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Middle St. Joseph River Watershed Management Plan

Hydrologic Unit Code 0410000305

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1.0 Introduction

The United States has over 3.5 million miles of streams stretching across its landscape which provide many eco-services to the citizens of the US such as recreational activities, sustenance, and transportation. However, rapid population growth, urban sprawl, industrial discharges, and unsustainable farming techniques pose many threats to the health of these valuable resources. In the early 1970's several focusing events, including the Cuyahoga River fires and Lake Erie hypoxia, brought national attention to the need for water pollution control policy which lead to the passing of the Clean Water Act (CWA) of 1972. The CWA brought industrial discharge into surface waters down precipitously, which reduced the number of fish kills and river fires. However, nonpoint source pollution (NPS) is believed to be the leading cause of surface water impairment in the United States, so in 1987 Congress amended the CWA to put more focus on NPS. Enforcement of NPS discharge is limited as NPS comes from unknown and diffuse areas and heavy restrictions would affect the livelihood of the nation's farmers. The development of a comprehensive watershed management plan (WMP) will help to avoid further restrictions on NPS and identify specific sources of pollution so that efforts to decrease pollution runoff can be focused to those areas that are found to be the biggest contributor to NPS within a watershed, without alienating producers and landowners.

The St. Joseph River Watershed Initiative (Initiative), a 501(c)3 non-profit organization composed of representatives from local Soil and Water Conservation Districts, universities, and concerned citizens, recognized the impact a WMP would have on a community and the water quality of a watershed and began writing WMPs in 1999, with the first, the greater St. Joseph River Watershed (Hydrologic Unit Code 04100003) being approved in 2001 by the Indiana Department of Environmental Management (IDEM). The Initiative has prided itself in its ability to cross political boundaries and engage all stakeholders in the watershed, as a watershed approach to water quality is the only way to have a long term positive impact on the quality of our river systems. The St. Joseph River WMP includes a large area crossing state lines into Ohio, Michigan and Indiana. However, since the WMP covers such a large area it was difficult to hone in on specific areas of concern in each of the subwatersheds located within HUC 04100003 which is why goal #1 of the greater St. Joseph River WMP is "By 2020, organize stakeholders and produce watershed plans for the HUC-11 subwatersheds which have not yet been completed…" Note that HUCs were converted to 10 and 12 digit scales nationwide in 2008. Therefore, the Initiative's goal for HUC-11 subwatersheds would now be referred to as HUC 10 subwatersheds.

The Initiative has written WMPs for two subwatersheds within the greater St. Joseph River Watershed; the Lower St. Joseph River – Bear Creek Watershed and the Cedar Creek

Watershed. After those two WMPs, there were another five HUC-10 subwatersheds that still required comprehensive WMPs. The Initiative then began to investigate which subwatershed to focus on next.

The Initiative examined historic land use and water quality data for each of the five remaining subwatersheds. Findings showed that water quality data for the Middle St. Joseph River watershed did not meet water quality standards at a higher frequency than the remaining four subwatersheds. Another study of riparian buffers and land use throughout the greater St. Joseph River watershed showed that the Middle St. Joseph watershed scored the lowest for wildlife habitat and had the highest concentration of animal feeding operations. Therefore, the Middle St. Joseph River watershed (HUC 0410000305) was chosen as the next subwatershed to focus efforts. In September, 2009 the Initiative applied for a Clean Water Act §319 grant administered by the IDEM to fund the Middle St. Joseph River Watershed (MSJRW) project. The grant was awarded to the Initiative and the project began in September, 2010.

It is necessary to engage the stakeholders in the watershed to write a comprehensive WMP. Therefore, the Initiative hosted two kick-off meetings, one in Edgerton, Ohio and another in Butler, Indiana, to explain the mission of the Initiative, the watershed planning process, and the motivation for working in the Middle St. Joseph watershed. The meetings also provided a forum for stakeholders to voice any concerns they had about the project or water quality and land uses throughout the project area. Public notices announcing the meetings were placed on the websites of the two urban centers located in the project area, Butler, IN (population 2,681) and Edgerton, OH (population 1,939) as well as the websites of DeKalb and Williams County SWCD, and the Initiative. Press releases were also sent to local newspapers. Mailing lists of landowners living within the project area were produced by the DeKalb and Williams County SWCDs and invitations to the meetings were sent to those addresses.

There were approximately 60 stakeholders in attendance at the kickoff meetings representing landowners, producers, industry, and agencies and the Initiative was able to solicit commitments from nine individuals to serve on the steering committee for the project. Table 1.1 below is a list of those steering committee members and what entity they represent.

Table 1.1: Steering Committee Members

Name	Affiliation
Andy Farnham	Landowner/Producer
Allen Haynes	DeKalb County SWCD – Natural Resource Technician
Dan Fry	DeKalb County Surveyors Office; Landowner/Producer
Judy Strock	DeKalb County SWCD Supervisor; Landowner
Brian Fritsch	Williams County Drainage Engineer
Bert Brown	Williams County SWCD – Natural Resource Technician
Jim Herman	Williams County SWCD Supervisor
Mike Kline	DeKalb County Surveyor
Ryan Sanders	Landowner/Certified Crop Advisor

The first steering committee meeting was held at the Butler Public Library on January 31, 2011. The agenda for the first meeting included group dynamics and ground rules for the steering committee, determining a chairman, discussing problems and successes regarding water quality and land uses throughout the watershed, and defining a mission statement. The mission statement developed by the steering committee is as follows,

"To take a watershed approach to conserve and enhance our natural resources by working across political boundaries to promote awareness, education, and community involvement in the middle St. Joseph River Watershed."

Table 1.2 is a list of stakeholder concerns regarding land use and water quality within the Middle St. Joseph watershed which were gathered at the kickoff meetings and at the first steering committee meeting. The table also contains columns for each concern's relevance to this project and the potential water quality problem associated with each concern.

Table 1.2: Stakeholder Concerns

Concerns	Relevance	Potential Problem
Animal Feeding Operation runoff	Stormwater will pick up pollutants from barnyards and carry them to open water if it is not properly contained or diverted from ditches, streams, rivers, and ponds	*E. coli* contamination, excess nutrients, and sediment
Combined Sewer Overflow	During heavy rain events the local Waste Water Treatment Plants cannot process both the residential and storm water. Therefore, both sources of waste may be discharged into a waterway without any treatment	*E. coli* contamination, excess nutrients, and sediment
Land conversion/Increase in impervious surfaces	As the industrial areas in the watershed expand, so does the impervious surfaces which increase stormwater runoff and will potentially carry pollutants to open water	Oil and grease, sediment, nutrients, increase in combined sewer overflows

Concerns	Relevance	Potential Problem
Pesticides	Historical water quality data in the St. Joseph River watershed shows spikes in pesticides found in open water during the spring of each year. Pesticides, which are applied during the spring, may runoff the land and enter waterways during spring rain events	Fish kills
Animal operations that fall below the CFO/CAFO level	Stormwater will pick up pollutants from barnyards and carry them to open water if it is not properly contained or diverted from open water. Some small animal operations allow direct access to waterways for drinking water or to move between pastures	*E. coli* contamination, excess nutrients, streambank erosion, sediment and impaired biotic communities
Lack of riparian buffers and wildlife corridors	Ditches and streambanks are often denuded and forests are fragmented to make more profitable farm land. This practice increases the potential for streambank erosion, increases stream temperatures, and limits essential wildlife habitat. It also poses a threat to animals that attempt to move between fragmented forest land as they are exposed to predators as well as roads	Bank erosion, sedimentation, wildlife habitat loss, impaired biotic community
Log Jams	Many large log jams have been noted throughout the St. Joseph River watershed. Log jams will divert water from its normal coarse and cause stream bank erosion	Sedimentation and flooding
Industrial discharge and runoff	An increase in industrial facilities has been noted south of Butler, Indiana. These facilities not only increase imperviousness, but they increase the potential for polluted effluent to be discharged directly into open water, or even leach through the soil to groundwater.	Oil and grease, sediment, nutrients, increase in combined sewer overflows, fish kills, impaired biotic community

Successes regarding land uses and water quality within the watershed were also discussed at the first steering committee meeting. One success discussed is DeKalb County's riparian buffer restoration project. DeKalb SWCD was awarded a Lake and River Enhancement grant, administered by the IN Department of Natural Resources, to plant trees and shrubs along unvegetated streambanks and has had great success in soliciting landowners to participate in the program. The steering committee also discussed the large number of acres in Williams County that have been converted from farm land through the Natural Resource Conservation Service's, Conservation Reserve Program.

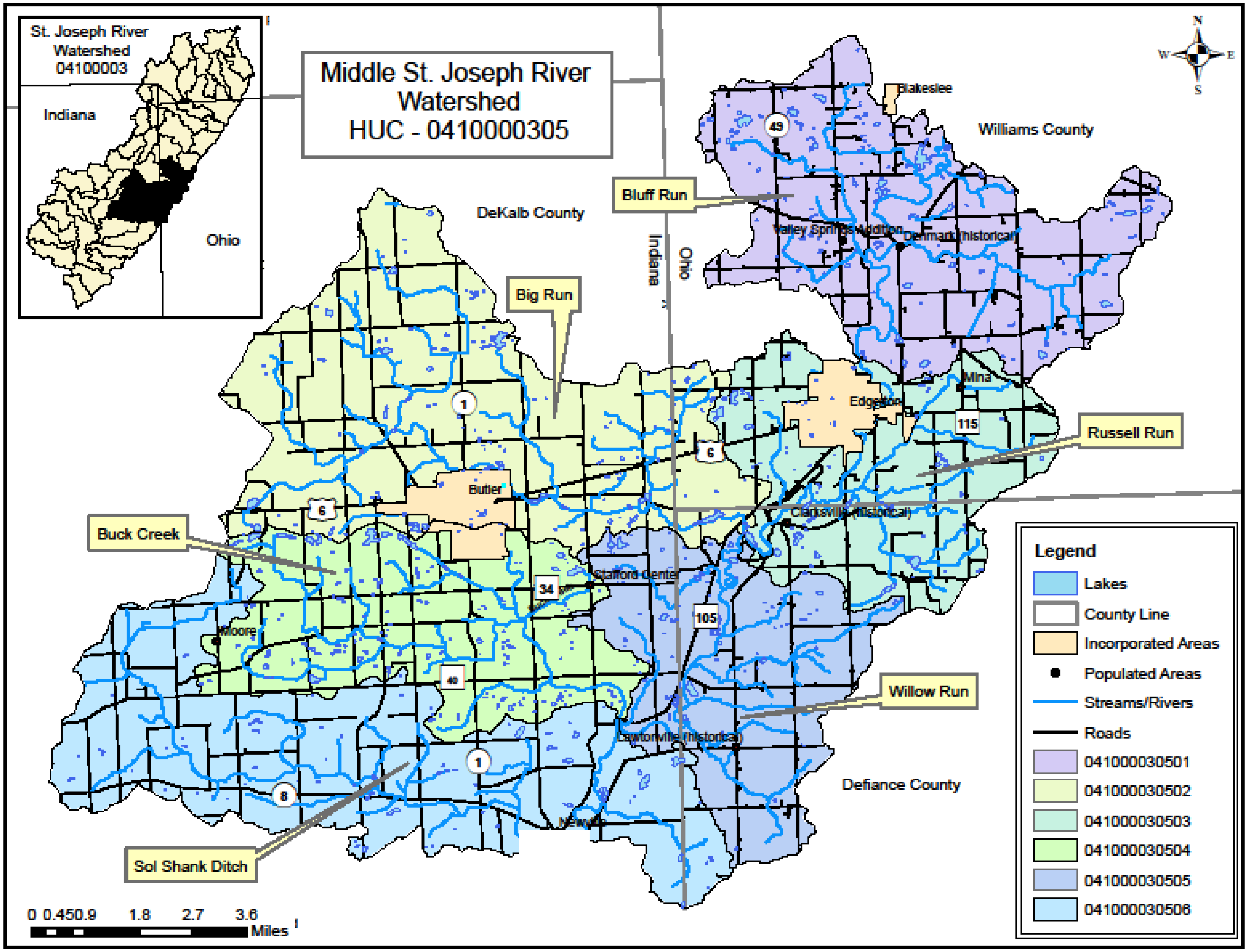
2.0 Physical Description of the Watershed Project Area

2.1 Watershed Location

A watershed is an area with defined boundaries such that all land and waterways drain into a particular point. Watersheds are given "addresses" called Hydrologic Unit Codes (HUC) that identify where they are located within the United States and into which point they drain. The largest HUC is a six digit and defines a particular region. The more digits to a HUC the more specific the drainage area is. The Middle St. Joseph River watershed is a 10 digit HUC (0410000305) located within the St. Joseph River watershed, a greater eight digit HUC (04100003) and is part of the Western Lake Erie region (041000). The MSJRW consists of six 12 digit HUCs; Bluff Run (041000030501), Big Run (041000030502), Russell Run (041000030503), Buck Creek (041000030504), Willow Run (041000030505), and Sol Shank Ditch (041000030506). Each of these subwatersheds will be discussed in further detail in section 3 of this WMP.

The St. Joseph River begins in Hillsdale County, MI and flows southwesterly through Hillsdale County, MI, Williams and Defiance County, OH, DeKalb County, IN and finally through Allen County, IN where it meets the Maumee River in Fort Wayne. The Maumee River then flows east and north to Toledo, OH where it empties into Lake Erie. The Middle St. Joseph River watershed is a 10 digit hydrologic unit code (0410000305) which is located predominantly within eastern DeKalb County, IN and southwestern Williams County, OH. A small portion of the watershed is also located within the northwest corner of Defiance County, OH (Figure 2.1). The watershed is 85,570 acres (134 square miles) and the major land use within the watershed, totaling over 70%, is agriculture (row crops and animal operations). There are also several industrial facilities located within the watershed as well as some small residential areas. The only incorporated urban areas that lie completely within the watershed are Butler, IN and Edgerton, OH. The most southern tip of Blakeslee, OH and the most northern tip of Newville, IN also lie in the watershed. The small villages of Stafford Center and Moore, IN and Mina, OH are also located within the project area.

Figure 2.1: Middle St Joseph River Watershed

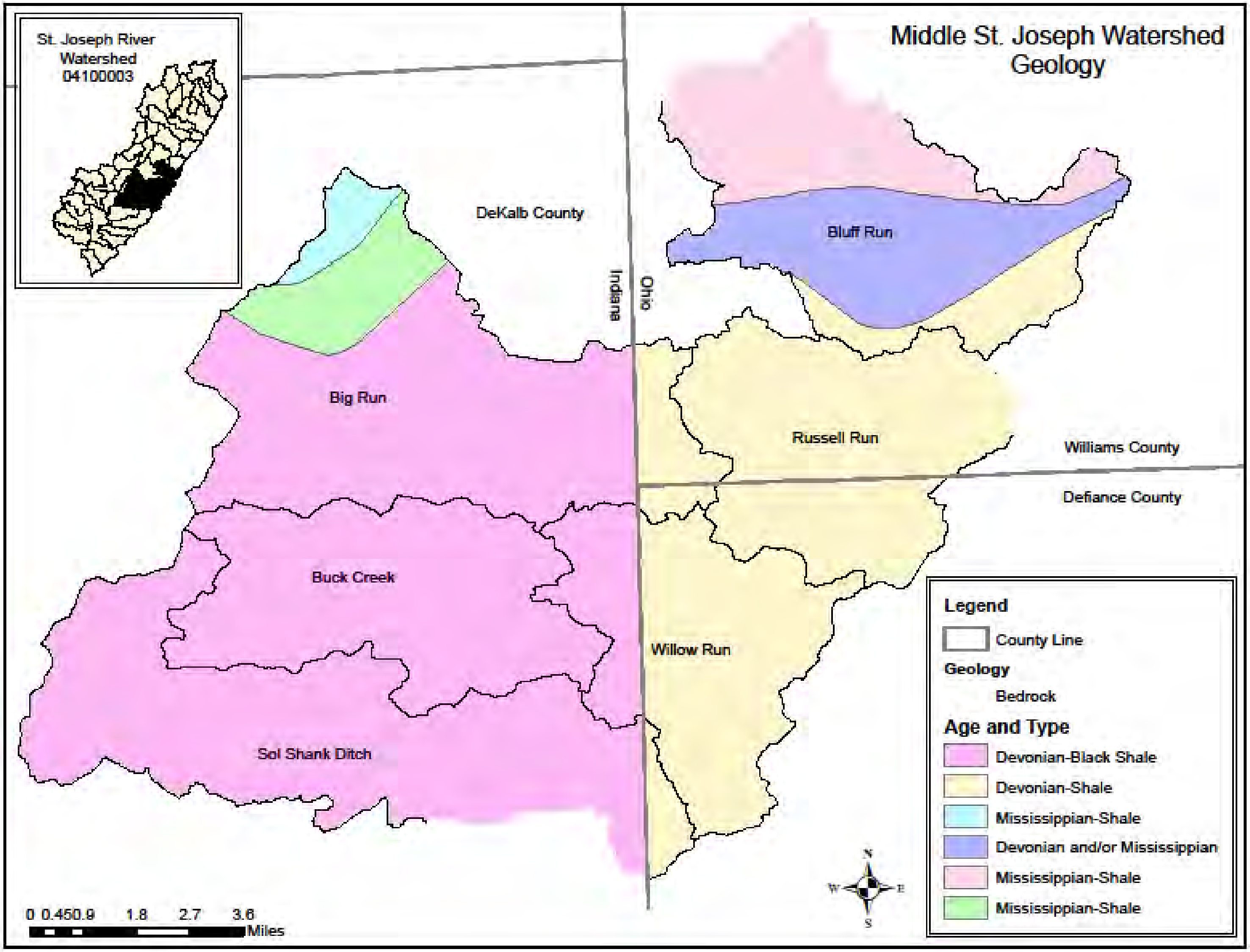


2.2 Geology, Topography, and Soils

The landscape of northern Indiana and Ohio is directly influenced by the last great glaciation which occurred over 14,000 years ago; the Wisconsinan glaciation. The glaciers significantly changed the landscape of the project area, filling and damming rivers which created lakes (including Lake Erie), as well as flattening the rolling hills that were present before the glaciers. The Wisconsinan glaciation extended as far south as Terre Haute and Richmond, Indiana and follows the line from Ashtabula County in northeast Ohio down to Hamilton County in southwest Ohio. As the glaciers melted they deposited rock, dirt and sand that they picked up while traveling across the landscape from Canada. In the project area of northern Indiana and Ohio, where the glaciers melted relatively rapidly, glacial till ridges, called moraines, were left.

The bedrock of the project area was deposited during the Devonian or Mississippian Age, some 300 to 360 million years ago. The rocks deposited during the Devonian Age predominately consist of sedimentary rocks such as siltstone, shale, and sandstone (Ohio Geological Survey, 2006). As can be seen in Figure 2.2 the predominant bedrock of the project area is shale or black shale. The surficial geology overlaying the bedrock ranges in thickness from 500 to 600 feet. The unconsolidated deposits, above the bedrock, are between 200 and 300 feet thick in the southern portion of the watershed and between 300 and 400 feet thick in the northern portion of the watershed. The project area is covered in glaciofluvial material over the deeper clay deposits. The glaciofluvial material consists of mostly sand and gravel or loamy till.

Figure 2.2: Middle St. Joseph River Watershed Geology



The project area is located within the Auburn Morainal Complex physiographic region in Indiana (Indiana Geological Survey) and the Central Ohio Clayey Till Plain physiographic region in Ohio (OH DNR). The topography of the area is relatively homogenous. The average elevation is between 810 and 870 feet above sea level. There are some areas were the slope of the land may exceed 5% slightly, but overall the landscape of the project area is unremarkable.

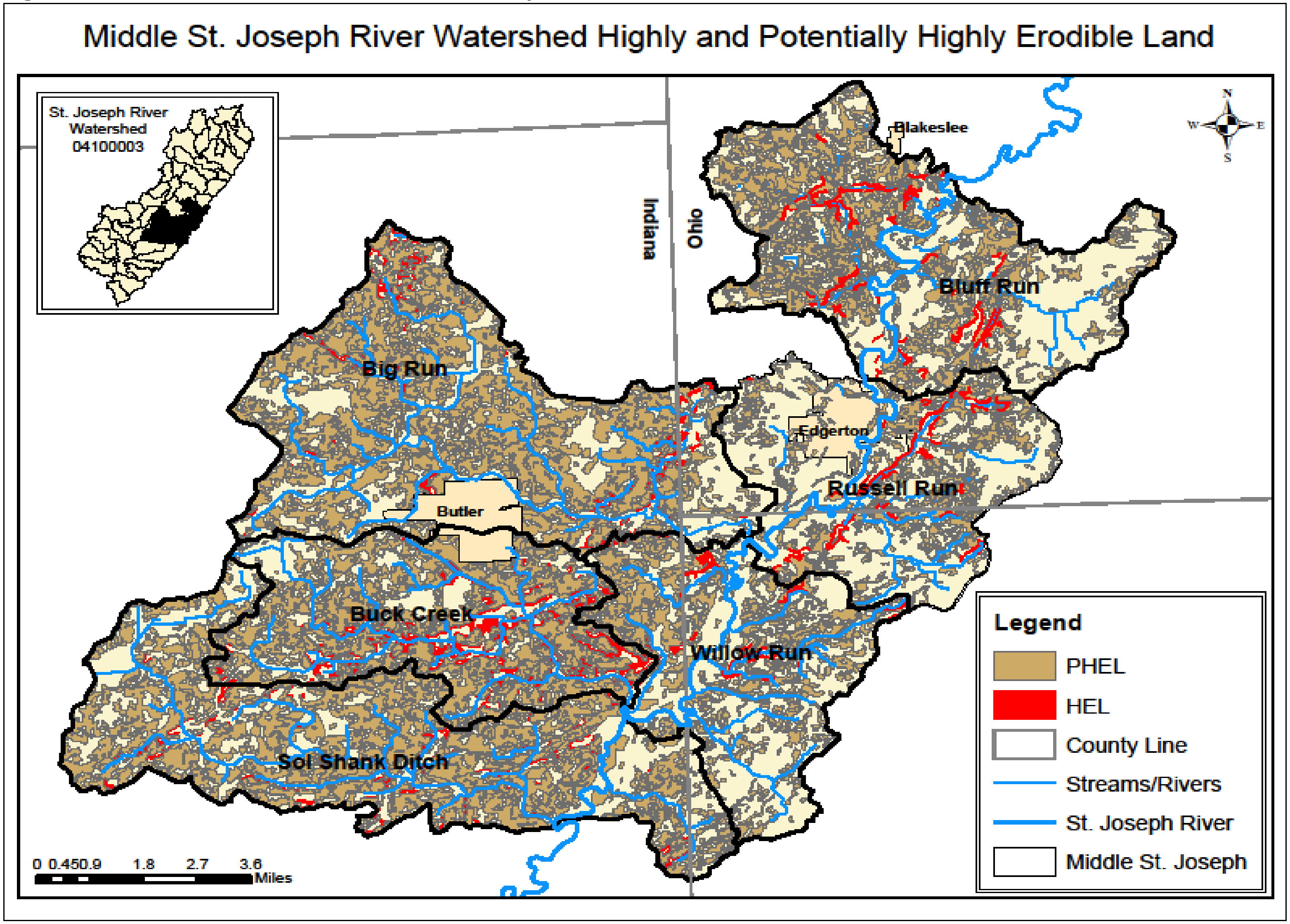
The project area is comprised of nine soil associations, three in each county. Table 2.1 is a list of the soil associations present in the project area and a description of each association. Soil association descriptions were taken from the DeKalb, Williams, and Defiance county USDA soil surveys.

Table 2.1: Soil Associations

County	Soil Association	Association Description
DeKalb	Glynwood-Pewamo-Morley	Deep, moderately well drained, very poorly drained, and well drained, nearly level to steep, loamy, clayey, and silty soils; on till plains and moraines
	Blount-Pewamo-Glynwood	Deep, moderately well drained to very poorly drained, nearly level and gently sloping, silty, clayey, and loamy soils; on till plains and moraines
	Boyer-Landes-Sebewa	Deep, well drained, moderately well drained, and very poorly drained, nearly level to moderately sloping, loamy soils underlain by sand and gravel; on terraces, outwash plains, and moraines
Defiance	Blount-Genesee-Oshtemo	Level to gently sloping, somewhat poorly drained and well drained soils formed in moderately fine textured to coarse textured glacial till, recent alluvium, and glacial outwash
	Glynwood-Blount	Sloping to nearly level, moderately well drained and somewhat poorly drained soils formed in moderately fine textured glacial till
	Blount-Glynwood-Pewamo	Level to sloping, somewhat poorly drained, moderately well drained, and very poorly drained soils formed in moderately fine textured glacial till
Williams	Blount-Pewamo	Nearly level and gently sloping, somewhat poorly drained and very poorly drained soils that have clayey and loamy subsoil; on uplands
	Blount-Oshtemo-Sloan	Nearly level to sloping, somewhat poorly drained, well drained and very poorly drained soils that have a sandy to clayey subsoil; on terraces and flood plains
	Blount-Glynwood	Nearly level to steep, somewhat poorly drained and moderately well drained soils that have a clayey and loamy subsoil; on uplands

The NRCS maintains a database of highly erodible land (HEL), potentially highly erodible land (PHEL), and hydric soils for each county. The soils that have been determined to be highly erodible are so designated by dividing their average rate of erosion by the soil loss tolerance, which is the maximum amount of soil loss that can occur before a long term reduction in productivity will be seen. Soils are determined potentially highly erodible based on the slope and length of the slope. The presence of HEL and PHEL in farmland can contribute significantly to NPS by increasing the amount of sediment carrying other pollutants such as, nutrients and pesticides, to open water. 3.5% of the soils in the project area are considered to be HEL and 57.6% are considered to be PHEL by the NRCS. Figure 2.3 is a map of the project area depicting the location of HEL and PHEL.

Figure 2.3: HEL and PHEL Located within the Project Area

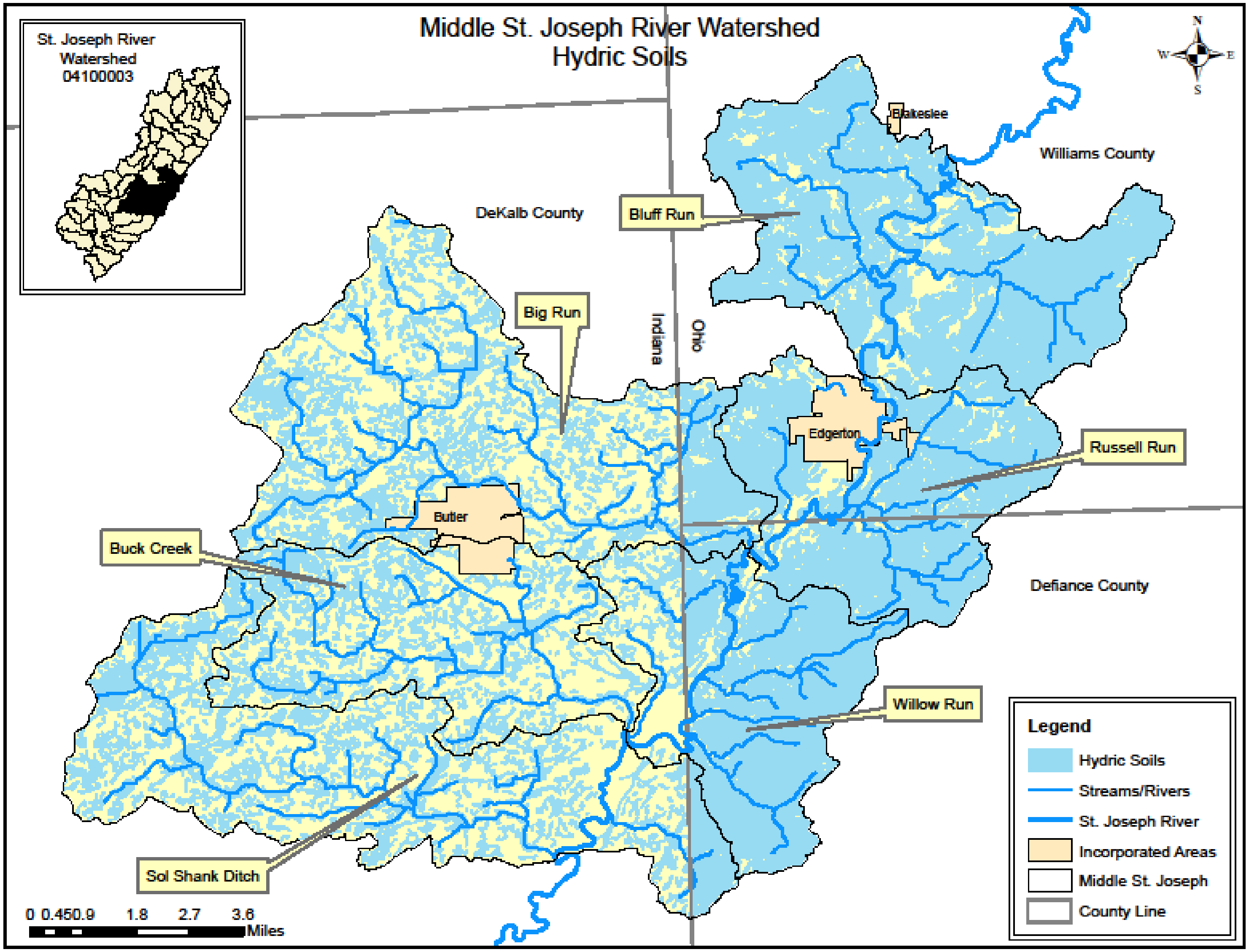


Approximately 52% of the soils present within the project area are classified by the local Natural Resource Conservation Service (NRCS) as hydric as can be seen in the following Figure 2.4. Hydric soils can pose threats to surface water when farmed due to excessive runoff of fertilizers, pesticides, and manure. Farmland located on hydric soils often requires the installation of field tiles to keep the fields from flooding or ponding. Field tiles can provide a direct conduit for water polluted with fertilizer, land applied manure, and sediment to reach surface waters. Hydric soils are also not suitable soils for septic usage as they do not allow for proper filtration of the septic leachate and may result in surface and/or groundwater contamination. Soils that are considered hydric are so classified for several reasons. The following explanation of hydric soils was taken from the NRCS, Field Office Technical Guide.

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
    - A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
    - B. are poorly drained or very poorly drained and have either:
        - 1.) water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
        - 2.) water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
        - 3.) water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for long/very long duration at the growing season.
4. Soils that are frequently flooded for long/very long duration at the growing season.

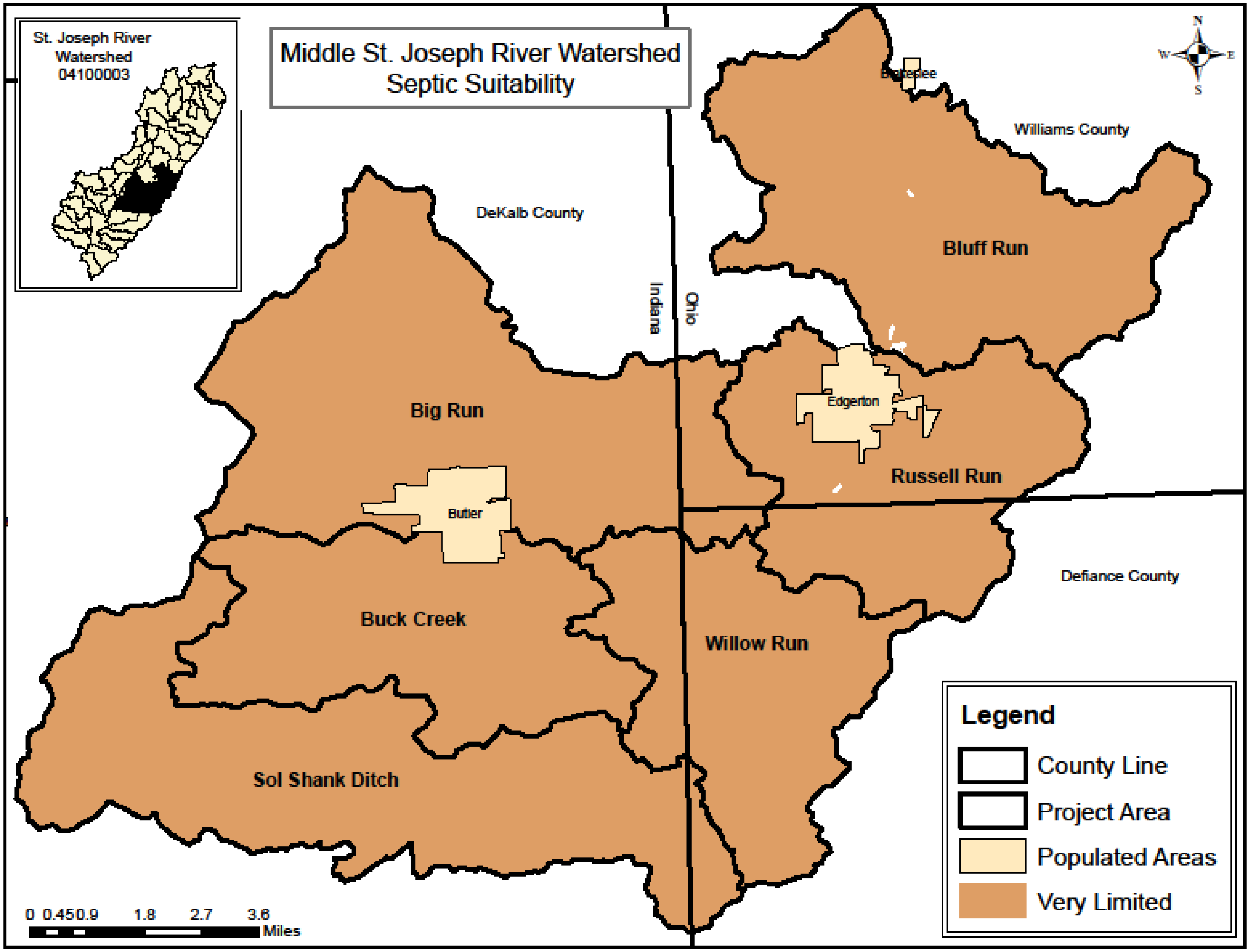
Hydric soils, while posing a significant problem when farmed, also are quite beneficial as they are prime locations to create or restore wetlands. Wetlands are great resources as they supply many ecological benefits. Wetlands will be discussed in further detail in section 2.5. A list of all soils found in Defiance, Williams, and DeKalb Counties that are considered either HEL, PHEL, or Hydric can be found in Appendix C of this document.

Figure 2.4: Middle St. Joseph River Watershed Hydric Soils



Soil type is important to consider when installing a septic tank as traditional septic tanks utilize the soil to absorb effluent discharged from the tank into absorption fields. Septic tank absorption fields are subsurface systems of french drains that distribute septic liquid waste evenly throughout the designated area and into the natural soil. Soil properties and landscape features that affect the ability of the soil to properly absorb and filter the effluent should be considered when designing a septic system. Most of the rural population within the MSJRW project area uses septic systems to process their wastewater, as the towns of Butler, IN and Edgerton, OH are the only population centers in the watershed and the only areas to have a centralized sewer system. However, nearly all soils located within the project area are rated as "very limited" for septic usage according to the NRCS. Only 12% of the soil located throughout Williams County is classified as "somewhat limited" for the installation of on-site sewage processing. Somewhat limited means that modifications can be made to either the site of septic installation or to the system itself to overcome any potential problems. A designation of "Very limited" means that modifications to the septic system site, or septic system itself, are either impractical or impossible. Due to the amount of soil in the project area deemed either somewhat limited or very limited for septic system placement, only 1% of the soils in the project area can handle the demands of an on-site septic system without modification (Figure 2.5).

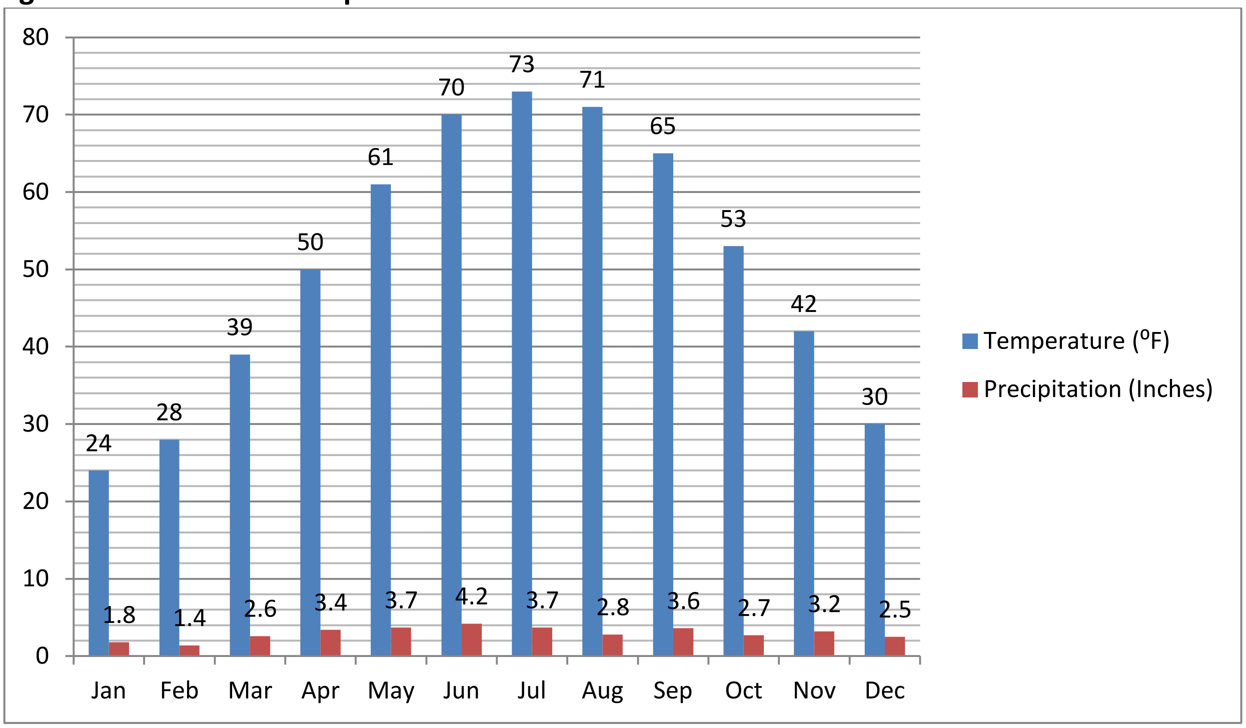
Figure 2.5: Soils Suitable for Septic Tank Use



2.3 Climate

The climate in the project area is considered temperate with warm summers and cold winters. The average high in July is 85°F and the average low in January is 17°F. There is an average of 34 inches of rain and 29 inches of snowfall each year. Figure 2.6 graphically illustrates the average temperature range and precipitation per month within the project area.

Figure 2.6: Middle St. Joseph Watershed Climate



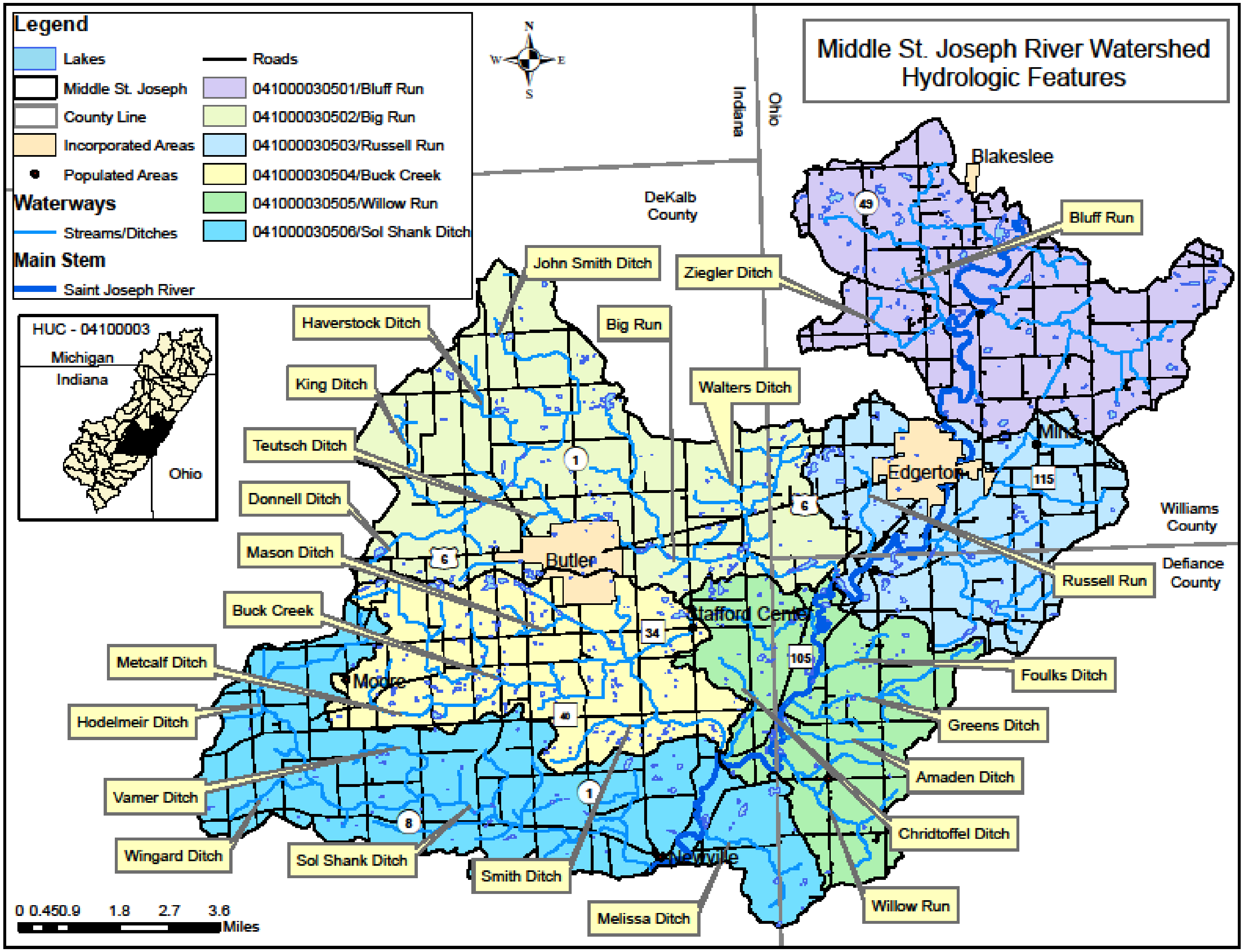
2.4 Hydrology

Of the over 1500 stream miles located within the St. Joseph River watershed 202.95 miles of streams, rivers, ditches, and canals are located solely within the Middle St. Joseph River sub-watershed as can be seen in Table 2.2 and Figure 2.7. The portion of the St. Joseph River located within the project area is 26.12 miles long. All streams located within the MSJRW are considered to be warm water streams. While the St. Joseph River is not well known as a prime fishing location, anglers can catch catfish, crappie, and bass.

Table 2.2: Stream Miles in the Middle St. Joseph River Watershed

Artificial Path	Canal/Ditch	Connector Ditch	Stream/River
29.27 (mi)	19.79 (mi)	0.05 (mi)	153.84 (mi)
		Total	202.95 miles

Figure 2.7: Hydrologic Features in the Middle St. Joseph Watershed



The St. Joseph River is a very slow flowing river, at times it may even seem to be not flowing at all. For this reason, it is a great river to canoe for the person interested in admiring the beautiful scenery as the banks of the St. Joseph are dominated by beach, maple, and sycamore trees and is home to many different types of terrestrial and aquatic wildlife including the endangered Indiana Bat and Copperbelly Water Snake. The IN DNR lists several canoe launching sites along the St. Joseph River, however only two sites are located within the MSJRW. One launch site is on County Road 40 at the bridge that crosses over the river just east of the Indiana-Ohio state line. The other launching site is on State Road 8 in Newville. The OH DNR also lists several launching sites for canoes in Ohio including County Line Road, southwest of Edgerton in Defiance County and at St. Joseph Twp. Road 39, northeast of Edgerton in Williams County.

Stakeholders in the watershed voiced concern regarding the many log jams that are found in the St. Joseph River. The slow flow of the St. Joseph River contributes to the buildup of fallen trees and branches causing log jams in the river as there is not enough velocity in the river to push the broken tree limbs and downed trunks downstream. Log jams contribute to bank cutting and sedimentation of the river system.

The natural streams, as well as legal drains, within the project area are used as a means to carry excess water from the land so that it may be used for agriculture, commerce, industry, and many other uses. However, due to the slow flow of the St. Joseph River system, many of the tributaries have been channelized to increase the velocity of water flowing downstream and decrease the risk of ponding and flooding.

Local drainage boards, SWCDs, and County Engineering Departments are charged with maintaining many of the streams and ditches so that they may continue to function properly for their designated use. These maintained waterways are often referred to as legal drains. There are 218.16 miles of legal drains maintained by the county government within the MSJRW. Table 2.3 provides a breakdown of legal drain miles within the project area for each county.

Table 2.3: Legal Drain Miles

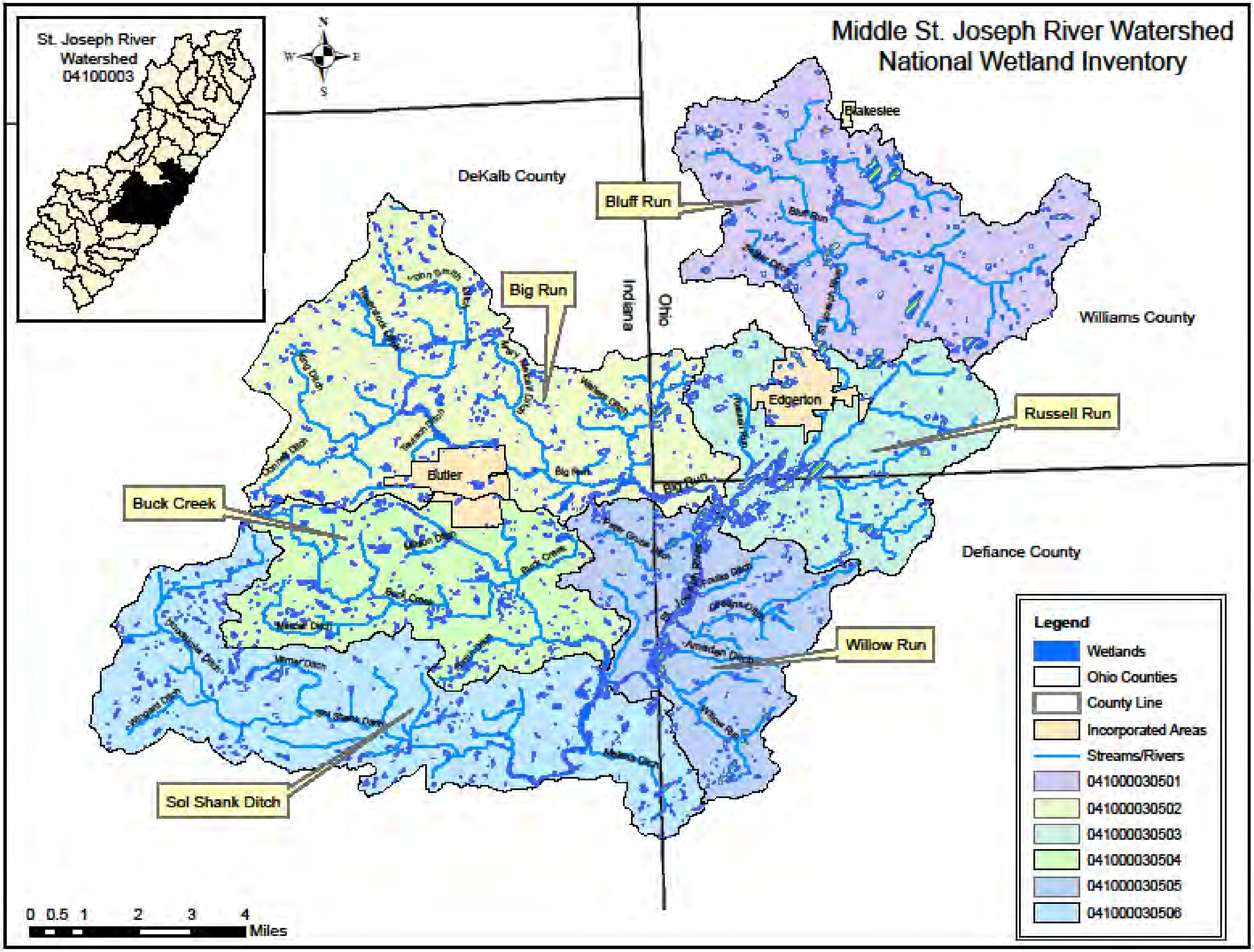
County	DeKalb	Williams	Defiance
Miles	181.1	24.26	12.8
			Total = 218.16

The MSJRW lies just north and west of the historic Great Black Swamp, which has since been drained and converted to prime Midwestern farmland. The proximity of the project area to this historic swamp accounts for the presence of so much hydric soil resulting in the many wetlands that are present in the watershed today. Table 2.4 provides the number of acres of each type of wetland present within the project area. Wetlands play an integral role in our lives as recreation areas for wildlife and bird watching, and fishing, as well as many other recreational past-times. Wetlands are also important as they help to lessen the impact of flooding and act as pollution sinks. The watershed has lost nearly 80% of the wetlands that use to be present when early settlers realized the crop production potential on the fertile soils of the wetlands. For that reason, many of the wetlands were drained using underground tile drains and drainage ditches. Today there are approximately 4,645 acres of wetlands present in the project area. Figure 2.8 shows where the wetlands within the project area have been delineated as determined by the USFWS National Wetland Inventory (NWI). The wetlands delineated in Figure 2.8 were not verified by a ground survey so should not be considered definite wetland boundaries but rather estimations only.

Table 2.4: Wetland Delineation in the Middle St. Joseph Watershed

Emergent Freshwater Wetland	Forested/Shrub Wetland	Pond	Lake	Riverine	Total	Units
1243.24	2664.95	421.01	43.43	273.13	4645.76	Acres

Figure 2.8: National Wetland Inventory



There are many small lakes and ponds located within the project area, however only three lakes located within the project area are of any significant size and have names including Big Lake (14.83 acres), Little Lake (6.92 acres), and Ladd Lake (9.39 acres). All three lakes are located in Defiance County, Ohio in the Russell Run sub-watershed. Ladd Lake is the only of the three lakes that has any development around it, which is only two houses. Ladd Lake is privately owned and is currently up for sale.

The MSJRW is located within the Michindoh aquifer boundary (Figure 2.9), which is a glacial, sand and gravel aquifer. The aquifer is at a depth of just below ground surface to 200 feet deep. In 2007 the City of Bryan, OH petitioned the US EPA to designate the Michindoh aquifer as a Sole Source Aquifer as it provides water to more than 385,000 people who withdraw 72 million gallons of water a day. The US EPA is continuing to do additional research before it will make a final determination.

All residents in the watershed acquire their drinking water through wells. The town of Butler and Village of Edgerton both have wells located in the watershed to extract potable water from the ground to supply drinking water to local residents. The town of Butler also has the only five water reservoirs present in the project area (Figure 2.10). Each reservoir is 0.25 acres in size. The county health departments are responsible for the safety of the groundwater for private water wells and test the water before a new well can be installed. The health departments report very few areas where the water has proven to be inadequate over the past six years. The wells are deemed inadequate by the County Health Department for drinking water if they test positive for the presence of fecal coliforms.

A survey of water withdrawals done by the USGS in 2005 showed that Indiana and Ohio withdraw 844 million gallons of water per day from ground water resources. Table 2.5 shows the total water withdrawals for Indiana and Ohio.

Table 2.5: Water Withdrawals within Indiana and Ohio (2005)

State	% of Population	Groundwater (Mgal/day)	Surface water (Mgal/day)	Total (Mgal/day)
Indiana	74	356	320	676
Ohio	83	488	647	1430

According to the Western Lake Erie Basin Study; St. Joseph Watershed Assessment, 14.9 million gallons of groundwater is withdrawn daily in the St. Joseph River Watershed. 86% of that is for public usage, 8.1% for industry, 0.9% for agriculture, 2.5% for mining, 1.7% for golf courses, and 0.4% for other uses.

Figure 2.9: Proposed Michindoh Sole Source Aquifer Boundary

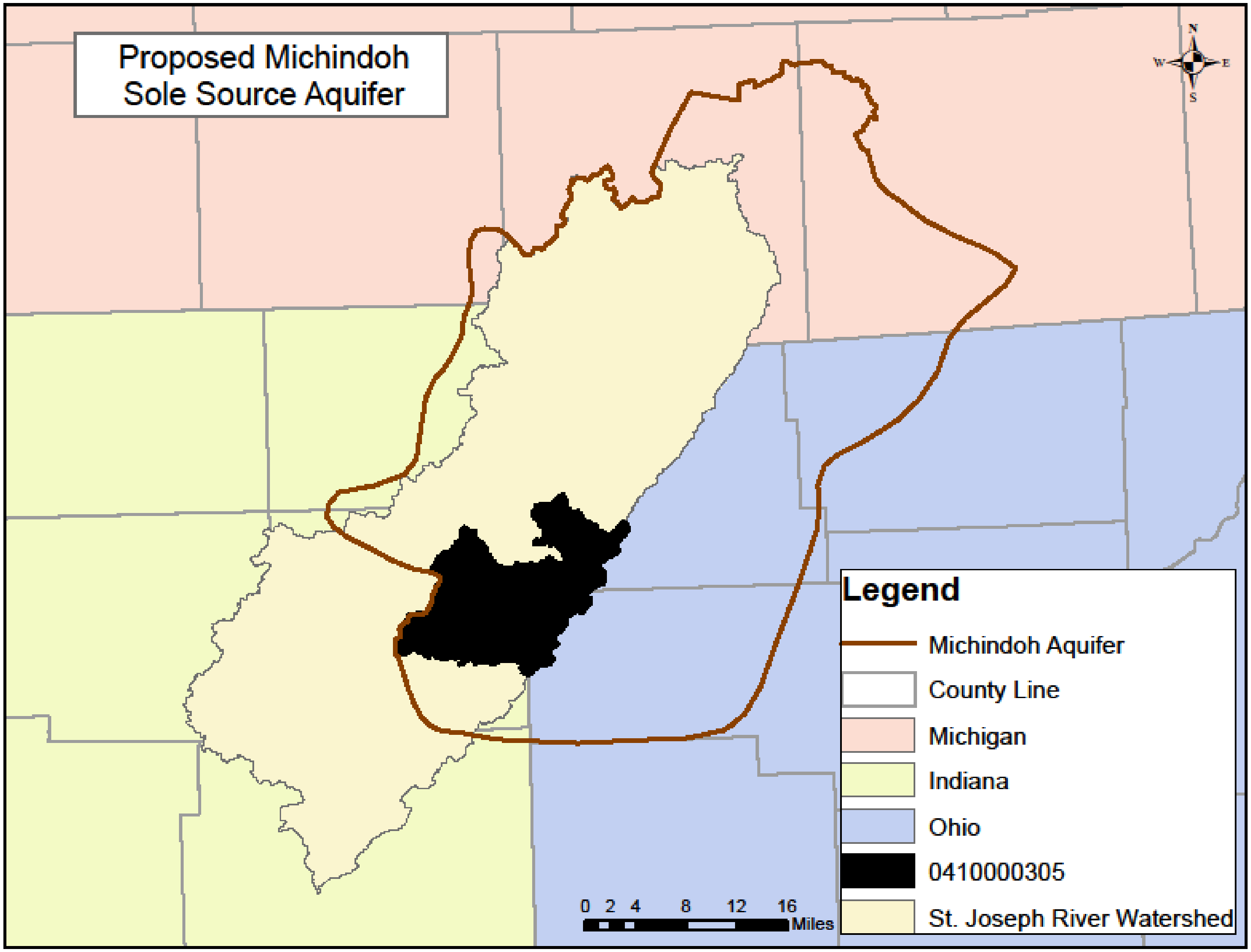
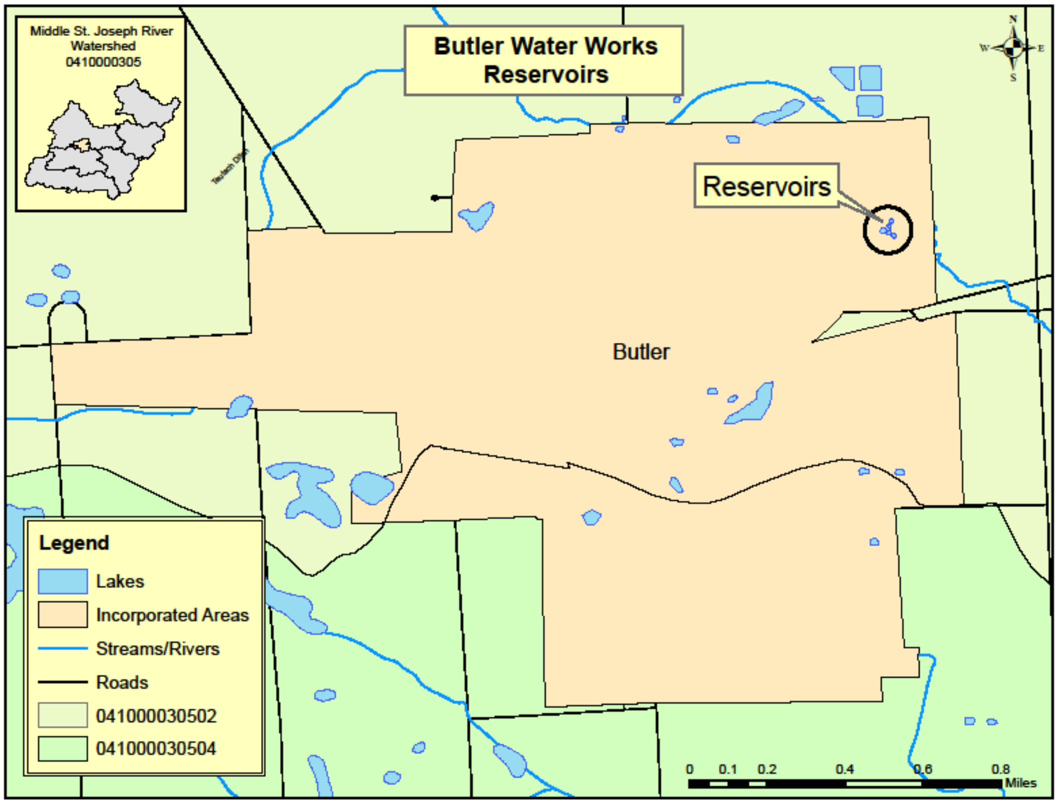


Figure 2.10: Butler Reservoirs



2.5 Land use

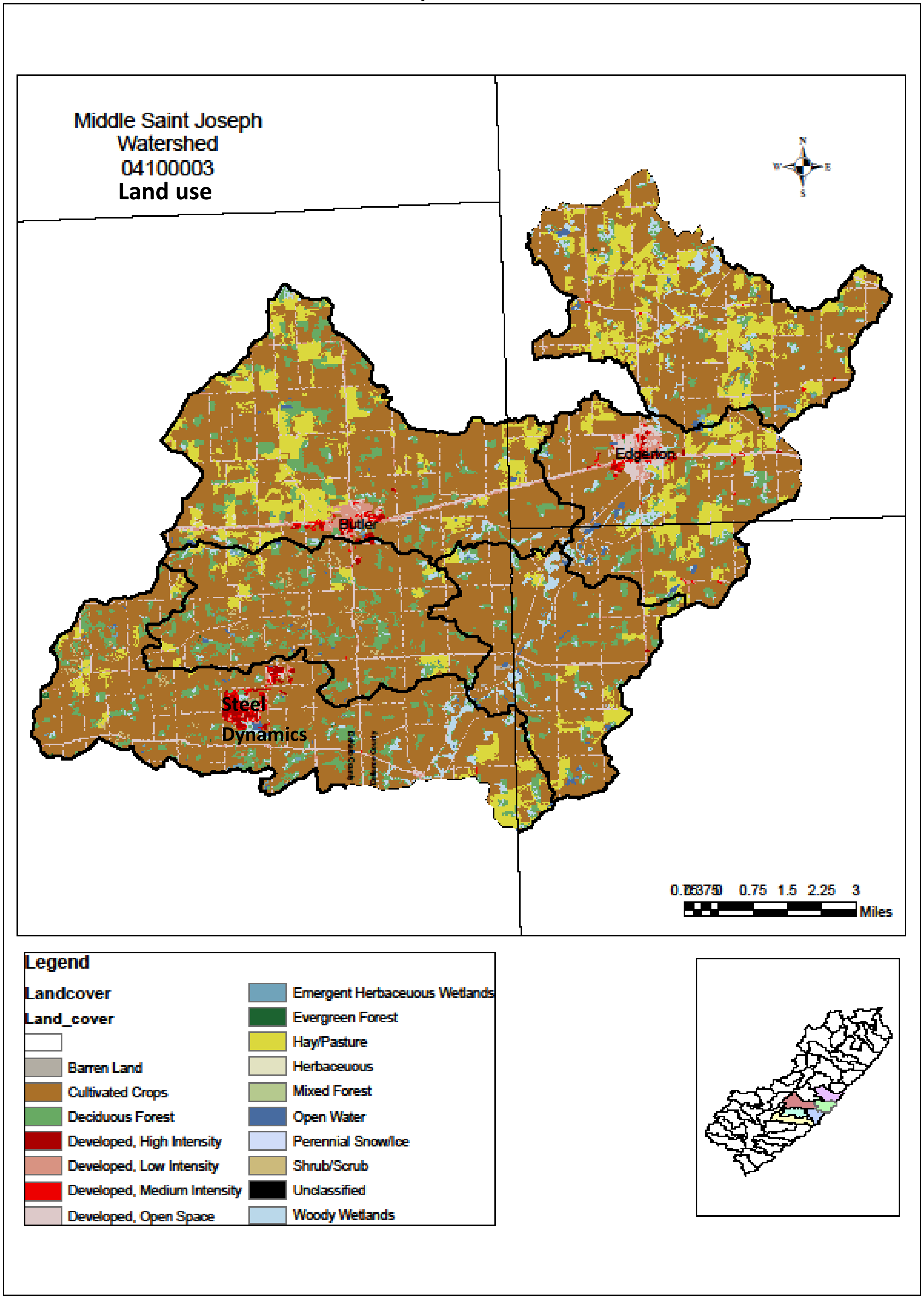
Land use in the project area greatly influences the quality of the water resources. Land in agricultural production has the potential to erode, especially if over worked or if it is conventionally tilled annually. Thus soil particles carrying high levels of nutrients and pesticides have the potential to reach open water sources and effect aquatic plants and animals and cause the water to become non-potable. Livestock rearing often can lead to high levels of bacteria in open water from manure storage areas that are not properly maintained or from livestock having direct access to open water sources. These two activities can also lead to high levels of sedimentation and nutrients in the water system. Industrial, residential and urban areas can pose a threat to water quality due to the increased imperviousness of the landscape, contaminated storm water runoff and industrial waste outfalls. For the reasons listed above, it is very important to investigate land use activities in the project area so as to determine the best method of remediating the pollution coming from the various land uses in the project area.

The predominant land use in the watershed is agriculture as can be seen in Figure 2.11. There are few urban settings including the incorporated town of Butler, IN (P = 2,681) and Village of Edgerton, OH (P = 1,939) and the southernmost tip of the Village of Blakeslee, OH (P=130). There are also several small populated areas located in the project area including the northernmost portion of Newville, IN, Moore and Stafford Center, IN and Mina, OH. The land used for agriculture is either in row crops, including corn, soybeans, grain or hay, in pasture, or used for livestock production. Table 2.6 below shows the number of acres of land in each type of land use per sub-watershed. Values were determined through the use of the Long Term Hydrologic Impact Analysis (L-THIA) program maintained by Purdue University's Engineering Department.

Table 2.6: Land use in the Middle St. Joseph River Watershed

Land use	**Sol Shank Ditch** (acres)	**Buck Creek** (acres)	**Big Run** (acres)	**Willow Run** (acres)	**Russell Run** (acres)	**Bluff Run** (acres)	**Middle St. Joseph Watershed Total** (acres)	**% of Total Water-shed**
Water	647.9	211	215.8	342.4	236.3	539.9	2,193.3	2.6%
Commercial	129.9	6.9	71.7	0	29.7	19.8	258	0.3%
Agriculture	12,291.9	8,677.1	10,403.40	7,678.1	5,026.4	7,408.1	51,485.00	60.2%
High Density Res.	123.8	21.5	462.1	25.9	73.9	117.5	824.7	1%
Low Density Res	873.8	571.3	607.5	302.6	447.2	551.8	3,354.2	3.9%
Grass/Pasture	930.6	536.5	2,622.8	713.9	1,332.2	2,857.3	8,993.3	10.5%
Forest	1,843.6	1,592.1	1,600.2	769.2	655.8	531	6,991.9	8.2%
Industrial	217.5	9.6	61.7	28.7	29.2	5.9	352.6	0.4%
Other/Unknown	380	10	3,263.8	659.2	3,661.3	3,142.7	11,117	12.9%
Total	17,439	11,636	19,309	10,520	11,492	15,174	85,570	100%

Figure 2.11: Land use in the Middle St. Joseph River Watershed



2.5.1: Tillage Transect

Since the three counties located within the project area are predominately agriculture based, the conservation partnership in each County (SWCDs, NRCS, ISDA, etc.) performs a tillage transect every other year, at a minimum, to gage the adoption of various conservation tillage practices in the county. Results of the most recent tillage transect performed by each county can be seen in Table 2.7 below.

Table 2.7: Tillage Transect Results

County	Year Data Collected	No-Till	Mulch Till	Reduced Till	No-Till	Mulch Till	Reduced Till	Unit
		Corn			Beans			
Defiance	2010	23	0.4	0.8	41	4.2	9.1	Percent
DeKalb	2010	46	28	20	80	9	6	Percent
Williams	2009	24.8	N/A	9.7*	62.6	N/A	5.9*	Percent

* Data provided is for mulch till and strip till practices combined.

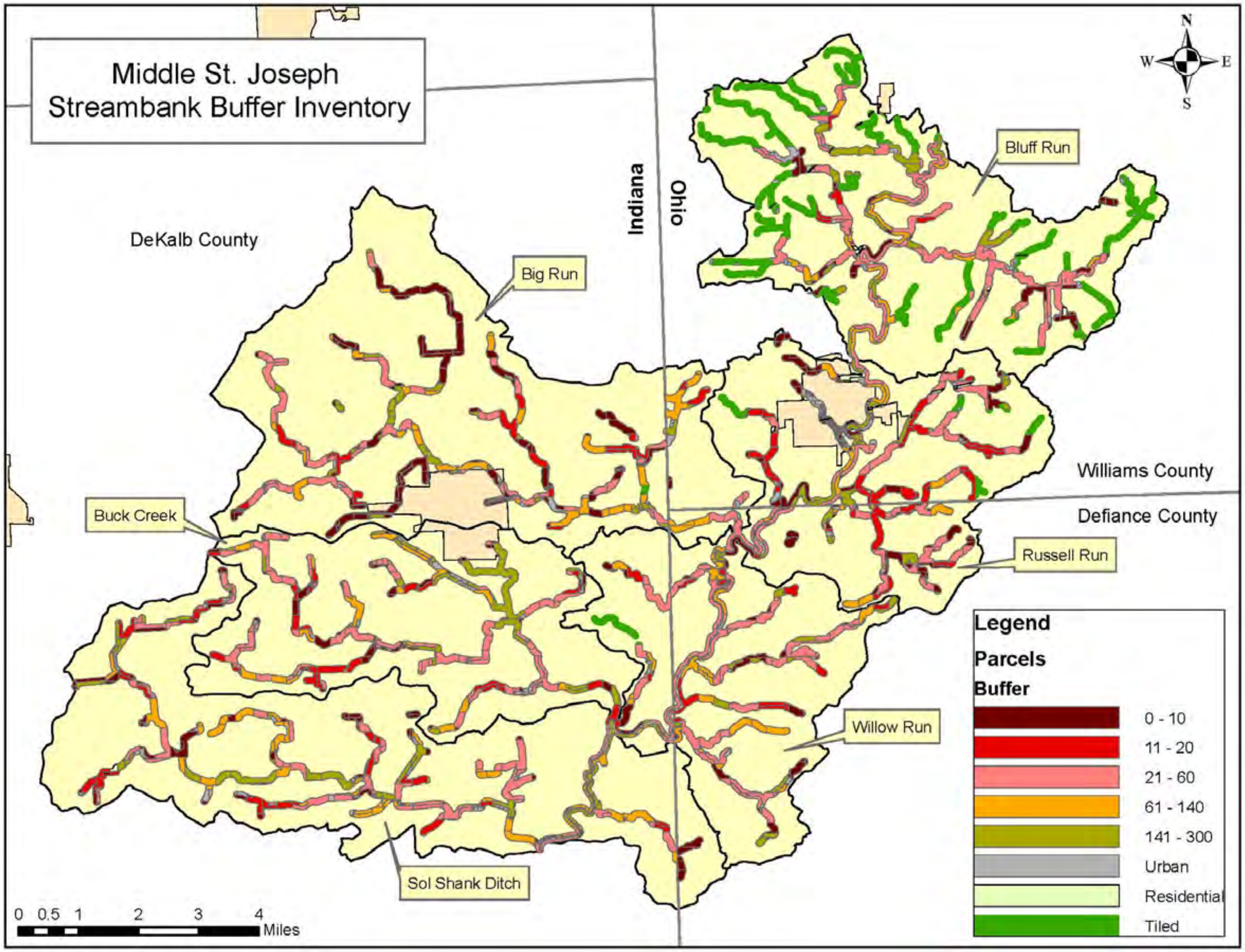
2.5.2: Stream Buffer Width

With 60% of the watershed being used for agriculture, it is not surprising that many ditches and streams have been moved, straightened, and/or deepened to aid in the quick removal of water from agricultural fields. Furthermore, many landowners, especially with the rising prices being paid for agricultural commodities, are planting row crops as close to the stream bank as possible. This practice can increase sedimentation and nutrient levels in ditches and streams. Therefore, the SJRWI contracted the Allen County Partnership for Water Quality to perform a stream buffer analysis within the Middle St. Joseph River Watershed. Parcel GIS layers were gathered from Defiance, Williams, and DeKalb Counties and overlaid with hydrology GIS layers from the USGS National Map Viewer site. Then aerial photos from 2011 were used to determine the width of the stream buffer for each parcel. Table 2.8 below is a breakdown of the percentages of parcels that have anywhere from 0 to 300 foot buffers. Figure 2.12 is a map that shows the location each buffer. Maps showing the stream buffers by subwatershed are provided in section 3.4; Land Use per Subwatershed.

Table 2.8: Stream Buffer Width in the Middle St. Joseph River Watershed

Middle St. Joseph River Watershed Stream Buffer Width			
	Buffer Width	**# of Parcels**	**% of Parcels**
	0-10	924	43%
	11-20	126	6%
	21-60	327	15%
	61-140	167	8%
	141-300	184	9%
	Urban	207	10%
	Residential	31	1%
	Tiled	174	8%
	TOTAL	2140	100%

Figure 2.12: Middle St. Joseph River Stream Buffers



2.5.3: Septic System Usage

Butler, IN and Edgerton, OH are the only areas where the population is served by a centralized sewer system. Therefore, all rural areas located within the MSJRW rely on on-site sewage disposal. DeKalb and Williams County Health Departments were contacted to obtain statistics on the number of septic systems in use within the county and the number of those that are currently failing and discharging untreated waste to either ground or surface water. The Williams County Health Department did not provide the total number of septic systems in use within the MSJRW but did provide the county's estimate of 2,087 septic systems currently failing within the MSJRW. The DeKalb County Health Department has record of 4,408 septic systems in use throughout the county and estimates that 50% of those are failing. Septic system leachate may increase nutrient levels, as well as, harmful bacteria in both surface and ground water, which is the sole source of drinking water within the project area.

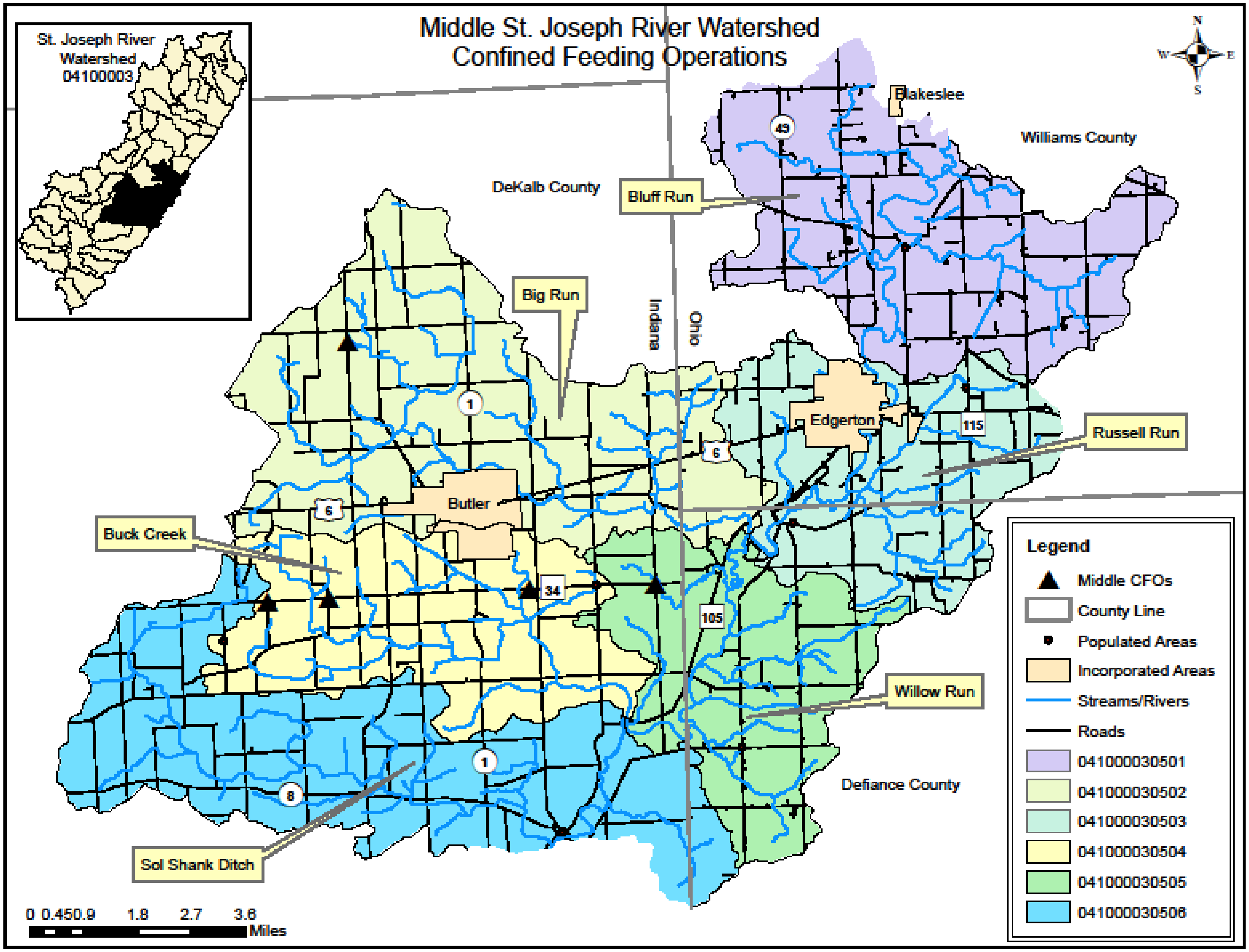
2.5.4: Confined Feeding Operations

Stakeholders voiced concern about animal feeding operations (AFOs) located within the project area as they can present a significant pollution problem if animal waste is not properly confined. There are five permitted confined feeding operations (CFOs) located within the project area, and all are located within Indiana. A confined feeding operation is so designated if there are 300 cattle, 500 horses, 600 swine or sheep, or 30,000 fowl present on the property and confined for at least 45 days during the year where there is no ground cover or vegetation present over at least half of the animals' confinement area. If the size of the operation is very large, or there have been compliance issues with an operation in the past, the CFO may be designated as a Concentrated Animal Feeding Operation (CAFO), and will be required to obtain a National Pollution Discharge Elimination System (NPDES) permit. The Steering Committee voiced concern regarding animal feeding operations, both regulated and non-regulated facilities. Table 2.9 below is a list of all CFOs in the project area and Figure 2.13 shows their location.

Table 2.9: CFO/CAFOs Holding a Permit in the Middle St. Joseph River Watershed per IDEM

Operation	Sub-watershed	Designation	Animal Type	Animal #
Don Hook Farms, Inc	Willow Run	CFO	Swine	1346
Carnahan Farms, Inc	Buck Creek	CFO	Dairy	334
Irish Acres Dairy	Big Run	CAFO	Dairy	1196
R & D Malcolm Farms, Inc	Buck Creek	CFO	Swine	701
Ridge Farms	Buck Creek	CFO	Swine	932

Figure 2.13: CFOs in the Middle St. Joseph River Watershed



2.5.5: Windshield Survey

A windshield survey was conducted throughout the watershed to identify areas where NPS may be an issue. The survey was conducted in May and June 2011, with three people per vehicle, driving each road within each subwatershed, and making note of any areas of significant soil loss, livestock access to open water, or other potential pollution sources. The survey revealed several areas of erosion, however there were numerous heavy rain events that occurred during the spring of 2011 so the erosion noted during the survey may not be typical. A hobby farm where the horses had direct access to a stream and severe bank erosion was noted during the windshield survey. There were also three other large animal operations that were noted during the windshield survey. However, these operations fall below the threshold to be considered a CFO. The windshield survey will be discussed in further detail in section three of this WMP.

2.5.6: National Pollution Discharge Elimination System

The steering committee voiced concern about industrial discharge and runoff in the watershed. Facilities that discharge directly into a waterbody are required to obtain an NPDES permit from the overseeing state agency (IDEM and OH EPA). The permit regulates the amount of contaminants a facility can discharge into surface water and requires the facility to conduct regular water quality monitoring. While these facilities are regulated by the State, there is the potential that they may have accidental discharges above permit limits, or in some cases, the facilities may release a substance that they are not required to report to the State which may pose a threat to water quality; phosphorus is a common parameter not required to be reported. There are five NPDES permitted facilities located within the project area which are outlined in Table 2.10.

Steel Dynamics, Inc. is the most significant of the five permitted facilities encompassing 306.5 acres of land and discharging into the Sol Shank Ditch. The NPDES permitted facilities will be mapped in their respective subwatershed in section three of this WMP.

Table 2.10: NPDES Permitted Facilities within the Middle St. Joseph River Watershed

Permit Name	Permit #	Issue Date	County Name	Street Address	City	State Code	Zip	State Water Body Name
Steel Dynamics, Inc	IN0059 021	11/17/ 2008	DeKalb	4500 CR 59	Butler	IN	46721	ST JOSEPH R VIA SOLOMON SHANK DITCH
East High School	ING25 0077	11/15/ 2008	DeKalb	603 E GREEN ST	Butler	IN	46721	ST JOSEPH R/BIG RUN CR/STORM SEWER
Stafford Gravel, Inc. Washler Pit	ING49 0043	6/13/ 2008	DeKalb	CR 40 and CR 55	Butler	IN	46721	ST JOSEPH R VIA CHRISTOFF EL DITCH
Village of Edgerton (Water Treatment Plant)	21Z000 40	03/01/ 2007	Williams	327 N Crane St	Edgerton	OH	43517	ST. JOSEPH RIVER
Village of Edgerton (Waste Water Treatment Plant)	2PB00 047	08/01/ 2011	Williams	03004 Twp Rd 5	Edgerton	OH	43517	ST. JOSEPH RIVER

The steering committee voiced concern regarding an increase in impervious surfaces due to the number of steel industries that have developed around the Steel Dynamics plant. These newly developed businesses include Heidtman Steel Products, Magic Coil Products, Paragon Steel, and New Process Steel. The heavy concentration of industry in the area required new roads to be built providing fast and easy access to each site, and has caused an increase in heavy truck use on local roads. Stakeholders are concerned about the increase in impervious surfaces as these surfaces limit the amount of stormwater infiltration through the ground, provide a direct conduit for oil, grease, street salt, sediment, lawn fertilizer, and other urban pollutants to surface waters, as well as increase the amount of water directed to area waste water treatment plants (WWTPs) which may cause a combined sewer overflow into surface waters. Combined sewers will be discussed in further detail in Section Three of this WMP.

2.5.7: Community Parks

Eight community parks are located within the project area totaling approximately 142 acres of land. Seven parks are located in Butler, IN and one in Edgerton, Ohio. The parks are predominantly used by local residents and are supplied with playground equipment and picnic tables for the public to enjoy. Miller Park in Edgerton and Maxton Park in Butler are the only two parks with nature trails and center around a surface water feature; Miller Pond and Big

Run, respectively. Table 2.11 lists all parks located within the project area, how many acres they encompass and who manages the parks.

Table 2.11: Parks Located within the Middle St. Joseph River Watershed

Name	Acres	Ownership	Facilities
Dick Miller Memorial Park	<1	City of Butler	Gazebo, flower gardens
Hathaway Park	3.49	City of Butler	Playground, baseball diamond, basketbal court, restrooms, pavillion, picnic tables
Hendrickson Park	11.73	City of Butler	Paintball course
Mason Memorial Park	<1	City of Butler	Playground, pavillion, picnic tables
Maxton Park	34	City of Buter	Playground, two softball diamonds, two pavillions, picnic tables, basketball court, nature trail, sledding hill
Southside Park	8.5	City of Butler	Playground, paved trail, pavillion, picnic tables
Susie Park	3.2	City of Butler	Open green space
Miller Park	>80	Village of Edgerton	Playground, pavillion, gazebo, three softball diamonds, shelter house, stocked pond (catch and release only), basketball court, tennis court,sand volleyball court, nature trail, sledding hill

2.5.8: Potential Contamination Sites

There are several remediation sites and potential contaminant sites located in the project area including underground storage tanks (USTs), leaking underground storage tanks (LUSTs), oil and gas wells, junkyards, and industrial waste sites (Figure 2.14). These sites must be monitored carefully to be sure that no contamination of surface or ground water occurs. There are no brownfield or superfund sites located within the project area.

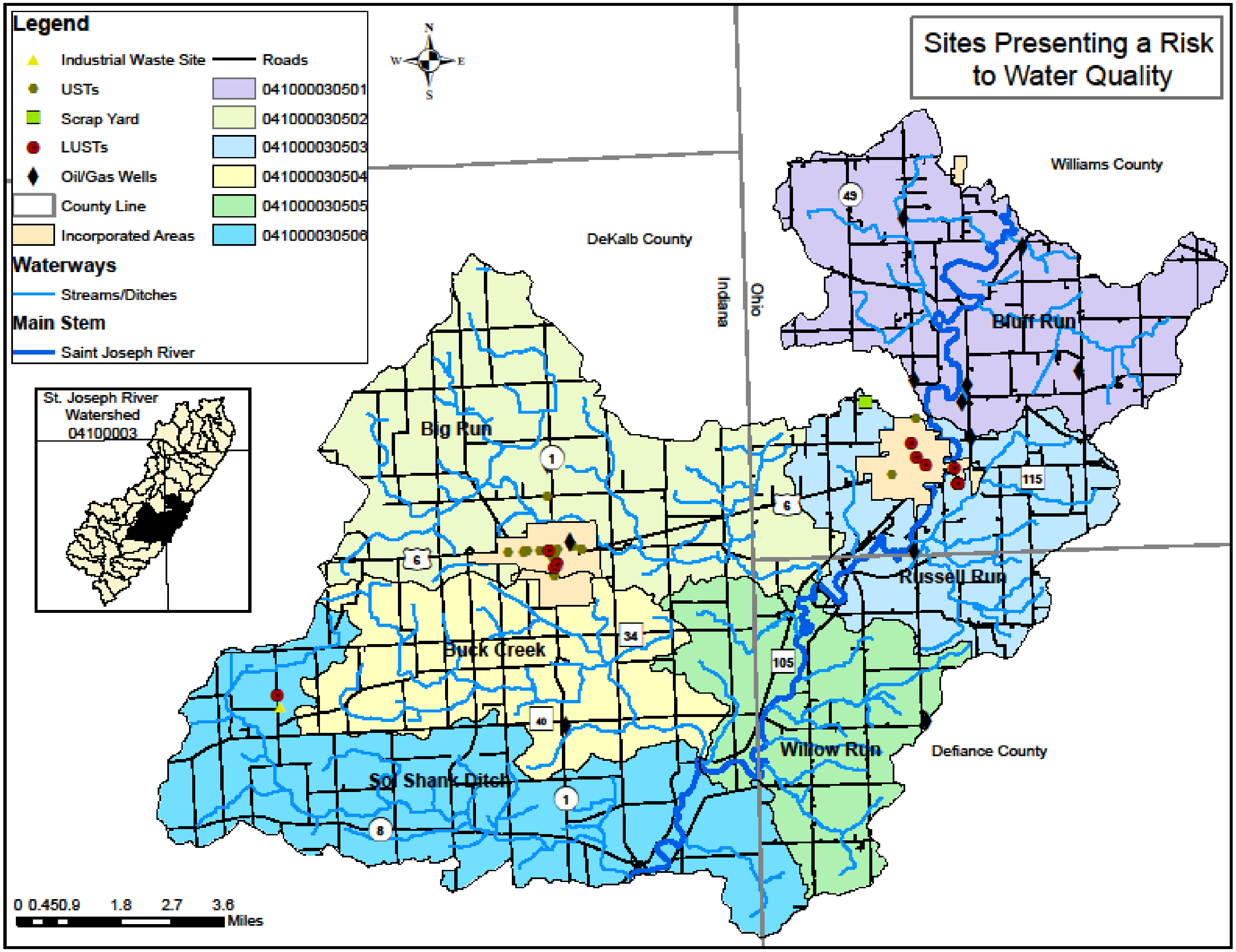
USTs are managed by the IDEM Office of Land Quality's Underground Storage Tank program and the OH Commerce Division of Fire Marshal, Bureau of Underground Storage Tank Regulations (BUSTER). However, the state of OH has not yet been granted state program approval by the US EPA to completely manage the UST program unsupervised. The states are charged with assuring all underground storage tanks meet both state and federal regulations so as to not contaminate surrounding land and/or water resources. The states are also responsible for making sure those tanks that do not meet requirements are properly closed or up graded. There are 36 USTs located in the project area, of those, 15 are considered to be LUSTs. LUSTs will be discussed in Section 3 under the respective subwatershed.

There are 12 oil and/or gas wells located in the project area. These sites should be monitored closely as there is the potential for ground and surface water contamination if the well fails or leaks. The oil and gas wells will be discussed in further detail in Section 3 under the respective subwatershed.

There is one scrap yard located in the project area northwest of the Village of Edgerton. Stormwater runoff from scrap yards has the potential to contaminate surface water as it can carry with it heavy metals, oil and grease, and sediment. Proper controls should be taken to limit the amount of polluted runoff from this scrap yard. This will be discussed in further detail in Section 3 under the respective subwatershed.

There is one industrial waste site located in the project area. The site is run under the Resource Conservation and Recovery Act (RCRA) which is the principle federal law regarding the disposal of hazardous waste. Industrial waste sites are typically designated as such if they require the disposal of potentially hazardous wastes. The industrial waste site will be discussed in Section 3 under the respective subwatershed.

Figure 2.14: Sites Presenting a Risk to Water Quality



2.6 Previous Watershed Planning Efforts

The Saint Joseph River plays an important role for residents of Indiana, Ohio, and Michigan as it provides drinking water to the more than 250,000 residents of the city of Fort Wayne, IN, recreational opportunities throughout the watershed, and it eventually flows to the Great Lake Erie by way of the Maumee River. For these reasons, the St. Joseph River is important to understand and protect. Many studies of the river system and the surrounding land uses have been conducted, as well as, several city and county master plans have been written to outline problems and threats to our natural resources, and propose ways of protecting those resources. This section provides a description of each of the previous studies and watershed planning efforts that have been conducted in the MSJRW.

St. Joseph River Watershed Management Plan

The St. Joseph River Watershed Initiative was provided a CWA§319 grant in 2004 to revise the watershed management plan for the entire eight digit HUC St. Joseph River watershed (04100003) that was originally approved by IDEM in 2001. The revised WMP was completed and approved by IDEM in 2006. During the St. Joseph River WMP investigation it was found that the Middle St. Joseph subwatershed had high levels of *E. coli* in the Big Run subwatershed, making the Big Run subwatershed a critical area in the WMP. A bacteria source tracking analysis performed between 2001 and 2004 showed that the source of the high *E. coli* levels was primarily from livestock and human sources. While the revised St. Joseph River WMP provided a lot of information, it was not detailed enough to pinpoint all the major issues that need to be addressed in each of the subwatersheds. For that reason, goal 1 of the St. Joseph River WMP is "By 2020, organize stakeholders and produce watershed plans for the HUC-11 subwatersheds which have not yet been completed…". It should be noted that since the approval of the St. Joseph River Watershed Management Plan the United States Geological Survey (USGS) re-delineated the boundaries of all HUCs and gave each HUC a new 10 or 12 digit "address". Therefore, the HUC-11s referred to in the above quote, now would be HUC-10s. The Middle St. Joseph River watershed is the fifth of nine 11 digit HUC (now 10 digit HUC) subwatersheds to have a WMP developed.

Bacteria Source Tracking Investigation

The St. Joseph River Watershed Initiative performed a bacteria source tracking investigation on the Enterococci collected from grab samples throughout the St. Joseph River watershed between 2001 and 2004. An antibiotic resistance analysis was performed to determine the source of the bacteria collected. Two sampling locations that were used during that study were located in the MSJRW; Sol Shank Ditch and Big Run. Results of the overall analysis showed that wildlife, particularly geese, contributed significantly to the *E. coli* present in the St. Joseph River watershed. However, as can be seen in Table 2.12, livestock, pets, and horses may contribute more to the bacteria in the river than geese. Though, it is important to mention that there was question about whether there was interference with horse bacteria from another source. It is known that this possible interference does not come from human sources. While there were not any human bacteria found in the Big Run sample, there was a small amount of human bacteria detected in the Sol Shank Ditch. This may be due to leaky septic systems, as there are no waste water treatment plants that discharge into the Sol Shank Ditch subwatershed, nor are there any combined sewer outfalls.

Table 2.12: Bacteria Source Tracking Analysis

Site #	Subwatershed	% livestock	%pets	% geese	% horse	% human
123	Sol Shank Ditch	11.9	21.4	33.3	31	2.4
127	Big Run	25	32.5	2.5	40	0

Rapid Watershed Assessment of Riparian Buffers in the St. Joseph River Watershed

A Cooperative Conservation Partnership Initiative grant was provided to the Ohio DNR to perform a rapid watershed assessment of the riparian buffers in the St. Joseph River watershed in 2006. The OH DNR contracted the Initiative to perform the study. The study was conducted to prioritize subwatersheds for the placement of riparian buffers to improve water quality and wildlife habitat. Five categories of information were determined to be the most useful in the ranking process; percent of watershed in crop production, percent of at least 30 meters of woodland in buffer zone, percent of natural vegetation in the watershed, water quality and species occurrence in the watershed. Using the above mentioned five parameters, the MSJRW was ranked as being in the worst condition, meaning it had a high amount of land in crop production, little natural vegetation, few areas where 30 meters of buffer zone was covered by woodland, and low water quality and species occurrence. The MSJRW stakeholders voiced concern regarding the lack of riparian buffer and wildlife corridors in the watershed. When that concern is combined with the Rapid Watershed Assessment (RWA), it is clear that the buffer zones in the watershed should be examined more closely. As part of this project, a more intense look at riparian buffers was examined and will be presented in section 3 of this WMP.

Western Lake Erie Basin Study: St. Joseph Watershed Assessment

In 2009 the US Army corps of Engineers completed a study of the St. Joseph River Watershed to provide watershed, city, and county planners with a tool to help restore, protect, and promote sustainable uses of water resources and the surrounding land within the Western Lake Erie Basin (WLEB). The study states that bacteria, pesticides, sediment, and excess nutrients are all water quality concerns throughout the eight digit HUC. It also states, that flooding is a major issue as it not only causes thousands of dollars in property damage, but also contributes pollutants to the water system. The WLEB St. Joseph study found that the majority of the pollution is coming from Combined Sewer Outfalls, agriculture operations, flow and habitat modifications, waste water treatment plant outfalls, and septic systems. The major findings of the study located solely within the MSJRW include;

- Big Run being ranked a priority 5, 6 or 8, out of 8, for flooding
- Sol Shank Ditch being ranked a priority 6 or 8, out of 8, for flooding
- Buck Creek being ranked a priority 6, out of 8, for flooding

However, the WLEB study conceded that a more in depth study of each subwatershed should be completed so as to be more exact in the determination of problems and causes.

Western Lake Erie Basin Partnership Strategic Plan

The Western Lake Erie Basin Partnership was formed in 2006 after the US Army Corps of Engineers and US NRCS brought together 14 federal, state, and regional partners to create a comprehensive watershed management partnership comprised of key stakeholders located within the WLEB. In 2007, the WLEB Partnership adopted a strategic plan to improve water quality throughout the WLEB. The Plan includes goals for the following topics;

- Invasive Aquatic Species Control
- Habitat Conservation and Species Management
- Stream and Coastal Health/Water Quality
- Areas of Concern/Contaminants
- Nonpoint Source Pollution
- Toxics
- Sustainable and Balanced Growth
- Hydrologic Management/Flooding Attenuation
- Forest Resource Protection
- Native Plant Community
- Public Information/Education

Many of the goals are in-line with concerns expressed by the MSJRW stakeholders such as industrial discharge and runoff, land conversion/increase in impervious surfaces, and nonpoint source pollution from AFOs, CSOs, and other animal operations.

DeKalb County Comprehensive Plan of 2004

In June, 2004 the Commissioners of DeKalb County adopted the DeKalb County Comprehensive Plan. This Plan is intended to be relevant for the county for the next five to ten years, at which point, the Plan will be updated. There are two chapters in the Plan that are relevant to the MSJRW project; Chapter 5 – Protect Environmental Assets and Chapter 7 – Provide High Quality Public Services. Chapter 5 has four objectives including protecting the quality and quantity of water resources, protect and enhance the natural environment, allow for sustainable growth, and reduce risks of flooding. This chapter encourages the development and protection of wetlands and swales for stormwater control, reducing point source discharges, enforcing wellhead protection plans, reserving open space, conserving tree stands, discouraging development of sensitive areas, the adoption of best management practices, allowing development within the 100 year flood plain on a minimal basis, and preserving regulated drains in the county. Chapter 7 also has four objectives including develop plans for community services to meet county growth, enhance public services, improve communication between city and county governments and agencies, and develop a county parks board and parks and recreation master plan, which has not yet been completed. These objectives will be met by protecting future park and recreational areas, encouraging the donation of land to the County to be used as a public park, and establishing public parks that provide passive recreation.

The DeKalb County comprehensive Plan, if implemented successfully, can address the Middle St. Joseph Steering Committee's concerns regarding land conversion/increase in impervious surfaces, lack of riparian buffers and wildlife corridors, and industrial discharge.

DeKalb County Unified Development Ordinance (UDO)

The UDO was adopted by DeKalb County in January, 2009. The UDO is a plan to allow for development while not decreasing the quality of the land and its resources. The UDO designated a small area within the MSJRW located north of Butler, IN to be used as only open space which decreases the amount of impervious surface in that area, and may maintain wildlife corridors, which are two of the MSJRW steering committee concerns. The UDO also states that no trees can be removed during construction unless they are dead or diseased, or replaced with comparable vegetation. Finally, the UDO outlined specific standards in wellhead protection areas, such as banning dry cleaners and laundromats, scrap yards, bulk chemical storage, CFOs, and put a maximum of 1000 gallons of above ground storage of liquid chemicals.

City of Butler 2001 Comprehensive Plan

The City of Butler adopted their comprehensive plan in 2001. The Plan does not have environmental goals or concerns outlined in it. The Plan does however, have objectives to promote the growth and development of new businesses and industry within the area. This may be why there has been an increase in the steel industry just south of the City of Butler, which was voiced as a concern of the MSJRW steering committee. The Plan does have an objective to support civic and recreational opportunities within the City of Butler, including providing support to the Butler Park Board so it can continue to improve local parks. According to the Plan, 38% of the City of Butler is currently zoned for light or heavy industrial use. 38% of a city's land use being designated as industrial is a significant portion of the total land use and the Plan has a projection of increasing industrial use over the next 20 years, which validates the steering committees concern over increased imperviousness, land conversion, and industrial discharge.

Butler Long Term Control Plan

The City of Butler is the only municipality in the MSJRW that has a combined sewer outfall (CSO) which is a concern of the MSJRW steering committee. All other population centers have separated storm sewers. A CSO carries both sanitary waste and storm water runoff through the same pipe to the waste water treatment plant (WWTP). However, during rain events, the WWTP often cannot process the amount of water coming in and must open the CSO to discharge into receiving waters; Big Run in Butler's case. Each population center that utilizes CSOs is required to write and implement a Long Term Control Plan (LTCP) to minimize the number of times the CSO is opened to discharge into receiving waters.

There are 2,700 people served by the Butler Wastewater System, as well as a large industrial area southwest of Butler which includes the Steel Dynamics complex. The WWTP processes approximately 800,000 gallons of wastewater per day, with 500,000 gal/day coming from industrial areas. The industrial waste is pretreated prior to being sent to the Butler WWTP. In 2002, the WWTP was expanded to process an average of 2 million gallons of water per day. This expansion has significantly decreased the number of times the CSO has discharged to Big Run. The LTCP states that through the implementation of the US EPAs nine minimum control measures, CSO discharges will be reduced to no more than four overflows annually and there will be no activation of the CSO during dry weather or wet weather with 0.5 inches of precipitation or less. The City of Butler had an engineering firm do a feasibility study on the cost and benefit of completely separating the sewer systems. It was determined that the environmental benefits were only marginal and the cost of the project was somewhat prohibitive. Therefore, Butler has no plans in the future to separate the CSO.

City of Butler Parks and Recreation Master Plan

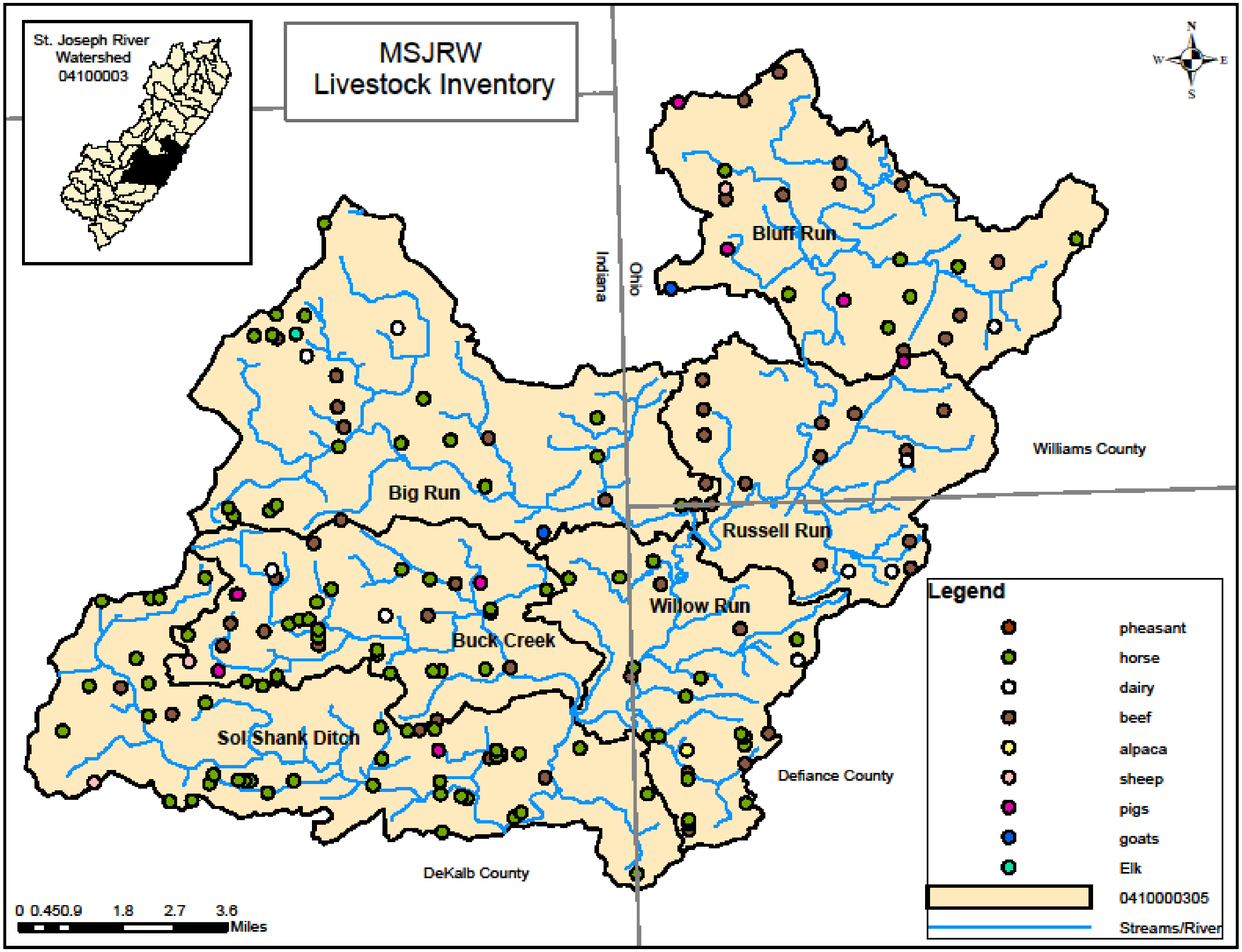
The Master Plan was developed for years 2005 – 2009. The updated Master Plan has yet to be approved and released to the public. As mentioned in Section 2.6, there are seven parks located within the City of Butler, and covered under this Master Plan. While this Master Plan does not relate specifically to the MSJRW steering committee's concerns, maintaining open spaces for recreational purposes is important as an educational tool to keep people aware of beneficial ecological resources, as well as, preventing the increase of impervious surfaces and helping to allow the infiltration of stormwater before it reaches combined sewer drains, or discharges directly into open water. The Master Plan focuses mainly on maintaining the parks for public entertainment. Goals of the Master Plan include staying active, upgrading existing facilities, promoting the donation of open space for conversion to a city park, and modify subdivision development ordinance to require the developer to set aside land and funds to create neighborhood parks.

St. Joseph River Watershed Livestock Inventory

The Initiative was awarded a grant from the OH DNR to do a complete livestock survey of the St. Joseph River Watershed. The Initiative and its partners drove each road within the entire eight digit HUC to take a detailed survey of livestock in the watershed including the number of livestock present, where they are housed, and what type of animal is present at the operation (excluding household pets such as dogs and cats). The inventory was completed in 2009. The inventory will help target education and outreach efforts, and where to spend cost-share dollars on livestock operations to improve water quality. The MSJRW steering committee expressed concern regarding regulated and unregulated animal feeding operations in the project area.

The inventory counted 5,921 head of livestock in the MSJRW including beef cows, dairy cows, horses, sheep, pigs, goats, pheasant, elk, and alpaca. It should be noted however, that natural resource planners in OH have noticed a steady decline in the number of animal operations throughout Williams County, so the head count of the 2009 livestock inventory may be greater than the current head count. Horses with direct access to open water was noted at one location during the Inventory in Willow Run subwatersheds. Livestock with direct access to open water can impact water quality by increasing sediment in the water column from the stream banks which become denude of vegetation from cattle walking down slope to the stream, and from fecal contamination which is occasionally deposited directly in the stream. There was also one location noted in Willow Run subwatershed where a barnyard was located a maximum of 100 feet from an open water source. Finally, there was one location in Sol Shank Ditch where the animal operation had direct discharge from the barnyard to an open stream. Figure 2.15 on the next page shows the location of the livestock operations that were present during the 2009 inventory. As can be seen in the map, the majority of the operations are for horses and only five of those operations have over 20 horses on site, with the majority of operations having less than five.

Figure 2.15: 2009 Livestock Inventory



Wellhead Protection Plans

Most of the population in the project area receives their drinking water from the vast supply of ground water present in the area. There are six community public water supply systems (CPWSS) in the project area (one in DeKalb County, IN, four in Williams County, OH, and one in Defiance County, OH) which draw their water through groundwater wells. A CPWSS is designated as such if it has 15 service connections or supplies drinking water to at least 25 people, according to the federal Safe Drinking Water Act. The entity controlling the system is required to develop a Wellhead Protection Plan (WHPP). A WHPP must contain five elements according to the IDEM; 1) Establishment of a local planning team, 2) Wellhead Protection Area Delineation of where ground water is being drawn from, 3) Inventory of potential sources of contamination to identify known and potential areas of contamination within the wellhead protection area, 4) Wellhead Protection Area Management to provide ways to reduce the risks found in step three, 5) Contingency Plan in case of a water supply emergency, and 6) New Wells to identify the ability to meet existing and future water needs will be examined.

There are two phases of wellhead protection. Phase I is the development of the WHPP which involves delineating the protection area and determining sources of potential contamination. Phase II is the implementation of the WHPP. All communities located within the project area have completed Phase I of the requirement and are slated to be working on Phase II. Table 2.13 identifies those CPWSSs located within the project area and which phase they are currently in. A map of well head protection areas is not available since the delineation of such areas is not made public.

Table 2.13: Wellhead Protection Plans

System Name	Population or Gallons per Day	Phase	Susceptibility to Contamination
Butler Water Works	N = 2725	Phase I	unknown
Edgerton Village	341,000 GPD	Phase I	Low
Edgerton Alliance Church	400 GPD	Phase I	Low
Zion Lutheran Church	870 GPD	Phase I	Low
Victory Barn Church	1,000 GPD	Phase I	Low

2.7 Endangered Species

The MSJRW is home to many federally and state listed endangered and threatened species. The US Fish and Wildlife Service (USFWS) maintains a database of those species that are either endangered or candidates to become endangered on the federal level which can be seen in Table 2.14. There are several species of significance that rely on wetland and upland forest areas like those found in the MSJRW, including the White Cat's Paw Pearly Mussel (*Epioblasma obliquata perobliqua*) which is no longer seen in the MSJRW and currently can only be found in the Fish Creek watershed located north of the MSJRW.

According to the USFWS, the Indiana Bat population has decreased by over half since it was originally listed as endangered in 1967. This decrease in population can be attributed to human activities disturbing the Indiana Bat's habitat. Indiana Bats are very vulnerable to disturbances in their hibernation grounds as they hibernate in mass numbers (20,000 to 50,000) in caves in southern Indiana. The reason the bats population has declined in northern Indiana is mainly due to their breeding and feeding grounds, riparian and upland forests, being cleared for agricultural land and expanding urban areas. The Eastern Massasauga Rattlesnake lives in wetland areas, many of which have been drained to be used for agriculture. The ancestral Black Swamp in Ohio which has all, but the northeast corner of the swamp near Toledo, been drained and converted to farm land is one such wetland area in which the Eastern Massasauga would use as prime habitat. With much of the Eastern Massasauga's habitat being converted for other uses, the snakes numbers have declined dramatically. Finally, the last known population of White Cat's Paw Pearly Mussel is located in the St. Joseph River. These mussels live in streams that have a coarse sand or gravel bottom. With the increase in intensive agriculture throughout the St. Joseph River watershed, the amount of sediment entering surface water has also increased, thus smothering the mussels in the streambed. According to the United States Fish and Wildlife Service (USFWS), pesticides and fertilizers that runoff agricultural fields have also contributed to the demise of the White Cat's Paw Pearly Mussel as the mussels are filter feeders and take in contaminated water each time they eat. The protection of the habitat in which all the species listed in Table 2.14 live is essential to their survival.

Table 2.14: Federally Listed Endangered Species by County

County	Species	Common Name	Status	Habitat
MAMMALS				
Williams and Defiance (OH) DeKalb (IN)	*Myotis sobalis*	Indiana Bat	Endangered	Hibernation in caves, swarming in wooded areas and stream riparian cooridors
MUSSELS				
Williams and Defiance (OH) DeKalb (IN)	*Pleurobema clava*	Clubshell	Endangered	Rivers
Williams and Defiance (OH) DeKalb (IN)	*Epioblasma torulosa rangiana*	Northern riffleshell	Endangered	Rivers
Williams (OH)	*Quadrula cylindrica cylindrica*	Rabbitsfoot	Candidate	Rivers
Williams and Defiance (OH)	*Villosa fabalis*	Rayed Bean	Proposed as Endangered	Smaller headwater creeks, sometimes larger rivers
Williams and Defiance (OH) DeKalb (IN)	*Epioblasma obliquata perobliqua*	White Cat's Paw Pearly Mussel	Endangered	Rivers
REPTILES				
Williams and Defiance (OH)	*Nerodia erythrogaster neglecta*	Copperbelly Water Snake	Threatened	Wooded and permanently wet areas such as oxbows, sloughs, brushy ditches and floodplain woods
Defiance (OH)	*Sistrurus c. catenatus*	Eastern Massasauga	Threatened	Wetlands and adjacent uplands

The IN DNR, Division of Nature Preserves and the OH DNR, Division of Wildlife maintain lists of federally and state endangered and threatened species by county. The Indiana database of species includes those that are considered rare, extirpated, of special concern, significant, and on a watch list for the state. Ohio's list of species contains those that are potentially threatened, threatened, endangered, of concern, and of special interest. The endangered and threatened species spreadsheet's for Williams, Defiance, and DeKalb counties are included in Appendix A.

2.8 Summary of Watershed Inventory

All of the elements described above, when combined, can provide a larger picture of how the watershed functions and what activities may pose a greater threat to our water resources. This section will summarize the characteristics of the project area and describe how they relate to each other. This will be examined more closely in subsequent sections.

The predominate land use in the MSJRW is agriculture due to the fertile soils, much of which use to be wetlands as can be seen by the amount of hydric soil present within the watershed (Figure 2.4, page 21). Hydric soils are not ideal for agricultural use due to the frequency of ponding and/or flooding. When soils are over saturated, excess nutrients and animal waste often wash off the field and may wash directly into surface waters. Many landowners install field tiles to prevent crop land from becoming over saturated, however, this practice provides a direct means for nutrients, sediment, and bacteria to enter surface water, or depending on the depth to the water table, to groundwater resources. For these reasons best management practices should be implemented on agricultural land with hydric soils.

Many of the soils in the MSJRW are considered to be HEL or PHEL as can be seen in Figure 2.3 on page 19. For this reason, it is important that special precautions be taken by those producers working HEL and PHEL land to limit the amount of soil erosion. As soil erodes, it can increase stream and lake sedimentation. The eroding soil particles often carry nutrients that bind to the particles and deposit in open water sources as well. This may cause an increase in phosphorus and nitrogen levels within the water system, leading to unsuitable water quality.

Since the majority of the land use in the MSJRW is agriculture, specifically row crops, sedimentation can have a major effect on water quality and biota. Tillage data collected by each county in the watershed indicates relatively low adoption of conservation tillage practices, especially in Williams and Defiance counties in OH. Conservation tillage requires a minimum of 30% residue cover on the land. This decreases the potential for soil erosion, decreases soil compaction, and can save the producer time and money by minimizing the number of passes made on each field while preparing for the next planting season. According to the US EPA, Region 5 Load Reduction Model, and assuming a clayey soil type, as it is the most prevalent soil type present throughout the watershed, the implementation of conservation tillage on one acre of land previously conventionally tilled can decrease runoff of sediment by 8 ton/yr, phosphorus by 10 ton/yr, and nitrogen by 18 ton/yr. When those reductions are multiplied by the 51,485 acres of land currently used for row crops in the MSJRW there is the potential for 411,880 ton/yr of sediment, 514,850 lbs/yr of phosphorus, and 926,730 lbs/yr of nitrogen to be prevented from running off the land and entering the water system.

Edgerton, OH and Butler, IN are the only population centers located within the MSJRW on a centralized sewer system. Therefore, the majority of the population uses an on-site waste disposal system. The USDA soil survey for Williams, Defiance, and DeKalb counties lists less than 1% of the soil in the project area as being suitable for on-site sewage treatment as can be seen in Figure 2.5 on page 23, and the county health department's state that nearly 50% of all septic systems in use in Williams, Defiance, and DeKalb counties are currently failing. These two facts may lead one to believe that bacteria contamination, and excessive nutrients found within the water system may be partly due to improperly sited septic systems and/or failing systems.

The entire population of the MSJRW acquires their drinking water from the MICHINDOH aquifer which lies under the entire St. Joseph River Watershed. Field tiles and improperly placed or faulty septic systems can seriously affect the integrity of the aquifer to be used for drinking water as the contaminated effluent may not be entirely filtered as it percolates through the soil. For this reason, special precautions must be taken to ensure that the watershed's populations drinking water source is not polluted.

As stated earlier, the majority of the land within the project area is used for agriculture and many of the wetlands that were once present have been drained for pasture land or row crops. However, wetlands play an important role in our ecosystem, not only as flood water traps and pollution sinks, but also as prime habitat for many of the species listed as endangered or threatened. For instance, the Indiana Bat, Copperbelly Water Snake, and Massasauga Rattlesnake all prefer the habitat provided by wetlands. Forest land, much of which has been cleared for agriculture, is also a vital habitat for endangered species, such as the Indiana Bat. Leaving some agricultural land fallow and letting that landscape return to forest or wetland will provide more vital habitat for those endangered and threatened species. The DeKalb County Unified Development Ordinance has provisions made for the preservation of key forest land and not disturbing significant natural resources.

Table 2.15, below, links those concerns that stakeholders from the public meetings had regarding the project area and water resources, to evidence found during the initial project area inventory. More evidence will be provided in subsequent sections at the 12 digit HUC level.

Table 2.15: Stakeholder Concerns and Evidence for Concern

Concerns	Evidence	Potential Problem
Animal Feeding Operation runoff	The 2009 Livestock Inventory estimated there to be 5,921 head of livestock present in the MSJRW including five CFOs. Two incidences of livestock with direct access to open water during the livestock inventory and one incidence during the windshield survey.	*E. coli* contamination, excess nutrients, sediment, impaired biotic communities
Combined Sewer Overflow	There is one CSO community; Butler, IN. While a LTCP has been developed, several CSO events occur each year.	*E. coli* contamination, excess nutrients, and sediment
Land conversion/Increase in impervious surfaces	There has been significant industrial growth surrounding Butler, IN. The City of Butler 2001 Comprehensive Plan encourages industrial growth. There is not a Comprehensive Plan for either OH county which encourages smart growth strategies.	Oil and grease, sediment, nutrients, increase in combined sewer overflows
Pesticides	60% of the watershed is in row crop production which often uses pesticides during the spring. The high percent of hydric soils in the MSJRW has the potential to increase polluted runoff due to the saturated soils and/or subsurface tile drains.	Fish kills, and impaired biotic communities
Unregulated animal operations	The 2009 Livestock Inventory counted 5,921 head of livestock in the MSJRW comprised mostly of smaller animal feeding operations.	*E. coli* contamination, excess nutrients, streambank erosion, sediment and impaired biotic communities
Lack of riparian buffers and wildlife corridors	The rapid watershed assessment of riparian buffers revealed that the MSJRW had more streambank buffers measuring less than 30 meters than any other 11 digit HUC in the St. Joseph River Watershed. The MSJRW has lost nearly 80% of its wetlands and forestland to agricultural uses. The Copperbelly Water Snake and Indiana bat, both of which rely on wooded areas for their habitat, are listed as endangered.	Bank erosion, sedimentation, wildlife habitat loss, impaired biotic community
Log Jams	The St. Joseph River is known to be a slow flowing river system which often contributes to the formation of log jams.	Bank erosion, sedimentation and flooding

Concerns	Evidence	Potential Problem
Industrial discharge and runoff	An increase in industrial facilities has been noted south of Butler, Indiana. There are five NPDES permitted facilities located in the MSJRW.	Oil and grease, sediment, nutrients, increase in combined sewer overflows, fish kills, impaired biotic community

3.0 Watershed Inventory by Subwatershed

3.1 Water Quality Data

An important aspect of the watershed planning process is to examine current water quality data as well as historic data to understand the issues present in the watershed. The historic data, some of which has been collected since as early as 1993, though only data collected since 2000 will be presented in this WMP, will provide a baseline in which to compare the data collected by the Initiative in 2011. The historical data of consequence was combined with the watershed assessment that was done as part of this project to characterize water quality problems and their sources and tie them to stakeholder concerns. The following sections will provide a detailed description of all water quality data that has been collected in the watershed to date.

3.1.1 Water Quality Parameters

After a report entitled *Weed Killers by the Glass*, published by the Environmental Working Group in 1995 stated that Fort Wayne's drinking water contained high levels of agricultural pesticides, the Initiative began its sampling program in the St. Joseph River watershed. As the program progressed more parameters were added to the Initiative's analysis of water quality. The parameters of interest for the MSJRW program include atrazine, alachlor, metolachlor, dissolved oxygen, temperature, *E. coli*, turbidity, total dissolved solids, phosphorus, nitrite + nitrate, stream flow, conductance, cloud cover, and air and water temperature. The Initiative also is interested in determining the Qualitative Habitat Evaluation Index (QHEI) and the macroinvertebrate Index of Biotic Integrity (mIBI). Provided below is a description of why each of those parameters are important to the quality of water.

Ammonia - Ammonia is common in the water system as it is released in the waste of living mammals. It is also released in to the water system via farmland runoff as ammonium hydroxide is used as a fertilizer for row crops. Ammonia is important to measure for two reasons: the free form of ammonia, NH_3, is toxic to fish and can lower reproduction and growth of aquatic organism, or even result in death, and the nitrification of ammonia removes dissolved oxygen from the water. Measuring the amount of ammonia in the water is also a good indicator for other pollutants that may be reaching the water as well. Due to the toxic nature of too much ammonia in the water, the state of Indiana has set a standard of between 0 and 0.21 mg/L, dependent on temperature.

Atrazine - Atrazine is one of the world's most used pesticides by row crop producers to control weeds. Atrazine is a highly soluble chemical that is not easily broken down in the water table. It has been shown that high levels of atrazine can cause some aquatic animals to become sterile, hermaphroditic, or even convert males to females. There is still debate in the scientific world as to whether or not atrazine can cause cancer in humans. But people who consume water containing high levels of atrazine over an extended period of time have been noted as presenting with cardio vascular problems. For these reasons the US EPA has set the Maximum Contaminant Level (MCL) for atrazine at 3ppb.

Alachlor - Alachlor is an herbicide used predominantly on corn, sorghum, and soybeans to control annual grasses and broadleaf weeds. Alachlor is used regularly by producers within the St. Joseph River watershed. It has been shown that people drinking water containing excessive amount of alachlor may present with eye, liver, kidney, or spleen problems. They may also experience anemia and an increased risk of getting cancer. For these reasons the US EPA has set the MCL for alachlor to be 2 ppb.

Metolachlor - Metolachlor is a pre-emergent grass weed herbicide that is effective on corn, soybeans, sorghum, peanuts, and cotton fields. While the product is very effective, its use is on the decline due to the deleterious effects it may have on organisms. Metolachlor has been shown to be a cytotoxin (toxic to cells) and a genotoxin (a toxic substance that damages DNA). The US EPA gave metolachlor a category C rating meaning that there is limited evidence showing it to be a carcinogen. However, the US EPA has given metolachlor a health advisory level of 52.5 ppb in drinking water. The Initiative uses the target of 50 ppb which is the Canadian drinking water standard for Metolachlor.

Dissolved Oxygen - Dissolved oxygen (DO) is the measure of oxygen in the water available for uptake by aquatic life. Typically, streams with a DO level greater than 8 mg/L are considered very healthy and streams with DO levels less than 2 mg/L are very unhealthy as there is not enough oxygen to supply to aquatic life. DO is affected by many factors including; temperature - the warmer the water the harder it is for oxygen to dissolve, flow –more oxygen can enter a stream where the water is moving faster and turning more, and aquatic plants – an influx of plant growth will use more oxygen than normal which does not leave enough available DO for other aquatic life, however photosynthesis will add oxygen to the water during the day. Thus, DO levels may change frequently when there is excessive aquatic plant growth. Excessive amounts of suspended or dissolved solids will decrease the amount of DO in the water. The state of Indiana has set a standard of at least an average of 5 mg/L per calendar day, but not less than 4 mg/L of DO for warm water streams. The US EPA recommends that DO not exceed 9 mg/L so as to avoid super-saturation of DO in the water system.

Temperature - As mentioned above, temperature can affect many aspects of the health of the water system. Water temperature is a controlling factor for aquatic organisms. If there are too many swings in water temperature, metabolic activities of aquatic organisms may slow, speed up, or even stop. Many things can affect water temperature including stream canopy, dams, and industrial discharges. The state of Indiana has set a standard for water temperature (which may be found in 327 IAC 2-1-6) depending on if the waterbody is a cold or warm water system.

Escherichia coli - *E. coli* is a bacteria found in all animal and human waste. *E. coli* testing is used as an indicator of fecal contamination in the water. While not all *E. coli* is harmful, there are certain strains that can cause serious illness in humans. *E. coli* may be present in the water system due to faulty septic systems, CSO overflows, wildlife; particularly geese, and from contaminated stormwater runoff from animal feeding operations. Due to the serious health risks from certain forms of *E. coli*, and other bacteria that may be present in water, the state of Indiana has developed the full body contact standard of less than 235 cfu/100 ml of *E. coli* in any one water sample and less than 125 cfu/100 ml for the geometric mean of five equally spaced samples over a 30 day period.

Total Kjeldahl Nitrogen - TKN is the sum of organic nitrogen, ammonia, and ammonium. High levels of TKN found in water is typically indicative of manure runoff from farmland or sludge discharging to the water from failing or inadequate septic systems. The level of TKN in the water is a good indicator of other pollutants that may be reaching the water. The US EPA recommends a target level not to exceed 0.076 mg/L.

Turbidity -Turbidity is the measure of the cloudiness of the water which may be caused by sediment or an overgrowth of aquatic plants or animals. High levels of turbidity can block out essential sunlight for submerged plants and animals and may raise water temperatures, which then can decreases DO. Sediment in the water causing it to be turbid can clog fish gills and smother nests when it settles, thus effecting the overall health of the aquatic biota. Turbid water may be caused from farm field erosion, feedlot or urban stormwater runoff, eroding stream banks, and excessive aquatic plant growth. The US EPA recommends that the turbidity in the water measure less than 10.4 NTUs.

pH - pH is the measure of a substances acidity or alkalinity and is an important factor in the health of a water system because if a stream is too acidic or basic it will affect the aquatic organisms' biological functions. A healthy stream typically has a pH between 6 and 9, depending on soil type and substances that come from dissolved bedrock. pH can also change the waters chemistry. For example, a higher pH means that a smaller amount of ammonia in the water may make it harmful to aquatic organisms and a lower pH may increase the amount of metal present in the water as it will not dissolve as easily. For these reasons, the state of Indiana has set a standard for pH of between 6 and 9.

Total Suspended Solids - Total suspended solids (TSS) is a measure of particulate matter in a water sample. TSS is measured by passing a water sample through a series of sieves of differing sizes, drying the particulate, and weighing the dried matter. The amount of Total Suspended Solids (TSS) in the water system will have the same type of deleterious effect on water quality as mentioned above under turbidity including, debilitating aquatic habitat and life, and carrying other pollutants to the water such as fertilizers and pathogens. The US EPA recommends a target of less than 25 mg/L of TSS to maintain a healthy aquatic ecosystem.

Total Dissolved Solids - Total dissolved solids are all dissolved organic or inorganic molecules that are found in the water. The difference between TDS and TSS is that TSS cannot pass through a sieve of 2 micrometers or smaller. So, the lower the TDS measurement in the water sample the purer the water is. TDS is a measurement of any pollutant in the water including salt, metal, and other minerals. The IN state code has a standard of <750 mg/L to maintain a healthy aquatic ecosystem.

Phosphorus - Phosphorus is an essential nutrient for aquatic plants however, too much phosphorus can create an over growth of plants which can lower the DO in a water system and decrease the amount of light that penetrates the surface thus killing other aquatic life that depends on these for survival. Some types of aquatic plants that thrive when phosphorus levels are high, such as blue-green algae, are toxic when consumed by humans and wildlife. Excessive amounts of phosphorus have also been found in ground water thus increasing the bacteria growth in underground water systems. Phosphorus can reach surface and ground water through contaminated runoff from row crop fields, and urban lawns where fertilizer has been applied, animal feeding operations, faulty septic tanks, and the disposal of cleaning supplies containing phosphorus in landfills or down the drain. The state of Indiana has set a target of 0.3 mg/L of total phosphorus in a water sample to list a waterbody as impaired on the state's impaired water list as required by the CWA § 303(d), often referred to as the 303(d) list. Though, the OEPA has set a standard of 0.08 mg/L in warm water headwater streams. The MSJRW steering committee is using the IDEM target as the OEPA uses biological criteria for the determination of impaired waters to list on the 303(d) list.

Nitrite - Nitrites are highly toxic to aquatic life and also toxic to humans, especially babies, if consumed in excessive amounts. Nitrites can cause shortness of breath and blue baby syndrome, which can lead to death in babies which is of great concern to those individuals who acquire their drinking water from wells. Nitrites are commonly found in the water system in trace amounts because nitrite is quickly oxidized to nitrate. However nitrites can be introduced in excessive amounts from sewage treatment plants if the oxidation process is interrupted, from farm field runoff, animal feeding lot runoff, and faulty septic systems. For the harmful health effects mentioned above, the state of Indiana adopted the US EPA MCL standard of less than 1 mg/L of nitrite in a water sample.

Nitrate - Nitrates can have the same effect on the water system as phosphorus, only to a much lesser degree. Nitrates can be found at levels up to 30mg/L in some waters before detrimental effects on aquatic life occur. However, due to the fact that infants who consume water with nitrate levels exceeding the US EPA MCL of 10 mg/L can become ill, nitrates in drinking water should be of particular concern to people who use wells as their drinking water source. The most common sources of nitrates are from fertilizer runoff from row crop fields, faulty septic systems, and sewage. The MSJRW steering committee and the Initiative has decided to use the US EPA reference level for nitrates in the water system, which is set at 1.6 mg/L.

Macroinvertebrate Index of Biotic Integrity - The Macroinvertebrate Index of Biotic Integrity (mIBI) is used as an indicator of water quality. Macroinvertebrates are collected from the water system and classified down to the genus level. The number and type of macroinverbrates found show the overall health of the water as some macroinvertebrates can only survive when little to no contaminants are present. The MSJRW steering committee and the Initiative set a target of the index ranking to be greater than 2.2 based on the IDEM method of collecting and ranking samples.

Qualitative Habitat Evaluation Index - The Qualitative Habitat Evaluation Index is another method used to determine the quality of a waterway. Various aspects of aquatic habitat are evaluated including in-stream habitat and the surrounding landuse, to determine the waterways ability to support aquatic life such as fish and macroinvertebrates. A score greater than 61 is considered to be a stream that fully supports aquatic life, and a score between 51 and 61 is considered a stream that partially supports aquatic life.

3.1.2 Water Quality Targets

When the above parameters are combined a greater picture of the overall quality of the waterway can be gleaned. For the purpose of interpreting inventory data and defining problems, target values were identified for water quality parameters of concern by the MSJRW steering committee (Table 3.1). It is important to note that the same parameters were not analyzed by each entity that collected water quality samples.

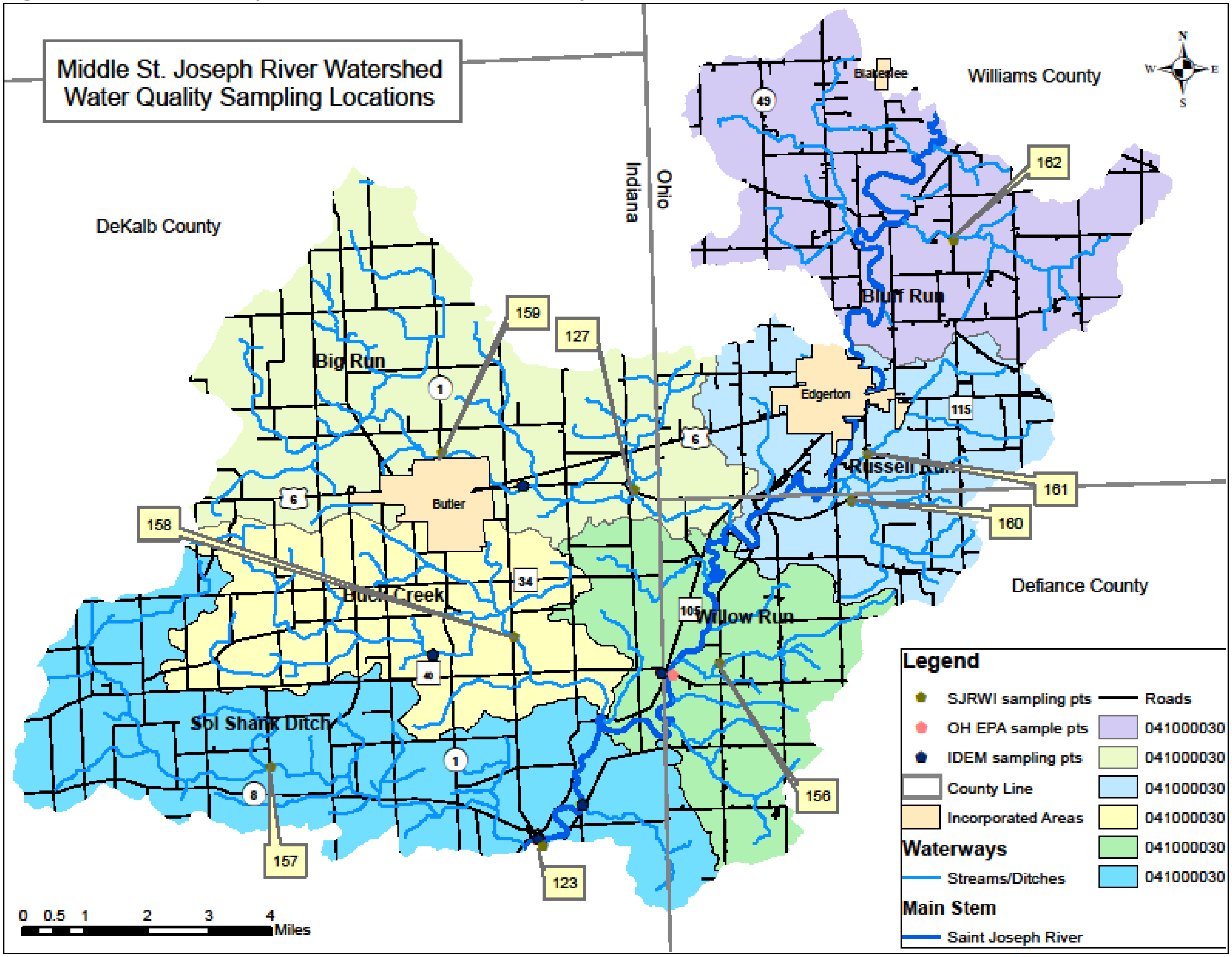
Table 3.1: Water Quality Targets

Parameter	Target	Source
Atrazine	< 3.0 ppb	US EPA drinking water MCL
Alachlor	< 2 ppb	US EPA drinking water MCL
Metolachlor	< 50 ppb	Canadian drinking water std
Dissolved Oxygen	> 5.0 mg/L but not <4 mg/L and not > 9 mg/L	327 IAC 2-1-6/US EPA recommendation
Temperature	4.44 – 29.44 degrees C	327 IAC 2-1-6
Escherichia Coli	< 235 CFU/100 ml	327 IAC 2-1.5-8
Turbidity	< 10.4 NTU	US EPA recommendation (2000)
pH	> 6 or < 9	327 IAC 2-1-6
Total Suspended Solids	< 25 mg/L	US EPA recommendation
Total Dissolved Solids	< 750 mg/L	327 IAC 2-1-6
Total Phosphorus	< 0.3 mg/L	IDEM 303d listing criteria
Nitrite	< 1 mg/L	327 IAC 2-1-6
Nitrate+nitrite	< 1.6 mg/L	US EPA reference level (2000)
Total Kjeldahl Nitrogen (TKN)	0.076 mg/L	US EPA recommendation (2000)
Total Ammonia	< 0.21 mg/L depending on temperature	327 IAC 2-1-6
Qualitative Habitat Evaluation index	> 51 pts	IDEM (2008)
Macroinvertebrate index of biotic Integrity	>2.2 points	IDEM (2008)
Orthophosphate	< 0.05 mg/L	North Carolina State University Recommendation

3.2 Historic Water Quality Sampling Efforts

A variety of water quality assessment projects have been completed within the MSJRW. These include the Indiana and Ohio Integrated Reports, the IDEM Watershed Assessment and Planning Branch studies, and the Initiative's sampling program. A summary of each study's methodology and general results are discussed below. Subsequent sections detail specific study information as it relates to each subwatershed. Figure 3.1 displays all the historic sampling locations in the project area. Note that the sample sites with numbers associated to them are sample locations of the Initiative's and the only sites that have assigned labels.

Figure 3.1: Historic Sample Sites in the Middle St. Joseph River Watershed



3.2.1 IDEM and OH EPA Integrated Reports

Each state is required to perform water quality analysis of its surface waters and report their findings to EPA in a report called the “Integrated Report” (IR) on a biannual basis, as mandated by the CWA§305(b). Prior to compiling the IR, a list of water bodies that do not meet state standards is developed as mandated by the Clean Water Act section 303(d). This has become commonly known as the 303(d) list. IDEM’s 2010 IR has not yet been approved for release by EPA. However, some of the streams located within the MSJRW are on the 2008 IDEM 303(d) list of impaired waters for *E. coli,* impaired biotic community, and PCBs in fish tissue. Ohio’s 2010 IR has been approved by the US EPA and shows that the entire portion of the MSJRW project area located within Ohio is impaired. A full list of those waters impaired, as designated by each State, can be found in Table 3.2 and Table 3.3 and a map of those listed waters can be seen in Figure 3.2.

Table 3.2: IDEM 303(d) Listed Waters

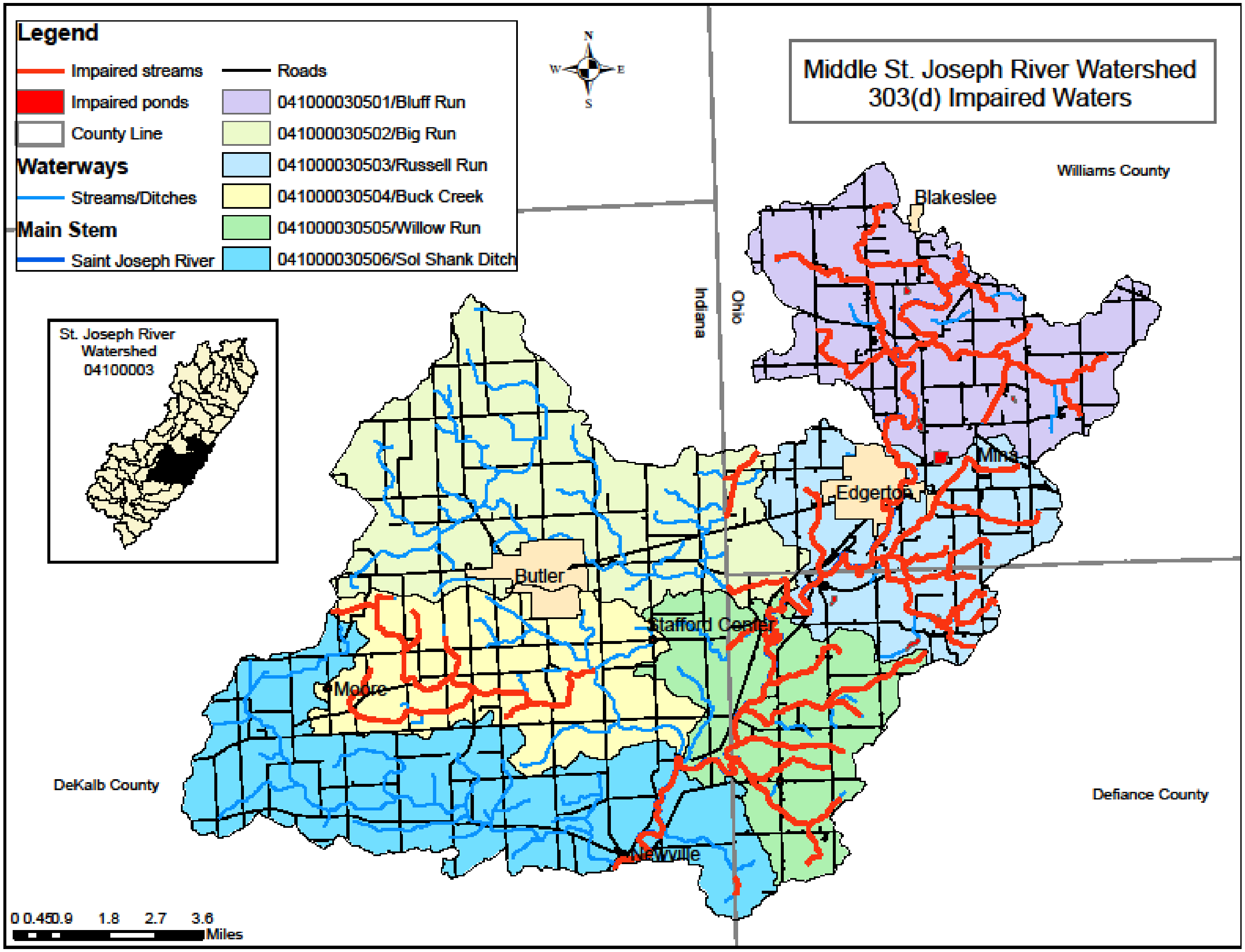
MAJOR BASIN	14-DIGIT HUC	COUNTY	Sub-watershed Name	ASSESSMENT UNIT NAME	CAUSE OF IMPAIRMENT	IRCAT
GREAT LAKES	4100003060050	DEKALB CO	Willow Run	ST. JOSEPH RIVER	PCBs in Fish Tissue	5B
GREAT LAKES	4100003060060	DEKALB CO	Buck Creek	METCALF DITCH AND TRIBS	IMPAIRED BIOTIC COMMUNITIES	5A
GREAT LAKES	4100003060070	DEKALB CO	Sol Shank Ditch	ST. JOSEPH RIVER	PCBs in Fish Tissue	5B

Table 3.3: OH EPA 303(d) Listed Waters

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recreation	Aquatic Life	Next Field Monitoring	Projected TMDL
41000030501	Bluff Run - St. Joseph River	23.7	5h	3	5hx	2012	2015
41000030502	Big Run	3	5h	3	5hx	2012	2015
41000030503	Russell Run - St. Joseph River	18	5h	3	5hx	2012	2015
41000030506	Sol Shank Ditch - St. Joseph River	1.2	5h	3	5hx	2012	2015
41000030505	Willow Run - St. Joseph River	12.4	5h	5	5hx	2012	2015

Category1		**Subcategory**	
0	No waters currently utilized for water supply		
1	Use attaining	h	Historical data
		x	Retained from 2008 IR
2	Not applicable in new (2010) Ohio system		
3	Use attainment unknown	h	Historical data
		i	Insufficient data
		x	Retained from 2008 IR
4	Impaired; TMDL not needed	A	TMDL complete
		B	Other required control measures will result in attainment of use
		C	Not a pollutant
		h	Historical data
		n	Natural causes and sources
		x	Retained from 2008 IR
5	Impaired; TMDL needed	M	Mercury
		h	Historical data
		x	Retained from 2008 IR

Figure 3.2: 303(d) Listed Waters



As part of the IDEM monitoring process, water samples are analyzed for numerous substances. Those relative to this WMP include: nitrogen as ammonia, inorganic nitrogen, TKN, pH, phosphorous, DO, TSS, turbidity, pesticides and *E. coli*. Data collected by IDEM since 2000 was analyzed and sorted for the purpose of this project.

Ohio EPA has not collected water quality data for the 303(d) list of impaired waters within the St. Joseph River Watershed since 1993. However, there was limited data available for a sample location on the St. Joseph River in Willow Run. The parameters analyzed that are relevant to this WMP include: nitrogen as ammonia, inorganic nitrogen, nitrite, orthophosphate, TKN, total phosphorus, and total suspended solids. OH EPA was scheduled to reassess the St. Joseph River watershed in 2012; however the data was not available for inclusion in this WMP.

3.2.2 Fish Consumption Advisory (FCA)

The Indiana Department of Environmental Management, the Indiana Department of Natural Resources and the Indiana Department of Health have worked together since 1972 on a collaborative effort to compile the Indiana Fish consumption advisory. The Ohio Department of Health, works in cooperation with Ohio EPA and the Ohio Department of Natural Resources to issue sport fish consumption advisories annually. It is important to note that a fish advisory on a body of water does not necessarily mean that the water is unsafe for other recreational activities.

All counties located within Indiana appear on the FCA for all carp, however there are no FCA for fish specifically found in the MSJRW. See: www.in.gov/isdh/files/2010_FCA.pdf for more information. The Ohio Fish Consumption Advisory for the MSJRW lists the St. Joseph River in Williams and Defiance counties for Channel Catfish due to mercury and PCBs found in fish tissue. See http://www.epa.ohio.gov/dsw/fishadvisory/sampledwaters.aspx, for more information.

3.2.3 St. Joseph River Watershed Initiative Monitoring Protocol

As mentioned previously, the Initiative began its monitoring protocol after a report was released stating that the city of Fort Wayne's drinking water source was contaminated with pesticides. Since nearly 300,000 people in Fort Wayne and New Haven, Indiana acquire their drinking water from the St. Joseph River, the Initiative began monitoring the St. Joseph River and its tributaries in 1996 at 24 sites weekly through the recreational season of April through October. Indiana University-Purdue University Fort Wayne is contracted to pull the samples and deliver them to various labs for analysis. Two of the Initiative's historic water quality monitoring sites are located in the MSJRW, Big Run and Sol Shank Ditch respectively.

The SJRWI also performed water quality analysis during this project at seven additional sites located within the MSJRW. The SJRWI contracted Indiana University-Purdue University, Fort Wayne (IPFW) to perform water quality analysis at nine (9) sites total in the MSJRW weekly from April through October of 2011. Parameters tested include atrazine, metolachlor, alachlor, *E. coli*, total coliform, total phosphorus, water temperature, pH, conductivity, TDS, D.O., turbidity, and nitrate+nitrites. Macroinvertebrate and habitat analysis was contracted to SNRT, Inc. Samples were collected once in October 2011 at six sites located within the MSJRW. Macroinverbrates collected during the sample cycle were identified down to the genus level.

3.3 Water Quality Data per Subwatershed

3.3.1 Big Run Subwatershed

IDEM collected water quality samples in the Big Run subwatershed several times in 2010 between the months of June and October. As can be seen in Table 3.4, *E. coli* exceeded the state standard of 235 cfu/100ml in 40% of the samples. The highest count of *E. coli* was from a sample taken in October, 2010 at 648 cfu/100ml. Turbidity exceeded the target of 10 NTU in 10% of the samples.

Table 3.4: Historic IDEM Water Quality Analysis in Big Run

Big Run (Lat. 41.42989047, Long. -84.84616096)			
Parameter	**Mean**	**Unit**	**# of Times Does Not Meet Target**
Coliforms (Total)	0	CFU/100ml	0/5
DO	5.629	mg/L	0/10
E. coli	220.56	CFU/100ml	2/5
Nitrogen, Ammonia	0	mg/L	0/3
pH	7.17	SU	0/10
Phosphorus, Total	0.21	mg/L	0/3
TSS	0	mg/L	0/3
Temperature	18.651	Celsius	0/10
TKN	0.33	mg/L	0/3
Turbidity	5.954	NTU	1/10

The Initiative has been sampling in the Big Run subwatershed since 1996, however only data collected since 2000 was analyzed for the MSJRW project. Table 3.5 shows the mean measurement of each parameter analyzed by the Initiative. As can be seen in the table below, both Alachlor and Atrazine exceeded US EPA MCL standards. Atrazine exceeded the MCL 11% of the time and Alachlor exceeded the MCL 5% of the time. This is likely due to the fact that Atrazine is more commonly used as a herbicide in the MSJRW. Dissolved oxygen fell below the standard of 4 mg/L in nine samples with the majority of those samples being collected in July and August. This may be due to an overgrowth of algae dying which attracts bacteria to the area to consume the detritus, thus much of the available oxygen being consumed as well. DO exceeded the target of 9 mg/L in 24 samples, which is evidence of oxygen oversaturation occurring within the water system, typically during the months of April, May, and October when the water temperature is low. Nitrates exceeded the target of 1.6 mg/L in 87% of the samples and phosphorus levels exceeded the target of 0.3 mg/L in 35%. Both nutrients can cause excessive plant growth which may have an effect on DO levels. The Initiative also found high turbidity in the stream as the measure of turbidity exceeded the target of 10.4 NTU in 80% of the samples and TDS exceeded the state standard of 750mg/L in 56% of the samples analyzed. *E. coli* exceeded the state standard of 235 cfu/100 ml 71% of the time and the *E. coli* cfu mean was over 2000. However, 21 of the samples measured greater than 10,000 cfu/100ml of *E. coli*. If those samples were eliminated, *E. coli* would still measure well above the state standard of 235 cfu/100ml at 1002 cfu/100ml.

Table 3.5: Historic Initiative Water Quality Analysis in Big Run

Big Run (Lat. 41.42694, Long. -84.8123)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.57612	ppb/L	19/384	5%
Atrazine	1.159243	ppb/L	33/304	11%
DO	8.004393	mg/L	273/280	98%
E. coli	2035.98	CFU/100ml	212/297	71%
Metolachlor	0.715845	ppb/L	0/296	0%
Nitrate	4.518	mg/L	71/82	87%
pH	7.88	SU	2/287	1%
Phosphorus, Total	0.1917	mg/L	30/86	35%
Specific Conductance	1.33127	umho/cm	N/A	N/A
TDS	833.515	mg/L	114/203	56%
Temperature	17.7215	celcius	0/282	0%
Turbidity	56.03808	NTU	227/282	80%

Water quality was analyzed at two sites in Big Run by the SJRWI weekly between April and October in 2011. As can be seen in the following table, at site 159, just north of the City of Butler, *E. coli* and turbidity both exceeded the target level in 53% of the samples. DO exceeded the target level in 30% of the samples, however the majority of those samples were taken when water temperatures were low, which can increase the amount of available oxygen within the water. Nitrate+nitrite levels exceeded the target level of 1.6mg/L in 40% of the samples. Also note that mIBI and QHEI scores for Big Run indicate a good aquatic ecosystem which is a bit perplexing since turbidity exceeded target levels in 53% of the samples analyzed.

Table 3.6: 2011-Initiative Water Quality Analysis in the Big Run Subwatershed Site 159

Big Run (Site 159)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.147	ppb/L	0/30	0%
Atrazine	0.25333	ppb/L	0/30	0%
Metolachlor	0.419667	ppb/L	0/30	0%
DO	8.317333	mg/L	9/30	30%
E. coli	639.333	CFU/100ml	16/30	53%
Total Coliform	6951.433	MPN		
Nitrate+Nitrite	2.148833	mg/L	12/30	40%
pH	8.010333	SU	0/30	0%
Phosphorus, Total	0.0848	mg/L	1/30	3%
TDS	399.51	mg/L	0/30	0%
Temperature	17.70667	celcius	0/30	0%
Turbidity	29.02	NTU	16/30	53%
Conductivity	0.624237	mhol		
mIBI	3.8	Score		
QHEI	79	Score		

Sample site 127, downstream of the City of Butler, was tested weekly from April through October in 2011 by the SJRWI. Results showed a high level of *E. coli* in the stream as *E. coli* exceeded state standards in 60% of the samples. Also of significant note, are that turbidity and TDS both exceeded target levels in 47% and 37% of the samples, respectively. Nitrate+nitrite levels exceeded the target level in 73% of all samples.

Table 3.7: 2011-Initiative Water Quality Analysis in the Big Run Subwatershed Site 127

Big Run (Site 127)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.061667	ppb/L	0/30	0%
Atrazine	0.147	ppb/L	0/30	0%
Metolachlor	0.276333	ppb/L	0/30	0%
DO	8.461667	mg/L	8/30	27%
E. coli	761.333	CFU/100ml	18/30	60%
Total Coliform	9391.7	MPN		
Nitrate+Nitrite	3.043448	mg/L	22/30	73%
pH	7.961	SU	0/30	0%
Phosphorus, Total	0.092733	mg/L	1/30	3%
TDS	625.3267	mg/L	11/30	37%
Temperature	18.304	celcius	0/30	0%
Turbidity	25.31667	NTU	14/30	47%
Conductivity	0.97711	mhol		
mIBI	4.4	Score		
QHEI	81	Score		

3.3.2 Buck Creek Subwatershed

IDEM collected water quality samples in Buck Creek subwatershed at various times between June and September, 2000. As can be seen in Table 3.8, TKN, nitrate+nitrite, and ammonia exceeded the targets in 100% of the samples. Turbidity also exceeded the target in 100% of the samples.

Table 3.8: Historic IDEM Water Quality Analysis in Buck Creek

Buck Creek (Lat. 41.391282 , Long. -84.87542)			
Parameter	**Mean**	**Unit**	**# of Times Does Not Meet Target**
DO	7.23	mg/L	0/3
Nitrogen, Ammonia	0.32	mg/L	2/2
Inorganic nitrogen	5.47	mg/L	3/3
pH	7.37	SU	0/3
Phosphorus, Total	0.22	mg/L	0/3
Temperature	16.55	celcius	0/3
TKN	2.5	mg/L	3/3
Turbidity	58.45	NTU	2/2

Water quality was analyzed at one site in Buck Creek by the Initiative weekly between April and October in 2011. As can be seen in the following table, *E. coli* exceeded the state standard of 235 cfu/100ml in 27% of the samples analyzed and turbidity exceeded the target level in 50% of the samples. DO exceeded the target level in 83% of the samples, this could be due to the heavy rains that occurred in the spring of 2011, thus increasing the flow of the stream which can promote more available oxygen to be present in the water. Nitrate+nitrite exceeded the target level in 30% of samples. Also note that mIBI and QHEI scores for Big Run indicate a good aquatic ecosystem which is a bit perplexing since turbidity exceeded target levels in 50% of the samples analyzed.

Table 3.9: 2011 – Initiative Water Quality Analysis in Buck Creek Subwatershed

Buck Creek (Site 158)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.077	ppb/L	0/30	0%
Atrazine	0.182	ppb/L	0/30	0%
Metolachlor	0.150333	ppb/L	0/30	0%
DO	10.08467	mg/L	25/30	83%
E. coli	334.6667	CFU/100ml	8/30	27%
Total Coliform	7352.067	MPN		
Nitrate+Nitrite	1.274833	mg/L	9/30	30%
pH	7.917	SU	0/30	0%
Phosphorus, Total	0.086933	mg/L	1/30	3%
TDS	411.073	mg/L	0/30	0%
Temperature	18.98633	celcius	0/30	0%
Turbidity	28.16667	NTU	15/30	50%
Conductivity	0.624237	mhol		
mIBI	4.2	Score		
QHEI	75	Score		

3.3.3 Sol Shank Ditch Subwatershed

IDEM has a fixed station in Sol Shank Ditch, located near Newville, IN. Data is collected monthly for DO, ammonia, inorganic nitrogen, total phosphorus, specific conductance, temperature, TKN, TSS, and turbidity. Grab samples were pulled for *E. coli* during the recreational season once in 1999 and again in 2005. As can be seen in Table 3.10, TKN exceeded the target, in 100% of the samples, nitrate+nitrite exceeded the target level in 35% of the samples, turbidity exceeded the target in 88% of the samples, TSS exceeded the target of 25 mg/L in 56% of the samples, and *E. coli* exceeded the state standard in the 1999 sample, though both samples were close to the standard. The mean measurement of DO was above the target of not greater than 9 mg/L indicating over saturation of oxygen supply in Sol Shank Ditch.

Though it should be noted that all samples exceeding the target of less than 9 mg/L occurred between the months of October and April. As described in section 3.1 low temperatures may increase the amount of dissolved oxygen found in the water column.

Table 3.10: Historic IDEM Water Quality Analysis in Sol Shank Ditch

Sol Shank Ditch (Lat. 41.3473, Long. -84.84388889)			
Parameter	**Mean**	**Unit**	**# of Times Does Not Meet Target**
DO	9.250394	mg/L	62/127
E. coli	245	CFU/100ml	1/2
Nitrogen, Ammonia	0.02	mg/L	3/125
pH	8.038	SU	0/127
Phosphorus, Total	0.121355	mg/L	4/127
Specific Conductance	573.4127	umho/cm	N/A
TSS	37.82	mg/L	65/117
Temperature	12.397	celcius	0/127
TKN	0.99	mg/L	127/127
Turbidity	58.35456	NTU	110/125
Inorganic Nitrogen	1.48	mg/L	45/127

The Initiative has been sampling in the Sol Shank Ditch subwatershed since 2001 which was analyzed for the MSJRW project. Table 3.11 shows the mean measurement of each parameter analyzed by the Initiative. As can be seen in the table below, Atrazine exceeded the US EPA MCL in 11% of the samples, nitrates exceeded the target of 1.6 mg/L in 20% of the samples, phosphorus exceeded the target of 0.3 mg/L in 8% of the samples, and turbidity exceeded the target of 10.4 NTU in 81% of the samples. *E. coli* exceeded the state standard of 235 cfu/100ml in 54% of the samples. In five of the E. coli samples more than 10,000 cfu were counted, with two of those being more than 20,000 cfu, and none of those high counts occurred in the same year. DO fell below the state standard of 4 mg/L on six occasions with four of those samples being taken in late July or early August. Ninety-one samples of DO exceeded the target level of less than 9 mg/L. High levels of DO were found scattered throughout the testing season of April through October.

Table 3.11: Historic Initiative Water Quality Data in Sol Shank Ditch

Sol Shank Ditch (Lat. 41.34601, Long. -84.8433)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.15685	ppb/L	0/273	0%
Atrazine	0.974212	ppb/L	31/273	11%
DO	8.395462	mg/L	237/249	95%
E. coli	862.923	CFU/100ml	145/271	54%
Metolachlor	0.400303	ppb/L	0/246	0%
Nitrate	1.269878	mg/L	16/82	20%
pH	7.9568	SU	3/257	1%
Phosphorus, Total	0.140233	mg/L	7/88	8%
Specific Conductance	0.749922	umho/cm	N/A	N/A
TDS	493.561	mg/L	1/205	0%
Temperature	16.9048	celcius	0/259	0%
Turbidity	38.52262	NTU	203/252	81%

Water quality was analyzed at two sites in Sol Shank Ditch by the Initiative weekly between April and October in 2011. As can be seen in the following Table 3.12 representing site 157 which is the most upstream sample site in Sol Shank Ditch, *E. coli* exceeded the state standard of 235 cfu/100ml in 40% of the samples analyzed and turbidity exceeded the target level in 75% of the samples. Nitrate+nitrite exceeded the target levels in 60% of the samples. DO exceeded the target level in 25% of the samples and was below the target level in 5% of the samples, and phosphorus exceeded the target level in 15% of the samples.

Table 3.13 represents the water quality analysis for site 123 which is on Sol Shank Ditch just before the confluence with the St. Joseph River. As can be seen in the table, *E. coli* and turbidity exceeded the target levels set for this project in at least 50% of the samples analyzed. The exceedances may be from leaky septic systems, unregulated livestock operation runoff, or wildlife waste. The high level of turbidity observed could also be from the industrial complex located within the Sol Shank Ditch subwatershed. Nitrate+nitrite exceeded the target level in 27% of the samples. Atrazine exceeded the MCL in two samples taken after spring application of the pesticide. TDS, TP, and DO also exceeded their respective targets in a few samples. All other parameters tested were within target levels.

Table 3.12: 2011 – Initiative Water Quality Analysis in Sol Shank Ditch (Site 157)

Sol Shank Ditch (Site 157)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.217	ppb/L	0/20	0%
Atrazine	0.6365	ppb/L	1/20	5%
Metolachlor	0.3125	ppb/L	0/20	0%
DO	8.2815	mg/L	1/20<4mg, 5/20>9mg	30%
E. coli	424	CFU/100ml	8/20	40%
Total Coliform	6722.15	MPN		
Nitrate+Nitrite	2.49025	mg/L	12/20	60%
pH	7.917	SU	0/30	0%
Phosphorus, Total	0.1413	mg/L	3/20	15%
TDS	365.02	mg/L	0/20	0%
Temperature	17.144	celcius	0/20	0%
Turbidity	40.6	NTU	15/20	75%
Conductivity	0.57035	mhol		

Table 3.13: 2011 – Initiative Water Quality Analysis in Sol Shank Ditch (Site 123)

Sol Shank Ditch (Site 123)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.185333	ppb/L	0/30	0%
Atrazine	0.619667	ppb/L	2/30	7%
Metolachlor	0.297	ppb/L	0/30	0%
DO	8.415	mg/L	5/30	17%
E. coli	487.333	CFU/100ml	18/30	60%
Total Coliform	8957.767	MPN		
Nitrate+Nitrite	1.181167	mg/L	8/30	27%
pH	7.99	SU	0/30	0%
Phosphorus, Total	0.091933	mg/L	1/30	3%
TDS	540.013	mg/L	3/30	10%
Temperature	17.45133	celcius	0/30	0%
Turbidity	31.26667	NTU	15/30	50%
Conductivity	0.843813333	mhol		
mIBI	4.9	Score		
QHEI	89	Score		

3.3.4 Willow Run Subwatershed

In 2000, IDEM collected water samples from Willow Run to measure the amount of pesticides present in the stream. Samples were taken once in March and April, and then weekly from May through July. As can be seen in Table 3.14, Atrazine exceeded the US EPA of 3 ppb in 31% of the samples; however neither Alachlor nor Metolachlor exceeded the MCL. Again, this is likely due to the fact the Atrazine is the predominant herbicide used by producers in the MSJRW. DO exceeded the target of 9 mg/L one time in March, 2000. Turbidity exceeded the target of 10.4 NTU in 100% of the samples.

Table 3.14: Historic IDEM Water Quality Data in Willow Run

Willow Run (Lat. 41.38555556, Long. -84.80444444)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.04	ppb/L	0/16	0%
Atrazine	2.79	ppb/L	6/16	38%
DO	7.56	mg/L	1/16	6%
Metolachlor	0.7375	ppb/L	0/16	0%
pH	7.783	SU	0/16	0%
Specific Conductance	522.375	umho/cm	N/A	N/A
Temperature	18.2375	celcius	0/16	0%
Turbidity	84.049	NTU	16/16	100%

The OH EPA collected and analyzed water quality samples in the St. Joseph River downstream of Newville in Willow Run subwatershed monthly between November 2005 and September 2007, and quarterly between March, 2008 and June, 2011. The means for those samples can be seen in Table 3.15. As can be seen in the table, TSS exceeded the target of 25 mg/L in 46% of the analyzed samples and total kjeldahl nitrogen exceeded the US EPA recommendation of 0.076 mg/L in 100% of the analyzed samples. Also, nitrate+nitrite exceeded the target level of 1.6 mg/L in 46% of the analyzed samples. Orthophosphate was measured by the OH EPA quarterly between March, 2010 and June, 2011. 33% of the samples analyzed were above the target suggested by North Carolina State University of 0.05 mg/L.

Table 3.15: Historic OH EPA Water Quality Data in Willow Run

Willow Run (St. Joseph River upstream of Newville at SR 249)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Nitrate-Nitrite	1.7831	mg/L	16/35	0%
Nitrite	0.0409	mg/L	0/35	0%
Nitrogen, Ammonia	0.1076	mg/L	1/35	3%
Orthophosphate	0.0536	mg/L	2/6	100%
Phosphorus, Total	0.1153	mg/L	2/35	6%
TSS	27.6765	mg/L	16/35	46%
TKN	0.7194	mg/L	35/35	100%

Water quality was analyzed at one site in Willow Run subwatershed by the Initiative weekly between April and October in 2011. As can be seen in the following Table 3.16, *E. coli* exceeded the state standard of 235 cfu/100ml in 59% of the samples analyzed and turbidity exceeded the target level in 94% of the samples. Nitrate+nitrite levels exceeded the target in 65% of the samples. DO exceeded the target level in 53% of the samples, and phosphorus exceeded the target level in 18% of the samples. It is assumed that the exceedances observed during the sampling cycle in 2011 were likely due to the fact that the stream was very shallow, and dry for nearly half of the sampling cycle. Therefore, there was a higher concentration of pollutants observed in the stream than in some of the higher order streams. This will be evident when flow is determined in subsequent sections.

Table 3.16: 2011 – Initiative Water Quality Analysis in the Willow Run Subwatershed

Willow Run (Site 156)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.295294	ppb/L	0/17	0%
Atrazine	2.210588	ppb/L	3/17	18%
Metolachlor	0.876471	ppb/L	0/17	0%
DO	9.123529	mg/L	9/17	53%
E. coli	881.1765	CFU/100ml	10/17	59%
Total Coliform	10996.65	MPN		
Nitrate+Nitrite	4.124706	mg/L	11/17	65%
pH	7.954706	SU	0/17	0%
Phosphorus, Total	0.176588	mg/L	3/17	18%
TDS	359.265	mg/L	0/17	0%
Temperature	18.01294	celcius	2/17	12%
Turbidity	95.22941	NTU	16/17	94%
Conductivity	0.561347	mhol		

3.3.5 Russell Run Subwatershed

There is no available historic water quality data for Russell Run subwatershed. However, water quality was analyzed at two sites in Russell Run subwatershed by the Initiative weekly between April and October in 2011. As can be seen in the following Table 3.17, which represent site 160 which accounts for pollutants entering surface water from the southeastern portion of the subwatershed, *E. coli* exceeded the state standard of 235 cfu/100ml in 44% of the samples, nitrate+nitrite exceeded the target level in 48% of the samples, and turbidity exceeded the target level in 96% of the samples analyzed. DO exceeded the target level in 48% of the samples, and phosphorus exceeded the target level in 26% of the samples. Atrazine exceeded the MCL in 15% of the samples, all after the typical spring application of atrazine. Scores for the mIBI indicate a fair to good aquatic ecosystem, where the QHEI score indicates a fair aquatic habitat.

As can be seen in Table 3.18, representative of site 161 which accounts for the pollutants entering the water system from the northeastern portion of the subwatershed, *E. coli* exceeded the state standard in 52% of the samples analyzed, turbidity exceeded the target level set by this project in 87% of the samples, phosphorus exceeded the target level in 26% of the samples, nitrate+nitrite exceeded the target level in 61% of the samples analyzed. DO exceeded the target level in 70% of the samples analyzed and water temperature exceeded the maximum temperature standard set by the state in 26% of the samples. Atrazine exceeded the MCL in 9% of the samples analyzed. Both samples that exceeded the MCL for atrazine were taken in the spring after the typical application of atrazine. Biological data was not collected at this site.

It is assumed that the exceedances observed during the sampling cycle in 2011 were likely due to the fact that the stream was very shallow with very low flow. Therefore, there was a higher concentration of pollutants observed in the stream than in some of the higher order streams. This will be evident when flow is determined in subsequent sections.

Table 3.17: 2011 – Initiative Water Quality Analysis in Russell Run (Site 160)

Russell Run (Site 160)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.235185	ppb/L	0/27	0%
Atrazine	1.39963	ppb/L	4/27	15%
Metolachlor	0.663704	ppb/L	0/27	0%
DO	9.171852	mg/L	13/27	48%
E. coli	1839.704	CFU/100ml	12/27	44%
Total Coliform	8531.593	MPN		
Nitrate+Nitrite	1.181167	mg/L	13/27	48%
pH	8.011852	SU	0/27	0%
Phosphorus, Total	0.209259	mg/L	7/27	26%
TDS	407.433	mg/L	0/27	0%
Temperature	20.19222	celcius	7/27	26%
Turbidity	55.60741	NTU	26/27	96%
Conductivity	0.636611	mhol		
mIBI	3.1	Score		
QHEI	57	Score		

Table 3.18: 2011 – Initiative Water Quality Analysis in the Russell Run (Site 161)

Russell Run (Site 161)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.242174	ppb/L	0/23	0%
Atrazine	0.839565	ppb/L	2/23	9%
Metolachlor	0.305217	ppb/L	0/23	0%
DO	11.82739	mg/L	16/23	70%
E. coli	1704.391	CFU/100ml	12/23	52%
Total Coliform	8956.217	MPN		
Nitrate+Nitrite	2.912609	mg/L	14/23	61%
pH	8.335652	SU	1/23	4%
Phosphorus, Total	0.142783	mg/L	1/23	4%
TDS	386.996	mg/L	0/23	0%
Temperature	19.23	celcius	6/23	26%
Turbidity	66.32174	NTU	20/23	87%
Conductivity	0.604661	mhol		

3.3.6 Bluff Run Subwatershed

There is no available historic water quality data for Bluff Run subwatershed. However, water quality was analyzed at one site in Bluff Run subwatershed by the Initiative weekly between April and October in 2011. As can be seen in the following Table 3.19, *E. coli* exceeded the state standard of 235 cfu/100ml in 54% of the analyzed samples, phosphorus exceeded the target set by this project in 11% of the samples, nitrate+nitrite exceeded the target level in 39% of the samples, and turbidity exceeded the target in 89% of the samples analyzed. The high turbidity level may account for temperature exceeding the maximum standard in 29% of the samples analyzed and DO exceeding the target in 18% of the samples analyzed. Atrazine exceeded the MCL in 20% of the samples analyzed. It should also be noted that the aquatic habitat for the sample site located in Bluff Run scored below the target score of 51 and the macroinvertebrate measure was just above the target score of 2.2 at 2.3. This may be due to the high level of turbidity as turbidity is an indicator of the amount of sediment present in the water which can bury key habitat for aquatic life.

Table 3.19: 2011- - Initiative Water Quality Analysis in the Bluff Run Subwatershed

Bluff Run (Site 162)				
Parameter	**Mean**	**Unit**	**# Exceedance**	**% Exceedance**
Alachlor	0.432143	ppb/L	0/28	0%
Atrazine	2.433929	ppb/L	8/28	29%
Metolachlor	2.003929	ppb/L	0/28	0%
DO	8.431429	mg/L	5/28	18%
E. coli	1808.964	CFU/100ml	15/28	54%
Total Coliform	8066.741	MPN		
Nitrate+Nitrite	2.099107	mg/L	11/28	39%
pH	7.818571	SU	0/28	0%
Phosphorus, Total	0.164964	mg/L	3/28	11%
TDS	393.043	mg/L	0/28	0%
Temperature	20.36179	celcius	8/28	29%
Turbidity	45.01429	NTU	25/28	89%
Conductivity	0.614143	mhol		
mIBI	2.3	Score		
QHEI	50	Score		

3.3.7: Summary of Water Quality Data

As can be gleaned from the sections above and Table 3.20 below, the major water quality problems observed throughout the watershed are nitrogen, *E. coli* and turbidity. All three of these pollutants can discharge from faulty septic systems, barnyard or animal feeding operation runoff, or improper application of manure on crop land. However, high nitrogen and turbidity levels can also come directly from row crop fields either through surface runoff or tiled discharge. High nitrogen and turbidity levels may also be the cause of inadequate dissolved oxygen levels found throughout the project area. Atrazine also exceeded EPA recommended MCLs after spring application, however atrazine is a minimal problem in comparison to *E. coli*, nitrogen, and turbidity. Though, it should be noted that many best management practices that should be implemented to minimize the impact on water quality from nitrogen and turbidity will also minimize the impact from herbicides and pesticides. Also of particular note is the low habitat score in Bluff Run subwatershed. Sources of pollutants will be easier to identify after combining the water quality analysis results with land use data.

Table 3.20 shows the average of all water quality data collected since 2000. Those values that are highlighted exceed the target levels set by this project for that parameter.

Table 3.20: Summary of All Water Quality Data Collected in the Project Area

Parameter	Big Run	Buck Creek	Sol Shank Ditch	Willow Run	Russell Run	Bluff Run
Alachlor (ppb)	0.26	0.08	0.19	0.21	0.24	0.43
Atrazine (ppb)	0.52	0.18	0.74	2.60	1.12	2.43
Metolachlor (ppb)	0.47	0.15	0.34	0.81	0.48	2.00
DO (mg/L)	7.86	8.66	8.51	8.34	10.50	8.43
***E. coli*(cfu)**	842.98	334.67	488.43	881.18	1772.05	1808.96
Total Coliform	8171.57	7352.07	7839.96	10996.65	8743.91	8066.74
Nitrogen, Ammonia (mg/L)	0.00	0.32	0.02	0.11		
Nitrate	4.52		1.27			
Nitrate + Nitrite (mg/L)	3.16	3.37	1.70	2.95	2.05	2.10
Nitrite				0.04		
TKN (mg/L)	0.33	2.50	0.99	0.72		
pH (SU)	7.83	7.64	7.97	7.87	8.17	7.82
Orthophosphate (mg/L)				0.05		
Phosphorus, Total	0.13	0.15	0.12	0.15	0.18	0.16
TDS (mg/L)	619.45	411.07	466.20	359.27	397.21	393.04
TSS (mg/L)	0.00		37.82	27.68		
Temperature ©	18.07	17.77	15.66	18.01	19.71	20.36
Turbidity (NTU)	28.44	43.31	40.10	89.64	60.96	45.01
Conductivity		0.62	0.57	0.56	0.62	0.61
QHEI	80	75	89		57	50
IBI (fish)	33		36			
mIBI	4.1	4.2	4.9		3.1	2.3

3.4 Land Use per Subwatershed

This section will provide information that was obtained through windshield and desktop surveys of each subwatershed, as well as information that has been gathered via government agencies (i.e. IDEM and OH EPA) and historic data found through research at the subwatershed level. However it is important to note that there are particular trends that have been found watershed wide as described below.

The predominate land use in the project area is agriculture, as can be seen in Table 2.6, and Figure 2.11 in Section 2.5, encompassing nearly 61% of the total land use in the project area. Landowners using modern farming practices are scattered throughout the project area. The stream bank buffer inventory conducted as part of this project in 2011 revealed that 64% of the parcels within the MSJRW have a riparian buffer less than 60 feet, with 43% of those parcels have a stream buffer equal to 0 – 10 feet in total width. The windshield survey conducted as part of this project revealed that erosion is a major issue contributing to NPS in surface waters, and reports from local health departments, as mentioned in Section 2, revealed that leaky septic systems may be a significant contributor to surface water pollution and the potential for groundwater pollution. In most cases, erosion control, buffering ditch banks, septic system education, and livestock management are the major BMP requirements in the MSJRW.

Although there are few urban areas in the project area, it has been found that urban stakeholders do influence the water system in the project area but to a lesser degree overall when compared to the agricultural community. Education and outreach activities regarding septic tanks and stormwater management will be the most effective way of managing urban NPS in the MSJRW. The utilization of small scale urban BMPs such as rain barrels and rain gardens will help with stormwater management in urban settings and provide a great resource for educational outreach. However, the quickest and most dramatic results in reducing nonpoint source pollutants in the MSJRW lie in utilizing BMP installation within the agricultural community.

3.4.1 Big Run Subwatershed Land Use

The primary influence on water quality in the Big Run subwatershed is agriculture, as can be seen in Table 3.21 and Figure 3.3 below. According to Purdue University's L-THIA program 53% of the land use in Big Run is agriculture, with another 13% in grass or pasture. The northern half of the town of Butler is located in Big Run, however, developed areas only comprise less than 9% of the total land use in Big Run.

Table 3.21: Land Use in Big Run Subwatershed

Water	Commercial	Row Crops	High Density Res.	Low Density Res.	Grass/ Pasture	Forest	Industry	Other	Total
215.8	71.7	10,403.4	462.1	607.5	2622.8	1600.2	61.7	3263.8	19,309
1%	<1%	53 %	2%	3%	13%	8%	3%	17%	100%

During the windshield survey 15 sites of particular concern were noted as can be seen in Figure 3.4. The 15 sites are categorized in Table 3.22 as to what type of NPS problem was observed.

Table 3.22: Windshield Survey Observations in Big Run Subwatershed

Observation	Soil Erosion	Stream Bank Erosion	Possible Livestock Issue	Remediation Site	Inadequate Riparian Buffer
Site #	4	4, 5, 13	8, 9, 14	1, 15	2, 3, 4, 6, 7, 10, 11, 12, 13

Many of the sites were observed having erosion issues either from the crop fields or from the stream banks which were lacking a vegetative buffer, both of which can be expected with a large portion of the watershed having either highly or potentially highly erodible land and the heavy rains that took place during the months of April through June in 2011. However, five locations were noted that were not the typical row crop erosion issues seen throughout the project area. Site one (labeled on the map in Figure 3.4) is an old scrap yard, site eight is Irish Acres Dairy, a large CAFO, site nine is a cattle AFO where a manure storage facility could not be identified during the windshield survey, site 14 is a cattle AFO with an open manure pile in the barnyard, and site 15 is an illegal dump site for unwanted household goods including furniture, toilets, broken glass, and other waste. All the sites noted pose an NPS pollution threat to surface and/or ground water resources. It should be noted that the Ohio portion of Big Run had a lot of land set aside in the Conservation Reserve Program (CRP).

As can be seen in Table 3.23 and Figure 3.5, 54% of the ditches and streams located within Big Run subwatershed have less than a 10 foot vegetative buffer present. That means that many landowners are planting crops directly up to the streambank, or just wide enough to get a piece of equipment along the edge of the crop field. The lack of riparian buffer may increase the amount of sediment and other contaminants reaching open water.

Table 3.23: Stream Buffers in Big Run Subwatershed

Big Run Subwatershed Stream Buffer Width			
	Buffer Width (ft)	**# of Parcels**	**% of Parcels**
	0-10	192	54%
	11-20	24	7%
	21-60	51	14%
	61-140	34	10%
	141-300	41	11%
	Urban	14	4%
	Residential	0	0%
	Tiled	1	0%
	TOTAL	357	100%

Figure 3.3: Land Use in Big Run Subwatershed

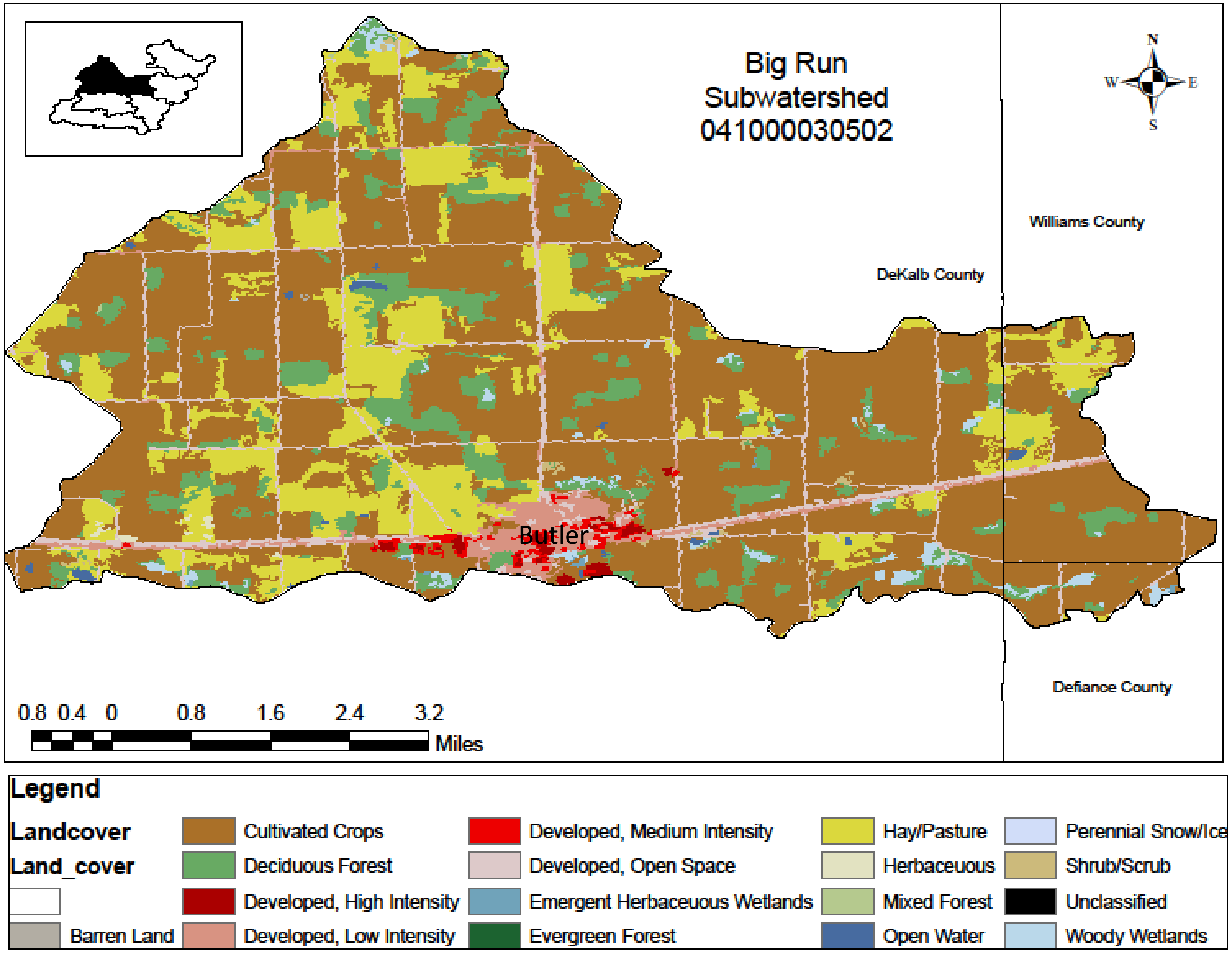


Figure 3.4: HEL, PHEL, and Windshield Survey Sites in Big Run Subwatershed

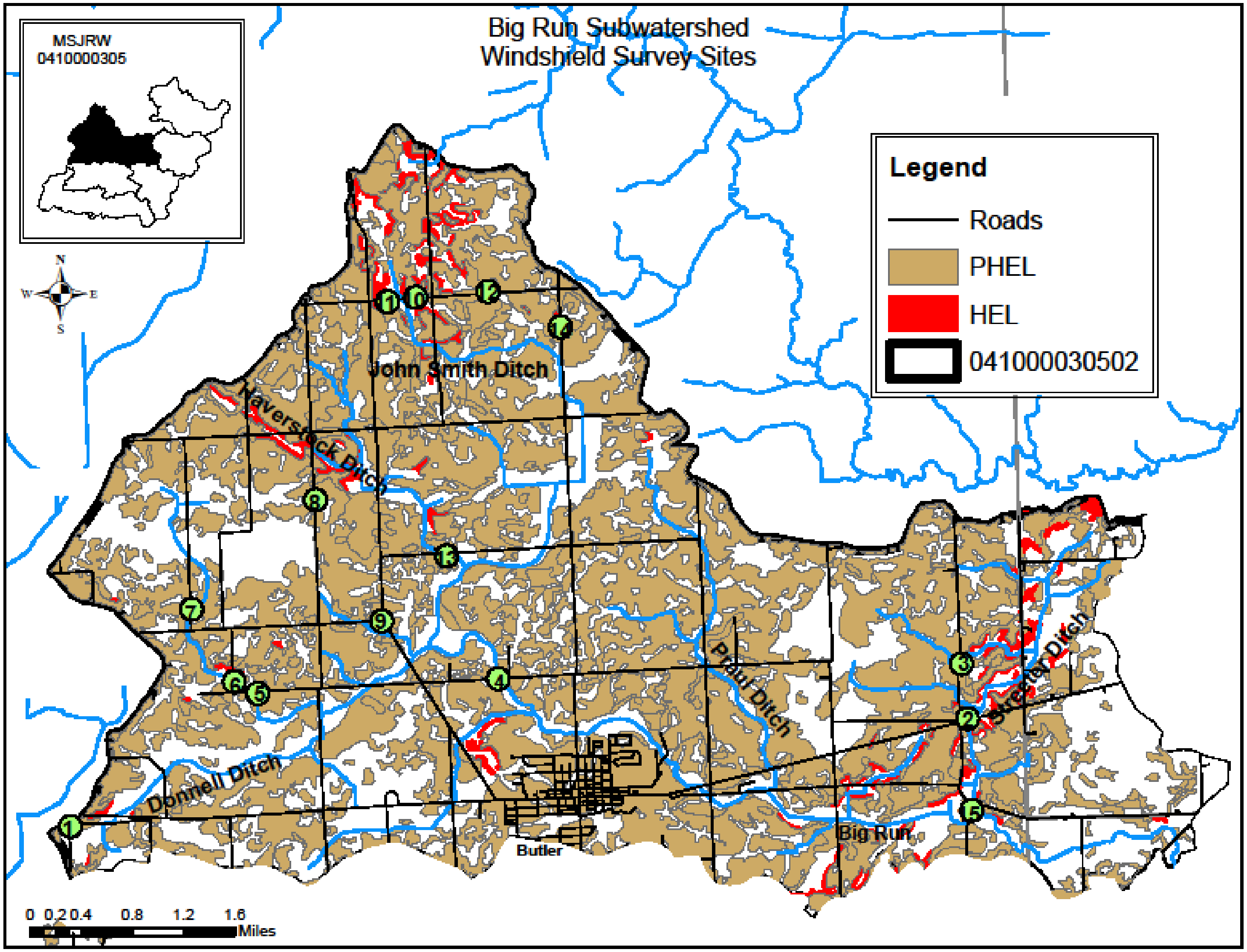
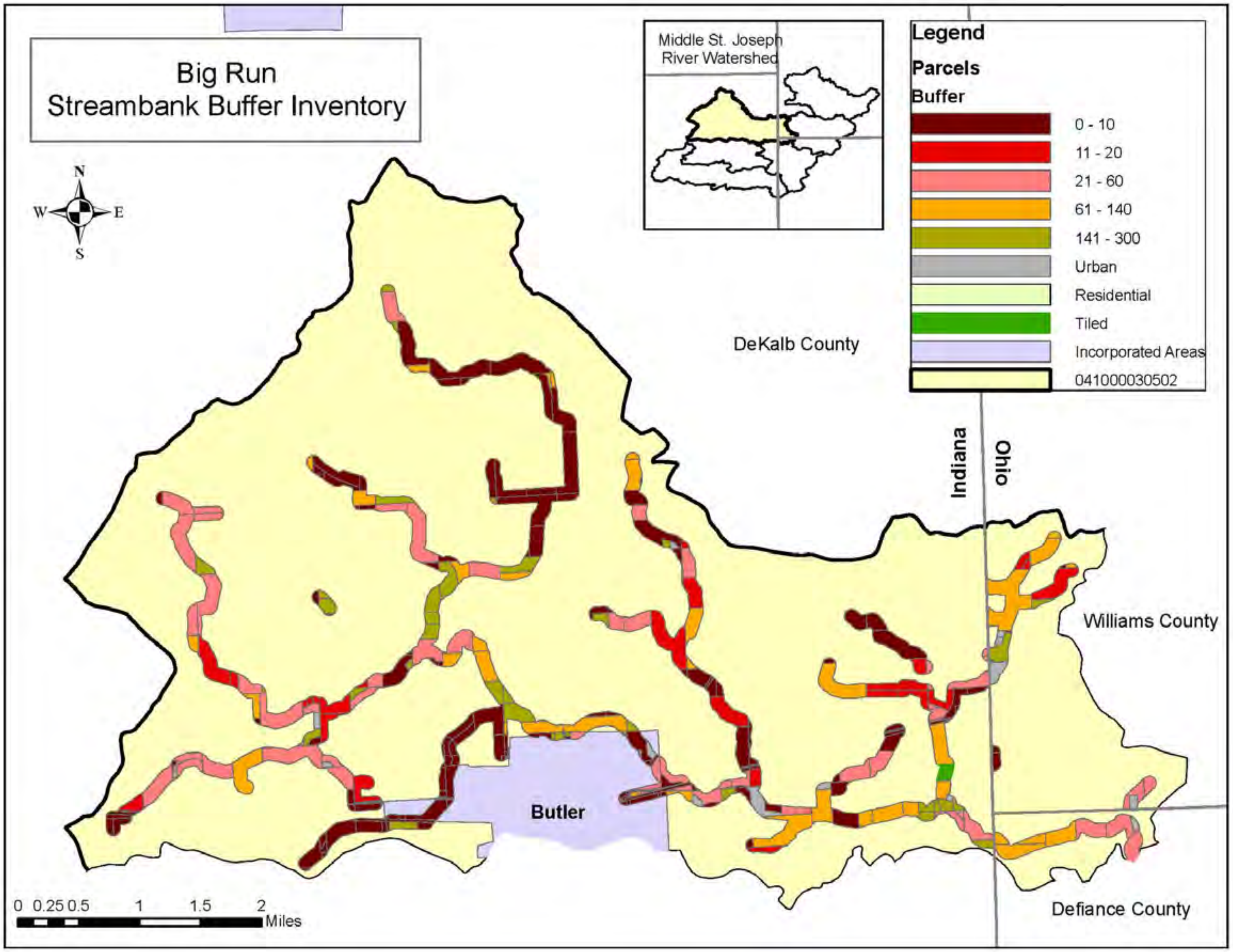


Figure 3.5: Big Run Stream Buffer Width



The livestock inventory conducted in 2009 indicated that there were several hobby farms in the Big Run subwatershed including 17 horse farms, one elk farm, and one goat farm. The inventory also indicated that there were six beef cattle farms, two dairies, and one pheasant farm, all of which were small enough not to require a NPDES CFO permit. The windshield survey conducted in 2011 revealed one beef cattle farm that was not identified during the livestock inventory (site 14) and there is one large CAFO in Big Run; Irish Acres Dairy. The location of each of these farms is identified in Figure 3.6.

Butler, IN is the only area within the MSJRW that has a combined sewer outfall. Butler's waste water treatment plant (WWTP) not only services the 2700 residents that live within or around Butler, but also services the waste from an industrial park located five miles south of Butler. The industrial park contributes approximately 0.50 MGD of wastewater to be processed by the Butler WWTP. During rain events the one CSO that Butler has is opened and untreated waste and stormwater is discharged into Big Run, approximately ¼ mile east of the city limit. According to the NPDES permit, the CSO discharges untreated waste approximately 12 times yearly. The Butler WWTP has two additional discharge points for treated wastewater and stormwater sewage. Both outfalls discharge into Big Run on the northeast edge of Butler. The location of the CSO is identified in Figure 3.7. The Butler WWTP has been in violation of its NPDES permit for the past 12 quarters, as reported to the EPA and can be found at http://www.epa-echo.gov. Non-compliance issues were due to heavy metals and excessive sludge.

East High School, located in Butler, is an NPDES permitted facility located within Big Run subwatershed, along with the CAFO, Irish Acres. East High School discharges into a storm sewer that outlets directly in the Big Run subwatershed. NPDES permitted facilities are required to monitor the effluent that is discharged into Big Run and report all discharges to the IDEM on a quarterly basis. There have not been any significant violations reported to date. However, it is important for water quality monitoring to take place downstream of the outfall so as to monitor the effect East High School has on the river system.

There are several remediation sites in Big Run including USTs, LUSTs, and gas and/or oil wells. Also, site 1 from the 2011 windshield survey, an abandoned scrap yard, is located on the western edge of Big Run and site 15, an illegal dumping site, is located in the southeast portion of the watershed. Most of the sites however, center around the city of Butler. These sites pose a threat to both ground and surface water. If the contents held in any of the facilities leak it can leach through the soil and reach groundwater, the primary drinking water source for residents of Big Run, or flow to surface water and decrease water quality and effect aquatic life. Two of the three LUSTs located in Big Run are still active and are leaking their contents into the soil and pose a significant risk to ground and/or surface water. The LUSTs located in Big Run are listed in Table 3.24. Table 3.25 lists the potential threats in Big Run. Figure 3.24 shows the location of each of the threats.

Table 3.24: Leaking Underground Storage Tanks in Big Run Subwatershed

UST FACILITY ID	NAME	STREET ADDRESS	CITY	STATE CODE	PRIORITY	AFFECTED AREA	Status
75	Sebert Oil Co. Inc. Office	501 S Broadway St	Butler	IN	Medium	Wellhead Protection, Soil, MTBE, Groundwater	Active
15492	Ramseys Express II	144 W Main St	Butler	IN	Low	Wellhead Protection, Soil	Discontinued (active)
16154	Sebert Oil Bulk Plant	E Willow St	Butler	IN	Medium	Wellhead Protection, Soil, Groundwater	Active

Table 3.25: Potential Water Quality Threats in Big Run Subwatershed

Type of Threat	Potential Contaminant	Number in Watershed
Underground Storage Tank	Oil/Gas	14
Leaky Underground Storage Tank	Oil/Gas	3
Gas/Oil Well	Oil/Gas	2
Abandoned Scrap Yard	Oil/Gas, Heavy Metals, Antifreeze	1
Illegal Dump Site	Household Waste	1

Figure 3.6: Big Run Livestock Inventory

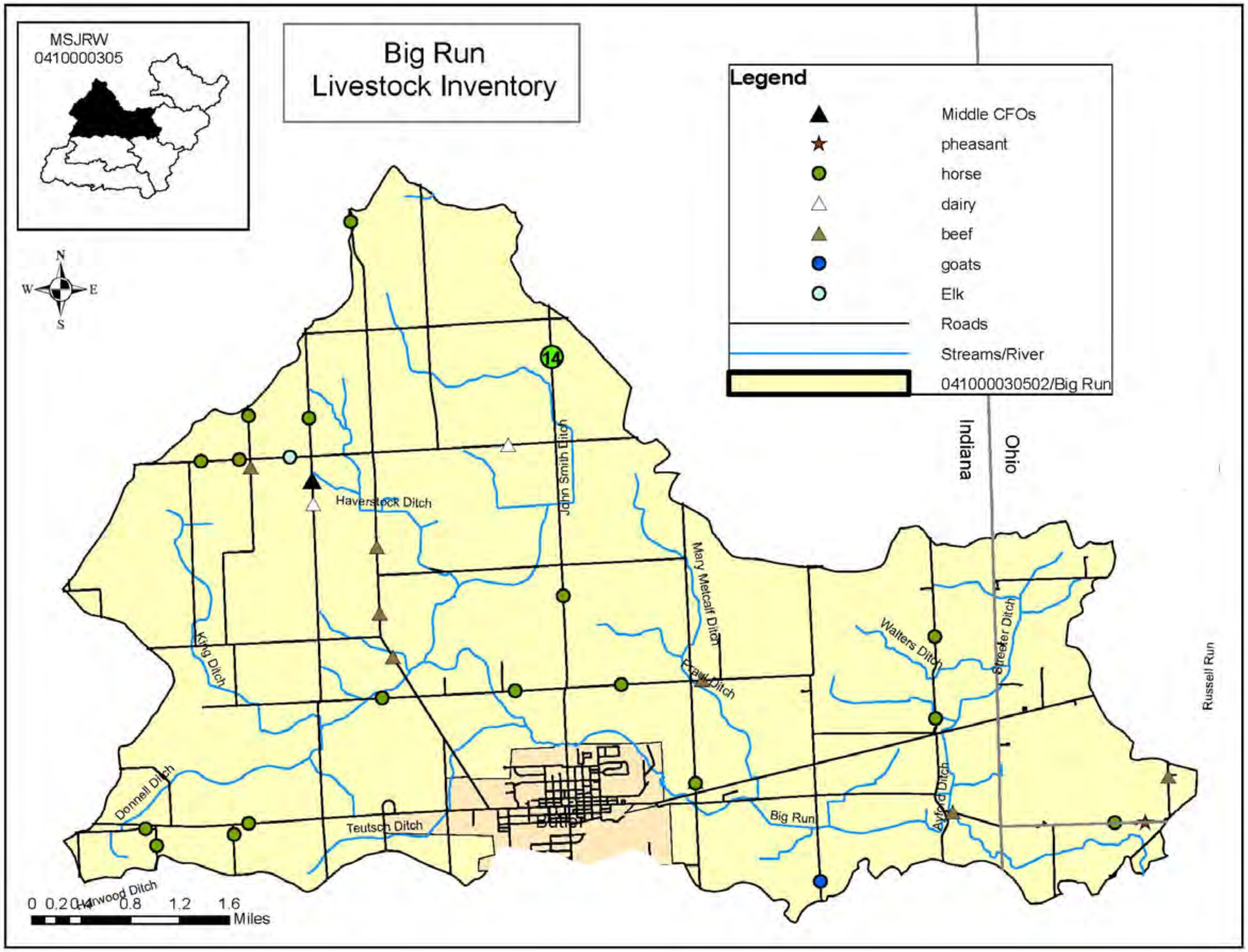
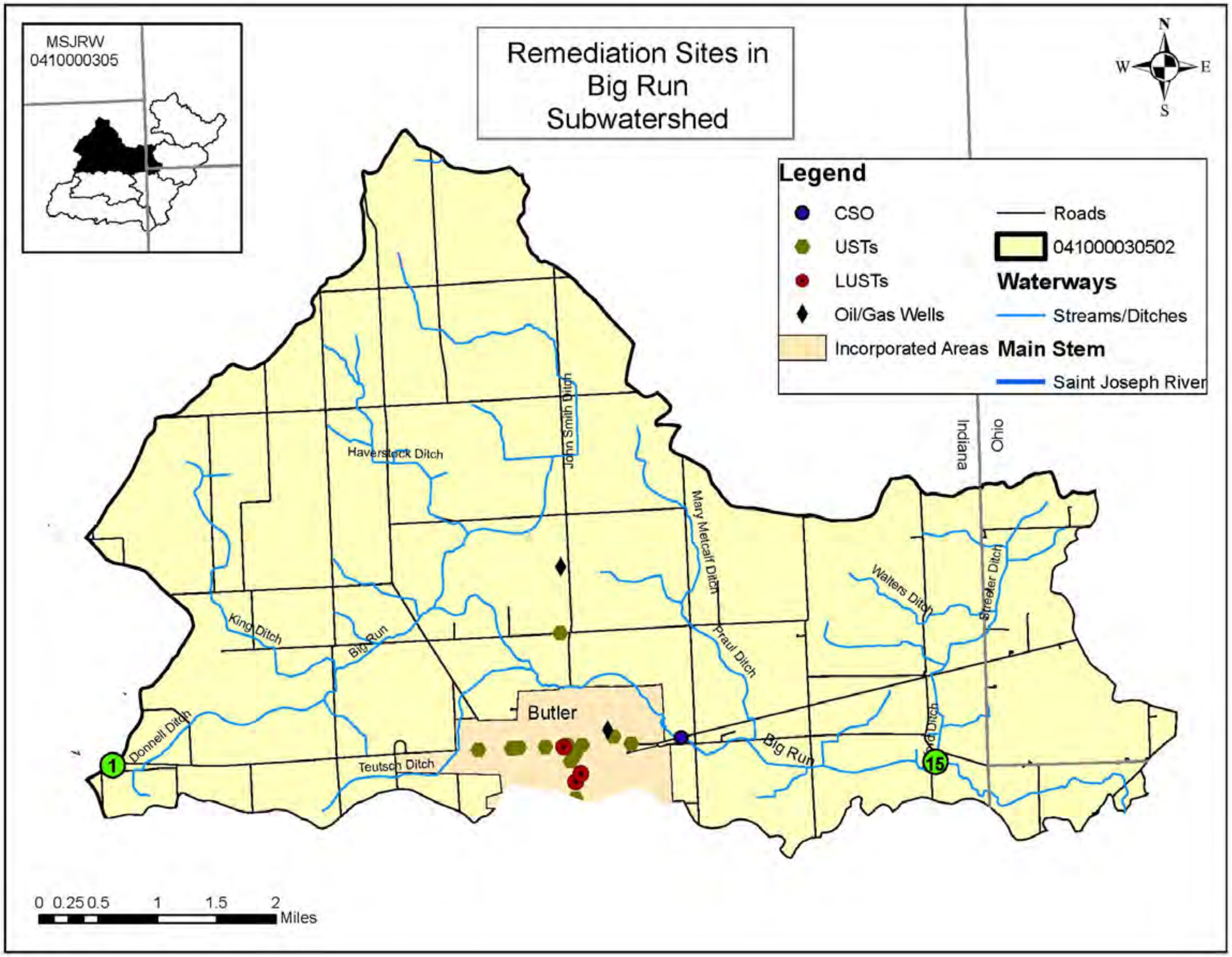


Figure 3.7: Big Run Remediation Sites



Water quality data collected in the Big Run subwatershed indicated there is a problem with *E. coli*, nutrients and turbidity in the watershed. After examining the land use within the Big Run subwatershed it was determined that pollution problems may be partly due to the CSO located downstream from Butler. The CSO discharges into Big Run and may contain such contaminates as *E. coli* bacteria, high levels of nitrogen and phosphorus, and other particulates leading to an increase in overall turbidity of Big Run. Other potential sources leading to the pollution problems in Big Run include the many unregulated livestock operations located in the subwatershed, and the fact that 53% of the watershed is in row crops and 75% of the parcels located adjacent to an open stream have a riparian buffer that is less than 60 feet. This can be further verified by the number of areas found during the windshield survey where either field or streambank erosion was present. Another contributing factor to the surface water being turbid could be because 2.45% of the soil in the watershed is classified as HEL and 57.98% of the soil is classified as PHEL by the NRCS. The acreage of row crops in conservation tillage is not known specifically for the Big Run subwatershed, however, from the 2010 tillage transect performed by the DeKalb County SWCD, it is known that nearly 95% of all crops in the county are in some sort of conservation tillage.

3.4.2 Buck Creek Subwatershed Land Use

The primary influence on water quality in the Buck Creek subwatershed is agriculture, as can be seen in Table 3.26 and Figure 3.8 below. According to Purdue University's L-THIA program over 74% of the land use in Buck Creek is agriculture, with another 4.6% in grass or pasture. The southern half of the town of Butler is located in Buck Creek, however, developed areas only comprise less than 6% of the total land use in Buck Creek. It should be noted that over 13% of the watershed is in forest land. This is a significant amount and should be protected from future development.

Table 3.26: Land use in Buck Creek Subwatershed

Water	Commercial	Ag.	High Density Res.	Low Density Res.	Grass/ Pasture	Forest	Industry	Other	Total
211	6.9	8,677.10	21.5	571.3	536.5	1592.1	9.6	10	11,636
1.80%	<1%	74.50%	<1%	4.90%	4.60%	13.70%	<1%	<1%	100%

During the windshield survey 12 sites of particular concern were noted. There was one site of significant good quality that was identified as it was a part of the Lake Erie Conservation Buffer effort in Ohio and had at least a 30 foot riparian buffer surrounding the ditch. The 13 sites are categorized in Table 3.27 as to what was observed during the windshield survey and Figure 3.9 shows the location of each of the sites.

Table 3.27: Windshield Survey Observation in Buck Creek

Observation	Soil Erosion	Dog Kennel	Possible Livestock Issue	Stream bank Erosion	Inadequate Riparian Buffer	Large Riparian Buffer
Site #	1, 2, 4, 9, 10, 13	11	7, 12	1, 6	3, 5, 6	8

Seven of the sites observed exhibited the typical field and stream bank erosion and lack of buffer strips that is common throughout the MSJRW due to the excessive amount of highly or potentially highly erodible land in the watershed. However, six locations were noted that were not the typical row crop erosion issues seen throughout the project area. Site four (labeled on the map in Figure 3.9) is a several acre plot of land that has been cleared and is slated to be developed as a residential neighborhood. No lots have been sold yet, but the land is barren and there is potential for erosion. Site seven is a dairy CFO. The producer has two manure pits to store animal waste and the producer uses cover crops to prevent erosion. Site eight is where a significant riparian buffer is present on all sides of Metcalf Ditch. Site 11 is a dog kennel. The handling of the animal waste was unclear at the time of the windshield survey but there is potential for contaminated stormwater to reach the adjacent Mason Ditch, a tributary to Buck Creek. Site 12 is an old dairy which is now used as a hobby horse farm. Again, the handling of the animal waste is unclear, but there is the potential for contaminated runoff to reach surface waters. Site 13 is an area where severe roadside erosion was evident. All the sites noted pose an NPS pollution threat to surface and/or ground water resources.

As can be seen in Table 3.28 and Figure 3.10, 40% of the parcel's ditches and streams located within Buck Creek subwatershed have less than a 10 foot vegetative buffer present. That means that many landowners are planting crops directly up to the streambank, or just wide enough to get a piece of equipment along the edge of the crop field. The lack of riparian buffer may increase the amount of sediment and other contaminants reaching open water. It should also be noted, however, that an unnamed tributary in the northeastern quadrant of Buck Creek has a significant buffer and that 17% of the parcels have ditches and streams with vegetative buffers in excess of 61 feet.

Table 3.28: Stream Buffer Width in Buck Creek Subwatershed

Buck Creek Subwatershed Stream Buffer Width			
	Buffer Width (feet)	**# of Parcels**	**% of Parcels**
	0-10	118	40%
	11-20	24	8%
	21-60	75	25%
	61-140	24	8%
	141-300	26	9%
	Urban	30	10%
	Residential	0	0%
	Tiled	0	0%
	TOTAL	297	100%

Figure 3.8: Land use in Buck Creek Subwatershed

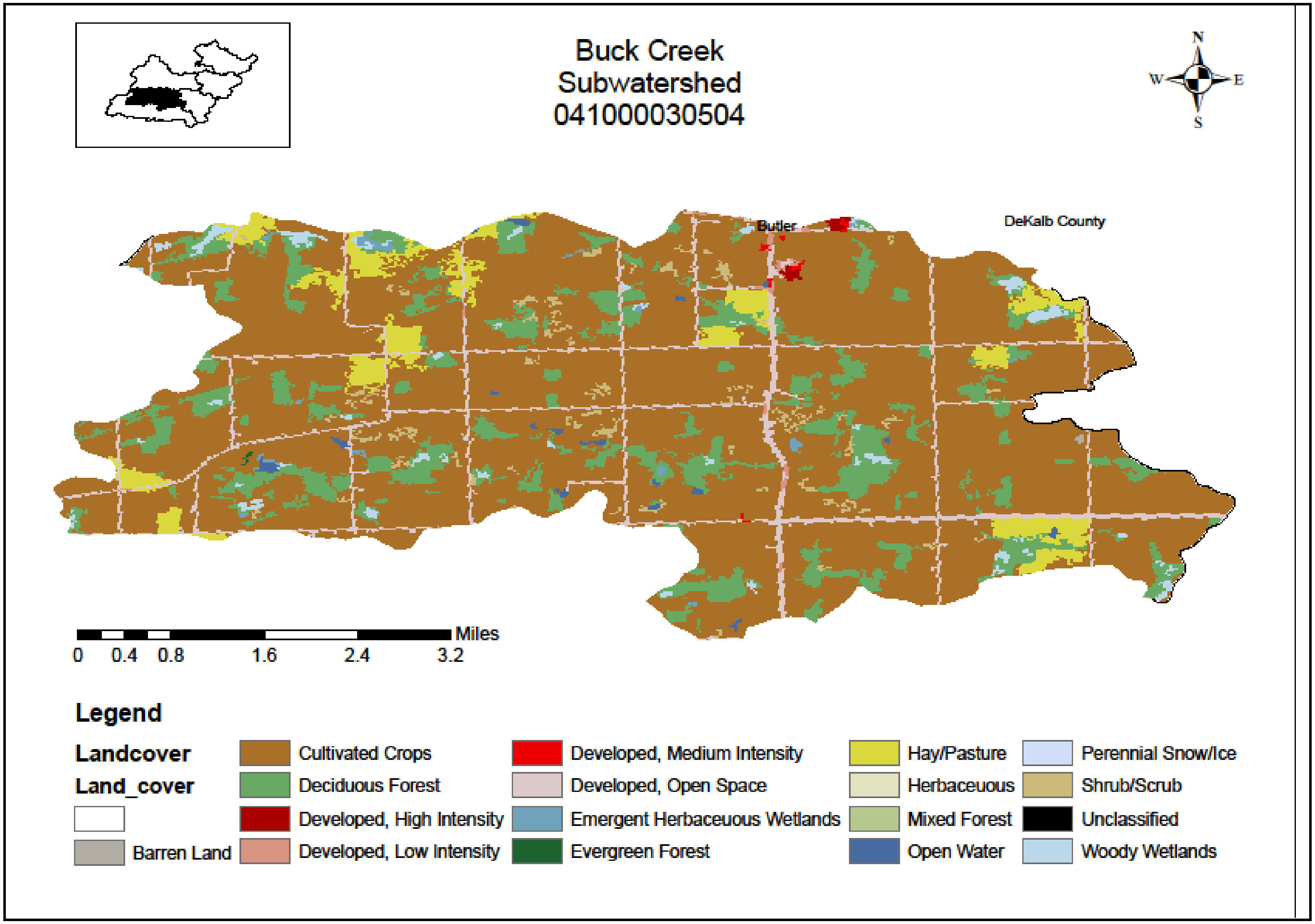


Figure 3.9: Windshield Survey Sites in Buck Creek Subwatershed

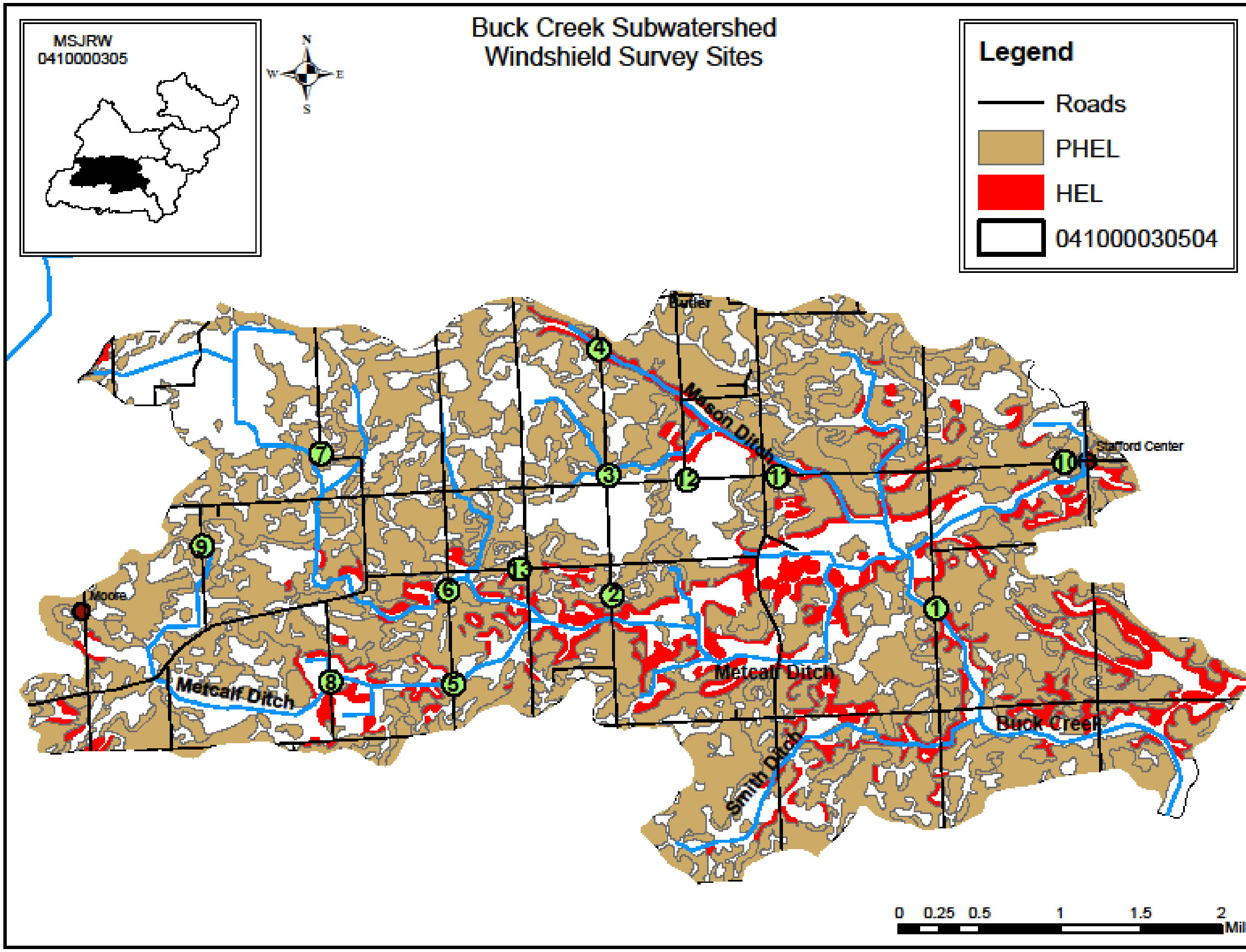
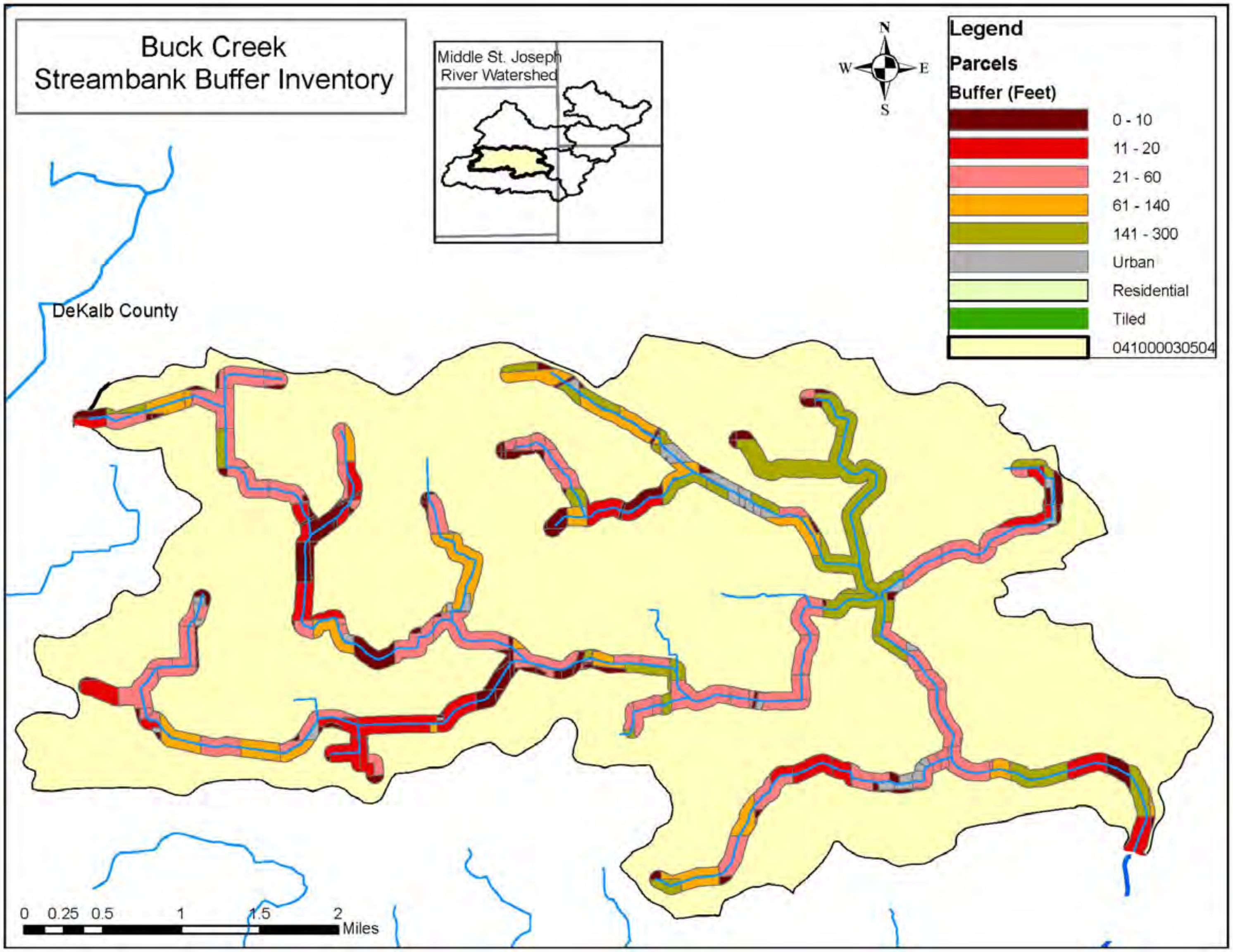


Figure 3.10: Buck Creek Stream Buffer Width



The livestock inventory conducted in 2009 indicated that there were several hobby farms in the Buck Creek subwatershed including 23 horse farms and one sheep farm. The inventory also indicated that there were 10 beef cattle farms, two dairies, and three hog farms. Two of the hog farms are large enough to require a NPDES CFO permit. The windshield survey conducted in 2011 revealed one horse hobby farm that was not identified during the livestock inventory (site 12). The livestock inventory did identify the two swine CFOs that are located within the Buck Creek subwatershed. However, there is also a NPDES permitted dairy CFO located within the Buck Creek subwatershed that was not identified during the 2009 livestock inventory. The location of each of these farms is identified in Figure 3.11.

There is only one remediation site located wholly within the Buck Creek subwatershed; an oil/gas well. A portion of an UST is located in the northern tip of the watershed in the city of Butler. These sites pose a threat to both ground and surface water. If the contents held in the facilities leak it can leach through the soil and reach groundwater, the primary drinking water source for residents of Buck Creek, or flow to surface water and decrease water quality and effect aquatic life. Site 11 from the 2011 windshield survey, a dog kennel, does pose a potential risk to water quality as well, if the animal waste is not properly handled. Table 3.29 lists the potential threats in Big Run. Figure 3.12 shows the location of each of the threats.

Table 3.29: Potential Water Quality Threats in Buck Creek Subwatershed

Type of Threat	Potential Contaminant	Number in Watershed
Underground Storage Tank	Oil/Gas	1
Gas/Oil Well	Oil/Gas	1
Dog Kennel	Animal Waste runoff	1

Figure 3.11: Buck Creek Subwatershed Livestock Inventory

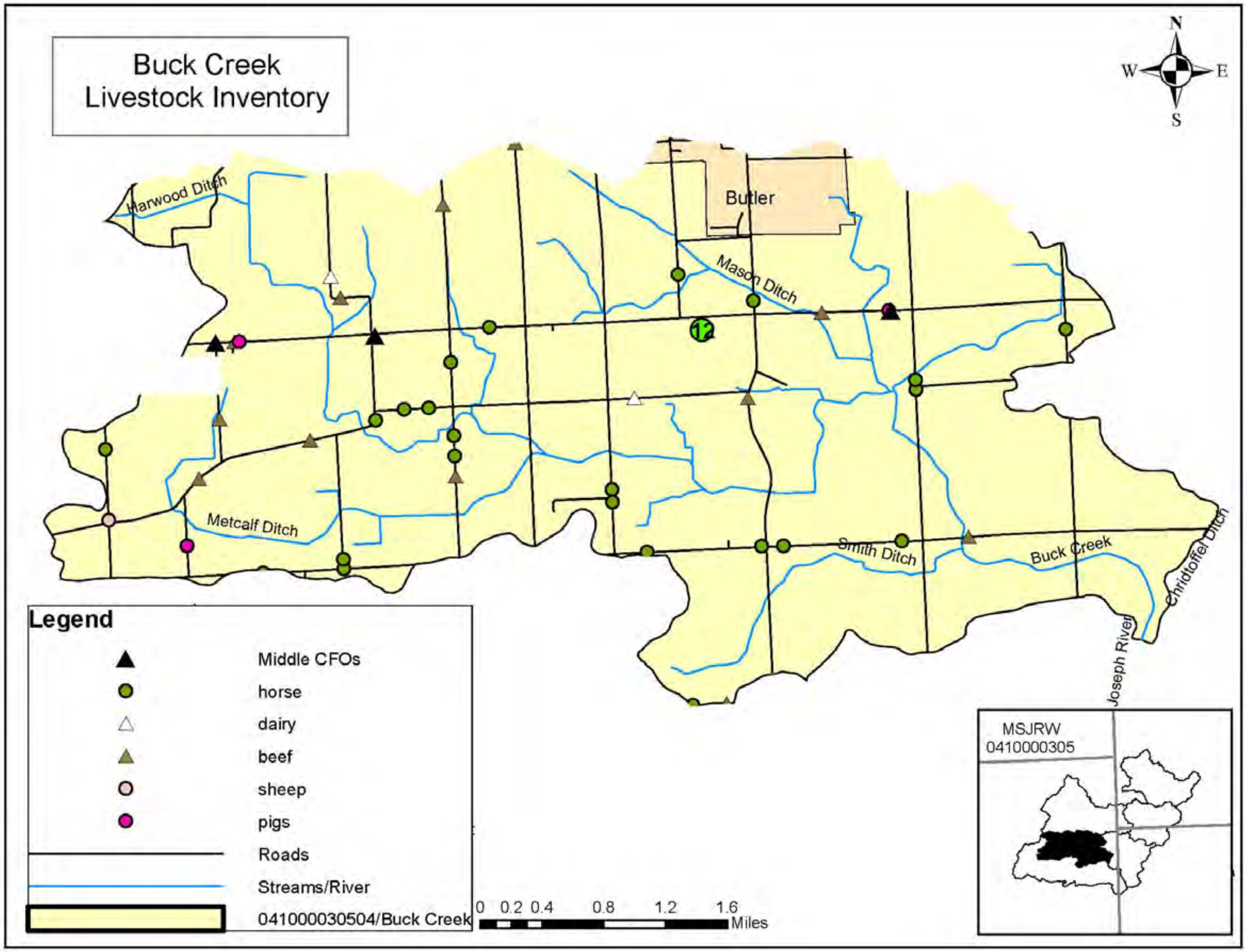
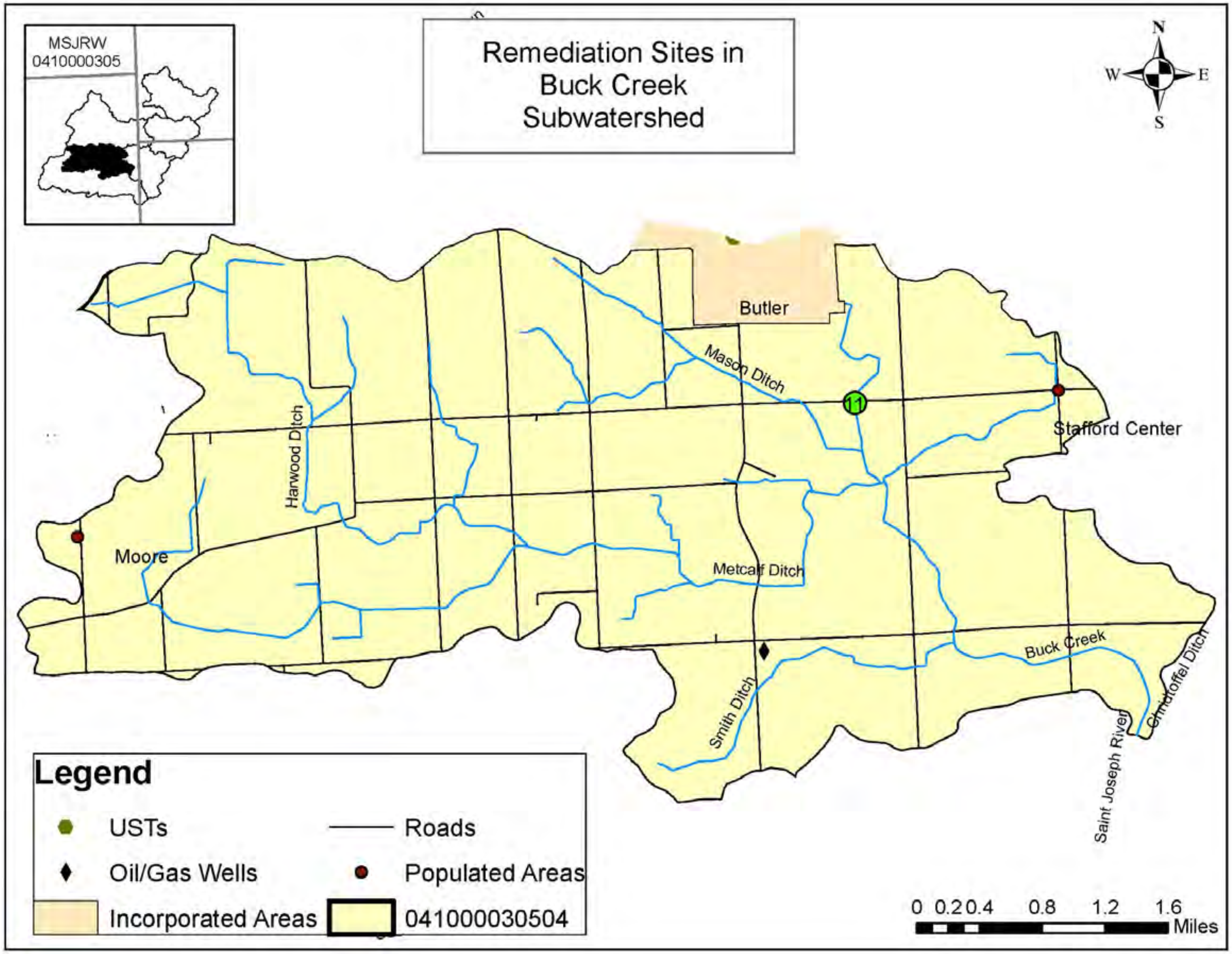


Figure 3.12: Buck Creek Remediation Sites



Water quality data collected in the Buck Creek subwatershed indicated there is a problem with *E. coli*, nutrients and turbidity in the watershed. After examining the land use within the Buck Creek subwatershed it was determined that pollution problems may be a result of faulty septic systems since the majority of soil located within the project area is classified as either very limited or somewhat limited for septic system placement. The pollution problems identified through water quality analysis may also be a result of the number of hobby farms and animal feeding operations located within the project area since improperly handled manure may runoff the land and enter streams directly. High turbidity and nutrient levels may also be a result of 74% of the land being in row crops and 8.39% of the soil in the watershed is classified as HEL and 54.76% of the soil is classified as PHEL by the NRCS soil survey. Another contributing factor to the surface water being turbid and containing high levels of nutrients could be a result of the inadequate riparian buffers as 73% of all parcels located adjacent to open water have less than 60 feet of vegetative riparian buffer with 40% of the buffers being less than 10 feet in width.

3.4.3 Sol Shank Ditch Subwatershed Land Use

The primary influence on water quality in the Sol Shank Ditch subwatershed is agriculture, as can be seen in Table 3.30 and Figure 3.13 below. According to Purdue University's L-THIA program over 70% of the land use in Sol Shank Ditch is agriculture, with another 5.33% in grass or pasture. The northern tip of Newville, IN is located in Sol Shank Ditch, however there are no significant urban areas. The Steel Dynamics industrial park is located within Sol Shank Ditch subwatershed which accounts for the 1.2% of the land that is designated as industrial.

Table 3.30: Land use in the Sol Shank Ditch Subwatershed

Water	Commercial	Ag.	High Density Res.	Low Density Res.	Grass/ Pasture	Forest	Industry	Other	Total
647.9	129.90	12,291.90	123.8	873.8	930.6	1843.6	217.5	380	17,439
3.70%	0.74%	70.49%	0.71%	5.01%	5.33%	10.60%	1.20%	2.22%	100%

The windshield survey revealed 12 sites of particular concern and three sites with a significantly sized riparian buffer on the ditch. The sites are labeled in Figure 3.14. The 15 sites are categorized in Table 3.31 as to what was observed during the windshield survey.

Table 3.31: Windshield Survey Observations in Sol Shank Ditch

Observation	Soil Erosion	Industrial Runoff/Outfall	Possible Livestock Issue	Stream bank Erosion	Inadequate Riparian Buffer	Large Riparian Buffer
Site #	2, 4, 13	6, 7, 8,9	12, 15	1, 11, 14	1, 11, 14	3, 5, 10

Sites 2, 4, and 13 are row crop fields with moderate to severe erosion, as is typical in the MSJRW due to the large amount of land that is either highly or potentially highly erodible. Sites 1, 11, and 14 lack adequate riparian buffers and exhibit some degree of bank erosion. However, site 3 was noted because of the 30+ feet of lush riparian buffer on all sides of the ditch. Sites 12 and 15 have livestock present and both sites have the potential to contaminate adjacent waterways due to stormwater runoff from the pasture fields directly adjacent to an open water source. Sites 6, 7, and 8 are at the Steel Dynamics Inc. complex. Site 6 is at the bridge over Sol Shank Ditch west of the SDI complex and has adequate riparian buffers. Site 7 is at SDI outfall 004 where runoff from the scrap yard drains. Site 8 is on the northwestern edge of the SDI complex. White material filled the roadside ditches at site 8 due to leachate from the berms built around the SDI complex and the heavy rains that occurred prior to the windshield survey. Barry Smith, the SDI Environmental Manager, told the Initiative that they were aware of the issue and were in the process of remediating the problem. Site 9 is a bridge over Sol Shank Ditch on Hwy 63, a road constructed for industrial traffic to bypass residential areas. The bridge had several deck drains which allow for stormwater to flow from the bridge directly to the ditch below. The bridge had a lot of sediment on it between the deck drains, indicating that sediment is pouring directly into the ditch below the bridge. Finally, sites 3, 5, and 10 were noted as having greater than 30 feet of buffer along the ditches.

As can be seen in Table 3.32 and Figure 3.15, 47% of the parcel's ditches and streams located within Sol Shank Ditch subwatershed have less than a 10 foot vegetative buffer present. That means that many landowners are planting crops directly up to the streambank, or just wide enough to get a piece of equipment along the edge of the crop field. The lack of riparian buffer may increase the amount of sediment and other contaminants reaching open water. It should also be noted, however, that 21% of the parcels have ditches and streams with vegetative buffers in excess of 61 feet.

Table 3.32: Stream Buffer Width in the Sol Shank Ditch Subwatershed

Sol Shank Ditch Subwatershed Stream Buffer Width			
	Buffer Width (feet)	**# of Parcels**	**% of Parcels**
	0-10	209	47%
	11-20	31	7%
	21-60	63	14%
	61-140	41	9%
	141-300	53	12%
	Urban	49	11%
	Residential	1	0%
	Tiled	0	0%
	TOTAL	447	100%

Figure 3.13: Land Use in Sol Shank Ditch Subwatershed

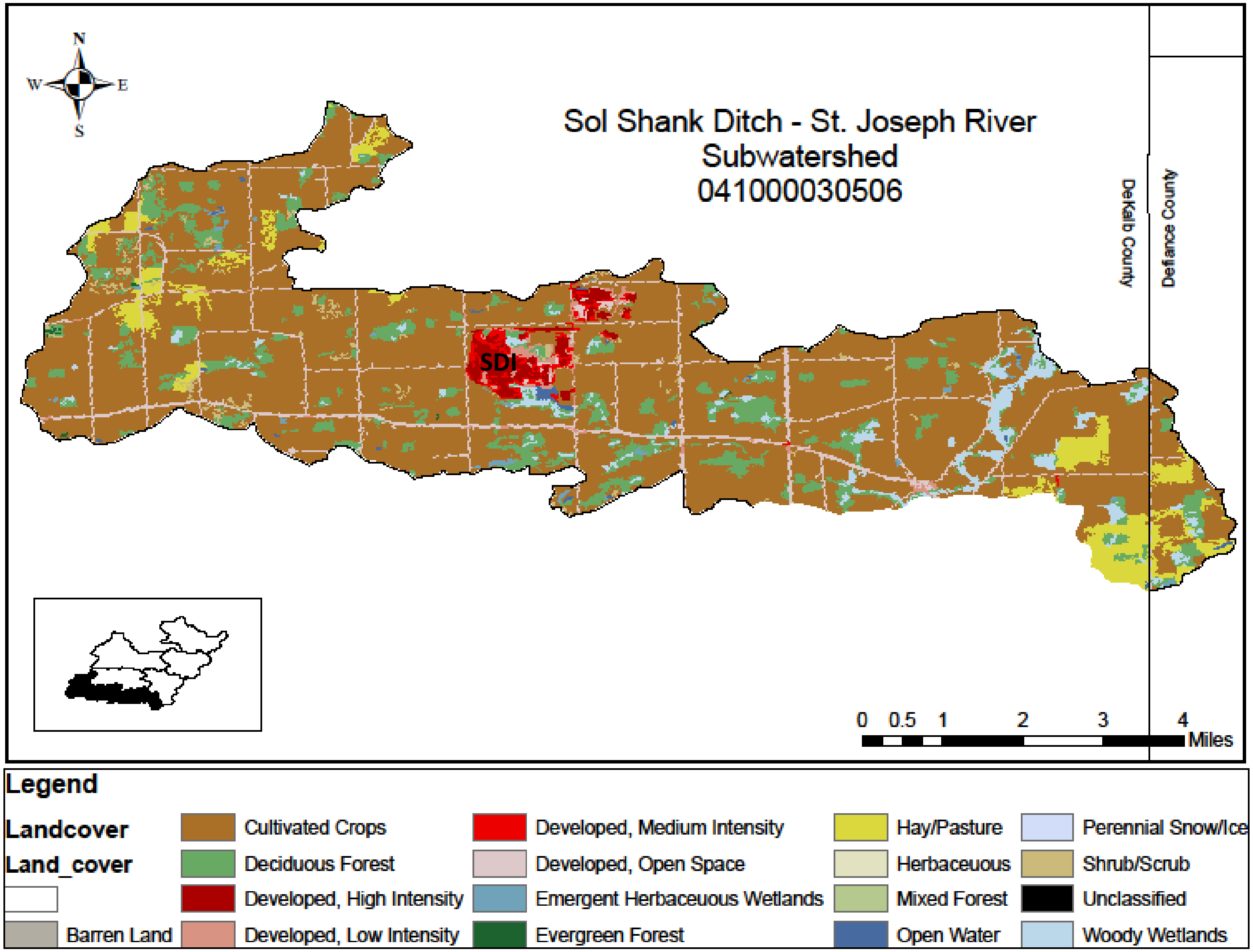


Figure 3.14: Windshield Survey Sites in Sol Shank Ditch Subwatershed

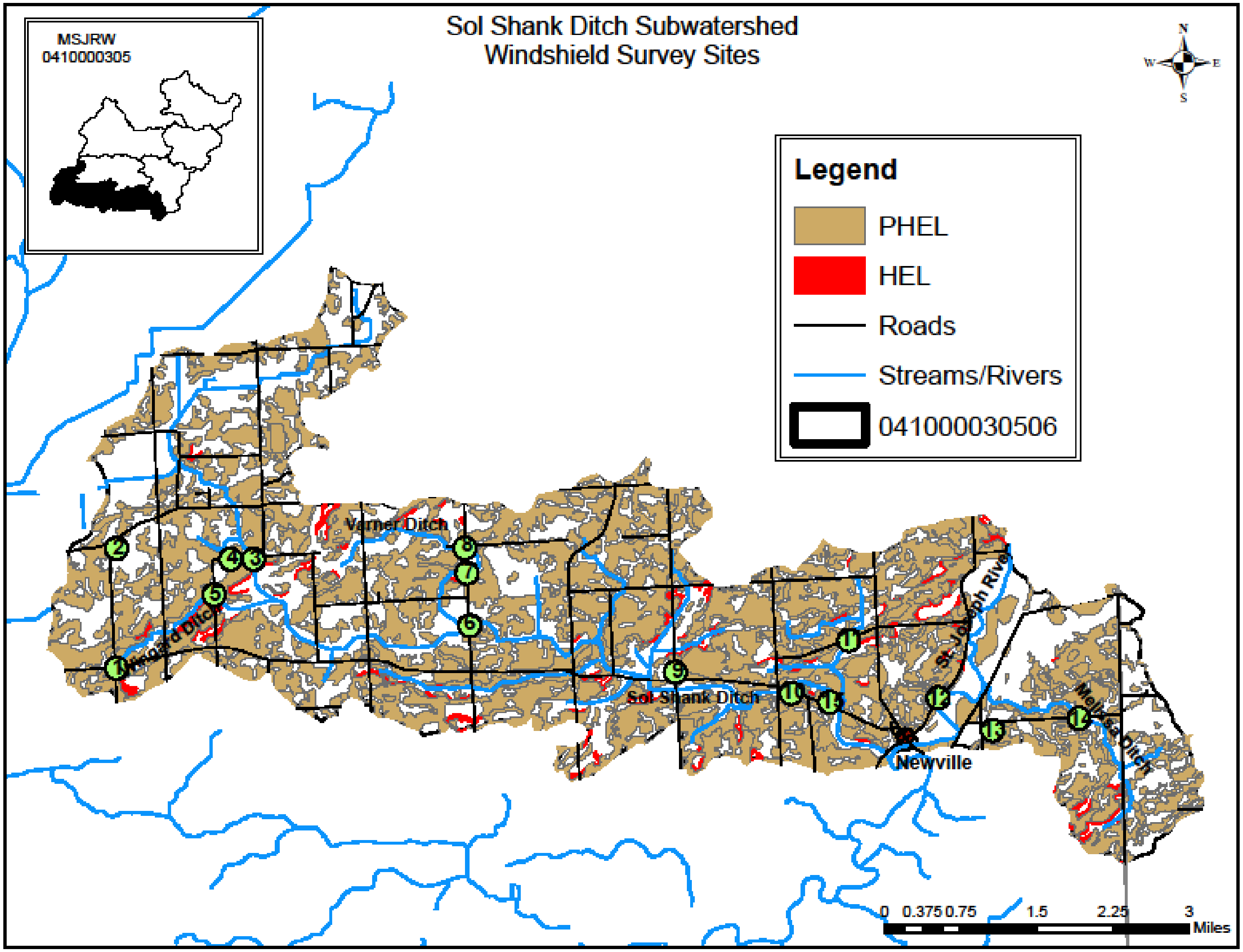
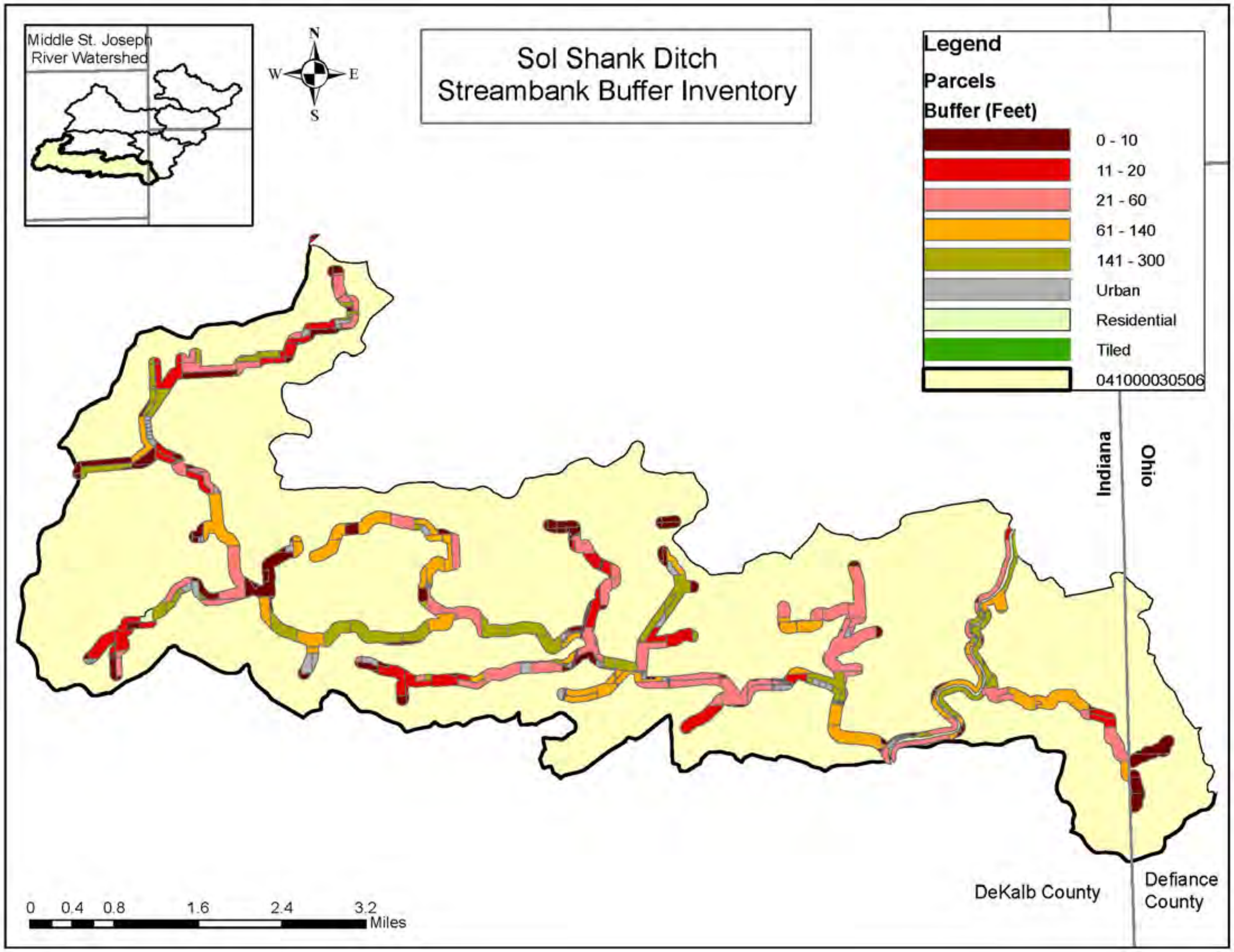


Figure 3.15: Sol Shank Ditch Subwatershed Stream Buffer Width



The Livestock inventory conducted in 2009 revealed several small hobby farms located within the Sol Shank Ditch subwatershed; mostly small horse farms. As can be seen in Figure 3.16, the investigators found 36 horse farms solely within Sol Shank Ditch subwatershed, and two horse farms on the northern border of the subwatershed, one sheep farm, one swine farm, and five beef cattle farms. Site 12 from the windshield survey was not identified during the livestock inventory. Site 12 is a small beef cattle farm where the pasture slopes down to the ditch, though the livestock do not appear to have direct access to the ditch. There are not any NPDES permitted CFOs located within Sol Shank Ditch Subwatershed.

There are two remediation sites located within the Sol Shank Ditch Subwatershed that pose a unique threat to water quality within the subwatershed. Also, two sites identified during the windshield survey (sites 8 and 9) need remediation before they too pose a significant risk to water quality. The location of the four sites can be found in Figure 3.17. There is an industrial waste site located in the northwest section of the subwatershed. Industrial waste sites are managed by the RCRA program to clean-up the waste and prevent further leakage of any contaminants. There is also a LUST located by the industrial waste site in the Sol Shank Ditch subwatershed. The name and location of the Industrial Waste and LUST sites can be found in Table 3.33.

Table 3.33: Regulated Remediation Sites in Sol Shank Ditch Subwatershed

Type	NAME	STREET ADDRESS	CITY	STATE CODE
RCRA	Merritt Transfer Station	3907 CR 47	Butler	IN
LUST	National Serv-All DBA-Merritt	3907 CR 47	Butler	IN

Windshield survey sites eight and nine are both around the Steel Dynamics, Inc. complex. Site eight is where SDI outfall 004 is located and it appears to be where a scrap yard drains to. Site nine is a bridge on Hwy 63 over Sol Shank Ditch. Due to the heavy industrial traffic on Hwy 63, there is a lot of road side sediment and the potential for other contaminants such as street salt and oil, to reach the Ditch. All of the above mentioned sites pose a threat to both ground and surface water. If the contents held in the facilities leak it can leach through the soil and reach groundwater, the primary drinking water source for residents of Sol Shank Ditch, or flow to surface water and decrease water quality and effect aquatic life. Table 3.34 lists the types of remediation sites present in Sol Shank Ditch subwatershed.

Table 3.34: Potential Water Quality Threats in Sol Shank Ditch Subwatershed

Type of Threat	Potential Contaminant	Number in Watershed
Leaking Underground Storage Tank	Oil/Gas	1
Industrial Waste Site	Oil/Gas, Heavy Metals, Household chemicals and waste, etc.	1
Industrial Waste Site	Heavy Metals	1
Industrial Use Highway Runoff	Salt, Oil, Sediment	1

Figure 3.16: Sol Shank Ditch Livestock Inventory

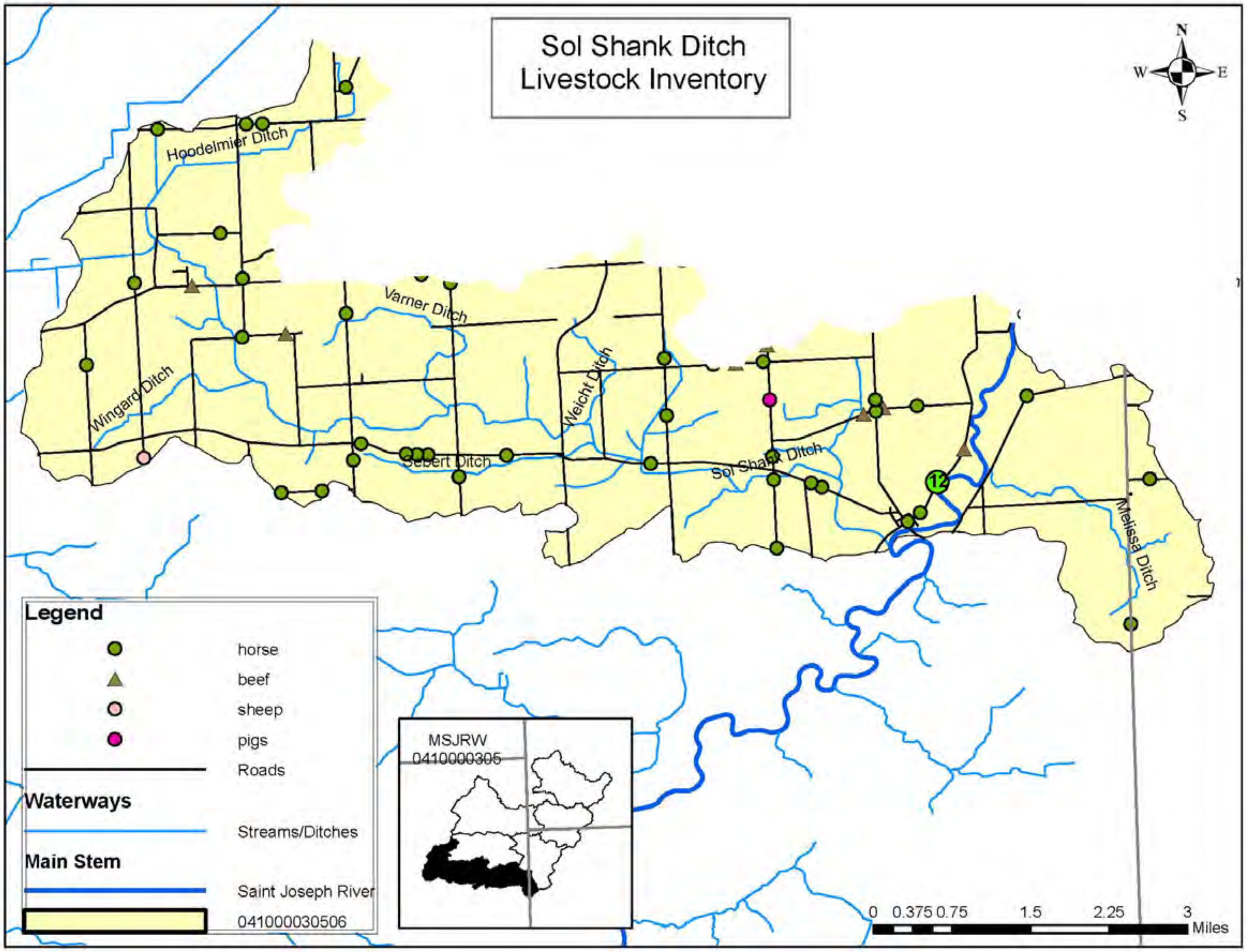
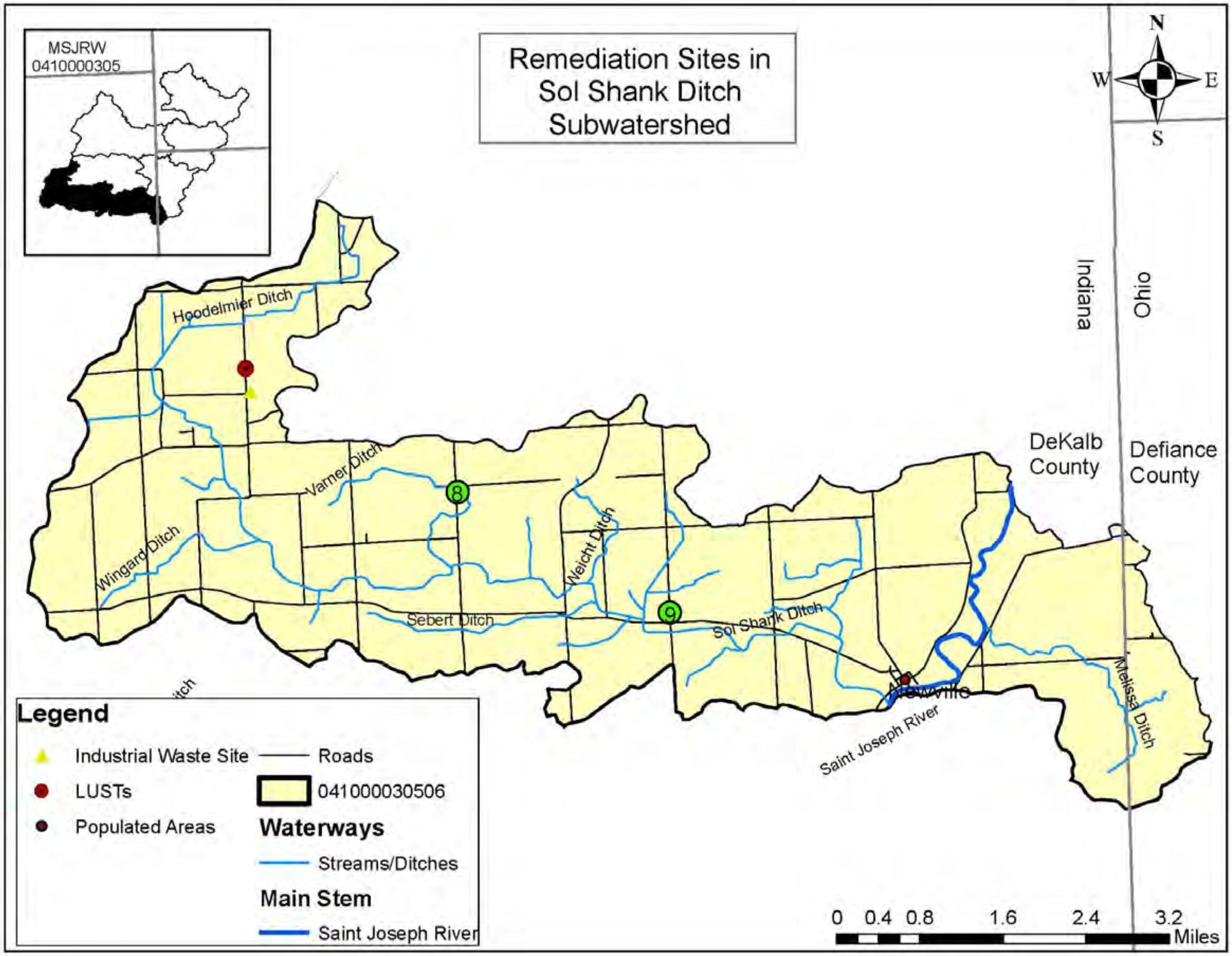


Figure 3.17: Sol Shank Ditch Remediation Sites



Water quality data collected in the Sol Shank Ditch subwatershed indicated there is a problem with *E. coli*, nutrients, total suspended solids and turbidity in the watershed. After examining the land use within the Sol Shank Ditch subwatershed pollution problems may a result of faulty septic systems since the majority of soil located within the project area is classified as either very limited or somewhat limited for septic system placement. The pollution problems identified through water quality analysis may also be a result of the number of hobby farms and animal feeding operations located within the project area, including beef cattle, horses, sheep and pigs. Improperly handled manure may runoff the land and enter streams directly from the barnyard or after being land applied as fertilizer on crop land. High turbidity and nutrient levels may also be a result of 71% of the land being in row crops and 2.31% of the soil in the watershed is classified as HEL and 55.87% of the soil is classified as PHEL by the NRCS soil survey. Another contributing factor to the surface water being turbid and containing high levels of nutrients and suspended solids could be a result of the inadequate riparian buffers as 68% of all parcels located adjacent to open water have less than 60 feet of vegetative riparian buffer with 47% of the buffers being less than 10 feet in width.

3.4.4 Willow Run Subwatershed Land Use

The primary influence on water quality in the Willow Run subwatershed is agriculture, as can be seen in Table 3.35 and Figure 3.18 below. According to Purdue University's L-THIA program nearly 73% of the land use in Willow Run is agriculture, with another 6.79% in grass or pasture. Residential land use accounts for less than 4% of the entire subwatershed and there is no land designated as commercial.

Table 3.35: Land Use in the Willow Run Subwatershed

Water	Commercial	Ag.	High Density Res.	Loq Density Res.	Grass/ Pasture	Forest	Industry	Other	Total
342.4	0	7,678.10	25.9	302.6	713.9	769.2	28.7	659.2	10,520
3.08%	0.00%	72.99%	<1%	2.87%	6.79%	7.31%	<1%	6%	100%

The windshield survey revealed 20 sites of particular concern. The sites are labeled in Figure 3.19. The 20 sites are categorized in Table 3.36 as to what type of NPS problem was observed.

Table 3.36: Windshield Survey Observations in the Willow Run Subwatershed

Observation	Soil Erosion	Livestock Access	Possible Livestock Issue	Stream bank Erosion	Inadequate Riparian Buffer	Quarry
Site #	2, 3, 5, 11	9, 12	4, 13, 17, 18, 19	2, 5, 7, 10, 12	1, 2, 3, 5, 6, 8, 10, 12, 14, 15	16, 20

The most common observation made during the 2011 windshield survey in the Willow Run subwatershed was the lack of an adequate (>30 ft) riparian buffer. When riparian buffers are less than 30 ft there is an increased potential for NPS to reach surface waters. The most common pollutant in Willow Run would likely be sediment, nutrients, and seasonal peaks of pesticides due to the fact that agriculture accounts for the majority of the land use in the subwatershed and the lack of proper filtration surrounding surface waters. There are several sites that were noted as having livestock present. Though, most sites had a relatively small number of livestock, there is potential for polluted runoff to reach surface waters, or if the manure is not properly managed, it could pollute both surface and ground water resources. Sites 9, 12, and 13 are three observations of livestock that pose a significant risk to water quality. It appeared that livestock may have direct access to the ditch at site 9 and obvious evidence of livestock access to the ditch was noted at site 12 as the banks were eroded and denude of vegetation. Surface waters that are regularly crossed by livestock are often polluted with excessive sediment, nutrients, and possibly have high quantities of *E. coli* present. At site 13 the barnyard sloped down toward the ditch allowing for stormwater runoff, carrying waste from the barnyard, to flow directly toward the ditch.

There are two quarries located in the Willow Run subwatershed which are a potential source of NPS pollution (sites 16 and 20). Stafford Gravel, site 16, is a sand and gravel quarry, the type of quarry of site 20 is not known at this time. Quarries pose a threat to both surface and ground water. Contamination of surface and/or groundwater can occur either from the operation of the quarry or from other sources as digging below the groundwater table can alter the flow path of the water and bring contaminated water in from other sources.

Finally, there were four sites noted as having significant soil erosion. While Willow Run has less HEL and PHEL than other subwatersheds in the project area, the heavy rains in the spring of 2011 indubitably contributed to the heavy erosion. However, site 2 was the location of an excavating company which had a large pile of soil located next to the ditch. The pile had large rills in it indicating that soil is eroding from the pile with the potential to contaminate the ditch with excessive sediment. Site 2 also lacked an adequate riparian buffer and some bank erosion was present.

As can be seen in Table 3.37 and Figure 3.20, 30% of the parcel's ditches and streams located within Willow Run subwatershed have less than a 10 foot vegetative buffer present and

65% have less than a 60 foot buffer present. That means that many landowners are planting crops directly up to the streambank, or just wide enough to get a piece of equipment along the edge of the crop field. The lack of riparian buffer may increase the amount of sediment and other contaminants reaching open water.

Table 3.37: Stream Buffer Width in Willow Run Subwatershed

Willow Run Subwatershed Stream Buffer Width			
	Buffer Width	**# of Parcels**	**% of Parcels**
	0-10	60	30%
	11-20	15	7%
	21-60	57	28%
	61-140	28	14%
	141-300	22	11%
	Urban	14	7%
	Residential	0	0%
	Tiled	6	3%
	TOTAL	202	100%

Figure 3.18: Land Use in Willow Run Subwatershed

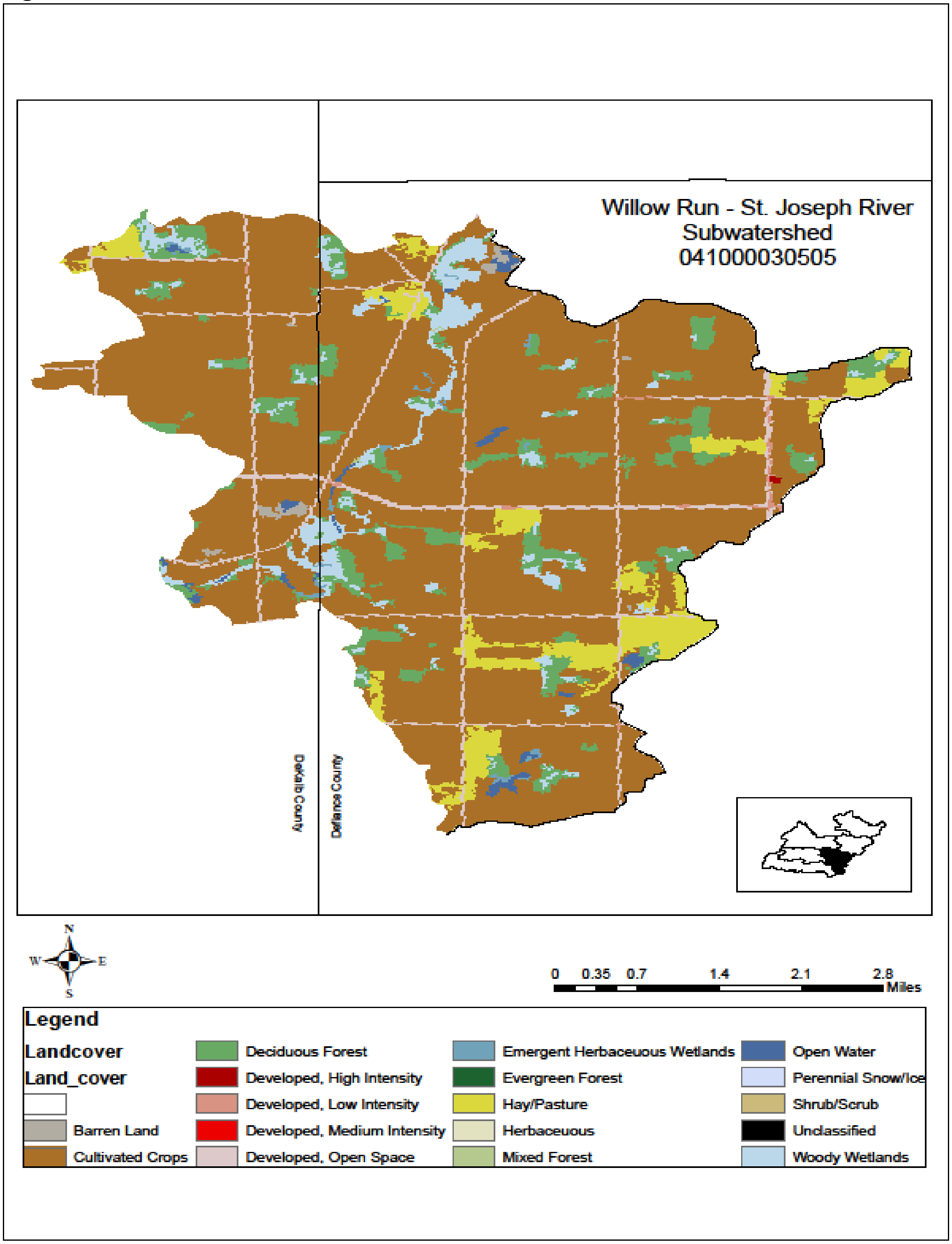


Figure 3.19: Windshield Survey Sites in Willow Run Subwatershed

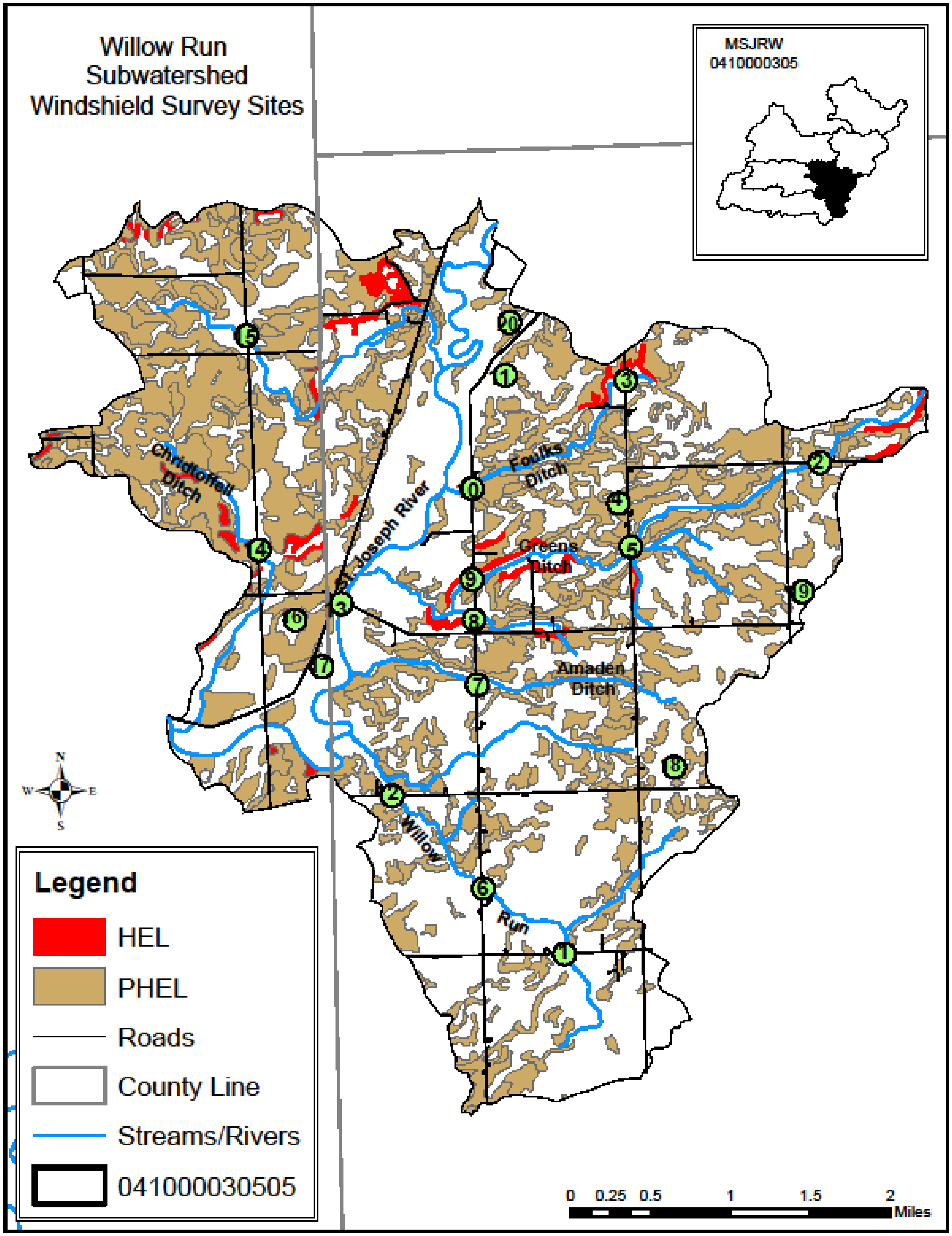
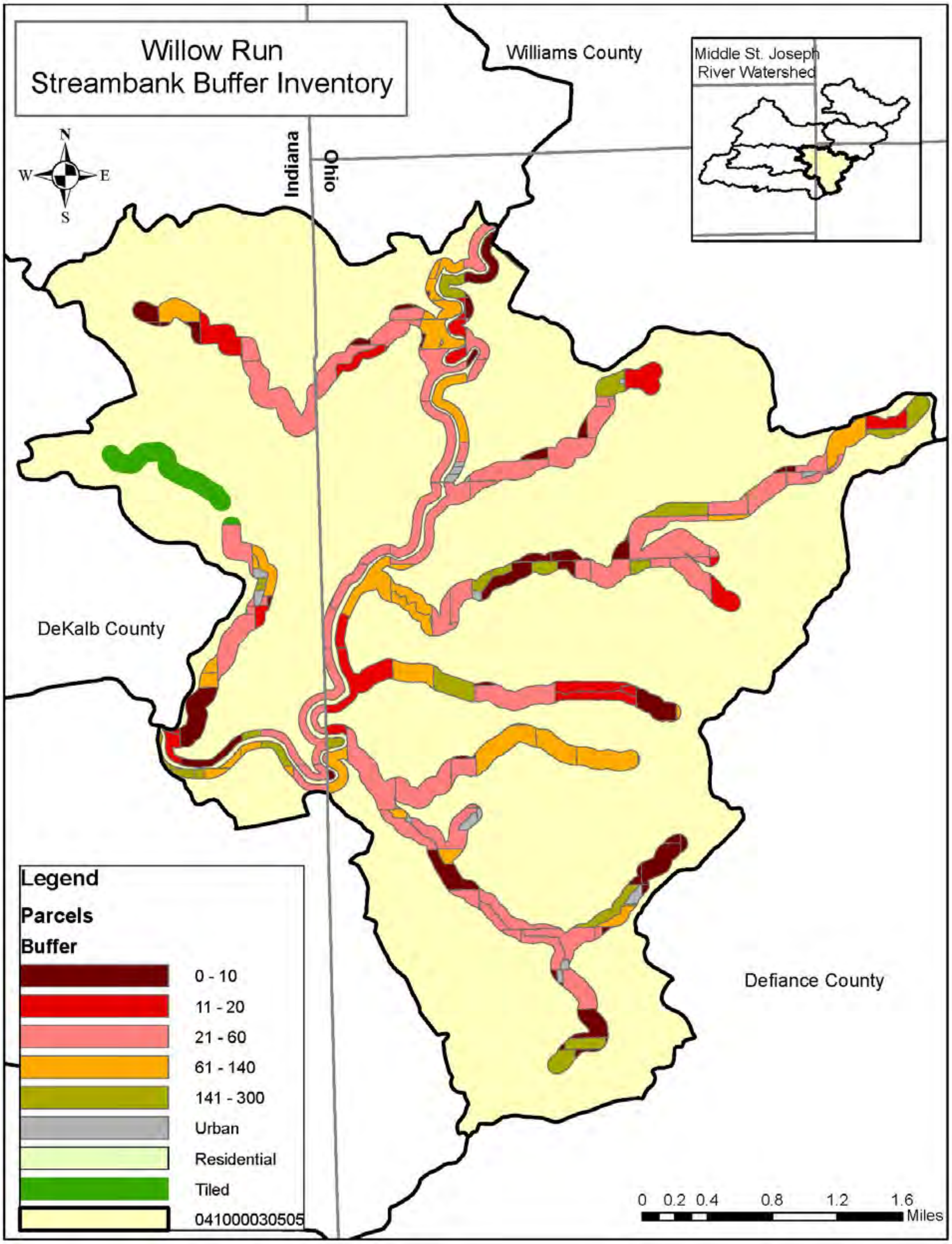


Figure 3.20: Willow Run Stream Buffer Width



The Livestock inventory conducted in 2009 revealed several small hobby farms located within the Willow Run subwatershed; mostly small horse farms. As can be seen in Figure 3.21, the investigators found 16 horse farms, six beef cattle farms, one dairy farm, and one alpaca farm. Sites 9, 17, and 18 from the windshield survey were not identified during the livestock inventory. The type of animal at site 9 is not known at this time as the animals were in the barn during the windshield survey. Site 17 is a horse pasture and site 18 is a small Amish farm with six beef cows on-site. There is one NPDES permitted CFO located within Willow Run Subwatershed; Don Hooks Farms which rears swine.

Stafford Gravel, Incorporated is an NPDES permitted facility located in Willow Run subwatershed. This gravel pit was identified as site 16 during the windshield survey and discharges to Chridtoffell Ditch.

There are two remediation sites located within the Willow Run that pose a unique threat to water quality within the subwatershed. One site is a oil/gas well, the other is site 2 from the windshield survey which is an excavation company with a large eroding dirt pile on their lot next to an open ditch. Both sites pose a risk to surface water and the oil/gas well poses a more significant risk to groundwater if the well fails.

Table 3.38: Potential Water Quality Threat in Willow Run

Type of Threat	Potential Contaminant	Number in Watershed
Oil/Gas Well (regulated)	Oil/Gas	1
Excavation Company	Sediment	1

Figure 3.21: Willow Run Livestock Inventory

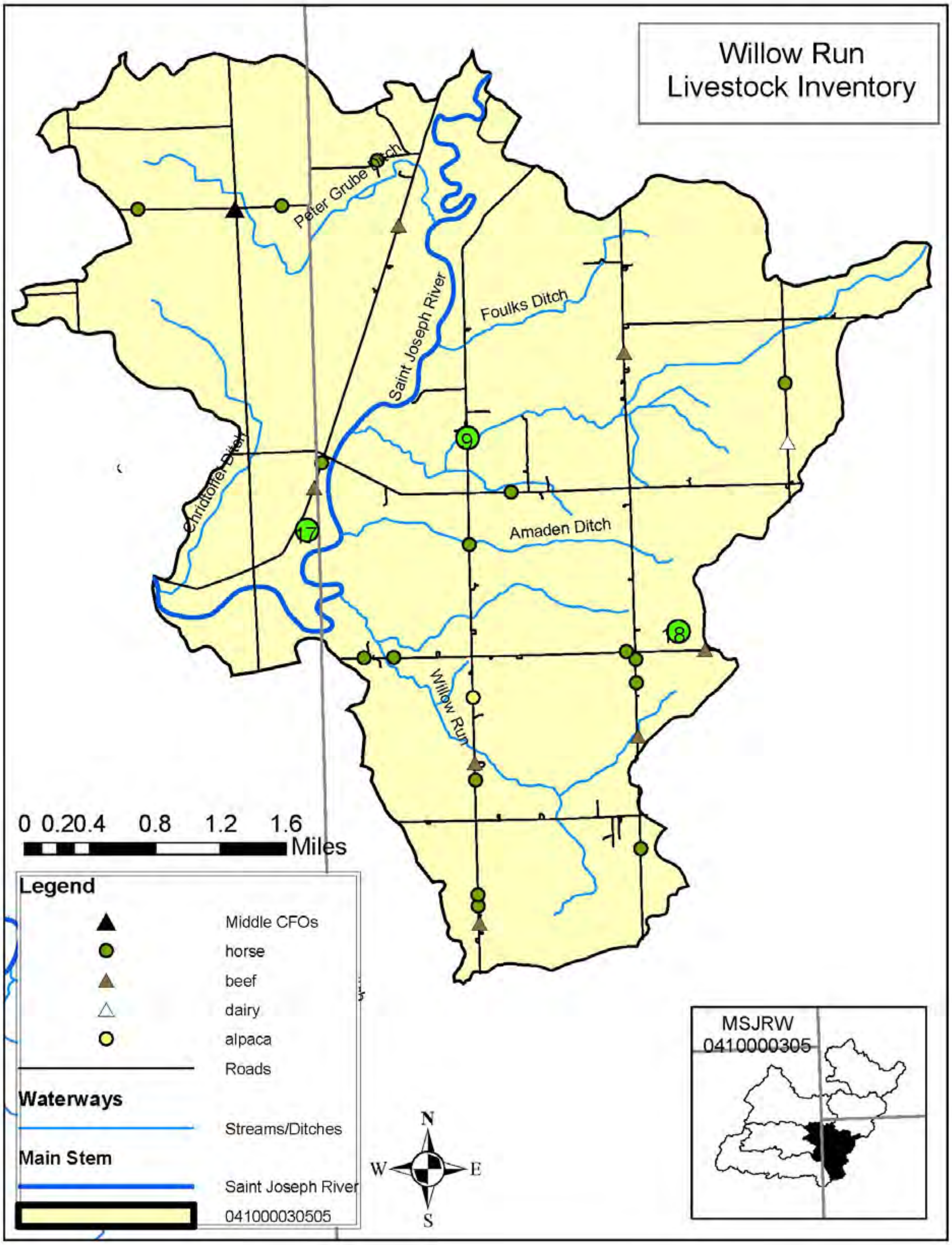
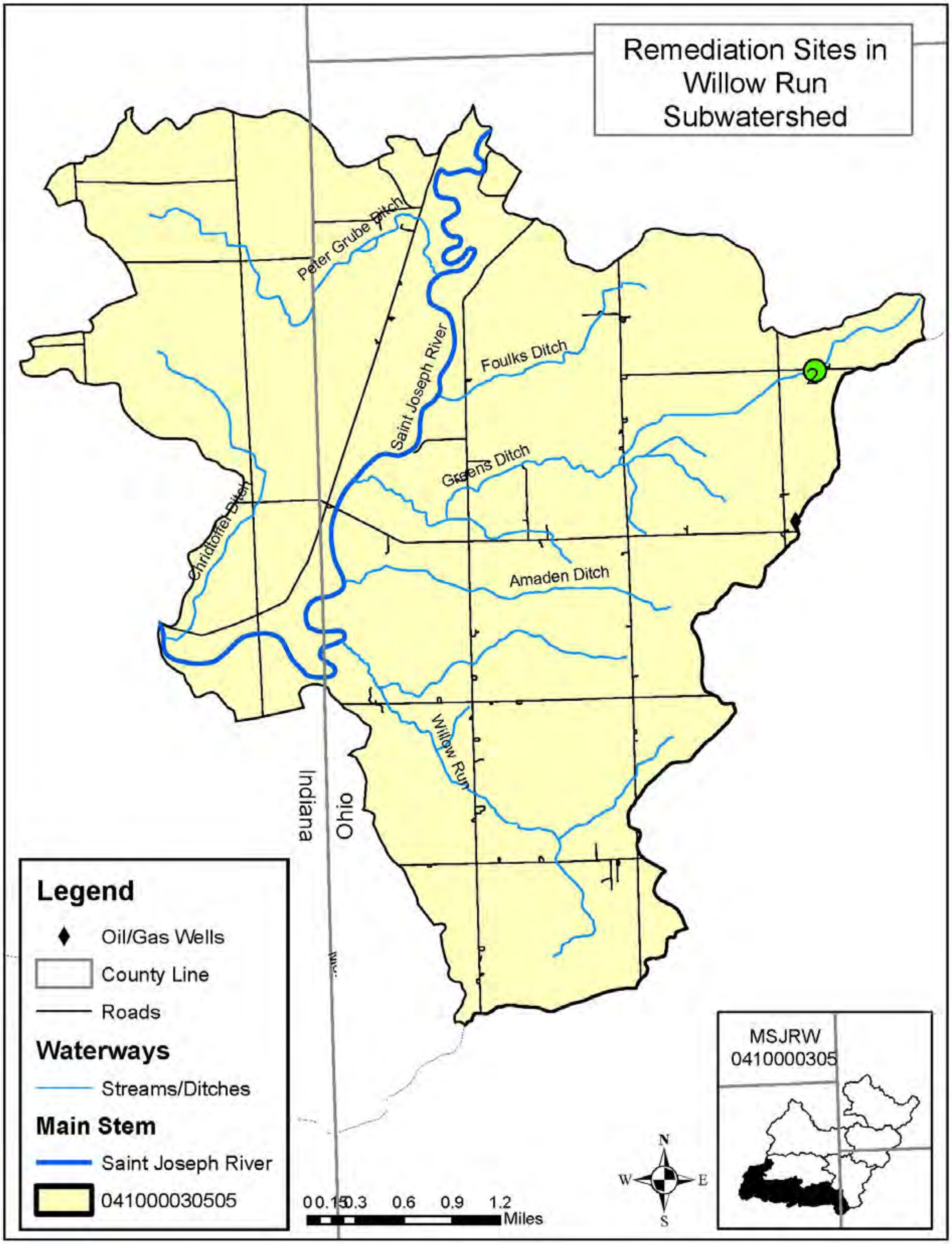


Figure 3.22: Remediation Site in Willow Run



Water quality data collected in the Willow Run subwatershed indicated there is a problem with *E. coli*, nutrients, total suspended solids and turbidity in the watershed. After examining the land use within the Willow Run subwatershed pollution problems may be a result of faulty septic systems as the majority of soil located within the project area is classified as either very limited or somewhat limited for septic system placement. The pollution problems identified through water quality analysis may also be a result of the number of hobby farms and animal feeding operations located within the project area, including beef and dairy cattle, horses, and one alpaca farm. There is also one CFO located within Willow Run which is located directly adjacent to the Peter Grube Ditch. Improperly handled manure may runoff the land and enter streams directly from the barnyard or after being land applied as fertilizer on crop land. High turbidity and nutrient levels may also be a result of 73% of the land being in row crops and 1.70% of the soil in the watershed is classified as HEL and 38.62% of the soil is classified as PHEL by the NRCS soil survey. Another contributing factor to the surface water being turbid and containing high levels of nutrients could be a result of the inadequate riparian buffers as 65% of all parcels located adjacent to open water have less than 60 feet of vegetative riparian buffer with 30% of the buffers being less than 10 feet in width. The buffer survey also revealed that atleast 3% of the parcels adjacent to a ditch were tiled, which could also account for high levels of nutrients, and turbid water as the tile provides a direct conduit for NPS to reach open water.

3.4.5 Russell Run Subwatershed Land Use

The primary influence on water quality in the Russell Run subwatershed is agriculture, as can be seen in Table 3.39 and Figure 3.23 below. According to Purdue University's L-THIA program almost 44% of the land use in Russell Run is agriculture, with another 11.59% in grass or pasture. The entire Village of Edgerton (population 1,939) is located within Russell Run. However, residential areas only comprise less than 5% of the entire subwatershed. It is important to note that while only a small area is urbanized, urban NPS can have a significant impact on water quality and BMPs to limit the amount of stormwater runoff should be implemented. 32% of the watershed's landuse is deemed "other" by the L-THIA program. It is not clear what "other" represents as windshield surveys revealed most of the area to be agricultural land.

Table 3.39: Land Use in Russell Run Subwatershed

Water	Commercial	Ag.	High Density Res.	Loq Density Res.	Grass/ Pasture	Forest	Industry	Other	Total
236.3	29.7	5,026.40	73.9	447.2	1332.2	655.8	29.2	3661.3	11,492
2.06%	<1%	43.74%	<1%	3.89%	11.59%	5.71%	<1%	32%	100%

During the windshield survey 12 sites of particular concern were noted as can be seen in Figure 3.24. The 12 sites are categorized in Table 3.40 as to what type of NPS problem was observed.

Table 3.40: Windshield Survey Observations in Russell Run Subwatershed

Observation	Soil Erosion	Gravel Pit	Possible Livestock Issue	Stream bank Erosion	Inadequate Riparian Buffer	Edgerton Waste Treatment Lagoons
Site #	6, 7, 8	10	2, 9	12	1, 4, 5, 11, 12	3

As is typical throughout the project area, many areas lacking an adequate riparian buffer of at least 30 feet and soil erosion from row crop fields were observed. However, site 2, 3, 9, and 10 were unique to this subwatershed. Site 2 is a swine operation that uses underground manure pits to hold manure prior to land application. The producer at site 2 uses an injector tool to apply the manure to his fields. This is an environmentally sustainable means of utilizing the manure produced on-site. Site 9 is a dairy operation that also uses underground manure pits to store the manure prior to land application. Site 10 is a gravel pit which can pose threats to water quality for the reasons mentioned previously. Finally, site 3 was the location of the Edgerton waste treatment lagoons (N = 2). There is one discharge point from the waste water treatment lagoon, into the St. Joseph River.

As can be seen in Table 3.41 and Figure 3.25, 58% of the parcel's ditches and streams located within Russell Run subwatershed have less than a 10 foot vegetative buffer present. That means that many landowners are planting crops directly up to the streambank, or planting to leave just wide enough a space to get a piece of equipment along the edge of the crop field. The lack of riparian buffer may increase the amount of sediment and other contaminants reaching open water. It should also be noted, that the town of Edgerton lies wholly within the Russell Run subwatershed leaving 12% of the parcels adjacent to a ditch or stream being designated as urban. Urban pollution such as lawn fertilizer, road salts, and pet and wildlife waste may reach the open water easier if there is a lack of vegetative riparian buffer present.

Table 3.41: Streambank Buffer Width in the Russell Run Subwatershed

Russell Run Subwatershed Stream Buffer Width			
	Buffer Width	**# of Parcels**	**% of Parcels**
	0-10	278	58%
	11-20	30	6%
	21-60	38	8%
	61-140	25	5%
	141-300	25	5%
	Urban	58	12%
	Residential	15	3%
	Tiled	13	3%
	TOTAL	482	100%

Figure 3.23: Land Use in Russell Run Subwatershed

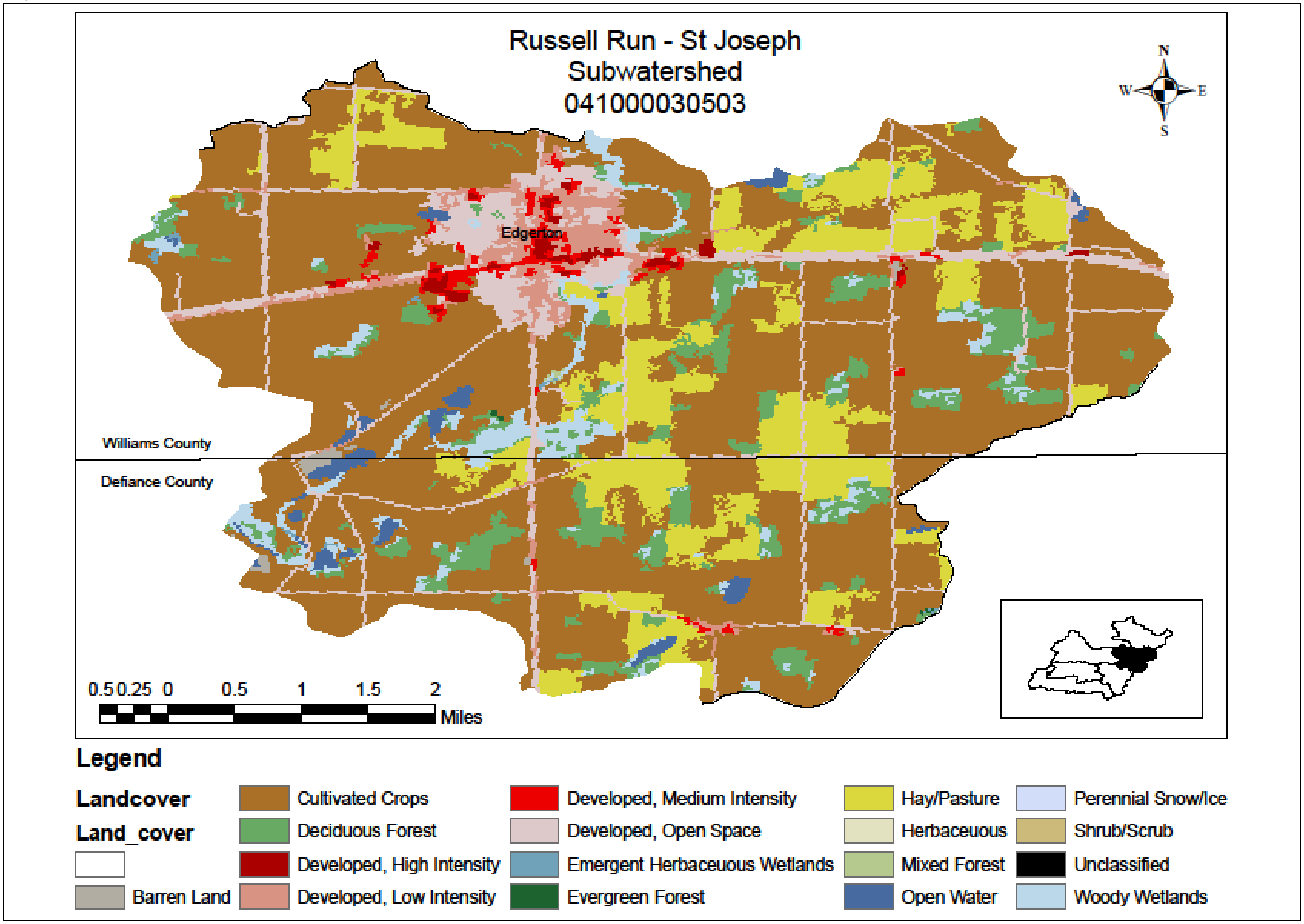


Figure 3.24: Windshield Survey Sites in Russell Run Subwatershed

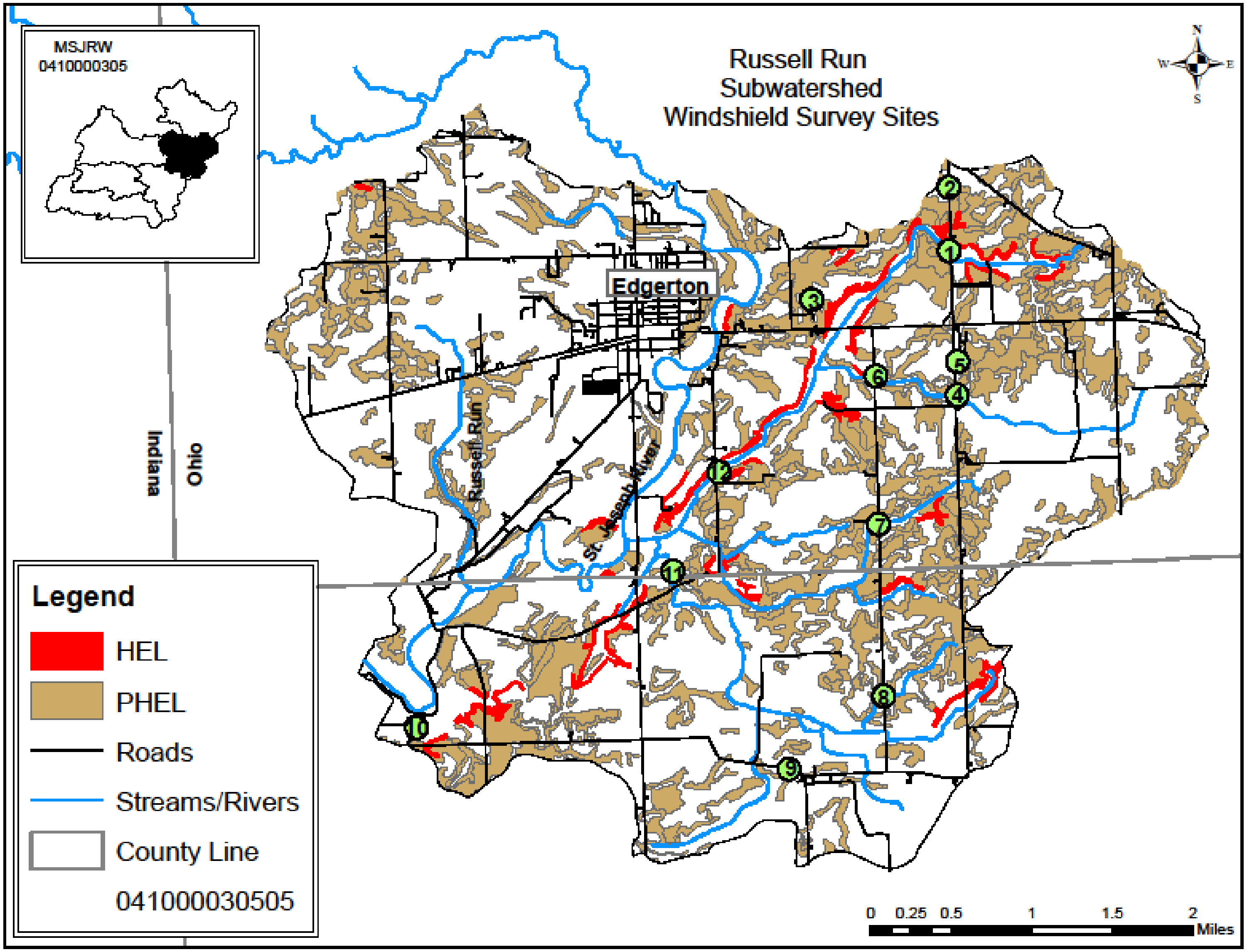
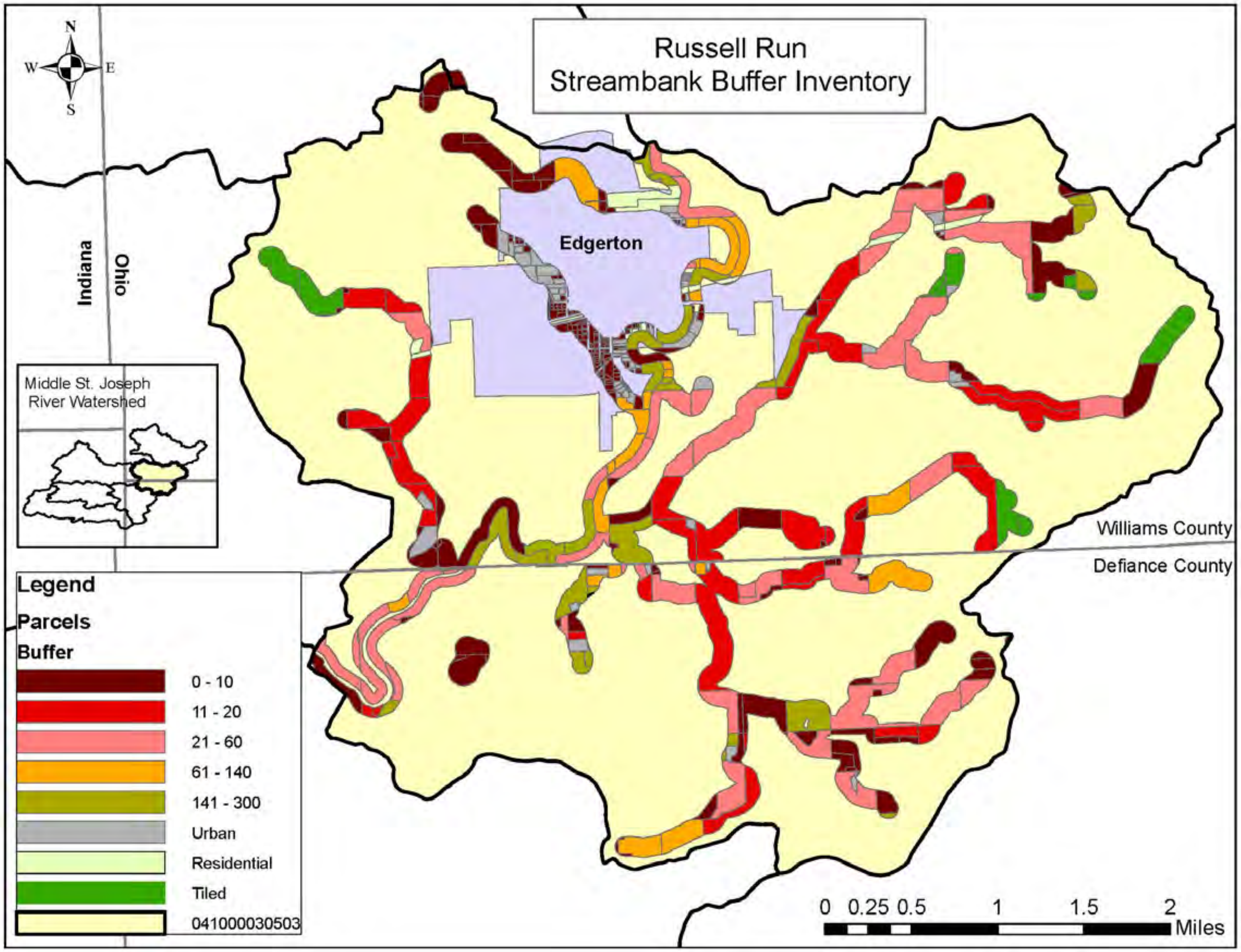


Figure 3.25: Russell Run Subwatershed Streambank Buffer



The Livestock inventory conducted in 2009 revealed several small hobby farms located within the Russell Run subwatershed; mostly beef cow farms. As can be seen in Figure 3.26, the investigators found 12 beef cow farms, three dairy farms, and one swine farm. No additional livestock operations were found during the windshield survey. There are no NPDES permitted CFOs located within Russell Run Subwatershed.

The Village of Edgerton has two NPDES permitted facilities; the Edgerton Water Treatment Plant and Edgerton Waste Water Treatment Plant. Both facilities discharge directly to the St. Joseph River in Russell Run subwatershed. The Edgerton WWTP has violated its permit in three quarters between January 2009 and December 2012 for either BOD, DO, or pH. There have been no violations reported to the EPA from the Edgerton WTP over the past three years.

There are several remediation sites in Russell Run including USTs, LUSTs, and gas and/or oil wells. Most of the sites center around the Village of Edgerton. These sites pose a threat to both ground and surface water. If the contents held in any of the facilities leaks it can leach through the soil and reach groundwater, the primary drinking water source for residents living in the MSJRW, or flow to surface water and decrease water quality and affect aquatic life. One of the five LUSTs located in Russell Run is still active and is leaking its contents into the soil and poses a significant risk to ground and/or surface water. The LUSTs located in Russell Run are listed in Table 3.42. Table 3.43 lists all potential threats in Russell Run. Figure 3.27 shows the location of each of the threats.

Table 3.42: Leaking Underground Storage Tanks in Russell Run

UST FACILITY ID	NAME	CITY	STATE CODE	PRIORITY	AFFECTED AREA	Status
86009981	Airway Mfg.	Edgerton	OH	Low	Wellhead Protection, Soil, Groundwater	Discontinued
86009416	Edgerton Local Schools	Edgerton	OH	Low	Wellhead Protection, Soil, Groundwater	Discontinued
86002219	Warners Auto Repair	Edgerton	OH	Low	Wellhead Protection, Soil, Groundwater	Discontinued
86009992	Edgerton Forge Inc	Edgerton	OH	Low	Wellhead Protection, Soil, Groundwater	Discontinued
86000121	Edgerton Wash and Fill	Edgerton	OH	Medium	Wellhead Protection, Soil, Groundwater	Active

Table 3.43: Potential Water Quality Threat in Willow Run

Type of Threat	Potential Contaminant	Number in Watershed
Underground Storage Tank	Oil/Gas	2
Leaky Underground Storage Tank	Oil/Gas	5
Gas/Oil Well	Oil/Gas	1
Scrap Yard	Oil/Gas, Heavy Metals, Antifreeze	1

Figure 3.26: Livestock Inventory in Russell Run Subwatershed

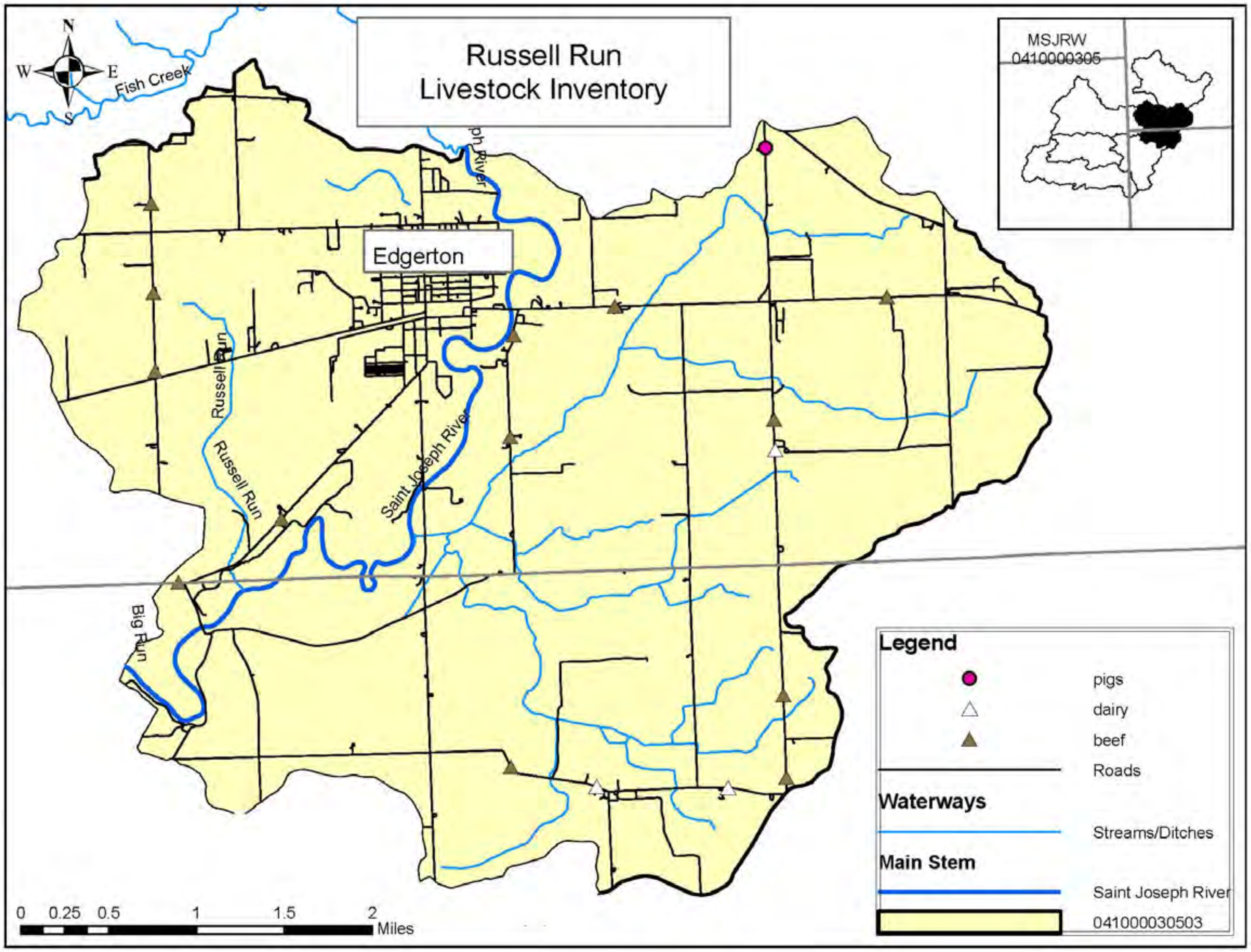
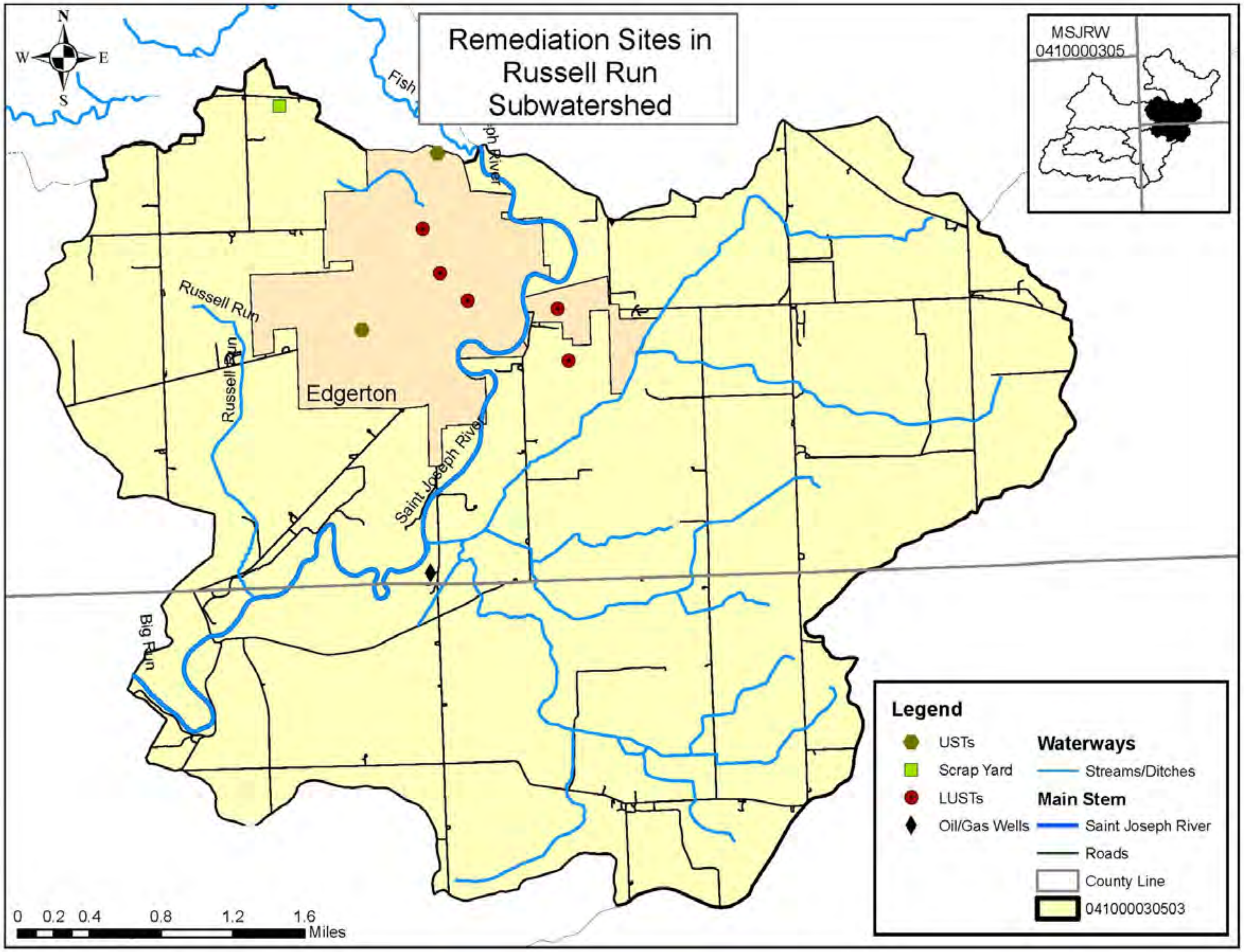


Figure 3.27: Remediation Sites in Russell Run Subwatershed



Water quality data collected in the Russell Run subwatershed indicated there is a problem with *E. coli*, nutrients, dissolved oxygen, and turbidity in the watershed. After examining the land use within the Russell Run subwatershed pollution problems may be a result of faulty septic systems as the majority of soil located within the project area is classified as either very limited or somewhat limited for septic system placement. The pollution problems identified through water quality analysis may also be a result of the number of hobby farms and animal feeding operations located within the project area, including beef and dairy cattle, and one pig farm. Improperly handled manure may runoff the land and enters streams directly from the barnyard or after being land applied as fertilizer on crop land. Pet waste left on lawns to wash into storm sewers may contribute to *E. coli*, and nutrient levels averaging higher than the target level set by this project. High turbidity and nutrient levels may also be a result of 44% of the land being in row crops and 1.67% of the soil in the watershed is classified as HEL and 28.60% of the soil is classified as PHEL by the NRCS soil survey. Another contributing factor to the surface water being turbid and containing high levels of nutrients could be a result of the inadequate riparian buffers as 72% of all parcels located adjacent to open water have less than 60 feet of vegetative riparian buffer with 58% of the buffers being less than 10 feet in width. The buffer survey also revealed that at least 3% of the parcels adjacent to a ditch were tiled, which could also account for high levels of nutrients, and turbid water as the tile provides a direct conduit for NPS to reach open water. High turbidity and nutrient levels may contribute to levels of DO that exceed the EPA recommended amount. While algae was not observed directly in the stream, it may contribute to DO levels that exceed EPA recommendations as the water level of the stream test site was very low, thus there was little flow which is good habitat for aquatic plant growth.

3.4.6 Bluff Run Subwatershed Land Use

The primary influence on water quality in the Bluff Run subwatershed is agriculture, as can be seen in Table 3.44 and Figure 3.28 below. According to Purdue University's L-THIA program, nearly 49% of the land use in Bluff Run is agriculture, with another 18.83% in grass or pasture. The southern tip of the town of Blakeslee is located in Bluff Run; however, developed areas comprise less than 5% of the total land use in Bluff Run.

Table 3.44: Land Use in Bluff Run Subwatershed

Water	Commercial	Ag.	High Density Res.	Loq Density Res.	Grass/ Pasture	Forest	Industry	Other	Total
539.9	19.8	7,408.10	117.5	551.8	2857.3	531	5.9	3142.7	15,174
3.55%	<1%	48.82%	<1%	3.64%	18.83%	3.50%	<1%	21%	100%

During the windshield survey 16 sites of particular concern were noted and three sites with exceptional riparian buffers on the banks of the ditch were noted, as can be seen in Figure 3.29. The 19 sites are categorized in Table 3.45 describing what was observed during the windshield survey.

Table 3.45: Windshield Survey Observations in Bluff Run Subwatershed

Observation	Soil Erosion	Dirt Farm	Possible Livestock Issue	Stream bank Erosion	Inadequate Riparian Buffer	Large Riparian Buffer	Unbuffered Tile Inlet
Site #	2, 4, 9, 10, 11, 15, 16, 17, 18	13	12	7, 8, 9, 11, 16, 17	5, 8, 10, 14, 16, 17	3, 6, 19	1

As is typical throughout the project area, many areas are lacking an adequate riparian buffer of at least 30 feet and soil erosion from row crop fields was observed. However, site 12 and 13 were unique to this subwatershed. Site 12 is a small dairy operation. There is a dry stack area on the property used for solid manure and a lagoon used for slurry. The slurry is pumped onto the crop fields through an irrigation system. This is an environmentally sustainable manner of handling the manure produced on site, as long as soil tests are taken from each field receiving manure every two years and the manure is applied at the proper agronomic rate. Site 13 is the location of a dirt farm. While the dirt farm is not directly adjacent to an open water source, there is still the potential for stormwater runoff to carry sediment from the site and degrade water quality by passing along compacted or over worked adjacent farm land. Several areas adjacent to open ditches were observed as being part of the OH Conservation Reserve Program where "Lake Erie Buffers", greater than 50 ft, were installed.

As can be seen in Table 3.46 and Figure 3.30, there are several historic ditches that have been tiled for the purposes of planting row crops. Because of the high percentage of tiled fields in the subwatershed, it can be expected that there are many tile inlets present in the Bluff Run subwatershed, many of which may not be properly buffered. Tiles also are a direct conduit for nutrients and pesticides to reach the surface water.

Table 3.46: Stream Buffers in the Bluff Run Subwatershed

Bluff Run Subwatershed Stream Buffer Width			
	Buffer Width	# of Parcels	% of Parcels
	0-10	71	19%
	11-20	6	1%
	21-60	47	12%
	61-140	22	6%
	141-300	22	6%
	Urban	42	11%
	Residential	14	4%
	Tiled	156	41%
	TOTAL	380	100%

Figure 3.28: Land Use in the Bluff Run Subwatershed

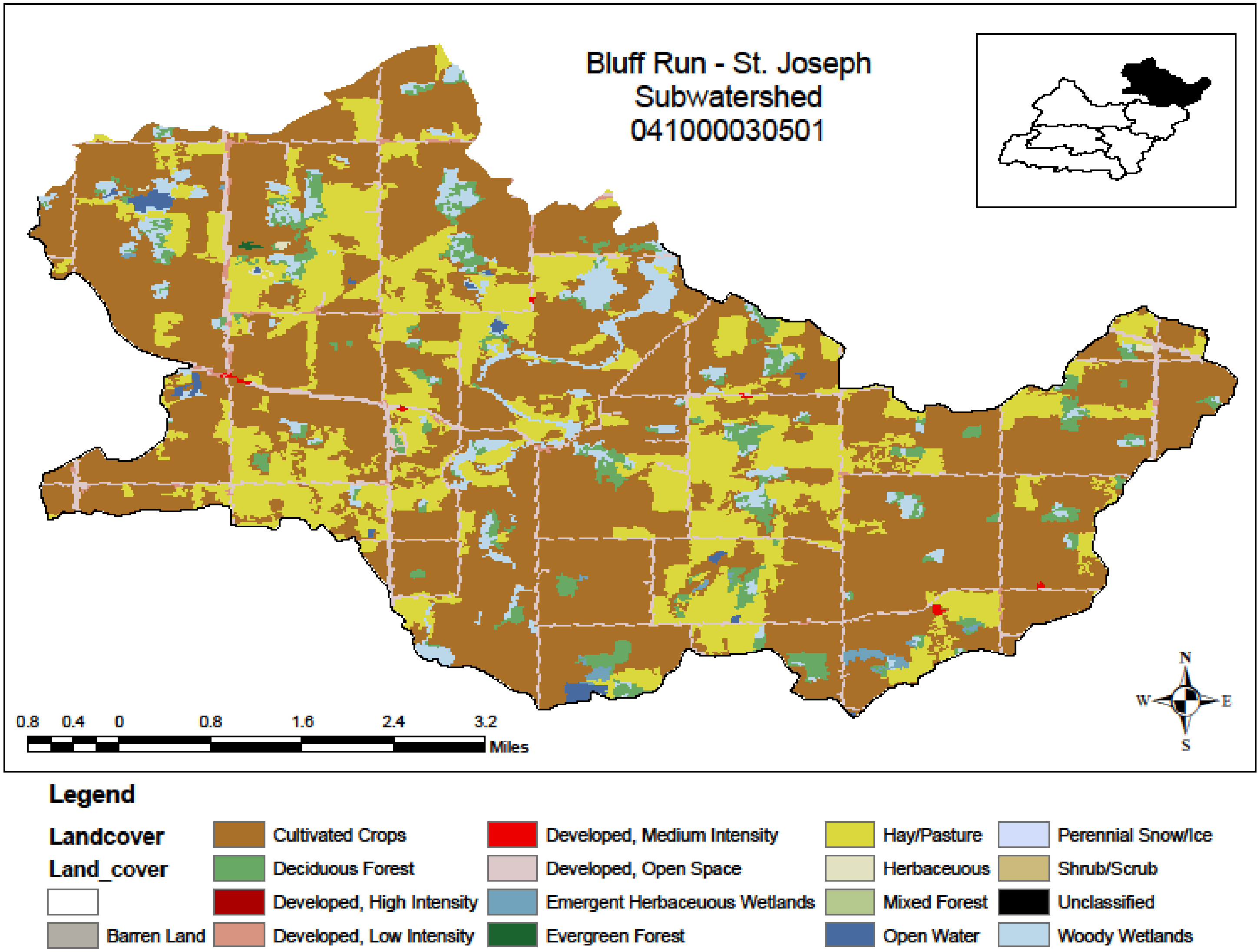


Figure 3.29: Windshield Survey Sites in the Bluff Run Subwatershed

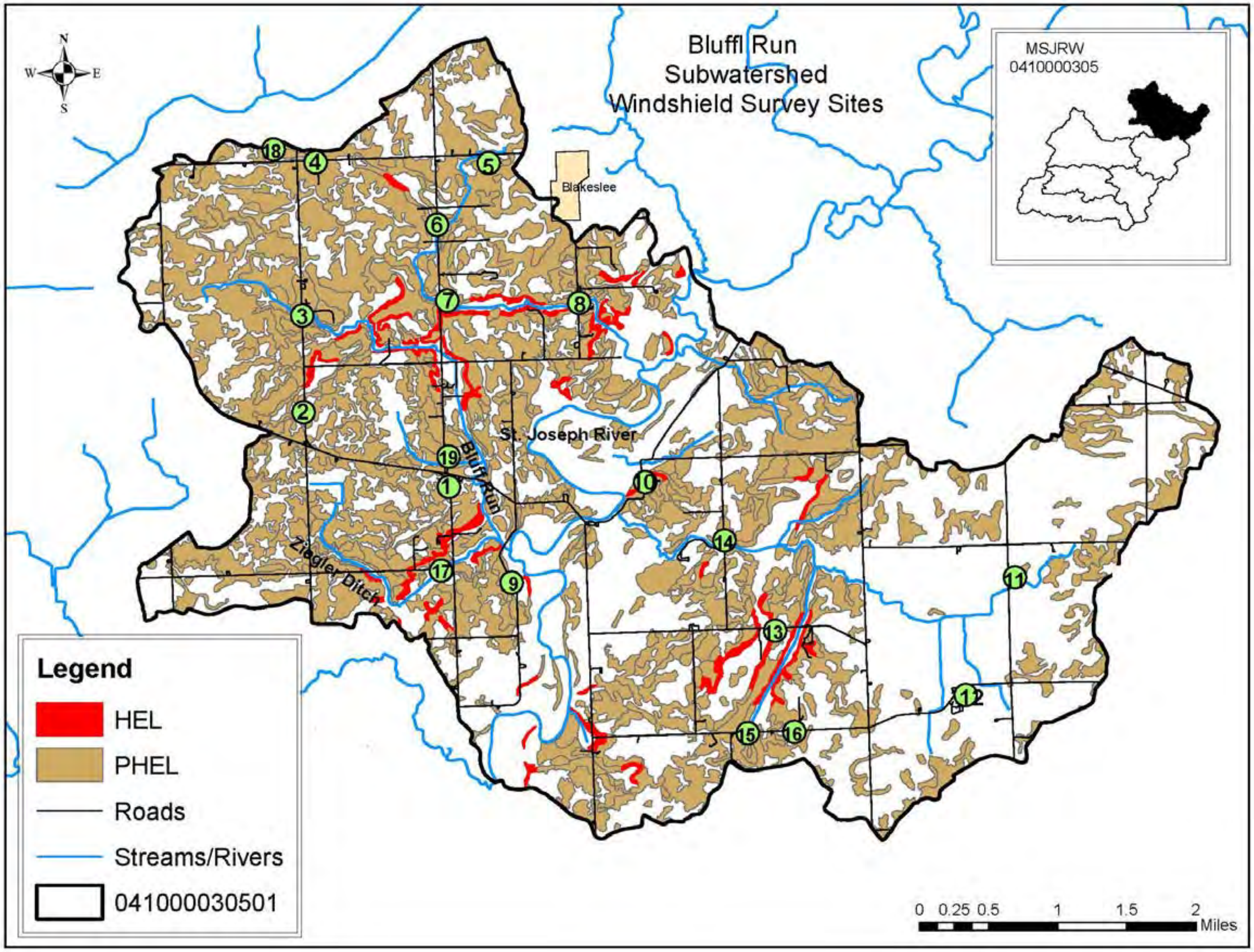
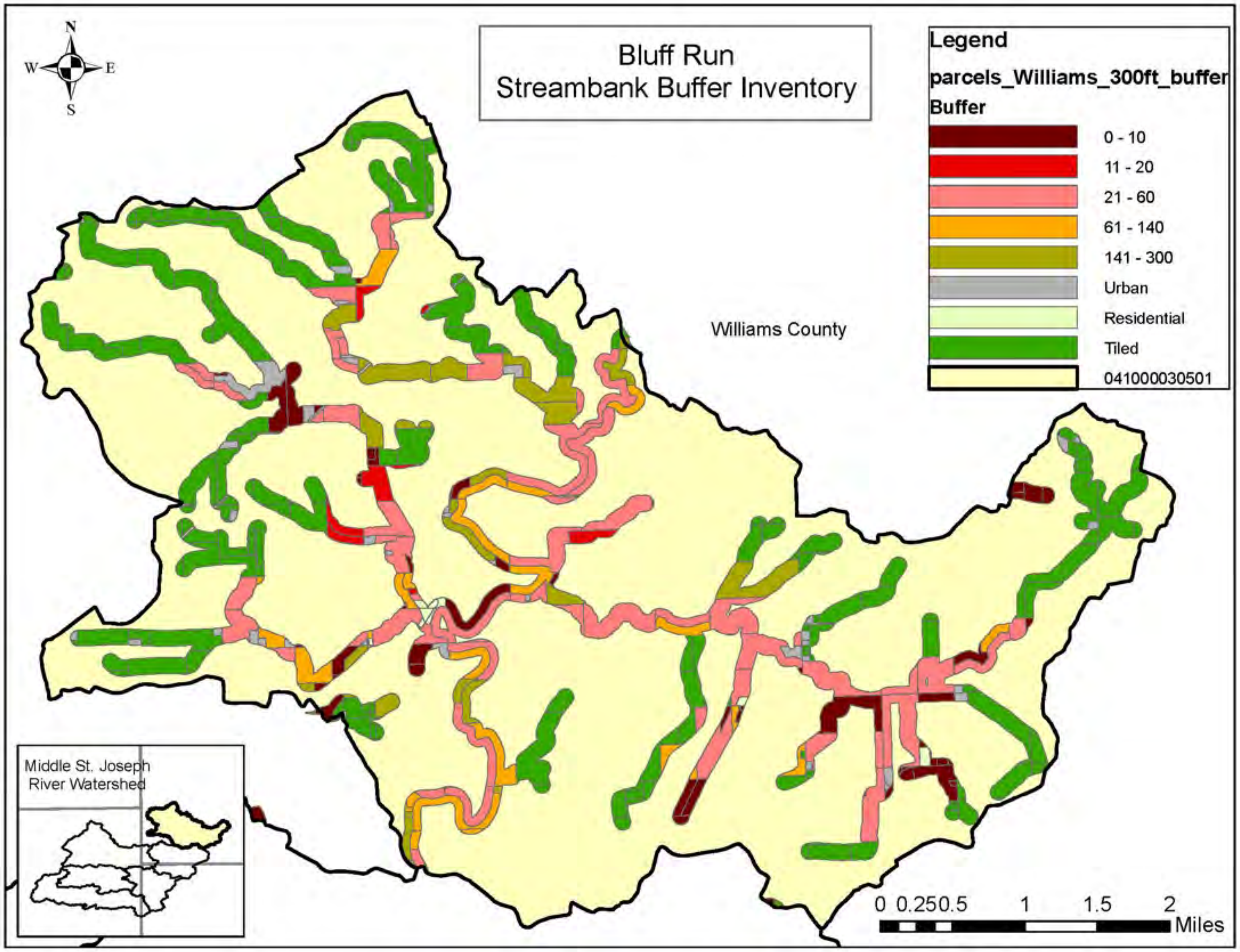


Figure 3.30: Bluff Run Stream Buffer Width



The Livestock inventory conducted in 2009 revealed several small hobby farms located within the Russell Run subwatershed; many of which are beef cow farms. As can be seen in Figure 3.31 the investigators found 10 beef cow farms, seven horse farms, three swine farm, one goat farm, and one sheep farm. No additional livestock operations were found during the windshield survey. There are no NPDES permitted CFOs located within Russell Run Subwatershed.

There are several remediation sites in Bluff Run; all of which are gas and/or oil wells. Gas/Oil wells pose a threat to both ground and surface water as there is the chance for the well, or the equipment used to extract the liquid, to leak or fail. If there is a failure groundwater, which is the primary drinking water source for residents in the MSJRW, may become contaminated, or the gas and/or oil may flow to surface water and decrease water quality and effect aquatic life. Figure 3.32 shows the location of each of the water quality threats.

Table 3.47: Potential Water Quality Threats in Willow Run

Type of Threat	Potential Contaminant	Number in Watershed
Gas/Oil Well	Oil/Gas	6

Figure 3.31: Livestock Inventory in the Bluff Run Subwatershed

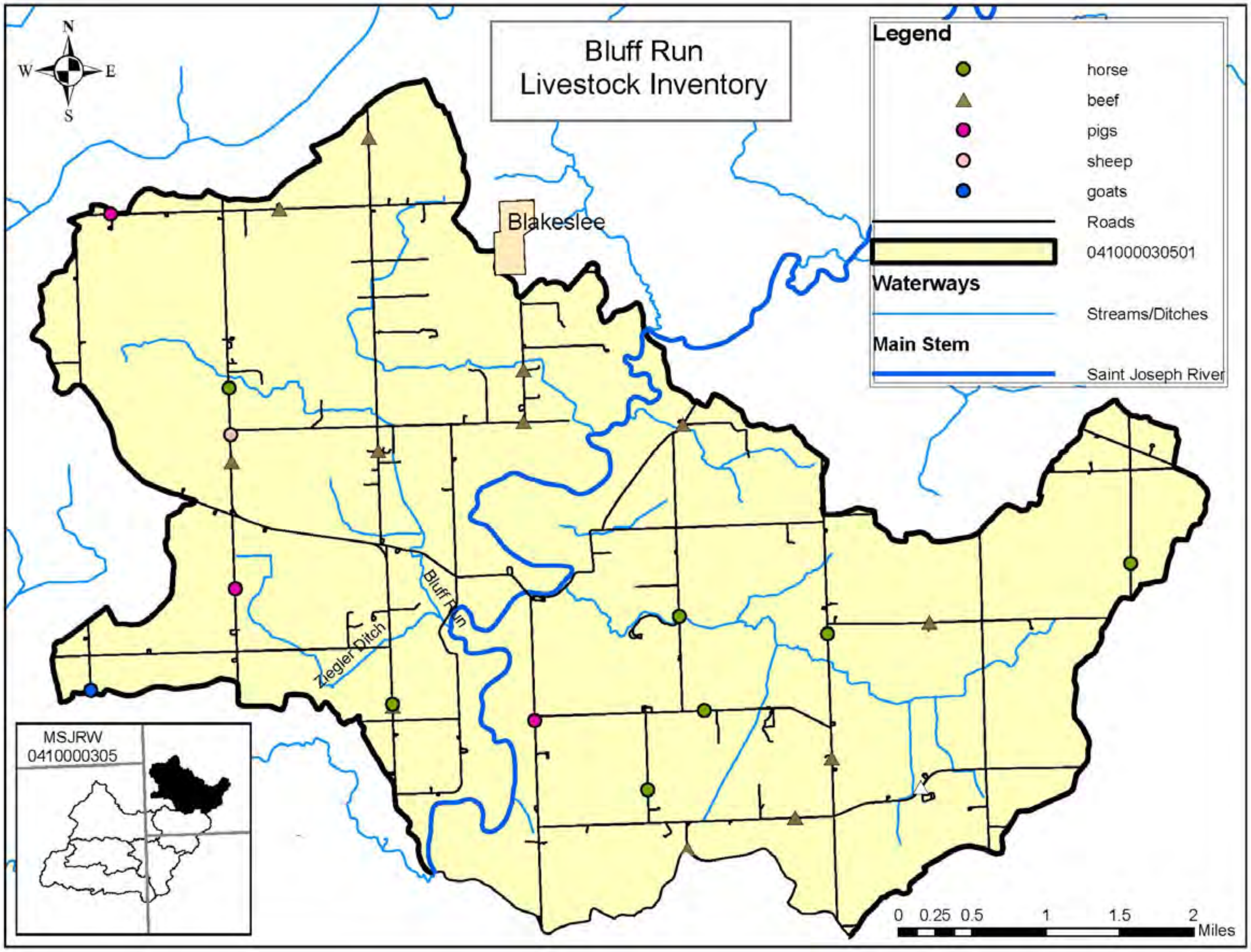
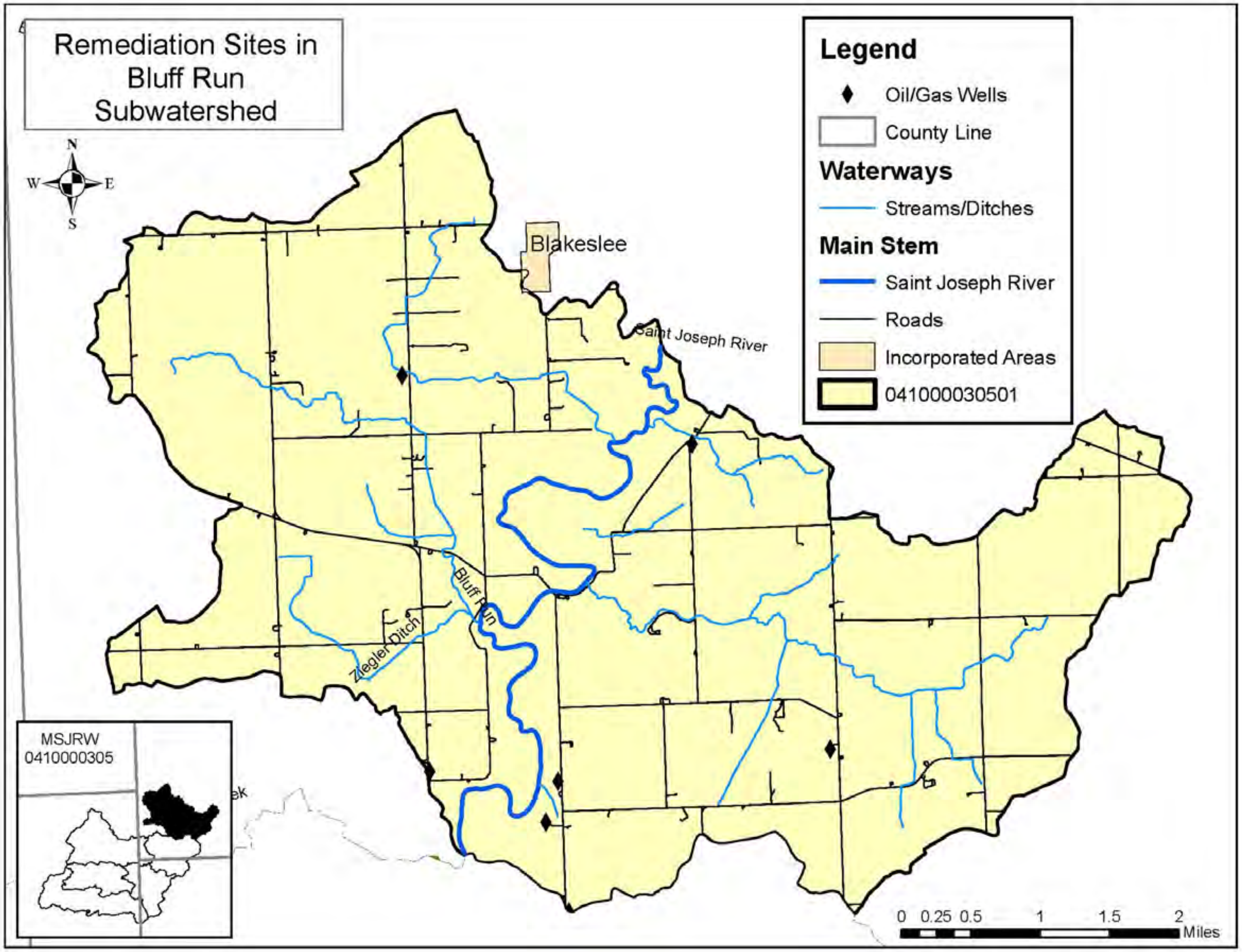


Figure 3.32: Remediation Sites in Bluff Run Subwatershed



Water quality data collected in the Bluff Run subwatershed indicated there is a problem with *E. coli*, nitrogen and phosphorus, and turbidity in the watershed. After examining the land use within the Bluff Run subwatershed pollution problems may a result of faulty septic systems as the majority of soil located within the project area is classified as either very limited or somewhat limited for septic system placement. The pollution problems identified through water quality analysis may also be a result of the number of hobby farms and animal feeding operations located within the project area, including beef cattle, horses, pigs, sheep, and goats. Improperly handled manure may runoff the land and enters streams directly from the barnyard or after being land applied as fertilizer on crop land. High turbidity and nutrient levels may also be a result of 49% of the land being in row crops and 1.73% of the soil in the watershed is classified as HEL and 44.15% of the soil is classified as PHEL by the NRCS soil survey. Another contributing factor to the surface water being turbid and containing high levels of nutrients could be a result of the inadequate riparian buffers as 32% of all parcels located adjacent to open water have less than 60 feet of vegetative riparian buffer with 19% of the buffers being less than 10 feet in width. However, a more likely source of nutrients and sediments entering the streams may be from tiles discharging directly to open water. The buffer inventory revealed that 41% of all parcels adjacent to open water within the Bluff Run subwatershed had field tiles in place.

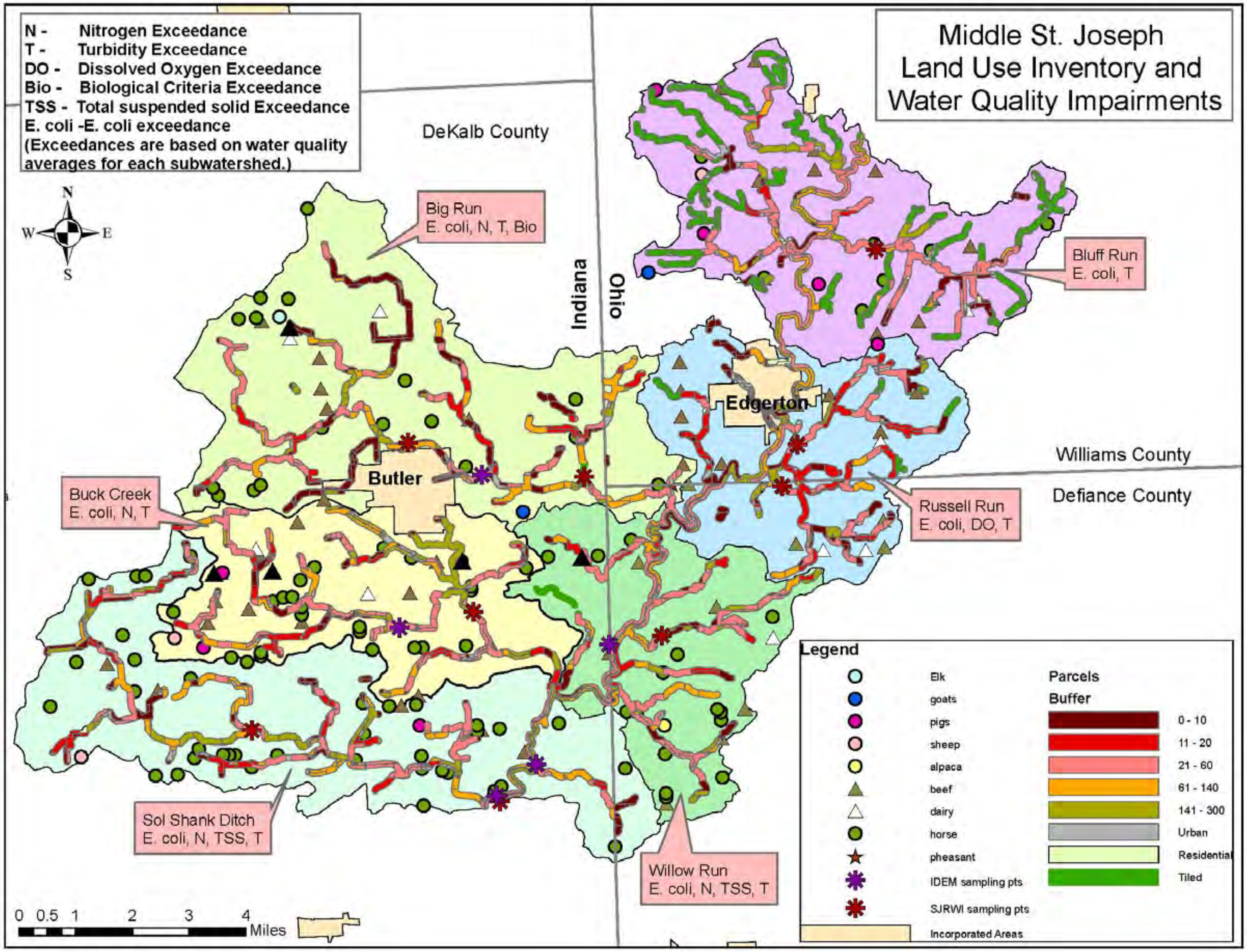
3.5 Watershed Inventory Summary

To better understand the water quality problems in the Middle St. Joseph River project area and what influences may be contributing to those problems, a map was developed outlining the water quality issues in each subwatershed as well as showing the results of the land use inventory (Figure 3.33). As can be seen in the figure, *E. coli* and turbidity levels were elevated in every subwatershed located within the project area, and nitrogen levels exceeded the target level in Big Run, Buck Creek, Sol Shank Ditch, and Willow Run. DO exceeded the state standard in Russell Run and biological data, specifically fish tissue samples, exceeded the IDEM standard in the Big Run subwatershed. Finally, total suspended solids exceeded the target level for this project in Sol Shank Ditch and Willow Run.

After examining water quality and land uses throughout the project area it can be determined that the problems and concerns contributing to water quality impairments within the MSJRW are fairly homogenous throughout the watershed.

Land uses throughout the watershed are primarily row crops, and few pasture fields. The soils within the project area are ideal for row crops as they are nutrient rich soils, however much of the land is classified as either HEL or PHEL, which means special precautions will need to be taken by landowners to prevent excessive soil erosion contributing to high turbidity and TSS levels. The buffer survey revealed inadequate buffer widths throughout the watershed, and that Bluff Run has the most fields that are tiled than in the other subwatersheds. When the buffer survey was ground truthed, it was discovered that most tiled fields also lack an adequate buffer at the tile inlet locations. The livestock inventory revealed that the watershed is scattered with small unregulated and/or hobby farms housing animals including horses, cattle, pigs, sheep, goats, and many other less common animals as well as five regulated confined feeding operations. Adequate manure storage and disposal was not easily observed at all animal operations, therefore manure runoff may be an issue throughout the watershed as well. The land use inventory also revealed that the majority of the project area is not on a centralized sewer system, meaning that most residences use an on-site sewage treatment system. Local health departments estimate that over half of all septic systems in the project area are inadequately installed or faulty, which may be a major contributor for the NPS problems found in the watershed.

Figure 3.33: Water Quality Concerns and Land Use Inventory Summary for the MSJRW



3.6 Analysis of Stakeholder Concerns

Stakeholders in the Middle St. Joseph River Watershed project area expressed concerns regarding water quality and land uses during the public meeting held in late 2010 and additional concerns were raised after performing the watershed inventory. These concerns are outlined in Table 3.48 as well as whether or not the concerns are supported by the collected data, quantifiable, outside the scope of this project, and whether or not the steering committee would like to focus on the concerns. The steering committee does not feel that most of the concerns listed in Table 3.48 are outside the scope of the project and wants to focus on those concerns. Some concerns will be addressed through education alone, while others will be addressed by implementing best management practices as well as an education and outreach program. There were three concerns voiced by local stakeholders that will not be addressed in the WMP. These concerns include log jams, industrial discharge and runoff, and fish consumption advisories. Log jams will not be addressed by this project as this is a problem that is typically addressed by the local surveyors office and often requires the acquisition of permits through the county, state and federal oversight agencies. Industrial discharge and runoff will not be a focus of this project as the MSJRW steering committee wants to put all its efforts on NPS pollution prevention and industrial facilities are point sources of pollution regulated by the state oversight agency. Finally, the concern related to the fish consumption advisory is outside the scope of this project as most fish are listed due to mercury and PCBs in fish tissue which is mostly due to particles from the air containing mercury and PCBs depositing in the open water.

Table 3.48: Analysis of Stakeholder Concerns

Concerns	Supported by Data?	Evidence	Able to Quantify?	Outside Scope?	Group Wants to Focus On?
Unregulated animal operations (those that fall below the CFO/CAFO level)	Yes	189 locations were found during the 2009 livestock inventory.	Yes	No	Yes
Stormwater Runoff From Barnyards	Yes	189 locations with livestock present were seen during the 2009 livestock inventory and adequate manure storage could not be identified during the survey	Yes	No	Yes
Combined Sewer Overflow	Yes	Butler, Indiana has one CSO which discharges to Big Run and discharges approximately 12 times annually.	Yes	No	Yes
Land Conversion/Increase in impervious surfaces	Yes	The SDI complex has grown significantly over the past decade. A highway was constructed to bypass the town of Butler and give direct access to the SDI complex. The 2001 Butler Comprehensive Plan encourages development and growth of the town, including increasing industrialization.	No	No	Yes

Concerns	Supported by Data?	Evidence	Able to Quantify?	Outside Scope?	Group Wants to Focus On?
Pesticides	Yes	It is common knowledge that ag. producers routinely apply pesticides on crop land annually, each spring. Water quality data collected indicates the presence of pesticides in the water system.	Yes	No	Yes
Lack of Riparian Buffers and Stream Bank Wildlife Corridors	Yes	Nearly 35% of the parcels adjacent to a stream/ditch have less than 20 feet of riparian buffer and over 58% of the parcels have a riparian buffer less than 60 feet.	Yes	No	Yes
Livestock with Direct Access to Open Water	Yes	One site was located during the 2011 windshield survey and several locations were identified during the 2009 livestock inventory where the pasture and/or barnyard were directly adjacent to open water.	Yes	No	Yes
Log Jams	No	There were no significant log jams observed during the windshield survey. Though, steering committee members indicated that historically log jams have been present in the watershed.	No	Yes	No
Industrial Discharge	Yes	There are five facilities located within the project area that have NPDES permits.	Yes	Yes	No
Lack of Proper Management of Land Classified as PHEL or HEL	Yes	The desktop survey revealed a large portion of the project area is comprised of soil on PHEL or HEL and the majority of the land use in the project area is agriculture. The Windshield survey revealed 26 areas of significant field soil erosion, and 35 areas with no riparian buffer.	No	No	Yes

Concerns	Supported by Data?	Evidence	Able to Quantify?	Outside Scope?	Group Wants to Focus On?
Water Contact is Unhealthy	Yes	E. coli exceeded the state standard in all Subwatersheds within the MSJRW.	Yes	No	Yes
Fish Consumption from Local Waterways is Unhealthy	Yes	All waters in Indiana are on the Fish Consumption Advisory for the consumption of Carp and the St. Joseph River in Ohio is listed for the consumption of Channel Catfish.	Yes	Yes	No
Endangered and Threatened Species That Rely on Water Resources as Their Habitat	Yes	There are 8 species of plants and animals federally listed as endangered or threatened.	Yes	No	Yes
Failing Septic Systems	Yes	The desktop survey revealed that nearly the entire watershed is classified as "Very Limited" for the placement of septic systems. Local Health Departments have determined significant septic system failure (Williams County - 2087; DeKalb County - 2204)	Yes	No	Yes
Nutrients	Yes	Water quality analysis of the Middle St. Joseph River Watershed revealed high levels of nitrogen in all subwatersheds except Bluff and Russell Run. All subwatersheds showed Phosphorus readings measuring higher than the target level during historic or 2011 water quality sampling.	Yes	No	Yes

4.0 Pollution Sources and Loads

4.1 Potential Causes of Water Quality Problems

In this section concerns identified by stakeholders in the watershed and through the watershed inventory will be linked to problems found through the watershed investigation. Additionally, potential causes for the problems identified will be expressed. Finally, potential sources will be identified. Table 4.1 shows the connection between stakeholder concerns, problems found in the watershed, and the potential causes of those problems. Table 4.2 takes it a step further by identifying potential sources to the problems found in the watershed.

Table 4.1: Concerns, Problems, and Potential Causes

Concern(s)	Problem	Potential Cause(s)
- Unregulated Animal Operations - Stormwater Runoff from Barnyards - Combined Sewer Overflows - Water Contact is Unhealthy - Failing Septic Systems - Livestock Access to Open Water	High levels of E. coli were discovered in area streams after reviewing historic and current water quality data.	- *E. coli* levels exceed the state standard. - Area producers are unaware of the water quality threat of not having adequate manure storage. - Stakeholders are unaware of proper septic system maintenance. - Excessive stormwater reaching open water through one CSO in Butler.
- Unregulated Animal Operations - Stormwater Runoff From Barnyards - Combined Sewer Overflows - Water Contact is Unhealthy - Failing Septic Systems - Landowners farming PHEL and HEL - Lack of Riparian Buffers and Wildlife Corridors	Area streams have nutrient levels exceeding the target level of this project.	- Nitrogen levels exceed the target level set by this project. - Phosphorus levels exceed the target level set by this project.
– Failing Septic Systems	Historic design and lack of maintenance of septic systems is an issue in the watershed.	– Nutrient and *E. coli* levels exceed targets set by this project. – Most of the soil in the watershed are rated as “very limited” for septic system placement. – Lack of education and outreach concerning septic system placement and maintenance.

Concern(s)	Problem	Potential Cause(s)
– Landowners Farming PHEL and HEL – Lack of Riparian Buffers and Wildlife Corridors – Stormwater Runoff From Barnyards – Pesticides	Landowners lack the knowledge of the cumulative effects of utilizing BMPs and/or the funds to install farming practices to limit NPS runoff.	– Turbidity and TSS exceed target levels set by this project. – Nutrient levels exceed target levels set by this project. – E. coli levels exceed target levels set by this project. – Pesticide levels increase during the spring application months. – Lack of education and outreach on the cumulative effects of utilizing BMPs
– Landowners Farming PHEL and HEL – Lack of Riparian Buffers and Wildlife Corridors – Stormwater Runoff from Barnyards – Combined Sewer Overflows – Land Conversion/Increase in Impervious Surfaces – Livestock Access to Open Water	Area streams are turbid.	– Turbidity and TSS exceed target levels set by this project.
- Unregulated Animal Operations - Stormwater Runoff From Barnyards - Combined Sewer Overflows - Water Contact is Unhealthy - Failing Septic Systems - Lack of Proper Management of Land Classified at PHEL or HEL - Lack of Riparian Buffers and Stream Bank Wildlife Corridors	Sections of the St. Joseph River and its tributaries are listed on the IN or OH 303(d) list.	– Turbidity and TSS exceed target levels set by this project. – Nutrient levels exceed target levels set by this project. – E. coli levels exceed target levels set by this project. – Pesticide levels increase during the spring application months. – D.O. levels exceed the target level set by this project.
– Endangered and Threatened Species that Rely on Water Resources as their Habitat - Lack of Riparian Buffer and Stream Bank Wildlife Corridors	There are eight (8) endangered and/or threatened species on the Federal Endangered Species list.	– Nutrient levels and dissolved oxygen levels exceed target levels and state standards, respectively thus lowering the quality of the water habitat. – Turbidity and TSS exceed target levels set by this project. – Land conversion and lack of forested areas. – Lack of riparian buffer.
– Combined Sewer Overflows	CSO's discharge untreated sewage directly into the St. Joseph River.	– Turbidity exceeds target level . – E. coli exceeds target level . – Nitrogen exceeds target level . – Inadequate Infrastructure

4.2 Potential Sources Resulting in a Water Quality Problem

Now that stakeholder concerns have been linked to water quality problems and potential causes of those problems, and a thorough watershed inventory has been conducted, sources to the problems can be outlined. Outlining the sources to the problems found in the watershed will help to narrow the land area of where to focus efforts which will have the greatest impact on improving water quality.

Table 4.2: Problems, Potential Causes, and Potential Sources

Problem	Potential Cause(s)	Potential Source(s)
High levels of *E. coli* were discovered in area streams after reviewing historic and current water quality data.	- *E. coli* levels exceed the state standard. - Area producers are unaware of the water quality threat of not having adequate manure storage. - Stakeholders are unaware of proper septic system maintenance. - Excessive stormwater reaching open water through one CSO in Butler.	- The City of Butler has one CSO which discharges into Big Run approximately 12 times annually (Big Run subwatershed). - Improperly placed and/or faulty septic systems throughout project area. - Livestock with direct access to open water or where the barnyard is directly adjacent to open water or with direct discharge (three locations in Willow Run subwatershed and one in Sol Shank Ditch). - 5,921 head of livestock counted during the 2009 livestock inventory. - 3 CFOs in Buck Creek, 1 CFO in Willow Run, and 1 CAFO in Big Run. - 15 possible livestock issues were found throughout the project area during the windshield survey. - Pet waste in urban areas predominately in Big Run, Buck Creek and Bluff Run. - According to County Health Departments, up to 4,291 septic systems are currently failing within the project area. - Edgerton WWTP discharges into the St. Joseph River in Russell Run.
Area streams have nutrient levels exceeding the target level of this project.	- Nitrogen levels exceed the target level set by this project. - Phosphorus levels exceed the target level set by this project.	- Lack of proper management of PHEL and HEL (57.6% and 3.5% of soils in the project area, respectively) on agricultural land throughout the project area. - 64% of parcels located throughout the project area lack a 60 foot riparian buffer which can filter polluted runoff from crop fields. - The City of Butler has one CSO which discharged into Big Run approximately 12 times annually. - Improperly placed and/or faulty septic systems throughout the project area (up to

Problem	Potential Cause(s)	Potential Source(s)
		4,291 failing systems). - Livestock with direct access to open water or where the barnyard is directly adjacent to open water or with direct discharge (three locations in Willow Run subwatershed and one in Sol Shank Ditch). - 15 possible livestock issues were found during the windshield survey. - 5,921 head of livestock counted during the 2009 Inventory. - 3 CFOs in Buck Creek, 1 CFO in Willow Run, and 1 CAFO located in Big Run. - While not all field tiles were identified during the buffer inventory, it was found that 8,592 acres of crop fields are tiled. - Edgerton WWTP discharges into the St. Joseph River in Russell Run.
Historic design and lack of maintenance of septic systems is an issue in the watershed.	− Nutrient and *E. coli* levels exceed targets set by this project. − Most of the soil in the watershed are rated as “very limited” for septic system placement. − Lack of education and outreach concerning septic system placement and maintenance.	− 87% of soil in the project area is classified as very limited and 12% is classified as somewhat limited for the placement of septic systems yet septic systems are installed throughout the project area. − Lack of education and outreach on proper septic system maintenance throughout the project area. − According to County Health Departments, up to 4291 septic systems are currently failing within the project area.
Landowners lack the knowledge of the cumulative effects of utilizing BMPs and/or the funds to install farming practices to limit NPS runoff.	− Turbidity and TSS exceed target levels set by this project. − Nutrient levels exceed target levels set by this project. − E. coli levels exceed target levels set by this project. − Pesticide levels increase during the spring application months. − Lack of education and outreach on the cumulative effects of utilizing BMPs	− Lack of Education and Outreach activities.
Area streams are turbid.	− Turbidity and TSS exceed target levels set by this project.	− The City of Butler has one CSO which discharges into Big Run approximately 12 times annually. − According to County Health Departments, up to 4291 septic systems are currently failing

Problem	Potential Cause(s)	Potential Source(s)
		within the project area. – Livestock with direct access to open water or where the barnyard is directly adjacent to open water or with direct discharge (three locations in Willow Run subwatershed and one in Sol Shank Ditch). – 5,921 head of livestock counted during the 2009 livestock inventory. – 3 CFOs in Buck Creek, 1 CFO in willow Run and 1 CAFO located in Big Run. – 15 possible livestock issues found during the windshield survey. – Over 61% of soil in the project area is classified as PHEL or HEL. – 64% of the parcels located along an open ditch in the project area have a riparian buffer that is less than 60 feet wide. – More than 65% of corn and 35% of beans grown in the watershed are conventionally tilled. – 2 quarries found in Willow Run. – 20 locations found during the windshield survey with significant stream bank erosion scattered throughout the project area. – While not all field tiles were identified during the buffer inventory, it was found that 8,592 acres of crop fields are tiled. – Edgerton WWTP discharges into the St. Joseph River in Russell Run.
Sections of the St. Joseph River and its tributaries are listed on the IN or OH 303(d) list.	– Turbidity and TSS exceed target levels set by this project. – Nutrient levels exceed target levels set by this project. – E. coli levels exceed target levels set by this project. – Pesticide levels increase during the spring application months. – D.O. levels exceed the target level set by this project.	– The City of Butler has one CSO which discharges into Big Run approximately 12 times annually. – Improperly placed and/or faulty septic systems throughout the project area. – Livestock with direct access to open water or where the barnyard is directly adjacent to open water or with direct discharge (three locations in Willow Run subwatershed and one in Sol Shank Ditch). – 5,921 head of livestock counted during the 2009 livestock inventory. – Over 61% of soil in the project area is

Problem	Potential Cause(s)	Potential Source(s)
		classified as PHEL or HEL. − 15 possible livestock issues were found during the windshield survey. − 64% of the parcels located along an open ditch in the project area have a riparian buffer that is less than 60 feet wide. − More than 65% of corn and 35% of beans grown in the watershed are conventionally tilled. − According to County Health Departments, up to 4291 septic systems are currently failing within the project area. − 2 quarries found in Willow Run. − 20 locations found during the windshield survey with significant stream bank erosion scattered throughout the project area. − 4 sites were found during the windshield survey in Sol Shank Ditch with industrial runoff issues. − 2 remediation sites were identified during the windshield survey in Big Run. − 5 NPDES facilities are located in the project area (Big Run-2, Russell Run-2, Willow Run-1). − While not all field tiles were identified during the buffer inventory, it was found that 8,592 acres of crop fields are tiled. − 45 remediation sites were identified during the landuse inventory (big Run-21, Buck Creek-3, Willow Run-2, Sol Shank Ditch-4, Russell Run-9, and Bluff Run-6).
There are eight (8) endangered and/or threatened species on the Federal Endangered Species list.	− Nutrient levels and dissolved oxygen levels exceed target levels and state standards, respectively thus lowering the quality of the water habitat. − Turbidity and TSS exceed target levels set by this project. − Land conversion and lack of forested areas. − Lack of riparian buffer.	− 64% of the parcels located along an open ditch in the project area have a riparian buffer that is less than 60 feet wide. − Only 8.2% of the watershed is classified as forest. The rest is water or in some other land use. − 20 sites were found during the windshield survey with significant stream bank erosion. − 2 locations were found during the windshield survey where livestock had direct access to open water causing soil erosion and increased sedimentation. − The buffer inventory revealed that 64% of the parcels in the project area have a stream buffer of less than 60 feet and 47% of the parcels have less than a 20 foot buffer.

Problem	Potential Cause(s)	Potential Source(s)
		− Only 8.2% of the watershed is forested. − The area has lost nearly 80% of its historic wetlands and only 5% of the project area is designated wetland by the NWI.
CSO's discharge untreated sewage directly into the St. Joseph River.	− Turbidity exceeds target level set by this project. − E. coli exceeds target level set by this project. − Nitrogen exceeds target level set by this project. − Inadequate Infrastructure	− The City of Butler has one CSO which discharges into Big Run approximately 12 times annually. − There is a lack of education and outreach in urban areas regarding stormwater management (primarily in Big Run, Buck Creek, Sol Shank Ditch (along industrial areas) and Russell Run subwatersheds) .

4.3 Pollution Loads and Necessary Load Reductions

After close review of historic water quality data from the SJRWI and IDEM, and current water quality data from the SJRWI it was decided that, for consistency of parameters measured in each of the subwatersheds, pollution loads and subsequent load reductions would be based on data collected by the SJRWI in 2011 only, which was funded through the 319 grant used for this project. Current pollution loads were determined for the St. Joseph River and its tributaries, and when compared to the water quality targets set by the MSJRW steering committee and outlined in Section 3, provides detail on how much pollution loads will need to be reduced to meet the targets set by this project.

Pollution loads and load reductions were analyzed for nitrate+nitrite, total phosphorus, and total dissolved solids only, as turbidity and *E.coli* loads cannot be accurately determined, and loads determined for the other parameters measured by the SJRWI would not be useful to this project. However, it is important to note that *E. coli* is a major concern of the MSJRW steering committee. Loads were determined by using the following equation; cfs * (X * 0.001) * 984.2589781, where cfs equals the average flow of the stream measured in cubic feet per second, X equals the average parameter measurement in mg/l, and 984.2589781 is a conversion factor. Table 4.3 is a reminder of the target concentrations for each of the parameters of concern that were set by this project's steering committee. Table 4.4 through Table 4.6 show the current and target loads and load reductions needed for nitrate + nitrite, total phosphorus, and total dissolved solids. TDS was used as an indicator for turbidity since turbidity loads cannot accurately be measured. As can be seen in the following tables, load reductions were only needed for nitrate+nitrite to reach water quality targets with the largest reduction needed in Willow Run which has a necessary load reduction of over 31 tons/year. Big Run and Bluff Run also need significant reductions totaling over 21 tons/year of combined excess nitrate+nitrite and Sol Shank Ditch and Russell Run need a combined reduction of over 17 tons/year for nitrate+nitrite. No reductions for nitrate+nitrite were needed in the Buck Creek subwatershed.

Table 4.3: Target Concentrations for Parameters of Concern

Parameter of Concern	Target Concentration
Nitrate+Nitrite	<1.6 mg/l
Total Phosphorus	<0.3 mg/l
Turbidity	< 10 NTU
E. coli	<235 cfu/100 ml
Total Dissolved Solids	< 750 mg/l

Table 4.4: Nitrate+Nitrite Pollution Load Reductions to Meet Target Load

			2010 Load		Target Load	Reduction Needed
Subwatershed	**Site**	**Mean CF/S**	**Nitrate + Nitrite**	**N (Tons)**	**Nitrate + Nitrite (Tons)**	**Nitrate + Nitrite (Tons)**
Sol Shank	123	5.789	1.181167	6.730142	9.116600359	0
Big Run	127	5.007	3.043448	14.99867	7.8850955	7.113578379
Willow Run	156	12.792	4.124706	51.93269	20.145025	31.78766685
Sol Shank	157	9.379	2.490250	22.98841	14.770184	8.218222581
Buck Creek	158	3.060	1.274833	3.839583	4.818932	0
Big Run	159	12.863	2.148833	27.20535	20.256837	6.948513125
Russell Run	160	2.649	1.181167	3.079659	4.1716833	0
Russell Run	161	7.058	2.912609	20.23360	11.11504	9.118563076
Bluff Run	162	14.649	2.099107	30.26578	23.069456	7.196328877
	Total			181.2739	115.3488532	65.92504192

Table 4.5: Phosphorus Load Reductions to Meet Target Load

			Current Load		Target Load	Necessary Reduction
Subwatershed	**Site**	**Mean CF/S**	**TP**	**TP (Tons)**	**Phosphorus**	**Phosphorus Reduction**
Sol Shank	123	5.789	0.091933	0.523823	1.709362567	0
Big Run	127	5.007	0.092733	0.457005	1.478455411	0
Willow Run	156	12.792	0.176588	2.223356	3.777192254	0
Sol Shank	157	9.379	0.141300	1.304392	2.769409487	0
Buck Creek	158	3.060	0.086933	0.261828	0.903549742	0
Big Run	159	12.863	0.084800	1.073612	3.798156971	0
Russell Run	160	2.649	0.209259	0.545601	0.78219061	0
Russell Run	161	7.058	0.142783	0.991899	2.08406996	0
Bluff Run	162	14.649	0.164964	2.378519	4.325522931	0
	Total			9.760035	21.62791	0

Table 4.6: Total Dissolved Solids Loads Reductions to Meet Target Load

Subwatershed	Site	Mean CF/S	2010 Load TDS	2010 Load TDS (Tons)	Target Load TDS (Tons)	Necessary Reduction TDS (Tons)
Sol Shank	123	5.789	540.013	3076.92669	4273.406418	0.00000
Big Run	127	5.007	625.3267	3081.72548	3696.138528	0.00000
Willow Run	156	12.792	359.265	4523.37658	9442.980636	0.00000
Sol Shank	157	9.379	365.02	3369.63284	6923.523717	0.00000
Buck Creek	158	3.060	411.073	1238.08301	2258.874355	0.00000
Big Run	159	12.863	399.51	5058.00564	9495.392426	0.00000
Russell Run	160	2.649	407.433	1062.30089	1955.476525	0.00000
Russell Run	161	7.058	386.996	2688.42246	5210.174901	0.00000
Bluff Run	162	14.649	393.043	5667.05503	10813.80733	0.00000
	Total			29765.52862	54,069.774836	0.00000

Even though load reductions cannot be determined for turbidity and *e. coli* it is important to understand the magnitude of the problem each of these parameters pose to the health of the watershed. Therefore, Table 4.7 shows the average concentration of turbidity and E. coli per sample site and an overall average for the entire project area.

Table 4.7: Average Concentration of Turbidity and *E. coli*

Subwatershed	Site	Average Turbidity (NTU)	Average E. coli (cfu)
Big Run	159	29.02	639.33
Big Run	127	25.32	761.33
Buck Creek	158	28.12	334.67
Sol Shank Ditch	157	40.6	424
Sol Shank Ditch	123	31.27	487.33
Willow Run	156	95.23	881.18
Russel Run	160	55.61	1839.7
Russel Run	161	66.32	1704.39
Bluff Run	162	45.01	1808.96
Project Area Average		46.28	986.77

5.0 Critical Areas and Project Goals

5.1 Critical Areas to Focus Implementation

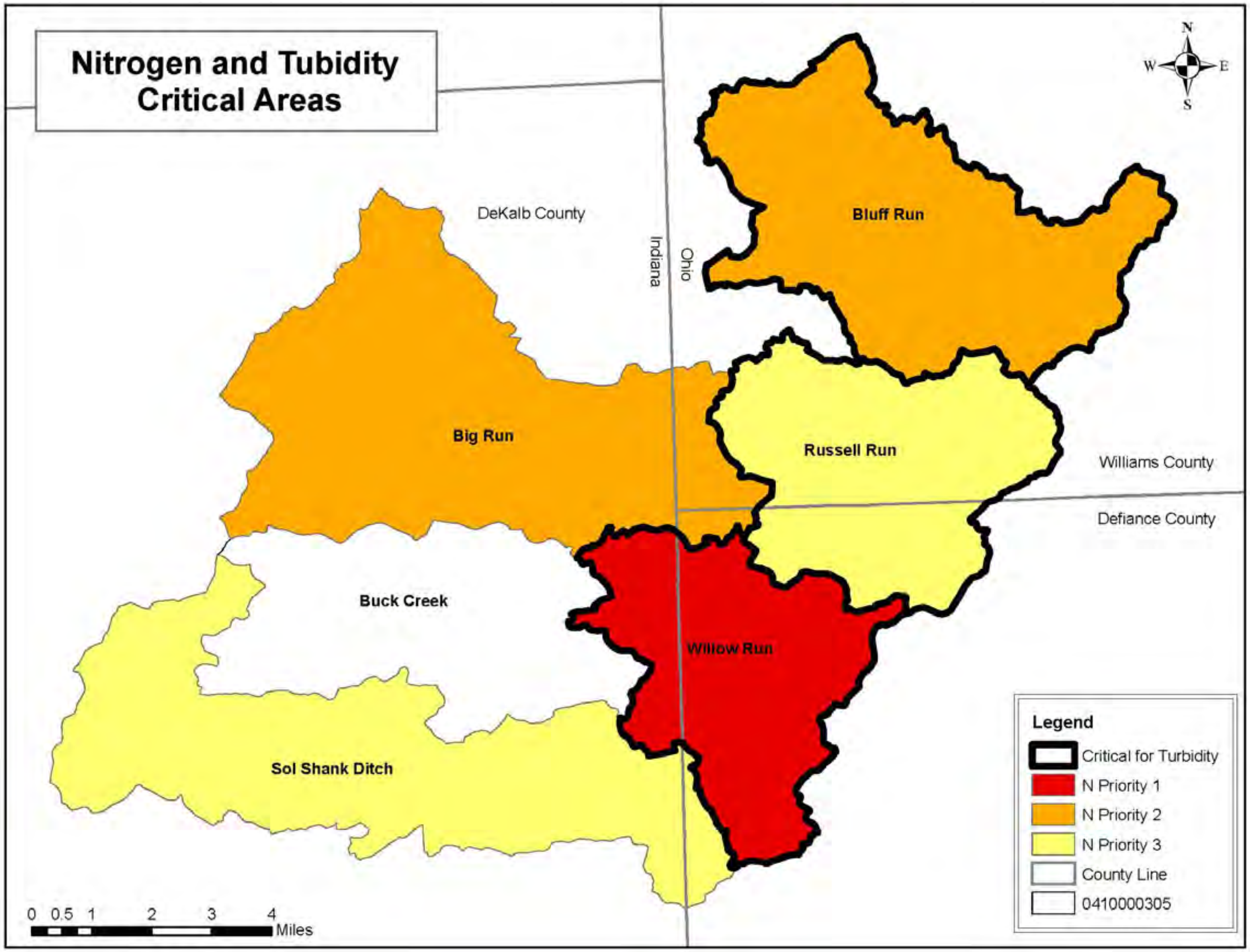
Based on information gathered in the Middle St. Joseph River Watershed including, historical studies, land use information, and water quality data, particular areas in the watershed were identified to focus implementation efforts. These areas of concern are categorized as “critical” for implementation either because the particular land use or practice in that area poses a significant risk to water quality, there is a lack of knowledge about particular practices or water quality issues, or historic data shows that the water quality in an area is already impaired. If there are several areas that are considered critical for a particular practice or parameter, a “priority” may be assigned to each area so that implementation will be focused on the areas that will have the biggest impact on water quality first. Once all possible implementation efforts have been exhausted in Priority Area 1, efforts will be focused on Priority Area 2, and so on.

5.1.1 Water Quality Parameter Based Critical Areas

As stated in Section 4, nitrogen load reductions were needed in all subwatersheds in the Middle St. Joseph River Watershed except for the Buck Creek Subwatershed. Due to the fact that a higher nitrogen load reduction was needed in Willow Run than in the other subwatersheds, the MSJRW steering committee decided to assign a priority in which implementation will occur to address excessive nitrogen in the water with the goal of mitigating the area with the greatest problem first. Therefore, Willow Run subwatershed is considered critical with a Priority 1 for the reduction of nitrogen. Bluff Run and Big Run subwatersheds have the next highest load reductions necessary to meet water quality targets and are therefore, considered critical with a Priority 2 for the reduction of nitrogen. Sol Shank Ditch and Russell Run subwatersheds need the least load reduction for nitrogen to meet water quality targets and therefore, Sol Shank Ditch and Russell Run subwatersheds are considered critical with a Priority 3 for the reduction of nitrogen loading. Figure 5.1 shows the subwatersheds that are considered critical for nitrogen, and the priority that was assigned to each subwatershed to increase the potential of reaching water quality goals.

In addition to Willow Run needing the highest load reduction to meet water quality targets set by the MSJRW steering committee, it also had the highest average results for turbidity levels at an average 89.64 NTU for the subwatershed. Therefore, the MSJRW steering committee deemed Willow Run as critical to address turbidity. Russell Run is also critical for turbidity since the subwatershed average for turbidity in 2011 was 60.9 NTU as well as Bluff Run since the subwatershed average for turbidity in 2011 was 45.01 NTU.

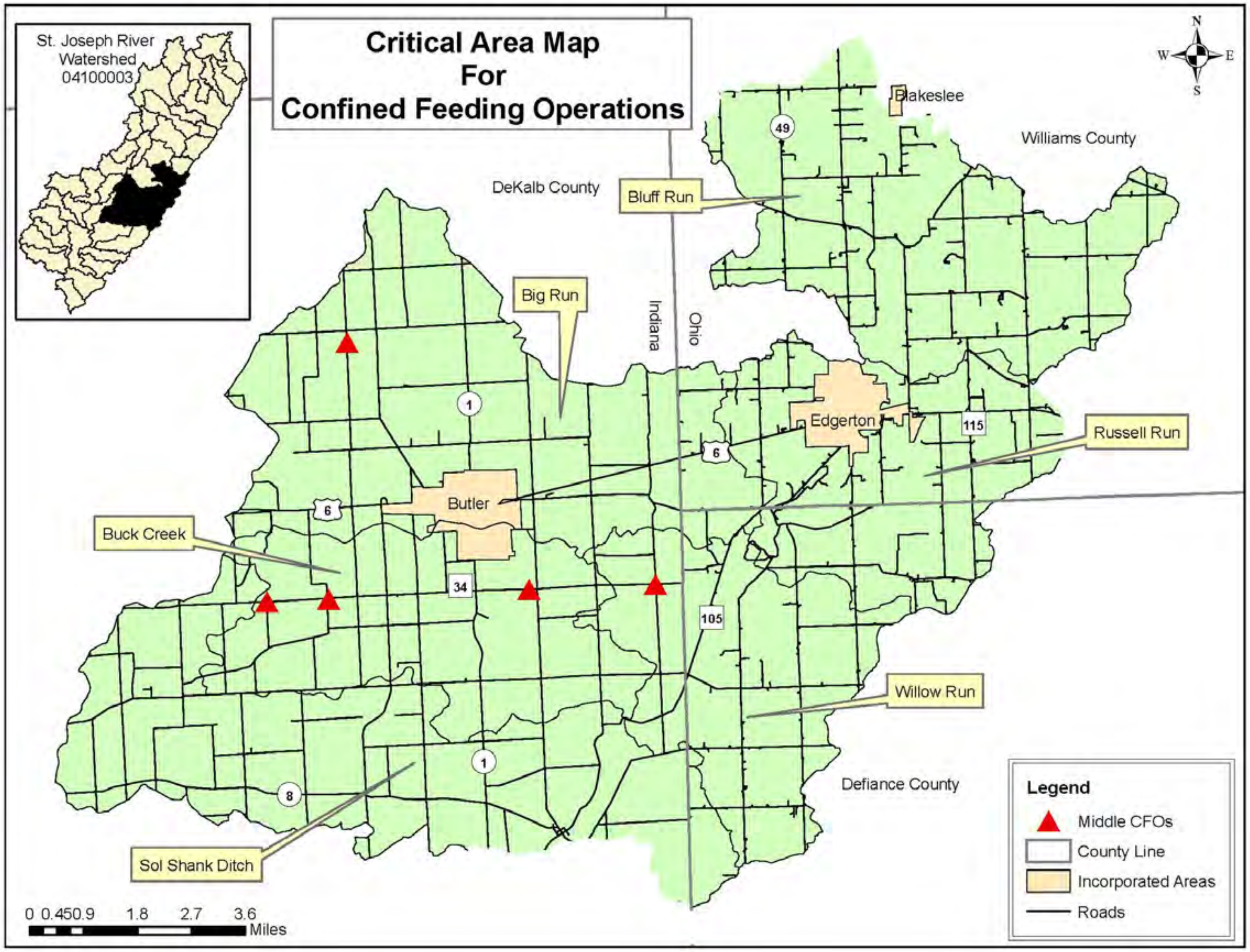
Figure 5.1: Water Quality Based Critical Areas



5.1.2 Confined Feeding Operations Based Critical Areas

Concern was voiced by the steering committee regarding CFO's located within the MSJRW as polluted runoff, containing contaminants such as excessive nutrients and bacteria, is a potential problem associated with CFOs. As can be seen in Section 3.3.7, all subwatersheds exceeded the state standard of 235 cfu/100 ml for *E. coli* and many of the subwatersheds had excessive nutrients, namely nitrate+nitrite. In light of those findings, the steering committee felt it was important that all current and future CFOs be considered critical for the prevention of nutrient and pathogen runoff. Figure 5.2, shows the location of all current CFOs in the MSJRW, however it is important to note that future CFOs that may be built in the MSJRW will also be critical for the prevention of polluted runoff.

Figure 5.2: Critical Areas for Current Confined Feeding Operations



5.1.3 Stream Buffer Width Based Critical Areas

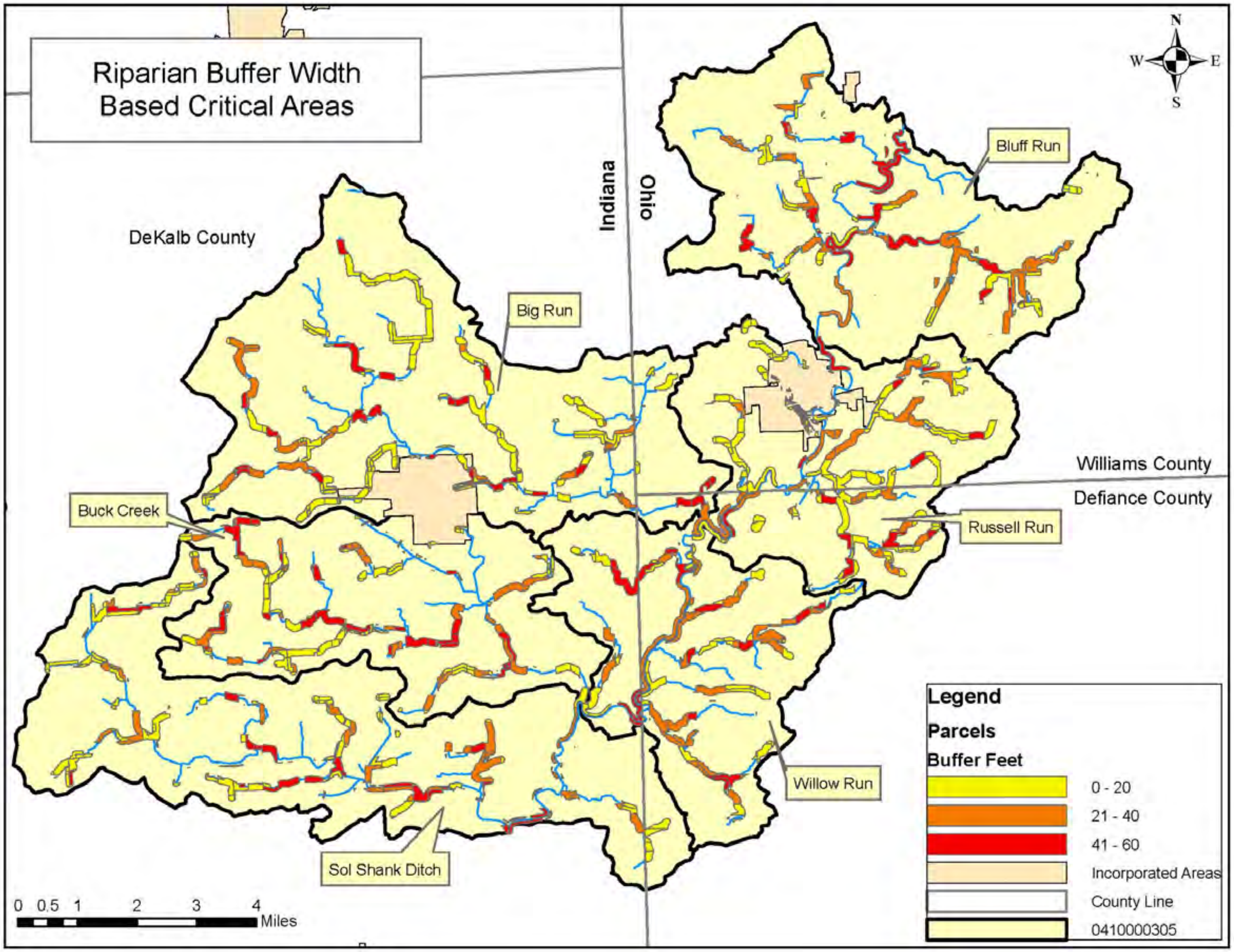
The windshield survey and computer based survey of stream buffers revealed that many of the streams in the watershed lack an adequate buffer to filter runoff before it enters the stream or supply suitable habitat for wildlife. Over 64% of the buffers in the watershed are less than 60 feet in width and over 47% of stream buffers are less than 20 feet in width.

Stream buffers are important to water quality as vegetated buffers help to slow the velocity of storm flow which allows time for sediment, much of which carries other pollutants attached to the soil particles, to settle out before entering the stream, as well as helps keep soil in place to prevent stream bank erosion. With the majority of streams in the watershed having inadequate buffers, the steering committee has decided to make stream buffer installation a priority of the project. Therefore, all stream buffers that are less than 20 feet are considered critical. Ideally, all stream buffers would be a minimum of 60 feet, however it is unrealistic to assume that landowners would be willing to give up some of their prime crop land and install a conservation buffer, therefore the steering committee has decided to make stream buffers that are located on land with a slope of 2-4% and a buffer less than 40 feet critical and stream buffers that are located on land with a slope of >4% and a buffer less than 60 feet critical for the installation of buffer strips. The critical areas for stream buffers are reiterated in Table 5.1. Figure 5.3 shows a map of all stream buffers that are currently less than 60 feet in width. However, it is important to note that slope was not depicted on this map, and therefore not all stream buffers that have been identified as being less than 60 feet qualify as "critical".

Table 5.1: Critical Area for Stream Buffers Based on Land Slope

Land Slope	Critical Buffer Width
0 - 2%	20 foot
2 - 4%	40 foot
> 4%	60 foot

Figure 5.3: Potential Critical Areas for Stream Buffers Less than 60 Feet

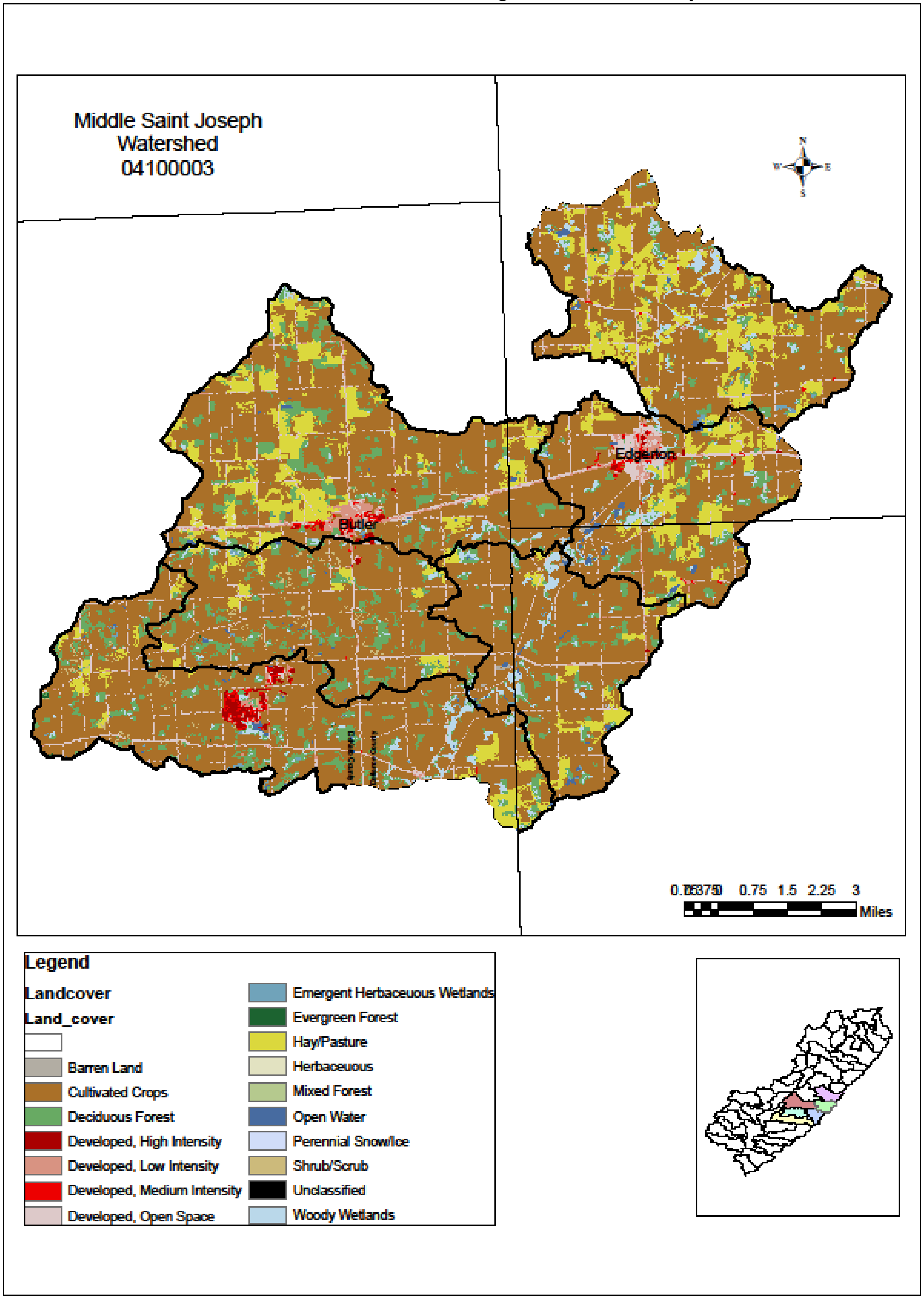


5.1.4 Subsurface Drainage Based Critical Areas

The fertile soil of the Midwest lends itself to being used for growing row crops. There is no exception for the land in the MSJRW as nearly 61% of all land in the watershed is used for agricultural purposes. With agriculture, comes the potential for many contaminants such as nutrients, pesticides, and bacteria, to reach open water through storm flow runoff, or direct access from tile drain outlets.

The MSJRW is located just north of the old Great Black Swamp and therefore has many wetlands located within the watershed. Though, many wetlands were drained during early settlement of the area to make farmland, especially in the northern portion of the project area. To keep the land from becoming oversaturated, tile drains needed to be installed in the fields. It is common practice to install tile inlets at low points in fields to collect water to be diverted from the field through those tile drains. However, many of the inlets are unmanaged meaning they are unbuffered or not maintained to work in the way in which it was designed to, and provide no protection to keep NPS from collecting at the inlets and draining through the tile system, directly into open water. Therefore, the MSJRW steering committee has made all unmanaged tile inlets to subsurface drainage in the watershed critical for the implementation of best management practices to limit nutrient, sediment, and pathogenic runoff from entering open water. While all tiled fields and tile inlets were not identified during the windshield survey, Figure 5.4 shows where all the cultivated crops are within the MSJRW (in brown) and where assistance will be offered to lower the impact on water quality from unmanaged tile inlets when identified as a problem.

Figure 5.4: Potential Critical Areas Where Unmanaged Tile Inlets May be Present



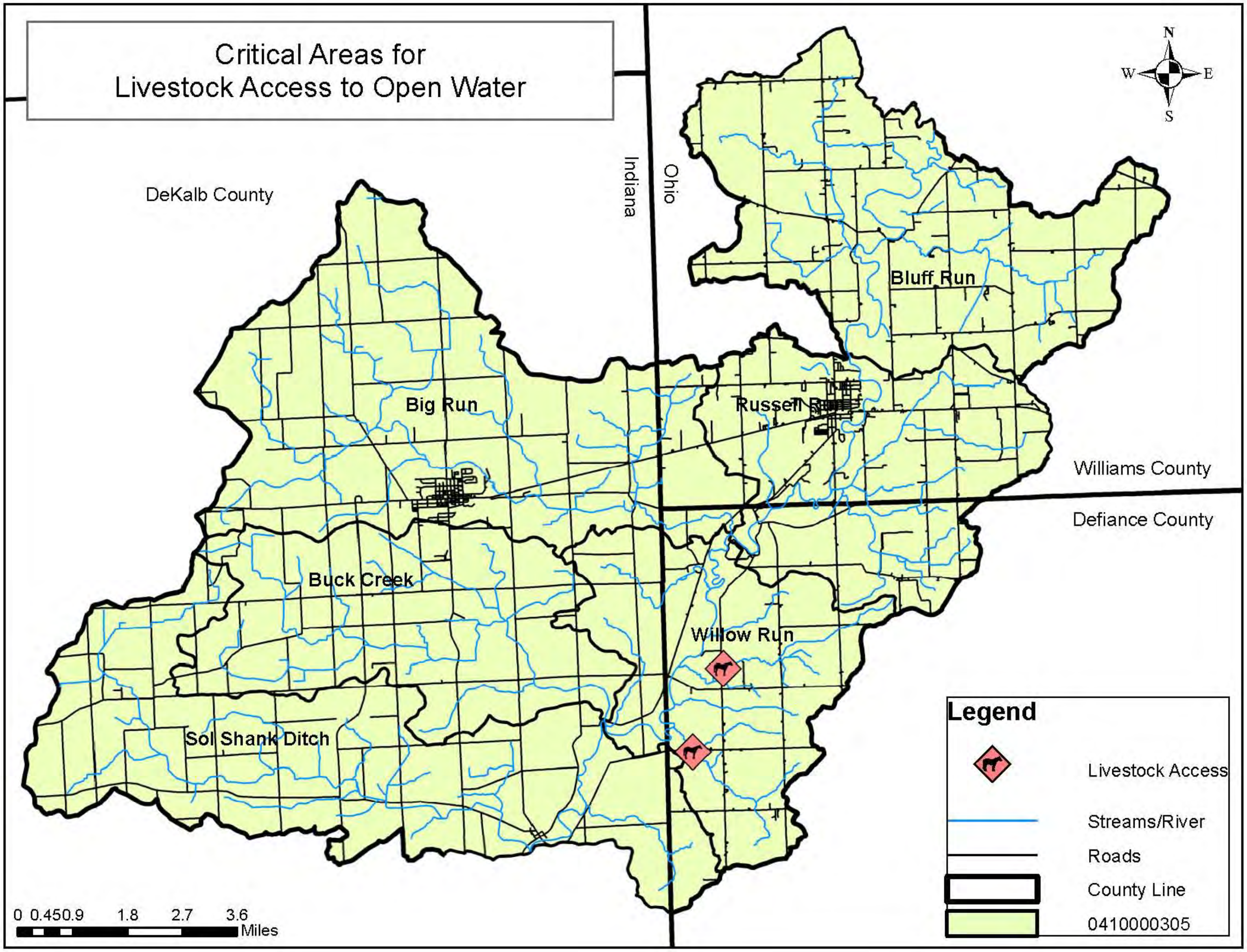
5.1.5 On-site Sewage Disposal System Based Critical Areas

Butler, IN and Edgerton, OH are the only areas with a centralized sewer system in the project area. Therefore, many of the residents in the MSJRW utilize on-site sewage disposal for their household waste. Many of the systems in place currently predate the more stringent system requirements and may have been installed improperly and may be failing, leaking, or discharging directly to open water or a tile drain. Estimates from the Williams County and DeKalb County Health Departments indicate that there may be upwards of 50% of the installed septic systems that are not working as they should. In addition, nearly all soils in the project area are considered “very limited” for septic placement. Therefore, the MSJRW steering committee has decided that all on-site sewage disposal systems that are failing, leaking or discharging directly to an open water source or tile drain within the project area is considered critical.

5.1.6 Livestock with Direct Access to Open Water Based Critical Areas

The MSJRW steering committee voiced concern regarding runoff from all animal feeding operations. This concern could be validated by the 2009 livestock inventory, discussed in Section 2, which revealed over 170 points where livestock operations could be seen from the road, most of which are small enough not to require state oversight of the operation, as many are small hobby farms. The concern could also be validated by the two locations that were observed during the windshield survey where livestock had direct access to open water which poses a direct threat to water quality from soil erosion, and the direct deposit of nutrients and pathogens. While only two locations were seen during the windshield survey, there could be more areas where livestock are posing a threat to water quality by having direct access to open water that may be identified in the future. Due to the overwhelming evidence supporting the concern, the steering committee has made all locations in the project area where livestock have direct access to open water critical. Figure 5.5 is a map showing the locations of the two areas where livestock were seen in, or where livestock access to the water was verified. However, it is important to note that any future locations identified where livestock have direct access to the water will also be critical for the implementation of best management practices to permanently remove the livestock from the open water source.

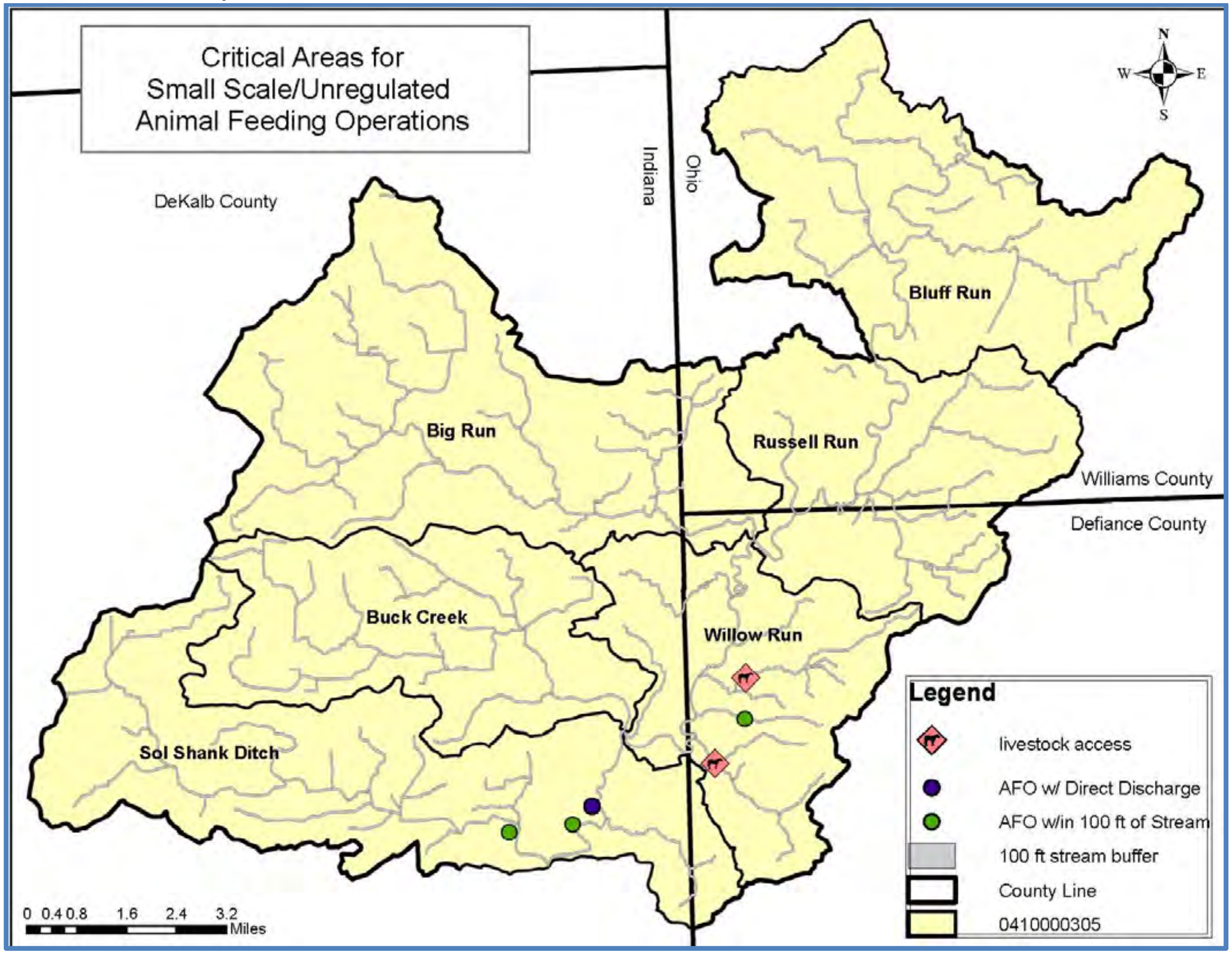
Figure 5.5: Livestock Access Based Critical Areas



5.1.7 Small Scale Animal Feeding Operation Based Critical Areas

The MSJRW steering committee voiced concern regarding animal feeding operations that fall below the threshold which would require state oversight. Since these animal operations are not monitored or held to any state regulations, it is possible that NPS will leach from the property if manure is not properly managed. Therefore the MSJRW steering committee has determined that all small scale animal feeding operations located within 100 feet of an identified ditch, stream, or river be deemed critical for the management of manure. As can be seen in Figure 5.6, one livestock operation identified during the 2009 livestock inventory of the MSJRW is located within 100 feet of a stream, one operation had direct discharge to an open stream, and two operations were noted during the 2011 windshield survey where livestock have direct access to open water. It is important to note, that while only three operations were identified during land surveys, there may be more operations located within 100 feet of an identified water source and will also be considered critical.

Figure 5.6: Small Scale Animal Operation Based Critical Areas

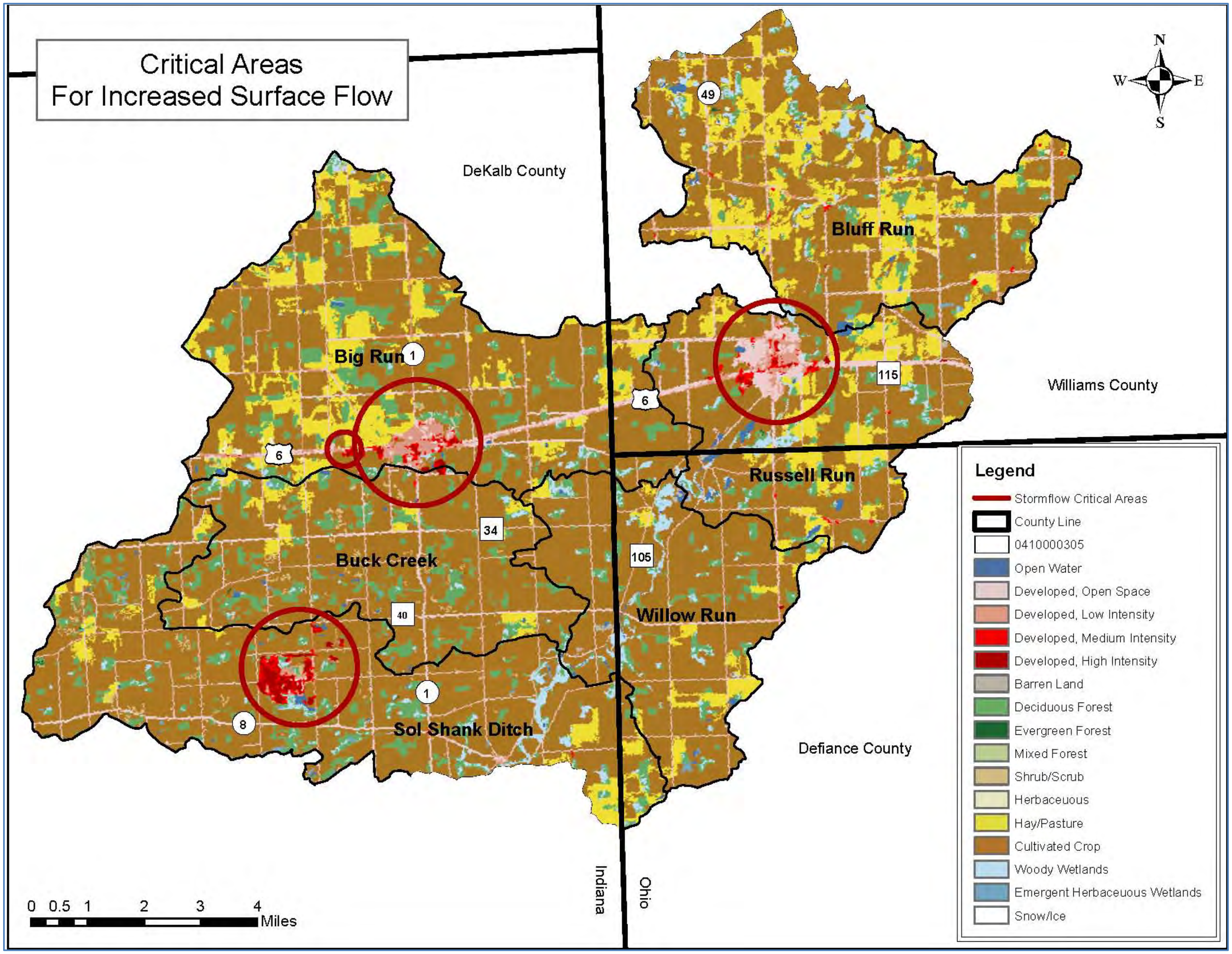


5.1.8 Excessive Storm Flow Based Critical Areas

The MSJRW steering committee voiced concern regarding combined sewer overflows and an increase in impervious surfaces. Impervious surfaces increases storm flow over the land as less water can be absorbed into the ground. As storm flow runs over solid surfaces it can pick up sediment, oil, salt, fertilizer from urban areas, and many other pollutants and deliver those pollutants directly to open water sources. An increase in storm flow can also increase the velocity of streams, ditches, and rivers which can cause stream bank erosion and an increase in sedimentation of those respective water sources. Another problem associated with an increase in impervious surfaces is that more storm water drains into storm sewers, which in the case where storm and sanitary sewers are combined, increases the number of CSO events.

Butler, IN is a CSO community and not only handles the water from within the city limits, but also handles the water from the nearby concentrated industrial park. For this reason, the MSJRW steering committee has determined that the City of Butler, and the current and any future concentrated industrial areas in the MWJRW are critical for the management of storm water. Edgerton, Ohio is also deemed critical by the MSJRW Steering Committee due to the amount of impervious service present in the area making a direct conduit to the St. Joseph River, which runs through the Village, for urban pollutants to reach the river. Figure 5.7 is a map where the critical areas for storm water management are delineated.

Figure 5.7: Excessive Storm Flow Based Critical Areas



5.2 Critical Area Summary

The MSJRW steering committee looked closely at all available data that has been gathered throughout this watershed investigation and determined that several areas in particular are contributing to NPS and the degradation of water quality within the MSJRW. Therefore, those areas were deemed critical by the steering committee and are outlined below.

- Nitrogen
  - Priority One – Willow Run
  - Priority Two – Bluff Run and Big Run
  - Priority Three – Sol Shank Ditch and Russell Run
- Turbidity – Willow Run, Russell Run, and Bluff Run
- All Confined Animal Feeding operations located within the Middle St. Joseph River Watershed
- Riparian Buffers that are:
  - Less than 20 feet in width
  - Less than 40 feet in width on a 2-4% slope
  - Less than 60 feet in width on a slope >4%
- All unmanaged inlets to subsurface drainage in the Middle St. Joseph River Watershed
- All on-site sewage disposal systems located within the Middle St. Joseph River Watershed that are leaking, failed, or discharging directly into a tile drain or open water source
- All areas where livestock have direct access to open water
- Small scale animal feeding operations located within 100 feet of an identified river, stream, or ditch and those with direct discharge from the barnyard
- The City of Butler and the Village of Edgerton for impervious surfaces and increased storm water runoff
- All current and future concentrated industrial areas for impervious surfaces and increased storm water runoff

5.3 Best Management Practices to Address Critical Areas

In order to address the concerns leading to the designation of the above mentioned critical areas, best management practices and conservation measures will need to be taken. The Middle St. Joseph River Watershed Steering Committee considered the plethora of management practices and measures available to address the critical area concerns and determined that certain practices will have the greatest impact on the critical areas and will be the focus of phase two of the Middle St. Joseph River Watershed project. In the table below, several practices and measures are outlined, and the predicted load reduction is presented, which will be the focus of the implementation efforts in the Middle St. Joseph River Watershed. Though, it should be noted that the following list is not all inclusive and other practices and management measures may be added to the list in the future.

Table 5.1: Management Measures to Address Critical Areas

Critical Area	Reason for Being Critical	BMP or Management Measure	Estimated Load Reduction per BMP/Acre		
			Sediment	Phosphorus	Nitrogen
Priority 1 - Willow Run, Priority 2 - Bluff & Big Run Priority 3 - Sol Shank Ditch, and Russell Run	Nitrogen	Agriculture, Urban, and Septic System Education Program	N/A	N/A	N/A
		Septic System Workshop	N/A	N/A	N/A
		Annual Ag. And Urban Workshops/Field Days	N/A	N/A	N/A
		Cover Crops*	11 ton/yr	12 lbs/yr	22 lbs/yr
		Two-stage ditch*	85 ton/yr	42.5 lbs/yr	42.5 lbs/yr
		Conservation Tillage**	32 ton/yr	22 lbs/yr	58 lbs/yr
		Blind and/or Buffered Tile Inlets	***	***	***
		Wetland Restoration/Creation*	15 ton/yr	14 lbs/yr	27 lbs/yr
		Nutrient Management	***	***	***
Willow Run, Russell Run, and Bluff Run	Turbidity	Agriculture, Urban, and Septic System Education Program	N/A	N/A	N/A
		Grassed Waterway (in addition to those practices listed above)*	29 ton/yr	0	0
All CFOs	E. coli, Nitrogen, and Turbidity	Education Program Geared Toward Livestock Operators	N/A	N/A	N/A
Riparian Buffers <20 feet	Nitrogen and Turbidity	Riparian Buffers of at least 20' 40' on a 2-4% slope 60' on >4% slope**	27 ton/yr	23 lbs/yr	60 lbs/yr
		Education Program on Riparian Buffers	N/A	N/A	N/A
Unmanaged Tile Inlets	Nitrogen, E. coli, and Turbidity	Blind Inlets	***	***	***
		Agriculture Education Program	N/A	N/A	N/A

Critical Area	Reason for Being Critical	BMP or Management Measure	Estimated Load Reduction per BMP/Acre		
			Sediment	Phosphorus	Nitrogen
Leaking or Failed On-Site Sewage Systems or Those That are Directly Discharging	Nitrogen, E. coli, and Turbidity	Work With Local Planners to Establish Rules for Proper Septic System Usage/Placement/Inspection	N/A	N/A	N/A
		Septic System Workshop	N/A	N/A	N/A
		Septic System Educational Program	N/A	N/A	N/A
		Septic System Maintenance/ Replacement Assistance	***	***	***
Livestock Access to Open Water/Small Scale Feeding Operations Within 100' of Open Water	Nitrogen, E. coli, and Turbidity	Education Program on Livestock Mngt	N/A	N/A	N/A
		Limited Access Stream Crossing/Exclusion Fencing/Alternative Watering Facility*	16 ton/yr	15 lbs/yr	29 lbs/yr
		Rotational Grazing	***	***	***
		Dry Stack Areas**	27 ton/yr	15 lbs/yr	40 lbs/yr
		Comprehensive Nutrient Mngt Plans	N/A	N/A	N/A
City of Butler, Industrial Complex in Sol Shank Ditch and future industrial areas, and Village of Edgerton	Increased Imperviousness, CSOs, Stormflow Runoff	Ordinance Review/Revision with Local Planners	N/A	N/A	N/A
		Urban Education Program	N/A	N/A	N/A
		Urban BMP Workshops	N/A	N/A	N/A
		Rain Barrels	73.6 lbs/yr	0.29 lb/yr	1.6 lbs/yr
		Rain Gardens (Residential)*	239 lbs/yr	0 lbs/yr	1 lb/yr
		Rain Garden (Commercial)*	915 lbs/yr	1 lb/yr	4 lbs/yr
		Weekly Street Sweeping (entire Critical Area)*	16 ton/yr	13 lbs/yr	0 lbs/yr
		Tree Planting****	***	***	***

* Estimated from the Region 5 model assuming 1 acre of land input (unless otherwise noted)

**Estimated from the STEPL model

***Too many variables, or too new of a technology, to accurately estimate load reductions

****A medium sized tree is estimated to uptake 2380 gallons of water annually (Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, Davis, California. July 2002)

6.0 Project Goals

The MSJRW steering committee used historic studies, land use, and water quality data, as well as current data, stakeholder input, problems found during the project investigation, and identified critical areas to determine overall goals for the watershed. The overarching goal of the project is to reduce pollutant loads and mitigate pollution sources so that water quality measurements will meet the project's target levels and/or state or federal water quality standards. However, to reach that principle goal of improving the quality of water in the MSJRW smaller, more attainable, goals were written. Each of the goal statements in the following Section is written to take small steps toward meeting the main goal of this project.

It is also important to be able to measure the progress being made toward meeting each of the goals. Therefore, indicators were determined that will be used as a measurement tool and are listed in the following section as well.

6.1 Goal Statements and Progress Indicators

6.1.1 Reduce Nitrogen Loading

The average nitrate+nitrite levels measured by the SJRWI in 2011 exceeded the target level in all subwatersheds, except for Buck Creek. Subsequently, load reductions for nitrogen are required in all subwatersheds except for in Buck Creek, to meet the target load. According to water samples collected by the SJRWI in 2011 a 61% load reduction for nitrogen is required in the Middle St. Joseph River Watershed to meet the target level. However, it is important to note that the 2011 recreational season, when water samples were collected and analyzed, was a particular wet one and that a 61% reduction may not be an accurate representation of what kind of reductions are needed for nitrogen levels to meet the target set by this project

Goal Statement

The Goal of this project is for nitrate+nitrite levels in all sampled water to meet the target level of 1.6 mg/l set by this project by year 2043.

Indicator

Water quality and social data will be used to show the progress toward meeting the goal for nitrogen levels in the MSJRW. An administrative goal will also be used to measure the progress toward meeting the goal for nitrogen levels in the MSJRW.

Water Quality Indicator

Nitrate+Nitrite will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The load reductions as a result of best management practices that are installed in the watershed, as determined by load reduction models, will be monitored.

6.1.2 Reduce Turbidity Levels

Turbidity levels measured by the SJRWI in 2011 exceeded the target levels set by this project in all subwatersheds, with the greatest exceedance present in Willow Run which measured an average of 79.24 NTU greater than the target level. For this reason, the MSJRW steering committee deemed Willow Run as critical for turbidity.

Goal Statement

The goal of this project is to have all sampled water within the MSJRW meet the target water quality level for turbidity of 10.4 NTU in 30% of samples by 2023, and in 75% of samples by 2043.

Indicator

Water quality and social data will be used to show the progress toward meeting the goal for turbidity levels in the MSJRW. An administrative goal will also be used to measure the progress toward meeting the goal for turbidity levels in the MSJRW.

Water Quality Indicator

Turbidity will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 on a three year cycle after implementation.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of best management practices that can reduce turbidity levels that are installed in the watershed will be monitored.

Administrative Indicator

The load reductions as a result of best management practices that are installed in the watershed, as determined by load reduction models, will be monitored.

6.1.3 Mitigate Runoff From Animal Feeding Operations

Both small scale and large animal feeding operations located within the MSJRW are a concern as they are a threat to water quality from sediment and fecal runoff, as well as increase nutrient loads to surrounding ditches. For these reasons the MSJRW steering committee deemed CFOs and small scale animal operations as critical.

Goal Statement

The goal of this project is to partner with the local extension offices, Soil and Water Conservation Districts, and other agencies in Indiana and Ohio to work with all current and future CFO and small scale animal operators within the MSJRW by 2016 to provide education and support to help limit the potential for polluted runoff from the properties.

Indicator

Social and administrative indicators will be used to measure the success toward meeting the goal of working with local partners to provide education and support to mitigate any potential problems associated with runoff from all animal operations.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of partnerships made with local extension offices, SWCDs, and other agencies in Indiana and Ohio will be measured.

Administrative Indicator

The number of CFO and small scale animal facility operators that are reached each year will be measured.

Administrative Indicator

The number of BMPs installed as a result of those partnerships will be measured.

6.1.4 Increase the Use of Riparian Buffer Strips

The land use and riparian buffer inventory performed in the MSJRW in 2011 revealed that 58% of identified land parcels located adjacent to an open ditch or stream has less than a 60 foot buffer. A buffer acts as a natural filter to slow stormwater runoff and limit the amount of polluted runoff that reaches open water.

Goal Statement

It is the goal of this project to have 90% of parcels located adjacent to an open ditch or stream to have a minimum of a 20 foot vegetated riparian buffer by 2023.

Indicator

Social and administrative indicators will be used to measure the success toward meeting the goal of increasing the installation and usage of riparian buffers.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of landowners who install a minimum of a 20 foot riparian buffer will be measured.

Administrative Indicator

The total number of feet of buffer that is installed each year will be measured.

Administrative Indicator

A revised desktop buffer inventory showing 90% of parcels located adjacent to open water having a minimum of a 20 foot buffer performed in 2023.

6.1.5 Increase Knowledge Regarding On-Site Waste Management

Less than 1% of all soils located within the MSJRW are considered acceptable for the installation of on-site waste management facilities, however most residents located in the rural areas of the project area have septic systems to manage their waste water. Leaking, failing, or straight pipe septic systems pose a threat to water quality by increasing nutrient and bacteria levels in the water.

Goal Statement

It is the goal of this project to have an on-going education program regarding the placement and maintenance of on-site waste management by 2016.

Indicator

Water Quality, social, and administrative indicators will be used to measure the success toward meeting the goal of increasing the knowledge of local stakeholders regarding on-site waste management.

Water Quality Indicator

Fecal coliform and *E. coli* will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of on-site waste management workshops held annually will be measured.

Administrative Indicator

The number of attendees at each of the on-site waste management workshops will be measured.

6.1.6 Reduce Polluted Runoff from Small Scale Animal Operations

Small scale animal operations pose many threats to water quality including bacteria contamination, sediment, and excessive nutrient loadings from barnyard runoff, pasture fields directly adjacent to open water, and from livestock access to open water.

Goal Statement

It is the goal of this project to have all livestock excluded from open water and offer cost-share opportunities to install best management practices to reduce barnyard and pasture runoff by 2016.

Indicator

Water Quality, social, and administrative indicators will be used to measure the success toward meeting the goal of reducing polluted runoff from small scale animal operations.

Water Quality Indicator

Nutrient and *E. coli* levels will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of BMPs installed in the project area to reduce the risk of pollution runoff from small scale livestock operations will be measured.

Administrative Indicator

The load reductions as a result of best management practices that are installed in the watershed, as determined by load reduction models, will be monitored.

6.1.7 Reduce *E. coli* Levels in the Watershed

After analyzing both water quality data collected by the SJRWI in 2010 and all historical water quality data, *E. coli* levels averaged to exceed the state standard of 235 cfu/100ml in all subwatershed located within the MSJRW. Excessive *E. coli* could be from wildlife, leaking failed or straight pipe on-site waste management, or animal operations located within the MSJRW.

Goal Statement

The goal of this project is to have 50% of water quality samples meet the state standard of 235 cfu/100ml for *E. coli* by 2030 and all water quality samples meet the state standard by 2043.

Indicator

Water Quality, social, and administrative indicators will be used to measure the success toward meeting the goal of reducing *E. coli* levels found in the MSJRW.

Water Quality Indicator

E. coli will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of BMPs designed to reduce the risk of E. coli pollution entering open water sources that are installed in the MSJRW will be measured.

Administrative Indicator

The load reductions as a result of best management practices that are installed in the watershed, as determined by load reduction models, will be monitored.

6.1.8 Reduce Stormwater Runoff Due to Increase in Imperviousness

An increase in impervious surfaces poses a threat to water quality as it allows for a direct conduit for stormwater runoff, carrying pollution to reach open water, as well as increases the potential for CSO events in the city of Butler, IN.

Goal Statement

It is the goal of this project to decrease the amount of stormwater runoff from reaching open water by implementing an urban best management practice program by 2016.

Indicator

Social and administrative indicators will be used to measure the success toward meeting the goal of reducing *E. coli* levels found in the MSJRW.

Social Indicator

A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.

Administrative Indicator

The number of urban BMPs installed in the MSJRW will be measured.

Administrative Indicator

The number of urban BMP workshops and urban pollution outreach events held annually will be measured.

Administrative Indicator

The number of attendees at each of the workshops and educational programs will be measured.

6.1.9 Establish a Permanent Stakeholder Group for the MSJRW

Implementation of this Watershed Management Plan is key to improving water quality within the Middle St. Joseph River Watershed which cannot occur without the support and guidance of stakeholders in the watershed.

Goal Statement

It is the goal of this project to establish a stakeholder group to oversee watershed management plan implementation, promote public awareness, and sustain funding to meet goals and objectives.

Indicator

Administrative goals will be used to measure the success in meeting the goal of establishing a permanent stakeholder group to guide the implementation of the WMP.

Administrative Indicator

The number of stakeholders that become members of the stakeholder group will be measured.

Administrative Indicator

Funding solicited and received will be recorded.

6.2 Action Register to Accomplish Goals

The goals set by the Middle St. Joseph River Watershed Steering Committee are ambitious, therefore the steering committee determined objectives to strive for which will help to reach the goals of the project. Each objective also has milestones to reach within a certain timeline to determine the progress toward reaching each of the goals. The following tables are action registers for each of the goals of this project which show the objectives set for each of the goals. The action registers also show the milestones for each objective, a cost estimate to reach each objective and/or milestone, and partners and technical assistance that will be needed to reach each objective.

Table 6.1: Goals 1 and 2 Action Register

Goal #1: The Goal of this project is for nitrate+nitrite levels to meet the target level of 1.6 mg/L set by this project by year 2043.
Goal #2: The goal of this project is to have all water sampled within the MSJRW meet the target water quality level for turbidity of 10.4 NTU in 30% of samples by 2023, and in 75% of samples by 2043.

Indicator #1: Nitrate+Nitrite and turbidity will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites measured in 2011 after three years of implementation.
Indicator #2: A pre and post implementation social survey will be conducted to determine the degree to which social changes occurred in the MSJRW.
Indicator #3: Load reductions, as measured by load reduction models, will be monitored.
Indicator #4: The number of best management practices that can reduce turbidity and nutrient levels that are installed in the watershed will be monitored.

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Develop and Implement an Agriculture Education Program	Middle St. Joseph River Watershed Agricultural landowners and operators	Within the first twelve months after WMP approval	Hire Personnel to Implement the WMP (6 months)	$60,000/ year	DeKalb, Defiance, and Williams County SWCDs (P, TA) DeKalb, Defiance, and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P, TA) Andersons (P, TA)
			Compile an ag. education/outreach plan (6 months)	$1,800 /year	
			Develop and disseminate an ag. education brochure (8 months)		
			Hold first annual ag. BMP workshop/field day (12 months)		
			Install a Demonstration Agricultural BMP in the Watershed (12 months)	$5,000	
Develop and Promote a Cost-Share Program	Middle St. Joseph River Watershed Agricultural landowners and operators	Ongoing	Cost-Share Program Developed (3 months)	$1,500/ year	DeKalb and Williams County SWCDs (P, TA) DeKalb and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P, TA) Andersons (P, TA)
			Develop and Disseminate a Cost-Share Brochure (4 months)		
			Quarterly Press Releases (3 months)		

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Implement an Agricultural Cost-Share Program	Middle St. Joseph River Watershed Agricultural landowners and operators	Ongoing	Secure Funding to Implement Cost-Share Program (12 months)	$500	DeKalb, Defiance and Williams County SWCDs (P, TA) DeKalb, Defiance, and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P) Area CCAs (TA) The Nature Conservancy IDEM and ODNR (P) DeKalb, Defiance, and Williams County Surveyors (P, TA)
			Install 700 Acres of Cover Crops Annually (2013 - 2030)	$24,500/ year	
			Install 1 Two-stage Ditch Every Two Years (1000 linear foot minimum) (2013-2043)	$100,000/ BMP	
			Implement Conservation Tillage on 700 Acres Annually (2013 - 2033)	$12,000/ year	
			Install Blind Inlets on 3 Properties Annually (2013 - 2043)	$9,000/ year	
			Increase Stream Buffer to a Minimum of 20 Feet in Width on 100 Acres Annually (2013 - 2035)	$12,000/ year	
			Install/Restore One Wetland Area Annually (2014 - 2043)	$5,500/ year	
			Enlist One Landowner to Install Equipment to Implement Nutrient/Pesticide Management Annually (2013 - 2043)	$4,000/ year	
			Install 2 Grassed Waterways Annually (2013 - 2043)	$8,000/ year	

Table 6.2: Goal 3 Action Register

<table>
<tr><td colspan="6"><u>Goal #3</u>: The goal of this project is to partner with the local extension ofices, Soil and Water Conservation Districts, and other agencies in Indiana and Ohio to work with all current and future CFO and small scale animal operators within the MSJRW by 2016 to provide education and support to help limit the potential for polluted runoff from the properties.</td></tr>
<tr><td colspan="6"><u>Indicator #1</u>: A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.
<u>Indicator #2</u>: The number of partnerships made with local extension offices, SWCDs, and other agencies in Indiana and Ohio will be measured.
<u>Indicator #3</u>: The number of CFO and small scale animal facility operators that are reached each year will be measured.
<u>Indicator #4</u>: The number of BMPs installed as a result of those partnerships will be measured.</td></tr>
<tr><th>Objective</th><th>Target Audience</th><th>Implementation Timeframe</th><th>Milestone</th><th>Estimated Cost</th><th>Partners (P) / Technical Assistance (TA)</th></tr>
<tr><td rowspan="2">Update the livestock inventory conducted in 2009</td><td rowspan="2">Middle St. Joseph River Watershed Stakeholders</td><td rowspan="2">Within 1 year after WMP approval</td><td>Hire Personnel to Implement the WMP (6 months)</td><td>$60,000/ year*</td><td rowspan="2">DeKalb, Defiance, and Williams County SWCDs and NRCS Offices (P), Purdue and Ohio State Extension Offices (P), Landowners (P)</td></tr>
<tr><td>A completed geo-referenced inventory of livestock within the MSJRW (1 year)</td><td>$3,000</td></tr>
<tr><td>Develop a Comprehensive list of livestock operators within the MSJRW</td><td>Middle St. Joseph River Watershed Stakeholders</td><td>Within 1 year after WMP approval</td><td>A comprehensive list of all small and large scale livestock operations within the MSJRW (1 year)</td><td>$500</td><td>DeKalb, Defiance, and Williams County SWCDs and NRCS Offices (P), Purdue and Ohio State Extension Offices (P), Landowners (P)</td></tr>
</table>

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Develop and implement an educational program geared toward livestock operators	Middle St. Joseph River Watershed Stakeholders	Within 6 months after WMP approval	Meet with local extension offices, NRCS, SWCDs, and other relevant agencies biannually to develop partnerships and an education program that will be suited for livestock operators in all counties (3 months)	$900/ year	DeKalb, Defiance, and Williams County SWCDs and NRCS Offices (P), Purdue and Ohio State Extension Offices (P)
			Educational program outline developed (6 months)		
			Quarterly Press Releases (3 months)		

Table 6.3: Goal 4 Action Register

<table>
<tr><td colspan="6"><u>Goal #4</u>: It is the goal of this project to have 90% of parcels located adjacent to an open ditch or stream to have a minimum of a 20 foot vegetated riparian buffer by 2035.</td></tr>
<tr><td colspan="6"><u>Indicator #1</u>: A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.
<u>Indicator #2</u>: The number of landowners who install a minimum of a 20 foot riparian buffer will be measured.
<u>Indicator #3</u>: The total number of feet of buffer that is installed each year will be measured.</td></tr>
<tr><th>Objective</th><th>Target Audience</th><th>Implementation Timeframe</th><th>Milestone</th><th>Estimated Cost</th><th>Partners (P) / Technical Assistance (TA)</th></tr>
<tr><td rowspan="6">Develop and Implement an Agriculture Education Program</td><td rowspan="6">Middle St. Joseph River Watershed Agricultural landowners and operators</td><td rowspan="6">Within the first twelve months after WMP approval</td><td>Hire Personnel to Implement the WMP (6 months)</td><td>$60,000/ year*</td><td rowspan="6">DeKalb, Defiance, and Williams County SWCDs (P, TA)
DeKalb and Williams County NRCS (P, TA)
Purdue and Ohio State Extensions (P, TA)
Andersons (P, TA)
IDEM and ODNR (P)</td></tr>
<tr><td>Secure Funding to Promote Education Program (6 months)</td><td>$500</td></tr>
<tr><td>Compile an ag. education/outreach plan (6 months)</td><td rowspan="3">$1,800 /year*</td></tr>
<tr><td>Develop and disseminate an ag. education brochure (8 months)</td></tr>
<tr><td>Hold first annual ag. BMP workshop/field day (12 months)</td></tr>
<tr><td>Purchase Two Billboards/County Advertising Stream Buffers</td><td>$2,000</td></tr>
<tr><td>Update the Riparian Buffer Inventory Conducted in 2011</td><td>Middle St. Joseph River Watershed Agricultural landowners and operators</td><td>During the Fifth Year After WMP approval</td><td>A completed geo-referenced inventory of Stream Buffers within the MSJRW (every 5 years)</td><td>$1,500/ every 5 years</td><td>DeKalb, Defiance, and Williams County SWCDs (P)
DeKalb and Williams County NRCS (P)
Purdue and Ohio State Extensions (P)</td></tr>
</table>

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Implement an Agricultural Cost-Share Program	Middle St. Joseph River Watershed Agricultural landowners and operators	Ongoing	Secure Funding to Implement Cost-Share Program (12 months)	$500*	DeKalb, Defiance and Williams County SWCDs (P, TA) DeKalb and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P, TA) IDEM and ODNR (P) DeKalb, Defiance, and Williams County Surveyors (P, TA)
			Develop a Cost-share Program	$1,500*	
			Increase Stream Buffer to a Minimum of 20 Feet in Width on 100 Acres Annually (2013 - 2035)	$12,000/ year*	
			90% of Riparian Areas Have a Minimum of a 20 Foot Buffer Installed by 2035		
* Cost accounted for in a previous goal's action register.					

Table 6.4: Goal 5 Action Register

<table>
<tr><td colspan="6"><u>Goal #5</u>: It is the goal of this project to have an on-going education program regarding the placement and maintenance of on-site waste management systems by 2016.</td></tr>
<tr><td colspan="6"><u>Indicator #1</u>: Fecal coliform and E. coli will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.
<u>Indicator #2</u>: A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.
<u>Indicator #3</u>: The number of on-site waste management workshops held annually will be measured.
<u>Indicator #4</u>: The number of attendees at each of the on-site waste management workshops will be measured.</td></tr>
<tr><th>Objective</th><th>Target Audience</th><th>Implementation Timeframe</th><th>Milestone</th><th>Estimated Cost</th><th>Partners (P) / Technical Assistance (TA)</th></tr>
<tr><td rowspan="3">Partner With Local Agencies and Organizations to Provide Education on Septic Maintenance</td><td rowspan="3">Middle St. Joseph River Watershed Stakeholders</td><td rowspan="3">Ongoing</td><td>Hire Personnel to Implement the WMP (6 months)</td><td>$60,000/ year*</td><td rowspan="3">DeKalb, Defiance, and Williams County Health Departments (P,TA) Septic Issues, Collaborative Solutions working group (P)</td></tr>
<tr><td>Meet with DeKalb, Defiance, and Williams County Health Departments Annually (6 months)</td><td rowspan="2">$900/year</td></tr>
<tr><td>Meet with Other Organizations Addressing Septic Issues including "Septic Issues, Collaborative Solutions" Biannually (6 months)</td></tr>
<tr><td rowspan="3">Develop and Implement a Septic System Educational Program</td><td rowspan="3">Middle St. Joseph River Watershed Stakeholders</td><td rowspan="3">Ongoing</td><td>Secure Funding to Promote Education Program (12 months)</td><td rowspan="3">$900/year</td><td rowspan="3">DeKalb, Defiance, and Williams County Health Departments (P,TA) Septic Issues, Collaborative Solutions working group (P)</td></tr>
<tr><td>Develop a Septic System Maintenance Brochure (6 months)</td></tr>
<tr><td>Hold an Annual Septic System Workshop (8 months)</td></tr>
</table>

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Offer Cost-share Assistance for Septic System Maintenance/ Replacement	Middle St. Joseph River Watershed Stakeholders	Ongoing	Secure Funding to Provide Cost-share Assistance (12 months)	$100,000	DeKalb, Defiance, and Williams County Health Departments (P,TA) Septic Issues, Collaborative Solutions working group (P)
			Local Septic System Companies Offer Discounts to Stakeholders Who Sign up for Regular Septic Maintenance (12 months)		

Table 6.5: Goal 6 Action Register

Goal #6: It is the goal of this project to have all livestock excluded from open water and offer cost-share opportunities to install best management practices to reduce barnyard and pasture runoff by 2016.

Indicator #1: E. coli, nitrate+nitrite, turbidity, phosphorus, and TDS will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.
Indicator #2: A pre and post implementation social indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.
Indicator #3: The number of BMPs installed in the project area to reduce the risk of pollution runoff from small scale livestock operations will be measured.
Indicator #4: The load reductions as a result of best management practices that are installed in the watershed, as determined by load reduction models, will be measured.

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Develop and Implement an Agriculture Education Program Geared Toward Livestock Operators	Middle St. Joseph River Watershed Livestock Operators	Within the first twelve months after WMP approval	Hire Personnel to Implement the WMP (6 months)	$60,000/ year*	DeKalb, Defiance, and Williams County SWCDs (P, TA) DeKalb, Defiance, and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P, TA) Andersons (P, TA)
			Compile a livestock education/outreach plan (6 months)	$1,800 /year	
			Develop and disseminate a livestock education brochure (8 months)		
			Hold first annual pasture walk (12 months)		
			Install a Demonstration Limited Access Stream Crossing in the Watershed (12 months)	$5,000	
Develop and Promote a Cost-Share Program	Middle St. Joseph River Watershed Livestock Operators	Ongoing	Cost-Share Program Developed (3 months)	$1,500/ year*	DeKalb, Defiance, and Williams County SWCDs and NRCS Offices (P, TA) Purdue and Ohio State Extensions (P, TA) Andersons (P, TA)
			Develop and Disseminate a Cost-Share Brochure (4 months)		
			Quarterly Press Releases (3 months)		

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Implement an Agricultural Cost-Share Program	Middle St. Joseph River Watershed Livestock Operators	Ongoing	Identify All Locations Where Livestock Have Direct Access to Open Water (1 year)	$3,000*	DeKalb, Defiance, and Williams County SWCDs (P, TA) DeKalb, Defiance, and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P) Area CCAs (TA)
			Install a Limited Access Stream Crossing or Exclusion Fencing at all Identified Livestock Access Points (3 years)	$3,000/ BMP	
			Implement Rotational Grazing on 1 Property Annually Until All Livestock Operators are Utilizing Rotational Grazing (2013 - 2043)	$6,000/ year	
			Increase Stream Buffer to a Minimum of 20 Feet in Width on 100 Acres Annually (2013 - 2035)	$12,000/ year*	
			Install a Manure Holding Facility at 1 Property Annually Until All Livestock Operators Have Adequate Storage (2014 - 2043)	$20,000/ BMP	
			Write one Comprehensive Nutrient Management Plan Annually Until All Livestock Operators Have a CNMP (2013 - 2043)	$6,000/ CNMP	

* Cost accounted for in a previous goal's action register.

Table 6.6: Goal 7 Action Register

<u>Goal #7</u>: The goal of this project is to have 50% of water quality samples meet the state standard for *E. coli* of 235 cfu/100 ml by 2030 and all water quality samples meet the state standard by 2043.

<u>Indicator #1</u>: *E. coli* will be measured weekly during the recreational season annually at two sites within the MSJRW as well as at all nine sites that were measured in 2011 after three years of implementation.
<u>Indicator #2</u>: The number of BMPs designed to reduce the risk of *E. coli* pollution entering open water sources that are installed in the MSJRW will be measured.
<u>Indicator #3</u>: The load reductions as a result of best management practices that are installed in the watershed, as determined by load reduction models, will be measured.

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Develop and Implement an Educational Program Regarding Bacteria Contamination	Middle St. Joseph River Watershed Stakeholders	Ongoing	Hire Personnel to Implement the WMP (6 months)	$60,000/ year*	DeKalb, Defiance, and Williams County SWCD (P) DeKalb, Defiance and Williams County Health Departments (P) City of Fort Wayne (P) IDEM and OEPA (P)
			Secure Funding to Implement Educational Program (6 months)	$500*	
			Conduct Bacteria Source Tracking Research to Determine Source of E. coli Contamination (12 months)	$6,000	
			Compile an E. coli Based Education Plan (6 months)	$1,800/ year	
			Develop an Educational Brochure Regarding Bacteria Contamination (6 months)		
			Conduct First Bacteria Contamination Workshop/Field Day (12 months)		
Develop and Promote a Cost-Share Program	Middle St. Joseph River Watershed Stakeholders	Ongoing	Cost-Share Program Developed (3 months)	$1,500/ year*	DeKalb and Williams County SWCDs and NRCS Offices (P, TA) Purdue and Ohio State Extensions (P, TA) Andersons (P, TA)
			Develop and Disseminate a Cost-Share Brochure (4 months)		
			Quarterly Press Releases (3 months)		

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Implement Cost Share Program Outlined for Goals, 1, 2, 3, 4, 5, and 6	Middle St. Joseph River Watershed Stakeholders	Ongoing	Milestones for Goals 1, 2, 3, 4, 5 and 6 Met by 2043		DeKalb and Williams County SWCDs (P, TA) DeKalb and Williams County NRCS (P, TA) Purdue and Ohio State Extensions (P) Area CCAs (TA)
* Cost accounted for in a previous goal's action register.					

Table 6.7: Goal 8 Action Register

Goal #8: The Goal of this project is to decrease the amount of stormwater runoff from reaching open water by implementing an urban best management practice program by 2016.

Indicator #1: A pre and post implementation soical indicator study will be conducted to determine the degree to which social changes occurred in the MSJRW.
Indicator #2: The number of urban BMPs installed in the MSJRW will be measured.
Indicator #3: The number if urban BMP workshops and urban pollution outreach events held annually will be measured. Indicator #4: The number of attendees at each of the workshops and educational programs will be measured.

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Work with City and County Planners to address increase in stormwater	City and County Planners	Within the first twelve months after WMP approval	Hire Personnel to Implement the WMP (6 months)	$60,000/ year*	DeKalb and Williams County Planning Commissions (P) Butler and Edgerton town Administrators (P)
			Make contact with City and County Planners (6 months)	$8,500	
			Meet with City and County Planners Monthly (8 months)		
			Develop a plan to address excess stormwater from Butler and Edgerton (18 months)		
			Work with City and County Planners to Encourage Low Impact Design for New Development (12 months)		
Develop and implement an urban education program	Middle St. Joseph River Watershed Stakeholders	Within the first twelve months after WMP approval	Compile an urban education/outreach plan (6 months)	$1,800	DeKalb and Williams County SWCDs (P) DeKalb and Williams County Health Departments (P) Butler and Edgerton Parks Departments (P)
			Develop and disseminate an urban education brochure (8 months)		
			Hold first annual urban BMP workshop (12 months)		
			Install a Demonstration Urban BMP in the Watershed (12 months)	$1,500	

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Develop and Promote an Urban Cost-Share Program	Middle St. Joseph River Watershed Urban Stakeholders	Ongoing	Cost-Share Program Developed (3 months)	$1,500/ year	DeKalb and Williams County SWCDs (P, TA) Butler and Edgerton City Planners (P) DeKalb County Planning Department (P) Stakeholders (P)
			Develop and Disseminate a Cost-Share Brochure (4 months)		
			Quarterly Press Releases (3 months)		
Provide Cost-share Dollars to Implement Urban BMPs	Middle St. Joseph River Watershed Urban Stakeholders	Ongoing	Install 3 Residential Rain Barrels and 1 Commercial Rain Barrel/Cistern Annually	$1000/ year	DeKalb and Williams County SWCDs (P, TA) Butler and Edgerton City Planners (P) DeKalb County Planning Department (P, TA) Stakeholders (P) Steel Dynamics (P)
			Install 2 Rain Gardens Annually	$2000/ year	
			Weekly Street Sweeping Program in Butler, Edgerton, and Roads Leading to Industrial Park (6 months)	$10,000/ year	
			Tree Planting Program Implemented (1 year)	$2,000/ year	
			Butler's CSO Events Decreased from 12 Events Annually to 8 Events Annually (1 year)	N/A	

* Cost accounted for in a previous goal's action register.

Table 6.8: Goal 9 Action Register

Goal #9: Establish a stakeholder group to oversee watershed management plan implementation, promote public awareness, and sustain funding to meet goals and objectives

Indicator #1: Consensus reached on responsibilities of stakeholder group for coordinating implementation of the watershed management plan
Indicator #2: Documented funding sources solicited
Indicator #3: Records of funding solicited and received

Objective	Target Audience	Implementation Timeframe	Milestone	Estimated Cost	Partners (P) / Technical Assistance (TA)
Expand Current steering committee to include additional key stakeholders to enhance implementation success	Middle St. Joseph River Watershed Stakeholders	Within the first six months after WMP approval	Hire Personnel to Implement the WMP (6 months)	$60,000/ year*	Stakehoders (P)
			Compile a list of key stakeholders(1 month)	$175	
			Make contact with key stakeholders (1 month)		
			Hold first quarterly steering committee meeting (3 months)		
Develop a funding strategy to sustain implementation and administration operation costs	Middle St. Joseph River Watershed Stakeholders	Ongoing	Identify funding sources (6 months)	$1500/ year	Stakeholders (P) DeKalb, Defiance, and Williams SWCDs (P) IDEM and OH EPA (P)
			Design funding strategy (6 months)		
			Implement funding strategy (1 year)		
			Secure operational funding (2 years)		

* Cost accounted for in a previous goal's action register.

7.0 Potential Load Reductions after Implementation

Actions outlined in Section 6 were determined by taking a combination of aspects of watershed management including how likely it is to get landowners willing to participate in a cost-share program to implement BMPs and the potential load reductions that would result from their implementation. Using the Spreadsheet Tool for Estimating Pollution Load (STEPL) and the Region 5 load reduction model, which both can be found at http://it.tetratech-ffx.com/steplweb/, potential load reductions were determined for nitrogen, phosphorus, and sediment on a per BMP per subwatershed scale.

The two load reduction models available for public use at this time do have some limitations in that not all BMPs can be modeled and as stated earlier in this WMP, estimates for *E. coli* cannot be determined accurately. Therefore, narrative assumptions for the benefit of certain BMPs and possible load reductions will be provided.

It is important to note that assumptions were made for the model inputs as exact acreage of implementation per subwatershed is dependent on the support for participation that is received by landowners in each of the subwatersheds. The load reductions presented in this document are derived from a model and are best guess scenarios only, and only account for year one of the implementation of a BMP assuming that no BMPs were in the past, or are currently being used. It is understood throughout the conservation community that load reductions from BMPs have a cumulative effect and that the reductions in pollutant loads will increase exponentially as they are implemented year after year. Accurate load reductions will be determined when the SJRWI performs water quality analysis on the nine sample sites in the MSJRW after three years of implementation. Each BMP is described below, including the general assumptions that were made to acquire a load reduction.

Cover Crops

Load reductions for cover crops were determined using the Region 5 load reduction model worksheet for agriculture fields. The MSJRW steering committee estimated that it is feasible to enlist 700 acres of land in the cover crop cost share program annually. Since it is impossible to know at this point where the cost-share program for cover crops will be accepted, the 700 anticipated acres of land which will utilize the cover crop program was split between the five subwatersheds deemed critical for nitrogen and sediment loading (Big Run, Sol Shank Ditch, Willow Run, Russell Run, and Bluff Run). This resulted in 140 acres per subwatershed being plugged into the model as the amount of land utilizing cover crops for the first time. The C-factor (cropping management factor) before implementation of the cover crop was based on a corn-soybean rotation with spring plowing (C=0.43). The C-factor for after implementation of the cover crop was based on cover crops being planted without any tillage before the cover crop (C=0.25).

Stream Buffer

Load reductions for stream buffers were determined using the STEPL load reduction model for filter strips. The MSJRW steering committee estimated that it was feasible to install a stream buffer long enough to slow the storm flow for 100 contributing acres of crop land annually. It is not clear yet where the cost-share program for the installation of a stream buffer will be most accepted so it was assumed that 100 acres of contributing land in each of the subwatersheds installed a stream buffer.

2-Stage Ditch Stream Bank Stabilization Design

Load reductions for 2-Stage Ditch designs were determined using the Region 5 load reduction model worksheet for bank stabilization. The MSJRW steering committee estimated that it was feasible to install a 1000 linear foot 2-Stage ditch within the agricultural community annually. It is not clear yet where the cost-share program for the installation of a 2-Stage Ditch will be most accepted so it was assumed that a 1000 linear foot 2-Stage Ditch was installed in each of the subwatersheds deemed critical for nutrient and sediment loading (Big Run, Sol Shank Ditch, Willow Run, Russell Run, and Bluff Run). Assumptions made were that the depth of the 2-Stage Ditch design would be 10 feet and that the P concentration of the soil is 0.031 lbs/lbs soil and the N concentration of the soil is 0.08 lbs/lb soil. The lateral recession rate was 0.1 which indicates moderate bank erosion with few rills and some vegetative overhang above the stream.

Conservation Tillage

The load reduction for conservation tillage was determined using the STEPL load reduction model for "Reduced Tillage Systems". The MSJRW steering committee estimated that it is feasible to enlist 700 acres of land in the cost-share program for conservation tillage annually. Since it is impossible to know at this point where the cost-share program for conservation tillage practice will be accepted, the 700 anticipated acres of land which will utilize the conservation tillage program was split between the five subwatersheds deemed critical for nitrogen and sediment loading (Big Run, Sol Shank Ditch, Willow Run, Russell Run, and Bluff Run). This resulted in 140 acres per subwatershed being plugged into the model as the amount of land being converted from conventional to conservation tillage practices.

Wetland

The load reduction for wetland restoration/creation was determined using the Region 5 load reduction model urban worksheet. There currently is not a model available that will estimate load reductions for wetlands on agricultural land, however, that is where the MSJRW steering committee deemed most critical for wetland implementation. The MSJRW steering committee estimated that is feasible to enlist one landowner to install a wetland with a contributing land area of 100 acres annually. Since it is impossible to know at this point where the cost-share program for wetland restoration/creation will be accepted, it was assumed that one wetland with 100 contributing acres was installed in each of the five subwatersheds deemed critical for nutrients and sedimentation (Big Run, Sol Shank Ditch, Willow Run, Russell Run, and Bluff Run). Wetland detention was chosen as the BMP to be implemented in the Region 5 load reduction model urban worksheet and the total acres of agricultural land in each of the subwatersheds was listed, while leaving all other landuses with zero acres of land contributing to the wetland BMP.

Grassed Waterway

The load reduction for grassed waterways was determined using the Region 5 load reduction model gully worksheet. The MSJRW steering committee estimated that it is feasible to install a 300 linear foot grassed waterway annually. It is not clear yet where the cost-share program for the installation of a grassed waterway will be most accepted so it was assumed that a 300 linear foot grassed waterway was installed in each of the subwatersheds deemed critical for nutrient and sediment loading (Big Run, Sol Shank Ditch, Willow Run, Russell Run, and Bluff Run). It was assumed that the top width of the gully is 10 ft and the bottom width is 5 ft. The depth of the gully is 1 ft and the length is 300 ft. Finally, the P concentration of the soil was assumed to be 0.031 lbs/lb soil and the N concentration of the soil was assumed to be 0.08 lbs/lb soil.

Waste Management System

The load reduction for waste management systems was determined using the Region 5 load reduction model Feedlot worksheet. The MSJRW steering committee estimated that it is feasible to install one waste management system annually until all identified problem animal operations have adequate manure storage. The windshield survey conducted as part of this WMP' development and the livestock inventory performed in 2009 identified three locations where livestock operations pose a threat to surface water in Sol Shank Ditch and in Willow Run subwatersheds. Each of those operations was assumed to take advantage of the cost-share program for the installation of a waste management system during year one of implementation. The number of animals present within each subwatershed was estimated by the STEPL load reduction model and those numbers were used in the Region 5 load reduction model to determine the potential reduction of nitrogen, phosphorus, and sediment after implementation of the waste management system. It is important to note that there may be more animal operations present within the MSJRW that was not identified as a problem during the investigation for the compilation of the WMP. As new operations are identified that may pose a threat to water quality and BMPs are implemented, the potential pollution load will be greater than presented in this model.

Limited Access Stream Crossing and Fencing

The load reduction for Limited Access Stream Crossing and Fencing was determined by the STEPL load reduction model. The MSJRW steering committee estimated that it is feasible to install fencing and a limited access stream crossing at the two areas where livestock were seen in the stream within three years. It was assumed for modeling purposes that both sites identified in the Willow Run subwatershed where livestock (horses) have direct access to the stream to pass from pasture to pasture and/or for drinking water, will be addressed in year one of implementation. Since the exact number of animals present at the sites identified during the windshield survey and livestock inventory is not known, estimated numbers of horses in the subwatershed from the STEPL load reduction model were used.

Cistern (commercial)

The load reduction for the implementation of cisterns on a commercial property was estimated using the STEPL load reduction model. The MSJRW steering committee estimated that it is feasible to install one commercial cistern annually. It is not clear yet where the cost-share program for the installation of a commercial cistern will be accepted, therefore it was assumed that one commercial cistern will be installed in each of the subwatersheds deemed critical for urban pollution (Big Run, Sol Shank Ditch, and Russell Run). Assumptions made to run the load reduction model include a 10 acre contributing area and the installation of a 300 gallon cistern.

Rain Barrel (residential)

The load reduction for the implementation of rain barrels on a residential property was estimated using the STEPL load reduction model. The MSJRW steering committee estimated that it is feasible to install three residential rain barrels annually. It is not clear yet where the cost-share program for the installation of a rain barrels will be accepted, therefore it was assumed that three rain barrels will be installed in each of the subwatersheds deemed critical for urban pollution (Big Run, Sol Shank Ditch, and Russell Run). Assumptions made to run the load reduction model include a 1 acre contributing area and the installation of a 50 gallon rain barrel.

Rain Garden

The load reduction for the implementation of a rain garden on a commercial property was estimate using the STEPL load reduction model. The MSJRW steering committee estimated that it is feasible to install two rain gardens annually. It is not clear yet where the cost-share program for the installation of a rain barrels will be accepted, therefore it was assumed that two rain gardens will be installed in each of the subwatersheds deemed critical for urban pollution (Big Run, Sol Shank Ditch, and Russell Run). It was assumed for the purposes of running the STEPL load reduction model that the contributing area to the rain garden was one acre for residential properties and 10 acres for commercial properties.

Weekly Street Cleaning

The load reduction for the implementation of the weekly street cleaning program was estimated by the Region 5 load reduction model. The MSJRW steering committee set a goal of starting a street sweeping program in Butler, Edgerton, and the SDI complex within six months of beginning implementing this WMP. To run the load reduction model for the street sweeping program in each target area, estimates of the total acreage of transportation corridors, and urban and industrial areas calculated by the STEPL load reduction model was used in the Urban Worksheet in the Region 5 load reduction model.

Un-Modeled BMPs

As stated above, not all BMPs that are listed in the MSJRW Action Register can be modeled to determine pollutant load reductions as they are either new technologies or there are too many variables involved to give an accurate estimate. The following list of practices is of four such BMPs.

Blind Inlets

The MSJRW steering commitee plans to cost share on blind inlets on crop land with unmanaged tile inlets in those subwatershed deemed critical for nitrogen and turbidity (Big Run, Sol Shank Ditch, Willow Run, Russell Run and Bluff Run). Blind inlets are a relatively new technology and research continues to determine how effective the technology is in lessening the pollutant load through tile inlets in crop land. One such study, conducted by the USDA Agriculture Research Service (ARS) in the St. Joseph River Watershed in 2010 indicates that blind inlets do in fact, have a significant impact on the amount of sediment and nutrients released to open water through field tiles. A copy of the study can be found at http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=267832.

Equipment Modification

The MSJRW steering committee also plans to cost share on equipment modification for the application of pesticides and nutrients including RTK, GPS, and others in subwatersheds that are deemed critical for nitrogen (Big Run, Sol Shank Ditch, Willow Run, Russell Run, and Bluff Run). These types of modifications to existing applicators can increase crop efficiency while decreasing the potential for overspray, which often leads to NPS reaching open water. The University of Missouri has several suggestions of how to optimize plant growth while limiting water and air pollution listed on their Division of Plant Science website, http://plantsci.missouri.edu/nutrientmanagement/nitrogen/practices.htm, and equipment modifications is one suggestion.

There currently are no estimates available of the amount of excess nutrients that are applied to crop fields due to the lack of proper equipment to limit over-spraying. For this reason, an accurate pollution load reduction cannot be determined until after at least one year of application while using the new technology. An estimated reduction can be made by simply subtracting the amount of fertilizer used during that spring application from the amount of fertilizer used the previous year. The difference will be the estimated pollution load reduction.

Rotational Grazing

Rotational Grazing is a practice used which can improve the health of the livestock, pasture plant and soil health, fish and wildlife habitat, as well as water quality. The University of Illinois Extension Office lists several studies which identify pastures as one of the best options for reducing runoff, erosion, and phosphorus pollution (http://www.livestocktrail.illinois.edu/pasturenet/paperDisplay.cfm?ContentID=6618). The Extension also refers to another study conducted by the Agricultural Research Service (ARS) which showed rainfall better infiltrated pasture land than adjacent wooded areas that were considered "pristine". For those reasons, it can be expected that implementing rotational grazing at the six sites identified as posing a potential threat to water quality within Sol Shank Ditch or Willow Run subwatershed, and any other sites that are noted in the future, would have a significant impact on the amount of runoff, which has the potential to carry fecal coliform and nutrients, reaching open water sources. Another benefit of rotational grazing is that plants have time to recover between grazing periods, thus increases plant and soil health and decreasing the potential for erosion.

Tree Planting

Urban areas within the MSJRW were deemed critical for excessive storm flow which increases the number of CSO events which contribute nutrients, fecal coliform, and sediment to open water, and carries other urban pollutants such as oil, salts, sediment and lawn fertilizer across impervious, denude surfaces directly to open water sources. As stated in Section 5.3, a medium sized tree can use 2,380 gallons of water annually, thus lessening the impact of storm flow in urban areas if planted and allowed to grow.

The major urban areas in the MSJRW are located in the Big Run, Buck Creek, Sol Shank Ditch and Russell Run subwatersheds. There is not currently an accurate way to measure the amount of pollution load reduction that will take place in these subwatersheds from a tree planting program due to the large number of variables that cannot be accounted for on a subwatershed basis. It can be noted, that significant storm flow decreases will take place if a successful tree planting program is implemented in Butler, Edgerton, and the industrial complex located in Sol Shank Ditch.

7.1 Big Run Subwatershed Potential Load Reductions

Referring back to Section 5 of this WMP, Big Run is deemed critical for excessive nitrogen pollution, a lack of adequate riparian buffers, CFOs, subsurface drainage, as well as urban pollution and excessive stormflow. For these reasons, BMPs were selected to implement in Big Run that would address the sources of pollution described above. Table 7.1 is a table listing the current pollution load as estimated by the STEPL model prior to implementation of any BMPs. Table 7.2 is a list of BMPs that will be implemented in the Big Run subwatershed and the potential pollution load reduction from implementation of the BMP in year one. It is important to remember that the BMPs listed in Table 7.2 will have a cumulative effect on pollution load reductions the longer the BMP is utilized. BMPs that will be implemented in the Big Run subwatershed that could not be modeled include equipment modification, blind inlets, and a tree planting program.

Table 7.1: Current Pollution Load in Big Run Subwatershed per STEPL

Nitrogen Loading (lbs/yr)	Phosphorus Loading (lbs/yr)	Sediment Loading (T/yr)
237,461.20	63,122.00	30,444.50

Table 7.2: Potential Load Reductions After BMP Implementation in Big Run

Goal Number(s)	BMP	Number/Size of BMP	Nitrogen Reduction (lbs/yr)	% N Reduction	Phosphorus Reduction (lbs/yr)	% P Reduction	Sediment Reduction (T/yr)	% Sediment Reduction	Model Used to Determine Reduction
1, 2, 7	Cover Crops	140 Acres	4016	1.7	2006	3.2	2456	8.1	Region 5
1, 2, 4, 7	Stream Buffer	100 Acres	491.5	0.3	159.6	0.4	110.7	0.4	STEPL
1, 2, 7	2-Stage Ditch	1000 linear ft	15300	10.17	5928.8	13.3	112.5	0.37	Region 5
1, 2, 7	Conservation Tillage	140 Acres	706	0.5	234.1	0.5	174.5	0.6	STEPL
1, 2, 7	Grassed Waterway	300 linear ft	1004.4	0.67	16.2	0.04	16.2	0.05	Region 5
1, 2, 7	Wetland	100 Acre contributing area	2700	4.1	1400	9.8	1500	54.4	Region 5
8	Cistern (commercial)	1	77.68	1.1	11.63	1.1	1.79	1.1	STEPL
8	Rain Barrel (residential)	3	6.4	0.9	0.82	0.07	0.13	0.08	STEPL
8	Rain Garden (residential)	2	5.07	0.07	1.59	0.01	0.05	0.09	STEPL
8	Weekly Street Sweeping	N/A	0	0	91	6	98.8	16	Region 5
TOTAL Load Reductions in Big Run Subwatershed per Year			24307.05	10.24	9849.74	15.6	4470.67	14.68	

7.2 Buck Creek Subwatershed Potential Load Reductions

Referring back to Section 5 of this WMP, Buck Creek is deemed critical for the lack of adequate riparian buffers, CFOs, as well as urban pollution and excessive stormflow. For these reasons, BMPs were selected to implement in Buck Creek that would address the sources of pollution described above. Table 7.3 is a table listing the current pollution load as estimated by the STEPL model prior to implementation of any BMPs. Table 7.4 is a list of BMPs that will be implemented in the Buck Creek subwatershed and the potential pollution load reduction from implementation of the BMP in year one. It is important to remember that the BMPs listed in Table 7.2 will have a cumulative effect on pollution load reductions the longer the BMP is utilized. BMPs that will be implemented in the Buck Creek subwatershed that could not be modeled include the tree planting program.

Table 7.3: Current Pollution Load in Buck Creek Subwatershed per STEPL

Nitrogen Loading (lbs/yr)	Phosphorus Loading (lbs/yr)	Sediment Loading (T/yr)
136,646.10	39,748.70	25,260.70

Table 7.4: Potential Load Reductions after BMP Implementation in Buck Creek

Goal Number(s)	BMP	Number/ Size of BMP	Nitrogen Reduction (lbs/yr)	% N Reduction	Phosphorus Reduction (lbs/yr)	% P Reduction	Sediment Reduction (T/yr)	% Sediment Reduction	Model Used to Determine Reduction
4	Stream Buffer	100 Acres	1576	1.2	844	2.1	626	2.5	STEPL
8	Cistern (Commercial)	1	77.68	2.4	11.63	2.3	1.79	2.4	STEPL
8	Rain Barrel (residential)	3	4.86	0.15	0.88	0.17	6.5	0.15	STEPL
8	Rain Garden (residential)	2	2.28	0.07	0.78	0.15	0	0	STEPL
8	Weekly Street Sweeping	N/A	0	0	40	6.1	43.61	16	Region 5
Total Load Reduction in Buck Creek Subwatershed per Year			1660.82	1.22	897.29	2.26	677.9	2.68	

7.3 Sol Shank Ditch Subwatershed Potential Load Reductions

Referring back to Section 5 of this WMP, Sol Shank Ditch is deemed critical for excessive nitrogen pollution, a lack of adequate riparian buffers, small scale animal operations, subsurface drainage, as well as urban and industrial pollution and excessive stormflow. For these reasons, BMPs were selected to implement in Sol Shank Ditch that will address the sources of pollution described above. Table 7.5 is a table listing the current pollution load as estimated by the STEPL model prior to implementation of any BMPs. Table 7.6 is a list of BMPs that will be implemented in the Sol Shank Ditch subwatershed and the potential pollution load reduction from implementation of the BMP in year one. It is important to remember that the BMPs listed in Table 7.6 will have a cumulative effect on pollution load reductions the longer the BMP is utilized. BMPs that will be implemented in the Sol Shank Ditch subwatershed that could not be modeled include equipment modification, blind inlets, rotational grazing, and a tree planting program.

Table 7.5: Current Pollution Load in Sol Shank Ditch Subwatershed per STEPL

Nitrogen Loading (lbs/yr)	Phosphorus Loading (lbs/yr)	Sediment Loading (T/yr)
222,205.50	64,269.20	32,082.20

Table 7.6: Potential Load Reductions after BMP Implementation in Sol Shank Ditch

Goal Number(s)	BMP	Number/ Size of BMP	Nitrogen Reduction (lbs/yr)	% N Reduction	Phosphorus Reduction (lbs/yr)	% P Reduction	Sediment Reduction (T/yr)	% Sediment Reduction	Model Used to Determine Reduction
1, 2, 7	Cover Crops	140 Acres	1982	0.80	987	1.4	1163	3.6	Region 5
1, 2, 4, 7	Stream Buffer	100 Acres	1576	0.7	844	1.3	626	2	STEPL
1, 2, 7	2-Stage Ditch	1000 linear ft	12,800	5.1	4960	7.1	80	0.2	Region 5
1, 2, 7	Conservation Tillage	140 Acres	1292.1	0.5	597.1	0.8	206.9	0.6	STEPL
1, 2, 7	Grassed Waterway	300 linear ft	2592	3.6	1004.4	1.4	16.2	0	Region 5
6	Waste Management System	3 Farms Identified as a Potential Problem	717	65.1	65	60	0	0	Region 5
1, 2, 7	Wetland	100 Acre contributing area	2700	2.1	1400	5.2	1500	32.3	Region 5
8	Cistern (Industrial)	1	7.3	0	1	0	0.1	0	STEPL
8	Rain Barrel (residential)	3	4.86	0.15	0.88	0.17	0.11	0.15	STEPL
8	Rain Garden (residential)	2	2.28	0.07	0.78	0.15	0.24	0.32	STEPL
8	Rain Garden (Commercial)	1	5.7	0.17	1.07	0.2	0	0	STEPL
8	Weekly Street Sweeping	N/A	0	0	221	6	226.05	16	Region 5
TOTAL Load Reductions in Sol Shank Ditch Subwatershed per Year			23679.24	10.66	10082.23	15.69	3818.6	11.9	

7.4 Willow Run Subwatershed Potential Load Reductions

Referring back to Section 5 of this WMP, Willow Run is deemed critical for excessive nitrogen pollution, turbidity, a lack of adequate riparian buffers, livestock access to open water and small scale animal operations, CFOs, and subsurface drainage. For these reasons, BMPs were selected to implement in Willow Run that will address the sources of pollution described above. Table 7.7 is a table listing the current pollution load as estimated by the STEPL model prior to implementation of any BMPs. Table 7.8 is a list of BMPs that will be implemented in the Willow Run subwatershed and the potential pollution load reduction from implementation of the BMP in year one. It is important to remember that the BMPs listed in Table 7.8 will have a cumulative effect on pollution load reductions the longer the BMP is utilized. BMPs that will be implemented in the Willow Run subwatershed that could not be modeled include equipment modifications, blind inlets, and rotational grazing.

Table 7.7: Current Pollution Load in Willow Run Subwatershed per STEPL

Nitrogen Loading (lbs/yr)	Phosphorus Loading (lbs/yr)	Sediment Loading (T/yr)
64,278.10	14,445.80	1,838.70

Table 7.8: Potential Load Reductions after Implementation in Willow Run Subwatershed

Goal Number(s)	BMP	Number/ Size of BMP	Nitrogen Reduction (lbs/yr)	% N Reduction	Phosphorus Reduction (lbs/yr)	% P Reduction	Sediment Reduction (T/yr)	% Sediment Reduction	Model Used to Determine Reduction
1, 2, 7	Cover Crops	140 Acres	226	0.35	113	0.8	96	5.2	Region 5
1, 2, 4, 7	Stream Buffer	100 Acres	1019.3	1.6	415.5	2.9	165.2	9	STEPL
1, 2, 7	2-Stage Ditch	1000 linear ft	12,800	19.9	4960	34.3	80	4.35	Region 5
1, 2, 7	Conservation Tillage	140 Acres	1394	2.2	522.5	3.6	267	14.5	STEPL
1, 2, 7	Grassed Waterway	300 linear ft	2304	3.6	892.8	6.2	14.4	0.8	Region 5
1, 2, 7	Wetland	100 Acre contributing area	4800	7.5	800	5.5	600	32.6	Region 5
6	Waste Management System	3 Farms Identified as a Potential Problem	312	0.5	44	0.3	0	0	Region 5
6	Fencing/Limited Access Stream Crossing	2 Farms Identified with Direct Access	1590.3	2.5	586.8	4.1	267	14.5	STEPL
TOTAL Load Reductions in willow Run Subwatershed per Year			24445.6	37.78	8334.6	57.7	1489.6	81.01	

7.5 Russell Run Subwatershed Potential Load Reductions

Referring back to Section 5 of this WMP, Russell Run is deemed critical for excessive nitrogen pollution, turbidity, subsurface drainage, a lack of adequate riparian buffers, as well as urban pollution and excessive stormflow. For these reasons, BMPs were selected to implement in Russell Run that would address the sources of pollution described above. Table 7.9 is a table listing the current pollution load as estimated by the STEPL model prior to implementation of any BMPs. Table 7.10 is a list of BMPs that will be implemented in the Russell Run subwatershed and the potential pollution load reduction from implementation of the BMP in year one. It is important to remember that the BMPs listed in Table 7.10 will have a cumulative effect on pollution load reductions the longer the BMP is utilized. BMPs that will be implemented in the Russell Run subwatershed that could not be modeled include equipment modification, blind inlets, and a tree planting program.

Table 7.9: Current Pollution Load in Russell Run per STEPL

Nitrogen Loading (lbs/yr)	Phosphorus Loading (lbs/yr)	Sediment Loading (T/yr)
65,263.40	14,300.70	2757.2

Table 7.10: Potential Load Reductions after Implementation in Russell Run

Goal Number(s)	BMP	Number/ Size of BMP	Nitrogen Reduction (lbs/yr)	% N Reduction	Phosphorus Reduction (lbs/yr)	% P Reduction	Sediment Reduction (T/yr)	% Sediment Reduction	Model Used to Determine Reduction
1, 2, 7	Cover Crops	140 Acres	462	0.7	231	1.6	189	6.9	Region 5
1, 2, 4, 7	Stream Buffer	100 Acres	467	0.7	283.5	2	21.7	0.8	STEPL
1, 2, 7	2-Stage Ditch	1000 linear ft	12800	19.6	4960	34.7	80	2.9	Region 5
1, 2, 7	Conservation Tillage	140 Acres	549.2	0.8	285.1	2	35.1	1.3	STEPL
1, 2, 7	Grassed Waterway	300 linear ft	2880	4.4	1116	7.8	18	0.7	Region 5
1, 2, 7	Wetland	100 Acre contributing area	2700	4.1	1400	9.8	1500	54.4	Region 5
8	Cistern (Industrial)	1	7.65	0.1	0.77	0.08	0.72	0.5	STEPL
8	Rain Barrel (residential)	3	3.07	0.04	0.56	0.06	0.07	0.05	STEPL
8	Rain Garden (residential)	2	3.38	0.05	1.16	0.1	0	0	STEPL
8	Rain Garden (Commercial)	1	65.82	1	12.4	1.3	0	0	STEPL
8	Weekly Street Sweeping	N/A	0	0	60	6	68.03	16	Region 5
TOTAL Load Reductions in Russell Run Subwatershed per Year			19938.12	30.55	8350.49	58.39	1912.62	69.37	

7.6 Bluff Run Subwatershed Potential Load Reductions

Referring back to Section 5 of this WMP, Bluff Run is deemed critical for excessive nitrogen pollution, turbidity, subsurface drainage, and a lack of adequate riparian buffers. For these reasons, BMPs were selected to implement in Bluff Run that would address the sources of pollution described above. Table 7.11 is a table listing the current pollution load as estimated by the STEPL model prior to implementation of any BMPs. Table 7.12 is a list of BMPs that will be implemented in the Bluff Run subwatershed and the potential pollution load reduction from implementation of the BMP in year one. It is important to remember that the BMPs listed in Table 7.12 will have a cumulative effect on pollution load reductions the longer the BMP is utilized. BMPs that will be implemented in the Bluff Run subwatershed that could not be modeled include equipment modification and blind inlets.

Table 7.11: Current Pollution Load in Bluff Run Subwatershed per STEPL

Nitrogen Loading (lbs/yr)	Phosphorus Loading (lbs/yr)	Sediment Loading (T/yr)
127,027.60	26,894.40	4642.2

Table 7.12: Potential Load Reductions after Implementation in Bluff Run

Goal Number(s)	BMP	Number/ Size of BMP	Nitrogen Reduction (lbs/yr)	% N Reduction	Phosphorus Reduction (lbs/yr)	% P Reduction	Sediment Reduction (T/yr)	% Sediment Reduction	Model Used to Determine Reduction
1, 2, 7	Cover Crops	140 Acres	462	0.4	231	0.9	189	4.07	Region 5
1, 2, 4, 7	Stream Buffer	100 Acres	476.4	0.4	437.6	1.6	19.3	0.4	STEPL
1, 2, 7	2-Stage Ditch	1000 linear ft	12800	10.1	4960	18.4	80	1.7	Region 5
1, 2, 7	Conservation Tillage	140 Acres	555.7	0.4	436.8	1.6	31.1	0.7	STEPL
1, 2, 7	Wetland	100 Acre contributing area	2700	2.1	1400	5.2	1500	32.3	Region 5
1, 2, 7	Grassed Waterway	300 linear ft	2880	2.3	1116	4.1	18	0.4	Region 5
TOTAL Load Reductions in Bluff Run Subwatershed per Year			19874.1	15.65	8581.4	31.91	1837.4	39.58	

8.0 Ohio Coastal Nonpoint Pollution Control Program

Per the Coastal Zone Act of 1990, each coastal state is required to submit for approval a coastal nonpoint pollution control program (CNPCP) to the US EPA and the National Oceanic and Atmospheric Administration (NOAA) with the purpose "to develop and implement management measures for nonpoint source pollution to restore and protect coastal waters, working in close conjunction with other State and local authorities."

Ohio was granted conditional approval of their CNPCP, administered by the ODNR, in 2002. Ohio therefore, requires all WMPs compiled for watershed located within the Lake Erie Basin to describe how the NPS management measures outlined in the CNPCP will be addressed. The following sections describe the management measures that will be taken to address the issues outlined in Appendix 8 of the Ohio CNPCP which can be found in Appendix B of this document.

There are several Management Measures outlined in the Ohio CNPCP that are applicable in Middle St. Joseph River Watershed. Those applicable management measures are listed below.

Applicable Management Measures

1. New Development
2. Watershed Protection
3. Site Development
4. Existing Development
5. Establish Protective Setbacks
6. Reduce Nitrogen Loading by 50%
7. Operating On-Site Disposal Systems
8. New On-Site Disposal Systems
9. Planning, Siting, and Developing Roads and Highways
10. Bridges
11. Road, Highway, and Bridge Operation and Maintenance
12. Road, Highway, and Bridge Runoff Systems
13. Operation and Maintenance Program for Existing Channels to Protect Surface Water and Restore In-stream and Riparian Habitat
14. Eroding Streambanks and Shorelines

Non-applicable Management Measures

Dams (There are no dams present in the watershed)
State Operated/Managed Roads, Highways, and Bridges

The Middle St. Joseph River Watershed does not have any dams, nor any plans for dams, in the MSJRW therefore; management measures for dams do not need to be addressed in this WMP. State operated roads, highways and bridges are subject to state rules and regulations. Those transportation corridors that are in development are subject to Rule 5 permitting and those corridors that are already in existence are subject to State's NPDES Stormwater Pollution Prevention Plans.

The majority of the management measures listed in the Ohio CNPCP are addressed in Section 6 of this WMP. However, further explanation of how those management measures will be implemented in the MSJRW is provided below.

8.1 New Development/Site Development/Establish Protective Setbacks

There are two small communities located within the project area, Edgerton, Ohio and Butler, Indiana. Both communities are small enough that a stormwater protection plan is not mandated by EPA, or either regulating state agency. Therefore, there are no regulations beyond the EPA mandate to control stormwater if 1 acre or more of land is disturbed, in place at this time.

The DeKalb County Planning Commission adopted a county Comprehensive Plan in 2004 which includes management measures on new development including " discouraging development of sensitive areas, the adoption of best management practices" and "allowing development within the 100 year flood plain on a minimal basis." DeKalb County also adopted the DeKalb County Unified Development Ordinance in 2009 which designates a small area north of Butler to be used only as open space as well as bans the removal of all trees during construction unless the trees are dead or diseased, or if trees must be removed they have to be replaced with comparable vegetation.

The Middle St. Joseph Steering Committee has outlined plans in the Action Register to work with City and County Planners to reduce stormwater runoff, encourage Low Impact Designs for all new developments, and encourage the adoption of protective setbacks for sensitive areas outlined in this WMP.

8.2 Watershed Protection

Implementation of this Watershed Management Plan will meet the management measure of watershed protection. All previous studies outlined in Section 2.6 offer ideas of how to mediate NPS within the MSJRW as well. Plans outlined in the Action Registers for each of the goals of the MSJRW project express how watershed protection will be accomplished including, but not limited to; wetland restoration and creation, implementation of BMPs, and working with City and County Planners to encourage the adoption of a comprehensive plan that requires LID be considered for all new development and, setbacks be followed for all sensitive areas.

8.3 Existing Development

As mentioned above Butler, Indiana and Edgerton, Ohio are the only population centers located within the MSJRW. Thirty-eight percent of Butler, Indiana is currently zoned for light to heavy industrial use and is projected to increase industrialization significantly over the next two decades. Butler also is a CSO community with a Long Term Control Plan approved by IDEM that allows for 12 CSO events to occur annually. The town of Edgerton is not currently expanding, however it is important to try to limit the amount of stormwater discharge from the town since the St. Joseph River runs within the towns jurisdiction.

The MSJRW project will meet with City and County planners to develop a plan to address the excess of stormwater runoff from the urbanized areas and to encourage BMP retrofits to limit stormwater runoff. It is the goal of this project to reduce CSO events from the current 12 annual events to 8 within one year of implementation. The MSJRW project will also work with private landowners to install other stormwater control practices such as rain gardens, wetland restoration and creation, and rain barrels or cisterns.

8.4 Reduce Nitrogen Loading by 50%

The MSJRW project tested nitrate+nitrite as an indicator of nitrogen levels within the waters of the MSJRW. The water quality testing conducted by the MSJRW project indicated that a 61% load reduction of nitrate+nitrite is needed to reach the goal of 1.6 mg/l. The action register for the MSJRW steering committee Goal 1, provided in Section 6 of this WMP, outlines specifically how this project will reduce nitrogen levels in the MSJRW. However, each objective for each of the nine goals of this project will help to reach the management measure of reducing nitrogen loading by 50% in the MSJRW.

8.5 Operating and New On-Site Disposal Systems

Both Butler, Indiana and Edgerton, Ohio are on centralized sewer systems. However, most of the rural community within the MSJRW utilizes on-site sewage disposal systems. The Williams County Health Department estimates that there are currently 2,087 failing on-site waste disposal systems within the MSJRW and the DeKalb County Health Department estimates there are 2,204 failing systems located within the county. Failing sewage disposal systems pose a threat of excessive nutrients, bacteria, and sediment reaching ground and surface waters. State and County Health Departments have regulations for the installation of all new on-site disposal systems. However, existing on-site disposal systems are grandfathered into the new laws.

The MSJRW set a goal of increasing knowledge of on-site sewage waste management systems with the objectives of working with County Health Departments and other organizations to develop an educational program regarding septic system placement and management, provide cost-share dollars for system replacement and maintenance, and work with local septic system companies to provide discounts to landowners who sign up for regular maintenance on their system.

8.6 Planning, Siting, and Developing Roads and Highways

The development of new roads can cause a significant risk to surface waters and sensitive areas as heavy equipment is used which has the potential to leak gas and oil, and soil disturbances can increase sedimentation of surrounding water resources. The best time to address these concerns is during the planning phase of the new road at which time, siting and development of the road should be considered to limit any detrimental effects on surrounding sensitive areas and water resources. Environmental impact assessments (EIA) are often required before construction of the new road can take place which will identify any potential harm to the surrounding environment. If, during the EIA, it is found that building a road in a particular location will cause harm to the environment, measures will need to be taken to minimize the impact of the road to the highest degree possible, or the road will need to be sited elsewhere. The use of BMPs during road construction is also very important as it will minimize the effects on water resources by minimizing land disturbances. The OCNPCP has three requirements to meet during the planning, siting, and development of roads and highways:

1. Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss
2. Limit land disturbance such as clearing and grading and cut and fill to reduce erosion and sediment loss
3. Limit disturbance of natural drainage features and vegetation

8.7 Bridges

Pollution from bridge decks can have an impact on water resources. Therefore, the OCNPCP requires that bridge maintenance and design be considered to limit the impact on critical habitat, fisheries, shellfish beds, wetlands, and domestic water supplies.

Bridge maintenance is on a regular rotating schedule with the Department of Transportation for inspection and repair as needed. There are no plans in the near term for bridge development within the watershed. However, it was noted during the windshield survey conducted in 2011 that the bridge leading to the SDI industrial park had a lot of sediment buildup on the sides of the bridge. This sediment may also have other pollutants including road salts, oil, and heavy metals as the bridge is traveled mostly by heavy trucks carrying metal scrap. The bridge has openings along its sides to drain stormwater directly into Sol Shank Ditch below. That is why it is an objective of this project to work with city and county planners, as well as the SDI complex, to begin a regular road sweeping program which will help to keep pollutants out of the rivers.

8.8 Road, Highway, and Bridge Operation and Maintenance

Operation and maintenance of roads, highways, and bridges is performed by the Indiana or Ohio Department of Transportation, local county, or township. Each entity must follow the good housekeeping rules laid out in their NPDES permit, if one exists. The MSJRW project plans to meet with local city and county planners to improve road, highway, and bridge housekeeping and as mentioned above, will work with local entities to incorporate a regular street sweeping program.

8.9 Road, Highway, and Bridge Runoff Systems

The majority of the pollution in the MSJRW is a result of agricultural land as it comprises over 60% of the watershed. Though, there are some areas where improvement can be made to mitigate the impact of excessive stormwater from urban areas. There are few storm drains located within the watershed. Those located in Butler are part of a combined sewer system, and those located in Edgerton are separated. Butler has a Long Term Control Plan in place which limits the number of CSO events to 12 a year but it is the goal of this project to limit the number of CSO events to eight annually within one year of the beginning of phase two of the MSJRW project by incorporating stormwater BMP retrofits, and offering cost-share dollars for landowners to install BMPs that capture stormwater throughout the watershed. The MSJRW also plans to work with City and County Planners to determine the best means of minimizing the impact of stormwater runoff from roads, highways, and bridges.

8.10 Operation and Maintenance Program for Existing Channels to Protect Surface Water and Restore In-stream and Riparian Habitat

Changes made to existing channels, or channel construction, can impact the integrity of the water system as a whole and may alter wildlife and aquatic habitat and can alter the chemical and physical integrity of the stream channel including, sediment, turbidity, salinity, temperature, nutrients, dissolved oxygen, and other contaminants. For these reasons, the MSJRW project plans to work with City and County Planners and county surveyors to implement a method that will maintain the integrity of the stream system, while serving the purpose of the stream channel modification. The MSJRW project will also encourage the use of a two-stage ditch design which will limit sedimentation and help to mediate increased nutrients in the stream channel, as well as offer cost-share dollars when possible to implement the two-stage stream design

8.11 Eroding Streambanks and Shorelines

Streambanks often begin to erode due to stream channel and bank modification and an increase in stormflow. Streambank erosion can cause economic hardship for farmers and landowners who rely on property adjacent to open water, as well as impact aquatic and wildlife habitat. There are not many areas of streambank erosion present in the MSJRW, however it is important to protect streambanks from future erosion which becomes more of a possibility with the increase in impervious surfaces in the watershed, leading to increased stream flow.

It is the goal of the MSJRW project to limit excessive storm flow runoff and the Steering Committee has developed a plan, which is outlined in the action register in Section 6.2, of how to accomplish that goal. The MSJRW also plans to work with landowners in the agricultural community to offer cost-share dollars to implement BMPs that will protect streambanks from erosion.

9.0 Future Activity

It is the goal of the St. Joseph River Watershed Initiative that this WMP will be reviewed and utilized by other organizations within the MSJRW including the DeKalb, Defiance and Williams County SWCDs, The Nature Conservancy's Western Lake Erie Basin Project, County Drainage Boards and Surveyors, and City and County Planning Offices. While the MSJRW projects first priority is to obtain funding to implement this WMP, we hope to work with other organizations that plan to do the same.

A watershed is continuously changing and therefore, this WMP must remain a 'living document' and be updated as needed by the St. Joseph River Watershed Initiative, or its partners, and every five years at a minimum.

Appendix A

Ohio Biodiversity Database
Rare Species List for Defiance Co.
As of 9/24/2010

Last Recorded	Scientific Name	Common Name	State Status	Federal Status
PLANTS				
1995	*Androsace occidentalis*	Western Rock-jasmine	T	
1958	*Arabis hirsuta var. adpressipilis*	Southern Hairy Rock Cress	P	
1977	*Carex oligosperma*	Few-seeded Sedge	T	
1995	*Conyza ramosissima*	Bushy Horseweed	P	
2004	*Juncus interior*	Inland Rush	E	
2004	*Lathyrus ochroleucus*	Yellow Vetchling	E	
1967	*Lechea villosa*	Hairy Pinweed	P	
2004	*Moehringia lateriflora*	Grove Sandwort	P	
1987	*Smilax pulverulenta*	Downy Carrion-flower	E	
1991	*Vernonia fasciculata*	Prairie Ironweed	T	
ANIMALS				
1999	*Cyclonaias tuberculata*	Purple Wartyback	SC	
1982	*Enallagma ebrium*	Marsh Bluet	T	
1999	*Epioblasma torulosa rangiana*	Northern Riffleshell	E	FE
2010	*Haliaeetus leucocephalus*	Bald Eagle	T	
1999	*Ligumia recta*	Black Sandshell	T	
1992	*Moxostoma valenciennesi*	Greater Redhorse	T	
1996	*Obliquaria reflexa*	Threehorn Wartyback	T	
2000	*Pleurobema clava*	Clubshell	E	FE
1999	*Pleurobema sintoxia*	Round Pigtoe	SC	
1975	*Quadrula cylindrica cylindrica*	Rabbitsfoot	E	
1999	*Truncilla donaciformis*	Fawnsfoot	T	
1999	*Truncilla truncata*	Deertoe	SC	

P=Potentially Threatened, T=Threatened, E=Endangered, SC=Species of Concern
SI=Special Interest, FT=Federally Threatened, FE=Federally Endangered

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Ohio Biodiversity Database
Rare Species List for Williams Co.
As of 10/15/2010

Last Recorded	Scientific Name	Common Name	State Status	Federal Status
PLANTS				
2005	*Acorus americanus*	American Sweet-flag	P	
2000	*Agalinis purpurea var. parviflora*	Small Purple-foxglove	E	
2003	*Betula pumila*	Swamp Birch	T	
2009	*Carex alata*	Broad-winged Sedge	P	
2003	*Carex aquatilis*	Leafy Tussock Sedge	P	
2008	*Carex atherodes*	Wheat Sedge	P	
2005	*Carex aurea*	Golden-fruited Sedge	P	
1989	*Carex bebbii*	Bebb's Sedge	P	
2009	*Carex diandra*	Lesser Panicled Sedge	T	
2009	*Carex lasiocarpa*	Slender Sedge	P	
2000	*Carex retrorsa*	Reflexed Bladder Sedge	E	
2009	*Carex sprengelii*	Sprengel's Sedge	T	
2000	*Cornus canadensis*	Bunchberry	E	
2009	*Eleocharis flavescens*	Green Spike-rush	T	
2009	*Eleocharis quinqueflora*	Few-flowered Spike-rush	T	
1981	*Helianthemum canadense*	Canada Frostweed	T	
2000	*Hieracium longipilum*	Long-bearded Hawkweed	E	
2000	*Hypericum boreale*	Northern St. John's-wort	T	
2000	*Krigia virginica*	Virginia Dwarf-dandelion	T	
2000	*Larix laricina*	Tamarack	P	
1980	*Lathyrus ochroleucus*	Yellow Vetchling	E	
2009	*Moehringia lateriflora*	Grove Sandwort	P	
2009	*Myriophyllum sibiricum*	American Water-milfoil	T	
1979	*Ophioglossum pusillum*	Northern Adder's-tongue	E	
2005	*Panicum boreale*	Northern Panic Grass	P	
1974	*Phlox latifolia*	Mountain Phlox	E	
2001	*Plagiothecium latebricola*	Lurking Leskea	T	
1991	*Plantago patagonica*	Woolly Plantain	E	
2001	*Platanthera flava*	Tubercled Rein Orchid	P	
2008	*Platanthera psycodes*	Small Purple Fringed Orchid	T	
2000	*Polygala polygama*	Racemed Milkwort	T	
2000	*Potamogeton natans*	Floating Pondweed	P	
1969	*Potamogeton praelongus*	White-stemmed Pondweed	E	
2009	*Potamogeton zosteriformis*	Flat-stemmed Pondweed	T	

P=Potentially Threatened, T=Threatened, E=Endangered, SC=Species of Concern
SI=Special Interest, FT=Federally Threatened, FE=Federally Endangered

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Indiana County Endangered, Threatened and Rare Species List

County: De Kalb

Species Name	Common Name	FED	STATE	GRANK	SRANK
Mollusk: Bivalvia (Mussels)					
Epioblasma obliquata perobliqua	White Cat's Paw Pearlymussel	LE	SE	G1T1	SX
Epioblasma torulosa rangiana	Northern Riffleshell	LE	SE	G2T2	SX
Lampsilis fasciola	Wavyrayed Lampmussel		SSC	G5	S3
Obovaria subrotunda	Round Hickorynut		SSC	G4	S1
Pleurobema clava	Clubshell	LE	SE	G2	S1
Ptychobranchus fasciolaris	Kidneyshell		SSC	G4G5	S2
Quadrula cylindrica cylindrica	Rabbitsfoot	C	SE	G3G4T3	S1
Simpsonaias ambigua	Salamander Mussel		SSC	G3	S2
Toxolasma lividus	Purple Lilliput		SSC	G3	S2
Villosa fabalis	Rayed Bean	C	SSC	G2	S1
Insect: Lepidoptera (Butterflies & Moths)					
Catocala marmorata	Marbled Underwing Moth		SE	G3G4	S1
Fish					
Moxostoma valenciennesi	Greater Redhorse		SE	G4	S2
Amphibian					
Ambystoma laterale	Blue-spotted Salamander		SSC	G5	S2
Reptile					
Emydoidea blandingii	Blanding's Turtle		SE	G4	S2
Thamnophis butleri	Butler's Garter Snake		SE	G4	S1
Bird					
Buteo platypterus	Broad-winged Hawk	No Status	SSC	G5	S3B
Circus cyaneus	Northern Harrier		SE	G5	S2
Cistothorus platensis	Sedge Wren		SE	G5	S3B
Rallus limicola	Virginia Rail		SE	G5	S3B
Mammal					
Lynx rufus	Bobcat	No Status	SSC	G5	S1
Taxidea taxus	American Badger		SSC	G5	S2
Vascular Plant					
Andromeda glaucophylla	Bog Rosemary		SR	G5	S2
Botrychium simplex	Least Grape-fern		SE	G5	S1
Carex echinata	Little Prickly Sedge		SE	G5	S1
Coeloglossum viride var. virescens	Long-bract Green Orchis		ST	G5T5	S2
Eriophorum spissum	Dense Cotton-grass		SX	G5T5	SX
Glyceria grandis	American Manna-grass		SX	G5	SH
Lathyrus ochroleucus	Pale Vetchling Peavine		SE	G4G5	S1
Luzula acuminata	Hairy Woodrush		SE	G5	S1
Milium effusum	Tall Millet-grass		SR	G5	S2
Panax trifolius	Dwarf Ginseng		WL	G5	S2

Indiana Natural Heritage Data Center
Division of Nature Preserves
Indiana Department of Natural Resources
This data is not the result of comprehensive county surveys.

Fed: LE = Endangered; LT = Threatened; C = candidate; PDL = proposed for delisting
State: SE = state endangered; ST = state threatened; SR = state rare; SSC = state species of special concern; SX = state extirpated; SG = state significant; WL = watch list
GRANK: Global Heritage Rank: G1 = critically imperiled globally; G2 = imperiled globally; G3 = rare or uncommon globally; G4 = widespread and abundant globally but with long term concerns; G5 = widespread and abundant globally; G? = unranked; GX = extinct; Q = uncertain rank; T = taxonomic subunit rank
SRANK: State Heritage Rank: S1 = critically imperiled in state; S2 = imperiled in state; S3 = rare or uncommon in state; G4 = widespread and abundant in state but with long term concern; SG = state significant; SH = historical in state; SX = state extirpated; B = breeding status; S? = unranked; SNR = unranked; SNA = nonbreeding status unranked

Appendix B

October 2010

GUIDANCE FOR WATERSHED PROJECTS TO ADDRESS OHIO'S COASTAL NONPOINT POLLUTION CONTROL PROGRAM (CNPCP)

A brief history of the Coastal Nonpoint Pollution Control Program

In recognition of the intense pressures facing our nation's coastal regions, Congress enacted the Coastal Zone Management Act (CZMA) which was signed into law on October 27, 1972. To address more specifically the impacts of nonpoint source pollution on coastal water quality, Congress enacted section 6217 of the Coastal Zone Act in November 1990. Section 6217 requires that each state with an approved coastal zone management program develop and submit for approval a Coastal Nonpoint Pollution Control Program(CNPCP) to the US EPA and the National Oceanic and Atmospheric Administration (NOAA). The purpose of the program "shall be to develop and implement management measures for nonpoint source pollution to restore and protect coastal waters, working in close conjunction with other State and local authorities."

To gain Federal approval, each state CNPCP must provide for the implementation, at a minimum, of management measures in conformance with those specified in the USEPA guidance published under subsection (g) of section 6217.

Status of Ohio's Coastal Nonpoint Pollution Control Program (CNPCP)

(November 24, 2003)

The Ohio CNPCP is administered by the ODNR Division of Soil and Water Conservation. Ohio received conditional approval of the CNPCP on June 04, 2002.

<u>Year One Conditions</u>

Ohio was provided one year to submit a legal opinion verifying that Ohio "has in place back-up authorities that can be used as enforceable policies and mechanisms in order to prevent nonpoint source based pollution and require management measure implementation." The legal opinion was developed by John Shailer, Assistant Attorney General-Environmental Enforcement Section/ODNR, and submitted by ODNR Office of Coastal Management to NOAA and USEPA June 04, 2003. The one-year conditions have been met.

<u>Year Two Conditions</u>

There are specific conditions that will need to be met for Ohio to receive final approval of its CNPCP. These conditions are organized by the major nonpoint source categories and subcategories. **These can be found on page 8 of the Appendix 8 update- outline of a watershed plan from "A guide to Developing Local Watershed Action Plans in**

Ohio".

NPS Management Measures that need addressed by Lake Erie Basin Watersheds

This area includes the entire Lake Erie Watershed, which includes portions of 35 counties and covers an area of 11,649 square miles. **The major sub-watersheds, or streams within the Lake Erie watershed include the Maumee, Portage, Sandusky, Huron, Vermillion, Black, Rocky, Chagrin, Cuyahoga, Grand and Ashtabula.**

Watershed plans within the Ohio Lake Erie Basin must (others are strongly encouraged) describe how the following **Management Measures** of the Ohio Coastal Nonpoint Pollution Control Program will be implemented within the specific watershed, if watershed inventory or sources and causes of impairment indicate applicability:

Management Measures (Defined)

Management measures" are defined in section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) as economically achievable measures to control the addition of pollutants to our coastal waters, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives.

Management Practices (Defined) – Specific practices found on web links provided.

In addition to specifying management measures, this chapter also lists and describes management practices for illustrative purposes only. While State programs are required to specify management measures in conformity with this guidance, State programs need not specify or require the implementation of the particular management practices described in this document. However, as a practical matter, EPA anticipates that the management measures generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices listed in this document have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measures. EPA has also used some of these practices, or appropriate combinations of these practices, as a basis for estimating the effectiveness, costs, and economic impacts of achieving the management measures. (Economic impacts of the management measures are addressed in a separate document entitled *Economic Impacts of EPA Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*.)

EPA recognizes that there is often site-specific, regional, and national variability in the selection of appropriate practices, as well as in the design constraints and pollution control effectiveness of practices. The list of practices for each management measure is not all-inclusive and does not preclude States or local agencies from using other technically sound practices. In all cases, however, the practice or set of practices chosen by a State needs to achieve the management measure.

URBAN

New Development Management Measure- This management measure is intended to accomplish the following: (1) decrease the erosive potential of increased runoff volumes and velocities associated with development-induced changes in hydrology; (2) remove suspended solids and associated pollutants entrained in runoff that result from activities occurring during and after development; (3) retain hydrological conditions to closely resemble those of the predisturbance condition; and (4) preserve natural systems including in-stream habitat.[2] For the purposes of this management measure, "similar" is defined as "resembling though not completely identical."
During the development process, both the existing landscape and hydrology can be significantly altered. As development occurs, the following changes to the land may occur (USEPA, 1977):

- Soil porosity decreases;
- Impermeable surfaces increase;
- Channels and conveyances are constructed;
- Slopes increase;
- Vegetative cover decreases; and
- Surface roughness decreases.

These changes result in increased runoff volume and velocities, which may lead to increased erosion of streambanks, steep slopes, and unvegetated areas (Novotny, 1991). In addition, destruction of in-stream and riparian habitat, increases in water temperature (Schueler et al., 1992), streambed scouring, and downstream siltation of streambed substrate, riparian areas, estuarine habitat, and reef systems may occur. An example of predicted effects of increased levels of urbanization on runoff volumes is presented in Table 4-4 (USDA-SCS, 1986). Methods are also available to compute peak runoff rates (USDA-SCS, 1986).

1. By design or performance:
    - After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid (TSS) loadings by 80 percent. For the purposes of this measure, an 80 percent TSS reduction is to be determined on an average annual basis, or
    - Reduce the postdevelopment loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings, and
2. To the extent practicable, maintain postdevelopment peak runoff rate and average volume at levels that are similar to predevelopment levels.

Sound watershed management requires that both structural and nonstructural measures be employed to mitigate the adverse impacts of storm water. Nonstructural Management Measures II.B and II.C can be effectively used in conjunction with Management Measure II.A to reduce both the short- and long-term costs of meeting the treatment goals of this management measure.

Applicability

This management measure is intended to be applied by States to control urban runoff and treat associated pollutants generated from new development, redevelopment, and new and relocated roads, highways, and bridges. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal nonpoint source (NPS) programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

For design purposes, postdevelopment peak runoff rate and average volume should be based on the 2-year/24-hour storm. **Areas under Stormwater Phase II permit requirements are exempt.**
http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-2a.html

Watershed Protection Management Measure- The purpose of this management measure is to reduce the generation of nonpoint source pollutants and to mitigate the impacts of urban runoff and associated pollutants that result from new development or redevelopment, including the construction of new and relocated roads, highways, and bridges. The measure is intended to provide general goals for States and local governments to use in developing comprehensive programs for guiding future development and land use activities in a manner that will prevent and mitigate the effects of nonpoint source pollution.

A watershed is a geographic region where water drains into a particular receiving waterbody. As discussed in the introduction, comprehensive planning is an effective nonstructural tool available to control nonpoint source pollution. Where possible, growth should be directed toward areas where it can be sustained with a minimal impact on the natural environment (Meeks, 1990). Poorly planned growth and development have the potential to degrade and destroy entire natural drainage systems and surface waters (Mantel et al., 1990). Defined land use designations and zoning direct development away from areas where land disturbance activities or pollutant loadings from subsequent development would severely impact surface waters. Defined land use designations and zoning also protect environmentally sensitive areas such as riparian areas, wetlands, and vegetative buffers that serve as filters and trap sediments, nutrients, and chemical pollutants. Refer to Chapter 7 for a thorough description of the benefits of wetlands and vegetative buffers.

Areas such as streamside buffers and wetlands may also have the added benefit of providing long-term pollutant removal capabilities without the comparatively high costs usually associated with structural controls. Conservation or preservation of these areas is important to water quality protection. Land acquisition programs help to preserve areas critical to maintaining surface water quality. Buffer strips along streambanks provide protection for stream ecosystems and help to stabilize the stream and prevent streambank erosion (Holler, 1989). Buffer strips protect and maintain near-stream vegetation that attenuates the release of sediment into stream channels and prevent excessive loadings. Levels of suspended solids increase at a slower rate in stream channel sections with well-developed riparian vegetation (Holler, 1989).

The availability of infrastructure specifically sewage treatment facilities, is also a factor in watershed planning. If centralized sewage treatment is not available, onsite disposal systems (OSDS) most likely will be used for sewage treatment. Because of potential ground-water and surface water contamination from OSDS, density restrictions may be needed in areas where OSDS will be used for sewage treatment. Section VI of this chapter contains a more detailed discussion of siting densities for OSDS.

Develop a watershed protection program to:

1. Avoid conversion, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss;
2. Preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota; and
3. Site development, including roads, highways, and bridges, to protect to the extent practicable the natural integrity of waterbodies and natural drainage systems.

1. Applicability

This management measure is intended to be applied by States to new development or redevelopment including construction of new and relocated roads, highways, and bridges that generate nonpoint source pollutants. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal nonpoint source programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.
http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-2b.html

Site Development- The goal of this management measure is to reduce the generation of nonpoint source pollution and to mitigate the impacts of urban runoff and associated pollutants from all site development, including activities associated with roads, highways, and bridges. Management Measure II.C is intended to provide guidance for controlling nonpoint source pollution through the proper design and development of individual sites. This management measures differs from Management Measure II.A, which applies to postdevelopment runoff, in that Management Measure II.C is intended to provide controls and policies that are to be applied during the site planning and review process. These controls and policies are necessary to ensure that development occurs so that nonpoint source concerns are incorporated during the site selection and the project design and review phases. While the goals of the Watershed Protection Management Measure (II.B) are similar, Management Measure II.C is intended to apply to individual sites rather than watershed basins or regional drainage basins. The goals of both the

Site Development and Watershed Protection Management Measures are, however, intended to be complementary and the measures should be used within a comprehensive framework to reduce nonpoint source pollution.

Plan, design, and develop sites to:

1. Protect areas that provide important water quality benefits and/or are particularly susceptible to erosion and sediment loss;
2. Limit increases of impervious areas, except where necessary;
3. Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss; and

Limit disturbance of natural drainage features and vegetation.

Applicability

This management measure is intended to be applied by States to all site development activities including those associated with roads, highways, and bridges. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.
http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-2c.html

Existing Development Management- The purpose of this management measure is to protect or improve surface water quality by the development and implementation of watershed management programs that pursue the following objectives:

1. Reduce surface water runoff pollution loadings from areas where development has already occurred;
2. Limit surface water runoff volumes in order to minimize sediment loadings resulting from the erosion of streambanks and other natural conveyance systems; and
3. Preserve, enhance, or establish buffers that provide water quality benefits along waterbodies and their tributaries.

Maintenance of water quality becomes increasingly difficult as areas of impervious surface increase and urbanization occurs. For the purpose of this guidance, urbanized areas are those areas where the presence of "man-made" impervious surfaces results in increased peak runoff volumes and pollutant loadings that permanently alter one or more of the following: stream channels, natural drainageways, and in-stream and adjacent riparian habitat so that predevelopment aquatic flora and fauna are eliminated or reduced to unsustainable levels and predevelopment water quality has been degraded. Increased bank cutting, streambed scouring, siltation damaging to aquatic flora and fauna, increases in water temperature, decreases in dissolved oxygen, changes to the natural structure and flow of the stream or river, and the presence of anthropogenic pollutants that are not generated from agricultural activities, in general, are indications of urbanization.

The effects of urbanization have been well described in the introduction to this chapter. Protection of water quality in urbanized areas is difficult because of a range of factors. These factors include diverse pollutant loadings, large runoff volumes, limited areas suitable for surface water runoff treatment systems, high implementation costs associated with structural controls, and the destruction or absence of buffer zones that can filter pollutants and prevent the destabilization of streambanks and shorelines.

As discussed in Section II.B of this chapter, comprehensive watershed planning facilitates integration of source reduction activities and treatment strategies to mitigate the effects of urban runoff. Through the use of watershed management, States and local governments can identify local water quality objectives and focus resources on control of specific pollutants and sources. Watershed plans typically incorporate a combination of nonstructural and structural practices.

An important nonstructural component of many watershed management plans is the identification and preservation of buffers and natural systems. These areas help to maintain and improve surface water quality by filtering and infiltrating urban runoff. In areas of existing development, natural buffers and conveyance systems may have been altered as urbanization occurred. Where possible and appropriate, additional impacts to these areas should be minimized and if degraded, the functions of these areas restored. The preservation, enhancement, or establishment of buffers along waterbodies is generally recommended throughout the section 6217 management area as an important tool for reducing NPS impacts. The establishment and protection of buffers, however, is most appropriate along surface waterbodies and their tributaries where water quality and the biological integrity of the waterbody is dependent on the presence of an adequate buffer/riparian area. Buffers may be necessary where the buffer/riparian area (1) reduces significant NPS pollutant loadings, (2) provides habitat necessary to maintain the biological integrity of the receiving water, and (3) reduces undesirable thermal impacts to the waterbody. For a discussion of protection and restoration of wetlands and riparian areas, refer to Chapter 7.

Institutional controls, such as permits, inspection, and operation and maintenance requirements, are also essential components of a watershed management program. The effectiveness of many of the practices described in this chapter is dependent on administrative controls such as inspections. Without effective compliance mechanisms and operation and maintenance requirements, many of these practices will not perform satisfactorily.

Where existing development precludes the use of effective nonstructural controls, structural practices may be the only suitable option to decrease the NPS pollution loads generated from developed areas. In such situations, a watershed plan can be used to integrate the construction of new surface water runoff treatment structures and the retrofit of existing surface water runoff management systems.

Retrofitting is a process that involves the modification of existing surface water runoff control structures or surface water runoff conveyance systems, which were initially designed to control flooding, not to serve a water quality improvement function. By enlarging existing surface water runoff structures, changing the inflow and outflow characteristics of the device, and increasing detention times of the runoff, sediment and associated pollutants can be removed from the runoff. Retrofit of structural controls, however, is often the only feasible alternative for improving water quality in developed areas. Where the presence of existing development or financial constraints limits treatment options, targeting may be necessary to identify priority pollutants and select the most appropriate retrofits.

Once key pollutants have been identified, an achievable water quality target for the receiving water should be set to improve current levels based on an identified objective or to prevent degradation of current water quality. Extensive site evaluations should then be performed to assess the performance of existing surface water runoff management systems and to pinpoint low-cost structural changes or maintenance programs for improving pollutant-removal efficiency. Where flooding problems exist, water quality controls should be incorporated into the design of surface water runoff controls. Available land area is often limited in urban areas, and the lack of suitable areas will frequently restrict the use of conventional pond systems. In heavily urbanized areas, sand filters or water quality inlets with oil/grit separators may be appropriate for retrofits because they do not limit land usage.

Develop and implement watershed management programs to reduce runoff pollutant concentrations and volumes from existing development:

1. Identify priority local and/or regional watershed pollutant reduction opportunities, e.g., improvements to existing urban runoff control structures;
2. Contain a schedule for implementing appropriate controls;
3. Limit destruction of natural conveyance systems; and
4. Where appropriate, preserve, enhance, or establish buffers along surface waterbodies and their tributaries.

Applicability

This management measure is intended to be applied by States to all urban areas and existing development in order to reduce surface water runoff pollutant loadings from such areas. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA). **Areas under Stormwater Phase II permit requirements are exempt.**
http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-4.html

New On-Site Disposal Systems **-** The purpose of this management measure is to protect the 6217 management area from pollutants discharged by OSDS. The measure requires that OSDS be sited, designed, and installed so that impacts to waterbodies will be reduced, to the extent practicable. Factors such as soil type, soil depth, depth to water table, rate of sea level rise, and topography must be considered in siting and installing conventional OSDS.

1. Ensure that new Onsite Disposal Systems (OSDS) are located, designed, installed, operated, inspected, and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. Where necessary to meet these objectives: (a) discourage the installation of garbage disposals to reduce hydraulic and nutrient loadings; and (b) where low-volume plumbing fixtures have not been installed in new developments or redevelopments, reduce total hydraulic loadings to the OSDS by 25 percent. Implement OSDS inspection schedules for preconstruction, construction, and postconstruction.
2. Direct placement of OSDS away from unsuitable areas. Where OSDS placement in unsuitable areas is not practicable, ensure that the OSDS is designed or sited at a density so as not to adversely affect surface waters or ground water that is closely hydrologically connected to surface water. Unsuitable areas include, but are not limited to, areas with poorly or excessively drained soils; areas with shallow water tables or areas with high seasonal water tables; areas overlaying fractured bedrock that drain directly to ground water; areas within floodplains; or areas where nutrient and/or pathogen concentrations in the effluent cannot be sufficiently treated or reduced before the effluent reaches sensitive waterbodies;
3. Establish protective setbacks from surface waters, wetlands, and floodplains for conventional as well as alternative OSDS. The lateral setbacks should be based on soil type, slope, hydrologic factors, and type of OSDS. Where uniform protective setbacks cannot be achieved, site development with OSDS so as not to adversely affect waterbodies and/or contribute to a public health nuisance;
4. Establish protective separation distances between OSDS system components and groundwater which is closely hydrologically connected to surface waters. The separation distances should be based on soil type, distance to ground water, hydrologic factors, and type of OSDS;
5. Where conditions indicate that nitrogen-limited surface waters may be adversely affected by excess nitrogen loadings from ground water, require the installation of OSDS that reduce total nitrogen loadings by 50 percent to ground water that is closely hydrologically connected to surface water.

Applicability

This management measure is intended to be applied by States to all new OSDS including package plants and small-scale or regional treatment facilities not covered by NPDES regulations in order to manage the siting, design, installation, and operation and maintenance of all such OSDS. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have flexibility in doing so. The application of management measure by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-2c.html

Operating On-Site Disposal Systems-The purpose of this management measure is to minimize pollutant loadings from operating OSDS. This management measure requires that OSDS be modified, operated, repaired, and maintained to reduce nutrient and pathogen loadings in order to protect and enhance surface waters. In the past, it has been a common practice to site conventional OSDS in coastal areas that have inadequate separation distances to ground water, fractured bedrock, sandy soils, or other conditions that prevent or do not allow adequate treatment of OSDS-generated pollutants. Eutrophication in surface waters has also been attributed to the low nitrogen reductions provided by conventional OSDS designs.

1. Establish and implement policies and systems to ensure that existing OSDS are operated and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. Where necessary to meet these objectives, encourage the reduced use of garbage disposals, encourage the use of low-volume plumbing fixtures, and reduce total phosphorus loadings to the OSDS by 15 percent (if the use of low-level phosphate detergents has not been required or widely adopted by OSDS users). Establish and implement policies that require an OSDS to be repaired, replaced, or modified where the OSDS fails, or threatens or impairs surface waters;
2. Inspect OSDS at a frequency adequate to ascertain whether OSDS are failing;
3. Consider replacing or upgrading OSDS to treat influent so that total nitrogen loadings in the effluent are reduced by 50 percent. This provision applies only:
    - where conditions indicate that nitrogen-limited surface waters may be adversely affected by significant ground water nitrogen loadings from OSDS, and
    - where nitrogen loadings from OSDS are delivered to ground water that is closely hydrologically connected to surface water.

Applicability

This management measure is intended to be applied by States to all operating OSDS. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. This management measure does not apply to existing conventional OSDS that meet all of the following criteria: (1) treat wastewater from a single family home; (2) are sited where OSDS density is less than or equal to one OSDS per 20 acres; and (3) the OSDS is sited at least 1,250 feet away from surface waters.

http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-5b.html

Planning, Siting and Developing Roads and Highways (Local Only)- The best time to address control of NPS pollution from roads and highways is during the initial planning and design phase. New roads and highways should be located with consideration of natural drainage patterns and planned to avoid encroachment on surface waters and wet areas. Where this is not possible, appropriate controls will be needed to minimize the impacts of NPS runoff on surface waters.

Plan, site, and develop roads and highways to:

1. Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss;
2. Limit land disturbance such as clearing and grading and cut and fill to reduce erosion and sediment loss; and
3. Limit disturbance of natural drainage features and vegetation.

Applicability

This measure is intended to be applied by States to site development and land disturbing activities for new, relocated, and reconstructed (widened) roads (including residential streets) and highways in order to reduce the generation of nonpoint source pollutants and to mitigate the impacts of urban runoff and associated pollutants from such activities. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7a.html

Bridges (Local Only)- This measure requires that NPS runoff impacts on surface waters from bridge decks be assessed and that appropriate management and treatment be employed to protect critical habitats, wetlands, fisheries, shellfish beds, and domestic water supplies. The siting of bridges should be a coordinated effort among the States, the FHWA, the U.S. Coast Guard, and the Army Corps of Engineers. Locating bridges in coastal areas can cause significant erosion and sedimentation, resulting in the loss of wetlands and riparian areas. Additionally, since bridge pavements are extensions of the connecting highway, runoff waters from bridge decks also deliver loadings of heavy metals, hydrocarbons, toxic substances, and deicing chemicals to surface waters as a result of discharge through scupper drains with no overland buffering. Bridge maintenance can also contribute heavy loads of lead, rust particles, paint, abrasive, solvents, and cleaners into surface waters. Protection against possible pollutant overloads can be afforded by minimizing the use of scuppers on bridges traversing very sensitive waters and conveying deck drainage to land for treatment. Whenever practical, bridge structures should be located to avoid crossing over sensitive fisheries and shellfish-harvesting areas to prevent washing polluted runoff through scuppers into the waters below. Also, bridge design should account for potential scour and erosion, which may affect shellfish beds and bottom sediments.

Site, design, and maintain bridge structures so that sensitive and valuable aquatic ecosystems and areas providing important water quality benefits are protected from adverse effects.

Applicability (Local Only)

This management measure is intended to be applied by States to new, relocated, and rehabilitated bridge structures in order to control erosion, streambed scouring, and surface runoff from such activities. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7b.html

Operation and Maintenance of Roads, Highways and Bridges - Incorporate pollution prevention procedures into the operation and maintenance of roads, highways, and bridges to reduce pollutant loadings to surface waters.

Substantial amounts of eroded material and other pollutants can be generated by operation and maintenance procedures for roads, highways, and bridges, and from sparsely vegetated areas, cracked pavements, potholes, and poorly operating urban runoff control structures. This measure is intended to ensure that pollutant loadings from roads, highways, and bridges are minimized by the development and implementation of a program and associated practices to ensure that sediment and toxic substance loadings from operation and maintenance activities do not impair coastal surface waters. The program to be developed, using the practices described in this management measure, should consist of and identify standard operating procedures for nutrient and pesticide management, road salt use minimization, and maintenance guidelines (e.g., capture and contain paint chips and other particulates from bridge maintenance operations, resurfacing, and pothole repairs).

Incorporate pollution prevention procedures into the operation and maintenance of roads, highways, and bridges to reduce pollutant loadings to surface waters.

Applicability

This management measure is intended to be applied by States to existing, restored, and rehabilitated roads, highways, and bridges. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measures and will have some flexibility in doing so. The application of measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. **Areas under Stormwater Phase II permit requirements are exempt.**
http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7e.html

<u>Runoff Systems for Roads, Highways, and Bridges</u>- Develop and implement runoff management systems for existing roads, highways, and bridges to reduce runoff pollutant concentrations and volumes entering surface waters.

This measure requires that operation and maintenance systems include the development of retrofit projects, where needed, to collect NPS pollutant loadings from existing, reconstructed, and rehabilitated roads, highways, and bridges. Poorly designed or maintained roads and bridges can generate significant erosion and pollution loads containing heavy metals, hydrocarbons, sediment, and debris that run off into and threaten the quality of surface waters and their tributaries. In areas where such adverse impacts to surface waters can be attributed to adjacent roads or bridges, retrofit management projects to protect these waters may be needed (e.g., installation of structural or nonstructural pollution controls). Retrofit projects can be located in existing rights-of-way, within interchange loops, or on adjacent land areas. Areas with severe erosion and pollution runoff problems may require relocation or reconstruction to mitigate these impacts.

Runoff management systems are a combination of nonstructural and structural practices selected to reduce nonpoint source loadings from roads, highways, and bridges. These systems are expected to include structural improvements to existing runoff control structures for water quality purposes; construction of new runoff control devices, where necessary to protect water quality; and scheduled operation and maintenance activities for these runoff control practices. Typical runoff controls for roads, highways, and bridges include vegetated filter strips, grassed swales, detention basins, constructed wetlands, and infiltration trenches.

1. Identify priority and watershed pollutant reduction opportunities (e.g., improvements to existing urban runoff control structures; and
2. Establish schedules for implementing appropriate controls.

<u>Applicability</u>

This management measure is intended to be applied by States to existing, resurfaced, restored, and rehabilitated roads, highways, and bridges that contribute to adverse effects in surface waters. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. **Areas under Stormwater Phase II permit requirements are exempt.**

http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7f.html

HYDROMODIFICATION

<u>Channelization and Channel Modification</u> <u>(Physical and Chemical Characteristics of Suface Waters)-</u> The purpose of this management measure is to ensure that the planning process for new hydromodification projects addresses changes to physical and chemical characteristics of surface waters that may occur as a result of the proposed work. Implementation of this management measure is intended to occur concurrently with the implementation of Management Measure B (Instream and Riparian Habitat Restoration) of this section. For existing projects, the purpose of this management measure is to ensure that the operation and maintenance program uses any opportunities available to improve the physical and chemical characteristics of the surface waters. Changes created by channelization and channel modification activities are problematic if they unexpectedly alter environmental parameters to levels outside normal or desired ranges. The physical and chemical characteristics of surface waters that may be influenced by channelization and channel modification include sediment, turbidity, salinity, temperature, nutrients, dissolved oxygen, oxygen demand, and contaminants.

Implementation of this management measure in the planning process for new projects will require a two-pronged approach:

1. Evaluate, with numerical models for some situations, the types of NPS pollution related to instream changes and watershed development.
2. Address some types of NPS problems stemming from instream changes or watershed development with a combination of nonstructural and structural practices.

Applicability

This management measure is intended to be applied by States to public and private channelization and channel modification activities in order to prevent the degradation of physical and chemical characteristics of surface waters from such activities. This management measure applies to any proposed channelization or channel modification projects, including levees, to evaluate potential changes in surface water characteristics, as well as to existing modified channels that can be targeted for opportunities to improve the surface water characteristics necessary to support desired fish and wildlife. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with management measures and will have some flexibility in doing so. The application of this management measure by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter6/ch6-2a.html#Description

Channelization and Channel Modification (Instream and Riparian Habitat Restoration)- The purpose of this management measure is to correct or prevent detrimental changes to instream and riparian habitat from the impacts of channelization and channel modification projects. Implementation of this management measure is intended to occur concurrently with the implementation of Management Measure A (Physical and Chemical Characteristics of Surface Waters) of this section.

Contact between floodwaters and overbank soil and vegetation can be increased by a combination of setback levees and use of compound-channel designs. Levees set back away from the streambank (setback levees) can be constructed to allow for overbank flooding, which provides surface water contact to important streamside areas (including wetlands and riparian areas). Additionally, setback levees still function to protect adjacent property from flood damage.

Compound-channel designs consist of an incised, narrow channel to carry surface water during low (base)-flow periods, a staged overbank area into which the flow can expand during design flow events, and an extended overbank area, sometimes with meanders, for high-flow events. Planting of the extended overbank with suitable vegetation completes the design.

Preservation of ecosystem benefits can be achieved by site-specific design to obtain predefined optimum or existing ranges of physical environmental conditions. Mathematical models can be used to assist in site-specific design. Instream and riparian habitat alterations caused by secondary effects can be evaluated by the use of models and other decision aids in the design process of a channelization and channel modification activity. After using models to evaluate secondary effects, restoration programs can be established.

Applicability

This management measure pertains to surface waters where channelization and channel modification have altered or have the potential to alter instream and riparian habitat such that historically present fish or wildlife are adversely affected. This management measure is intended to apply to any proposed channelization or channel modification project to determine changes in instream and riparian habitat and to existing modified channels to evaluate possible improvements to instream and riparian habitat. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with management measures and will have some flexibility in doing so. The application of this management measure by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

Dams (Protection of Surface Water Quality and Instream and Riparian Habitat)- The purpose of this management measure is to protect the quality of surface waters and aquatic habitat in reservoirs and in the downstream portions of rivers and streams that are influenced by the quality of water contained in the releases (tailwaters) from reservoir impoundments. Impacts from the operation of dams to surface water quality and aquatic and riparian habitat should be assessed and the potential for improvement evaluated. Additionally, new upstream and downstream impacts to surface water quality and aquatic and riparian habitat caused by the implementation of practices should also be considered in the assessment. The overall program approach is to evaluate a set of practices that can be applied individually or in combination to protect and improve surface water quality and aquatic habitat in reservoirs, as well as in areas downstream of dams. Then, the program should implement the most cost-effective operations to protect surface water quality and aquatic and riparian habitat and to improve the water quality and aquatic and riparian habitat where economically feasible.

Applicability

This management measure is intended to be applied by States to dam operations that result in the loss of desirable surface water quality, and of desirable instream and riparian habitat. Dams are defined as constructed impoundments which are either:

- 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
- 6 feet or more in height *and* greater than 50 acre-feet in capacity.

This measure does not apply to projects that fall under NPDES jurisdiction. This measure also does not apply to the extent that its implementation under State law is precluded under *California* v. *Federal Energy Regulatory Commission*, 110 S. Ct. 2024 (1990) (addressing the supersedence of State instream flow requirements by Federal flow requirements set forth in FERC licenses for hydroelectric power plants under the Federal Power Act). http://www.epa.gov/owow/nps/MMGI/Chapter6/ch6-3c.html

Eroding Streambanks and Shorelines-Several streambank and shoreline stabilization techniques will be effective in controlling coastal erosion wherever it is a source of nonpoint pollution. Techniques involving marsh creation and vegetative bank stabilization ("soil bioengineering") will usually be effective at sites with limited exposure to strong currents or wind-generated waves. In other cases, the use of engineering approaches, including beach nourishment or coastal structures, may need to be considered. In addition to controlling those sources of sediment input to surface waters which are causing NPS pollution, these techniques can halt the destruction of wetlands and riparian areas located along the shorelines of surface waters. Once these features are protected, they can serve as a filter for surface water runoff from upland areas, or as a sink for nutrients, contaminants, or sediment already present as NPS pollution in surface waters

Applicability

This management measure is intended to be applied by States to eroding shorelines in coastal bays, and to eroding streambanks in coastal rivers and creeks. The measure does not imply that all shoreline and streambank erosion must be controlled. Some amount of natural erosion is necessary to provide the sediment for beaches in estuaries and coastal bays, for point bars and channel deposits in rivers, and for substrate in tidal flats and wetlands. The measure, however, applies to eroding shorelines and streambanks that constitute an NPS problem in surface waters. It is not intended to hamper the efforts of any States or localities to retreat rather than to harden the shoreline. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter6/ch6-4.html

ADDITIONAL INFORMATION ON OHIO'S COASTAL NONPOINT POLLUTION CONTROL PROGRAM:

http://www.dnr.state.oh.us/soilandwater/coastalnonpointprogram.htm

(above is a link to the ODNR, Division of SWC's coastal program) The following information came from that site:

In order to address the unique nonpoint pollution concerns within the Lake Erie basin and to focus public resources on the most achievable solutions, the Ohio Department of Natural Resources and the Ohio Environmental Protection Agency with funding from the National Oceanic and Atmospheric Administration (NOAA) developed the Ohio Coastal Nonpoint Pollution Control Program Plan. The plan was submitted to NOAA and the U.S. Environmental Protection Agency for comment in September 2000. We arrived at this important milestone thanks to the hard work of numerous individuals, organizations, and other Lake Erie stakeholders. With this achievement, we look confidently toward a successful future.
A copy of the Executive Summary is available for viewing or downloading by clicking on the link below:

Executive Summary (in Acrobat Reader 4.0* format) <docs/CNPCPexecsumm.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/CNPCPexecsumm.pdf

Executive Summary (Microsoft Word format or text only) <docs/ExecutiveSummaryText.doc>

http://www.dnr.state.oh.us/soilandwater/docs/ExecutiveSummaryText.doc

You can also view or download the complete program plan in Acrobat Reader 4.0* format by clicking on the link below:

Coastal Nonpoint Pollution Control Program Plan (36.4 mb) <docs/FinalCNPCP.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/FinalCNPCP.pdf

Or, download or view a specific chapter by clicking on the corresponding link below:

Chapter 1 (Introduction and Program Summary) <docs/Chapter%2001.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2001.pdf

Chapter 2 (General Program Overview) <docs/Chapter%2002.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2002.pdf

Chapter 3 (Management Measures for Agricultural Sources) <docs/Chapter%2003.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2003.pdf

Chapter 4 (Management for Forestry:Request for Exclusion for Forestry) <docs/Chapter%2004.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2004.pdf

Chapter 5 (Management Measures for Urban Areas) <docs/Chapter%2005.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2005.pdf

Chapter 6 (Management Measures for Marinas and Recreational Boating) <docs/Chapter%2006.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2006.pdf

Chapter 7 (Management Measures for Hydromodification) <docs/Chapter%2007.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2007.pdf

Chapter 8 (Management Measures for Wetlands and Riparian Areas) <docs/Chapter%2008.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2008.pdf

Chapter 9 (Additional Management Measures for Critical Coastal Areas and Impaired or Threatened Areas) <docs/Chapter%2009.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2009.pdf

Chapter 10 (Developing Sustainable Watershed Protection Programs) <docs/Chapter%2010.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2010.pdf

Chapter 11 (Water Quality Monitoring and Tracking Techniques) <docs/Chapter%2011.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2011.pdf

Chapter 12 (Conclusions) <docs/Chapter%2012.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2012.pdf

Chapter 13 (References and Bibliography) <docs/Chapter%2013.pdf>

http://www.dnr.state.oh.us/soilandwater/docs/Chapter%2013.pdf

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Appendix C

Highly and Potentially Highly Erodible Land and Hydric Soils in the Project Area

DeKalb					
Soil Map Unit	**Soil Name**	**% Slope**	**HEL**	**PHEL**	**Hydric**
BAB2	Blount	1-4%		X	
BOB	Boyer	0-6%		X	X
BOC	Boyer	6-12%		X	
GNB2	Glynwood	3-6%		X	
Hw	Haughton	N/A			X
Mc	Martisco	N/A			X
MOC2	Morley	6-12%	X		
MOD2	Morley	12-18%	X		
MOE2	Morley	18-30%	X		
MRC3	Morley	6-12%	X		
MRD3	Morley	12-18%	X		
Pe	Pewamo	N/A			X
RAB	Rawson	2-6%		X	
Re	Rennselaer	N/A			X
Se	Sebewa	N/A			X
SRB2	Strawn	2-6%		X	
SRC2	Strawn	6-12%		X	
STC3	Strawn	6-12%	X		
STD3	Strawn	12-18%	X		
UD	Udorthents	0-12%		X	
Wa	Wallkill	N/A			X
Defiance					
Soil Map Unit	**Soil Name**	**% Slope**	**HEL**	**PHEL**	**Hydric**
BmB	Belmore	2-6%		X	
BrB	Bronson	1-6%		X	
B vE	Broughton	12-35%	X		
BwC3	Broughton	6-12%		X	X
DfA	Del Rey	0-3%			X
Ge	Genesee	N/A			X
Gf	Gilford	N/A			X
GwB	Gynwood	2-6%		X	X

Soil Map Unit	Soil Name	% Slope	HEL	PHEL	Hydric
GwB2	Glynwood	2-6%		X	X
GwC2	Glynwood	6-12%		X	
Gx	Granby	N/A			X
MrD2	Morley	12-18%	X		
RmB	Rawson	2-6%		X	
SaB	St. Clair	2-6%		X	
SbC2	St. Clair	6-12%		X	
SbD3	St. Clair	18-35%	X		
ScD3	St. Clair	12-18%	X		
ScE3	St. Clair	18-35%	X		
Ud	Udorthents	rolling		X	
Wa	Wallkill	N/A			X
Wd	Wallkill	N/A			X
Williams					
Soil Map Unit	**Soil Name**	**% Slope**	**HEL**	**PHEL**	**Hydric**
ApB	Arkport	2-6%		X	X
BlB	Belmore	1-6%		X	X
BmA	Blount	0-3%			X
BnA	Blount	0-2%			X
BnB	Blount	2-6%		X	X
BnB2	Blount	2-6%		X	X
BoA	Blount	0-2%			X
BoB	Blount	2-6%		X	
Bp	Bono				X
BrC	Boyer	6-12%		X	
BsD	Boyer	12-18%		X	
Ca	Carlisle				X
Ce	Cereco				X
Ch	Cohoctah				X
Cn	Colwood				X
Cp	Colwood				X
DdA	Del Rey	0-3%			X
DeA	Del Rey	0-2%			X
DeB	Del Rey	2-6%		X	X
DfA	Del Rey	0-2%			X
DfB	Del Rey	2-6%		X	X
DgA	Digby	0-3%			X
DmA	Digby	0-3%			X
Ed	Edwards				X
Ee	Eel				X

Soil Map Unit	Soil Name	% Slope	HEL	PHEL	Hydric
FsA	Fulton	0-2%			X
FsB	Fulton	2-6%		X	
FuA	Fulton	0-2%			X
FuB	Fulton	2-6%		X	
FvA	Fulton	0-3%			X
Ge	Genesee				X
Gf	Gilford				X
GlB	Glynwood	2-6%		X	
GlB2	Glynwood	2-6%		X	
GlC	Glynwood	6-12%		X	
GlC2	Glynwood	6-12%		X	
GlD2	Glynwood	12-18%	X		
GlE2	Glynwood	18-40%	X		
HaB	Haney	1-6%		X	X
HcA	Hoytville				X
HeB	Haney	1-6%		X	X
HeC	Haney	6-12%		X	X
HhA	Haskins	0-2%			X
HkA	Haskins	0-3%			X
HnA	Haskins	0-3%			X
Hoa	Hoytville	0-1%			X
KIA	Kibbie	0-2%			X
KlB	Kibbie	2-6%		X	X
KmA	Kibbie	0-3%			X
La	Lamson				X
Lc	Latty				X
Lf	Lenawee				X
LuB2	Lucas	2-6%		X	
LuC2	Lucas	6-12%		X	
LuD2	Lucas	12-15%	X		
Ma	Martisco				X
Md	Mermill	loam			X
Mh	Millgrove	loam			X
Mk	Millgrove	Clay			X
NnB	Nappanee	2-6%		X	
OrC	Oshtemo	6-12%		X	
Pa	Paulding	Clay			X
Pk	Pewamo	N/A			X
Pm	Pewamo	N/A			X
RlB	Rawson	2-6%		X	

Soil Map Unit	Soil Name	% Slope	HEL	PHEL	Hydric
RlC	Rawson	6-12%		X	
RmB	Rawson	2-6%		X	
RmC	Rawson	6-12%		X	
RnA	Rimer	0-3%			X
RsA	Roselms	0-2%			X
RsB	Roselms	2-6%		X	X
SbB2	St. Clair	2-6%		X	
SbC2	St. Clair	6-12%		X	
SbD2	St. Clair	12-25%	X		
SdC	Seward	6-12%			X
SgB	Shinrock	2-6%		X	
SgC	Shinrock	6-12%		X	
Sh	Shoals	Loam			X
SpC	Spinks	6-18%		X	
TuB	Tuscola	1-6%		X	
TuC	Tuscola	6-12%		X	
Wa	Wallkill	N/A			X

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Endorsements

We, the undersigned, agree to support the implementation of the Middle St. Joseph River Watershed Management Plan by partnering with the SJRWI, offering technical assistance, or pursuing funding on our own to implement the WMP.

Organization	Signature
Defiance County Soil and Water Conservation District	
DeKalb County Soil and Water Conservation District	
Williams County Soil and Water Conservation District	
Defiance County NRCS District Conservationist	
DeKalb County NRCS District Conservationist	
Williams County NRCS District Conservationist	
Defiance County Health Department	
DeKalb County Health Department	
Williams County Health Department	
City of Butler	
Village of Edgerton	
The Nature Conservancy; Western Lake Erie Basin Project	
Purdue University Extension	
Ohio State University Extension	
DeKalb County Planning Commission	