system malfunction or old system with no filtration field
  - <u>Location</u>:
    - manure storage sites and cropland receiving manure applications
    - residences
  - <u>Extent</u>:
    - 40% of cropland
    - potentially all residences with septic systems more than 30 years old

- <u>Sedimentation of Surface Water</u>
  - <u>Causes/Sources</u>:
    - steep ditch bank slopes susceptible to collapse
    - destruction of vegetation along stream banks
    - sheet and rill erosion of cropland
    - loss of floodwater retention areas upstream
  - <u>Location</u>:
    - along streams and ditches
    - scattered shallow gullies
    - tile outlet structures
  - <u>Extent</u>:
    - 2 miles of ditch length

Critical Areas for Potential Treatment

Critical areas for implementing water quality protection practices were identified by comparing pollutant loads and yields from individual sub-watersheds. The project area was divided into five sub-watersheds (Figure 5) defined by the location of water sampling sites (Table 5). The size of these sub-watersheds was estimated from 1:20,000 scale soil maps using an acreage measuring grid.

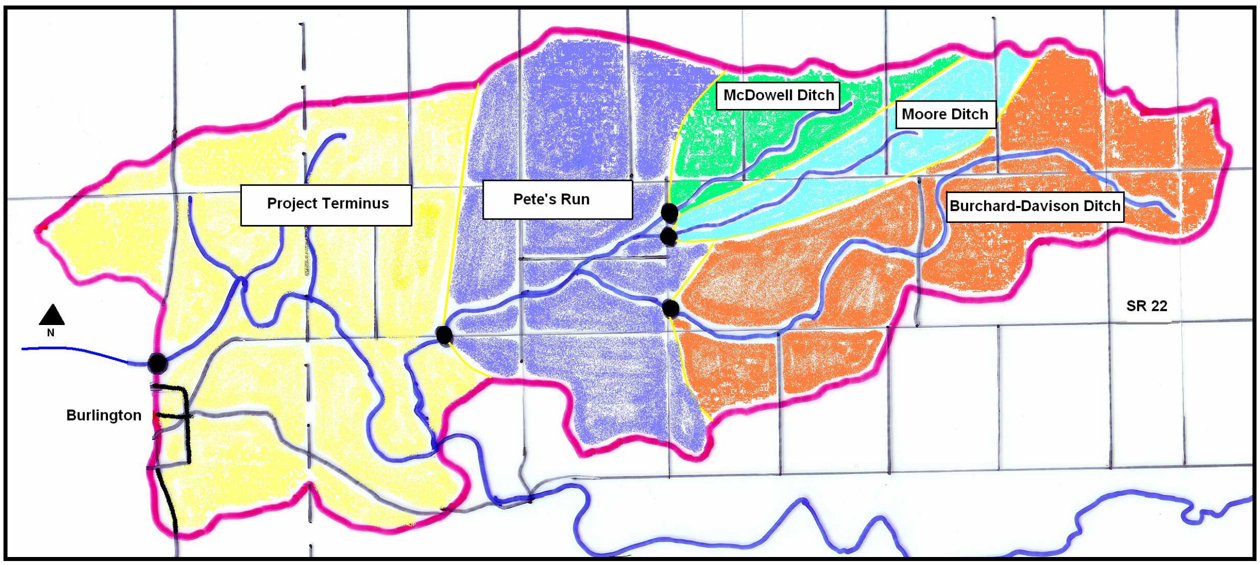

Figure 5. Sub-watersheds of Pete's Run 205j Project Area.

Table 5. Estimated Sub-watersheds of Pete's Run 205j Project Area.

Name	Acres	Sampling Site
Project terminus [1]	10,283	PR 1
Pete's Run above SR22	2,300	PR 2
McDowell Ditch	700	PR 3
Moore Ditch	1,100	PR 4
Burchard-Davison Ditch	2,400	PR 5

[1] This location is at State Road 29 on Wildcat Creek.

Pollutant Loads

The quantity of pollutant leaving a watershed over time is called a load. Comparison of pollutant loads is useful for identifying problem areas (critical areas) within a watershed. Pollutant loads were calculated for each sub-watershed using test results for spring and fall water samples plus stream discharge measurements (Table 6). Although this is a rough analysis and there are only two water samples to compare at each site, this approach helps in locating needs for certain conservation practices.

Table 6. Pollutant Loads from Pete's Run Watershed During High and Low Stream Flow.

Pollutant	Spring Total Load		Fall Total Load (lbs/day)	
	Site PR-1[a]	Site PR-2[b]	Site PR-1	Site PR-2
Ammonia (lbs/day)	54	59	80	3
Total Kjeldahl Nitrogen (lbs/day)	1,615	394	956	20
Nitrate+Nitrite (lbs/day)	3,445	2,167	5,896	512
Total Phosphorus (lbs/day)	388	91	96	3
Atrazine (g/day)	215	507	188	9
E. Coliform bacteria (cfu/day)	1.E + 14	2.E + 13	1.E + 12	1.E + 11

[a] Site PR-1 is project terminus on Wildcat Creek.
[b] Site PR-2 is Pete's Run above SR22 watershed outlet.

Nutrient loads in spring runoff are much higher than in fall stream flow as shown in Figures 6-11. Note that stream discharge at site PR-1 is many times greater than at the other sampling sites for this 205j project. Pollutant loads at PR-1 are coming from the Pete's Run watershed plus all upstream watersheds in the Wildcat Creek basin. Within the Pete's Run 205j project, the three most upstream sub-watersheds (McDowell Ditch, Moore Ditch, and Burchard-Davison Ditch) carry significant loads of nitrogen and phosphorus when stream discharge is high, such as after a rain event of at least 0.5" as was measured in this project. Pollutant loads drop to low levels when stream discharge falls.

In rural watersheds, high loads are usually associated with agricultural activities that take place during spring when vegetative cover to protect soils from rains is at a minimum and the application of manure and chemicals (pesticides and fertilizers) is taking place. Failing or incomplete septic systems are also a source of nutrient loading. In the case of ammonia and nitrate+nitrite, the fall pollutant load is greater than the spring load at site PR-1 (see Figures 6 and 8). This is likely due to the influence of wastewater discharges in Kokomo and other upstream sources.

As mentioned previously, sampling site PR-1 is on Wildcat Creek and receives pollutant loads from a large watershed including the city of Kokomo and town of Greentown. In comparison, site PR-2 receives loads from approximately 2,300 acres in the Pete's Run watershed. Considering that PR-2 receives runoff from a small fraction of the land area that impacts PR-1, the spring pollutants loads at PR-2 are a significant contribution to the total loads measured at site PR-1. This is especially true for forms of nitrogen (ammonia, total Kjeldahl nitrogen, and nitrate+nitrite).

Spring discharge at PR-1 was estimated from US Geological Survey records for gages on Wildcat Creek at U.S. 31 in Kokomo, and on Kokomo Creek at the confluence with Wildcat Creek. The latter location is several miles upstream of the PR-1 site; therefore, it is likely that spring discharge at PR-1 has been underestimated and the pollutant loads are actually higher. In this case, the loads from Pete's Run watershed would be a lower fraction of total loads at PR-1. Nonetheless, spring pollutant loads from the Pete's Run watershed are considerable.

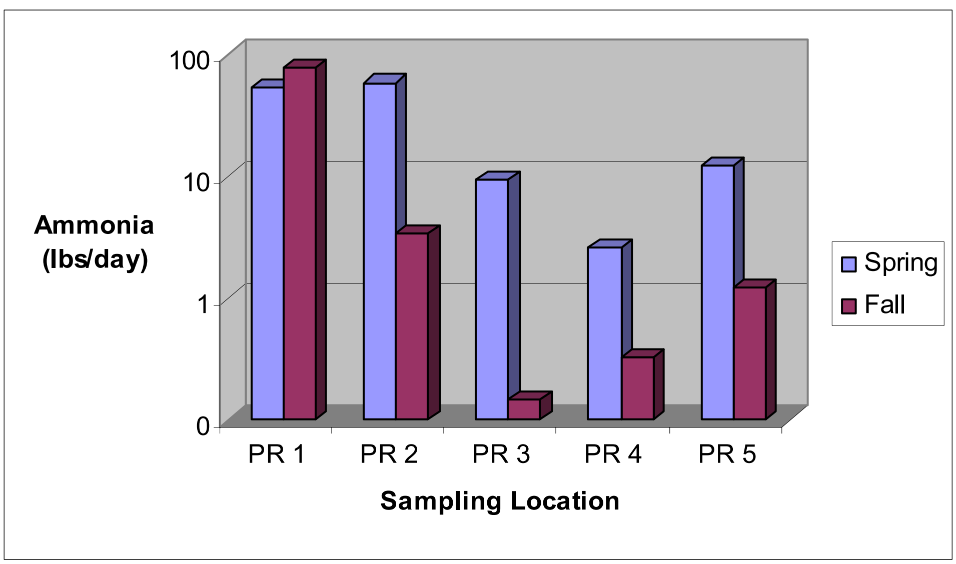

Figure 6: Ammonia Load: Spring vs. Fall (2003)

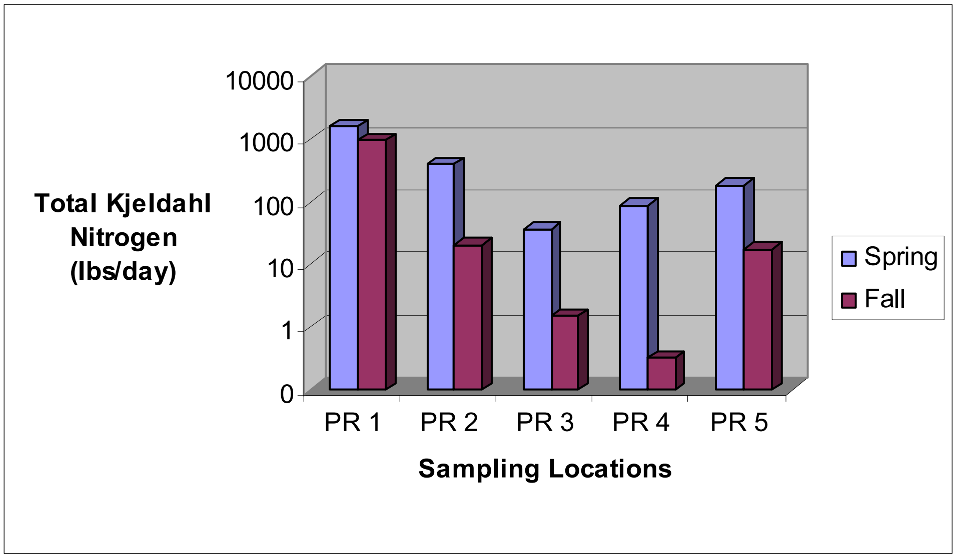

Figure 7. Total Kjeldahl Nitrogen Load: Spring vs. Fall (2003)

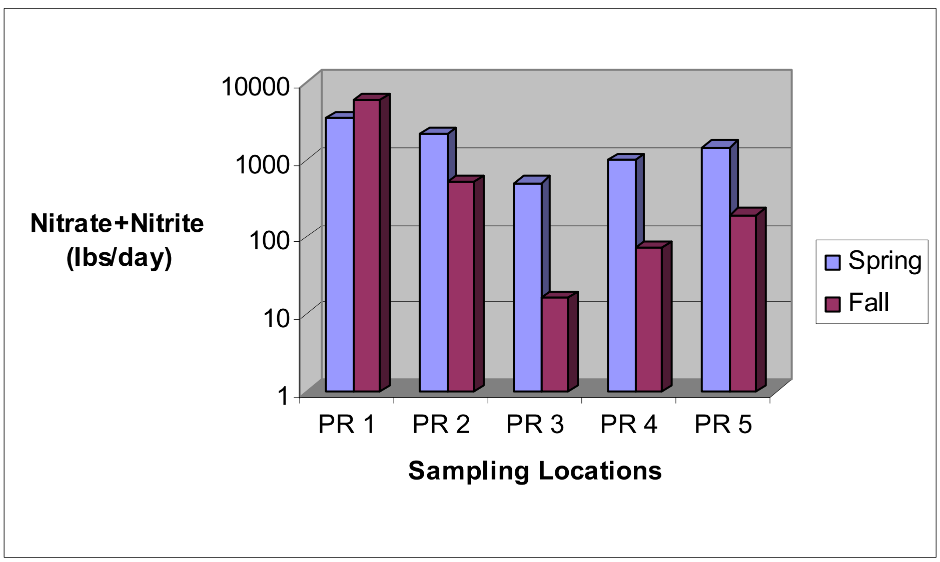

Figure 8. Nitrate+Nitrite Load: Spring vs. Fall (2003)

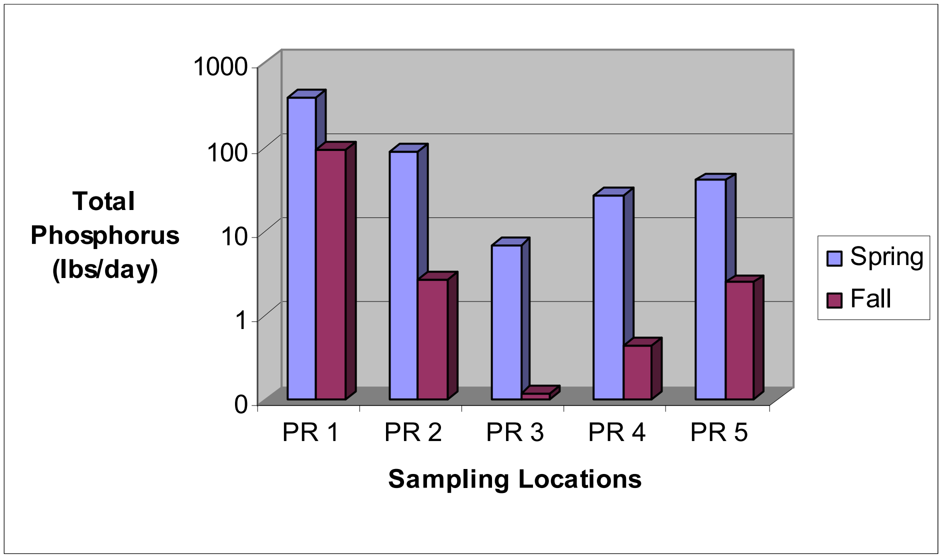

Figure 9. Total Phosphorus Load: Spring vs. Fall (2003)

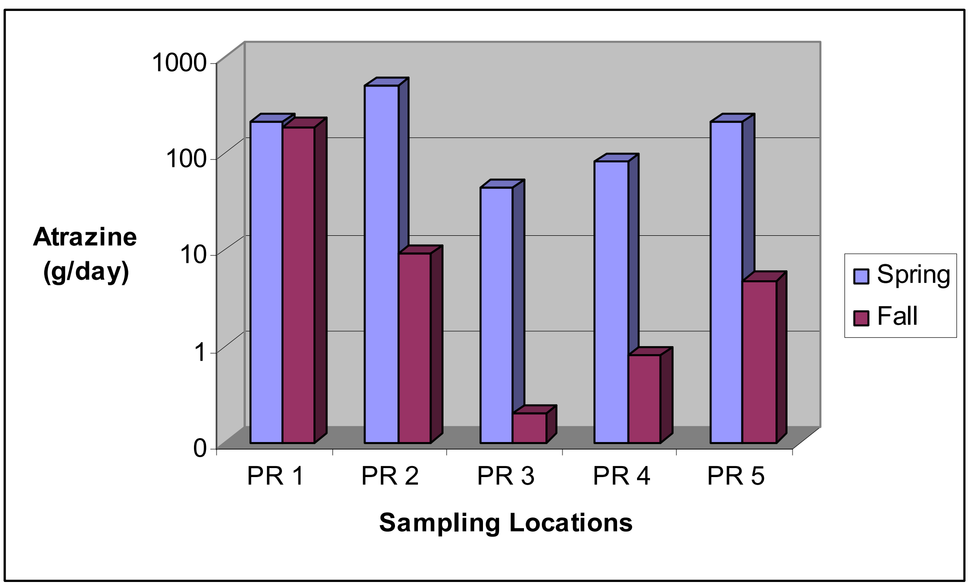

Figure 10. Atrazine Load: Spring vs. Fall (2003)

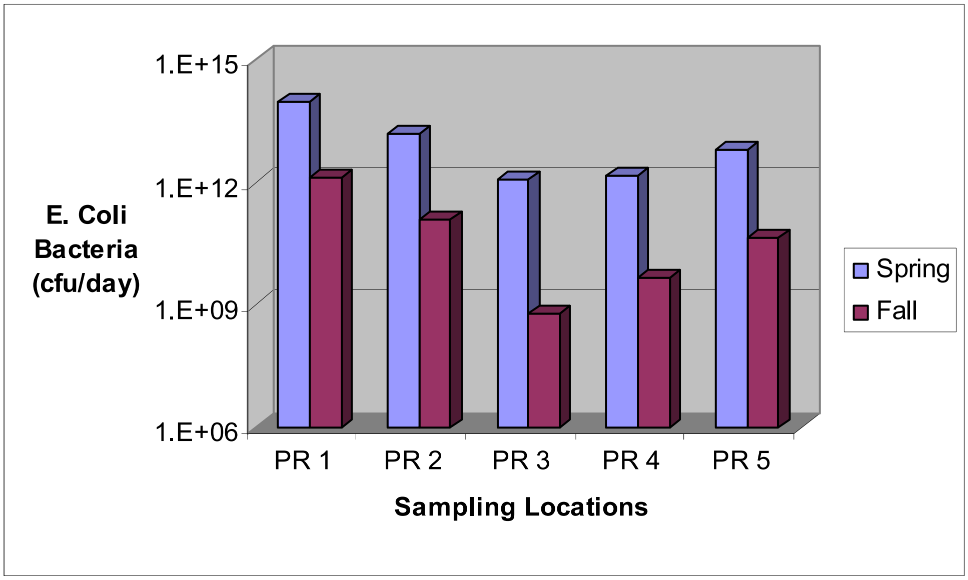

Figure 11. E. Coliform Bacteria Load: Spring vs. Fall (2003)

Pollutant Yields

Another method of comparing the amount of pollutants contributed from the different sub-watersheds is to calculate pollutant yield (load divided by drainage area), or the amount of pollutant generated per acre in each sub-watershed. Figures 12 and 13 show nutrient and Atrazine yields from four sub-watersheds in the project area. The sub-watershed draining to site PR-1 is excluded because Wildcat Creek is not entirely within the project area. The three upstream sub-watersheds have similar nutrient yields, but slightly greater amounts, except for ammonia, come from Moore and Burchard-Davison Ditches. These are the priority sub-watersheds for reducing nutrient and Atrazine loads to surface waters.

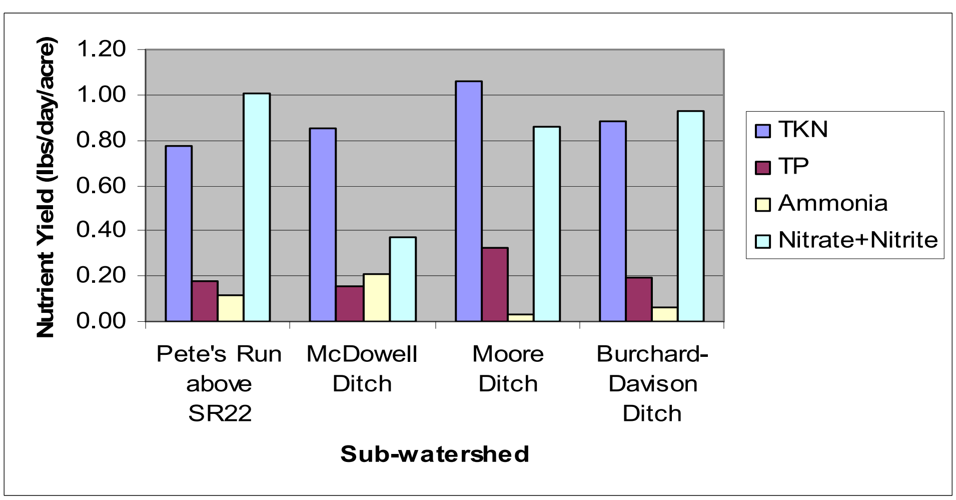

Figure 12. Nutrient Yields from Sub-watersheds: Spring (2003).

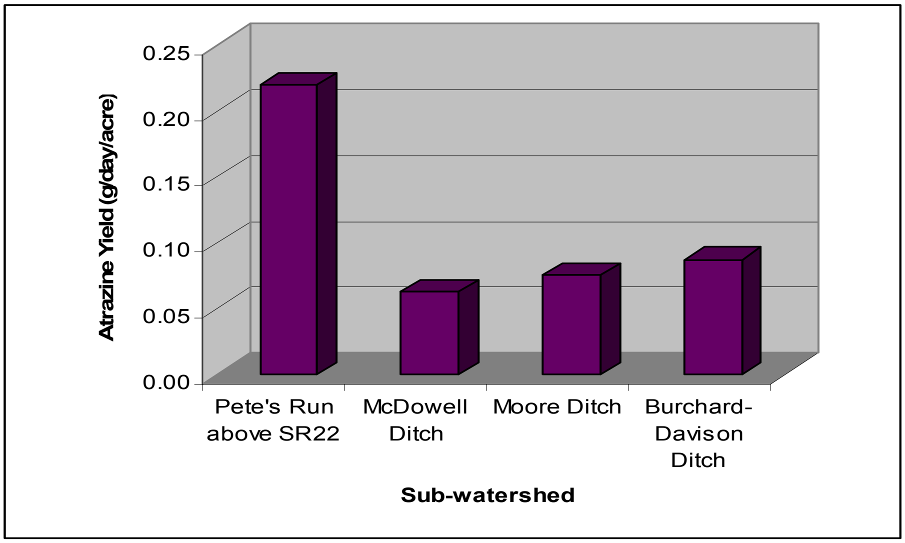

Figure 13. Atrazine Yields from Sub-watersheds: Spring (2003)

E. coli yields are shown in Figure 14. Burchard-Davison Ditch sub-watershed is the largest of the upstream sub-watersheds and has the greatest yield of E. coli. This is the top priority sub-watershed for manure management and upgrade of manure storage facilities. Some of the larger livestock operations are located in this sub-watershed, which is likely a factor in the high E. coli loads. Further E. coli sampling along these ditches could help clarify the source of fecal waste and determine appropriate water quality protection practices. In fact, all sampling sites in the project show high E. coli numbers indicating that practices to prevent waste contamination of surface water, including from septic systems, are needed throughout the project area.

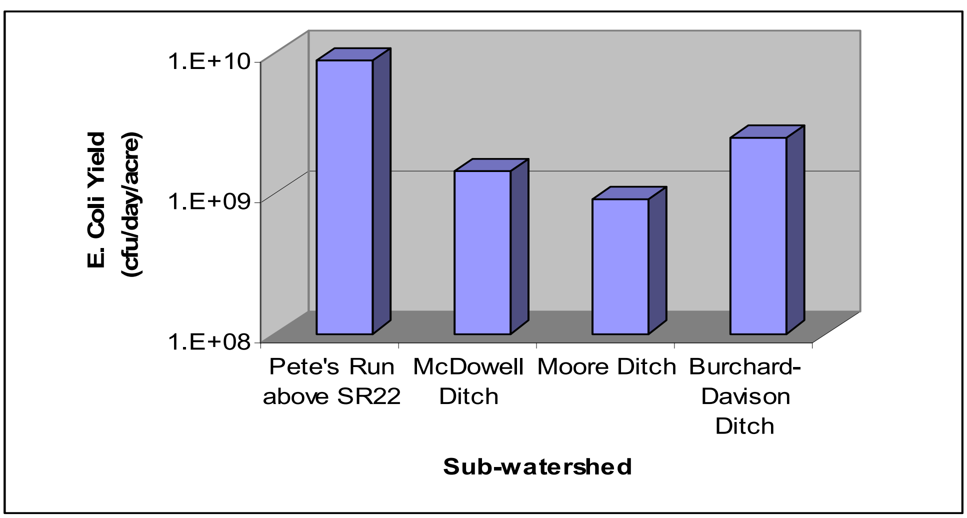

Figure 14. E. Coli Bacteria Yields from Sub-watersheds: Spring (2003)

WATERSHED MANAGEMENT GOALS

The watershed management goal is to reduce peak pollutant loads associated with rain events. The expectation is that implementation of selected conservation practices for agriculture combined with educational programs about water quality and land use will result in lowered pollutant loads. Estimating the reduction in pollutant loads associated with these activities is difficult; nonetheless, estimates based on good information are useful for planning purposes. For this watershed, there is one set of water quality data (high flow and low flow) and one set of biological data. Both sets indicate that water uses are impaired by pollutants moving off-site during rain events. Therefore, land treatment is proposed to reduce polluted runoff.

In Table 7, the environmental goal is paired with the associated conservation practices needed to address the goal. In addition to stakeholder concerns, the watershed coordinator used input from the 205j steering committee, USDA-NRCS District Conservationist, IDNR Resource Specialist, and Howard SWCD Resource Conservationist to select and prioritize conservation practices. This table also includes the priority area for land treatment and the responsible party for overseeing implementation.

Table 7. Land Treatment Measures to Achieve Environmental Goals.

Environmental Goal	Land Treatment Measure [a]	Priority Area	Responsible Party (specifications)
Reduce animal waste contamination of surface water	590–nutrient mgmt. 633-livestock waste utilization 313-manure storage pits	Burchard-Davison sub-watershed All livestock producers	USDA Natural Resources Conservation Service (Field Office Technical Guide) Howard SWCD Purdue Cooperative Extension Service (educational materials)
Reduce nutrient and Atrazine loads at watershed outlet	393-filter strips 590-nutrient mgmt. 595-pest mgmt.	Moore and Burchard-Davison sub-watersheds	
Reduce soil loss	393-filter strips 410-grade stabilization structures	McDowell, Moore, & Burchard-Davison sub-watersheds	USDA Natural Resources Conservation Service (Field Office Technical Guide) Howard SWCD

[A] Practice numbers correspond to USDA NRCS cost share practice codes.

Pollutant Load Reductions

Target levels for land treatment were determined by the watershed coordinator, SWCD Board, NRCS District Conservationist, and DNR Resource Specialists. These levels were established based on the amount of cropland receiving manure and chemical applications where improved management would have a positive effect on water quality. The estimate for grade stabilization structures is from sites within the watershed that would benefit from this practice. Using these levels of land treatment, the IDEM Loading Workbook (Microsoft Excel spreadsheet) was used to calculate estimated pollutant load reductions. Results are shown in Table 8. The computer program does not include calculations for Atrazine and E. coliform bacteria. Workbook worksheets are in Appendix H.

Table 8. Pollutant Load Reductions Estimated with IDEM Loading Workbook.

Planned Practices	Sediment (tons/year)	Phosphorus (lbs/year)	Nitrogen (lbs/year)
1,900 (20%) cropland acres in conservation tillage system	3,919	4,018	8,036
29 acres of filter strips	2,548	4,068	7,585
10 grade stabilization structures	10 (10 units x 1 tons/year/unit)	10 (10 units x 1 lbs/year/unit)	10 (10 units x 1 lbs/year/unit)
15 grassed waterways	15 (15 units x 1 ton/year/unit)	15 (15 units x 1 lb/year/unit)	15 (15 units x 1 lb/year/unit)
Total	6,492	8,111	15,646

The total pollutant load reductions in Table 8 are rough estimates. They do not reflect additional nutrient load reductions associated with improved nutrient (including manure) management and manure storage structures.

Utilizing the available water quality data and estimated load reductions, this plan proposes a target level of 30 percent (or greater) reduction in levels of nutrients, sediment, E. coliform bacteria, and Atrazine herbicide measured in stream flow after a rain event of 0.5 inches or more. Where water quality standards exist (E. coli – contact recreation, Atrazine – aquatic life), such standards are the target level. Note that peak ammonia and Atrazine concentrations currently do not violate aquatic life support standards; however, any reduction in these pollutants lost to surface runoff will be measured as a favorable accomplishment. If the state of Indiana establishes water quality standards for nutrients, these standards become the target goal for nutrients.

This reduction is considered achievable based on estimated land treatment needs. Table 9 lists goals, target reductions for pollutants, and indicators of progress toward the goals. The target date is five years from the beginning of an implementation project. This date reflects a period of time desired to achieve sufficient land treatment and evaluate water quality impacts.

Table 9. Target Levels for Pollutant Load Reductions.

<table>
<tr><th>Goal</th><th>Present Pollutant Level</th><th>Target Pollutant Level</th><th>Progress Indicators</th></tr>
<tr><td>Reduce animal waste contamination of surface water</td><td>E. coli bacteria levels above 235 cfu/100ml</td><td>235 cfu/100 ml (body contact recreation standard)</td><td rowspan="3">Acres of best management practices for manure and adequate manure storage facilities

Acres of best management practices for nutrients and pesticides

Adoption of riparian filter strips installed

Adoption of reduced tillage and number of erosion control practices installed</td></tr>
<tr><td>Reduce nutrient loads & peak Atrazine concentration after spring rain at sampling site PR-2 (Pete’s Run watershed above SR22)</td><td>Loads:
Ammonia:
59 lbs/day
TKN:
394 lbs/day
Nitrate+Nitrite:
2,167 lbs/day
Total Phosphorus:
91 lbs/day
Atrazine:
5.66 ug/l

2003 Aquatic Biotic Index:
Site 4: 45
Site 5: 68</td><td>30 % reduction from spring 2003 samples in 205j plan

Improvement in index score (min. -- no change in score)</td></tr>
<tr><td>Reduce sedimentation of surface waters</td><td>Turbidity levels at 800 NTU in spring runoff</td><td>30% Reduction from spring samples in 205j plan</td></tr>
</table>

Educational Programs

In addition to the selected measures for land treatment, there are five topic areas where education is needed to address stakeholders' concerns and support overall watershed management goals. These areas are septic system installation and maintenance, drainage and ditch maintenance, dumping, drinking water protection, and wildlife habitat. Proposed measures to provide education on these topics are listed in Table 10.

Most stakeholders who attended the project meetings were overwhelmingly concerned with drainage and ditch maintenance. In the upper, or eastern, portion of this project area, flat topography, the loss of wetlands for floodwater storage, broken tile and obstructed drainage ditches all contribute to widespread ponding of water after significant rains. This may be impacting septic system function as well as interfering with many other land use activities.

Table 10. Education Measures to Support Watershed Management Goals.

Topic	Activity	Target Audience	Responsible Party
Septic System Maintenance	Offer a series of 3 community meetings	All residents using septic systems for on-site wastewater treatment	County Health Department
Drainage and Ditch Maintenance	Develop a drainage and ditch maintenance manual for homeowners	All landowners paying ditch assessment tax	County Surveyor's Office
Dumping	Place county ordinance signs and enforce violations	Where dumping occurs regularly at selected stream crossings	County Government
Drinking Water Protection	Offer Farm-A-Syst and Home-A-Syst to educate landowners about drinking water protection	All interested landowners	Purdue Cooperative Extension Service
Wildlife Habitat	Promote wildlife habitat plantings	All interested landowners	Howard County SWCD

Techniques planned for encouraging public awareness and participation in water quality protection include personal contacts, public meetings, direct mailings, and public exhibits (county fair, field days, demonstrations, etc.).

Potential Impacts: Costs, Benefits

The primary potential impact is improved water quality at the watershed outlet. There are economic benefits to this that could be attached to reductions in lost fertilizer and herbicide locally, as well as downstream improvements in water quality for drinking, recreation, and improved aquatic health. Additional benefits could include greater efficiency in agricultural pest and nutrient management, enhanced environmental values (e.g., landscape beauty, presence of wildlife, quality of stream habitat and biota), and greater social responsibility for local land use issues.

The majority of costs associated with nonpoint pollution control are born by the public who fund cost-share implementation programs. Some costs for educational programs will be shared with local cooperating agencies. Significant private costs that are not covered by cost-share programs are associated with fixing septic systems. These costs are often cited as a deterrent to addressing this problem. Some water quality monitoring costs may be shared with the Howard County Health Department and the Indiana-American Water Company office in Kokomo, Indiana.

The consequences of doing nothing include continued violation of water quality standards for certain pollutants, worsened water quality in some streams, further loss of aquatic habitat, and loss of public support for local land use planning and conservation.

IMPLEMENTATION STRATEGY

Tasks and Timeline

The tasks and estimated financial resources for implementing this watershed management plan are listed in Table 11. This table also includes a timeline for completing tasks in each year of a five-year project.

Table 11. Implementation Tasks, Timeline and Estimated Resources Needed.			
Tasks	Implementation Timeline (5 year project)	Responsible Party	Estimated Resources Needed
Manure Management on 40% of cropland receiving manure (1,500 acres) 7 storage units	Year 1: 500 ac / 3 storage units Year 2: 500 ac / 4 storage units Year 3: 500 ac	USDA NRCS Purdue CES IDNR Howard Co. SWCD	$135,000 planning $50,000 equipment $100,000 manure storage $2,000 CES materials
Nutrient and Pest Management on 40% of cropland (3,800 acres)	Year 1: 1,000 ac Year 2: 2,000 ac Year 3: 800 ac	USDA NRCS Purdue CES IDNR Howard Co. SWCD	$102,600 cost share $2,000 CES materials
Conservation tillage on 20% or cropland (1,900 acres)	Year 1: 500 ac Year 2: 900 ac Year 3: 500 ac	USDA NRCS IDNR Howard Co. SWCD	$57,000 cost share
Riparian filter strips along 2 miles of ditch (29 acres)	Year 1: 0.5 mile Year 2: 1 mile Year 3: 0.5 mile	USDA NRCS IDNR Howard Co. SWCD	$4,350 CRP ($150 per acre)
Grade stabilization structures along ditches (10 units)	Year 1: 3 units Year 2: 5 units Year 3: 2 units	USDA NRCS IDNR Howard Co. SWCD	$65,000 cost-share
Grassed waterways (15,000 feet)	Year 2: 5,000 feet Year 3: 10,000 feet	USDA NRCS IDNR Howard Co. SWCD	$82,500 cost share
WASCOB (10 units)	Year 1: 3 units Year 2: 5 units Year 3: 2 units	USDA NRCS IDNR Howard Co. SWCD	$55,000 cost share
Riparian tree planting (25 acres)	Year 1: 5 acres Year 2: 10 acres Year 3: 10 acres	USDA NRCS IDNR Howard Co. SWCD	$10,000 cost share
Offer 3 educational meetings on septic systems	Year 1, 2, 3	SWCD with County Health Department	$3,000
Develop & distribute homeowners' guide to ditch & tile maintenance	Year 2, 3	SWCD with County Surveyor's Department	$3,000
Display & distribute Farm-A-Syst & Home-A-Syst	Year 2, 3	Purdue CES	$1,000

Table 11 (continued). Implementation Tasks, Timeline and Estimated Resources Needed.			
Tasks	Implementation Timeline (5 year project)	Responsible Party	Estimated Resources Needed
Hire Watershed Coordinator	Year 1	Howard Co. SWCD	$40,000
Water Quality Monitoring (surface water variables, biological monitoring & E. coli virus source i.d.)	Year 1: virus matching Year 3, 4, 5: surface water monitoring Year 5: biological	Howard Co. SWCD with cooperators	$12,000
		Grand Total	$724,450

Monitoring and Evaluation

The implementation and effectiveness of this plan will be monitored in three ways: water quality testing, adoption of best management practices, and landowner contacts for information or assistance.

In the first year of the implementation project, water samples from each sampling site should be collected for E. coli virus matching. This technique provides more detail for pollutant source matching. The E. coli in a water sample can be matched to a specific animal (e.g., swine, cattle, poultry, human), which would be valuable information to use when talking with stakeholders about the E. coli contamination problem.

Follow-up water quality monitoring of peak runoff events should be planned for the third through fifth year of the implementation project. The monitoring design could be grab sampling similar to what was conducted for this plan; but the sampling frequency should be increased to cover multiple events of at least 0.5 inches rainfall during May and June. Monitoring should continue at sites PR-2 through PR-5. Sample analysis may be handled by the same cooperators participating in the watershed planning phase (Indiana American Water Company – Atrazine testing, and Howard County Health Department – E. coli bacteria plus nutrients). The watershed coordinator will be responsible for collecting water samples and transporting them for analysis. Follow-up monitoring should also include biological monitoring at the end of the implementation project. The purpose is to compare the pre- and post-implementation scores for aquatic habitat and biological community.

The adoption of nutrient (including manure) and pest management practices implemented under USDA, IDNR or IDEM cost share programs will be monitored by recording practices and mapping the tracts involved. Contacts with landowners, either individually or in a group, will be recorded to indicate progress for educational programs. This includes requests for printed material, on-site visits, and educational meetings.

CONCLUSION

The Pete's Run Watershed Management Plan was developed over two years and funded by a Clean Water Act Section 205j grant from the Indiana Department of Environmental Management. This plan identifies concerns about water quality held by local landowners and natural resource professionals, and proposes a strategy for addressing these concerns through implementing best management practices and educating the public about water quality. This plan does not contain mandatory or legally binding recommendations. It is intended to provide guidance for water quality protection efforts in the Pete's Run watershed of Howard County, Indiana.

A copy of this plan is on file at the Kokomo-Howard County Public Library. Lists of contributors to this written plan and its distribution are in Appendix I. Comments or questions about the plan should be directed to the Howard County Soil and Water Conservation District, 1103 S. Goyer Rd., Kokomo, Indiana 46902, telephone (765)457-2114(ext. 3).

Appendix A: Watershed Assessment Survey.

Watershed Assessment- Pete's Run

Thank you for helping with the development of the Pete's Run and McKay Dredge-Harrison Harlan Ditch Watershed Management Plans. In order to evaluate the success of this grant project, we will conduct a survey of stakeholder's knowledge and concerns at the beginning and end of the two-year grant period. Please assist us by taking a few minutes to fill out this anonymous survey. If you have any questions please contact the Howard County Soil and Water Conservation District at (765) 457-2114 ext. 3.

Soil, Fertilizers and Nutrients	Agree	Disagree	Unsure
1. What I do on my property affects water quality no matter how far away I live from a stream or ditch.	10(83%)	1(8%)	1(8%)
2. I would like the ditches and streams in my watershed to have clean enough water to be considered safe for fishing and swimming by the state of Indiana.	10(77%)	2(15%)	1(8%)
3. I am concerned about keeping water in my watershed clean for people who live downstream and for future generations.	12(92%)	1(8%)	0
4. I have used a soil testing kit or service to determine how much fertilizer to put on my yard, garden or farm field.	8(67%)	2(16%)	2(16%)
5. I leave grass clippings or crop residue on my property to reduce the amount of fertilizer it needs.	11(84%)	1(8%)	1(8%)
6. I typically identify nuisance pests before selecting and applying a pesticide to treat them.	9(69%)	1(8%)	3(23%)
7. I am familiar with soil and water conservation practices such as filter strips, tree plantings, grass waterways, grade stabilization structures, crop scouting & nutrient management.	9(75%)	0	3(25%)

Please list any conservation practices you have installed or performed (including composting, mulching, water conservation, recycling, etc.)
Grassed Waterway (4), Filter strip (2), Block Chute (1), Tree Buffer (2), Recycle (2)

Septic Systems			
1. The wastewater from my home is treated by a septic system.	10(83%)	0	2(17%)
2. I know where my septic system is located.	11(92%)	0	1(8%)
3. Periodic maintenance is performed on my septic system. (i.e. cleaning out septic tank, checking baffles)	11(92%)	0	1(8%)
4. My septic system consists of a septic tank & absorption field.	9(82%)	0	2(18%)
5. I am careful about putting garbage disposal waste and household chemicals in my septic system.	11(100%)	0	0

Planning and Zoning, Forestry and Stormwater	Agree	Disagree	Unsure
1. Planning and zoning is important to protect water quality.	11(92%)	1(8%)	0
2. Planting and maintaining existing tree stands is important to protect water quality.	11(92%)	1(8%)	0
3. Managing stormwater from rain events is important to protect water quality. (i.e. retention ponds, buffers)	11(92%)	0	1(8%)

Respondents: 11(100%) adults 0 students

Background: 7(64%) agricultural 4(36%) non-agricultural

Comments and concerns: zoning, septic systems, creek bank erosion

Appendix B: List of Meetings for 205j Plan Development

January 2003 – December 2004

Steering Committee

2003
- March 19
- April 23
- May 22
- June 25
- July 23
- August 27
- September 12
- October 22
- November 19
- December 17

2004
- January 28
- February 18
- March 17
- May 19
- June 23
- July 28
- August 25
- September 22
- October 27

Stakeholder Meetings

2003
- April 1
- June 3
- August 19
- November 3

2004
- January 26
- March 15
- June 29
- September 2

Appendix C: IDEM 303 (d) List of Impaired Waterbodies.

Waterbody Segment ID	Hydrologic Unit Code	Waterbody Segment Name	Size	Units	Draft Year 303(d)	Aquatic Life Support	Drinking Water Supply	Fish Consumption	Primary Contact	PCBs	Pathogens	Assessment Date (yyyymmdd)
INB0727_00	05120107020	Petes Run and other tributaries	11.9	Miles		F		X	F			
INB0727_T10	05120107020	Wildcat - mainstem	1.7	Miles	1996	F		N	N	H	S	19991108
INB0727_T10	05120107020	Unnamed tributaries	3.3	Miles		X		X	X			
INB0727_T10	05120107020	Wildcat Creek - mainstem	1.6	Miles	1996	F		N	F	H		19991108

F = fully supporting
P = partially supporting
N = not supporting
x = not assessed

Appendix D: ISDH Fish Consumption Advisory for Howard County.

2004 Indiana Fish Consumption Advisory: Streams and Rivers (Indiana State Department of Health)				
Location	**Species**	**Fish Size (inches)**	**Contaminant**	**Group**
Wildcat Creek Howard County (downstream of waterworks dam in Kokomo) and Carroll County	ALL SPECIES	ALL	PCBs	5
Group 5 = DO NOT EAT				

Appendix E. List of Confined Feeding Operations in Pete's Run 205j Project Area.

Operation/Owner	Operation Location	Animals
Eller Farms	900 W 200 N	swine
Schoeter	700 W 200 N	swine
Wilson [a]	800 W 300 N (2 operations)	swine
[a] This facility is at the edge of the Pete's Run 205j project area.		

Appendix F: Endangered, Threatened and Rare Species.

Endangered, Threatened, and Rare Species Documented from Howard County, Indiana. (IDNR Nature Preserves Division, 11/12/99)

Species Name	Common Name	State	Federal
Vascular Plant			
Crataegus Pedicellata	Scarlet Hawthorn	Threatened	Not Listed
Crataegus Prona	Illinois Hawthorn	Endangered	Not Listed
Crataegus Succculenta	Fleshy Hawthorn	Rare	Not Listed
Glyceria Grandis	American Manna-Grass	Extirpated	Not Listed
Linum Sulcatum	Grooved Yellow Flax	Rare	Not Listed
Reptiles			
Thamnophis Butleri	Butler's Garter Snake	Endangered	Not Listed
Birds			
Ardea Herodias	Great Blue Heron	Endangered	Not Listed
Mammals			
Lynx Rufus	Bobcat	Endangered	Not Listed
Myotis Sodalis	Indiana Bat	Endangered	Endangered
High Quality Natural Community			
Forest – Flatwoods Central Till Plain	Central Till Plain Flatwoods	Significant	Not Listed

Appendix G: Latitude and Longitude Coordinates for Water Sampling Sites.

Site Name	Location	Latitude	Longitude
PR-1	Wildcat Creek at State Road 29	N 40^{0} 29.227’	W 86^{0} 23.670’
PR-2	Pete’s Run at State Road 22	N 40^{0} 29.335’	W 86^{0} 21.447’
PR-3	McDowell Ditch at 1050 W	N 40^{0} 30.037’	W 86^{0} 19.687’
PR-4	Moore Ditch at 1050 W	N 40^{0} 29.895’	W 86^{0} 19.695’
PR-5	Burchard Davison Ditch at 1050 W	N 40^{0} 29.471’	W 86^{0} 19.702’

Appendix H. IDEM Pollutant Load Reduction Worksheets.

12/2/200

Agricultural Fields and Filter Strips

Please fill in the gray areas below. Once you have successfully estimated the sediment and nutrient load reductions, please print two (2) copies of this worksheet. Attach both copies to the 319A or 319U cost-share form.
If you have any questions, please contact Wes Stone (317/233-6299).

These may include:
Prescribed Grazing
Residue Management, Mulch Till
Conservation Crop Rotation
Conservation Cover
Cover and Green Manure
Critical Area Planting
Stripcropping, Contour
Stripcropping, Field
Filter Strips

		Example
IDEM Project Manager:	Howard SWCD	**WWS**
Project ARN:	205j	**95-992**
Landowner Initials:	Pete's Run	**HJK**
Date practices completed:		**8/8/1999**

Please check which BMPs apply:
☑ Agricultural Field Practices
☑ Filter Strips

RUSLE	Before Treatment	After Treatment	Example Before Treatment	Example After Treatment
Rainfall-Runoff Erosivity Factor (R)	145	145	**120**	**120**
Soil Erodibility Factor (K)	0.49	0.49	**0.35**	**0.35**
Length-Slope Factor (LS)	0.528	0.528	**0.44**	**0.44**
Cover Management Factor (C)	0.3	0.15	**0.7**	**0.5**
Support Practice Factor (P)	1	1	**0.775**	**0.11**
Predicted Avg Annual Soil Loss (ton/acre/year)	11.25	5.63	**10.03**	**1.02**

		Example
Contributing Area (acres)	1,900	**14**

The portion of the treated field which contributes eroded soil to the waterbody. The contributing area is defined by the runoff flowpath and by topography and may differ in size from the actual treated field.

Please select a gross soil texture:

- ○ Clay (clay, clay loam, and silt clay)
- ● Silt (silt, silty clay loam, loam, and silt loam)
- ○ Sand (sand, sandy clay, sandy clay loam, sandy loam, and loamy sand)
- ○ Peat

Estimated Load Reductions for Agricultural Field Practices

	Treated	Example
Sediment Load Reduction (ton/year)	3919	**85**
Phosphorus Load Reduction (lb/year)	4018	**100**
Nitrogen Load Reduction (lb/yr)	8036	**200**

Estimated Additional Load Reductions through Filter Strips

	Filter Strips	Example
Sediment Load Reduction (ton/year)	2548	**92**
Phosphorus Load Reduction (lb/year)	4068	**114**
Nitrogen Load Reduction (lb/yr)	7585	**227**

Total Estimated Load Reductions

	Total	Example
Sediment Load Reduction (ton/year)	6467	**92**
Phosphorus Load Reduction (lb/year)	8085	**114**
Nitrogen Load Reduction (lb/yr)	15621	**227**

Gully Stabilization

These may include:

- Grade Stabilization Structure
- Grassed Waterway
- Critical Area Planting in areas with gullies
- Water and Sediment Control Basins

Please fill in the gray areas below. Once you have successfully estimated the sediment and nutrient load reductions, please print two (2) copies this worksheet. Attach both copies to the 319A or 319U cost-share form.
If you have any questions, please contact Wes Stone (317/233-6299).

		Example
IDEM Project Manager:	Howard SWCD	**WWS**
Project ARN:	205j	**99-787**
Landowner Initials:	Pete's Run	**HJK**
Date practices completed:		**8/30/1999**

Please select a soil textural class:

- ( ) Sands, loamy sands
- ( ) Sandy loam
- ( ) Fine sandy loam
- ( ) Loams, sandy clay loams, sandy clay
- ( ) Silt loam
- (•) Silty clay loam, silty clay
- ( ) Clay loam
- ( ) Clay
- ( ) Organic

Parameter		**Gully**	**Example**	
Top Width (ft)		10	**15**	
Bottom Width (ft)		5	**4**	
Depth (ft)		0.7	**5**	
Length (ft)		1000	**20**	
Number of Years		10	**5**	
Soil P Conc (lb/lb soil)*	DEFAULT	0.0005	**0.0005**	*
Soil N Conc (lb/lb soil)*	DEFAULT	0.001	**0.001**	*

* indicates default values for P and N soil concentrations

Estimated Load Reductions

	Gully	**Example**
Sediment Load Reduction (ton/year)	1	**10**
Phosphorus Load Reduction (lb/year)	1	**8**
Nitrogen Load Reduction (lb/yr)	1	**16**

Bank Stabilization

Please fill in the gray areas below. If estimating for just one bank, put "0" in areas for Bank #2.
Once you have successfully estimated the sediment and nutrient load reductions,
please print two (2) copies of this worksheet. Attach both copies to the 319A or 319U cost-share form.

If you have any questions, please contact Wes Stone (317/233-6299).

		Example
IDEM Project Manager:	Howard SWCI	**WWS**
Project ARN:	205j	**95-992**
Landowner Initials:	Pete's Run	**HJK**
Date practices completed:		**8/8/1999**

Please select a soil textural class:

- (Sands, loamy sands
- (Sandy loam
- (Fine sandy loam
- (Loams, sandy clay loams, sandy clay
- (Silt loam
- (•) Silty clay loam, silty clay
- (Clay loam
- (Clay
- (Organic

Parameter		Bank #1	Bank #2	Example	
Length (ft)		100	0	**500**	
Height (ft)		10	0	**15**	
Lateral Recession Rate (ft/yr)*		0.2	0	**0.5**	
Soil P Conc (lb/lb soil)**	DEFAULT	0.0005	0.0005	**0.0005**	**
Soil N Conc (lb/lb soil)**	DEFAULT	0.001	0.001	**0.001**	**

** indicates default values for P and N soil concentrations
*Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgement may be required to estimate the LRR. Please refer to the narrative descriptions in Table 1.

Table 1

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), as printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).

Estimated Load Reductions

	Bank #1	Bank #2	Example
Sediment Load Reduction (ton/year)	1	1	**150**
Phosphorus Load Reduction (lb/year)	1	1	**150**
Nitrogen Load Reduction (lb/yr)	1	1	**300**

Appendix I. Contributors’ Page and Distribution List

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Michelle Arvin, Vice Chairman
Shane Campbell, District Supervisor
Myron Maish, District Supervisor
B.J. Matchett, District Supervisor

Distribution of the Little Deer Headwaters WMP
Indiana Department of Environmental Management Watershed Management Section
Howard County SWCD
Howard County Health Department
Indiana-American Water Company, Kokomo, Indiana
Howard County Extension Office
Howard County Plan Commission
Howard County Surveyor’s Office
Kokomo-Howard County Library