Tile/Pipe Discharge

The presence of pipes was noted in all subwatersheds of Eagle Creek watershed. Many of the pipes observed represent agricultural tiles, although a few are stormwater and other regulated drainage pipes. Agricultural tiles have been common practice in the Midwest since the 19th century. Their purpose is to drain excess surface water from farm fields to enhance crop production. When managed properly, the agricultural tile drainage network can be a beneficial practice for environmental farm management. However, when improperly managed, tile outflow can carry contaminants and pollute nearby waterways. Increased nitrogen, pesticides and pathogens have been found to move through tile drains impacting water quality.

During the windshield survey, tiles were noted in all subwatersheds. Eagle Creek/Dixon Branch, Fishback Creek, Mounts Run, and School Branch subwatersheds had pipes noted at 60% or more of the survey sites. Eagle Creek/Finley Creek subwateshed had the least amount of pipes observed with only one site out of nine with a pipe in viewing range. Figure V-10 shows the survey sites with pipes observed.

Mounts Run – Pipe discharging into stream.

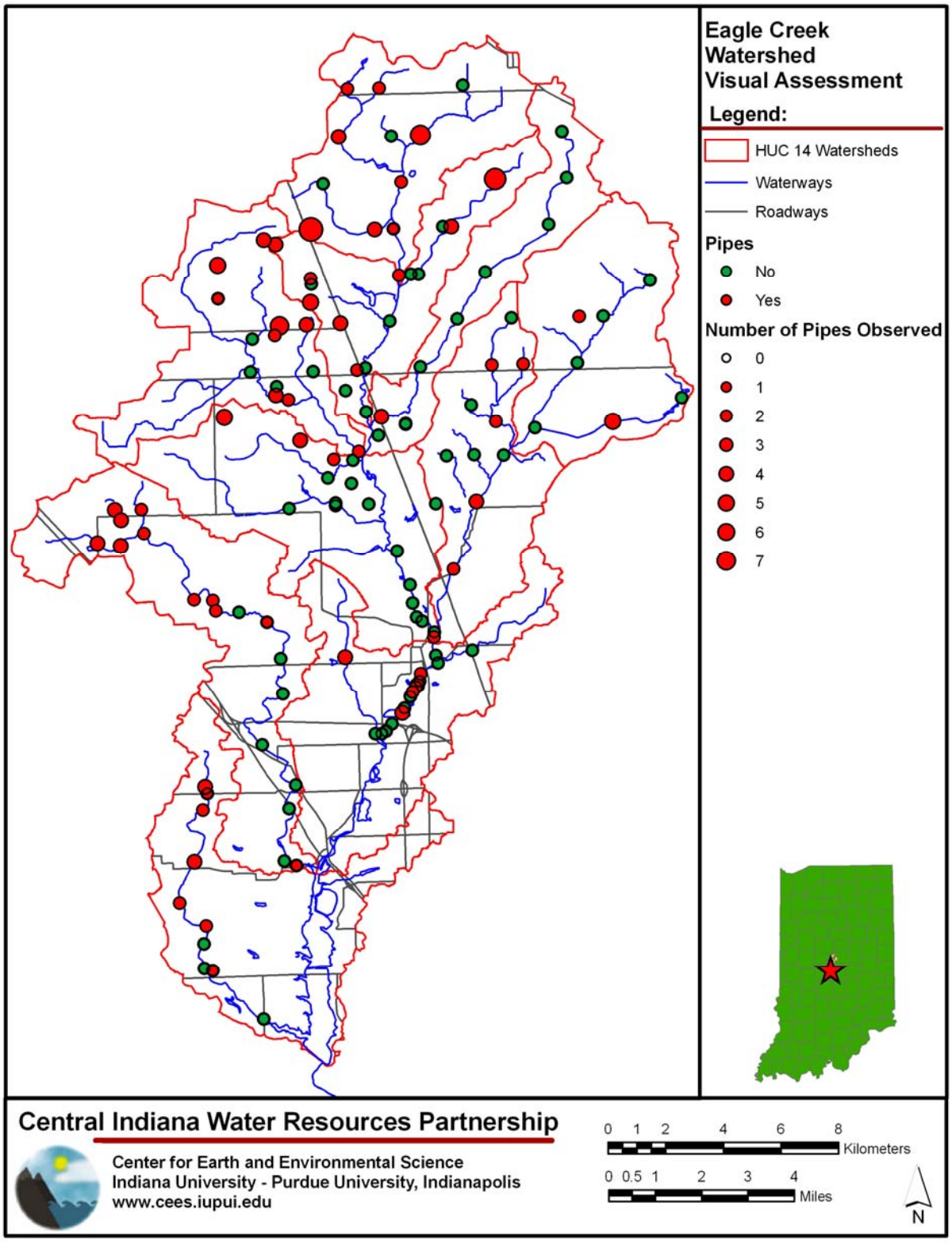

Figure V-10: Visual Assessment – Location of Tile/Pipes Observed in Watershed

NPDES Point Source Data

The National Pollutant Discharge Elimination System (NPDES) Program was established by the Federal Water Pollution Control Act Amendments of 1972. Under this program, all facilities that discharge pollutants from a point source into any US waterway must obtain a permit. The permit regulates the amount of allowable pollutants discharged from a point source. Point sources are specific locations of discharge such as pipes or man-made ditches and include "discharges from publicly owned treatment works (POTWs), discharges from industrial facilities, and discharges associated with urban runoff" (USEPA, www.epa.gov/npdes/pubs/101pape.pdf). Concentrated animal feeding operations (CAFOs) are also considered a point source and require NPDES permits, although most other agricultural activities are non-point sources.

Fifteen NPDES permitted pipes are located within Eagle Creek Watershed (Table V-9). Eagle Creek–Long Branch/Irishman Run subwatershed has eight of the fifteen permitted discharge pipes (outfalls). Little Eagle Branch–Headwaters and Little Eagle Branch–Woodruff Branch subwatersheds each have two and Eagle Creek–Dixon Branch, Eagle Creek–Jackson Run, and Fishback Creek (Eagle Creek Reservoir) subwatersheds each have one permitted discharge pipe. Table V-9 lists the NPDES pipe discharge sources and the type of discharge that is permitted with each pipe. The permit number and outfall number in Table V-9 for which GPS data are available correlate with the pipes mapped in Figure V-11.

Four confined animal feeding operations (Figure V-12 and Table V-10) are located in Eagle Creek Watershed. These operations are permitted through the NPDES program to ensure they comply with the Clean Water Act. Although Clark's Pork Farm is shown to fall outside of the Eagle Creek Watershed boundary, it is important to note the location of this CAFO with respect to Eagle Creek Watershed because of it close proximity to the watershed and the possibility of the tile drainage system transporting water across watershed boundaries.

Table V-9: NPDES Point Sources in Eagle Creek Watershed

Permit Number	Outfall Number	Subwatershed	Facility Name	Waste Description
INP000025	001A	Eagle Creek – Dixon Branch	Biddle Screw Products Co.	Process Water
IN0055280	001A	Little Eagle Branch – Headwaters	Eagletown Treatment Plant	Sanitary
IN0109762	001A	Little Eagle Branch – Headwaters	Eagletown Estates M.H.P.	Sanitary
ING340063	001A	Little Eagle Branch – Woodruff Branch	Jolietville Terminal - Country Mart Cooperative	Stormwater Runoff
ING340063	002A	Little Eagle Branch – Woodruff Branch	Jolietville Terminal - Country Mart Cooperative	Stormwater Runoff
IN0020796	001A	Eagle Creek – Jackson Run	Whitestown Municipal STP Waste Water Treatment Plant	Sanitary
ING080130	001A	Fishback Creek (Eagle Creek Reservoir)	Stuckey's Gas Station	Groundwater Treatment
ING080225	001A	Eagle Creek – Long Branch/Irishman Run	Village Pantry 471	Groundwater Treatment
IN0055760	001A	Eagle Creek – Long Branch/Irishman Run	Clay Township Regional Waste District	Sanitary
IN0060054	001A	Eagle Creek – Long Branch/Irishman Run	DOW Chemical Biological Lab	Groundwater Treatment
IN0045209	001A	Eagle Creek – Long Branch/Irishman Run	Buckeye Terminals LLC Zionsville	Other
IN0045209	002A	Eagle Creek – Long Branch/Irishman Run	Buckeye Terminals LLC Zionsville	Other
IN0045209	003A	Eagle Creek – Long Branch/Irishman Run	Buckeye Terminals LLC Zionsville	Other
IN0043559	001A	Eagle Creek – Long Branch/Irishman Run	Shady Hills Utility Company, Inc.	Sanitary
ING080082	001A	Eagle Creek – Long Branch/Irishman Run	Traders Point #1 IDOT Garage	Groundwater Treatment
IN0061832	001A	Eagle Creek Reservoir - School Branch	Lewis Group Wastewater Treatment Plant	Sanitary
IN0059544	001A	Little Eagle Breek – Headwaters	Westfield Municipal Wastewater Treatment Plant	Sanitary
IN0059544	001T	Little Eagle Branch – Headwaters	Westfield Municipal Wastewater Treatment Plant	Sanitary
IN0025569	001A	Eagle Creek – Jackson Run	Pine Ridge Mobile Home Park	Sanitary
IN0036951	001A	Eagle Creek – Long Branch/Irishman Run	Zionsville Wastewater Treatment Plant	Sanitary

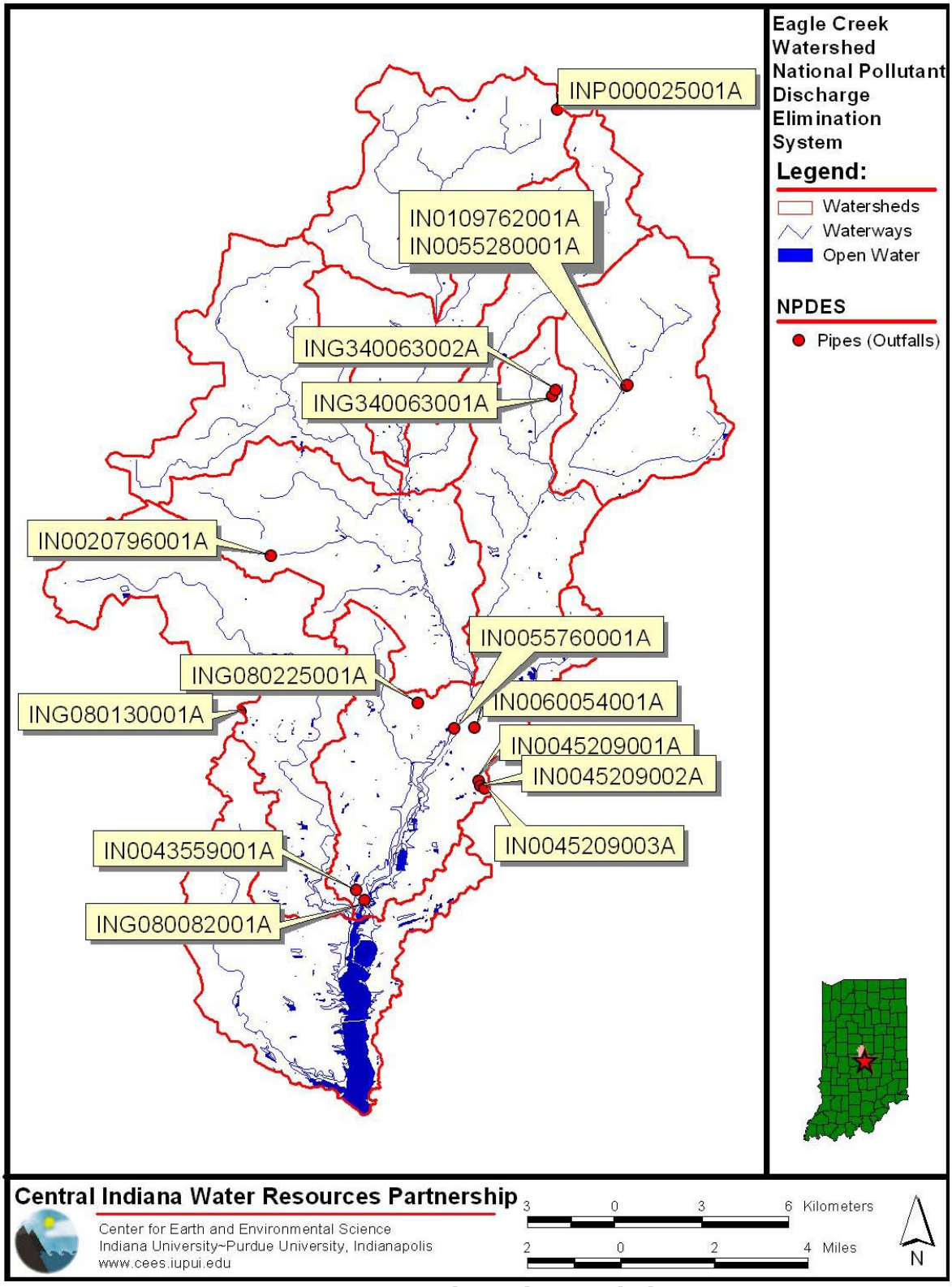

Figure V-11: NPDES Point Sources in Eagle Creek Watershed

Table V-10: Confined Animal Feeding Operations in Eagle Creek Watershed

Permit Type	Subwatershed	Facility Name
CAFO	Eagle Creek – Dixon Branch	Double Bridge Farm
CAFO	Eagle Creek – Kreager Ditch	Tom's Place - Primary
CAFO	Eagle Creek – Kreager Ditch	Kouns Farms Incoroporated
CAFO	Fishback Creek (Eagle Creek Reservoir)	Kaser Farm Partnership
CAFO	White Lick Creek - Wiley Thompson Ditch (*outside Eagle Creek Watershed*)	Clark's Pork Farm Number 1

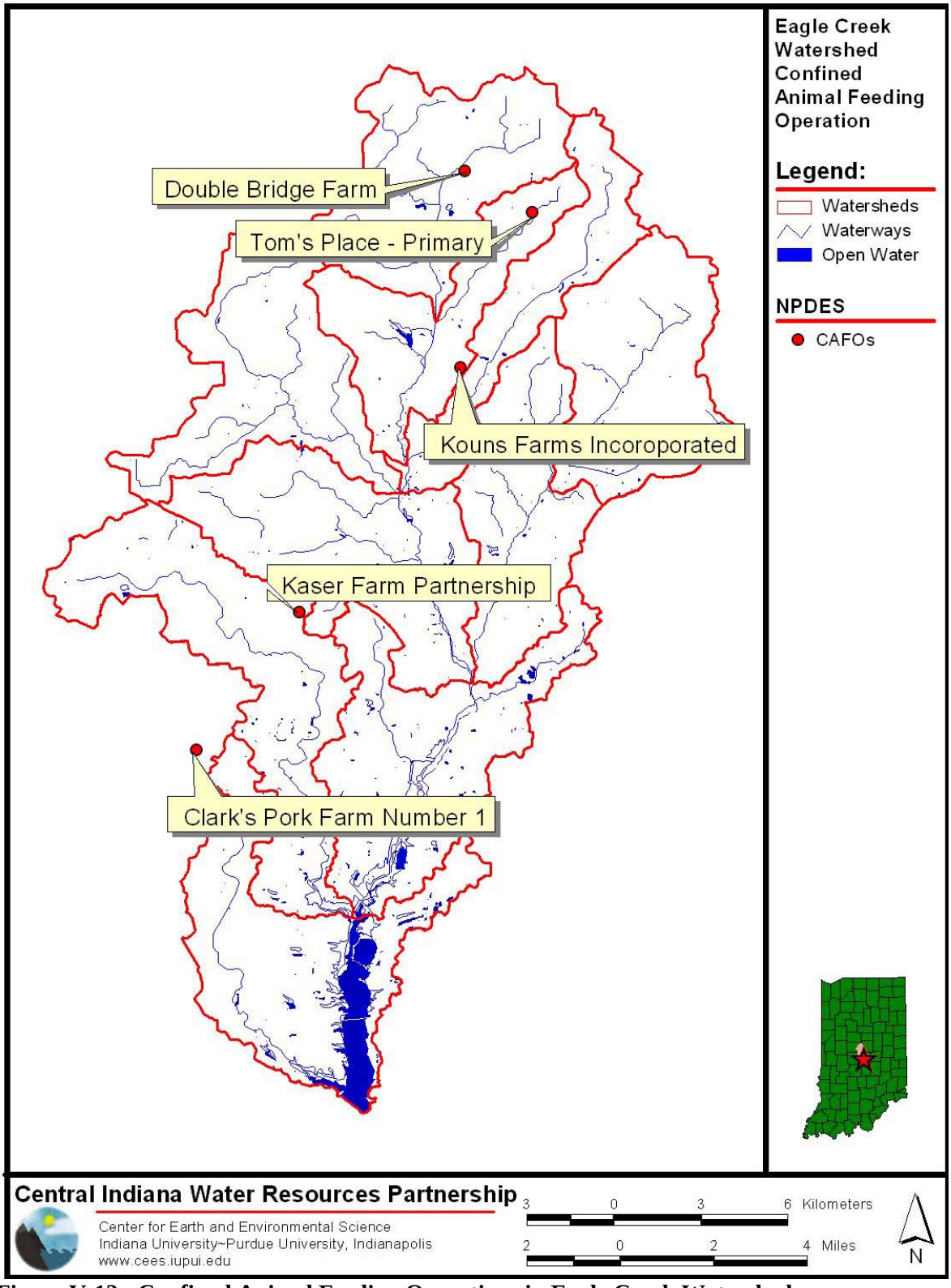

Figure V-12: Confined Animal Feeding Operations in Eagle Creek Watershed

Septic Systems

Unsewered communities are a possible source of human waste contamination into streams. Contaminants such as *E. coli*, ammonia, and phosphorous are associated with human waste. While well-maintained septic systems can remove most contaminants before the waste enters the stream, septic system failures can release excess *E. coli* and nutrients, especially ammonia and ammonia compounds into surface waters. In Indiana, common causes of septic system failure are soil wetness (seasonally high water table), undersized systems, system age, and limited space for the soil absorption field (Taylor *et al*., 1977).

As septic systems can be a source of contamination to the streams in Eagle Creek Watershed, the location and efficiency of septic systems is important to Watershed health. However, septic system location and function information is difficult to obtain. Sources of information are often limited to permits that were issued during or prior to building, and these permits are often imbedded in county records that are not easily accessed or searched. While work on developing a map of septic systems in Eagle Creek Watershed is on-going, preliminary data show that, of the homes in each county that lie within Eagle Creek Watershed, most of the homes located outside of the major urban areas (e.g., Indianapolis and Zionsville) rely on septic systems for waste disposal: the majority of the homes within the Watershed in Marion county are sewered, and the majority of homes within the Watershed in Hamilton county, Boone county (outside of Zionsville), and Hendricks county are on septic systems.

Previous data collected on septic systems in Eagle Creek Watershed were compiled by the Indiana Community Action Association (INCAA) and the Boone County Department of Health.

INCAA Unsewered Communities Report

As unsewered communities present a concern to surface water quality, the Indiana State Department of Health and the Rural Community Assistance Program conduct regular surveys to identify communities needing assistance with resolving outstanding sewage disposal problems. This information is published by the INCAA as the "Unsewered Community Survey Report."

Work by the Center for Urban Policy and the Environment at IUPUI suggests that approximately 31 percent of Indiana households are on septic systems (Lindsey, 2003). The Indiana State Department of Health estimates that 25 percent of the septic systems in the state are inadequate or failing, and that for every failing septic system over 82,000 gallons of untreated wastewater is released into the environment annually (Lee *et al*., 2004). A common cause of septic system failure stems from the placement of septic systems in improper soils: soils that do not allow for proper drainage.

A list of unsewered communities in Eagle Creek Watershed are shown in Table V-11 and Figure V-13. This is only a partial list of the number of unsewered homes in watershed and includes Hortonville despite that the community lies just outside the

Watershed boundaries. Preliminary studies by the ECWA indicate that many other homes exist outside community boundaries that are also unsewered. The ECWA is currently mapping the location of all known unsewered homes and businesses in the watershed.

Table V-11: List of Unsewered Communities in Eagle Creek Watershed by County

County	Community*	Subwatershed	Residences	Businesses	Community Type
Boone	Big Springs	Eagle Creek – Kreager Ditch	16	1	Unincorporated
	Rosston	Eagle Creek – Kreager Ditch	10	0	Unincorporated
	Royalton	Fishback Creek (Eagle Creek Reservoir)	22	1	Unincorporated
Hamilton	Eagletown*	Little Eagle Branch – Headwaters	48	4	Unincorporated
	Hortonville†	Little Eagle Branch – Headwaters	57	4	Unincorporated
	Jolietville	Little Eagle Branch – Woodruff Branch	62	2	Unincorporated
Hendricks	None				
Marion	None				

* On June 12, 2003, Eagletown was issued an NPDES permit for a sanitary treatment plant.

† While Hortonville lies just outside of the watershed boundaries, the extent of tile drainage could direct septic system outfalls into Little Eagle Branch –Headwaters (Figure V-13). However, as the amount of this is unknown, this unsewered community was not used in the subwatershed ranking.

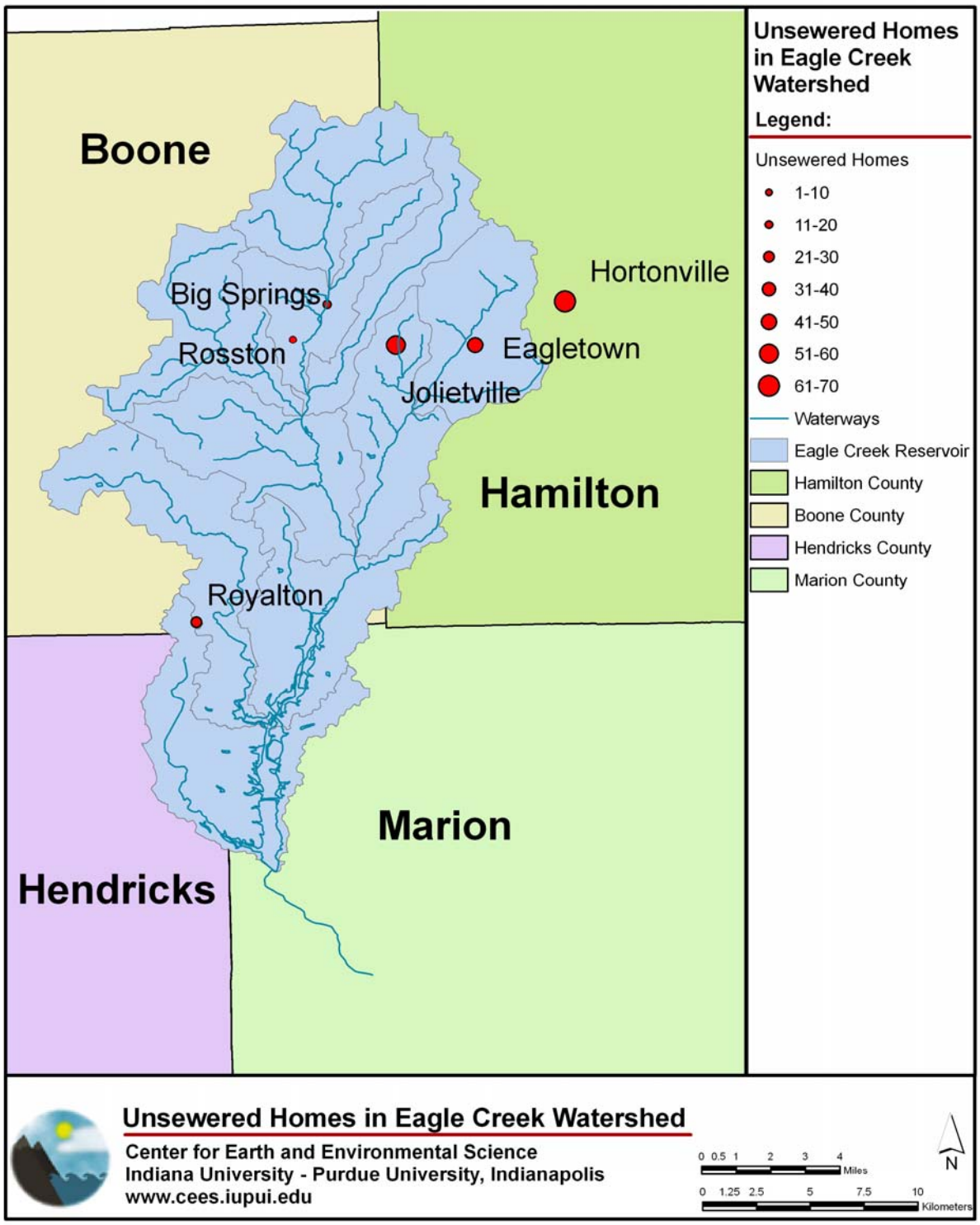

Figure V-13: Unsewered Homes in Eagle Creek Watershed

Boone County Department of Health Septic System Field Survey

In 1999, the Boone County Health Department conducted a septic system field survey in response to concerns regarding the pathogen levels in Eagle Creek Watershed. To determine how well septic systems were working, field surveys were taken in area of Boone County which overlaps Eagle Creek Watershed. (Fifty percent of Eagle Creek Watershed lies within Boone County.) The field surveys recorded the age, size of the system, and the type of soil in which each system is located. Additionally, a total of 324 houses were asked to complete informational questionnaire surveys while surveyors were on their property. Homeowners either answered the questionnaires in an interview with the surveyor or were given the questionnaire to be answered and mailed in later. Fifty-seven homeowners (17.5%) responded that their septic system had undergone some replacement or repair. The questionnaire also revealed that some homeowners were not aware of the history of the septic system on their land before their ownership. That many septic systems have failed shows that education on septic system maintenance is needed in the Watershed (Griggs, 1999).

In terms of soil data, the field survey showed that soil type was integral to properly functioning septic systems. In Eagle Creek Watershed, the three primary soil associations are Brookston-Crosby (55%), Miami-Crosby (35%), and Genesee-Shoals (10%) (Griggs, 1999). Brookston-Crosby soil associations tend to have poor drainage and are, therefore, poor for septic systems. Miami-Crosby is good for septic system use because they provide efficient drainage. Genesee-Shoals soils are problematic in that while they are well drained, they are floodplain soils which can drain very quickly into nearby surface water bodies. As only 35% of the Watershed is Miami-Crosby, a soil type suitable for properly functioning septic systems, the remaining 65% of the Watershed is ill-suited for septic systems.

In addition to field and informational surveys, water samples were taken to determine septic influence on stream bacteria loads. Samples were taken once a week on Irishman's Run Creek and Fishback Creek. The study showed that *E. coli* concentrations increased at locations downstream of residential areas and then decreased as the stream flowed through agricultural lands. This suggests that *E. coli* was entering the streams from residential areas and not agricultural areas (Griggs, 1999). However, these preliminary results require further study to confirm these findings. The Central Indiana Water Resources Partnership is currently collecting data on the distribution of septic systems throughout the Eagle Creek Watershed to provide additional location information.

Stream Order Classification

Using the hierarchical classification developed by Horton (1945) as modified by Strahler (1952, 1964) (Figure V-14), all streams in Eagle Creek Watershed were categorized by stream order. This allowed for the delineation of headwater streams which are defined as 1st and 2nd order streams. In Eagle Creek Watershed, stream classification and length measurement were done using a combination of high resolution maps and visual

assessments of stream locations (Table V-12). This classification showed that more than 80% of the stream miles in Eagle Creek Watershed can be designated headwater streams.

In most watersheds, like Eagle Creek Watershed, headwater streams are the most abundant stream class in a watershed – in the Midwest most people live within 1 – 2 miles of a headwater stream. As these streams supply all downstream reaches, headwater streams are particularly important to watershed ecosystem health as their water quality affects downstream water quality. Properly functioning headwater streams, particularly primary head water streams[8], with adequate buffers are important in controlling downstream sediment, nutrient, and contaminant loads: As these small streams have a close connection to groundwater, subsurface flows, and wetlands, a healthy headwater stream will also mitigate flooding by allowing water to be recharged into groundwater or be retained in wetlands. In addition to contaminant and flood control, headwater streams play a crucial role in the ecological health of a watershed: using the River Continuum Concept (Vannote *et al*., 1980), the wooded area of a healthy headwater stream is the site of transported nutrient inputs to a stream, a critical source for nutrients (carbon, phosphorus, and nitrogen) to the upstream community as well as downstream communities which receive these nutrients from downstream transport. Therefore, protecting these small 1st and 2nd order streams is critical to the overall water quality of the watershed.

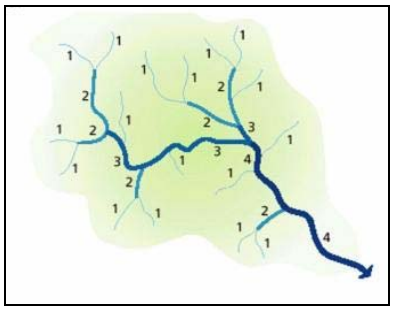

Figure V-14: Hierarchical stream classification developed by Horton (1945) as modified by Strahler (1952, 1964).

[8] Ohio EPA(2003) defines primary head water streams as ephemeral, intermittent, or perennial streams that have a watershed area generally less than one square mile.

Table V-12: Stream Classification and Stream Length

Subwatershed	Total	1st Order		2nd Order		3rd Order		Trunk		Trunk Order*
	mi	*mi*	*%*	*mi*	*%*	*mi*	*%*	*mi*	*%*	
Eagle Creek - Dixon Branch	28.7	15.8	*55%*	8.3	*29%*			4.6	*16%*	3rd Order
Eagle Creek - Finley Creek	15.2	15.2	*100%*							
Eagle Creek - Kreager Ditch	19.4	13.1	*68%*					6.3	*32%*	3rd Order
Little Eagle Branch - Headwaters	20.6	13.4	*65%*	7.3	*35%*					
Mounts Run - Neese Ditch	36.2	26.5	*73%*	2.9	*8%*	6.9	*19%*			
Little Eagle Branch - Woodruff Branch	26.2	15.9	*61%*	2.8	*11%*	7.5	*29%*			
Eagle Creek - Jackson Run	30.9	19.5	*63%*	3.1	*10%*			8.3	*27%*	4th Order
Fishback Creek (Eagle Creek Reservoir)	31.2	8.0	*26%*	23.2	*74%*					
Eagle creek - Long Branch/Irisman Run	22.1	12.1	*55%*					10.0	*45%*	4th Order
Eagle Creek Reservoir - School Branch	12.1	12.1	*100%*							
Eagle Creek Watershed Total	242.7	151.5	*62%*	47.7	*20%*	14.4	*6%*	29.1	*12%*	

* Based on Horton (1945) as modified by Strahler (1952, 1964) hierarchical stream classification system.