VFC Index - Watershed (Plan)

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Project Manager: Kathleen Hagan

Salt-Pipe Creek

Watershed Management Plan

EPA Approved 2019

SALT-PIPE CREEK WATERSHED MANAGEMENT PLAN

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SALT-PIPE CREEK WATERSHED MANAGEMENT PLAN

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Salt-Pipe Creek Watershed Project Initiation

Decatur County Soil and Water Conservation District (SWCD), along with Franklin County SWCD, were concerned about the water quality in the watershed, particularly Salt Creek, for many years. Since 2010, they have applied for many grants through the Clean Water Indiana and Lake and River Enhancement programs but were unable to receive any money for cost-share. After Indiana Department of Environmental Management (IDEM) completed a Total Maximum Daily Load (TMDL) report for the Southern Whitewater River Watershed, which included both Salt Creek and Pipe Creek watersheds, Decatur and Franklin SWCDs decided it would be an ideal time to develop a watershed management plan and utilize the data IDEM collected for the TMDL. The SWCDs thought it would be nice to have a watershed management plan for both Salt Creek Watershed and Pipe Creek Watershed. After closer review and comparing the two watersheds, they decided to combine the two watersheds and create one watershed management plan representing the area as a whole. Both watershed areas have very similar landuses and resource concerns so one grant and WMP made more sense instead of duplicating efforts. A 205(j)/319 grant application was submitted to IDEM in 2016. The project was awarded a 205(j) grant in 2017. Due to staffing and financial security, the Decatur SWCD was the sponsoring agency for the grant.

Watershed Steering Committee

The watershed steering committee is the governing body of the project. When the project was first notified of being awarded the 205(j) grant, the project partners were contacted and were invited to have members be a part of the steering committee. The project also held two Kick-off Meetings in late 2017 to invite and inform the public about the project and everything that will be expected to take place over the next two years. The attendees of the Kick-off Meetings were also invited to become members of the steering committee. A mailing list was compiled from project partners and a newsletter was sent out inviting anyone who was interested in the project to become a steering committee member. Many people responded to the invitations and a steering committee was formed for the Salt-Pipe Creek Watershed Project. The representation of the watershed area is very good.

Figure 1: Salt-Pipe Creek Watershed Steering Committee Members

Member Name	Affiliation	Area Represented
Marilyn Yager	Landowner	Northwest – Salt Creek
Carol Yager	Landowner	NW and NE Salt Creek
Allen Clark	Landowner	Central Salt Creek
John Kruse	Landowner	Southeast Pipe Creek
Matt Raver	Landowner	Southwest Salt Creek
Don & Beth Lamping	Landowner	Central Salt Creek
Bill Stoner	Landowner	Central Salt Creek
Ruthie Mannix	Landowner	Central Pipe Creek
Mark & Connie Haverkos	Landowner	Southeast Salt Creek
Dave Hartman	Landowner	Central Pipe Creek
Mike Schwegman	Landowner	Central Pipe Creek
Glen Suttman	Landowner	Central Salt
Mark & Mildred Simmermeyer	Landowner	Central Pipe Creek
Robert & Chris Braun	Landowner	Central Pipe Creek

Member Name	Affiliation	Area Represented
Mary Rodenhuis	Franklin Co Purdue Extension	Franklin County
Katie Hardin	Franklin Co SWCD	Franklin County
Kim Lampert	Franklin Co NRCS	Franklin County
Jenna Nicholson	Decatur Co SWCD	Decatur County
Scott Sanders	Decatur Co SWCD	Decatur County
Jason Kirchhoff	Decatur Co ISDA	Decatur County
Jeff Hermesch	Decatur Co Purdue Extension	Decatur County
Michael Hughes	Decatur Co NRCS	Decatur County
Steve Franklin	Ripley Co SWCD	Ripley County
Tim Schwipps	Ripley Co NRCS	Ripley County
Matt Jarvis	Dearborn Co NRCS	Dearborn County
John Hawley	Dearborn Co Purdue Extension	Dearborn County
Joyce Miller	Rush Co SWCD	Rush County
Dave Caldwell	Fayette Co SWCD	Fayette County

Stakeholder Concerns

In order to gather information from the public on their views and perspective of the watershed, a stakeholder concern survey was developed and distributed at watershed events, meetings, and partners' offices. The following table shows the results from the survey.

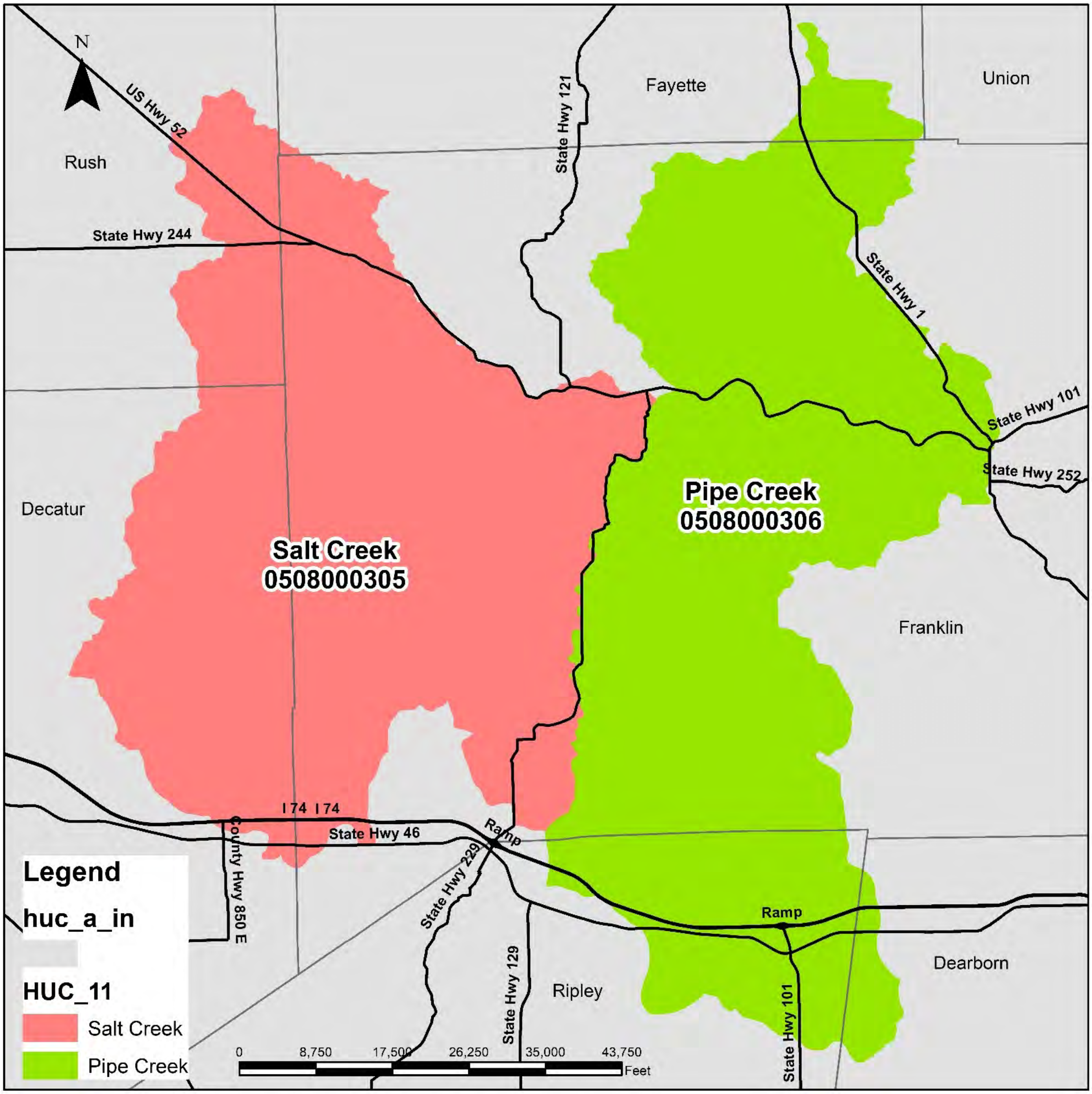
Figure 2: Stakeholder Concerns

Stakeholder Concerns Survey Results				
Stakeholder Concern	Not a Problem	Slight Problem	Moderate Problem	Major Problem
Water Quality throughout the Watershed	7	13	4	7
Contaminated Runoff entering Streams	9	7	7	7
Livestock Access to Streams/Sensitive Areas	11	8	7	4
Septic System Failures	16	9	1	3
Excessive Nutrients entering Streams	7	13	7	2
Streambank Erosion	1	4	9	17
Gully Erosion	1	10	8	12
Sediment entering Streams	2	14	11	4
Overgrazed Pastures	14	9	5	2
No Residue/Cover on Fields	7	12	9	1
Invasive Species invading Areas	5	9	4	3
Trash/Dumping Sites	10	6	3	3
Flooding				1
Pulling Stone from Creek				1
No Riparian Buffers				1

Overall Watershed Description

Salt-Pipe Creek Watershed is located in portions of 6 counties in southeastern Indiana - Rush, Fayette, Decatur, Franklin, Ripley, and Dearborn. Salt Creek Watershed (Hydrologic Unit Code (HUC) 0508000305) and Pipe Creek Watershed (HUC 0508000306) are very similar in size and characteristics.

Figure 3: Salt Creek Watershed and Pipe Creek Watersheds



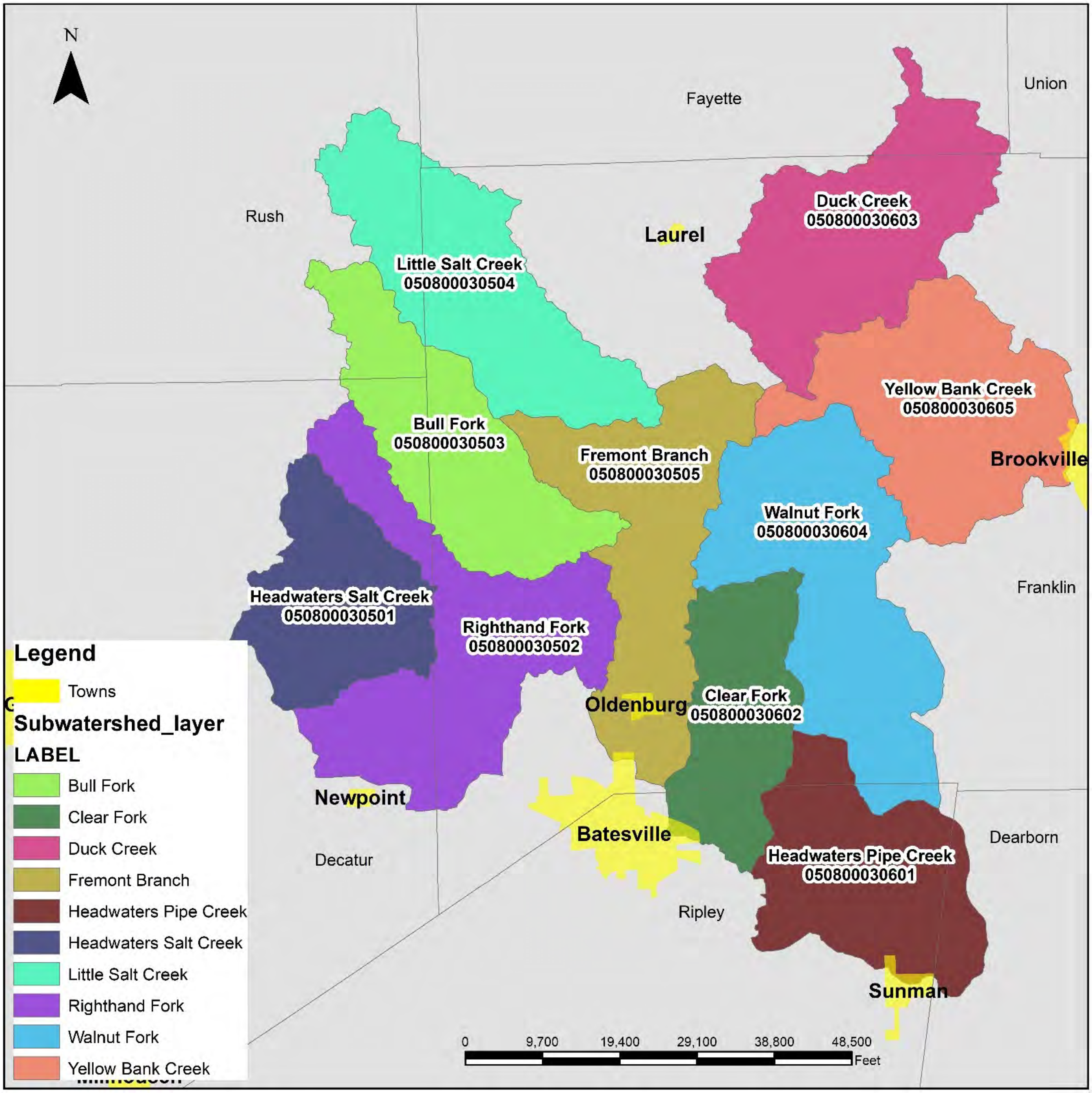
Subwatersheds

Salt-Pipe Creek Watershed is comprised of 10 HUC 12 subwatersheds. See the table and map below for more details.

Figure 4: Salt-Pipe Creek Subwatersheds

Subwatershed Name	HUC	Approx. Area
Headwaters Salt Creek	050800030501	11,090 acres
Righthand Fork	050800030502	18,210 acres
Bull Fork	050800030503	13,804 acres
Little Salt Creek	050800030504	16,084 acres
Fremont Branch	050800030505	15,911 acres
Headwaters Pipe Creek	050800030601	13,902 acres
Clear Fork	050800030602	10,115 acres
Duck Creek	050800030603	16,475 acres
Walnut Fork	050800030604	18,992 acres
Yellow Bank Creek	050800030605	16,592 acres

Figure 5: Salt-Pipe Creek Subwatersheds Map

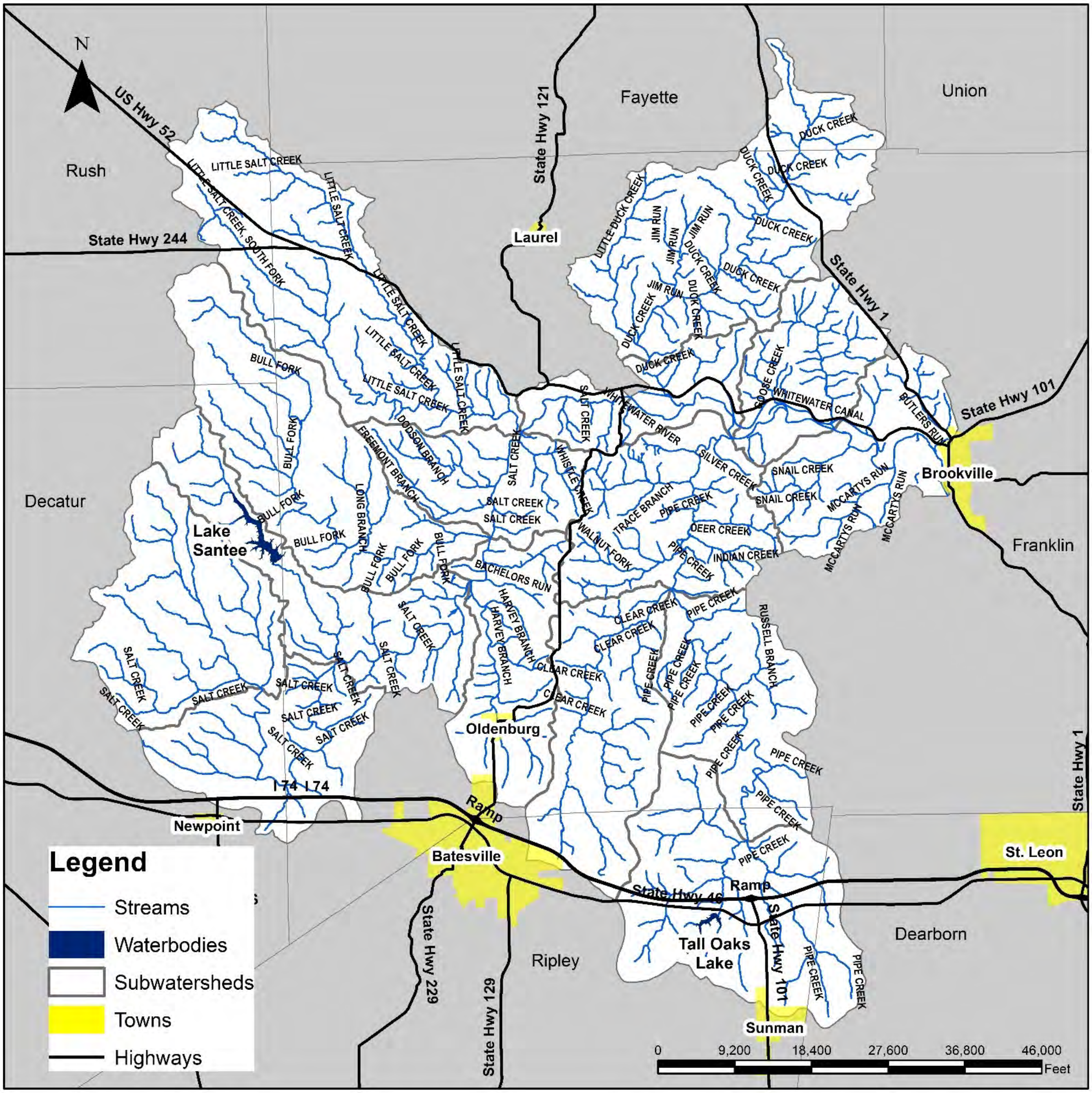


Salt-Pipe Creek Watershed Streams and Waterbodies

The Salt Creek watershed (HUC 0508000305) is located farthest west and comprises approximately 117 square miles (75,098.96 acres). The tributaries of Salt Creek watershed originate in Rush and Decatur counties and flow east into Franklin County. They include Little Salt Creek, Bull Fork, Righthand Fork Salt Creek, Fremont Branch and Harvey Branch among others. Salt Creek then flows north before its confluence with Whitewater River.

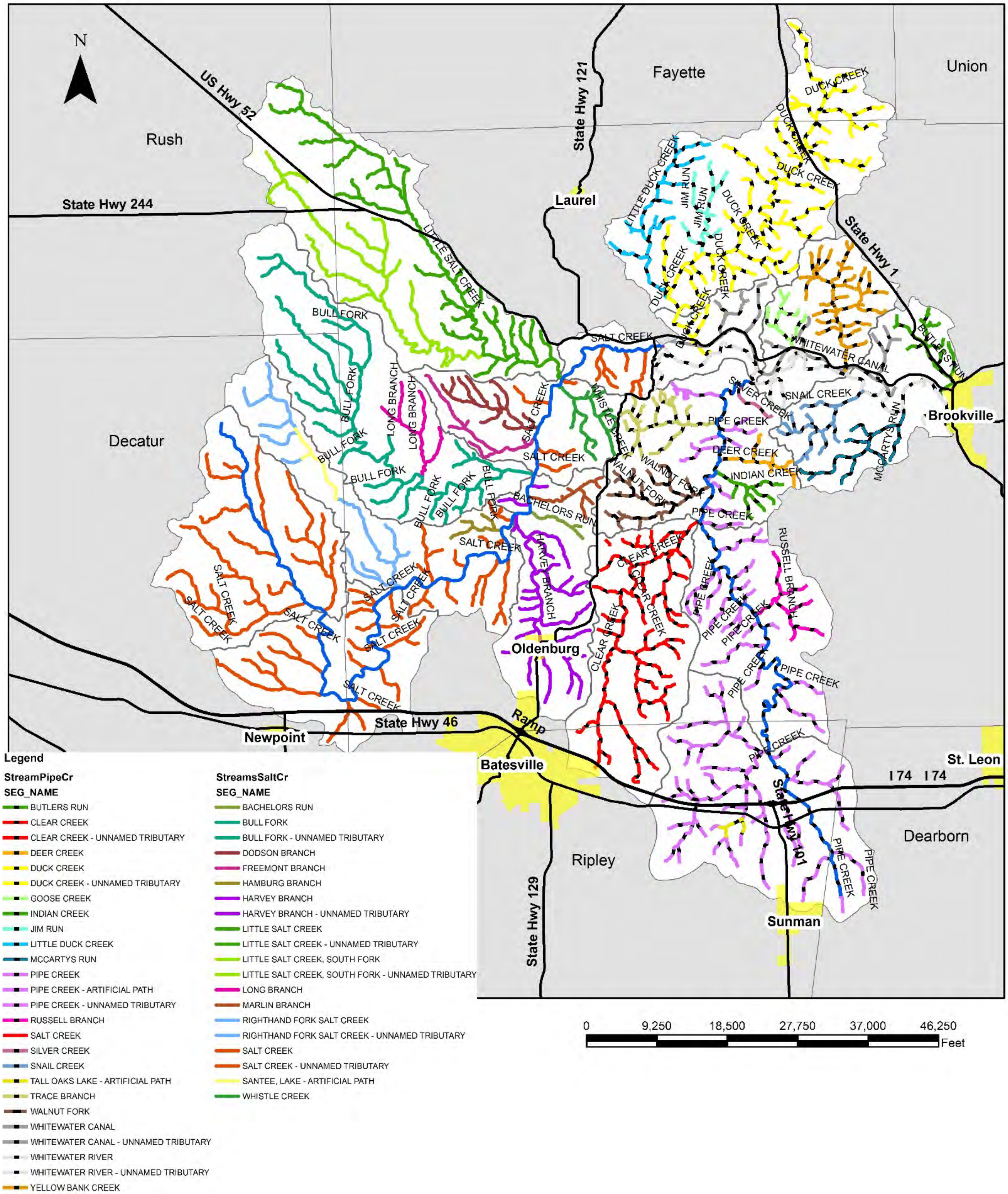
The Whitewater River continues flowing east through Pipe Creek watershed (HUC 0508000306) which covers approximately 118 square miles (76,088.40 acres) and drains a total of 842 square miles (538,880 acres). The watershed encompasses parts of Fayette, Franklin, Dearborn and Ripley counties. The Whitewater River flows through the middle of the watershed in Franklin County. The tributaries flowing into the Whitewater River from the north include Duck Creek, Little Duck Creek and Yellow Bank River. The tributaries flowing into the Whitewater River from the south include Pipe Creek, Clear Fork, Walnut Fork, Snail Creek, and McCartys Run. Together the watershed area is 151,187.36 acres and has approximately 549. 7 stream miles (Salt Creek - 259.1 stream miles and Pipe Creek - 290.6 stream miles). The watershed also has approximately 1,258 waterbodies (1,264 acres) including ponds and lakes. The largest waterbody is Lake Santee which is located along the eastern side of Decatur County. Lake Santee is about 215 acres. The second largest waterbody is Tall Oaks Lake, which is almost 50 acres, and located in the northeastern Ripley County. The public uses the main stem of the Whitewater River and the large lakes for recreation. The Whitewater River is widely known for its scenery and is used by a large number of visitors throughout the recreational period. They go fishing, canoeing, kayaking, tubing, and swimming. Lake Santee is a drinking water source and also a recreational site where boating, swimming, and fishing are very popular. The public also uses Tall Oaks Lake for swimming and fishing.

Figure 6: Streams and Waterbodies of the Salt-Pipe Creek Watershed Map



The Salt-Pipe Creek Watershed has many streams and tributaries as shown above. It is a challenge to determine flow direction and location of the main stems of Salt Creek and Pipe Creek. The map below has the main stems highlighted and the tributaries color coded, which helps show flow direction.

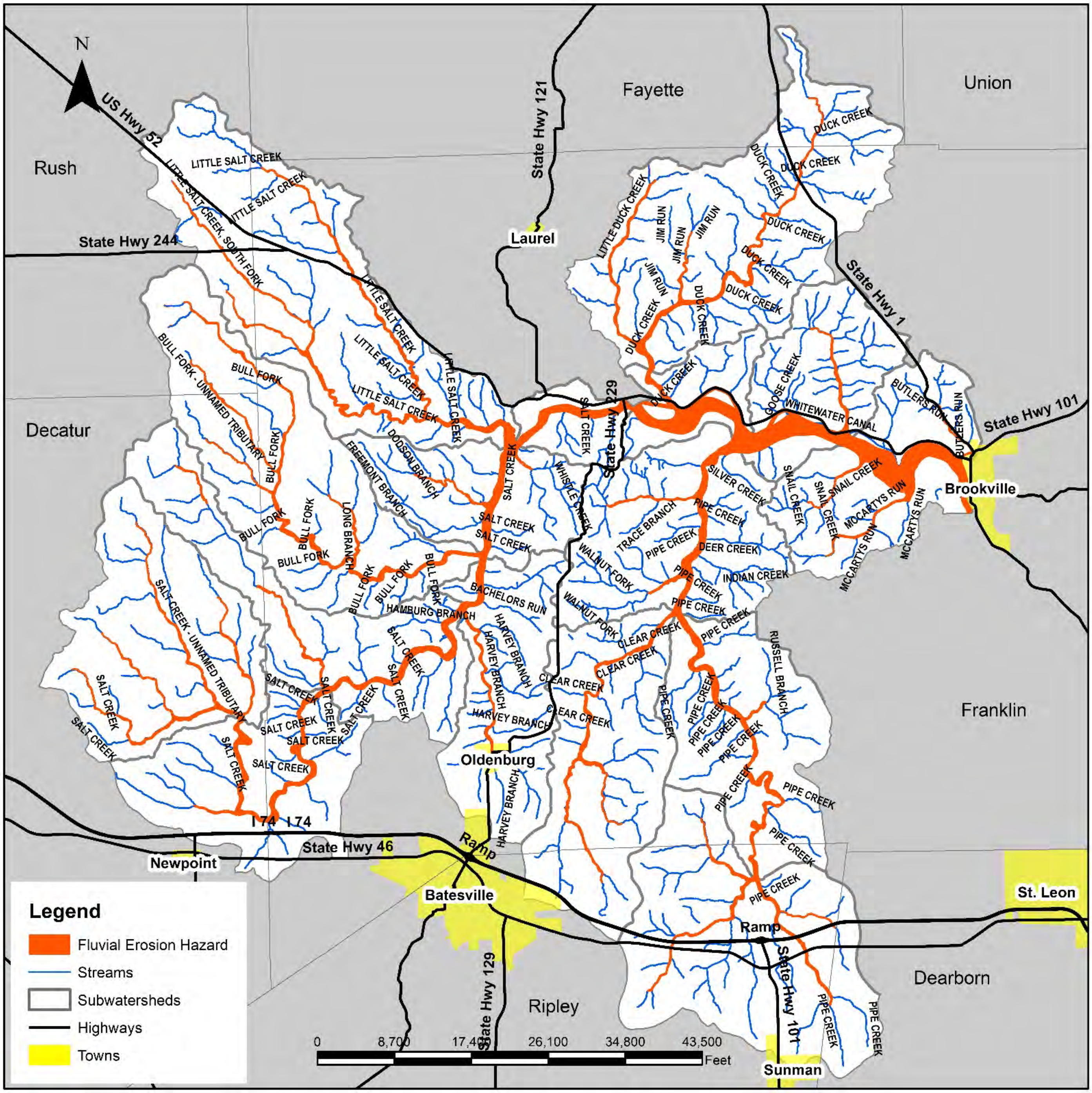
Figure 7: Streams and Waterbodies of the Salt-Pipe Creek Watershed Color Coded Map



Stream Movement and Erosion

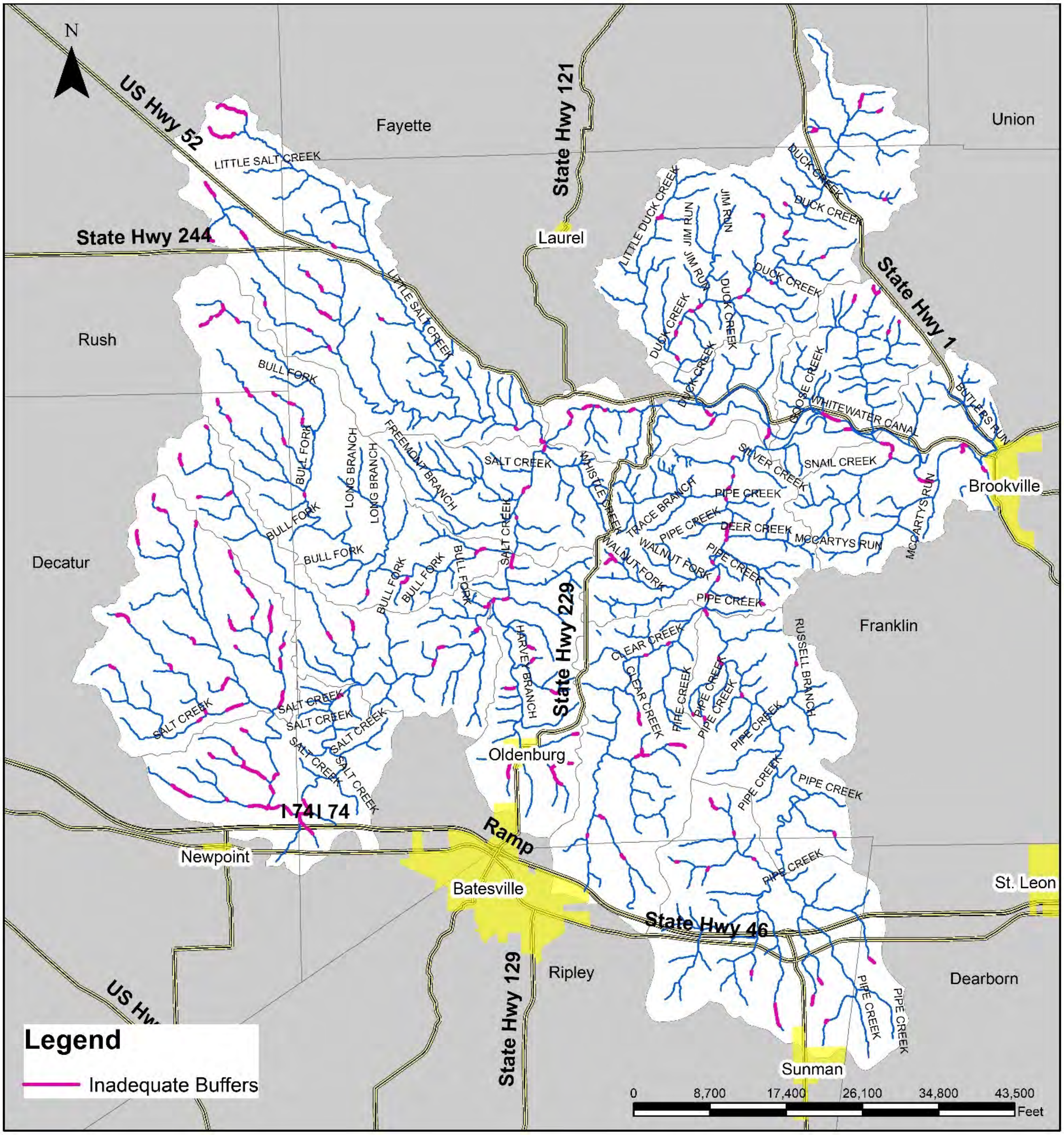
According to research completed by the Silver Jackets and Indiana University/Purdue University of Indianapolis (IUPUI) fluvial erosion hazard (FEH) represents a significant concern in areas where human development and infrastructure are established in close proximity to natural waterways. In mild cases, this may be seen as the gradual loss of a farm field or the undermining of a fence row when gradual channel migration consumes private land. In more severe cases, the FEH risk may threaten properties and/or structures to the degree that they become uninhabitable or even lost to natural channel processes. How quickly a river moves is determined by a number of factors. Local geology, sediment load, slope, vegetation abundance and type, land use, and climate can all affect the rate of river movement. Fluvial erosion hazard mitigation is possible through understanding how and why a river moves across the landscape, and using that knowledge to communicate potential risk to those who may be susceptible. The FEH study identified approximately 9,732 acres in the Salt-Pipe Creek Watershed as fluvial erosion hazard areas. See the FEH map below.

Figure 8: Fluvial Erosion Hazard Map



evaluating the streams in the Salt-Pipe Creek Watershed using aerial imagery, there were 26 stream miles with inadequate buffers. The classification of "inadequate buffer" is defined as buffers that are 20 feet or less. See the areas in the watershed with inadequate buffers below.

Figure 9: Inadequate Buffers Map



Hydromodification

According the Southern Whitewater River Watershed TMDL report, changes made to the natural drainage patterns of a watershed are referred to as hydromodification. Historically, drain tiles have been used throughout Indiana to drain marsh or wetlands and make them either habitable or tillable for agricultural purposes. While tile drainage is understood to be pervasive – estimated at thousands of miles in Indiana – it is extremely challenging to quantify on a watershed basis because these tiles were established by varying authorities, including County Courts, County Commissioners, or County Drainage Boards. Records were not kept by private landowners as to the location and quantity of these tiles.

In addition to tile drainage, regulated drains are another form of hydromodification. A regulated drain is a drain which was established through either a Circuit Court or Commissioners Court of the County prior to January 1, 1966 or by the County Drainage Board since that time. Regulated drains can be an open ditch, a tile drain, or a combination of both. The County Drainage Board can construct, maintain, reconstruct or vacate a regulated drain. In the Salt Creek watershed, there are approximately 1 mile of tile drains and 1 mile of open ditches under the jurisdiction of the Rush County Drainage Board.

Landuse

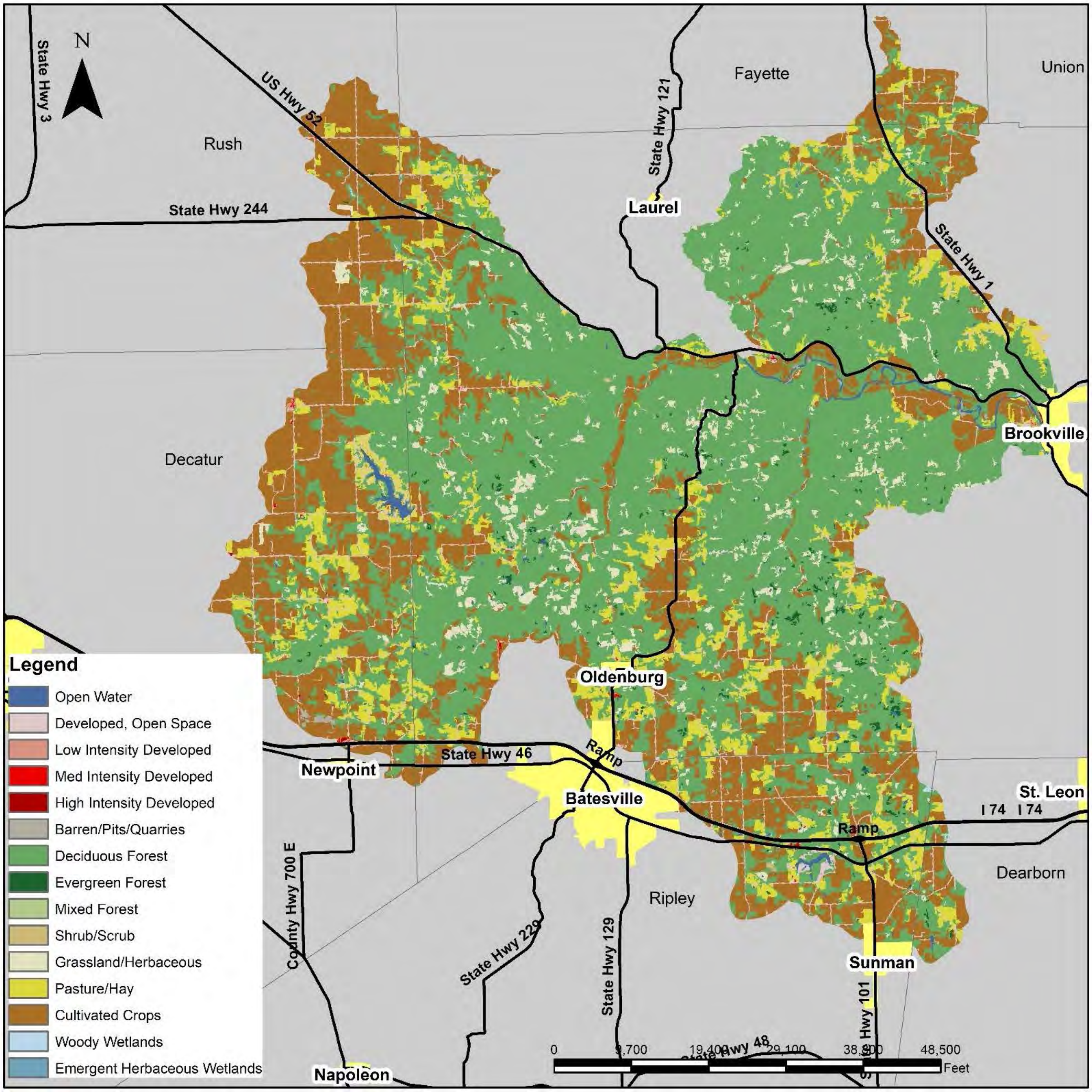
Salt-Pipe Creek Watershed is a very rural watershed. Forested land, agricultural land, and pasture/hay make up the vast majority of the watershed (93.7%). Forested land makes up just a little over half of the watershed's landuse (55%). The areas that are predominantly forested tend to encompass the watershed's steeper terrain. Since the watershed has such a large amount of acreage that is considered forested, wildlife is very abundant in the area. Almost a quarter (24.4%) of the watershed is agricultural land or cropland which is mainly planted to corn and soybeans. Just under 15% of the landuse in the watershed is hay/pasture. According to the Southern Whitewater River Watershed TMDL report, the predominant land use types in the Salt-Pipe Creek Watershed can indicate potential sources of E. coli, nutrients and sediment loadings. Different types of land uses are characterized by different types of hydrology. For example, developed lands are characterized by impervious surfaces that increase the potential of storm water events during high flow periods delivering E. coli, nutrients and sediment to downstream streams and rivers. Forested land and wetlands allow water to infiltrate slowly, thus reducing the risks of polluted water running off into waterbodies. In addition to differences in hydrology, land use types are associated with different types of activities that could contribute E. coli, nutrients and sediment to the watershed. For example, the abundance of wildlife in the forested areas could contribute to the direct deposition of E. coli into streams. Even though the vast majority of the watershed is rural, there are a few higher populated areas where pet waste may be a concern. Understanding the unique challenges of various land uses will help identify the type of implementation approaches that watershed stakeholders can use to achieve E. coli, nutrient and sediment load reductions.

There are several stakeholder concerns that were identified which correspond directly with landuse. Concerns related to agricultural/cropland and pasture/hay landuses include no residue/cover, overgrazed pastures and livestock access to streams. Other stakeholder concerns, such as streambank erosion, gully erosion, excessive nutrients entering the streams, and stream sedimentation are not landuse dependent and could occur throughout the entire watershed. Excess nutrients entering waterways is a stakeholder concern for the entire watershed across all land uses. Even though there is a very small amount of developed land in the watershed, there are some areas, like Lake Santee and golf courses, which stakeholders believe may have over-fertilization problems. There is also a potential of fertilizer runoff from cropland due to the topography and timing of application. The state has a program, Rule 5, which regulates oversite runoff and sedimentation from construction sites that have over an acre of disturbance. Due to the lack of development, construction, and sprawl, the lack of Rule 5 enforcement is not a concern for the watershed. The landuse of the watershed is listed in the table below and shown on the below map.

Figure 10: Landuse Types and Acres of the Salt-Pipe Creek Watershed

Landuse	Acres	Percent
Forested Land	83,080.71	55.0
Agricultural Lands	36,881.07	24.4
Pasture/Hay	21,694.39	14.3
Developed Land	7,165.12	4.7
Shrub/Scrub	1,517.85	1.0
Open Water	842.21	0.6
Wetlands	6.01	<0.1
TOTAL	**151,187.36**	**100**

Figure 11: Landuse of the Salt-Pipe Creek Watershed Map



Livestock

Since almost 40% of the watershed has either agricultural or hay/pasture landuse, there are a fair amount of farms with livestock in the watershed. Some of the operations are very small with only a couple of animals while others are large with thousands of animals. According to the Southern Whitewater River TMDL report, the following table shows the estimated number of animals in each subwatershed.

Figure 12: Livestock in the Watershed

Subwatershed	Pigs	Cattle	Sheep & Goats	Horses	Total Animals
Headwaters of Salt Creek	8,250	528	20	18	**8,816**
Righthand Fork	4,250	893	40	40	**5,223**
Bull Fork	2,715	550	20	24	**3,309**
Little Salt Creek	3,333	820	40	36	**4,229**
Freemont Branch	1,268	782	30	37	**2,117**
Headwaters of Pipe Creek	1,328	415	210	25	**1,978**
Clear Fork	880	463	20	23	**1,386**
Duck Creek	1,343	806	40	38	**2,227**
Walnut Fork	1,535	924	40	44	**2,543**
Yellow Bank Creek	1,320	816	30	39	**2,205**
Total	**26,222**	**6,997**	**490**	**324**	**34,033**

Some of the operations are classified as Confined Feeding Operations (CFOs) by the state of Indiana. A CFO is an agricultural operation where animals are kept and raised in confined situations. It is a lot or facility where the following conditions are met:

- Animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period
- Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.
- The number of animals present meets the requirements for the state permitting action.

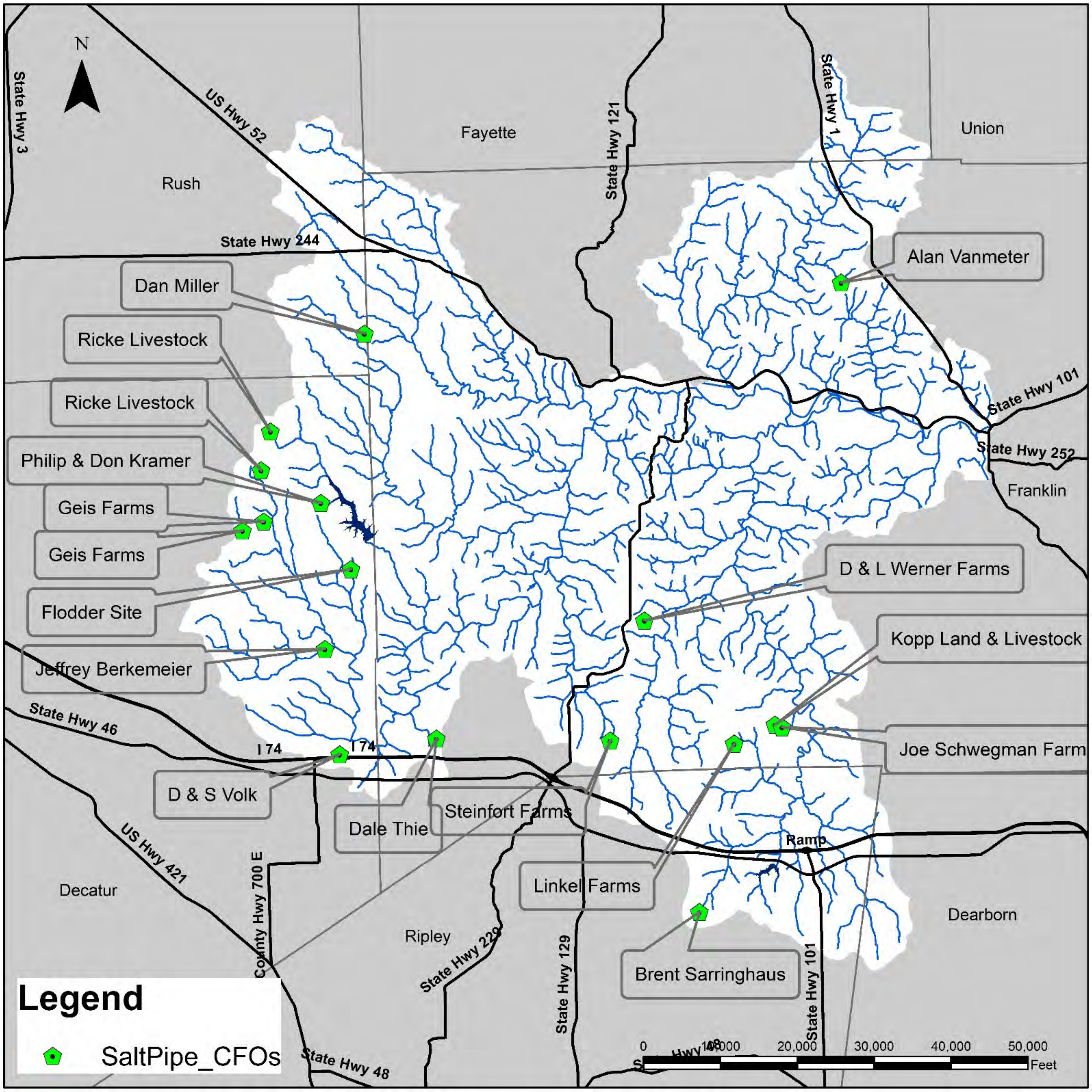
There are 17 CFOs in the Salt-Pipe Creek Watershed. These operations raise pigs, cattle, or a combination of both. Listed below are the CFOs located in the watershed and the associated animal type.

Figure 13: Watershed Confined Feeding Operations

Subwatershed	CFO Name	Animal Raised
Headwaters of Salt Creek	Flodder Site	Finisher Pigs
Headwaters of Salt Creek	Jeffrey Berkemier	Finisher Pigs
Headwaters of Salt Creek	Ricke Livestock	Nursery & Finisher Pigs
Headwaters of Salt Creek	Geis Farms	Farrow to Finish Pigs
Headwaters of Salt Creek	Geis Farms	Farrow to Finish Pigs
Righthand Fork	Dale Thie	Nursery & Finisher Pigs and Beef Cattle
Righthand Fork	D & S Volk	Nursery & Finisher Pigs
Righthand Fork	Philip & Don Kramer	Farrow to Finish Pigs
Righthand Fork	Ricke Livestock	Farrow to Finish Pigs and Beef Cattle
Little Salt Fork	Dan Miller	Finisher Pigs and Dairy Cattle

Subwatershed	CFO Name	Animal Raised
Fremont Branch	Steinfort Farms	Farrow to Finish Pigs
Headwaters of Pipe Creek	Brent Sarringhaus	Farrow to Finish Pigs
Headwaters of Pipe Creek	Linkel Farms	Farrow to Finish Pigs
Clear Fork	D & L Werner Farms	Farrow to Finish Pigs and Beef Cattle
Walnut Fork	Kopp Land & Livestock	Beef Cattle
Walnut Fork	Joe Schwegman Farm	Farrow to Finish Pigs and Beef Cattle
Yellow Bank Creek	Alan Vanmeter	Farrow to Finish Pigs

Figure 14: Watershed CFOs Map



Cropland

The Indiana State Department of Agriculture (ISDA) tracks trends in conservation and cropland through annual county tillage transects. Data collected through the tillage transect help determine adoption of conservation practices and estimate the average annual soil loss from Indiana's agricultural lands. Tillage practices captured in ISDA's tillage transect include No-Till, Mulch-Till, Reduced-Till and conventional tillage practices. ISDA defines No-Till as any direct seeding system including site preparation, with minimal soil disturbance. Mulch-Till is any tillage system leaving greater than 30 percent residue cover after planting, excluding no-till. Reduced-Till is a tillage system leaving 16 percent to 30 percent residue cover after planting. Conventional-Till is any tillage system leaving less than 30 percent residue cover after planting. The following information is from data collected during the Spring 2017 Tillage Transect.

Figure 15: Spring 2017 Tillage Transect Data for Watershed

Crop	Tillage Practice %	Decatur	Rush	Franklin	Fayette	Ripley	Dearborn	Average
Corn	No-Till	22	6	15	29	29	20	**20**
	Mulch Till	15	29	17	18	5	60	**24**
	Reduced Till	5	2	16	18	0	0	**7**
	Conventional Till	58	63	51	35	66	20	**49**
Soybeans	No-Till	61	59	56	60	52	67	**59**
	Mulch Till	24	23	27	26	16	23	**23**
	Reduced Till	2	3	5	7	0	0	**3**
	Conventional Till	13	15	11	6	33	9	**15**

According to the transect information, Conventional Till practices for corn and No-Till practices for soybeans are predominant in the Salt-Pipe Creek Watershed.

Geology/Topography

Topographic and geologic features of a watershed play a role in defining a watershed's drainage pattern. The majority of Salt-Pipe Creek Watershed is located in the Eastern Corn Belt Plain (ECBP) ecoregion with the middle section of the watershed located in the Interior Plateau (IP) ecoregion. The ECBP is characterized by extensive cropland agriculture with some natural forest cover and gently rolling glacial till plains dissected by moraines, kames and outwash plains. The IP ecoregion includes a till plain of low topographic relief formed from Illinoian glacial drift materials, rolling to modestly or deeply dissected basin terrain. Layers of sandstone, siltstone, shale and limestone underlie much of the Interior Plateau. Limestone outcrops are common, as are areas pitted with limestone sinks. Elevations in the watershed range from 610 feet to 1090 feet. The landscape changes from gentle slopes in the north and western portions of the watershed to steeper slopes as you move east through the center of the watershed. The steep slopes within the watershed produce rapid flows of water which often causes heavy erosion along the banks and more opportunity for pollutants to enter the streams through runoff, which are both listed in the stakeholder concerns. The watershed topography and elevation can be seen in the following maps.

Figure 16: Topography in the Salt-Pipe Creek Watershed

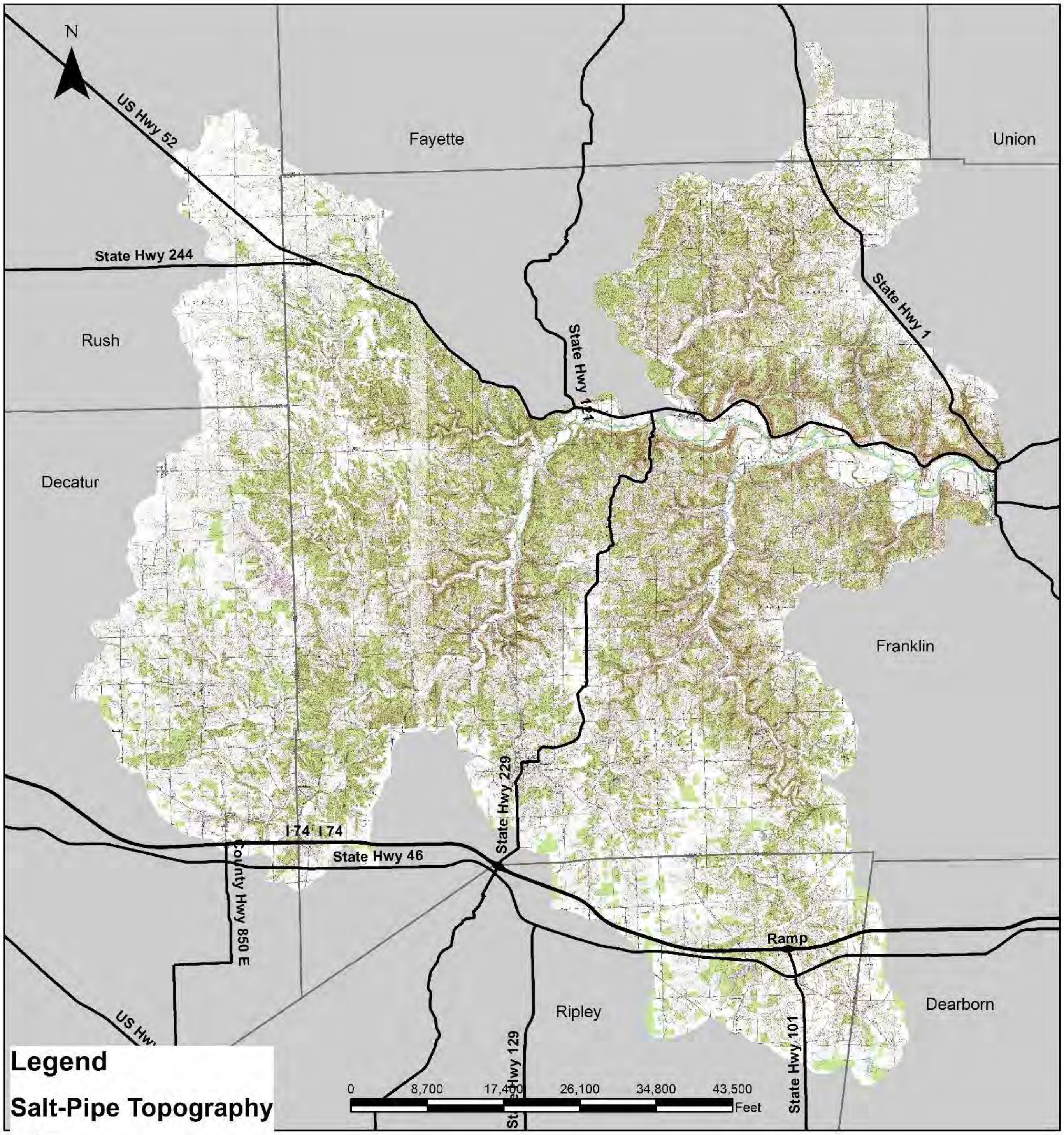
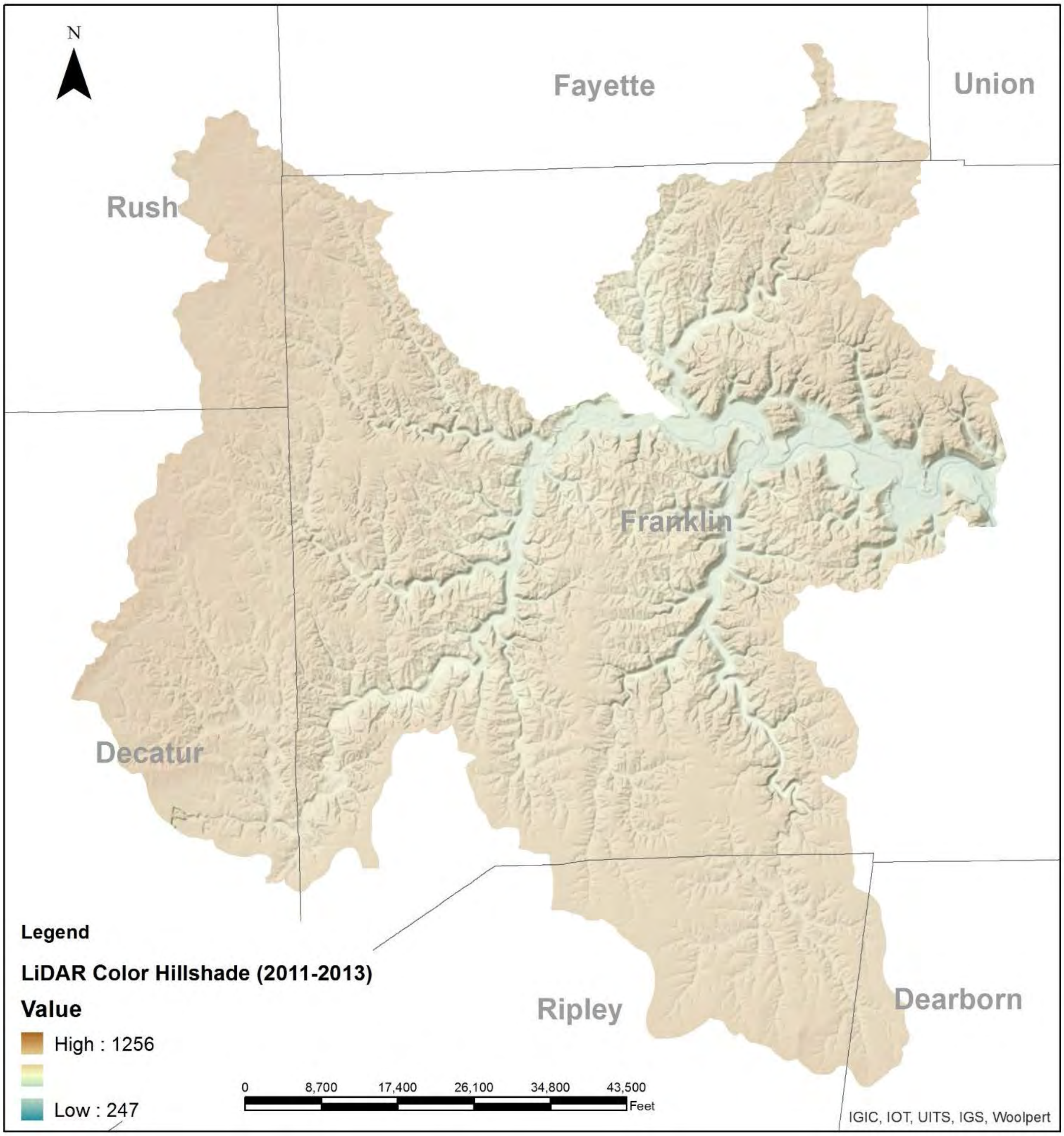


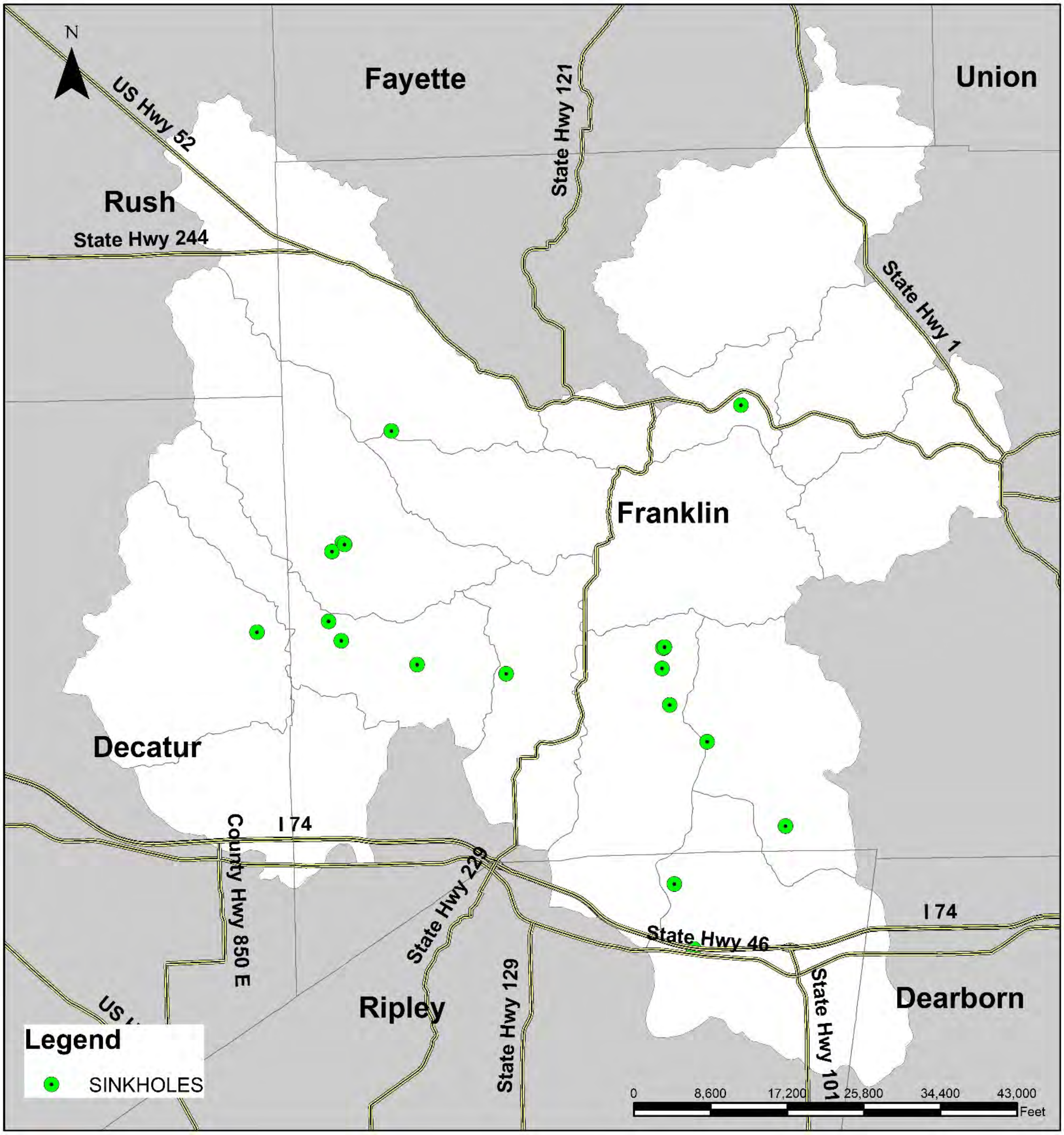
Figure 17: Elevation of the Salt-Pipe Creek Watershed



Karst Features

Karst is defined as a landscape with topographic depressions such as sinkholes and caves, caused by underground dissolution of limestone bedrock. The hollow nature of karst terrain results in very high pollution potential because streams and surface runoff entering sinkholes or caves bypass natural filtration through the soil and provide direct conduits for contaminants. Groundwater can travel quite rapidly through these underground networks and contaminants can be transmitted quickly to wells and springs in the vicinity. There are no known caves in the watershed but there are 18 sinkholes identified on the Southern Indiana/Northern Kentucky Inventory created by the Indiana Geological Survey, which can be seen in the map below

Figure 18: Sinkholes of the Salt-Pipe Creek Watershed



Soils

The Salt-Pipe Creek Watershed is made up of many different soil types and with each soil type comes different soil characteristics. Some of the soil characteristics include soil drainage, septic tank suitability, soil saturation, and soil erodibility. These different characteristics can affect the health of the watershed.

Soil Drainage

According to the National Soil Survey Handbook, a "Hydrologic group" is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are: the depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and the depth to a layer with a very slow water transmission rate. When considering the dual soil groups, up to 49% of soils in the Salt-Pipe Creek Watershed could potentially be classified as Hydrologic Group D, which has a high runoff potential and very slow infiltration rate.

Figure 19: Soils of the Salt-Pipe Creek Watershed

Hydrologic Group	Group Characteristics	Acres in Watershed	Percentage
A	High infiltration rate, low runoff potential when thoroughly wet; Very deep, well drained to excessively drained; sands or gravelly sands; high rate of water transmission.	2,365.0	1.6%
B	Moderate infiltration rate, moderate runoff potential when thoroughly wet; moderately deep or deep, moderately well drained to well drained; moderately fine to moderately coarse; moderate rate of water transmission.	16,789.4	11.1%
B/D Dual Soil Group	When drained acts like a B, when not drained it acts like a D. (adequately drained means that the seasonal high water table is kept at least 60 centimeters [24 inches] below the surface in a soil where it would be higher in a natural state)	11,897.8	7.9%
C	Slow infiltration rate, slow runoff potential when thoroughly wet; has layer that impedes downward movement of water; moderately fine to fine; slow rate of water transmission.	56,888.5	37.6%
C/D	When drained acts like a C, when not drained it acts like a D. (adequately drained means that the seasonal high water table is kept at least 60 centimeters [24 inches] below the surface in a soil where it would be higher in a natural state)	29,449.5	19.5%
D	Very slow infiltration rate, high runoff potential when thoroughly wet; has permanent high water table, claypan or clay layer at or near surface, or shallow over nearly impervious layer; clayey soil that has high shrink-swell potential; very slow rate of water transmission.	32,674.2	21.6%
Not Rated	No group rating	1,123.0	0.7%
	TOTALs	**151,187.4**	**100%**

Figure 20: Hydrologic Groups of the Watershed Map

Sewered and Unsewered Areas

The vast majority of the Salt-Pipe Creek Watershed is rural with no sewer service. The watershed does border some larger sewered areas including Brookville, Batesville, and Sunman. Three smaller wastewater treatment plants are located within the watershed and service the areas of Lake Santee, Oldenburg, and Metamora. There are no large known unsewered communities within the watershed area. The majority of the watershed residents rely on septic systems for their waste treatment.

According to the Southern Whitewater River Watershed TMDL report, septic systems require soil characteristics and geology that allow gradual seepage of wastewater into the surrounding soils. Seasonal high water tables, shallow compact till and coarse soils present limitations for septic systems. While system design can often overcome these limitations (i.e., perimeter drains, mound systems or pressure distribution), sometimes the soil characteristics prove to be unsuitable for any type of traditional septic system.

Heavy clay soils require larger (and therefore more expensive) absorption fields; while sandier, well-drained soils are often suitable for smaller, more affordable gravity-flow trench systems.

The septic system is considered failing when the system exhibits one or more of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures

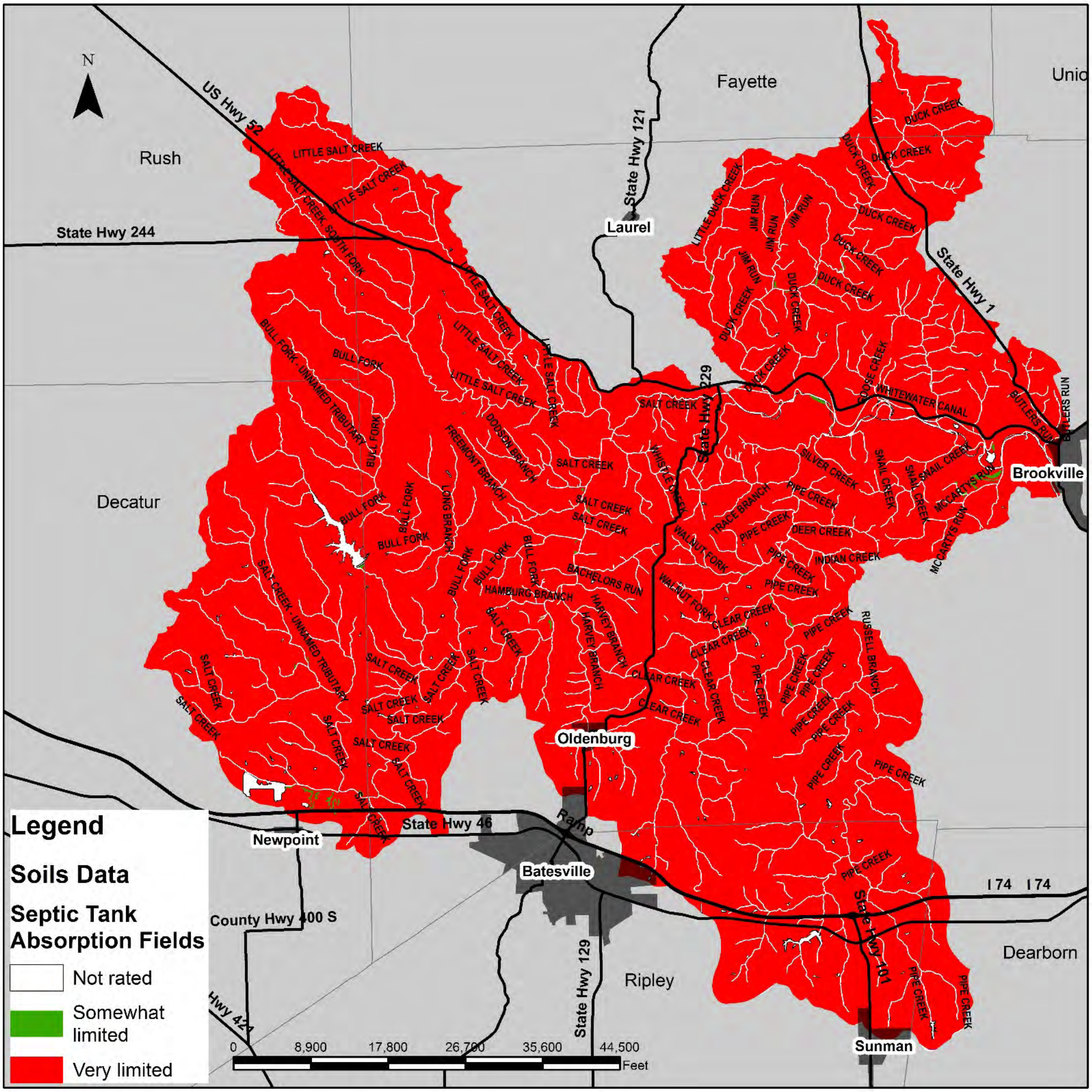
2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters

3. Effluent is discharged from the system causing contamination of a potable water supply, ground water, or surface water.

Only that part of the soil between depths of 24 and 60 inches is evaluated for septic system suitability. The ratings are based on the soil properties that affect absorption of the effluent, construction, maintenance of the system, and public health.

Soils labeled “very limited” indicate that the soil has at least one feature that is unfavorable for septic systems. Over 99 percent (149,890.8 acres) of the Salt-Pipe Creek Watershed is considered “very limited” in terms of soil suitability for septic systems. These limitations generally cannot be overcome without major soil reclamation or expensive installation designs. Less than one percent of the soils within the Pipe Creek watershed are “not rated,” meaning these soils have not been assigned a rating class because it is not industry standard to install a septic system in these geographic locations, and less than one percent of the soils in the Salt-Pipe Creek Watershed are designated “not limited,” meaning that the soil type is suitable for septic systems. Since the majority of the watershed is unsewered and almost all of the soil is considered “very limited” for septics systems, septic system failure is a stakeholder concern.

Figure 21: Septic Suitability for the Salt-Pipe Creek Watershed Map



Highly Erodible Land

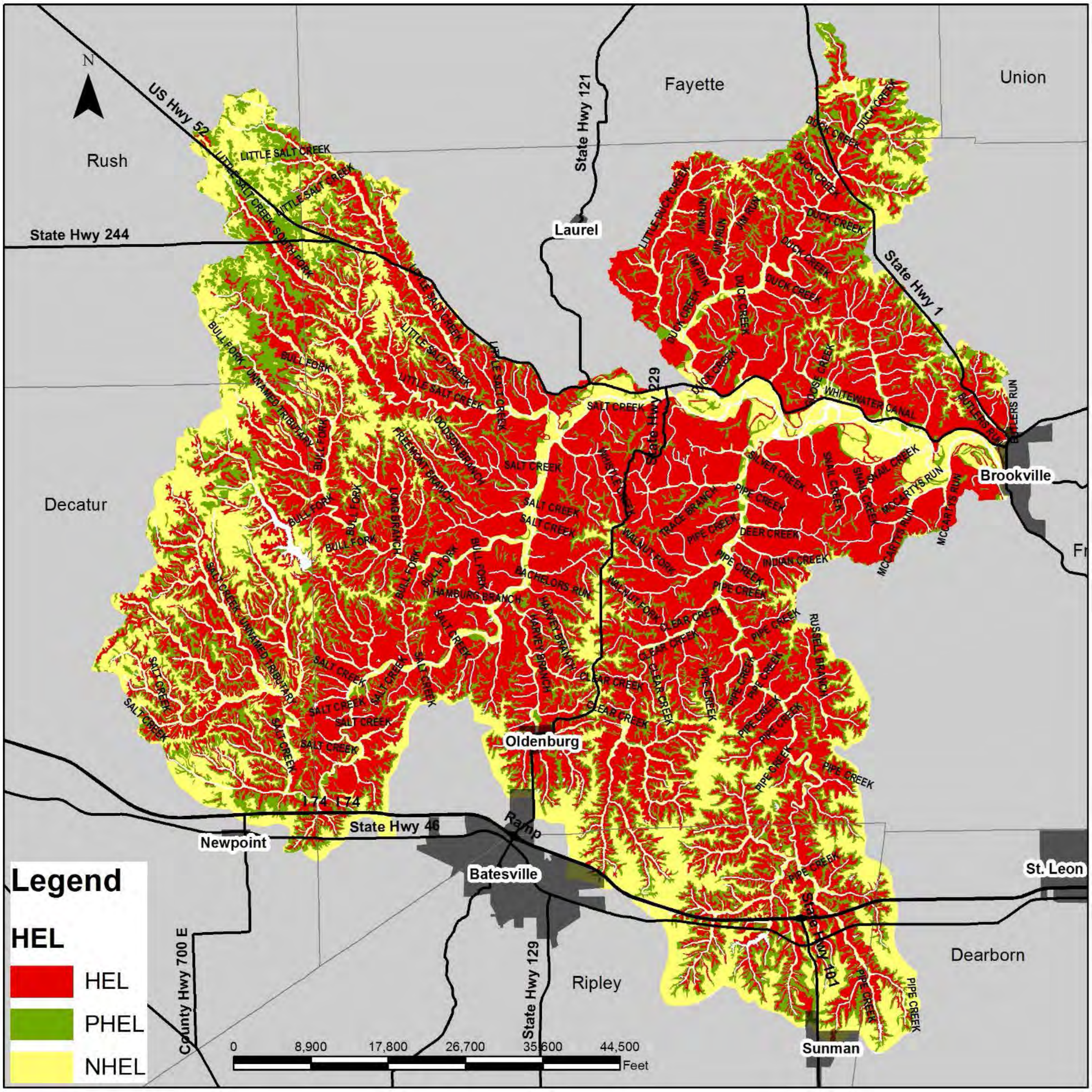
Although erosion is a natural process within stream ecosystems, excessive erosion negatively impacts the health of watersheds. Erosion increases sedimentation of the streambeds, which impacts the quality of habitat for fish and other organisms. Erosion also impacts water quality as it increases nutrients and decreases water clarity. As water flows over land and enters the stream as runoff, it carries pollutants and other nutrients that are attached to the sediment.

Sediment suspended in the water blocks light needed by plants for photosynthesis and clogs respiratory surfaces of aquatic organisms.

The NRCS maintains a list of highly erodible lands (HEL) units for each county based upon the potential of soil units to erode from the land. HELs are especially susceptible to the erosional forces of wind and water. Wind erosion is common in flat areas where vegetation is sparse or where soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing productive top soil from one place and depositing it in another. The classification for HELs is based upon an erodibility index for a soil, which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss tolerance (T) value, which is the maximum annual rate of erosion that could occur without causing a decline in long-term productivity.

The Salt-Pipe Creek Watershed is comprised of 79,414.4 acres of land classified as HEL, which is about 53% of the watershed. An additional 28,804.3 acres are classified as PHEL, potentially highly erodible land. Altogether 108,218.7 acres or approximately 72% of the watershed are either HEL or PHEL. Gully and sheet/rill erosion are likely to occur on this type of soil. Gully erosion is a stakeholder concern along with sedimentation entering the stream. The remaining acres in the watershed are classified as non-highly erodible lands (NHEL).

Figure 22: Highly Erodible Lands of Salt-Pipe Creek Watershed

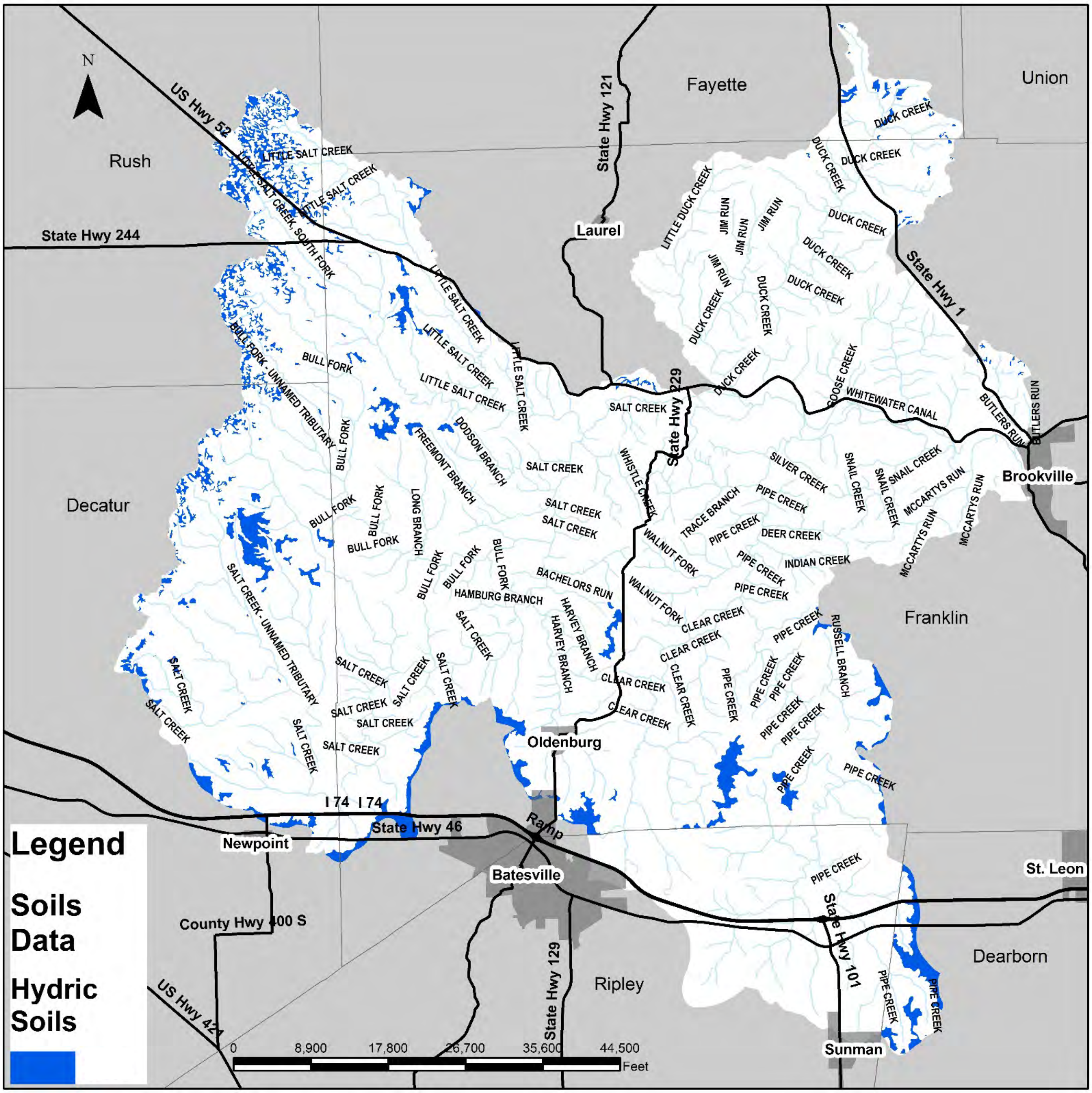


Hydric Soils

Soils that remain saturated or inundated with water for a sufficient length of time become hydric through a series of chemical, physical, and biological processes. Once a soil takes on hydric characteristics, it retains those characteristics even after the soil is drained. Hydric soils have been identified in the Salt-Pipe Creek Watershed and are important in consideration of wetland restoration activities. Approximately 5,931 acres, or 4% of the Salt-Pipe Creek

Watershed area, contains soils that are considered hydric. However, a large majority of these soils have been drained for either agricultural production or urban development and would no longer support a wetland. The location of remaining hydric soils can be used to consider possible locations of wetland creation or enhancement.

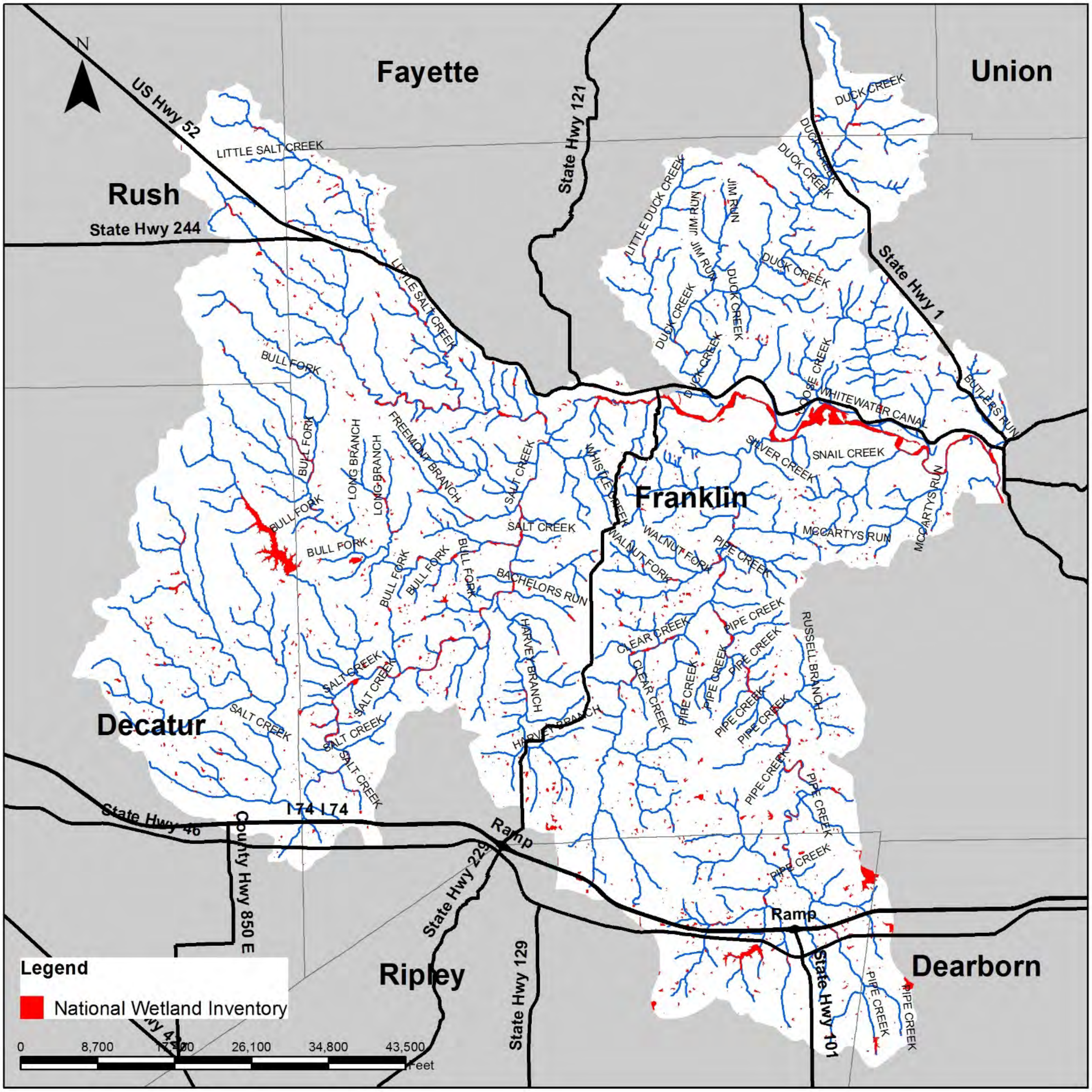
Figure 23: Hydric Soils of the Salt-Pipe Creek Watershed



Wetlands

A wetland is a land area that is saturated with water either permanently or seasonally, creating its own ecosystem. Wetlands play a number of important roles for the environment including, water purification, flood control, acting as a carbon sink, and shoreline stability. They also allow water to infiltrate slowly, thus reducing the risks of contaminated water runoff into waterbodies. Wetlands are also considered the most biologically diverse ecosystem, by being the home of a wide range of animal and plant life. Agencies such as the USGS and U.S. Fish and Wildlife Service (USFWS) estimate that Indiana has lost approximately 85 percent of the state's original wetlands. The Salt-Pipe Creek Watershed has approximately 2,251 acres of wetlands.

Figure 24: Wetlands of the Salt-Pipe Creek Watershed

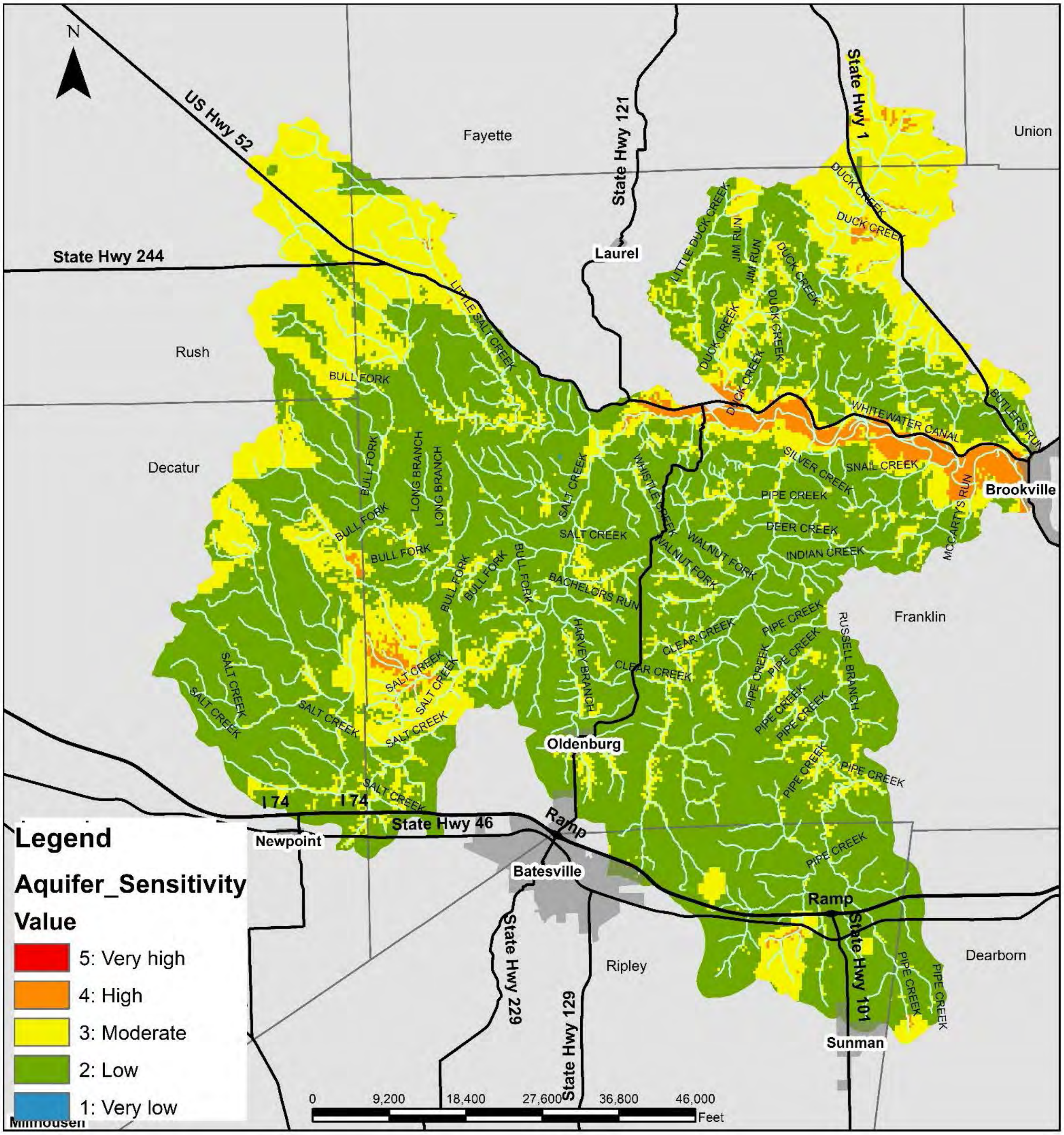


Ground Water

According to a study conducted by the Indiana Geological Survey, the Salt-Pipe Creek Watershed is sensitive to ground water pollution through surface water. According to the Southern Whitewater River Watershed TMDL report, hydrogeological settings help to interpret the occurrence, movement, and sensitivity to contamination of ground water in relation to the surface and subsurface environment. Generally, the Salt-Pipe Creek watershed is located in the bottomlands of southern Indiana, which are often associated with large bedrock valleys and significant quantities of late glacial till outwash. These outwash deposits are the major ground water resources for the entire southern part of the state. They are characterized by shallow water table conditions and are consequently also zones of significant interaction between surface water and ground water.

Specifically, the outwash in the Southern Whitewater River valley constitutes the primary source of ground water in this part of the state, as suitable aquifers are generally sparse in the adjoining uplands. Most of the valley bottom is in floodplain, so water table depths are typically between 5 and 15 feet. A considerable amount of ground water is transmitted down-valley within the outwash and interacts with the river at frequent meanders that cut across the aquifer. The valley as a whole is generally a ground water discharge area, although it is unlikely that there is an appreciable volume of actual discharge to this segment of the valley in view of the poor water-transmitting properties of the surrounding bedrock and till. Overall characteristics indicate that ground water beneath the valley floor is likely to be relatively sensitive to contamination, and that finding replacement water sources would be difficult should contamination affect a part of the aquifer. This should be of special concern since there is currently one surface drinking water source known in the Salt Creek watershed. All other drinking water sources are ground water sources.

Figure 25: Aquifer Sensitivity in Salt-Pipe Creek Watershed



Wellhead Protection

The Safe Drinking Water Act and the Indiana Wellhead Protection Rule (327 IAC 8-4.1) mandates a wellhead program for all Community Public Water Systems. There are 2 wellhead protection areas located in the Salt-Pipe Creek Watershed. They are the Franklin County Water Association, which serves approximately 9,018 people, and Sunman Water Works, which serves approximately 1,094 people. The Sunman Water Works area is only partially located in the Salt-Pipe Creek Watershed. Both areas have a plan which is required to be updated every 5 years. The mandatory updates include an updated wellhead protection area delineation and updated inventory of potential sources of contamination, if necessary.

Source Water Assessment for Lake Santee

The Safe Drinking Water Act also mandates an assessment is completed for all public water supplies in Indiana that utilize surface water as part or all of their supply. The community of Lake Santee (approx. 1,385 people) obtains its water supply from Right Hand Fork. Each assessment includes an evaluation of conditions affecting the susceptibility of the drinking water supply.

Leaking Underground Storage Tanks (LUSTs)

An Underground Storage Tank (UST) is a tank or combination of tanks which hold regulated substances and have at least ten percent of their volume underground, including underground piping connected to the tank. USTs that contain petroleum or hazardous substances are regulated by IDEM.

The report lists a priority and a disposition for each site. IDEM assigns a priority to each site to ensure that the ones with the greatest chance of impacting people are cleaned up first. The priority is based on information submitted by the responsible party and/or their consultant.

- "High" – Sites with one or more of the following conditions: measurable free product, drinking water impacts, surface impacts, or vapors in buildings or utilities.
- "Medium" – Sites with no high priority conditions, but there is possible ground water contamination.
- "Low" – Sites only have soil contamination.
- "Unknown" – Inadequate information is available to make a priority determination.

IDEM also assigns a disposition -- open, closed, or other -- to every LUST site:

Open

- Active – The LUST is currently undergoing site characterization or corrective action.
- Discontinued – Discontinued sites are still active, but IDEM designates them as "discontinued" for different reasons, including:

    The site was referred to another program because the release is not from a regulated UST.

    The facility identification number and the LUST number were assigned based on a complaint, and not to a known facility.

    The LUST is a dead end because the owner cannot be located, and it is a lower priority based on site information and potential threats to human health and the environment.

Closed:

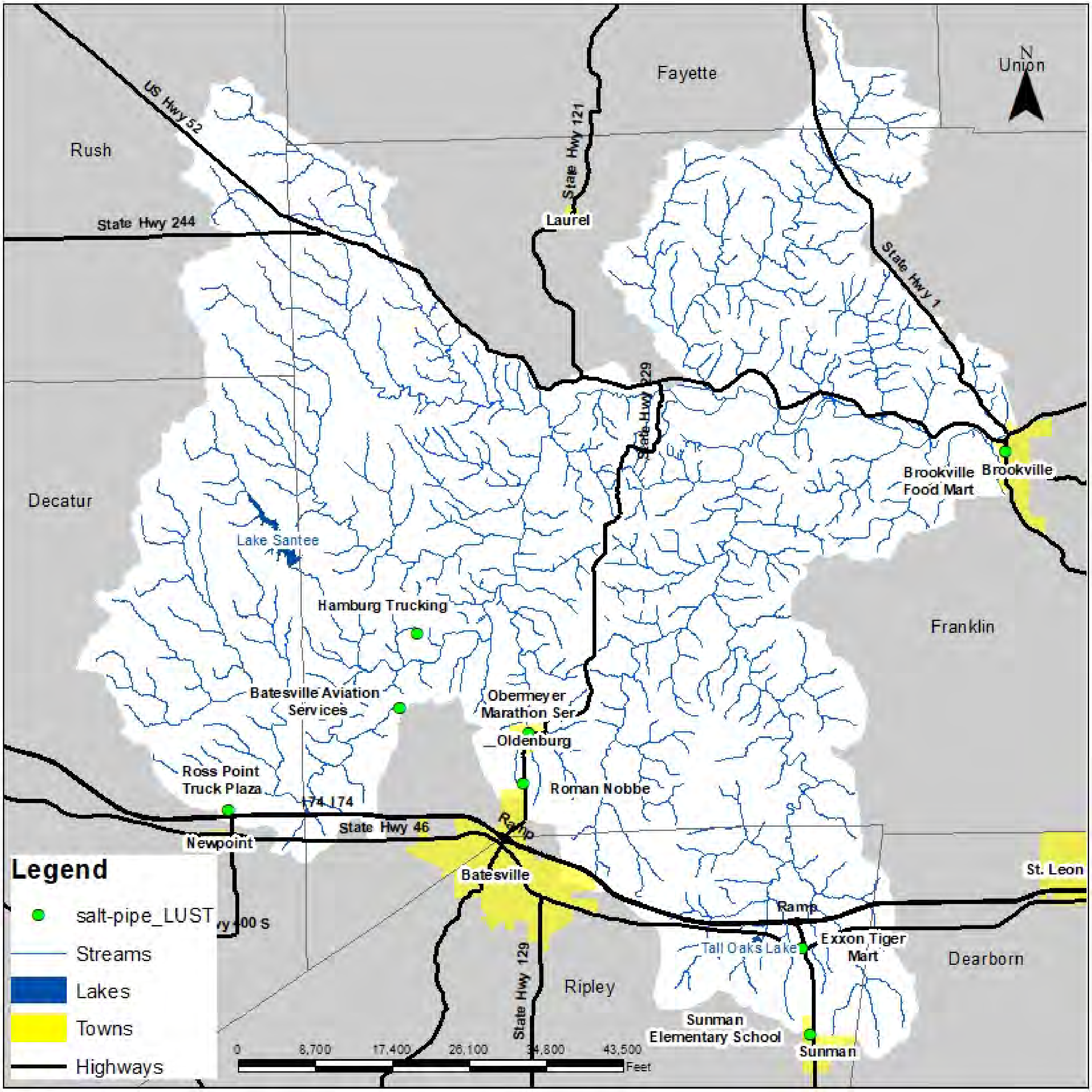
- NFA - Conditional Closure – The site was granted a "no further action (NFA)" because it was closed with an environmental restrictive covenant.
- NFA - Unconditional Closure – The site was granted an NFA because it was closed without property use restrictions.

According to the IDEM LUST Report (Updated January 2019 at https://www.in.gov/idem/tanks/2392.htm) there are 8 LUST sites in the Salt-Pipe Creek watershed with 10 incidents. See the summary of the LUST report below and map of locations.

Figure 26: LUST Report Summary

HUC 050800030-	UST Facility ID	Incident Number	Facility Name	Street Address	City	County	Priority	Disposition
502	4393	199811700	Batesville Aviation Services	25222 Enochsburg Rd	Batesville	Franklin	Medium	NFA-Unconditional Closure
502	4393	201305504	Batesville Aviation Services	25222 Enochsburg Rd	Batesville	Franklin	Medium	NFA-Conditional Closure
502	15698	199812602	Hamburg Trucking	6023 N Hamburg Rd	Oldenburg	Franklin	Low	NFA-Unconditional Closure
502	6843	198911515	Ross Point Truck Plaza	I-74 & New Point Interchange	Greensburg	Decatur	Low	Discontinued (active)
505	15746	199003546	Obermeyer Marathon Ser	22183 Main St	Oldenburg	Franklin	Low	NFA-Unconditional Closure
505	15746	199804520	Obermeyer Marathon Ser	22183 Main St	Oldenburg	Franklin	Low	NFA-Unconditional Closure
505	16327	201109507	Roman Nobbe	2121 SR 229	Batesville	Franklin	Low	NFA-Unconditional Closure
601	7487	201506512	Exxon Tiger Mart	8845 E Sr 46	Sunman	Ripley	High	Active
601	288	199011582	Sunman Elementary School	Sr 101	Sunman	Ripley	Medium	NFA-Unconditional Closure
605	12008	199101562	Brookville Food Mart	1010 Main St	Brookville	Franklin	Low	NFA-Unconditional Closure

Figure 27: LUSTs in Salt-Pipe Creek Watershed Map



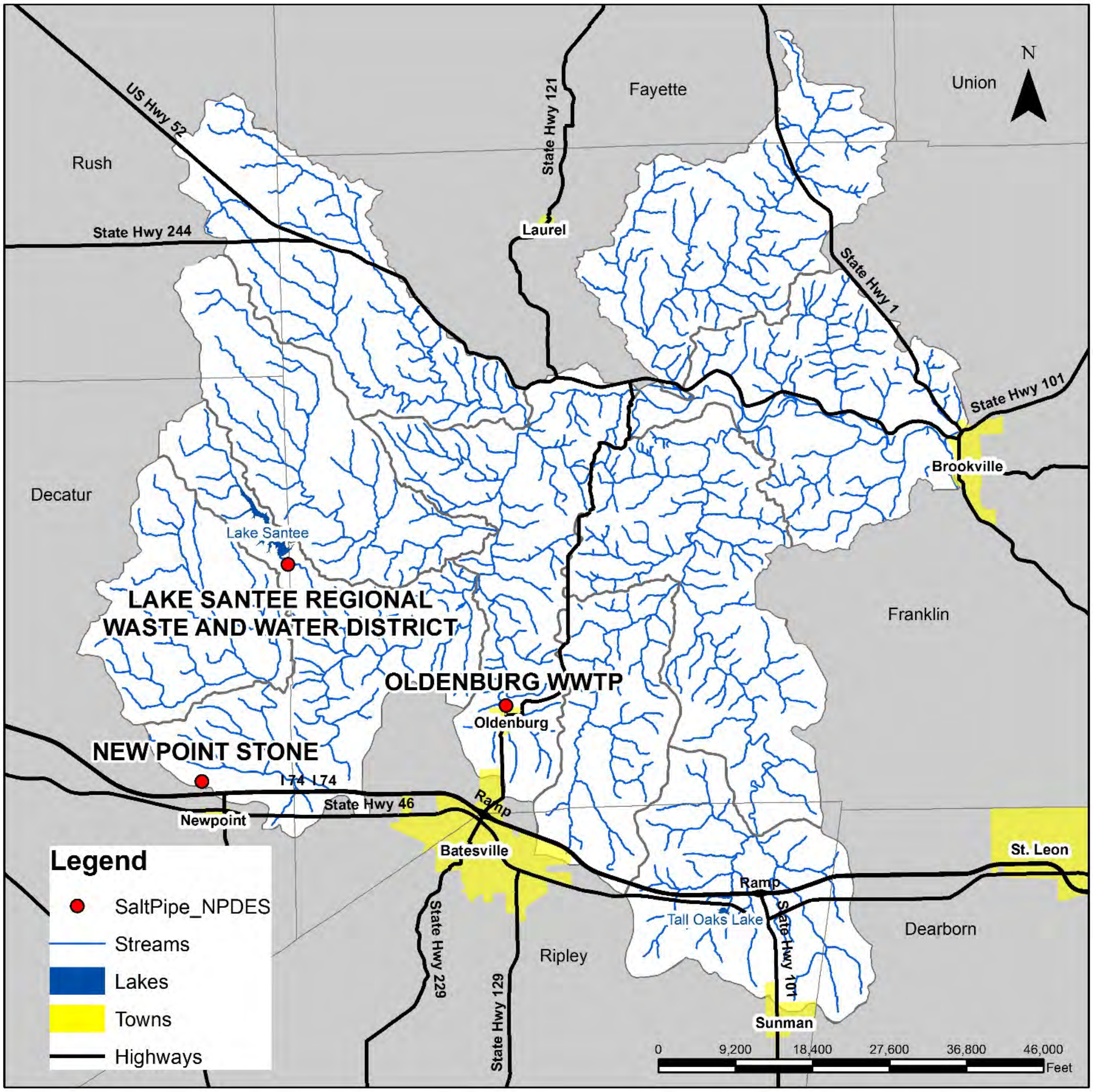
Discharge Permits

The National Pollutant Discharge Elimination System (NPDES) permit program, created in 1972 by the Clean Water Act (CWA), helps address water pollution by regulating point sources that discharge pollutants to waters of the United States. An NPDES permit is typically a license for a facility to discharge a specified amount of a pollutant into a receiving water under certain conditions. There are three facilities within the Salt-Pipe Creek Watershed that have NPDES permits for discharging effluent. The table below contains information from Environmental Protection Agency's Enforcement and Compliance History Online website. Facilities in non-compliance have violated an environmental requirement set by the government. Non-compliance could indicate anything from a report that wasn't submitted to the release of excessive pollutants. Formal enforcement actions come in many forms if the facility cannot get back into compliance on their own. It could be lawsuit or a specific order of actions or clean-up to reestablish compliance. Formal action may also contain penalties. As you can see below, none of the facilities in the Salt-Pipe Creek watershed has had any recent compliance/enforcement issues.

Figure 28: NPDES Compliance Summary

Facility Name	Lake Santee Regional Waste and Water District	Oldenburg Wastewater Treatment Plant	New Point Stone
Subwatershed	Righthand Fork	Fremont Branch	Righthand Fork
Receiving Stream	Righthand Fork	Harvey Branch	Salt Creek
Type of Facility	Wastewater Treatment	Wastewater Treatment	Quarry
Quarters in Non-compliance (3 yrs)	0	0	0
Formal Enforcement Action (5 yrs)	0	0	0

Figure 29: NPDES Permit Facility Map



County Comprehensive Plans

Decatur County – The Comprehensive Plan was last updated in 2016 and was adopted May 15, 2017. The plan addresses the county's natural resources and water quality in several areas. The plan's Policy 12: *Preserve Natural Resources*, has 3 major themes: Conservation – creating a stronger relationship between the natural and built environments, Preservation – retaining and protecting existing environmental, agriculture and natural resources, and Restoration – adding to natural resources wherever possible. It states floodplains and wetlands should be protected from development and reduction in woodlands should be minimized. The plan's Policy 14: *Protect Water Quality*, has several recommendations to protect both ground water and surface water. They include creating a storm water management oversight committee to develop storm water runoff policies, insuring there is adequate separation between well sites and septic systems, and continuing to require a backup septic field location.

Franklin County – The comprehensive plan was last updated in March 2015 but does not contain any information about natural resources or water quality.

Threatened and Endangered Species

The Salt-Pipe Creek Watershed is home to several endangered plant and animal species on both the state and federal level. These species are known to inhabit some of the sensitive habitats found in the watershed.

Mammals:

Indiana Bat (Myotis sodalis): The Indiana Bat is a medium sized mouse eared bat that was once commonly distributed across the Midwestern and Eastern states. Due to the rapid spread of White Nose Syndrome, populations have been reduced by as much as 50 percent . Currently the Indiana bat is listed as endangered in Indiana and also on the federal endangered species list.

Northern Long-Eared Bat (Myotis septentrionalis): This small-sized bat is listed as state endangered for Indiana. Its decline is attributed to the declining coniferous forests habitat and the outbreak of White Nose Syndrome.

Fish:

Variegate Darter (Etheostoma variatum): The variegate darter is one of the most colorful darter species and is restricted to the Ohio River drainage area. This colorful fish is listed as state endangered for Indiana.

Redside Dace (Clinostomus elongates): The redside dace is state endangered for Indiana and can only be found in the Whitewater River Watershed. Globally this small fish is rare and uncommon. Known for leaping into the air to capture insects, this little fish is found in small streams with high gradients and cool water.

Reptiles and Amphibians:

Eastern Hellbender (Cryptobranchus alleganiensis alleganiensis): The Eastern Hellbender is listed as endangered in the state of Indiana. These salamanders grow to be on average about 2 feet long. In addition, they serve to fill unique niches in ecosystems where they can be both predator and prey.

Timber Rattlesnake (Crotalus horridus): As one of the 4 venomous snake species found in Indiana, the timber rattlesnake is listed as state endangered. Due to human disturbances and general fear of its venomous nature, the timber rattlesnake's population has dwindled over the years.

Birds:

Bald Eagle (Haliaeetus leucocephalus): Known as the National Bird, the Bald eagle has been a national symbol since 1782. The eagle is designated as state endangered in Indiana, and is thought to be in decline because of decreasing wetland habitat. The watershed is home to nesting pairs near Brookville Reservoir.

Peregrine Falcon (Falco peregrinus): Although listed as a species of "least concern" internationally, the Peregrine Falcon is listed as endangered in the state of Indiana. The falcon is known for its high speeds. While hunting, a dive can reach speeds of over 200 mph, making it one of the fastest animals in the animal kingdom.

Loggerhead Shrike (Lanius ludovicianus): The Loggerhead Shrike is listed as endangered in Indiana. This bird has a long hooked beak and feeds on insects, smaller birds, and lizards. Their population decline has been attributed to loss of suitable habitat and pesticide use.

Black-crowned Night-heron (Nycticorax nycticorax): This large bird has been listed as endangered in Indiana mainly due to decreasing habitat, since they prefer either salt or freshwater wetland areas.

Interior Least Tern (Sternula antillarum athalassos): The Interior Least Tern is listed as state endangered in Indiana. This small bird is a migratory bird that overwinters in Central America.

Barn Owl (Tyto alba): Though they are listed as endangered in Indiana, Barn Owls are one of the most widely distributed owls worldwide. With their white faces, they have been the inspiration for many ghost tales and hauntings in the Indiana area.

Mollusks:

Fanshell (Cyprogenia stegaria): The Fanshell is listed as federally endangered. This species of mollusk is only known to have breeding populations in three rivers of the United States. The species is threatened by loss and degradation of its natural habitat.

Snuffbox mussel (Epioblasma triquetra): The Snuffbox mussel is listed as federally endangered in the Endangered Species Act. Known to attach to the gills of fish, this mollusk has experienced population declines because of human interference.

Sheepnose Mussel (Plethobasus cyphyus): The Sheepnose Mussel is listed as state endangered in Indiana. Known as a freshwater or river mussel, their population has been on the decline due to their sensitivity to water pollution.

Insects:

Cobblestone Tiger Beetle (Cicindela marginipennis): The Cobblestone Tiger Beetle is listed as state endangered for Indiana and can be found in Franklin County, Indiana. The small black beetle is native to the mid-eastern United States.

Vascular Plants:

Running Buffalo Clover (Trifolium stoloniferum): The Running Buffalo Clover is listed as endangered in Indiana. The plant is typically found in rich soils in woodland habitats. This species of plant was once thought to be extinct, until populations were discovered in West Virginia in the late 1980's and now can be found in Dearborn County, Indiana.

Shaggy False-Gromwell (Onosmodium hispidissimum): Shaggy False-Gromwell is a state endangered species in Indiana, found in Franklin County. This plant blooms from June to July and prefers partly shaded prairie habitat. Due to the decrease of prairies nationwide, the population of the Shaggy False-Gromwell has declined.

Lake Cress (Armoracia aquatic): The Lake Cress is listed as state endangered in Indiana. The Lake Cress prefers wetland habitat. Due to human development and expansion, numbers of this plant have declined. The Lake Cress is found in Dearborn County, Indiana.

Matted Broomspurge (Euphorbia serpens): Matted Broomspurge is a state endangered plant in Indiana. Originally from Central America, it was originally introduced in the United States as a weed. This small fruiting plant prefers shaded rich soils.

Gray Beardtongue (Penstemon canescens): The Gray Beardtongue is a state endangered plant in Indiana. The stems can reach a maximum height of 1 meter. The Gray Beardtongue is a native plant to the southeastern United States.

Relationships Between Watershed Characteristics

After reviewing the different characteristics of the Salt-Pipe Creek Watershed, there are three which stand out as major influencers on others. These are topography, soils, and landuse. These characteristics influence and are related to other characteristics. Some examples of these relationships are listed below.

Areas of the watershed with steeper terrain are also areas with hydrologic group ratings of C & D, with low infiltration rates and high runoff potential. The landuse of those areas are mainly forested with some hay/pasture, which are more natural conditions. The steepness of the land, low infiltration rates, and high runoff potential make these areas not as feasible for farmers to plant and harvest row crops like in the flatter terrain. The combination of those steep terrain characteristics and the forested and pasture landuse can lead to water quality issues like sedimentation and E.coli contamination from both livestock and wildlife.

There is also a very close relationship between Highly Erodible Land (HEL) soils and landuse. If the two maps are overlapped, the areas of the watershed which are classified as Non-Highly Erodible Land (NHEL) fall in line with the agricultural lands, Potentially Highly Erodible Land (PHEL) with hay/pasture, and HEL with forested lands. The watershed's topography is a key component of this relationship.

The soil types and topography are also related to the fluvial erosion hazard areas. The steep slopes and slow infiltration of the soils leads to large amounts of runoff during heavy rainfalls. The runoff leads to flooding and streambank erosion potential which is identified by the fluvial erosion hazard.

Monitoring Efforts

There have been two different monitoring/planning efforts in the Salt-Pipe Creek Watershed area. The first monitoring effort was in 2008 for the Salt Creek Watershed. The effort was a part of the Lake and River Enhancement (LARE) grant received by Franklin and Decatur County SWCDs in 2007. The water monitoring included 15 testing sites which were sampled once during storm flow (Jan. 2008) and once during base flow (August 2008). The Salt Creek Diagnostic Study was completed in 2009. It identified sediment as the #1 priority problem. E. coli was identified as a problem for the Upper Salt Creek and was listed as a medium priority for management. There were several sites identified where livestock had direct access to the streams. The Upper Salt Creek also had the highest predicted loading for nitrogen and phosphorous according to the LARE study and the Middle Salt Creek was second. The next monitoring effort started in 2013 in the entire Southern Whitewater River Watershed area, which included both Salt Creek Watershed and Pipe Creek Watershed. This effort was a part of the TMDL (Total Maximum Daily Load) report. The TMDL report contains a lot of valuable information and data, which was used for the development of this watershed management plan. The data from the TMDL is discussed in more detail in the data section of the WMP.

Water Monitoring Data Collection

In order to evaluate the watershed further, water quality monitoring data was acquired from IDEM. IDEM sampled at 33 stream sites (T1-T33) between November 2013 and October 2014 as part of the Southern Whitewater River Watershed TMDL report. IDEM selected the sites using a modified geometric and targeted design process in order to get the necessary spatial representation of the study area. Twelve additional sites (P1-P12) were sampled between three times between April 2014 and October 2014 as part of the IDEM probabilistic monitoring program. There were 26 testing sites in the Salt-Pipe Creek Watershed (18 were TMDL sites and 8 were probabilistic sites). TMDL sites located at subwatershed pour points were sampled monthly for a year, while the other TMDL sites were sampled monthly during only the recreational season (April - October). Some of the testing sites also dried up during the summer months so samples could not be collected. These differences in the sites resulted in different number of samples collected during the testing period. Listed below are the testing site locations along with stream name and road crossing for each testing site.

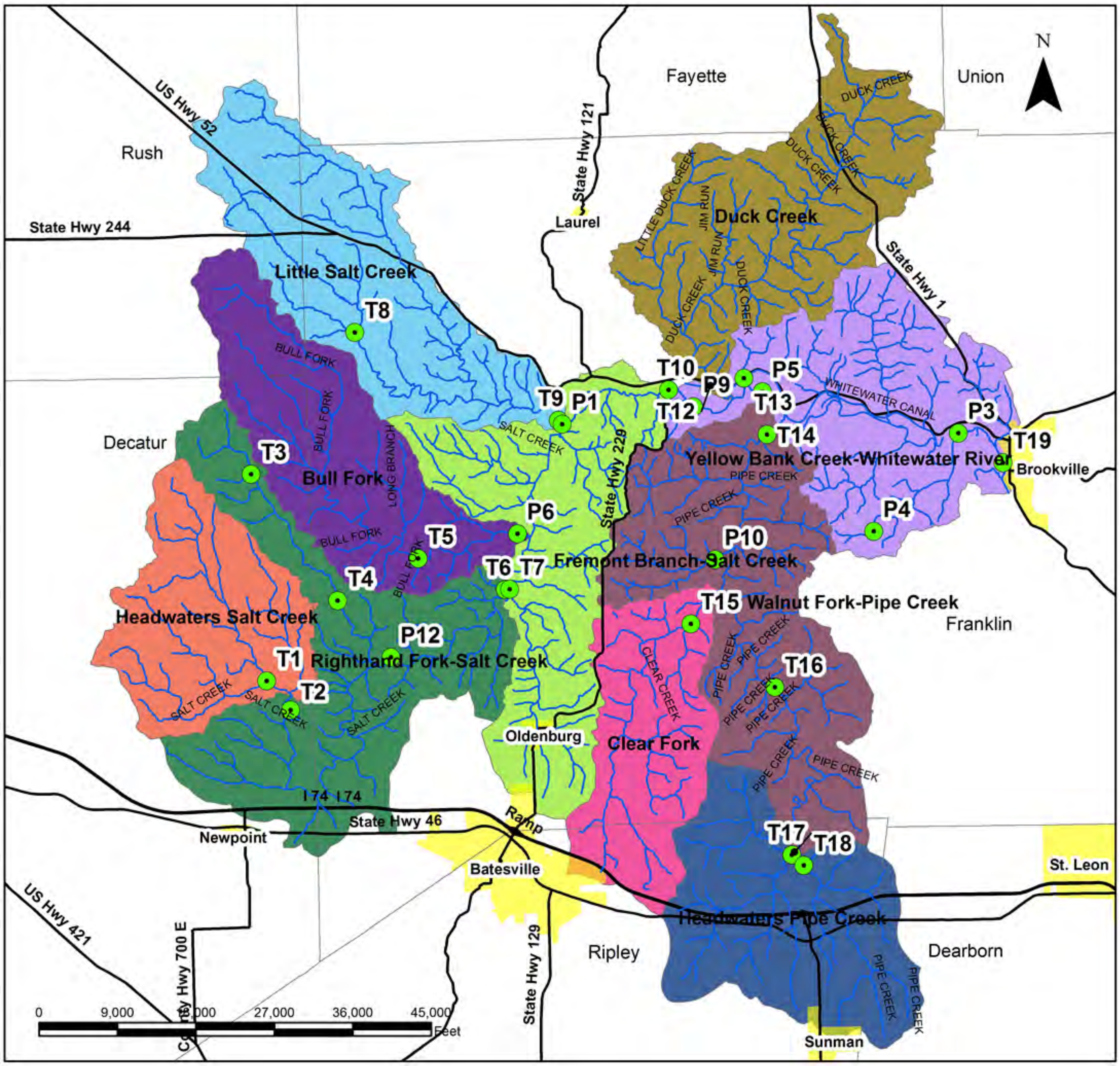
Figure 30: Water Monitoring Sites of the Salt-Pipe Creek Watershed

Site ID	Stream Name	Road Name	Latitude	Longitude
50800030501 - Headwaters of Salt Creek				
T1	Tributary of Salt Creek	CR 150 N	39.357061	-85.31587
50800030502 - Righthand Fork				
P12	Salt Creek	Giesting Rd	39.363736	-85.26524
T2	Salt Creek	CR 50 N	39.347695	-85.30637
T3	Righthand Fork Salt Creek	E CR 550 N	39.422252	-85.32061
T4	Righthand Fork Salt Creek	Hamburg Rd	39.38193	-85.28635
T6	Salt Creek	Rail Fence Rd	39.384362	-85.21837
50800030503 - Bull Fork				
P6	Bull Fork	Bullfork Rd	39.401673	-85.21285
T5	Bull Fork	Bullfork Rd	39.394734	-85.25344
50800030504 - Little Salt Creek				
P1	Little Salt Creek	Stipps Hill Rd	39.435772	-85.19399
T8	South Fork Little Salt Creek	Chapel Rd	39.466287	-85.2774
T9	Little Salt Creek	Stipps Hill Rd	39.437368	-85.19543
50800030505 - Fremont Branch				
T10	Salt Creek	SR 229	39.446263	-85.15047
T7	Harvey Branch	Rail Fence Rd	39.384462	-85.21654
50800030601 - Headwaters of Pipe Creek				
T17	Tributary of Pipe Creek	St Marys Rd	39.299046	-85.1043
T18	Pipe Creek	Pipe Creek Rd	39.295623	-85.09958
50800030602 - Clear Fork				
T15	Clear Fork	Schwegman Rd	39.372458	-85.14334
50800030603 - Duck Creek				
T12	Duck Creek	US 52	39.44842	-85.13298
50800030604 - Walnut Fork				
P10	Walnut Fork	Walnut Fork Rd	39.391952	-85.13294
T14	Pipe Creek	Silver Creek Rd	39.431516	-85.11079
T16	Pipe Creek	St. Marys Rd	39.351869	-85.10973
50800030605 - Yellow Bank Creek				
P3	Whitewater River	St. Mary Rd	39.430419	-85.03297
P4	McCartys Run	St. Mary Rd	39.400263	-85.06806
P5	Whitewater River	Silver Creek Rd	39.44507	-85.11229

P9	Whitewater River	Pennington Rd	39.440748	-85.14043
T13	Whitewater Canal	Unnamed Rd	39.449403	-85.11966
T19	Whitewater River	Saint Mary Rd	39.421072	-85.01524

See the watershed map below with the monitoring sites identified.

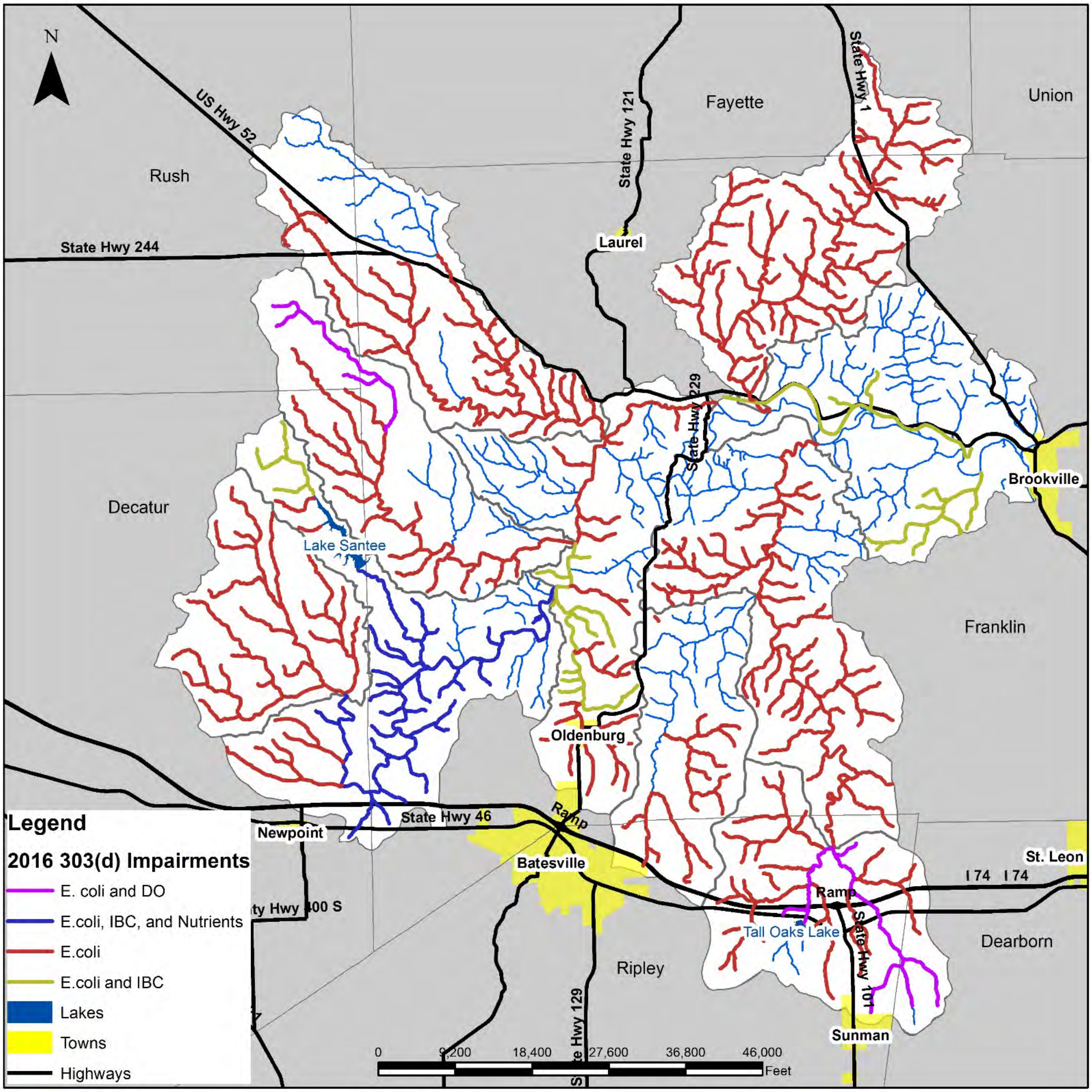
Figure 31: Water Monitoring Sites Location Map



303(d) Impairment Streams

The data collected was also used for the updated 2016 303(d) List of Impairments. There are 382.6 stream miles listed as impaired on the 2016 303(d) List for E. coli in the Salt-Pipe Creek watershed. Some of those stream miles are also impaired for dissolved oxygen (17.7 miles), biological communities (67.9 miles), and nutrients (35.3 miles). Below is the map of the impairments.

Figure 32: 2016 303(d) Impairment Watershed Streams Map



Parameters and Targets

There are many different targets for water quality parameters used depending on the importance to human health and designated use. Water that is used as a source of drinking water typically is the most stringent. Water that is used for recreation with full contact like swimming, kayaking, canoeing, and tubing would have different standards than water used for wildlife. The Salt-Pipe Creek Watershed has many uses, including a source of drinking water, full contact recreation, fishing, and it is also the home to some threatened and endangered species. The water from Salt-Pipe Creek Watershed flows into the Whitewater River Watershed (HUC 0508000308), which has its own watershed management plan that was approved by EPA in August of 2016. The two watersheds have very similar uses so the Salt-Pipe Creek Watershed adopted the same water quality targets as the Whitewater River Watershed. Below is a list of the adopted targets for the parameters of the Salt-Pipe Creek Watershed.

Figure 33: Water Monitoring Parameters and Targets

Parameter	Target	Reference
pH	> 6.5 and < 9	Ohio Administrative Code 3745-1-34 to 3745-1-36
Temperature	Monthly standard	Indiana Administrative Code (327 IAC 2-1-6)
Dissolved oxygen	> 4 mg/L and < 12mg/L	Indiana Administrative Code (327 IAC 2-1-6) & Consolidated Assessment and Listing Methodology (CALM)
Nitrate-nitrite	< 1.0 mg/L	2001 OH EPA
Total Kjehldahl Nitrogen TKN	< 0.591 mg/L	U.S. EPA recommendation
Total phosphorus	< 0.06 mg/L	Ohio EPA "Technical Support Document for Nutrient Water Quality Standards for Ohio Rivers and Streams" (December 2011)
E. coli	< 235 cfu (or MPN) /100 mL Geo Mean <125 cfu/100mL	Indiana Administrative Code (327 IAC 2-1.5-8)
Total suspended solids	< 25 mg/L	Sediment in streams: sources, biological effects and control. American Fisheries Society, Bethesda, MD (Waters T.F., 1995)
Turbidity	10.4 NTU	U.S. EPA recommendation
Qualitative Habitat Evaluation Index	>51 points	Ohio EPA "Methods for Assessing Habitat in Flowing Waters Using the Qualitative Habitat Evaluation Index (QHEI)" (June 2006) IDEM (2000)
Fish Index of Biotic Integrity (IBI)	>35	IDEM (2012)
Macroinvertebrate Index of Biotic Integrity (mIBI)	>35	IDEM (2012)

Impaired Biotic Communities (IBC)

Biological communities, the fish and aquatic invertebrates in stream, are indicators of the cumulative effects of activities that affect water quality conditions over time. An IBC listing on Indiana's 303(d) list and testing site summary means IDEM's monitoring data shows one or both of the aquatic communities are not as healthy as they should be.

Windshield Survey

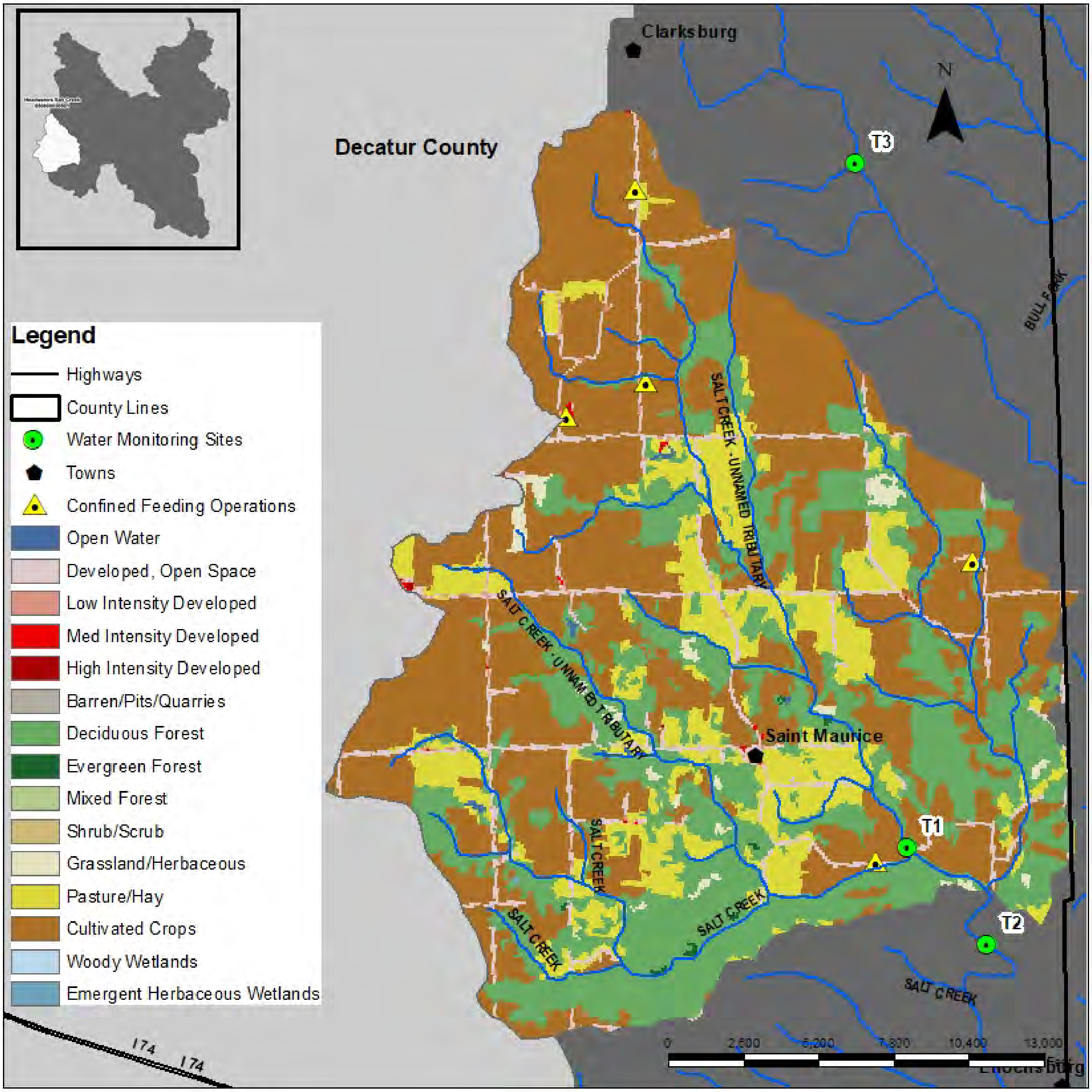
A windshield survey was completed during the spring of 2018 by watershed partners, staff, and steering committee members. The windshield survey is a tool to gather existing practices and conditions of the watershed area and to quantify the concerns. Spring was a good time to conduct the survey because tree leaves weren't present, so the line of sight from the roads was good. The results (described in the subwatershed summaries below) show what the baseline is for the watershed and potential concerns that could be focused on in the future.

Subwatershed Summaries

Headwaters of Salt Creek Subwatershed (HUC 050800030501)

The Headwaters of Salt Creek subwatershed is located on the western portion of the watershed. It is approximately 11,090 acres in size and has 34.3 miles of streams. According to the 2016 303(d) List of Impaired Waters, all of the streams in the subwatershed are impaired for E. coli. Approximately 4.3 miles of the streams have inadequate buffers. The subwatershed's main landuses are 47% (5,258 ac.) agriculture, 31% (3,387 ac.) forest, and 16% (1,807 ac.) hay/pasture. There is one small town located in the southeast corner called Saint Maurice. There are also four CFOs located throughout the subwatershed. Along the entire western edge of the subwatershed there are small pockets of areas with hydric soils. The western and northern edges of the subwatershed have some non highly erodible land and the majority of the remaining area is highly erodible land. Based on the septic suitablility of the soil, the entire subwatershed is classified as very limited. T1 is the only water monitoring site located within this subwatershed but T2 is discussed here because it is considered a pour point of this subwatershed.

Figure 34: Headwaters of Salt Creek Subwatershed (HUC 050800030501) Map



The water monitoring site T1 is located on a tributary of Salt Creek where it intersects County Road 150N in Decatur County. The following are the results from the testing which was conducted between April and October 2014.

Figure 35: Site T1 Testing Results

Water Monitoring Site – T1							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.38 SU	8.75 SU	7.94 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	4.78 mg/L	14.36 mg/L	8.73 mg/L	1	9%
Nitrite & Nitrate	< 1.0 mg/L	6	0.05 mg/L	9.6 mg/L	4.025 mg/L	3	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.15 mg/L	0.8 mg/L	0.43 mg/L	1	17%
Total Phosphorus	< 0.06 mg/L	6	0.024 mg/L	0.122 mg/L	0.048 mg/L	1	17%
E. coli	< 235 cfu/100mL	10	49.6 cfu/100mL	24,196 cfu/100mL	5,275.7 cfu/100mL	6	60%
Total Suspended Solids (TSS)	< 25 mg/L	7	4 mg/L	35 mg/L	17.3 mg/L	2	29%
Turbidity	< 10.4 NTU	11	2.54 NTU	76.9 NTU	18.13 NTU	3	27%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	2,555.7 cfu/100mL	No
Fish IBI	>35	44	Yes
QHEI (Fish IBI)	>51	67	Yes
Macroinvertebrate IBI (mIBI)	>35	38	Yes
QHEI (Macro mIBI)	>51	55	Yes
IBC	NA	NA	Pass

The water monitoring site T2 is located on Salt Creek where it intersects County Road 50N in Decatur County. The following are the results from the testing which was conducted between April and October 2014.

Figure 36: Site T2 Testing Results

Water Monitoring Site – T2							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.71 SU	8.52 SU	8.05 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	5.18 mg/L	15.37 mg/L	9.75 mg/L	2	18%
Nitrite & Nitrate	< 1.0 mg/L	6	0.05 mg/L	6.4 mg/L	2.642 mg/L	3	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.4 mg/L	0.8 mg/L	0.48 mg/L	1	17%
Total Phosphorus	< 0.06 mg/L	6	0.024 mg/L	0.128 mg/L	0.050 mg/L	1	17%
E. coli	< 235 cfu/100mL	10	82 cfu/100mL	24,196 cfu/100mL	5,747.4 cfu/100mL	9	90%
Total Suspended Solids (TSS)	< 25 mg/L	7	4 mg/L	86 mg/L	32.3 mg/L	2	29%
Turbidity	< 10.4 NTU	11	4.77 NTU	156 NTU	29.64 NTU	5	45%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	4,038.9 cfu/100mL	No
Fish IBI	>35	34	No
QHEI (Fish IBI)	>51	56	Yes
Macro mIBI	>35	36	Yes
QHEI (Macro mIBI)	>51	56	Yes
IBC	NA	NA	Fail

Figure 37: Headwaters of Salt Creek Water Monitoring Result Summary

Headwaters of Salt Creek Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	22	7.38 SU	8.75 SU	7.99 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	22	4.78 mg/L	15.37 mg/L	9.24 mg/L	3	14%
Nitrite & Nitrate	< 1.0 mg/L	12	0.05 mg/L	9.6 mg/L	3.333 mg/L	6	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	12	0.15 mg/L	0.8 mg/L	0.45 mg/L	2	17%
Total Phosphorus	< 0.06 mg/L	12	0.024 mg/L	0.128 mg/L	0.049 mg/L	2	17%
E. coli	< 235 cfu/100mL	20	49.6 cfu/100mL	24,196 cfu/100mL	5,511.6 cfu/100mL	15	75%
Total Suspended Solids (TSS)	< 25 mg/L	14	4 mg/L	86 mg/L	24.8 mg/L	4	29%
Turbidity	< 10.4 NTU	22	2.54 NTU	156 NTU	23.9 NTU	8	36%
E. coli Geomean	< 125 cfu/100mL	2	2,555.7 cfu/100mL	4,038.7 cfu/100mL	3,297.2 cfu/100mL	2	100%
Fish IBI	>35	2	34	44	39	1	50%
QHEI (Fish IBI)	>51	2	56	67	62	0	0%
Macro mIBI	>35	2	36	38	37	0	0%
QHEI (Macro mIBI)	>51	2	55	56	56	0	0%
IBC	NA	2	NA	NA	NA	1	50%

As shown above, the Headwaters of Salt Creek subwatershed monitoring sites did not meet the target over 75% of the time for E. coli and 50% of the time for nitrite & nitrate and also for IBC. According to the TMDL report, the highest E. coli concentrations can be attributed to runoff from rainfall events, but high levels of E. coli remained constant from May through August. The precipitation graph for site T1 shows the stream is susceptible to high loads of E. coli from run-off. During a sampling event in April, cows were observed having access downstream of the T2 site bridge and a manure odor was observed. Excessive algae growing on rocks in stream was also observed during a site visit, which can be caused by excessive nutrient loading. The Site T2 data also shows dissolved oxygen swings from month to month. In the months of April, May, and June samples were reading 11-15 mg/L and then fell to 5-6 mg/L the following two sample times in mid July. During the July 21st sampling events the fish crew recorded a DO of 5 mg/L and within an hour the water chemistry crew recorded a DO of 15 mg/L.

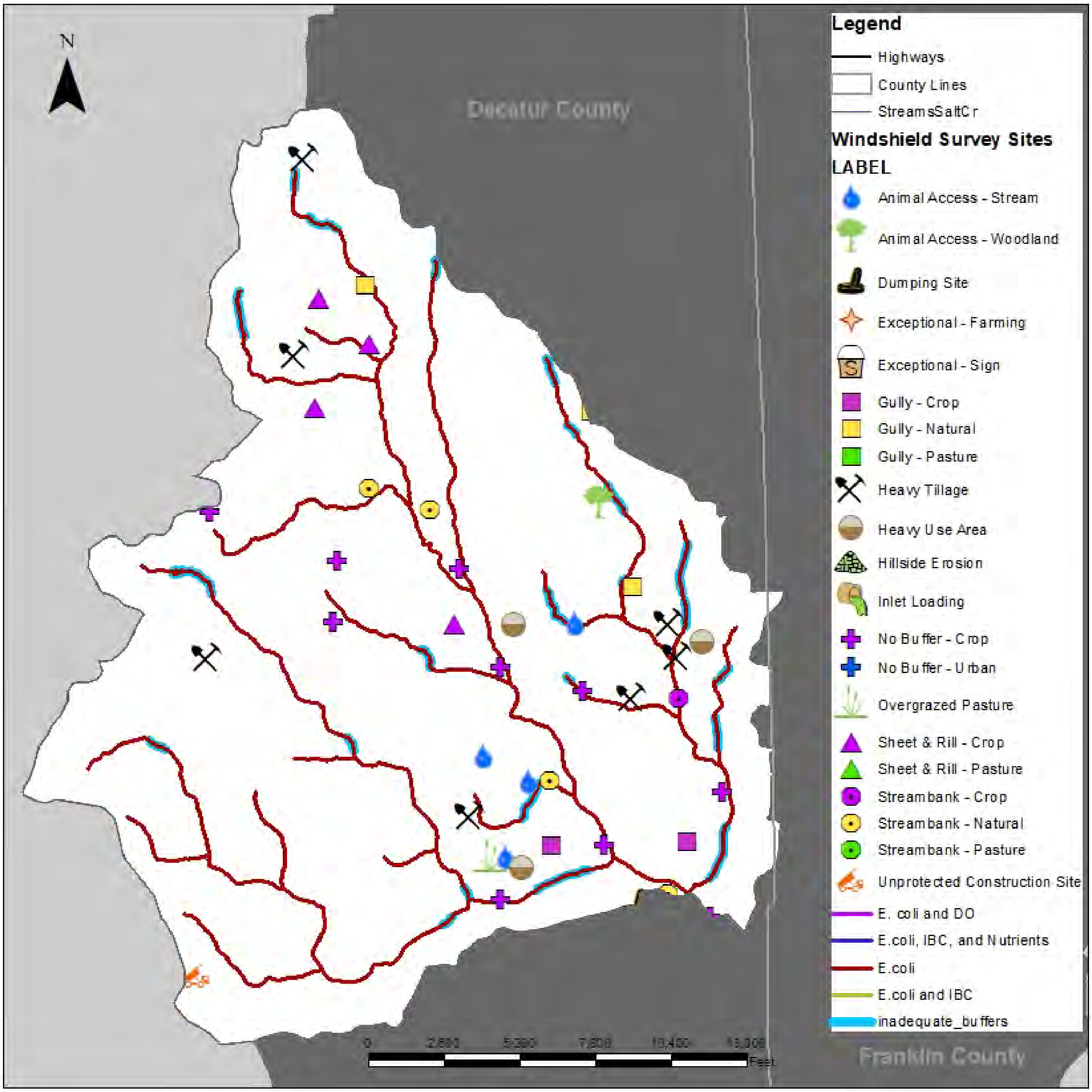
Below are the results of the windshield survey for the Headwaters of Salt Creek subwatershed. The most prevalent findings were both cropland related. The most common finding, with 10 occurrences identified during the windshield survey, was a lack of buffers along streams on cropland. Following that was the presence of heavy tillage, with 7 occurrences observed.

Figure 38: Headwaters of Salt Creek Windshield Survey Results

Headwaters of Salt Creek Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	4
Animal Access - Woodland	1
Dumping Site	1
Gully – Crop	2
Gully - Natural	2
Heavy Tillage	7
Heavy Use Area	3
No Buffer - Crop	10
Overgrazed Pasture	1
Sheet & Rill - Crop	4
Streambank - Crop	1
Streambank - Natural	4
Unprotected Construction Site	1
Total	**41**

The Headwaters of Salt Creek Summary Map below displays the results from the windshield survey and also identifies the watershed impairments from the 2016 303(d) List, as well as areas with inadequate stream buffers.

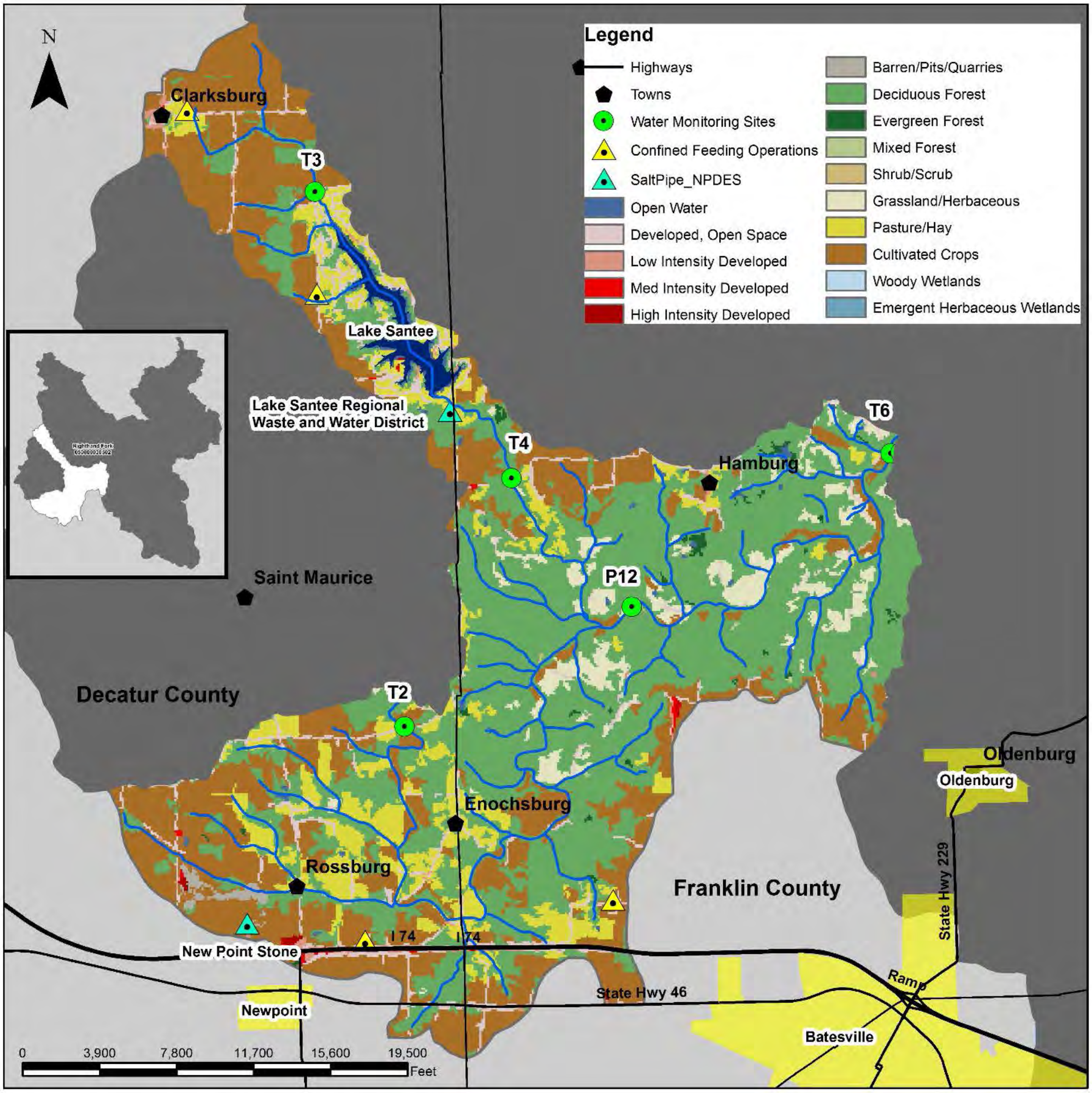
Figure 39: Headwaters of Salt Creek Summary Map



Righthand Fork Subwatershed (HUC 050800030502)

The Righthand Fork subwatershed borders the Headwaters of Salt Creek subwatershed to the east and is the southeastern section of the Salt-Pipe Creek Watershed. It is approximately 18,210 acres in size and has 62.1 miles of streams. According to the 2016 303(d) List of Impaired Waters, the Righthand Fork subwatershed has 35.3 miles of streams impaired for E.coli, biological communities, and nutrients, 9.8 miles of streams impaired by only E. coli, and 4.1 miles of streams impaired for both E. coli and biological communities. Approximately 5.3 miles of the streams have inadequate buffers. The subwatershed's main landuses are 48% (8,674 ac.) forest, 28% (5,118 ac.) agriculture, and 15% (2,781 ac.) hay/pasture. The large lake community of Lake Santee and four small towns of Clarksburg, Hamburg, Enochsburg, and Rossburg are located in this subwatershed . There are four CFOs located throughout the subwatershed and two facilities with NPDES permits, Lake Santee Regional Waste and Water District and New Point Stone. There are also three LUST facilities, Batesville Aviation Services, Hamburg Trucking, and Ross Point Truck Plaza. The Lake Santee Community uses the water in the lake for drinking water. The southern edge of the subwatershed and the northern section, near Lake Santee, have some areas with hydric soils and NHEL ground, but the majority of the subwatershed is HEL. Almost the entire subwatershed is classified as *very limited*, based on the septic suitablility of the soil. There are five water monitoring sites in this subwatershed: P12, T2, T3, T4, and T6, but since T2 is a pour point for the Headwaters of Salt Creek subwatershed, it is not discussed for this subwatershed.

Figure 40: Righthand Fork Subwatershed (HUC 050800030502) Map



The water monitoring site P12 is located on Salt Creek where it intersects Geisting Road in Franklin County. This site is along Salt Creek located downstream of the confluence with Righthand Fork Salt Creek, which was sampled as part of the IDEM probabilistic program. The following are the results from the testing which was conducted between May and September 2014.

Figure 41: Site P12 Testing Results

Water Monitoring Site – P12

Parameter	Target	# of samples	Min	Max	Average	# not meeting target	% not meeting target
pH	>6.5 and <9 SU	8	7.92 SU	8.58 SU	8.08 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	8	7.81 mg/L	14.92 mg/L	9.21 mg/L	1	13%
Nitrite & Nitrate	< 1.0 mg/L	3	0.14 mg/L	2.6 mg/L	1.347 mg/L	2	67%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	0.57 mg/L	0.43 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	3	0.074 mg/L	0.094 mg/L	0.083 mg/L	3	100%
E. coli	< 235 cfu/100mL	5	328.2 cfu/100mL	4611 cfu/100mL	1690.8 cfu/100mL	5	100%
Total Suspended Solids (TSS)	< 25 mg/L	3	2 mg/L	7 mg/L	4.3 mg/L	0	0%
Turbidity	< 10.4 NTU	8	5.41 NTU	65.6 NTU	20.64 NTU	4	50%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	1,018.8 cfu/100mL	No
Fish IBI	>35	NA	NA
QHEI (Fish IBI)	>51	NA	NA
Macro mIBI	>35	NA	NA
QHEI (Macro mIBI)	>51	NA	NA
IBC	NA	NA	NA

The water monitoring site T3 is located on Righthand Fork where it intersects County Road 550N in Decatur County. T3 is located upstream of Lake Santee. It is a small headwater tributary and the field notes indicate there is little flow or isolated pools during dry summer months. The following are the results from the testing which was conducted between April and October 2014.

Figure 42: Site T3 Testing Results

Water Monitoring Site – T3							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.44 SU	8.5 SU	7.77 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	5.18 mg/L	16.37 mg/L	7.96 mg/L	1	9%
Nitrite & Nitrate	< 1.0 mg/L	6	0.1 mg/L	7.3 mg/L	3.267 mg/L	3	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.15 mg/L	0.5 mg/L	0.39 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	6	0.028 mg/L	0.185 mg/L	0.087 mg/L	5	83%
E. coli	< 235 cfu/100mL	10	88.4 cfu/100mL	2,419.6 cfu/100mL	984.0 cfu/100mL	8	80%
Total Suspended Solids (TSS)	< 25 mg/L	7	4 mg/L	14 mg/L	10.2 mg/L	0	0%
Turbidity	< 10.4 NTU	11	3.98 NTU	18.7 NTU	12.08 NTU	7	64%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	1,035 cfu/100mL	No
Fish IBI	>35	12	No
QHEI (Fish IBI)	>51	59	Yes
Macro mIBI	>35	36	Yes
QHEI (Macro mIBI)	>51	54	Yes
IBC	NA	NA	Fail

The water monitoring site T4 is located on Righthand Fork where it intersects Hamburg Road in Franklin County. It is located downstream of Lake Santee and the Lake Santee WWTP outfall. The following are the results from the testing which was conducted between April and October 2014.

Figure 43: Site T4 Testing Results

Water Monitoring Site – T4

Parameter	Target	# of samples	Min	Max	Average	# not meeting target	% not meeting target
pH	>6.5 and <9 SU	11	7.48 SU	9.18 SU	7.91 SU	1	9%
Dissolved Oxygen	>4 and <12 mg/L	11	6.03 mg/L	14.23 mg/L	8.51 mg/L	1	9%
Nitrite & Nitrate	< 1.0 mg/L	6	0.3 mg/L	16 mg/L	6.117 mg/L	5	83%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.6 mg/L	1.1 mg/L	0.87 mg/L	6	100%
Total Phosphorus	< 0.06 mg/L	6	0.138 mg/L	3.945 mg/L	1.199 mg/L	6	100%
E. coli	< 235 cfu/100mL	10	11 cfu/100mL	2,419.6 cfu/100mL	1,013.6 cfu/100mL	7	70%
Total Suspended Solids (TSS)	< 25 mg/L	7	4 mg/L	25 mg/L	12.8 mg/L	0	0%
Turbidity	< 10.4 NTU	11	5.23 NTU	31.6 NTU	13.10 NTU	7	64%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	1,472.4 cfu/100mL	No
Fish IBI – Sampled twice	>35	28/28	No
QHEI (Fish IBI) – Sampled twice	>51	60/65	Yes
Macro mIBI	>35	36	Yes
QHEI (Macro mIBI)	>51	60	Yes
IBC	NA	NA	Fail

The water monitoring site T6 is located on Salt Creek where it intersects Rail Fence Road in Franklin County. T6 is considered the pour point of the subwatershed. The following are the results from the testing sampled between November 2013 and October 2014.

Figure 44: Site T6 Testing Results

Water Monitoring Site – T6

Parameter	Target	# of samples	Min	Max	Average	# not meeting target	% not meeting target
pH	>6.5 and <9 SU	16	7.45 SU	8.35 SU	7.85 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	16	6.49 mg/L	13.57 mg/L	9.62 mg/L	5	31%
Nitrite & Nitrate	< 1.0 mg/L	11	0.1 mg/L	4 mg/L	1.773 mg/L	7	64%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	11	0.15 mg/L	0.8 mg/L	0.42 mg/L	2	18%
Total Phosphorus	< 0.06 mg/L	11	0.019 mg/L	0.147 mg/L	0.056 mg/L	3	27%
E. coli	< 235 cfu/100mL	10	60.9 cfu/100mL	5,475 cfu/100mL	922.6 cfu/100mL	4	40%
Total Suspended Solids (TSS)	< 25 mg/L	12	5 mg/L	43 mg/L	15.3 mg/L	1	8%
Turbidity	< 10.4 NTU	16	2.08 NTU	44.4 NTU	13.32 NTU	8	50%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	758.6 cfu/100mL	No
Fish IBI	>35	52	Yes
QHEI (Fish IBI)	>51	67	Yes
Macro mIBI	>35	42	Yes
QHEI (Macro mIBI)	>51	67	Yes
IBC	NA	NA	Pass

Figure 45: Righthand Fork Subwatershed Water Monitoring Result Summary

Righthand Fork Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	46	7.44 SU	9.18 SU	7.88 SU	1	2%
Dissolved Oxygen	>4 and <12 mg/L	46	5.18 mg/L	16.37 mg/L	8.89 mg/L	8	17%
Nitrite & Nitrate	< 1.0 mg/L	26	0.1 mg/L	16 mg/L	3.071 mg/L	17	65%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	26	0.15 mg/L	1.1 mg/L	0.52 mg/L	8	31%
Total Phosphorus	< 0.06 mg/L	26	0.019 mg/L	3.945 mg/L	0.330 mg/L	17	65%
E. coli	< 235 cfu/100mL	35	11 cfu/100mL	5,475 cfu/100mL	1,075.9 cfu/100mL	24	69%
Total Suspended Solids (TSS)	< 25 mg/L	29	2 mg/L	43 mg/L	11.7 mg/L	1	3%
Turbidity	< 10.4 NTU	46	2.08 NTU	65.6 NTU	14.2 NTU	26	57%
E. coli Geomean	< 125 cfu/100mL	4	758.6 cfu/100mL	1,472.4 cfu/100mL	1,071.2 cfu/100mL	4	100%
Fish IBI	>35	4	12	52	30	3	75%
QHEI (Fish IBI)	>51	4	59	67	63	0	0%
Macro mIBI	>35	3	36	42	38	0	0%
QHEI (Macro mIBI)	>51	3	54	67	60	0	0%
IBC	NA	4	NA	NA	NA	2	50%

As shown above, the Righthand Fork subwatershed monitoring sites do not meet the target over 50% of the time for several parameters, including the E. coli geomean, Fish IBI, E. coli single sample maximum, Nitrite & Nitrate, Total Phosphorus, and Turbidity. The IBC determination also didn't pass 50% of the time. None of the sites had an E. coli geomean that met the target or even came close, with an average of 1,071.2 cfu/100mL. The TMDL report noted that the Lake Santee WWTP has a land application permit, and if the fields used are in close proximity to the stream, it could potentially be contributing to the high E. coli levels at Site T4. According to the TMDL report, there were high nutrient values upstream of the lake, which could lead to high nutrient levels in the lake itself. Discharge from lakes are often more nutrient rich than natural streams, which could be contributing to high nutrient levels. There is also a possibility that the Lake Santee WWTP is discharging high levels of TP and TN. The results indicate the exceedances of these nutrients occur during low flows, when the WWTP discharge makes up a higher percentage of the stream flow. These higher levels of nutrients are likely discharged year round but are diluted by the natural stream flow during normal to high flow regimes. Nutrients are not regulated in the NPDES permit unless the facility is considered a major discharger (>1.0 MGD), therefore the facility is not in violation of the parameters currently regulated. The treatment processes used in some WWTPs converts ammonia to nitrate and then to nitrite. This is the reason elevated levels of nitrate-nitrite are sometimes found downstream of dischargers.

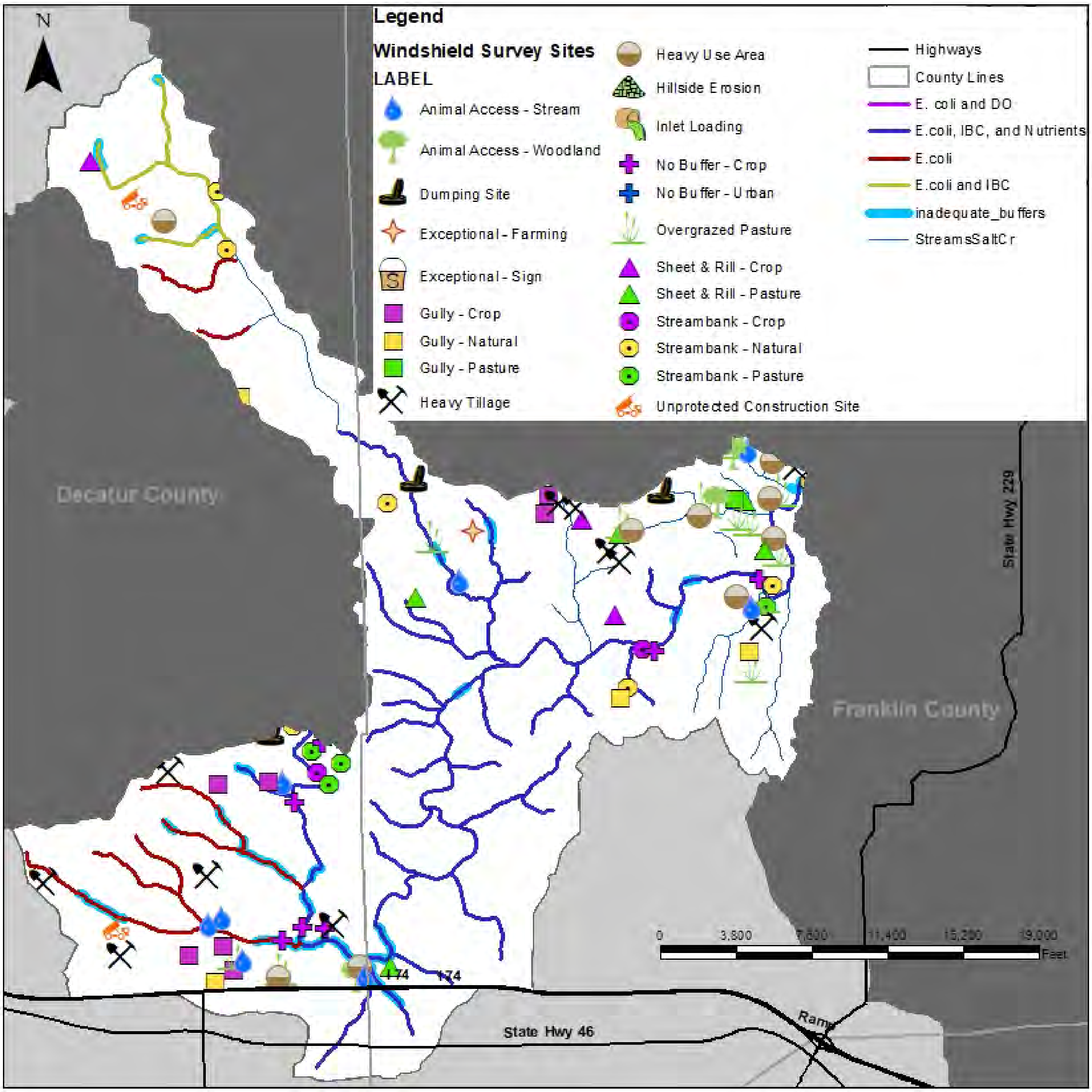
Below are the results of the windshield survey for the Righthand Fork subwatershed. Overgrazed pasture was observed the most during the windshield survey, with 12 occurrences, and following that was heavy tillage, with 11 occurrences.

Figure 46: Righthand Fork Windshield Survey Results

Righthand Fork Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	8
Animal Access - Woodland	3
Dumping Site	2
Exceptional Farming	1
Gully - Crop	7
Gully - Natural	4
Gully - Pasture	1
Heavy Tillage	11
Heavy Use Area	9
No Buffer - Crop	6
Overgrazed Pasture	12
Sheet & Rill - Crop	3
Sheet & Rill - Pasture	5
Streambank - Crop	1
Streambank - Natural	3
Streambank - Pasture	3
Unprotected Construction Site	2
Total	**81**

The Righthand Fork Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

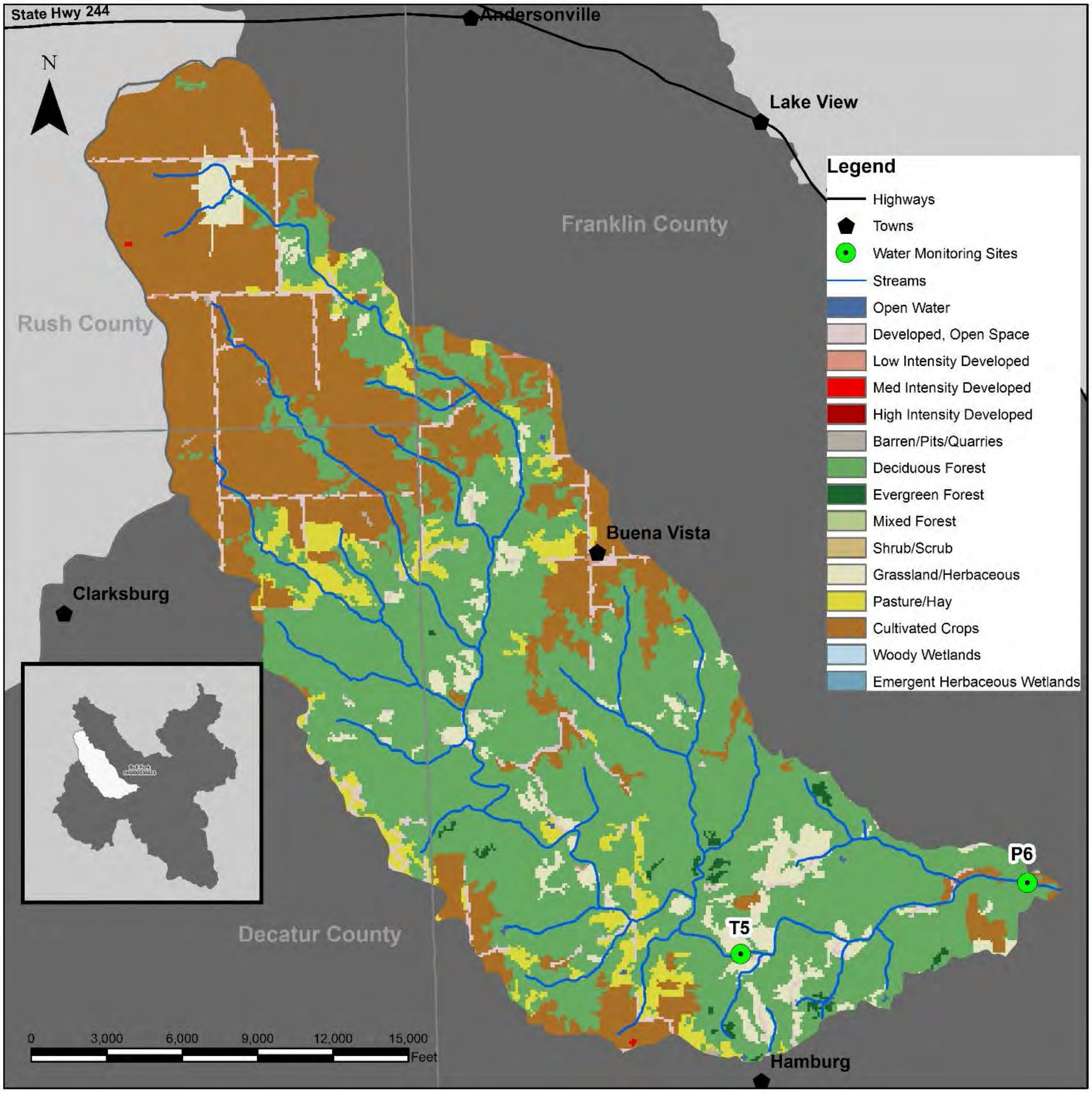
Figure 47: Righthand Fork Summary Map



Bull Fork Subwatershed (HUC 050800030503)

The Bull Fork subwatershed borders the Little Salt Creek subwatershed to the north and Righthand Fork subwatershed to the south. It is approximately 13,804 acres in size and has 41.7 miles of streams. According to the 2016 303(d) List of Impaired Waters, the Bull Fork subwatershed has 26.8 miles of streams impaired for E. coli and 6.6 miles of streams impaired for both E. coli and dissolved oxygen. Approximately 1.9 miles of the streams have inadequate buffers. The subwatershed's main landuses are 55% (7,553 ac.) forest, 28% (3,923 ac.) agriculture, and 12% (1,625 ac.) hay/pasture. The small town of Buena Vista is located in this subwatershed. There are no CFOs or facilities with NPDES permits located in this subwatershed. Along the northwestern edge of the subwatershed and near Buena Vista, there are small pockets of areas with hydric soils and NHEL ground, but the majority of the subwatershed is HEL. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There are two water monitoring sites in this subwatershed, T5 and P6.

Figure 48: Bull Fork Subwatershed (HUC 050800030503) Map



The water monitoring site T5 is located on Bull Fork where it intersects Bullfork Road in Franklin County. It is the upstream site along Bull Fork and located just downstream from the confluence with Long Branch. The following are the results from the testing sampled from April to October 2014.

Figure 49: Site T5 Testing Results

Water Monitoring Site – T5							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.77 SU	8.62 SU	7.99 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	5 mg/L	12.11 mg/L	8.79 mg/L	1	9%
Nitrite & Nitrate	< 1.0 mg/L	6	0.05 mg/L	5.5 mg/L	2.408 mg/L	3	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.15 mg/L	0.3 mg/L	0.25 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	6	0.014 mg/L	0.03 mg/L	0.019 mg/L	0	0%
E. coli	< 235 cfu/100mL	10	10.9 cfu/100mL	2,419.6 cfu/100mL	402.2 cfu/100mL	3	30%
Total Suspended Solids (TSS)	< 25 mg/L	7	10 mg/L	21 mg/L	15.5 mg/L	0	0%
Turbidity	< 10.4 NTU	10	2.59 NTU	44.1 NTU	10.77 NTU	4	40%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	400.1 cfu/100mL	No
Fish IBI	>35	52	Yes
QHEI (Fish IBI)	>51	65	Yes
Macro mIBI	>35	44	Yes
QHEI (Macro mIBI)	>51	67	Yes
IBC	NA	NA	Pass

The water monitoring site P6 is located on Bull Fork where it intersects Bullfork Road in Franklin County. It is the downstream site and is located at the pour point of the subwatershed. The following are the results from the testing sampled from May to September 2014.

Figure 50: Site P6 Testing Results

Water Monitoring Site – P6

Parameter	Target	# of samples	Min	Max	Average	# not meeting target	% not meeting target
pH	>6.5 and <9 SU	10	7.46 SU	8.26 SU	7.83 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	6.67 mg/L	10.84 mg/L	8.45 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	3	0.2 mg/L	5.1 mg/L	2.600 mg/L	2	67%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	0.6 mg/L	0.42 mg/L	1	33%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.025 mg/L	0.025 mg/L	0	0%
E. coli	< 235 cfu/100mL	5	26.2 cfu/100mL	344.8 cfu/100mL	186.0 cfu/100mL	2	40%
Total Suspended Solids (TSS)	< 25 mg/L	3	0.5 mg/L	3 mg/L	1.8 mg/L	0	0%
Turbidity	< 10.4 NTU	10	1.32 NTU	11.2 NTU	4.30 NTU	2	20%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	129.3 cfu/100mL	No
Fish IBI	>35	42	Yes
QHEI (Fish IBI)	>51	64	Yes
Macro mIBI	>35	40	Yes
QHEI (Macro mIBI)	>51	57	Yes
IBC	NA	NA	Pass

Figure 51: Bull Fork Subwatershed Water Monitoring Result Summary

Bull Fork Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	21	7.46 SU	8.62 SU	7.92 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	21	5 mg/L	12.11 mg/L	8.63 mg/L	1	5%
Nitrite & Nitrate	< 1.0 mg/L	9	0.05 mg/L	5.5 mg/L	2.472 mg/L	5	56%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	9	0.15 mg/L	0.6 mg/L	0.31 mg/L	1	11%
Total Phosphorus	< 0.06 mg/L	9	0.014 mg/L	0.03 mg/L	0.021 mg/L	0	0%
E. coli	< 235 cfu/100mL	15	10.9 cfu/100mL	2,419.6 cfu/100mL	330.1 cfu/100mL	5	33%
Total Suspended Solids (TSS)	< 25 mg/L	10	0.5 mg/L	21 mg/L	7.3 mg/L	0	0%
Turbidity	< 10.4 NTU	20	1.32 NTU	44.1 NTU	7.53 NTU	6	30%
E. coli Geomean	< 125 cfu/100mL	2	129.33 cfu/100mL	400.1 cfu/100mL	264.7 cfu/100mL	2	100%
Fish IBI	>35	5	42	52	47	0	0%
QHEI (Fish IBI)	>51	5	64	65	65	0	0%
Macro mIBI	>35	4	40	44	42	0	0%
QHEI (Macro mIBI)	>51	4	57	67	62	0	0%
IBC	NA	2	NA	NA	NA	0	0%

As shown above, the Bull Fork subwatershed monitoring sites do not meet the target over 50% of the time for the E. coli geomean or for nitrite & nitrate. None of the sites in this subwatershed had an E. coli geomean that met the target. In 2009 there were two LARE sites (5 and 6) located on this stream. The results of that study showed low DO during base flow and high TP, high nitrogen and high TSS during storm flow. The study determined this subwatershed has high nutrient loadings and defined nutrients as the primary pollutant in this stream.

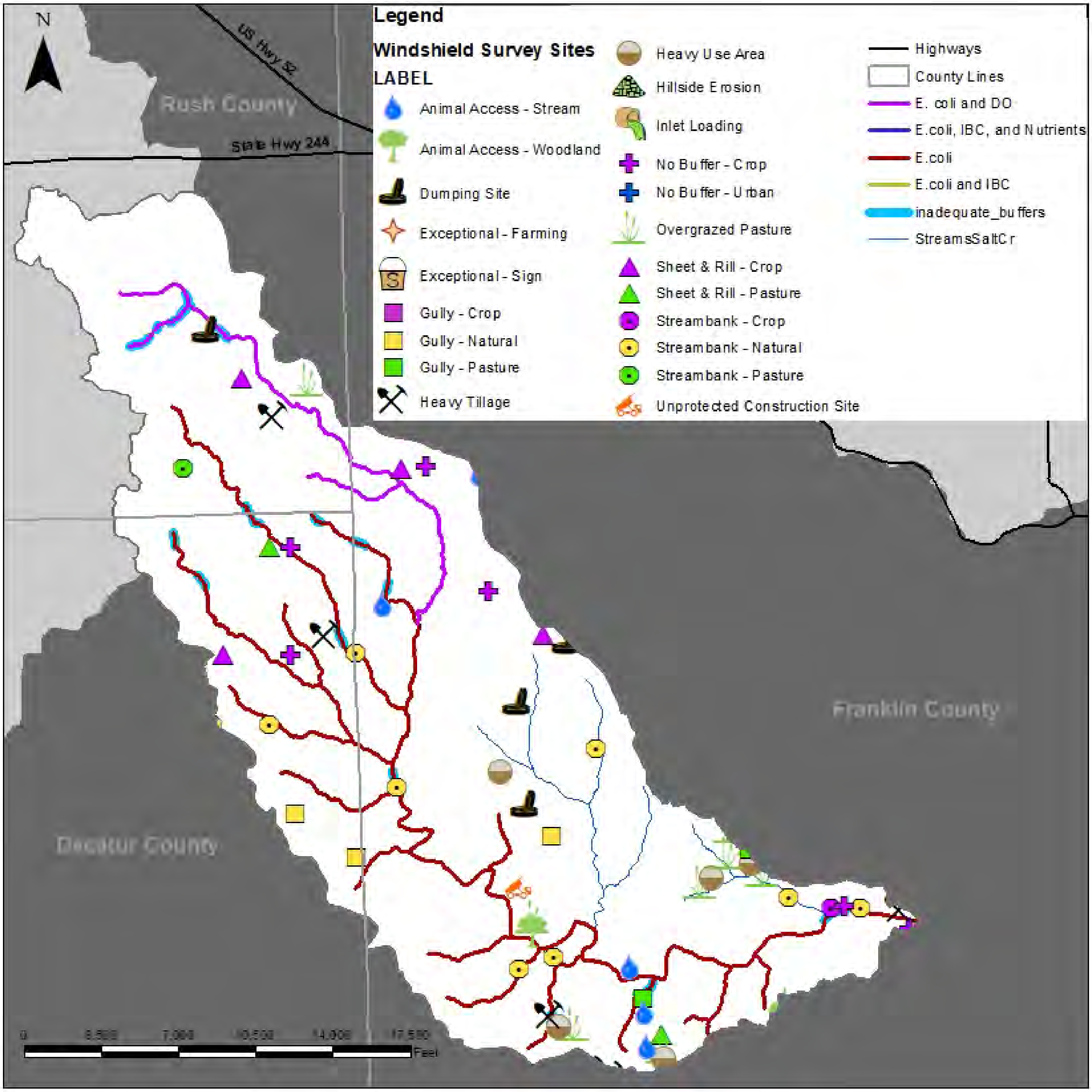
Below are the results of the windshield survey for the Bull Fork subwatershed. Natural streambank erosion was the top finding of the windshield survey, with eight occurrences, and overgrazed pastures were second with seven occurrences.

Figure 52: Bull Fork Windshield Survey Results

Bull Fork Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	4
Animal Access - Woodland	1
Dumping Site	4
Gully - Natural	3
Gully - Pasture	1
Heavy Tillage	4
Heavy Use Area	5
No Buffer - Crop	6
Overgrazed Pasture	7
Sheet & Rill - Crop	4
Sheet & Rill - Pasture	2
Streambank - Crop	1
Streambank - Natural	8
Streambank - Pasture	1
Unprotected Construction Site	1
Total	**52**

The Bull Fork Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

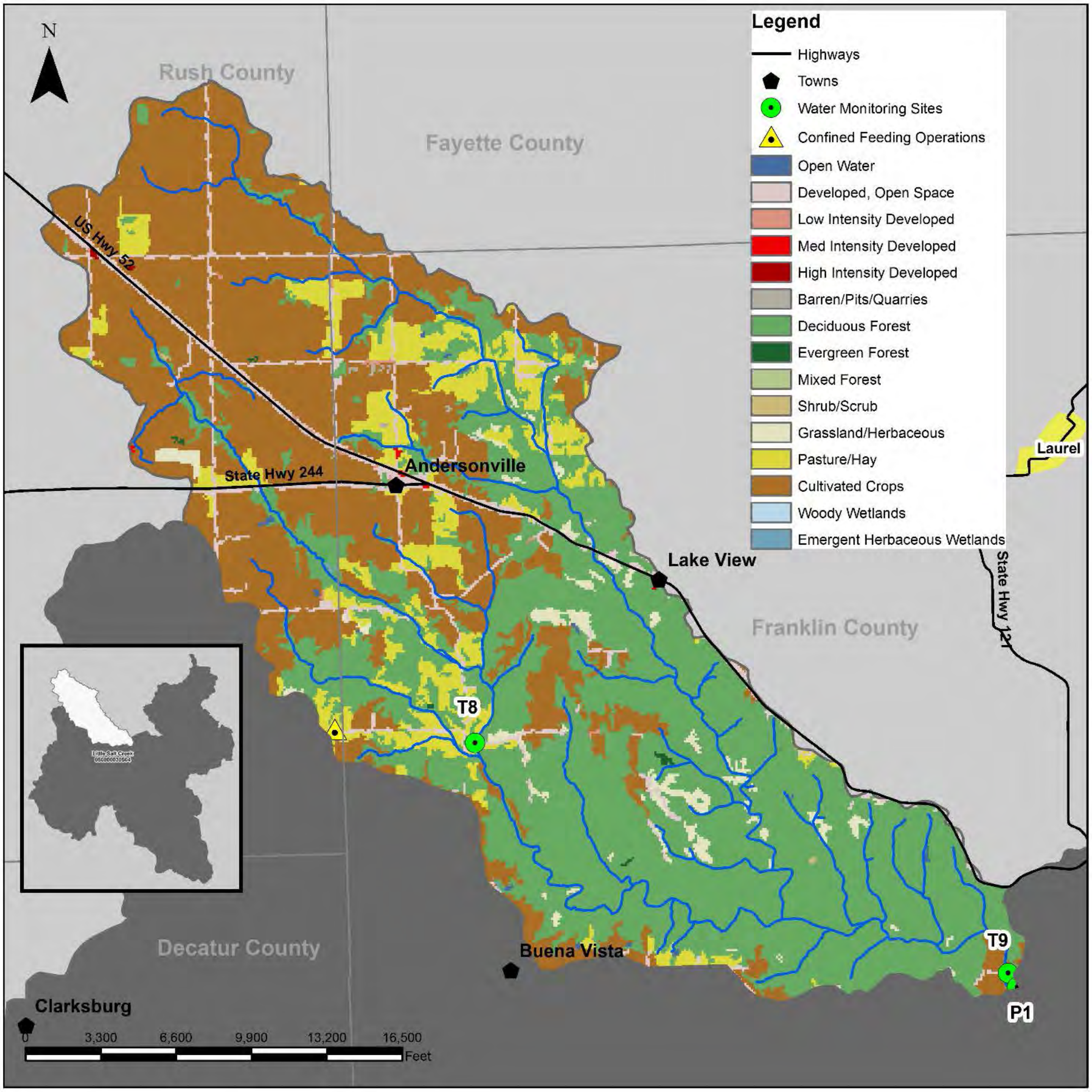
Figure 53: Bull Fork Summary Map



Little Salt Creek Subwatershed (HUC 050800030504)

The Little Salt Creek subwatershed is located in the northwest corner of the Salt-Pipe Creek Watershed. It is approximately 16,084 acres in size and has 56.2 miles of streams. According to the 2016 303(d) List of Impaired Waters, the Little Salt Creek subwatershed has 40.8 miles of streams impaired for E. coli. Approximately 3.2 miles of the streams have inadequate buffers. The subwatershed's main landuses are 48% (7,542 ac.) forest, 36% (5,694 ac.) agriculture, and 11% (1,777 ac.) hay/pasture. The small towns of Andersonville and Lake View are located in this subwatershed. There is one CFO and no facilities with NPDES permits located in this subwatershed. Along the north western edge of the subwatershed and south of US 52, between Andersonville and Lake View, there are small pockets of areas with hydric soils and NHEL ground, but the majority of the subwatershed is HEL. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There are three water monitoring sites in this subwatershed, P1, T8, and T9.

Figure 54: Little Salt Creek Subwatershed (HUC 050800030504) Map



The water monitoring site P1 is located on Little Salt Creek, where it intersects Stipps Hill Road in Franklin County. It is in close proximity to site T9 in the pour point area of the subwatershed. The following are the results from the testing sampled from May to October 2014.

Figure 55: Site P1 Testing Results

Water Monitoring Site – P1							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	10	7.43 SU	8.17 SU	7.73 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	6.24 mg/L	9.53 mg/L	8.07 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	3	0.13 mg/L	4.1 mg/L	1.977 mg/L	2	67%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	1.5 mg/L	0.74 mg/L	1	33%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.94 mg/L	0.330 mg/L	1	33%
E. coli	< 235 cfu/100mL	5	325.5 cfu/100mL	727 cfu/100mL	459.0 cfu/100mL	5	100%
Total Suspended Solids (TSS)	< 25 mg/L	3	6 mg/L	400 mg/L	138.7 mg/L	1	33%
Turbidity	< 10.4 NTU	10	1.64 NTU	682 NTU	74.87 NTU	3	30%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	441.5 cfu/100mL	No
Fish IBI	>35	42	Yes
QHEI (Fish IBI)	>51	79	Yes
Macro mIBI	>35	42	Yes
QHEI (Macro mIBI)	>51	58	Yes
IBC	NA	NA	Pass

The water monitoring site T9 is located on Little Salt Creek where it intersects Stipps Hill Road in Franklin County. It is in close proximity to site P1 in the pour point area of the subwatershed. The following are the results from the testing sampled from April to October 2014.

Figure 56: Site T9 Testing Results

Water Monitoring Site – T9							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.57 SU	8.5 SU	7.83 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	7.09 mg/L	12.54 mg/L	10.41 mg/L	2	18%
Nitrite & Nitrate	< 1.0 mg/L	7	0.05 mg/L	4.7 mg/L	1.407 mg/L	3	43%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	7	0.15 mg/L	0.6 mg/L	0.24 mg/L	1	14%
Total Phosphorus	< 0.06 mg/L	7	0.008 mg/L	0.104 mg/L	0.029 mg/L	1	14%
E. coli	< 235 cfu/100mL	10	9.6 cfu/100mL	4,352 cfu/100mL	483.3 cfu/100mL	1	10%
Total Suspended Solids (TSS)	< 25 mg/L	7	4 mg/L	51 mg/L	27.5 mg/L	1	14%
Turbidity	< 10.4 NTU	11	1.75 NTU	98.5 NTU	12.53 NTU	1	9%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	79.4 cfu/100mL	Yes
Fish IBI	>35	38	Yes
QHEI (Fish IBI)	>51	60	Yes
Macro mIBI	>35	42	Yes
QHEI (Macro mIBI)	>51	60	Yes
IBC	NA	NA	Pass

The water monitoring site T8 is located on South Fork-Little Salt Creek where it intersects Chapel Road in Franklin County. The following are the results from the testing sampled from April to October 2014.

Figure 57: Site T8 Testing Results

Water Monitoring Site – T8							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.54 SU	8.78 SU	8.01 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	5.39 mg/L	13.51 mg/L	8.88 mg/L	1	9%
Nitrite & Nitrate	< 1.0 mg/L	6	0.05 mg/L	8.3 mg/L	3.475 mg/L	3	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.15 mg/L	0.9 mg/L	0.32 mg/L	1	17%
Total Phosphorus	< 0.06 mg/L	6	0.017 mg/L	0.212 mg/L	0.062 mg/L	1	17%
E. coli	< 235 cfu/100mL	10	52.9 cfu/100mL	2,419.6 cfu/100mL	846.0 cfu/100mL	8	80%
Total Suspended Solids (TSS)	< 25 mg/L	7	5 mg/L	31 mg/L	17.7 mg/L	1	14%
Turbidity	< 10.4 NTU	11	2.58 NTU	49.1 NTU	12.75 NTU	3	27%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	656.2 cfu/100mL	No
Fish IBI	>35	44	Yes
QHEI (Fish IBI)	>51	72	Yes
Macro mIBI	>35	46	Yes
QHEI (Macro mIBI)	>51	72	Yes
IBC	NA	NA	Pass

Figure 58: Little Salt Creek Subwatershed Water Monitoring Result Summary

Little Salt Creek Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	32	7.43 SU	8.78 SU	7.86 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	32	5.39 mg/L	13.51 mg/L	9.15 mg/L	3	9%
Nitrite & Nitrate	< 1.0 mg/L	16	0.05 mg/L	8.3 mg/L	2.289 mg/L	8	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	16	0.15 mg/L	1.5 mg/L	0.36 mg/L	3	19%
Total Phosphorus	< 0.06 mg/L	16	0.008 mg/L	0.94 mg/L	0.098 mg/L	3	19%
E. coli	< 235 cfu/100mL	25	9.6 cfu/100mL	4,352 cfu/100mL	623.5 cfu/100mL	14	56%
Total Suspended Solids (TSS)	< 25 mg/L	17	4 mg/L	400 mg/L	65.5 mg/L	3	18%
Turbidity	< 10.4 NTU	32	1.64 NTU	682 NTU	32.09 NTU	7	22%
E. coli Geomean	< 125 cfu/100mL	3	79.4 cfu/100mL	656.2 cfu/100mL	392.4 cfu/100mL	2	67%
Fish IBI	>35	3	38	44	41	0	0%
QHEI (Fish IBI)	>51	3	60	79	70	0	0%
Macro mIBI	>35	3	42	46	43	0	0%
QHEI (Macro mIBI)	>51	3	58	72	63	0	0%
IBC	NA	3	NA	NA	NA	0	0%

As shown above, the Little Salt Creek subwatershed monitoring sites do not meet the target over 50% of the time for the E. coli geomean, E. coli single sample maximum, or nitrite & nitrate. According to the TMDL report, T9 and P1 are both located at the pour point of the subwatershed in close proximity of each other and had very drastically different geometric mean results. The geometric mean for T9 was 79.40 MPN and there was 1/10 samples in exceedance of the single sample max. For site P1, the geometric mean was 441.52 MPN with 5/5 samples in exceedance of the single sample max. The geometric means from site T9 and P1 were taken one day apart for five consecutive weeks. No weather events happened during the sampling period to explain the differing results. These results suggest consistent loadings and a specific cause has not been identified.

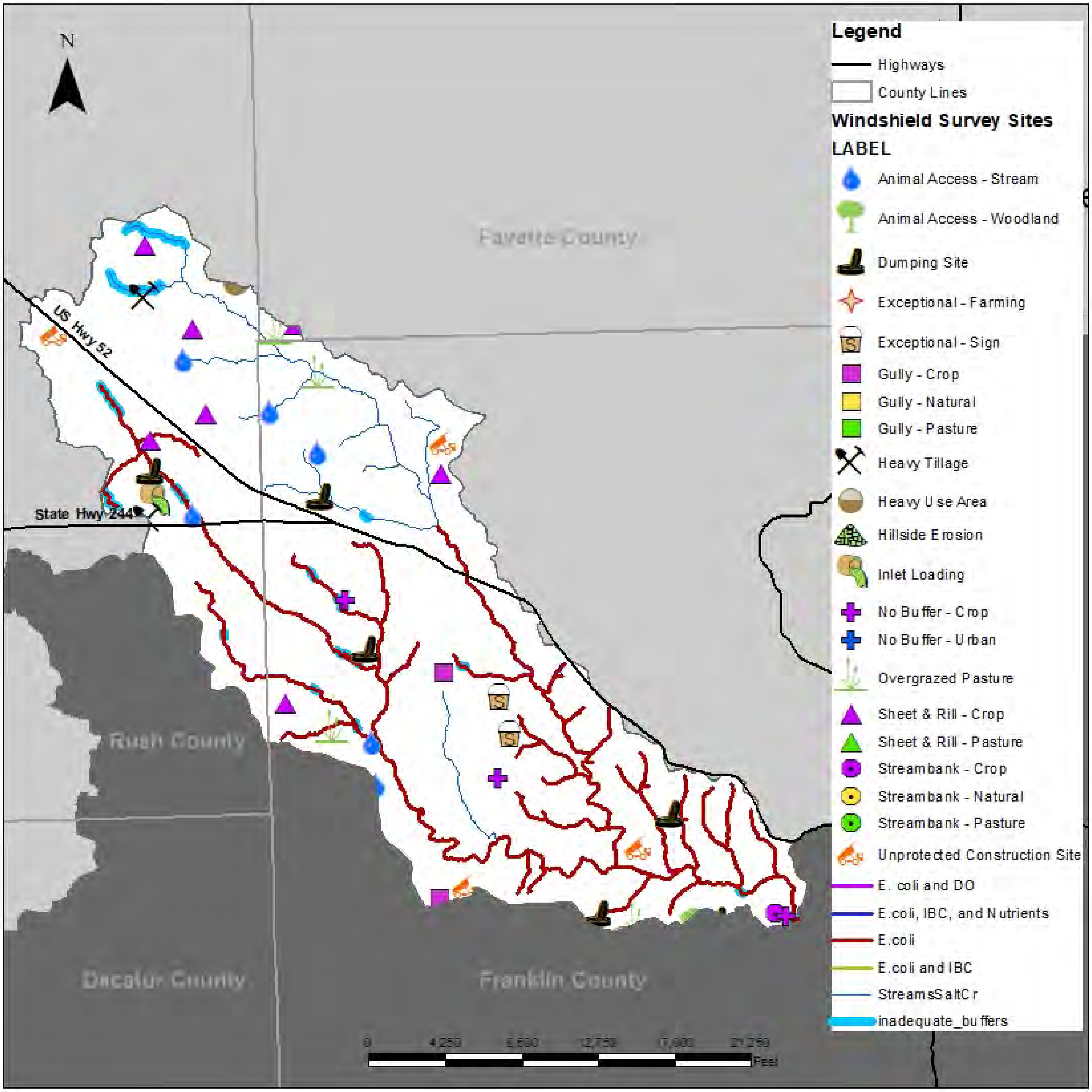
Here are the results of the windshield survey for the Little Salt Creek subwatershed. Sheet and rill erosion in cropland was the windshield survey finding with the most occurrences with seven. Animal access to streams came in second with six occurrences.

Figure 59: Little Salt Creek Windshield Survey Results

Little Salt Creek Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	6
Dumping Site	5
Exceptional Sign promoting Conservation	2
Gully - Crop	3
Heavy Tillage	2
Heavy Use Area	1
Inlet Loading	1
No Buffer - Crop	3
Overgrazed Pasture	4
Sheet & Rill - Crop	7
Streambank - Crop	1
Unprotected Construction Site	4
Total	**39**

The Little Salt Creek Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

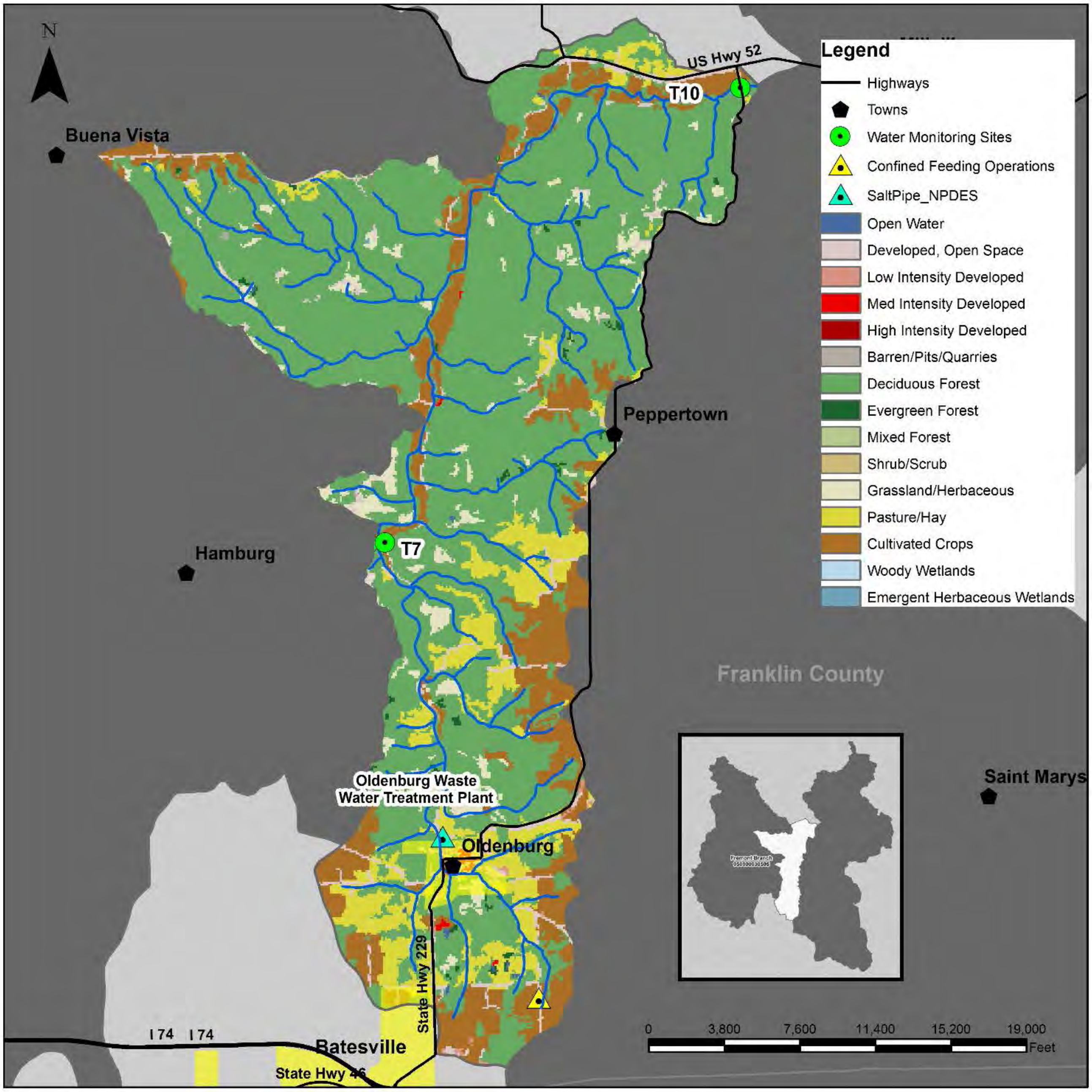
Figure 60: Little Salt Creek Summary Map



Fremont Branch Subwatershed (HUC 050800030505)

The Fremont Branch subwatershed is located in the center of the Salt-Pipe Creek Watershed. It is approximately 15,911 acres in size and has 64.9 miles of streams. According to the 2016 303(d) List of Impaired Waters, the Fremont Branch subwatershed has 24.4 miles of streams impaired for E. coli and 11.5 miles of streams impaired for E. coli and biological communities. Approximately 3.2 miles of the streams have inadequate buffers. The subwatershed's main landuses are 67% (10,730 ac.) forest, 14% (2,169 ac.) hay/pasture, and 14% (2,133 ac.) agriculture. The far northern section of the City of Batesville, the larger town of Oldenburg, and the small town of Peppertown are located in this subwatershed. There is one CFO and one facility with an NPDES permit, Oldenburg Waste Water Treatment Plant, located in this subwatershed. There are also two LUST facilities, Roman Nobbe and Obermeyer Marathon Service. Along the southern edge of the subwatershed there are a couple of small pockets of areas with hydric soils. This area plus along the main stem of Salt Creek and the Whitewater River have NHEL ground, but the majority of the subwatershed is HEL. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There are two water monitoring sites in this subwatershed, T7 and T10.

Figure 61: Fremont Branch Subwatershed (HUC 050800030505) Map



The water monitoring site T7 is located on Harvey Branch where it intersects Rail Fence Road in Franklin County. The following are the results from the testing sampled from April to October 2014.

Figure 62: Site T7 Testing Results

Water Monitoring Site – T7							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.61 SU	8.74 SU	7.94 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	4.67 mg/L	14.97 mg/L	8.68 mg/L	2	18%
Nitrite & Nitrate	< 1.0 mg/L	6	0.05 mg/L	1.7 mg/L	0.592 mg/L	1	17%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.4 mg/L	0.5 mg/L	0.43 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	6	0.021 mg/L	0.198 mg/L	0.094 mg/L	4	67%
E. coli	< 235 cfu/100mL	10	27.5 cfu/100mL	6,488 cfu/100 mL	820.6 cfu/100mL	3	30%
Total Suspended Solids (TSS)	< 25 mg/L	7	8 mg/L	114 mg/L	43.7 mg/L	1	14%
Turbidity	< 10.4 NTU	11	3.74 NTU	120 NTU	21.44 NTU	7	64%
Parameter			**Target**		**Result**		**Meets Target**
E.coli Geomean			< 125 cfu/100mL		489.4 cfu/100mL		No
Fish IBI			>35		44		Yes
QHEI (Fish IBI)			>51		61		Yes
Macro mIBI			>35		34		No
QHEI (Macro mIBI)			>51		61		Yes
IBC			NA		NA		Fail

The water monitoring site T10 is located on Salt Creek where it intersects State Road 229 in Franklin County. This site is the pour point for this subwatershed and is the mainstem Salt Creek where all other subwatersheds are contributing loads. The following are the results from the testing sampled from November 2013 to October 2014.

Figure 63: Site T10 Testing Results

Water Monitoring Site – T10

Parameter	Target	# of samples	Min	Max	Average	# not meeting target	% not meeting target
pH	>6.5 and <9 SU	16	7.59 SU	8.2 SU	7.85 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	16	6.55 mg/L	13.54 mg/L	9.94 mg/L	5	31%
Nitrite & Nitrate	< 1.0 mg/L	12	0.05 mg/L	4 mg/L	1.329 mg/L	6	50%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	12	0.15 mg/L	0.5 mg/L	0.33 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	12	0.012 mg/L	0.124 mg/L	0.037 mg/L	1	8%
E. coli	< 235 cfu/100mL	10	32.4 cfu/100mL	579.4 cfu/100mL	209.6 cfu/100mL	3	30%
Total Suspended Solids (TSS)	< 25 mg/L	12	5 mg/L	30 mg/L	16.3 mg/L	3	25%
Turbidity	< 10.4 NTU	16	4.25 NTU	35.6 NTU	14.32 NTU	11	69%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	177.7 cfu/100mL	No
Fish IBI	>35	44	Yes
QHEI (Fish IBI)	>51	55	Yes
Macro mIBI	>35	44	Yes
QHEI (Macro mIBI)	>51	55	Yes
IBC	NA	NA	Pass

Figure 64: Fremont Branch Subwatershed Water Monitoring Result Summary

Fremont Branch Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	27	7.59 SU	8.74 SU	7.89 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	27	4.67 mg/L	14.97 mg/L	9.42 mg/L	7	26%
Nitrite & Nitrate	< 1.0 mg/L	18	0.05 mg/L	4 mg/L	1.083 mg/L	7	39%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	18	0.15 mg/L	0.5 mg/L	0.36 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	18	0.012 mg/L	0.198 mg/L	0.056 mg/L	5	28%
E. coli	< 235 cfu/100mL	20	27.5 cfu/100mL	6,488 cfu/100mL	515.1 cfu/100mL	6	30%
Total Suspended Solids (TSS)	< 25 mg/L	19	5 mg/L	114 mg/L	23.2 mg/L	4	21%
Turbidity	< 10.4 NTU	27	3.74 NTU	120 NTU	17.22 NTU	18	67%
E. coli Geomean	< 125 cfu/100mL	2	177.7 cfu/100mL	489.4 cfu/100mL	333.6 cfu/100mL	2	100%
Fish IBI	>35	2	44	44	44	0	0%
QHEI (Fish IBI)	>51	2	55	61	58	0	0%
Macro mIBI	>35	2	34	44	39	1	50%
QHEI (Macro mIBI)	>51	2	55	61	58	0	0%
IBC	NA	2	NA	NA	NA	1	50%

As shown above, the Fremont Branch subwatershed monitoring sites do not meet the target over 50% of the time for the E. coli geomean, turbidity, Macro mIBI, or IBC. None of the monitoring sites met the target for the E. coli geomean, with an average of 333.6 cfu/100mL. In 2009, LARE site 15 was located at the same location as T10. The study showed there were high TP (0.41 mg/L) and high TSS (97 mg/L) during storm flows. The study identified the lower portion of this watershed as having high sediment loadings.

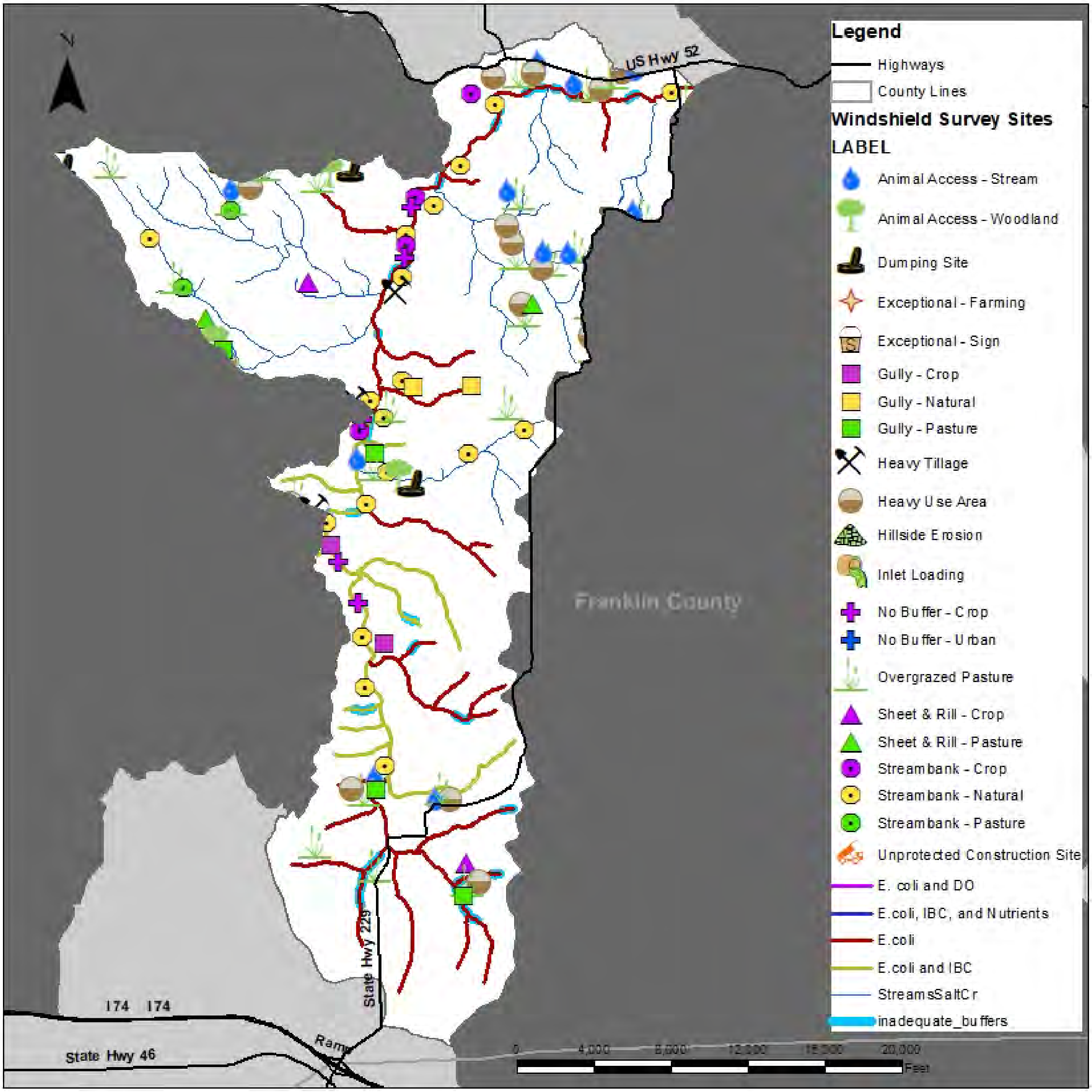
Here are the results of the windshield survey for the Fremont Branch subwatershed. The windshield survey finding of overgrazed pasture had the most occurrences, 23, and natural streambank erosion was second with 18 occurrences.

Figure 65: Fremont Branch Windshield Survey Results

Fremont Branch Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	11
Animal Access - Woodland	3
Dumping Site	2
Gully - Crop	2
Gully - Natural	2
Gully - Pasture	4
Heavy Tillage	2
Heavy Use Area	12
No Buffer - Crop	4
Overgrazed Pasture	23
Sheet & Rill - Crop	2
Sheet & Rill - Pasture	2
Streambank - Crop	4
Streambank – Natural	18
Streambank - Pasture	2
Total	**93**

The Fremont Branch Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

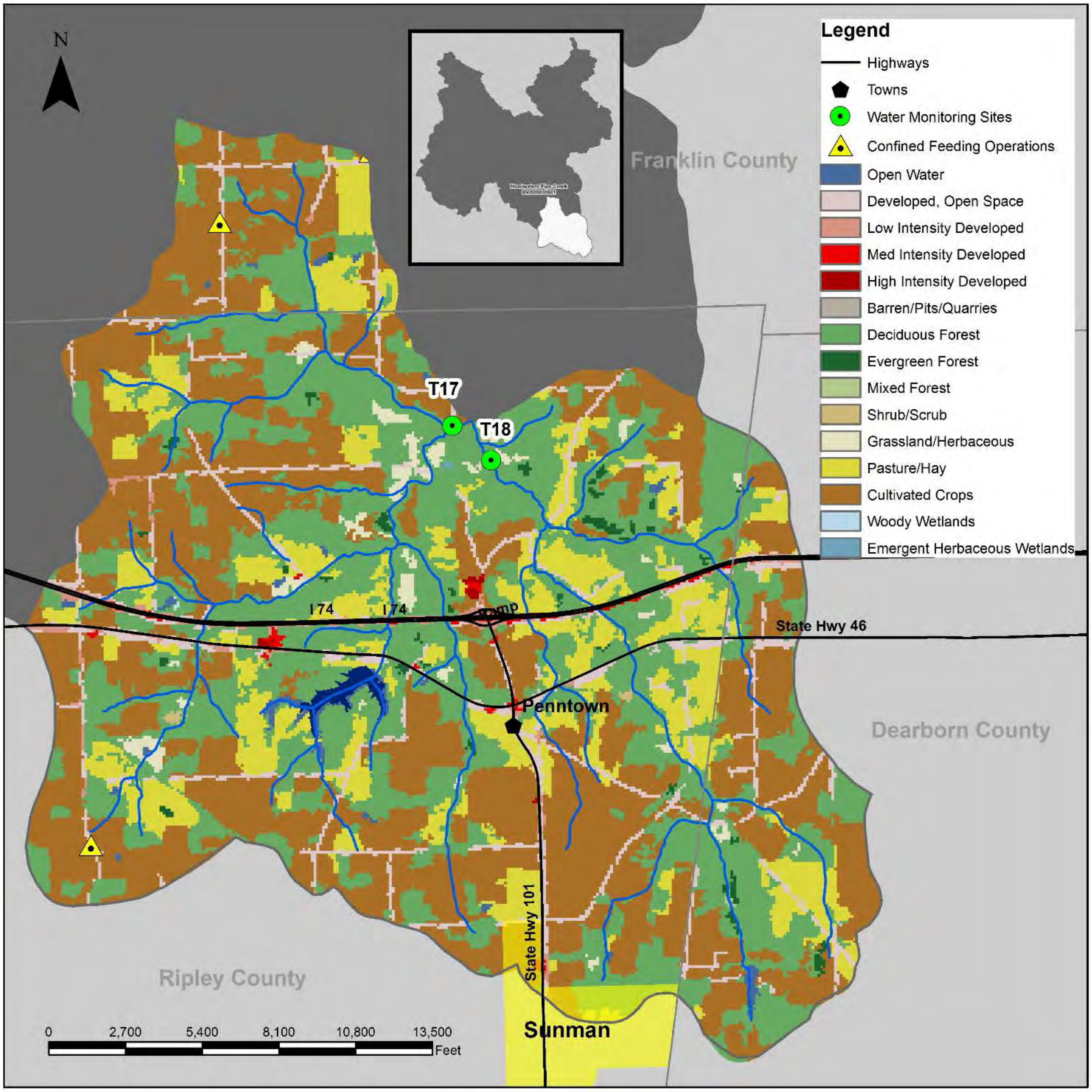
Figure 66: Fremont Branch Summary Map



Headwaters of Pipe Creek Subwatershed (HUC 050800030601)

The Headwaters of Pipe Creek subwatershed is located in southeast corner of the Salt-Pipe Creek Watershed. It is approximately 13,902 acres in size and has 40.6 miles of streams. According to the 2016 303(d) List of Impaired Waters, the Headwaters of Pipe Creek subwatershed has 26.4 miles of streams impaired for E. coli and 11.2 miles of streams impaired for E. coli and DO. Approximately 1.5 miles of the streams have inadequate buffers. The subwatershed's main landuses are 37% (5,151 ac.) forest, 34% (4,748 ac.) agriculture, and 21% (2,882 ac.) hay/pasture. The northern section of the larger town of Sunman and the small town of Penntown are located in this subwatershed. The Tall Oaks Lake and campground is also located in the Headwaters of Pipe Creek subwatershed. There are two CFOs and no facilities with NPDES permits located in this subwatershed. There are also two LUST facilities, Exxon Tiger Mart and Sunman Elementary School. There are hydric soils along the eastern edge of the subwatershed and a few pockets in the northern section. This subwatershed has NHEL ground located around the edge and some through the middle and the rest is HEL or PHEL. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There are two water monitoring sites in this subwatershed, T17 and T18.

Figure 67: Headwaters of Pipe Creek Subwatershed (HUC 050800030601) Map



The water monitoring site T17 is located on the Tributary of Pipe Creek where it intersects St. Mary's Road in Ripley County. The following are the results from the testing sampled from April to October 2014 with no samples in August or September.

Figure 68: Site T17 Testing Results

Water Monitoring Site – T17							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	8	7.37 SU	8 SU	7.64 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	8	2.41 mg/L	8.4 mg/L	5.85 mg/L	2	25%
Nitrite & Nitrate	< 1.0 mg/L	5	0.3 mg/L	1.8 mg/L	1.020 mg/L	2	40%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	5	0.4 mg/L	1.5 mg/L	0.72 mg/L	3	60%
Total Phosphorus	< 0.06 mg/L	5	0.035 mg/L	0.343 mg/L	0.123 mg/L	3	60%
E. coli	< 235 cfu/100mL	7	172.5 cfu/100mL	2,419.6 cfu/100mL	1,109.1 cfu/100mL	6	86%
Total Suspended Solids (TSS)	< 25 mg/L	5	8 mg/L	39 mg/L	16.5 mg/L	1	20%
Turbidity	< 10.4 NTU	8	4.48 NTU	46.9 NTU	18.62 NTU	5	63%
Parameter			**Target**		**Result**		**Meets Target**
E.coli Geomean			< 125 cfu/100mL		NA		**No – 10% Rule
Fish IBI			>35		36/30		Yes/No
QHEI (Fish IBI)			>51		66/63		Yes
Macro mIBI			>35		36		Yes
QHEI (Macro mIBI)			>51		61		Yes
IBC			NA		NA		Pass

**The geometric mean could not be calculated because the site went dry during the 5 weeks of sampling. However there were 6/7 sampling events where the results were in exceedance of the single sample max. Since more than 10% of the samples were in exceedance, the 10% rule indicated impairment. Three of those samples were >1000 MPN.

The water monitoring site T18 is located on Pipe Creek where it intersects Pipe Creek Road in Ripley County. The following are the results from the testing sampled from April to October 2014 with no samples in September.

Figure 69: Site T18 Testing Results

Water Monitoring Site – T18							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	8	7.33 SU	7.97 SU	7.63 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	8	2.84 mg/L	8.59 mg/L	5.89 mg/L	1	13%
Nitrite & Nitrate	< 1.0 mg/L	5	0.05 mg/L	0.6 mg/L	0.410 mg/L	0	0%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	5	0.4 mg/L	1.3 mg/L	0.68 mg/L	3	60%
Total Phosphorus	< 0.06 mg/L	5	0.022 mg/L	0.079 mg/L	0.049 mg/L	2	40%
E. coli	< 235 cfu/100mL	7	121.1 cfu/100mL	2,419.6 cfu/100mL	1,007.0 cfu/100mL	6	86%
Total Suspended Solids (TSS)	< 25 mg/L	5	7 mg/L	14 mg/L	10.8 mg/L	0	0%
Turbidity	< 10.4 NTU	8	5.91 NTU	42.2 NTU	15.83 NTU	5	63%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	NA	**No – 10% Rule
Fish IBI	>35	38	Yes
QHEI (Fish IBI)	>51	50	No
Macro mIBI	>35	38	Yes
QHEI (Macro mIBI)	>51	50	No
IBC	NA	NA	Pass

**The geometric mean could not be calculated because the site went dry during the 5 weeks of sampling. However, there were 6/7 sampling events where the results were in exceedance of the single sample max. Since more than 10% of the samples were in exceedance, the 10% rule indicated impairment. Three of those samples were >1000 MPN.

Figure 70: Headwaters of Pipe Creek Subwatershed Water Monitoring Result Summary

Headwaters of Pipe Creek Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	16	7.33 SU	8 SU	7.63 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	16	2.41 mg/L	8.59 mg/L	5.87 mg/L	3	19%
Nitrite & Nitrate	< 1.0 mg/L	10	0.05 mg/L	1.8 mg/L	0.715 mg/L	2	20%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	10	0.4 mg/L	1.5 mg/L	0.70 mg/L	6	60%
Total Phosphorus	< 0.06 mg/L	10	0.022 mg/L	0.343 mg/L	0.086 mg/L	5	50%
E. coli	< 235 cfu/100mL	14	121.1 cfu/100mL	2,419.6 cfu/100ml	1,058.0 cfu/100mL	12	86%
Total Suspended Solids (TSS)	< 25 mg/L	10	7 mg/L	39 mg/L	13.6 mg/L	1	10%
Turbidity	< 10.4 NTU	16	4.48 NTU	46.9 NTU	17.23 NTU	10	63%
E. coli Geomean	< 125 cfu/100mL	The geometric mean could not be calculated because both sites went dry during the 5 weeks of sampling. However, there were 6/7 sampling events at both sites where the results were in exceedance of the single sample max. Since more than 10% of the samples were in exceedance, the 10% rule indicated impairment for both sites.					
Fish IBI	>35	3	30	38	35	1	33%
QHEI (Fish IBI)	>51	3	50	66	60	1	33%
Macro mIBI	>35	2	36	38	37	0	0%
QHEI (Macro mIBI)	>51	2	50	61	56	1	33%
IBC	NA	2	NA	NA	NA	0	Pass

As shown above, the Headwaters of Pipe Creek subwatershed monitoring sites do not meet the target over 50% of the time for E. coli, Turbidity, Total Kjeldahl Nitrogen, and Total Phosphorus. 86% of the samples did not meet the E. coli single sample maximum target and had an average of 1,058 cfu/100mL.

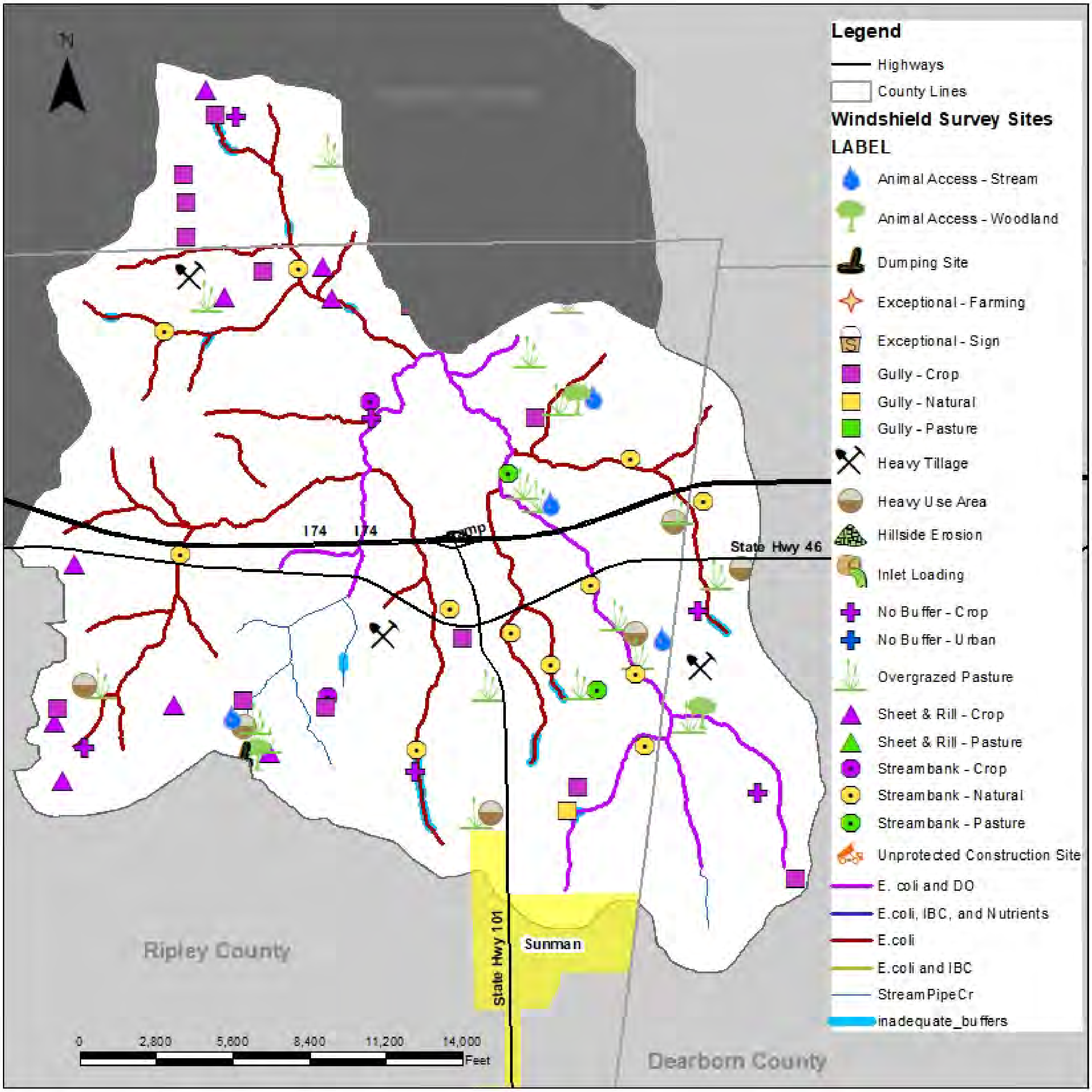
Below are the results of the windshield survey for the Headwaters of Pipe Creek subwatershed. Overgrazed pasture had the most occurrences for the windshield survey, with 17 occurrences. Gully erosion in cropland and natural streambank erosion had the second most occurrences, with 12 each.

Figure 71: Headwaters of Pipe Creek Windshield Survey Results

Headwaters of Pipe Creek Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	4
Animal Access - Woodland	3
Dumping Site	1
Gully - Crop	12
Gully - Natural	1
Heavy Tillage	3
Heavy Use Area	6
No Buffer - Crop	6
Overgrazed Pasture	17
Sheet & Rill - Crop	9
Streambank - Crop	2
Streambank – Natural	12
Streambank - Pasture	2
Total	**78**

The Headwaters of Pipe Creek Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List as well as areas with inadequate stream buffers.

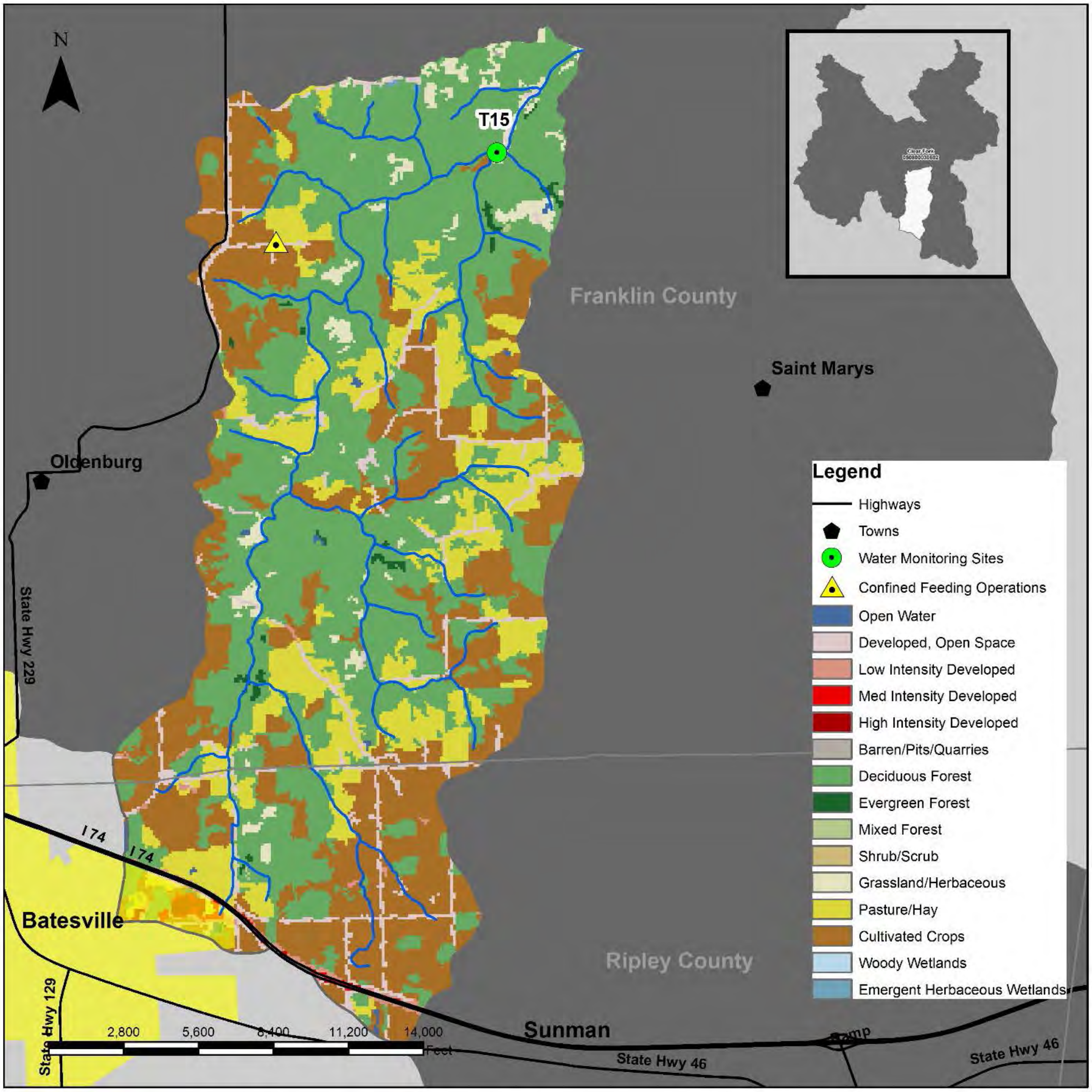
Figure 72: Headwaters of Pipe Creek Summary Map



Clear Fork Subwatershed (HUC 050800030602)

The Clear Fork subwatershed is located in west side of the Headwaters of Pipe Creek subwatershed. It is approximately 10,115 acres in size and has 33.3 miles of streams. According to the 2016 303(d) List of Impaired Waters, the Clear Fork subwatershed has 14.5 miles of streams impaired for E. coli. Approximately 1.3 miles of the streams have inadequate buffers. The subwatershed's main landuses are 47% (4,766 ac.) forest, 26% (2,655 ac.) agriculture, and 20% (1,982 ac.) hay/pasture. The far eastern edge of the City of Batesville is located in the southern part of this subwatershed. There is one CFO and no facilities with an NPDES permit located in this subwatershed. There is one pocket of hydric soils along the northwest edge of the subwatershed. This subwatershed has NHEL ground along the edge of the southern half of the watershed. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There is one water monitoring site in this subwatershed, T15.

Figure 73: Clear Fork Subwatershed (HUC 050800030602) Map



The water monitoring site T15 is located on Clear Fork where it intersects Schwegman Road in Franklin County. The following are the results from the testing sampled from April to October 2014.

Figure 74: Site T15 Testing Results

Water Monitoring Site – T15							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	10	7.62 SU	8.41 SU	7.99 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	5.77 mg/L	11.54 mg/L	9.39 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	6	0.05 mg/L	1.2 mg/L	0.650 mg/L	1	17%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.15 mg/L	0.9 mg/L	0.37 mg/L	1	17%
Total Phosphorus	< 0.06 mg/L	6	0.014 mg/L	0.16 mg/L	0.042 mg/L	1	17%
E. coli	< 235 cfu/100mL	9	8.5 cfu/100mL	2,419.6 cfu/100mL	318.1 cfu/100mL	1	11%
Total Suspended Solids (TSS)	< 25 mg/L	6	4 mg/L	56 mg/l	30.0 mg/L	1	17%
Turbidity	< 10.4 NTU	10	2.61 NTU	86.8 NTU	12.83 NTU	1	10%
Parameter			**Target**		**Result**		**Meets Target**
E.coli Geomean			< 125 cfu/100mL		NA-Stream went dry		Yes
Fish IBI			>35		46		Yes
QHEI (Fish IBI)			>51		57		Yes
Macro mIBI			>35		40		Yes
QHEI (Macro mIBI)			>51		59		Yes
IBC			NA		NA		Pass

As shown above, the Clear Fork subwatershed monitoring sites meets the target over 50% of the time for all parameters. There was one high E coli reading, but it was during a rain event, so it was determined that it did not meet the 10% rule for E. coli impairment.

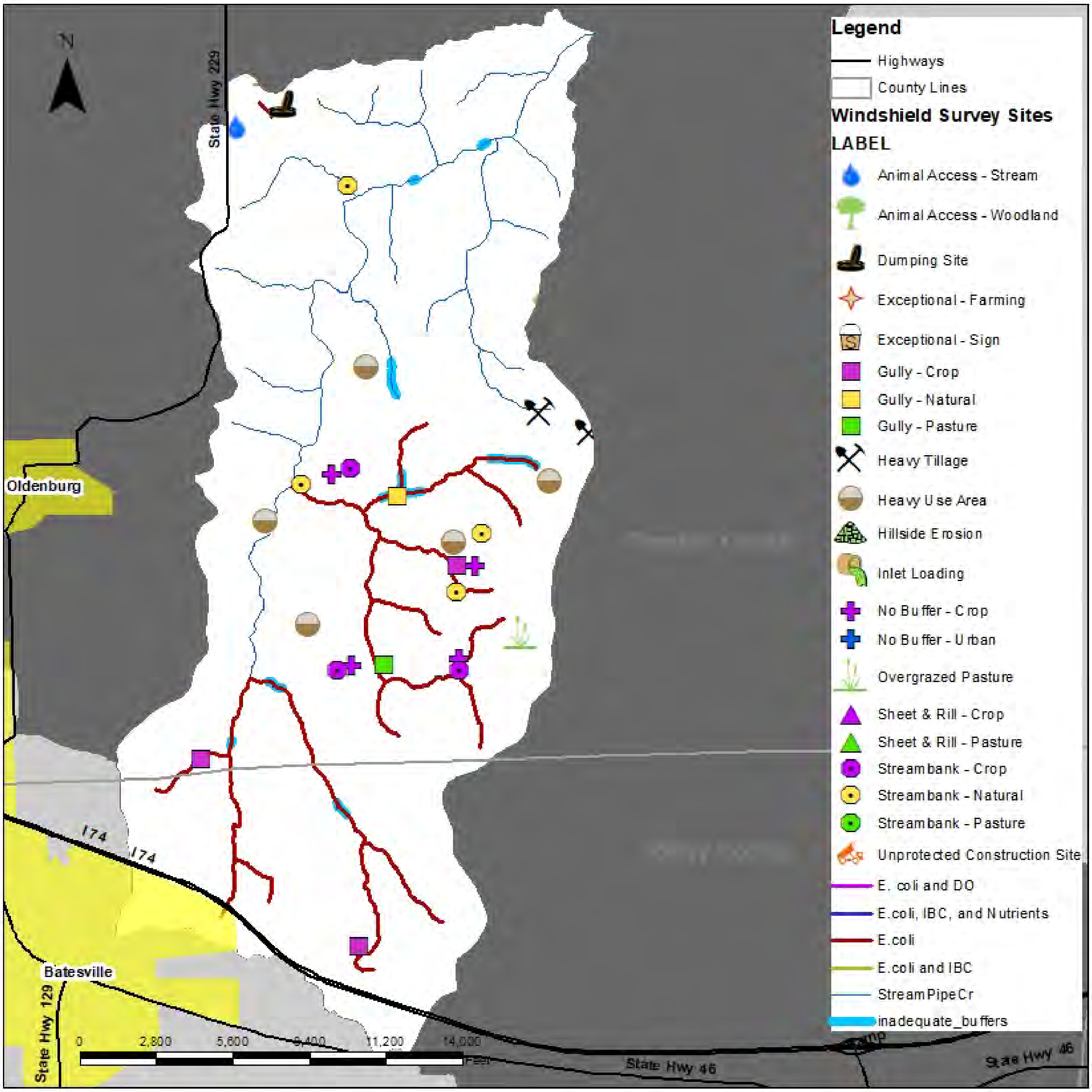
Below are the results of the windshield survey for the Clear Fork subwatershed. The *Heavy Use Area* finding occurred the most, five times, and *natural streambank erosion* and *no buffer along stream in cropland* tied for second, with four occurrences each.

Figure 75: Clear Fork Windshield Survey Results

Clear Fork Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	1
Dumping Site	1
Gully - Crop	3
Gully - Natural	1
Gully - Pasture	1
Heavy Tillage	2
Heavy Use Area	5
No Buffer - Crop	4
Overgrazed Pasture	1
Streambank - Crop	3
Streambank – Natural	4
Total	**26**

The Clear Fork Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

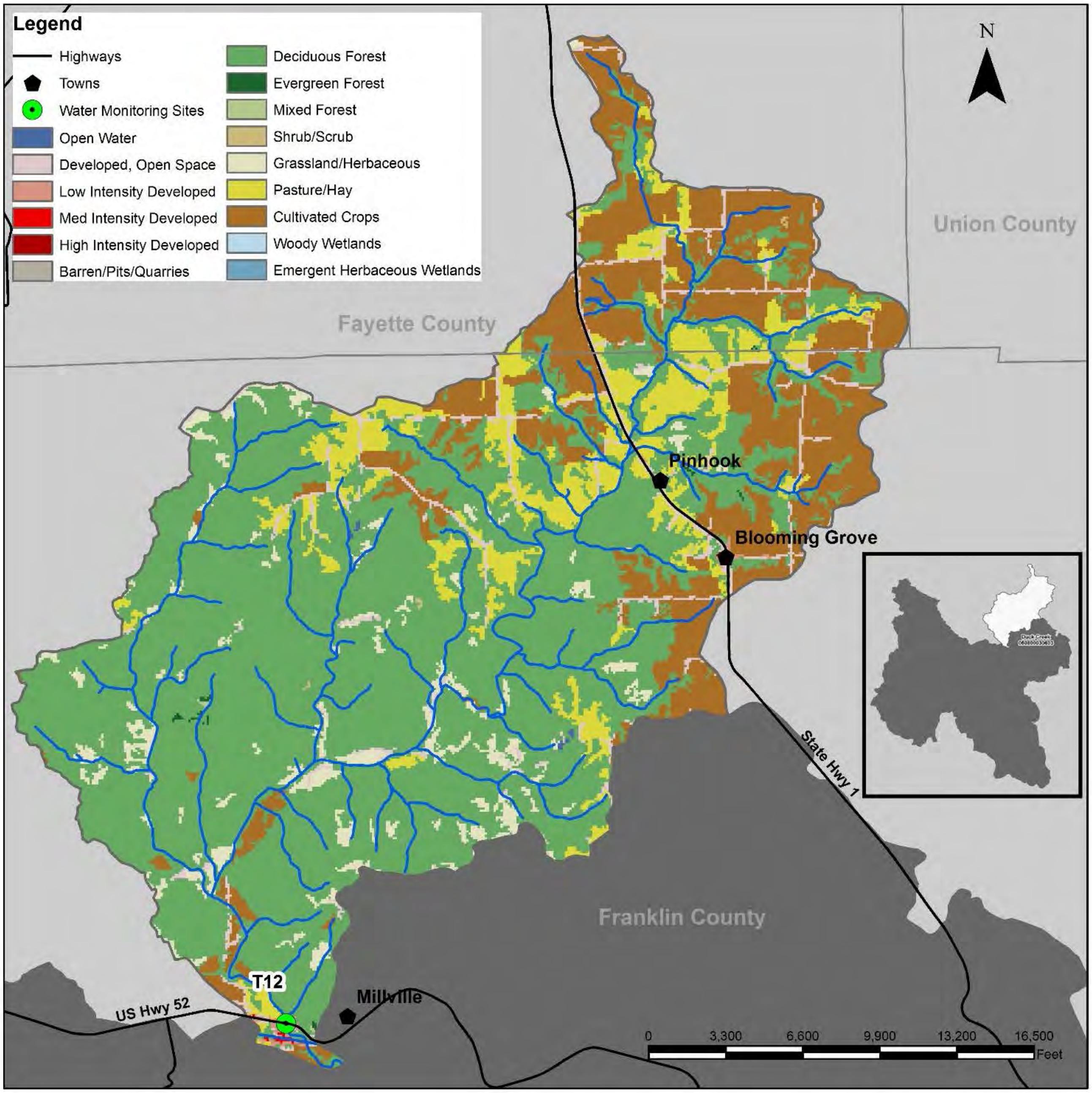
Figure 76: Clear Fork Summary Map



Duck Creek Subwatershed (HUC 050800030603)

The Duck Creek subwatershed is located in the far northeast side of the Salt-Pipe Creek subwatershed. It is approximately 16,475 acres in size and has 53.7 miles of streams. According to the 2016 303(d) List of Impaired Waters, all of the streams (53.7 miles) in the Duck Creek subwatershed are impaired for E. coli. Approximately 1.6 miles of the streams have inadequate buffers. The subwatershed's main landuses are 62% (10,277 ac.) forest, 20% (3,318 ac.) agriculture, and 12% (2,010 ac.) hay/pasture. There are two small towns located in this subwatershed, Pinhook and Blooming Grove. There are no CFOs or facilities with an NPDES permit located in this subwatershed. There are a few small pockets of hydric soils along the northern edge of the subwatershed. This subwatershed has NHEL ground along the northern and eastern edge of the watershed. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There is one water monitoring site in this subwatershed, T12.

Figure 77: Duck Creek Subwatershed (HUC 050800030603) Map



The water monitoring site T12 is located on Duck Creek where it intersects US Hwy 52 in Franklin County. During the sampling, the field staff observed that just downstream of site T12 the Whitewater Canal aquaduct crosses over the stream and it was leaking. It was noted that large amounts of sediment were entering the stream through the aquaduct. T12 is located at the pour point of the subwatershed before it enters the Whitewater River. The following are the results from the testing sampled from April to October 2014 with no samples in September.

Figure 78: Site T12 Testing Results

Water Monitoring Site – T12							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	7	7.76 SU	8.51 SU	8.03 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	7	7.79 mg/L	12.61 mg/L	10.26 mg/L	1	14%
Nitrite & Nitrate	< 1.0 mg/L	6	0.3 mg/L	1.4 mg/L	0.750 mg/L	2	33%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	6	0.15 mg/L	2 mg/L	0.66 mg/L	2	33%
Total Phosphorus	< 0.06 mg/L	6	0.012 mg/L	0.569 mg/L	0.159 mg/L	2	33%
E. coli	< 235 cfu/100mL	7	17.3 cfu/100mL	12,997 cfu/100mL	3,767.6 cfu/100mL	2	29%
Total Suspended Solids (TSS)	< 25 mg/L	6	4 mg/L	768 mg/L	265.5 mg/L	2	33%
Turbidity	< 10.4 NTU	7	3.6 NTU	1,000 NTU	221.65 NTU	3	43%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	NA – Stream went dry	No – 10% Rule
Fish IBI	>35	NA	NA
QHEI (Fish IBI)	>51	NA	NA
Macro mIBI	>35	NA	NA
QHEI (Macro mIBI)	>51	NA	NA
IBC	NA	NA	NA

This stream went dry during the summer months and the E. coli geometric mean and biological communities were not able to be collected. As shown above, the Duck Creek subwatershed monitoring site meets the target over 50% of the time for all parameters. A geomean could not be calculated, but based on the 10% rule, the site was determined to be impaired for E. coli.

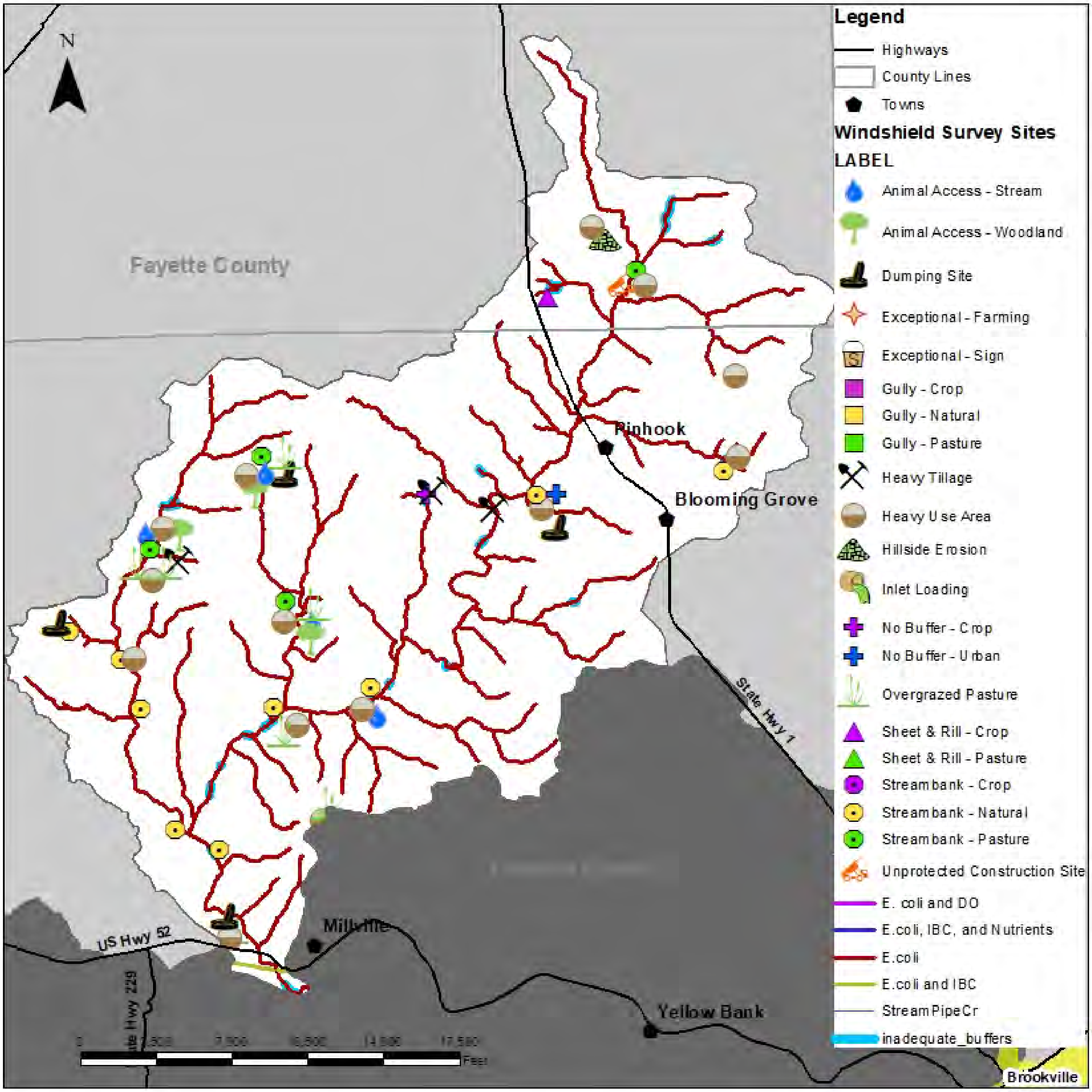
Below are the results of the windshield survey for the Duck Creek subwatershed. *Heavy use area* was present the most, with 13 occurrences, and *natural streambank erosion* was second, with 9 occurrences.

Figure 79: Duck Creek Windshield Survey Results

Duck Creek Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	4
Animal Access - Woodland	3
Dumping Site	4
Heavy Tillage	3
Heavy Use Area	13
Hillside Erosion	1
No Buffer - Crop	1
No Buffer - Urban	1
Overgrazed Pasture	6
Sheet & Rill - Crop	1
Streambank – Natural	9
Streambank - Pasture	3
Unprotected Construction Site	1
Total	**50**

The Duck Creek Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

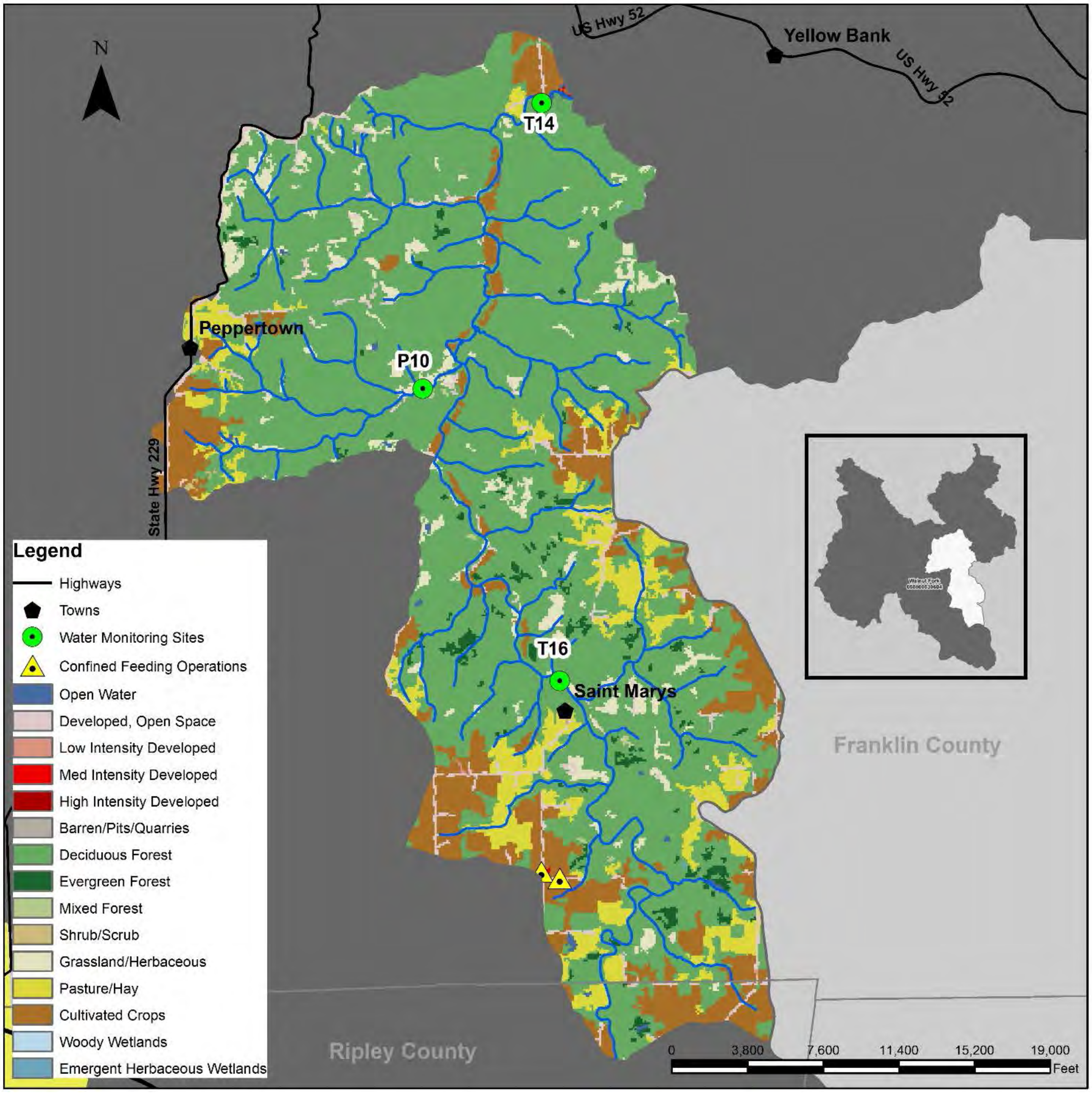
Figure 80: Duck Creek Summary Map



Walnut Fork Subwatershed (HUC 050800030604)

The Walnut Fork subwatershed is located in the far northeast side of the Salt-Pipe Creek subwatershed. It is approximately 18,992 acres in size and has 75.7 miles of streams. According to the 2016 303(d) List of Impaired Waters, 54.2 miles in the Walnut Fork subwatershed are impaired for E. coli. Approximately 1.4 miles of the streams have inadequate buffers. The subwatershed's main landuses are 72% (13,662 ac.) forest, 13% (2,514 ac.) hay/pasture, and 11% (2,052 ac.) agriculture. The small town of St. Marys is located in this subwatershed. There are two CFOs and no facilities with an NPDES permit located in this subwatershed. There are a few small pockets of hydric soils along the eastern edge of the subwatershed. This subwatershed has NHEL ground along the edge of the southern half of the watershed. The entire subwatershed is classified as *very limited*, based on the septic suitability of the soil. There are three water monitoring sites in this subwatershed, P10, T14, and T16.

Figure 81: Walnut Fork Subwatershed (HUC 050800030604) Map



The water monitoring site P10 is located on Walnut Fork where it intersects Walnut Fork Road in Franklin County. The following are the results from the testing sampled from May to September 2014.

Figure 82: Site P10 Testing Results

Water Monitoring Site – P10

Parameter	Target	# of samples	Min	Max	Average	# not meeting target	% not meeting target
pH	>6.5 and <9 SU	10	7.72 SU	8.19 SU	8.01 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	6.45 mg/L	11.92 mg/L	9.29 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	3	0.038 mg/L	0.88 mg/L	0.332 mg/L	0	0%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	0.32 mg/L	0.21 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.025 mg/L	0.025 mg/L	0	0%
E. coli	< 235 cfu/100mL	5	28.2 cfu/100mL	4,106 cfu/100mL	893.2 cfu/100mL	1	20%
Total Suspended Solids (TSS)	< 25 mg/L	3	2 mg/L	7 mg/L	3.7 mg/L	0	0%
Turbidity	< 10.4 NTU	10	1.65 NTU	81.6 NTU	12.21 NTU	1	10%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	156.6 cfu/100mL	No
Fish IBI	>35	40	Yes
QHEI (Fish IBI)	>51	55	Yes
Macro mIBI	>35	46	Yes
QHEI (Macro mIBI)	>51	51	No
IBC	NA	NA	Pass

The water monitoring site T14 is located on Pipe Creek where it intersects Silver Creek Road in Franklin County. T14 is the pour point of the subwatershed. The following are the results from the testing sampled from November 2013 to October 2014.

Figure 83: Site T14 Testing Results

Water Monitoring Site – T14							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	16	7.32 SU	8.31 SU	7.71 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	16	3.77 mg/L	13.85 mg/L	8.41 mg/L	5	31%
Nitrite & Nitrate	< 1.0 mg/L	12	0.05 mg/L	1.4 mg/L	0.496 mg/L	2	17%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	12	0.15 mg/L	0.6 mg/L	0.35 mg/L	1	8%
Total Phosphorus	< 0.06 mg/L	12	0.006 mg/L	0.104 mg/L	0.043 mg/L	2	17%
E. coli	< 235 cfu/100mL	10	30.9 cfu/100mL	1,413.6 cfu/100mL	227.2 cfu/100mL	1	10%
Total Suspended Solids (TSS)	< 25 mg/L	12	6 mg/L	37 mg/L	18.9 mg/L	2	17%
Turbidity	< 10.4 NTU	16	3.76 NTU	28.9 NTU	17.67 NTU	13	81%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	136.8 cfu/100mL	No
Fish IBI	>35	46	Yes
QHEI (Fish IBI)	>51	58	Yes
Macro mIBI	>35	40	Yes
QHEI (Macro mIBI)	>51	58	Yes
IBC	NA	NA	Pass

The E. coli exceeded the single sample max one time and it occurred when the TSS was also elevated, suggesting the event was driven by nonpoint sources. Turbidity exceeded limits over 80% of the time.

The water monitoring site T16 is located on Pipe Creek where it intersects St. Marys Road in Franklin County. Results from upstream site T17 indicate there are high levels of E. coli flowing into the subwatershed. The following are the results from the testing sampled from April to October 2014.

Figure 84: Site T16 Testing Results

Water Monitoring Site – T16							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.43 SU	8.64 SU	7.90 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	6.7 mg/L	10.8 mg/l	8.65 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	7	0.05 mg/L	0.6 mg/L	0.250 mg/L	0	0%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	7	0.15 mg/L	0.9 mg/L	0.41 mg/L	1	14%
Total Phosphorus	< 0.06 mg/L	7	0.017 mg/L	0.188 mg/L	0.050 mg/L	1	14%
E. coli	< 235 cfu/100mL	10	47.3 cfu/100mL	2,419.6 cfu/100mL	398.8 cfu/100mL	3	30%
Total Suspended Solids (TSS)	< 25 mg/L	7	4 mg/L	29 mg/L	10.8 mg/L	1	14%
Turbidity	< 10.4 NTU	11	2.61 NTU	39.9 NTU	9.24 NTU	2	18%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	365.5 cfu/100mL	No
Fish IBI	>35	48	Yes
QHEI (Fish IBI)	>51	66	Yes
Macro mIBI	>35	42	Yes
QHEI (Macro mIBI)	>51	55	Yes
IBC	NA	NA	Pass

Figure 85: Walnut Fork Subwatershed Water Monitoring Result Summary

Walnut Fork Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	37	7.32 SU	8.64 SU	7.85 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	37	3.77 mg/L	13.85 mg/L	8.72 mg/L	5	14%
Nitrite & Nitrate	< 1.0 mg/L	22	0.038 mg/L	1.4 mg/L	0.395 mg/L	2	9%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	22	0.15 mg/L	0.9 mg/L	0.35 mg/L	2	9%
Total Phosphorus	< 0.06 mg/L	22	0.006 mg/L	0.188 mg/L	0.043 mg/L	3	14%
E. coli	< 235 cfu/100mL	25	28.2 cfu/100mL	4,106 cfu/100mL	429.0 cfu/100mL	5	20%
Total Suspended Solids (TSS)	< 25 mg/L	22	2 mg/L	37 mg/L	13.7 mg/L	3	14%
Turbidity	< 10.4 NTU	37	1.65 NTU	81.6 NTU	13.69 NTU	16	43%
E. coli Geomean	< 125 cfu/100mL	3	136.8 cfu/100mL	365.5 cfu/100mL	219.6 cfu/100mL	3	100%
Fish IBI	>35	3	40	48	45	0	0%
QHEI (Fish IBI)	>51	3	55	66	60	0	0%
Macro mIBI	>35	3	40	46	43	0	0%
QHEI (Macro mIBI)	>51	3	51	58	55	1	33%
IBC	NA	3	NA	NA	NA	0	0%

As shown above, the Walnut Fork subwatershed has no monitoring sites that met the target for the E. coli geomean. 43% of the sites sampled did not meet the target for turbidity. All other parameters met the target at least 67% of the time or more.

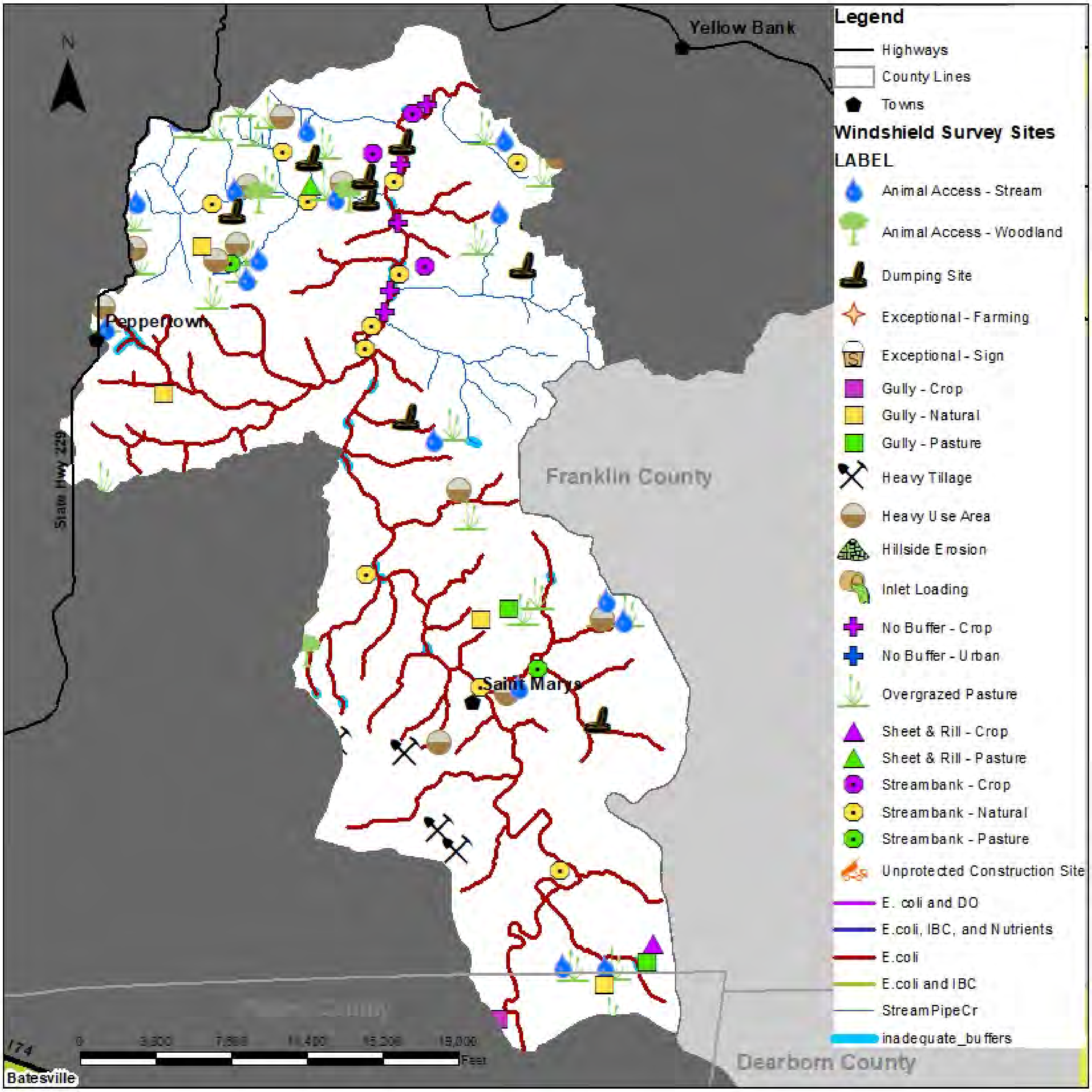
Below are the results of the windshield survey for the Walnut Fork subwatershed. *Overgrazed pasture* was the top finding of the windshield survey, with 24 occurrences. *Animal access to streams* was second highest, with 15 occurrences.

Figure 86: Walnut Fork Windshield Survey Results

Walnut Fork Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	15
Animal Access - Woodland	3
Dumping Site	8
Gully - Crop	1
Gully - Natural	4
Gully - Pasture	2
Heavy Tillage	3
Heavy Use Area	11
No Buffer - Crop	5
Overgrazed Pasture	24
Sheet & Rill - Crop	1
Sheet & Rill - Pasture	1
Streambank - Crop	3
Streambank – Natural	11
Streambank - Pasture	2
Total	**94**

The Walnut Fork Summary Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

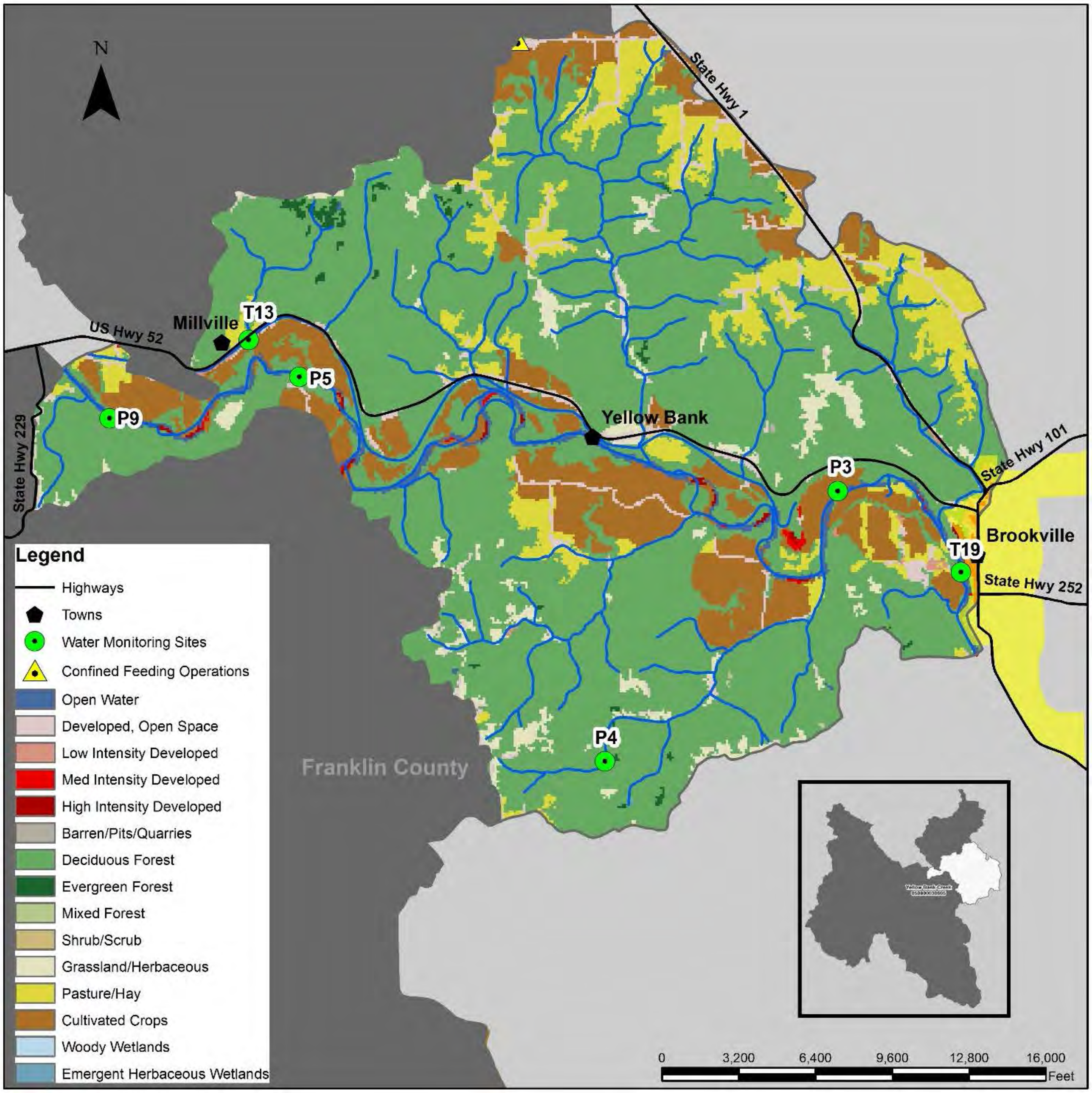
Figure 87: Walnut Fork Summary Map



Yellow Bank Creek Subwatershed (HUC 050800030605)

The Yellow Bank Creek subwatershed is located between Walnut Fork and Duck Creek subwatersheds. It is approximately 16,592 acres in size and has 74.7 miles of streams. According to the 2016 303(d) List of Impaired Waters, 16.2 miles in the Yellow Bank Creek subwatershed are impaired for E. coli and biological communities. Approximately 2.3 miles of the streams have inadequate buffers. The subwatershed's main landuses are 68% (11,349 ac.) forest, 13% (2,134 ac.) hay/pasture, and 12% (1,991 ac.) agriculture. The western side of the large town of Brookville, in addition to the two small towns of Yellow Bank and Millville are located in this subwatershed. There is one CFO and no facilities with an NPDES permit located in this subwatershed. There is also one LUST facility, Brookville Food Mart. There are no hydric soils located in the subwatershed. This subwatershed has NHEL ground along the main stem of the Whitewater River. The entire subwatershed is classified as *very limited* based on the septic suitability of the soil, except for two very small areas located along the Whitewater River. There are six water monitoring sites in this subwatershed, P3, P4, P5, P9, T13, and T19.

Figure 88: Yellow Bank Creek Subwatershed (HUC 050800030605) Map



The water monitoring site P3 is located on Whitewater River where it intersects St. Marys Road in Franklin County. The following are the results from the testing sampled from May to September 2014.

Figure 89: Site P3 Testing Results

Water Monitoring Site – P3							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	10	7.81 SU	8.19 SU	8.07 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	7.42 mg/L	12.53 mg/L	9.42 mg/L	1	10%
Nitrite & Nitrate	< 1.0 mg/L	3	1.5 mg/L	4.1 mg/L	2.900 mg/L	3	100%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	0.57 mg/L	0.40 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.26 mg/L	0.178 mg/L	2	67%
E. coli	< 235 cfu/100mL	5	9.8 cfu/100mL	4,106 cfu/100mL	980.9 cfu/100mL	2	40%
Total Suspended Solids (TSS)	< 25 mg/L	3	4 mg/L	140 mg/L	81.3 mg/L	2	67%
Turbidity	< 10.4 NTU	10	3.64 NTU	189 NTU	49.57 NTU	5	50%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	117.5 cfu/100mL	Yes
Fish IBI	>35	48	Yes
QHEI (Fish IBI)	>51	71	Yes
Macro mIBI	>35	44	Yes
QHEI (Macro mIBI)	>51	64	Yes
IBC	NA	NA	Pass

The water monitoring site P4 is located on McCartys Run where it intersects St. Marys Road in Franklin County. The following are the results from the testing sampled from May to September 2014.

Figure 90: Site P4 Testing Results

Water Monitoring Site – P4							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	10	7.98 SU	8.19 SU	8.12 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	6.78 mg/L	11.4 mg/L	8.78 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	3	0.087 mg/L	0.87 mg/L	0.379 mg/L	0	0%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	0.15 mg/L	0.15 mg/L	0	0%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.056 mg/L	0.035 mg/L	0	0%
E. coli	< 235 cfu/100mL	5	151.5 cfu/100mL	17,329 cfu/100mL	4,154.6 cfu/100mL	4	80%
Total Suspended Solids (TSS)	< 25 mg/L	3	6 mg/L	15 mg/L	10.7 mg/L	0	0%
Turbidity	< 10.4 NTU	10	9.3 NTU	68.3 NTU	27.87 NTU	8	80%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	1,031.5 cfu/100mL	No
Fish IBI	>35	22	No
QHEI (Fish IBI)	>51	67	Yes
Macro mIBI	>35	38	Yes
QHEI (Macro mIBI)	>51	63	Yes
IBC	NA	NA	Fail

The water monitoring site P5 is located on Whitewater River where it intersects Silver Creek Road in Franklin County. The following are the results from the testing sampled from May to September 2014.

Figure 91: Site P5 Testing Results

Water Monitoring Site – P5							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	10	7.7 SU	8.34 SU	8.06 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	8.36 mg/L	12.49 mg/L	9.85 mg/L	1	10%
Nitrite & Nitrate	< 1.0 mg/L	3	1.9 mg/L	4.4 mg/L	3.233 mg/L	3	100%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	1.1 mg/L	0.62 mg/L	2	67%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.25 mg/L	0.142 mg/L	2	67%
E. coli	< 235 cfu/100mL	5	34.5 cfu/100mL	727 cfu/100mL	275.1 cfu/100mL	2	40%
Total Suspended Solids (TSS)	< 25 mg/L	3	2 mg/L	140 mg/L	64.0 mg/L	2	67%
Turbidity	< 10.4 NTU	10	3.16 NTU	105 NTU	27.23 NTU	4	40%
Parameter			**Target**		**Result**		**Meets Target**
E.coli Geomean			< 125 cfu/100mL		124.9 cfu/100mL		Yes
Fish IBI			>35		54		Yes
QHEI (Fish IBI)			>51		82		Yes
Macro mIBI			>35		42		Yes
QHEI (Macro mIBI)			>51		70		Yes
IBC			NA		NA		Pass

The water monitoring site P9 is located on Whitewater River where it intersects Pennington Road in Franklin County. The following are the results from the testing sampled from May to September 2014.

Figure 92: Site P9 Testing Results

Water Monitoring Site – P9							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	10	7.94 SU	8.42 SU	8.06 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	10	8.04 mg/L	15.52 mg/L	9.98 mg/L	1	10%
Nitrite & Nitrate	< 1.0 mg/L	3	1.8 mg/L	4.1 mg/L	3.133 mg/L	3	100%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	3	0.15 mg/L	1.3 mg/L	0.76 mg/L	2	67%
Total Phosphorus	< 0.06 mg/L	3	0.025 mg/L	0.27 mg/L	0.182 mg/L	2	67%
E. coli	< 235 cfu/100mL	5	35.9 cfu/100mL	770.1 cfu/100mL	276.6 cfu/100mL	2	40%
Total Suspended Solids (TSS)	< 25 mg/L	3	2 mg/L	130 mg/L	87.3 mg/L	2	67%
Turbidity	< 10.4 NTU	10	2.09 NTU	123 NTU	31.95 NTU	5	50%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	121.3 cfu/100mL	Yes
Fish IBI	>35	54	Yes
QHEI (Fish IBI)	>51	80	Yes
Macro mIBI	>35	44	Yes
QHEI (Macro mIBI)	>51	71	Yes
IBC	NA	NA	Pass

The water monitoring site T13 is located on Whitewater Canal where it intersects Unnamed Road in Franklin County. The following are the results from the testing sampled from April to October 2014.

Figure 93: Site T13 Testing Results

Water Monitoring Site – T13							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	11	7.55 SU	8.19 SU	8.04 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	11	6.78 mg/L	10.87 mg/L	9.06 mg/L	0	0%
Nitrite & Nitrate	< 1.0 mg/L	7	0.05 mg/L	4.6 mg/L	1.921 mg/L	5	71%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	7	0.5 mg/L	1.3 mg/L	0.77 mg/L	3	43%
Total Phosphorus	< 0.06 mg/L	7	0.056 mg/L	0.584 mg/L	0.189 mg/L	5	71%
E. coli	< 235 cfu/100mL	10	49.6 cfu/100mL	9,804 cfu/100mL	1,423.3 cfu/100mL	5	50%
Total Suspended Solids (TSS)	< 25 mg/L	7	29 mg/L	380 mg/L	117.1 mg/L	7	100%
Turbidity	< 10.4 NTU	11	40.6 NTU	1000 NTU	175.46 NTU	11	100%

Parameter	**Target**	**Result**	**Meets Target**
E.coli Geomean	< 125 cfu/100mL	1,062.6 cfu/100mL	No
Fish IBI	>35	16/16	No/No
QHEI (Fish IBI)	>51	25/25	No/No
Macro mIBI	>35	36/34	Yes/No
QHEI (Macro mIBI)	>51	24	No
IBC	NA	NA	Fail

The water monitoring site T19 is located on Whitewater River where it intersects St. Marys Road in Franklin County. T19 is the pour point of the subwatershed and the entire Salt-Pipe Creek drainage area, plus the northern part of the Whitewater River watershed flows through this site. The following are the results from the testing sampled from November 2013 to October 2014.

Figure 94: Site T19 Testing Results

Water Monitoring Site – T19							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	16	7.91 SU	8.34 SU	8.07 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	16	7.93 mg/L	13.9 mg/L	10.50 mg/L	5	31%
Nitrite & Nitrate	< 1.0 mg/L	12	1.5 mg/L	3.8 mg/L	2.333 mg/L	12	100%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	12	0.15 mg/L	0.6 mg/L	0.31 mg/L	2	17%
Total Phosphorus	< 0.06 mg/L	12	0.009 mg/L	0.222 mg/L	0.045 mg/L	2	17%
E. coli	< 235 cfu/100mL	10	17.3 cfu/100mL	686.7 cfu/100mL	170.6 cfu/100mL	2	20%
Total Suspended Solids (TSS)	< 25 mg/L	12	5 mg/L	76 mg/L	30.0 mg/L	4	33%
Turbidity	< 10.4 NTU	16	2.25 NTU	64.5 NTU	17.65 NTU	9	56%

Parameter	Target	Result	Meets Target
E.coli Geomean	< 125 cfu/100mL	91.5 cfu/100mL	Yes
Fish IBI	>35	54	Yes
QHEI (Fish IBI)	>51	78	Yes
Macro mIBI	>35	36	Yes
QHEI (Macro mIBI)	>51	69	Yes
IBC	NA	NA	Pass

Figure 95: Yellow Bank Creek Subwatershed Water Monitoring Result Summary

Yellow Bank Creek Subwatershed Water Monitoring Result Summary							
Parameter	**Target**	**# of samples**	**Min**	**Max**	**Average**	**# not meeting target**	**% not meeting target**
pH	>6.5 and <9 SU	67	7.55 SU	8.42 SU	8.07 SU	0	0%
Dissolved Oxygen	>4 and <12 mg/L	67	6.78 mg/L	15.52 mg/L	9.67 mg/L	8	12%
Nitrite & Nitrate	< 1.0 mg/L	31	0.05 mg/L	4.6 mg/L	2.271 mg/L	26	84%
Total Kjeldahl Nitrogen (TKN)	< 0.591 mg/L	31	0.15 mg/L	1.3 mg/L	0.48 mg/L	9	29%
Total Phosphorus	< 0.06 mg/L	31	0.009 mg/L	0.584 mg/L	0.112 mg/L	13	42%
E. coli	< 235 cfu/100mL	40	9.8 cfu/100mL	17,329 cfu/100ml	1,109.4 cfu/100mL	17	43%
Total Suspended Solids (TSS)	< 25 mg/L	31	2 mg/L	380 mg/L	65.0 mg/L	17	55%
Turbidity	< 10.4 NTU	67	2.09 NTU	1000 NTU	53.41 NTU	42	63%
E. coli Geomean	< 125 cfu/100mL	6	91.5 cfu/100mL	1,062.6 cfu/100mL	424.9 cfu/100mL	2	33%
Fish IBI	>35	7	16	54	38	3	43%
QHEI (Fish IBI)	>51	7	22	82	61	2	29%
Macro mIBI	>35	7	34	44	39	1	14%
QHEI (Macro mIBI)	>51	6	24	70	60	1	17%
IBC	NA	6	NA	NA	NA	2	33%

As shown above, the Yellow Bank Creek subwatershed monitoring sites do not meet the target over 50% of the time for Nitrite & Nitrate, Turbidity, or Total Suspended Solids.

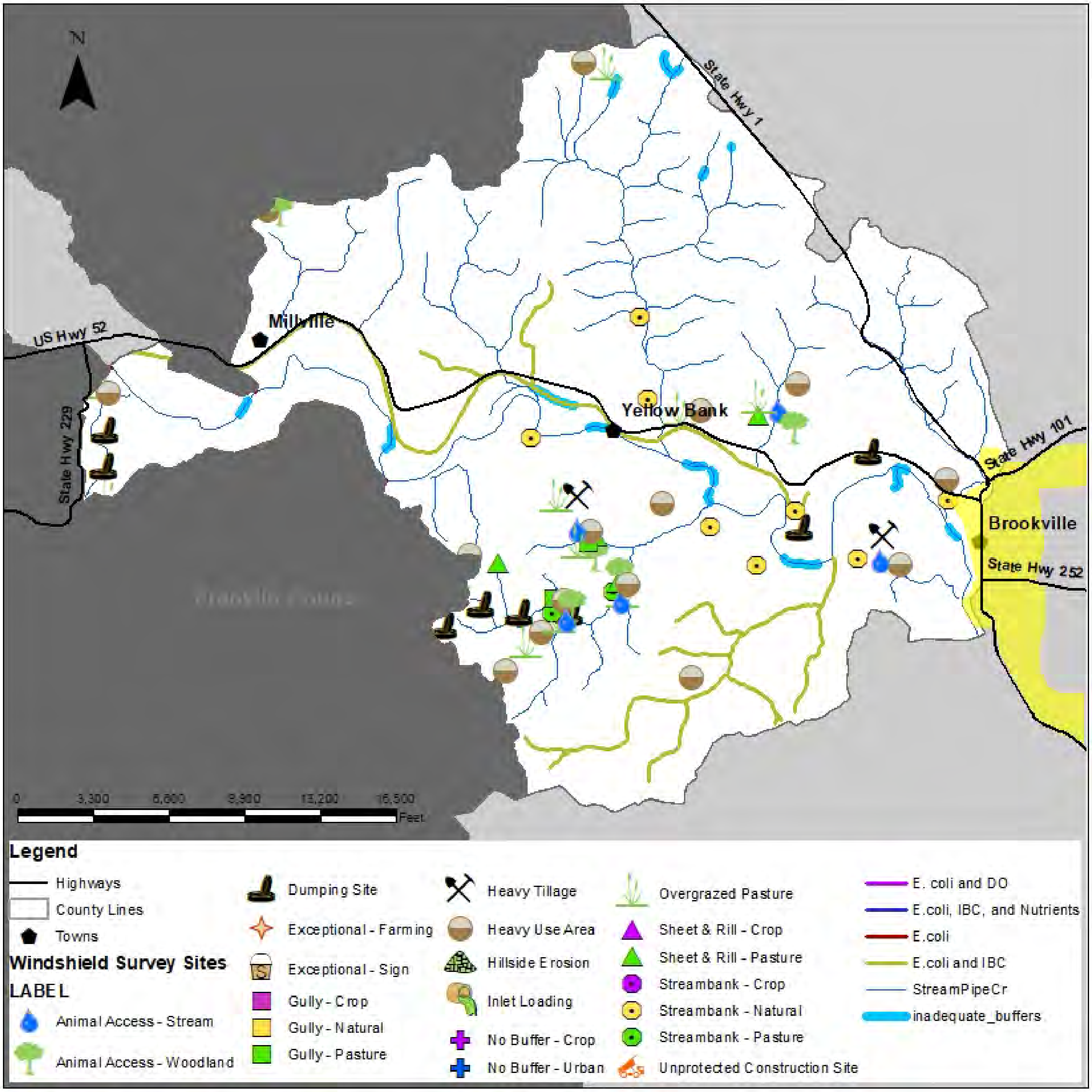
Here are the results of the windshield survey for the Yellow Bank Creek subwatershed. *Heavy use area* was found the most during the windshield survey, with 15 occurrences. There was a three way tie with *dumping site*, *overgrazed pasture*, and *natural streambank erosion* for second, most with 8 each.

Figure 96: Yellow Bank Creek Windshield Survey Results

Yellow Bank Creek Subwatershed Windshield Survey Results	
Finding	**# Present**
Animal Access - Stream	5
Animal Access - Woodland	5
Dumping Site	8
Gully - Pasture	2
Heavy Tillage	2
Heavy Use Area	15
Overgrazed Pasture	8
Sheet & Rill - Pasture	4
Streambank – Natural	8
Streambank - Pasture	2
Total	**59**

The Yellow Bank Creek Map below shows the results from the windshield survey and also identifies the impairments on the 2016 303(d) List, as well as areas with inadequate stream buffers.

Figure 97: Yellow Bank Creek Summary Map



Watershed Inventory Summary

Over the past few years, a lot of information and time has been put into collecting data and analyzing the Salt-Pipe Creek Watershed. IDEM started with conducting water monitoring throughout the watershed area to develop a TMDL and update the 303(d) List of Impaired Waters for 2016. The Salt-Pipe Creek Watershed is very rural but does border the City of Batesville and the larger towns of Brookville and Sunman. The lake community of Lake Santee and the campground of Tall Oaks Lake are located in the watershed. The watershed is 55% forested, 24% agriculture, 14% pasture/hay, and 5% developed.

Watershed Data Summary

The Salt-Pipe Creek Watershed's water quality is important to the health and wellbeing of the community and its surroundings. The watershed is the home of Lake Santee which is a drinking water source for the surrounding area and home to several endangered plant and animal species. The public uses the main stem of the Whitewater River and the large lakes of Lake Santee and Tall Oaks Lake for recreation. The Whitewater River is widely known for its scenery and is used by a large number of visitors throughout the recreational period. They go fishing, canoeing, kayaking, tubing, and swimming. Lake Santee is also a very recreational place. Boating, swimming, and fishing are very popular. The public also uses Tall Oaks Lake for swimming and fishing.

The Salt-Pipe Creek Watershed has approximately 549.7 miles of streams. There are 382.6 stream miles listed as impaired on the 2016 303(d) List for E. coli in the Salt-Pipe Creek Watershed, which is 70% of its streams. Some of those stream miles are also impaired for dissolved oxygen (17.7 miles), biological communities (67.9 miles), and nutrients (35.3 miles). According to the water monitoring data, the following were the percentage of samples that did not meet the target: 14% (39/285) for dissolved oxygen, 83% (76/92) for nitrite-nitrate, 37% (34/92) for TKN, 55% (51/92) for phosphorus, 36% (36/100) for TSS, 48% (137/284) for turbidity and 48% (101/ 210) for E. coli. Based on soils, 99% of the watershed has very limited septic capabilities. None of the NPDES facilities or CFOs in the watershed have any known issues.

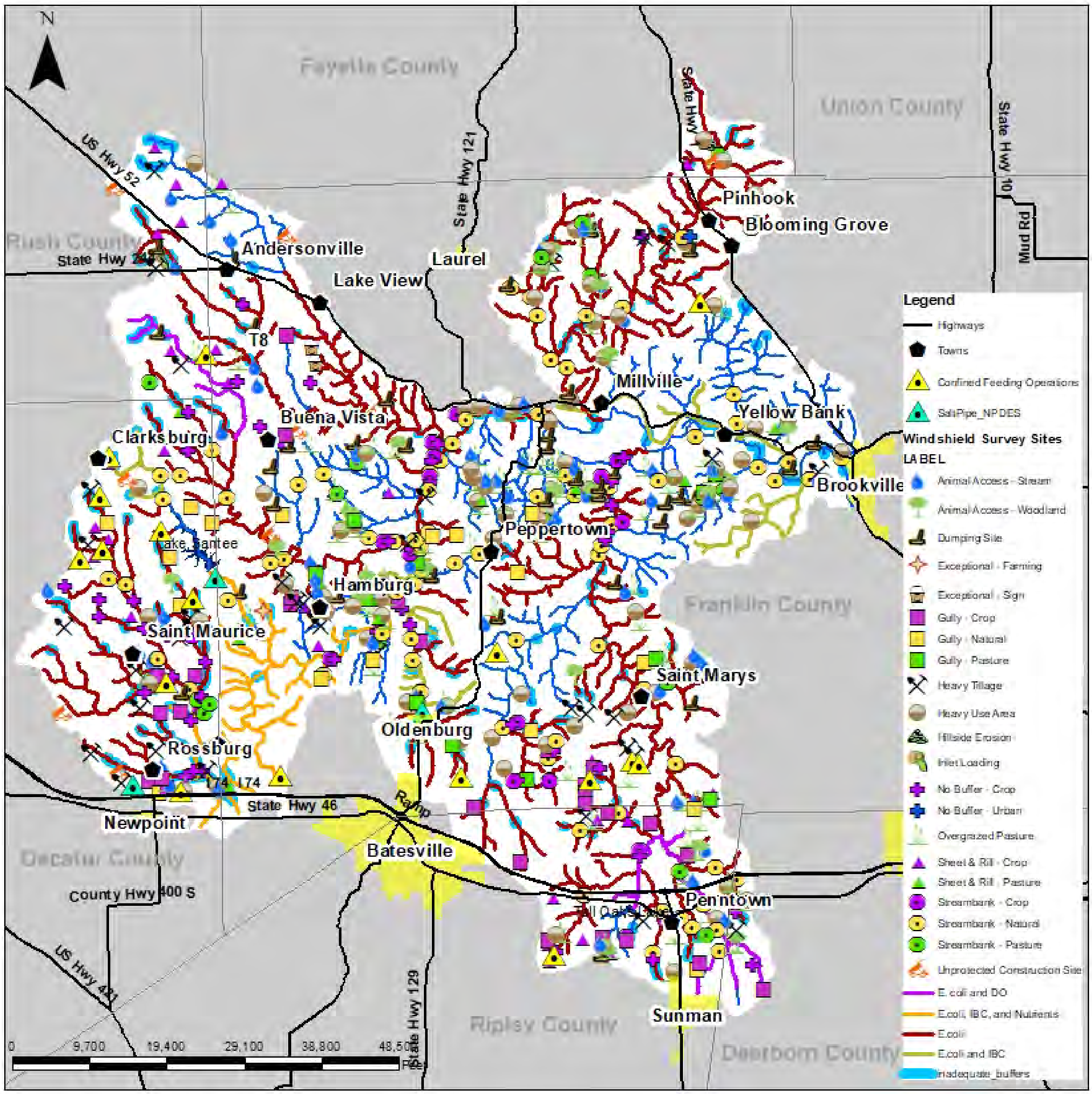
The windshield survey was conducted in the spring of 2018 to give a baseline of the problems and concerns in the watershed. It is also a tool that can be used in the future to see what types of best management practices are needed the most to address the current problems and concerns. Below is a summary of the findings of the windshield survey.

Figure 98: Salt-Pipe Creek Watershed Windshield Survey Results Summary

Salt-Pipe Creek Watershed Windshield Survey Results Summary	
Finding	**# Present**
Animal Access - Stream	62
Animal Access - Woodland	22
Dumping Site	36
Exceptional Farming	1
Exceptional Sign	2
Gully – Crop	30
Gully - Natural	17
Gully - Pasture	11
Heavy Tillage	39
Heavy Use Area	80
Hillside Erosion	1
Inlet Loading	1
No Buffer - Crop	45
No Buffer – Urban	1
Overgrazed Pasture	103
Sheet & Rill - Crop	31
Sheet & Rill - Pasture	14
Streambank - Crop	16
Streambank – Natural	77
Streambank - Pasture	15
Unprotected Construction Site	9
Total	**613**

As you can see from the summary of the windshield survey results above, *overgrazed pasture* (103 occurrences) was the problem that was identified the most often in the Salt-Pipe Creek Watershed. *Heavy use areas* (80 occurrences) were second, *streambank erosion* (77 occurrences) in the natural setting was third, followed by *animal access to streams* (62 occurrences), and *no buffer along streams in cropland* (45 occurrences). Below is the map displaying all of the findings from the windshield survey, along with the 2016 303(d) listed impairments, CFOs, and NPDES facilities for the entire watershed.

Figure 99: Salt-Pipe Creek Watershed Inventory Summary Map



Since the watershed inventory summary map contains a lot of information and it is hard to see the details, the chart below also shows the summary information in data form by subwatershed.

Figure 100: Watershed Inventory Summary Data by Subwatersheds

Subwatershed	Landuse %				Total Stream Miles In Subwatershed	IDEM 303(d)List Stream Miles				Inadequate Buffers - Miles	Number of CFOs	Number of NPDES	Number of LUSTs	Total Findings on Windshield Survey	Primary Resource Concerns (Windshield Survey)
	Agriculture	Pasture	Forest	Developed		E. coli and DO	E. coli, IBC, and Nutrients	E. coli and IBC	E. coli Only						
Headwaters of Salt Creek - 501	47	16	31	5	34.3				34.3	4.3	4			41	No Buffer – Crop Heavy Tillage
Righthand Fork - 502	28	15	48	6	62.1		35.3	4.1	9.8	5.3	4	2	3	81	Overgrazed Pasture, Heavy Tillage, and Heavy Use Area
Bull Fork - 503	28	12	55	3	41.7	6.6			26.8	1.9				52	Streambank – Natural, Overgrazed Pasture, and No Buffer - Crop
Little Salt Creek - 504	36	11	48	5	56.2				40.8	3.2	1			39	Sheet & Rill – Crop, Animal Access – Stream, and Dumping Site
Fremont Branch - 505	14	14	67	4	64.9			11.5	24.4	3.2	1	1	2	93	Overgrazed Pasture, Streambank – Natural, Heavy Use Area, and Animal Access - Stream
Headwaters Pipe Creek - 601	34	21	37	7	40.6	11.2			26.4	1.5	2		2	78	Overgrazed Pasture, Gully – Crop, Streambank - Natural
Clear Fork – 602	26	20	47	6	33.3				14.5	1.3	1			26	Heavy Use Area, No Buffer – Crop, and Streambank - Natural
Duck Creek – 603	20	12	62	4	53.7				53.7	1.6				50	Heavy Use Area, Streambank – Natural, and Overgrazed Pasture
Walnut Fork – 604	11	13	72	3	75.7				54.2	1.4	2			94	Overgrazed Pasture, Animal Access – Stream, Heavy Use Area, and Streambank - Natural
Yellow Bank Creek - 605	12	13	68	5	74.7			16.2		2.3	1		1	59	Heavy Use Area, Streambank – Natural, Overgrazed Pasture, and Dumping Site

Analysis of Stakeholder Concerns

The steering committee analyzed the list of concerns from the stakeholder concern survey and public to determine if: the concern is supported by data, if there is any evidence of concern, if the concern is quantifiable and within the project's scope, and finally what priority the concern should have for the project.

For the focus priority:

A = Provide cost-share, conduct education, and look for partners and programs

B = Provide limited cost-share, conduct education, and look for partners and programs

C = Conduct education and look for partners and programs

Below are the results of the analysis

Figure 101: Analysis of Stakeholder Concerns

Stakeholder Concern	Supported By Data	Evidence for Concern	Quantifiable	In Project Scope	Focus Priority
Water Quality throughout the Watershed Needs Improved	Yes	2016 303d List of Impairments 398 Stream Miles	Yes	Yes	A
Contaminated Runoff entering Streams	Yes	Windshield Survey Results 440 sites	Yes	Yes	A
Livestock Access to Streams/Sensitive Areas	Yes	2016 303d List of Impairments for E. coli 382 Stream Miles Windshield Survey Results 84 sites	Yes	Yes	A
Septic System Failures	Yes	2016 303d List of Impairments for E. coli 382 Stream Miles Septic Suitability Data – 99% of Soils - Very Limited Failing septic systems are listed as a potential source in the TMDL	No	Yes	C

Stakeholder Concern	Supported By Data	Evidence for Concern	Quantifiable	In Project Scope	Focus Priority
Excessive Nutrients entering Streams	Yes	2016 303d List of Impairments for Nutrients 35 Stream Miles 83% (76/92) of the samples did not meet the target for nitrite-nitrate 55% (51/92) of samples did not meet target for phosphorus	Yes	Yes	A
Streambank Erosion	Yes	Windshield Survey Results 108 sites	Yes	Yes	B
Gully Erosion	Yes	Windshield Survey Results 58 sites	Yes	Yes	A
Sediment entering Streams	Yes	Windshield Survey Results 573 sites 36% (36/100) of sample did not meet target for TSS 48% (137/284) of samples did not meet target for turbidity	Yes	Yes	A
Overgrazed Pastures	Yes	Windshield Survey Results 103 sites	Yes	Yes	A
No Residue/Cover on Fields	Yes	Windshield Survey Results 38 sites Tillage Transect Data 49% of Corn is Conventional Till	Yes	Yes	A
Invasive Species invading Areas	No	No	No	No	No
Trash/Dumping Sites	Yes	Windshield Survey Results 36 sites	Yes	Yes	C

Stakeholder Concern	Supported By Data	Evidence for Concern	Quantifiable	In Project Scope	Focus Priority
Flooding	Yes	Data from County Highway Depart.	Yes	Yes	C
Pulling Stone from the Creek	No	# of Permits	Yes	No	No
Inadequate Riparian Buffers	Yes	Windshield Survey Results 46 sites	Yes	Yes	A
		26 Stream Miles Aerial Imagery			

There are some concerns that do not have evidence with the windshield survey or water monitoring data that need more explanation. Invasive species invading areas was a concern that one person wrote in on the survey. After the steering committee discussed the concern, they determined the concern was not in the project scope and had no evidence of the concern. Flooding is another concern for the watershed and water quality. Flooding is in the project scope and the County Highway Department keeps record of the number of times and the locations where flooding occurs in the county, so it is quantifiable and evidence of concern exists. Pulling stone from the creek was another write-in concern on the survey. After the steering committee discussed the concern, they determined it was not in the project's scope and they were not aware of any evidence that states pulling stone from the creek has a negative impact on water quality. Landowners in the county can obtain permits to remove gravel from state agencies and the number of permits and amount of stone removed can be quantified.

Water Quality Concerns and Problems Analysis

The steering committee then broke down the concerns into the problems they cause for the watershed. They grouped together nitrogen and phosphorus problems as high nutrient levels. Many of the concerns result in the same problems, as shown in the table below.

Figure 102: Watershed Concerns and Problems

Concerns of the Watershed	Problems
Water Quality throughout the Watershed	High Nutrient Levels Sedimentation High E.coli Levels Degraded Habitat & Biodiversity
Contaminated Runoff entering Streams	High Nutrient Levels Sedimentation High E.coli Levels Degraded Habitat & Biodiversity
Livestock Access to Streams/Sensitive Areas	High Nutrient Levels Sedimentation High E.coli Levels Degraded Habitat & Biodiversity
Septic System Failures	High E.coli Levels High Nutrient Levels
Excessive Nutrients entering Streams	High Nutrient Levels

Concerns of the Watershed	Problems
Streambank Erosion	Sedimentation High Nutrient Levels Degraded Habitat & Biodiversity
Gully Erosion	Sedimentation High Nutrient Levels Degraded Habitat & Biodiversity
Sediment entering Streams	Sedimentation High Nutrient Levels Degraded Habitat & Biodiversity
Overgrazed Pastures	Sedimentation High Nutrient Levels High E.coli Levels Degraded Habitat & Biodiversity
No Residue/Cover on Fields	Sedimentation High Nutrient Levels Degraded Habitat & Biodiversity
Trash/Dumping Sites	Degraded Habitat & Biodiversity
Flooding	Sedimentation High Nutrient Levels Degraded Habitat & Biodiversity
Inadequate Riparian Buffers	Sedimentation High Nutrient Levels High E.coli Levels Degraded Habitat & Biodiversity

Finally, the steering committee analyzed the problems and came up with potential causes and sources for each of the problems, as well as the magnitude of each. See below for the results of the analysis.

Figure 103: Water Quality Concerns and Problems Analysis

Problem	Potential Causes	Potential Sources	Magnitude
Sedimentation	Sedimentation Total Suspended Solids (TSS) and Turbidity Levels Exceed Target	Erosion	526 Survey Sites Identifying Erosion – all subwatersheds Animal Access to Sensitive Areas – 84 Streambank - 108 Gully - 58 Sheet & Rill - 45 Overgrazed Pasture - 103 Heavy Use Area - 80 Heavy Tillage - 39 Unprotected Construction Site - 9
		Inadequate Buffers	46 Survey Sites – No Buffer HUC 501, 502, 503, 601
			26 Stream Miles – Aerial Imagery HUC -502, 501, 504, & 505

High Nutrient Levels	Nutrient Levels Exceed Target	Erosion	526 Survey Sites Identifying Erosion – all subwatersheds Animal Access to Sensitive Areas – 84 Streambank - 108 Gully - 58 Sheet & Rill - 45 Overgrazed Pasture - 103 Heavy Use Area - 80 Heavy Tillage - 39 Unprotected Construction Site - 9
		Animal Access to Sensitive Areas	84 Survey Sites Animal Access to Sensitive Areas HUC 604, 505, 502, & 605
		Failing Septic Systems	99% of watershed has very limited soils for septic systems
			Failing septic systems are listed as a potential source in the TMDL
		Improper Fertilizer/Manure Applications	Cropland – (fertilizer use) makes up 24% of the watershed (36,881 ac.)
			4.7% of watershed is developed – Excessive fertilizer use is a potential problem but no current data is available
			No current data available but the potential problem does exist with the amount of livestock present
High E.coli Levels	E.coli Levels Exceed Target	Animal Access to Sensitive Areas	84 Survey Sites Animal Access to Sensitive Areas HUC 604, 505, 502, & 605
		Failing Septic Systems	99% of watershed has very limited soils for septic systems
			Failing septic systems are listed as a potential source in the TMDL
		Improper Manure Applications	No current data available but potential problem exists with large amount of livestock present HUC 501, 502, 504, & 503
		Pet Waste	TMDL – Approx. 1,609 dogs & 2,081 cats – HUC 505, 601, 602, & 605
		Wildlife Waste	TMDL – All subwatersheds TMDL – Managed Land – 495 ac. Classified Land – 7,417.7 ac. HUC 502, 505, 603, 604, & 605

Degraded Habitat & Biodiversity	Sedimentation Nutrients Levels Exceed Target	Erosion	<u>526 Survey Sites Identifying Erosion – all subwatersheds</u> Animal Access to Sensitive Areas – 84 Streambank - 108 Gully - 58 Sheet & Rill - 45 Overgrazed Pasture - 103 Heavy Use Area - 80 Heavy Tillage - 39 Unprotected Construction Site - 9
		Animal Access to Sensitive Areas	84 Survey Sites Animal Access to Sensitive Areas HUC 604, 505, 502, & 605
		Failing Septic Systems	99% of watershed has very limited soils for septic systems
			Failing septic systems are listed as a potential source in the TMDL
		Improper Fertilizer/Manure Applications	Cropland – (fertilizer use) makes up 24% of the watershed (36,881 ac.)
			4.7% of watershed is developed – Excessive fertilizer use is a potential problem but no current data is available
			No current data available but the potential problem does exist with the amount of livestock present
		Inadequate Buffers	46 Survey Sites – No Buffer HUC 501, 502, 503, 601
			26 Stream Miles – Aerial Imagery HUC -502, 501, 504, & 505
		Dumping/Trash	36 Survey Site – Dumping Sites HUC – 604, 605, & 504

Watershed Pollutant Load Reductions

The Web-based Load Duration Curve (https://engineering.purdue.edu/mapserve/ldc/pldc/) was used to estimate the loads and reductions needed. The water quality data for each site, the USGS flow data from the Whitewater River gage at Brookville, and the project targets were all entered into the program. The water quality data from site T19 was used to calculate the loads for the Whitewater River Watershed, which included the Salt-Pipe Creek watershed area along with the upstream section of the Whitewater River watershed. The Salt-Pipe Creek watershed area comprises 28% of the calculated area, so the estimated loads were multiplied by 28% to determine the reductions needed for the Salt-Pipe Creek watershed. To estimate the required reductions, the water quality data was plotted on the load duration curve. Estimated current loads are derived from the 90th percentile of observed loads for each flow regime (90% of the observed values are lower than the value listed, 10% are higher). Estimated reductions needed for each flow regime, as well as an overall reduction, was calculated. The steering committee reviewed the calculations and decided to use the high flow regime figures, which include the most runoff and would be the most protective of the watershed.

Figure 104: Salt-Pipe Creek Watershed Pollutant Load Reductions

High Flow Regime	Target Load (lb/d)	Current Load (lb/d)	Required Reduction (%)	Reduction per day	Reduction per year	Salt-Pipe Reduction per year
Nitrate-Nitrite	20,468 lb/d	56,164 lb/d	63.56%	35,696 lb/d	13,029,193 lb/yr	**3,650,389 lb/yr**
Total Phosphorus	1,228 lb/d	3,778 lb/d	67.49%	2,550 lb/d	930,732 lb/yr	**260,763 lb/yr**
Total Suspended Solids	511,690 lb/d	1,293,464 lb/d	60.44%	781,774 lb/d	142,674 ton/yr	**39,973 ton/yr**

The committee also decided to use the % reductions needed for E.coli that are listed in the Southern Whitewater River TMDL. As shown below, reductions needed range from 32% to 99%.

Figure 105: Watershed % Reductions for E.coli

Subwatershed	Site #	Period of Record	Total # of Samples	% of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction Based on Maximum Value
Headwaters Salt Creek	T1	4/21/2014-10/20/2014	10	60	24,196	5,275.73	99.03
	T2	4/21/2014 – 10/20/2014	10	90	24,196	5,747.37	99.03
Righthand Fork	T3	4/21/2014-10/20/2014	10	80	2,419.6	984.01	90.29
	T4	4/21/2014-10/20/2014	10	70	2,419.6	1,013.58	90.29
	T6	4/21/2014-10/20/2014	10	40	5,475	922.57	95.71
	P12	7/15/2014-8/12/2014	5	100	4,611	1,690.76	94.90
Bull Fork	T5	4/21/2014-10/20/2014	10	30	2,419.6	402.17	90.29
	P6	7/15/2014-8/12/2014	5	40	344.8	186.04	31.84
Little Salt Creek	T8	4/21/2014-10/20/2014	10	80	2,419.6	846.04	90.29
	T9	4/21/2014-10/20/2014	10	10	4,352	483.29	94.60

Subwatershed	Site #	Period of Record	Total # of Samples	% of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction Based on Maximum Value
	P1	7/15/2014-8/12/2014	5	100	727	459.02	67.67
Fremont Branch	T7	4/21/2014 – 10/20/2014	10	30	6,488	820.56	96.38
	T10	4/21/2014-10/20/2014	10	30	579.4	209.57	59.44
Headwaters Pipe Creek	T17	4/21/2014 – 10/20/2014	7	86	2,419.6	1,109.06	90.29
	T18	4/21/2014-10/20/2014	7	86	2,419.6	1,006.99	90.29
Clear Fork	T15	4/21/2014-10/20/2014	9	10	2,419.6	318.1	90.29
Duck Creek	T12	4/21/2014-10/20/2014	7	29	12,997	3,767.6	98.19
Walnut Fork	T14	4/21/2014-10/20/2014	10	10	1,413.6	227.16	83.37
	T16	4/21/2014-10/20/2014	10	40	2,419.6	398.82	90.29
	P10	7/15/2014-8/12/2014	5	20	4,106	893.24	94.28
Yellow Bank Creek	T13	4/21/2014-10/20/2014	10	50	9,804	1,423.28	97.6
	T19	4/21/2014-10/20/2014	10	20	686.7	170.56	65.78
	P3	7/15/2014-8/12/2014	5	40	4,106	980.94	94.28
	P4	7/15/2014-8/12/2014	5	80	17,329	4,154.56	98.64
	P5	7/15/2014-8/12/2014	5	40	727	275.1	67.68
	P9	7/15/2014-8/12/2014	5	40	770.1	276.56	69.48

Salt-Pipe Creek Watershed Goals and Objectives

The Steering Committee used the reductions needed to come up with goal statements for nitrogen, phosphorous, sediment, and E. coli. The committee decided to set goals in 3 to 5 year increments to easily keep track of progress. Different practices and strategies can be used to improve water quality in a watershed and are often referred to as best management practices (BMPs). BMPs are effective, practical, structural or nonstructural methods which prevent or reduce the movement of sediment, nutrients, bacteria, and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of various land use activities.

Watershed Goals

Goal #1 – Nitrogen needs to be reduced within the watershed. Of the water samples collected, 49% (76/156) exceeded the target for NO_3-NO_2. The load reduction needed to meet the <1.0 mg/L target is 3,650,389 lbs/yr. We would like to see the following decreases:

Decrease the nitrogen load by 2% in 3 years (73,007 lbs)

Decrease the nitrogen load by 4% in 6 years (145,016 lbs)

Decrease the nitrogen load by 6% in 9 years (219,023 lbs)

Decrease the nitrogen load by 8% in 12 years (292,031 lbs)

Decrease the nitrogen load by 10% in 15 years (365,039 lbs)

Goal # 2 – Phosphorous needs to be reduced within the watershed. Of the water samples collected, 33% (51/156) exceeded the target. The load reduction needed to meet the <0.06 mg/L target for TP is 260,763 lbs/yr. We would like to see the following decreases:

Decrease the load of phosphorous by 20% in 3 years (52,153 lbs)

Decrease the load of phosphorous by 40% in 6 years (104,305 lbs)

Decrease the load of phosphorous by 60% in 9 years (156,458 lbs)

Decrease the load of phosphorous by 80% in 12 years (208,610 lbs)

Decrease the load of phosphorous by 100% in 15 years (260,763 lbs)

Goal #3 – Reduce soil erosion and amount of sedimentation entering the streams. Of the water samples collected, 22% (36/164) exceeded the TSS target. The load reduction needed to meet the <25 mg/L target is 39,973 tons/yr. We would like to see the following decreases:

Decrease the load of sediment by 20% in 3 years (7,995 tons)

Decrease the load of sediment by 40% in 6 years (15,973 tons)

Decrease the load of sediment by 60% in 9 years (23,984 tons)

Decrease the load of sediment by 80% in 12 years (31,978 tons)

Decrease the load of sediment by 100% in 15 years (39,973 tons)

Goal #4 – Reduce E. coli concentrations throughout the watershed not only to meet water quality target but to have the impaired stream segments delisted (382.6 miles). Of the water samples collected, 48% (101/210) exceeded the E. coli target of < 235 cfu/100mL and 77% (20/26) of the testing sites exceeded the geomean E. coli target of <125 cfu/100mL. E. coli reductions needed based on maximum value range from 31.84 to 99.03%. We would like to see the following decreases:

Decrease reductions needed to 55% or less in 15 years - Water quality monitoring by IDEM will serve as an indicator to determine progress towards E. coli target value

Exclude 150 head of livestock from the stream/sensitive areas in 3 years

Exclude 300 head of livestock from the stream/sensitive areas in 6 years

Exclude 450 head of livestock from the stream/sensitive areas in 9 years

Exclude 600 head of livestock from the stream/sensitive areas in 12 years

Exclude 750 head of livestock from the stream/sensitive areas in 15 years

Provide education through 6 workshops or publications every 3 years for the next 15 years – Topics covered may include septic system maintenance, proper septic system installation, importance of livestock restriction to sensitive areas, importance of maintaining adequate grazing heights in pasture to reduce the amount of runoff, and best management grazing practices that could help.

Goal #5 – Improve the water quality and habitat of the streams in the watershed to increase biodiversity of both macroinvertebrates and fish in 15 years.

Strive to achieve nutrient, sediment, and E. coli goals listed above

Delist the streams from IDEM's 303(d) list for impaired biotic communities

Install practices to protect or restore stream habitats

Increase macroinvertebrate and fish population and diversity so mIBI and IBI scores are passing (>35)

Improve stream habitat so QHEI scores are passing (>60)

Goal #6 – Increase public awareness and provide education on how individual choices and activities impact the watershed

Encourage partnerships and project involvement by creating and designating "Friends of Salt-Pipe Creek Watershed." Use signage to create public awareness of designation.

Educate and promote best management practices (BMPs) to landowners, operators, and public

Obtain funds and resources to conduct water monitoring testing to determine the species source of E. coli throughout the watershed

Goal #7 – Partner with government agencies and landowners on decreasing streambank erosion

Educate partners and landowners on the importance of buffers, increasing infiltration, and streambank stabilization

Seek out programs and funds to assist with efforts

Goal Objectives and Indicators

The Steering Committee developed a set of objectives and indicators for each of the watershed goals.

Goal #1 – Nitrogen needs to be reduced within the watershed. Of the water samples collected, 49% (76/156) exceeded the target for NO3-NO2. The load reduction needed to meet the <1.0 mg/L target is 3,650,389 lbs/yr. Decrease the nitrogen load by 2% (approx. 73,000 lbs.) every 3 years.

Goal # 2 – Phosphorous needs to be reduced within the watershed. Of the water samples collected, 33% (51/156) exceeded the target. The load reduction needed to meet the <0.06 mg/L target for TP is 260,763 lbs/yr. Decrease the load of phosphorous by 20% (approx. 52,150 lbs.) every 3 years.

Figure 106: Nutrients Goal Objectives & Indicators

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Cropland					
Educate landowners and operators on proper nutrient management and application	Education through publications and workshops	Landowners and Operators	Watershed, SWCD, and Partner Staff	2019-2034	# of publications distributed # of people attending workshops # of nutrient management plans developed # of nutrient management plans implemented lbs. of phosphorus and nitrogen from the calculated load reductions from BMPs installed Water quality improvement based on monitoring for P and N parameters
	Provide financial assistance to farmers for the development and implementation of nutrient management plans				

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Promote the use of cover crops on all cropland acres	Education through publications and field days Provide financial assistance to plant cover crops	Landowners and Operators	Watershed, SWCD, and Partner Staff	2019-2034	# of publications distributed # of people attending workshops # of acres planted to cover crops lbs. of phosphorus and nitrogen from the calculated load reductions from BMPs installed Water quality improvement based on monitoring for P and N parameters
Livestock					
Promote proper manure application	Education through publications and workshops Provide financial assistance to farmers for the development and implementation of nutrient management plans	Livestock Owners	Watershed, SWCD, and Partner Staff	2019-2034	# of publications distributed # of people attending workshops # of nutrient management plans developed # of nutrient management plans implemented lbs. of phosphorus and nitrogen from the calculated load reductions from BMPs installed Water quality improvement based on monitoring for P and N parameters

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Promote good pasture management by maintaining adequate grazing heights	Educate livestock owners on pasture management through publications and field days	Livestock Owners	Watershed, SWCD, and Partner Staff	2019-2034	# of publications # of people attending field days # of cost-share participants implementing an improved pasture management plan lbs. of phosphorus and nitrogen from the calculated load reductions from BMPs installed Water quality improvement based on monitoring for P and N parameters # of prescribed grazing plans implemented
	Provide financial assistance to implement improved pasture management systems				
Urban					
Promote proper nutrient management	Education through publications and workshops	General public	Watershed, SWCD, and Partner Staff	2019-2034	# of publications # of people attending workshops # of people in the watershed that pledge to do various activities on the Clear Choices, Clean Water website – covering fertilizer, septic maintenance, and several other items.

Goal #3 – Reduce soil erosion and amount of sedimentation entering the streams. Of the water samples collected, 22% (36/164) exceeded the TSS target. The load reduction needed to meet the <25 mg/L target is 39,973 tons/yr. Decrease the load of sediment by 20% every 3 years.

Figure 107: Sedimentation Goal Objectives & Indicators

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Cropland					
Plant cover crops on HEL fields	Education through field days/workshops Education through publications Provide financial assistance to plant cover crop	Agricultural landowners and operators	Watershed, SWCD, and Partner Staff	2019 - 2034	# of people attending workshops # of publications distributed # of acres planted Tons of sediment calculated from the load reductions of BMPs installed Water quality improvement based on monitoring for turbidity and TSS parameters
Increase the number of acres being no-tilled	Education through workshops and field days Education through publications Provide financial assistance to landowners who convert from tillage to no-till	Agricultural landowners and operators	Watershed, SWCD, and Partner Staff	2019 - 2034	# of people attending workshops # of publications distributed # of acres converted Change in tillage transect data Tons of sediment calculated from the load reductions of BMPs installed Water quality improvement based on monitoring for turbidity and TSS parameters

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Establish buffers in sensitive areas	Provide financial assistance to landowners to establish grassed waterways Provide financial assistance to landowners to establish filter strips	Agricultural landowners and operators	Watershed, SWCD, and Partner Staff	2019 - 2034	# of landowners enrolled in cost-share programs for buffers # of feet of buffers installed Tons of sediment calculated from the load reductions of BMPs installed Water quality improvement based on monitoring for turbidity and TSS parameters
Pasture/Hay					
Reduce acres of overgrazed pasture	Educate livestock owners on stocking density through publications and field days Educate livestock owners on proper overwintering practices through field days and publications Provide financial assistance to implement prescribed grazing plans	Landowners with livestock	Watershed, SWCD, and Partner Staff	2019 - 2034	# of people attending field days # of publications distributed # of prescribed grazing plans implemented Tons of sediment calculated from the load reductions of BMPs installed Water quality improvement based on monitoring for turbidity and TSS parameters

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Reduce livestock access to sensitive areas along streams and woodlands	Education through publications	Landowners with livestock	Watershed, SWCD, and Partner Staff	2019 - 2034	# of publications # of head removed from sensitive areas Tons of sediment calculated from the load reductions of BMPs installed Water quality improvement based on monitoring for turbidity and TSS parameters
	Provide financial assistance for fencing and watering systems				
Natural Areas					
Increase riparian buffers along streams	Education through workshops and publications	Landowners	Watershed, SWCD, and Partner Staff	2019 - 2034	# of landowners who attended workshops # acres and length of established buffers Tons of sediment calculated from the load reductions of BMPs installed Water quality improvement based on monitoring for turbidity and TSS parameters
	Provide financial assistance to establish riparian buffers				
Urban					
Promote the use of urban best management practices	Educate urban landowners about best management practices that would help reduce runoff through publications and workshops	Urban Landowners	Watershed, SWCD, and Partner Staff	2019 - 2034	# of publications # of people who attend workshops USGS Flow – Volume of Runoff

Goal #4 – Reduce E. coli concentrations throughout the watershed not only to meet water quality targets but to have the impaired stream segments delisted (382.6 miles). Of the water samples collected, 48% (101/210) exceeded the E. coli target of < 235 cfu/100mL (single sample maximum) and 77% (20/26) of the testing sites exceeded the geomean E. coli target of <125 cfu/100mL. E. coli reductions needed based on maximum value range from 31.84 to 99.03%. Decrease reductions needed by 15% every 5 years or less

Figure 108: E. coli Goal Objectives & Indicators

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Livestock					
Fence livestock away from streams and ponds	Educate livestock owners on the importance of access control through publications Provide financial assistance for exclusion and alternative watering systems	Livestock Owners	Watershed, SWCD, and Partner Staff	2019-2034	# of publications # farmers willing to exclude livestock # of head excluded Water quality improvement based on monitoring for E. coli #/amount of exclusion fences installed
Promote good pasture management by maintaining adequate grazing heights	Educate livestock owners on pasture management through publications and field days Provide financial assistance to implement improved pasture management systems	Livestock Owners	Watershed, SWCD, and Partner Staff	2019-2034	# of publications # of people attending field days # of cost-share participants implementing an improved pasture management plan Water quality improvement based on monitoring for E. coli #/amount of improved pasture BMPs implemented

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Septic System/Sewage					
Educate homeowners and renters about the importance of septic system maintenance and proper working conditions	Develop and distribute publications about septic system maintenance	Homeowners and Renters	Watershed, SWCD, and Partner Staff	2019-2022	# of publications distributed # of people who attend workshops Water quality improvement based on monitoring for E. coli
	Hold Septic System workshops				
Educate septic contractors and developers on appropriate sites feasible for septic system functionality	Hold workshops on proper site selection and installation	Contractors and Developers	Watershed, SWCD, and Partner Staff	2019-2024	# of people attending workshops
Work with local sewer districts on extending service to problem areas with failing systems	Assist in identifying priority areas	Local Sewer Districts and Public Officials	Watershed, SWCD, and Partner Staff	2019-2029	# of priority areas identified # of failing systems hooked onto service Water quality improvement based on monitoring for E. coli
	Provide data and support for funding				

Goal #5 – Improve the water quality and habitat of the streams in the watershed to increase biodiversity of both macroinvertebrates and fish in 15 years.

Strive to achieve nutrient, sediment, and E. coli goals listed above

Delist the streams from IDEM's 303(d) list for impaired biotic communities

Install practices to protect or restore stream habitats

Increase macroinvertebrate and fish population and diversity so mIBI and IBI scores are passing (>35)

Improve stream habitat so QHEI scores are passing (>60)

Figure 109: Habitat & Biodiversity Goal Objectives & Indicators

Objective	Action - Cost	Target Audience	Performed By	Time Schedule	Indicator
Habitat and Biodiversity					
Improve water quality and habitat to obtain passing mIBI, IBI, and QHEI scores and delist streams currently on IDEM's 303(d) list for IBC	Provide financial assistance to install riparian buffers Provide financial assistance for BMPs that reduce nutrient and sediment loading Monitor changes in populations and habitat	Generals Public, Landowners, Public Officials, and Local Agencies	Watershed, SWCD, IDEM, and Partner Staff	Within 15 years	# of stream segments delisted for IBC mIBI scores QHEI scores # of feet of riparian buffers installed Reduction of sediment and nutrients

Goal #6 – Increase public awareness and provide education on how individual choices and activities impact the watershed

Encourage partnerships and project involvement by creating and designating "Friends of Salt-Pipe Creek Watershed". Use signage to create public awareness of designation.

Educate and promote best management practices to landowners, operators, and public

Obtain funds and resources to conduct water monitoring testing to determine the species source of E. coli throughout the watershed. Approximately 70% of the watershed is impaired by E. coli. When the species sources are identified, the project can address the problem more effectively through education and implementing BMPs specific to the source.

Figure 110: Public Education and Outreach Goal Objectives & Indicators

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
		Outreach			
Encourage partnerships and project involvement by creating and designating "Friends of Salt-Pipe Creek Watershed". Use signage to create public awareness of designation.	Obtain partners and volunteers	Landowners, Organizations, and General Public	Watershed, SWCD, and Partner Staff	2019-2034	# of partners # of volunteers # of signs distributed
		Education			
Educate and promote best management practices to landowners, operators, and public	Hold educational events/workshops	Landowners, Operators, and General Public	Watershed, SWCD, and Partner Staff	2019-2034	# of events/workshops held # of people attending
	Develop and distribute publications on best management practices				# of publications distributed
		E. coli Testing			
Obtain funds and resources to conduct water monitoring testing to determine the species source of E. coli throughout the watershed	Obtain funds and resources	General Public	Watershed, SWCD, and Partner Staff	2019-2024	E. coli species results
	Educate and implement bmps specific to the identified source	Landowners, Operators, and General Public			# of publications distributed # of workshops held # of people attending # of BMPs installed

Goal #7 – Partner with government agencies and landowners on decreasing streambank erosion

Educate partners and landowners on the importance of buffers, increasing infiltration, and streambank stabilization

Seek out programs and funds to assist with efforts

Figure 111: Streambank Stabilization Goal Objectives & Indicators

Objective	Action	Target Audience	Performed By	Time Schedule	Indicator
Streambank Stabilization					
Educate partners and landowners on the importance of buffers, increasing infiltration, and streambank stabilization.	Hold events/workshops on topics	Landowners, Organizations, and General Public	Watershed, SWCD, and Partner Staff	2019-2034	# of events/workshops held
	Develop and distribute publications on topics				# of publications distributed
Seek out programs and funds to assist with efforts of goal	Find partners and resources and obtain needed funds	Landowners, Organizations, and General Public	Watershed, SWCD, and Partner Staff	2019-2034	# of partners/resources # of funds obtained

Identification of Watershed Critical Areas

One of the most crucial steps in watershed management planning is defining the critical areas in the project. For our purposes, a critical area is an area in the watershed which has the worst water quality, produces high pollutant loads, and where best management practices are needed the most.

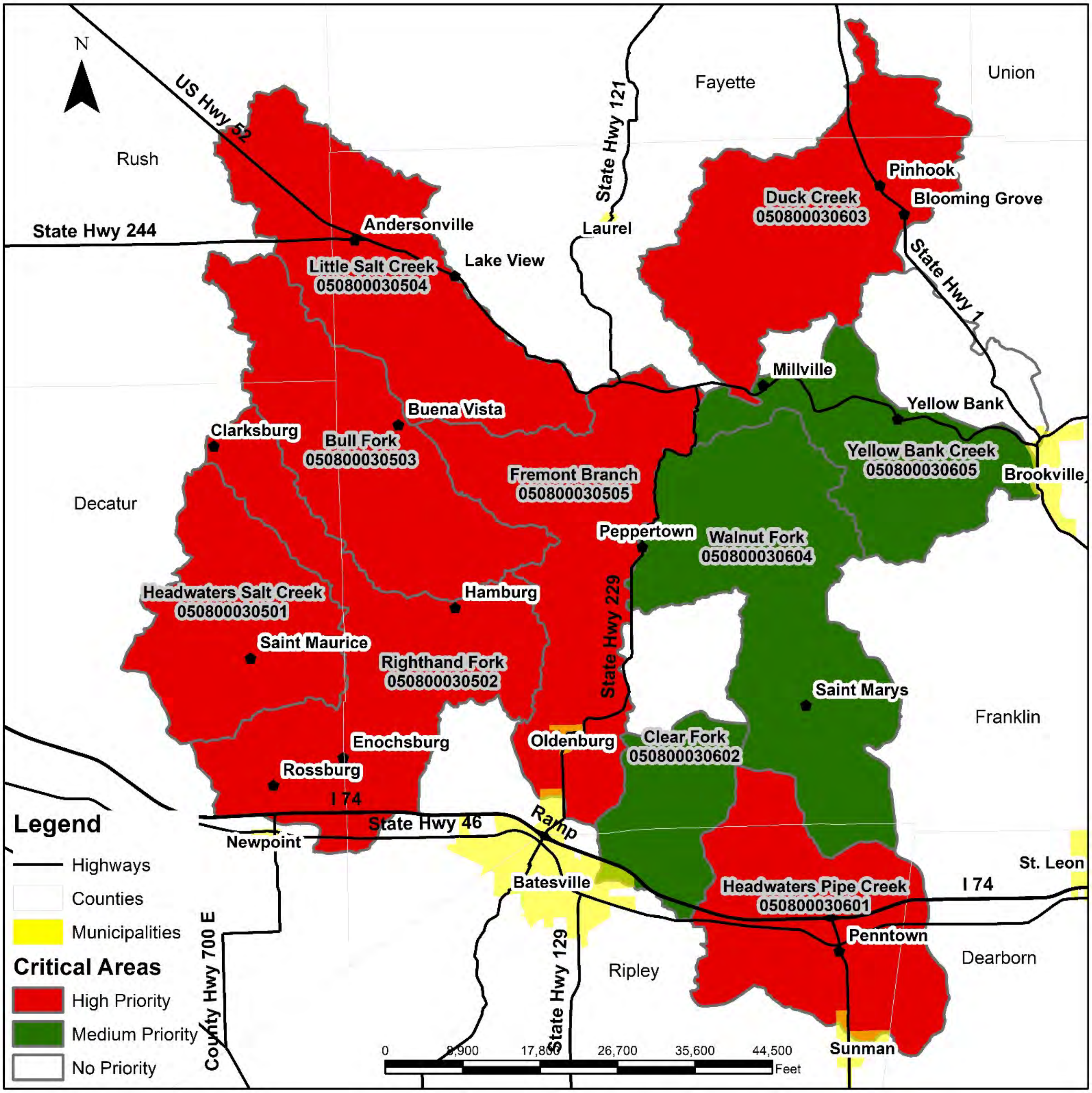
There are a variety of ways to determine and prioritize critical areas, and the Salt-Pipe Creek Watershed project considered a variety of criteria and factors in determining which subwatershed and areas would be defined as critical areas and their priority level. Water monitoring data in the form of nutrient, dissolved oxygen, sediment, E. coli data, and biology was used to compare subwatersheds to one another. Biological data was compared in various subwatersheds to determine overall quality of aquatic life. Habitat data in the form of indexes and windshield surveys were considered. Data covering land use types, current practices in the watershed, windshield survey data, and individual account and recommendations were all factored into the ranking process. The Salt-Pipe Creek Steering Committee analyzed the overall data available for the subwatersheds and the individual monitoring sites located in each subwatershed to determine what areas in the watershed should be designated as critical. After reviewing the information, the steering committee decided to designate the subwatersheds of Headwaters of Salt Creek (501), Righthand Fork (502), Bull Fork (503), Little Salt Creek (504), Fremont Branch (505), Headwaters of Pipe Creek (601), and Duck Creek (603) as *high priority critical areas*. Walnut Fork (604) and southern sections of Clear Fork (602), and Yellow Bank Creek (605) were designated as medium priority critical areas. The northern sections of Clear Fork (602) and Yellow Bank Creek (605) were designated as *no priority*. All of the subwatersheds have impaired waterbodies on the 2016 303(d) list. Clear Fork and Yellow Bank Creek subwatersheds have the lowest percentages of stream impaired, at 22% and 44% respectively. The northern sections of the subwatersheds that are designated as *no priority* do not have any impaired streams. To clarify, a designation of *no priority* does not mean there is no need for improvement or that there aren't resource concerns to address. EPA's planning guidance states that the entire watershed cannot be considered critical. The project and other organizations could also obtain funding through sources other than Section 319 to implement BMPs in these areas. The table below illustrates the summary of the data used to prioritize the critical areas of the watershed. The subwatershed column is also color coded to identify the priority level with red = high, green = medium, and white = no priority. The map below shows the critical areas and their priority level.

Figure 112: Subwatershed Critical Area Determination Data Summary

Subwatershed	**Landuse %**			**# of Livestock**	**% of Impaired Stream Miles on 303(d) List**	**Number of Samples Not Meeting Target / %**								**Inadequate Buffers - Miles**	**Total Findings on Windshield Survey**	**Primary Resource Concerns (Windshield Survey)**
	Agriculture	**Pasture**	**Forest**			**Dissolved Oxygen**	**Nitrite & Nitrate**	**Totlal Kjeldahl Nitrogen**	**Total Phosphorus**	**E. coli**	**Total Suspended Solids**	**Turbidity**	**E.coli Geomean**			
Headwaters of Salt Creek - 501	47	16	31	8,816	100	1/ 9%	3/ 50%	1/ 17%	1/ 17%	6/ 60%	2/ 29%	3/ 27%	1/ 100%	4.3	41	No Buffer – Crop Heavy Tillage
Righthand Fork - 502	28	15	48	5,223	79	10/ 18%	20/ 63%	9/ 28%	18/ 56%	33/ 73%	3/ 8%	31/ 54%	5/ 100%	5.3	81	Overgrazed Pasture, Heavy Tillage Heavy Use Area
Bull Fork - 503	28	12	55	3,309	80	1/ 5%	5/ 56%	1/ 11%	0/ 0%	5/ 33%	0/ 0%	6/ 30%	2/ 100%	1.9	52	Streambank – Natural, Overgrazed Pasture, and No Buffer - Crop
Little Salt Creek - 504	36	11	48	4,229	73	3/ 9%	8/ 50%	3/ 19%	3/ 19%	14/ 56%	3/ 18%	7/ 22%	2/ 67%	3.2	39	Sheet & Rill – Crop, Animal Access – Stream, and Dumping Site
Fremont Branch - 505	14	14	67	2,117	55	7/ 26%	7/ 39%	0/ 0%	5/ 28%	6/ 30%	4/ 21%	18/ 67%	2/ 100%	3.2	93	Overgrazed Pasture, Streambank – Natural, Heavy Use Area, and Animal Access - Stream
Headwaters Pipe Creek - 601	34	21	37	1,978	93	3/ 19%	2/ 20%	6/ 60%	5/ 50%	12/ 86%	1/ 10%	10/ 63%	2/ 100%	1.5	78	Overgrazed Pasture, Gully – Crop, Streambank - Natural

Subwatershed	Landuse %			# of Livestock	% of Impaired Stream Miles on 303(d) List	Number of Samples Not Meeting Target / %								Inadequate Buffers - Miles	Total Findings on Windshield Survey	Primary Resource Concerns (Windshield Survey)
	Agriculture	Pasture	Forest			Dissolved Oxygen	Nitrite & Nitrate	Totlal Kjeldahl Nitrogen	Total Phosphorus	E. coli	Total Suspended Solids	Turbidity	E.coli Geomean			
Clear Fork – 602 (partial)	26	20	47	1,386	44	0/ 0%	1/ 17 %	1/ 17%	1/ 17 %	1/ 11 %	1/ 17%	1/ 10 %	NA	1.3	26	Heavy Use Area, No Buffer – Crop, and Streambank – Natural
Duck Creek – 603	20	12	62	2,227	100	1/ 14 %	2/ 33 %	2/ 33%	2/ 33 %	2/ 29 %	2/ 33%	3/ 43 %	NA	1.6	50	Heavy Use Area, Streambank – Natural, and Overgrazed Pasture
Walnut Fork – 604	11	13	72	2,543	72	5/ 14 %	2/ 9%	2/ 9%	3/ 14 %	5/ 20 %	3/ 14%	16/ 43 %	3/ 100 %	1.4	94	Overgrazed Pasture, Animal Access – Stream, Heavy Use Area, and Streambank - Natural
Yellow Bank Creek – 605 (partial)	12	13	68	2,205	22	8/ 12 %	26/ 84 %	9/ 29%	13/ 42 %	17/ 43 %	17/ 55%	42/ 63 %	2/ 33%	2.3	59	Heavy Use Area, Streambank – Natural, Overgrazed Pasture, and Dumping Site

Figure 113: Map of Watershed Critical Areas



Best Management Practices

Different practices and strategies can be used to improve water quality in a watershed and are often referred to as best management practices. BMPs are effective, practical, structural or nonstructural methods which prevent or reduce the movement of sediment, nutrients, bacteria, and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of various land use activities. These practices are developed to achieve a balance between water quality protection, conservation, and the land production within natural and economic limitations. Each parcel of land in the watershed is unique and faces its own challenge or challenges. Therefore, there may be more than one applicable BMP for meeting the challenges of that particular area. The right BMPs are ones that are practical and economical while maintaining and improving both water quality and the productivity of the land. The following are BMPs which would be beneficial in improving the water quality of the Salt-Pipe Creek watershed.

Agricultural Best Management Practices

Agricultural best management practices are implemented on agricultural lands, typically row crop agricultural lands and pastures, in order to protect water resources and aquatic habitat while improving land resources and quality. These practices control nonpoint source pollutants, reducing their loading to the Salt-Pipe Creek Watershed by minimizing the volume of available pollutants. Potential agricultural best management practices designed to control and trap agricultural nonpoint sources of pollution include:

- Alternate Watering Systems
- Riparian Buffer Strips (Shrub/Tree)
- Conservation Tillage (No till end goal)
- Cover Crops
- Drainage Water Management
- Filter Strips (grass)
- Hay/Pasture Planting
- Livestock Restriction or Rotational Grazing
- Manure Management
- Nutrient Management
- Roof runoff & collection structures
- Heavy Use Area Protection
- Access Roads

These practices are appropriate for all of the subwatersheds, since the watershed is mostly agricultural. In addition, crop and pasture resource concerns were observed in every subwatershed during the windshield survey. Priority for BMP implementation will be based on the ranking of the critical areas: (High – Headwaters of Salt Creek (501), Righthand Fork (502), Bull Fork (503), Little Salt Creek (504), Fremont Branch (505), Headwaters of Pipe Creek (601), and Duck Creek (603)), (Medium - Walnut Fork (604) and southern sections of Clear Fork (602), and Yellow Bank Creek (605)), and (No Priority - northern sections of Clear Fork (602) and Yellow Bank Creek (605)). The *high priority* critical areas will receive funding first.

Alternate Watering Systems

Alternative watering systems provide an alternate location for livestock to seek water rather than using a surface water source. This removes the negative impacts of livestock access to streams including direct deposit of manure and bank erosion and destabilization, while improving the health of livestock by providing a clean water source and better footing while drinking. This results in less E. coli, phosphorus, nitrogen, and sediment entering a surface waterbody. Two main types of alternative watering systems are used including pump systems and gravity systems.

Riparian Buffer Strips/Filter Strips

Installing natural buffers or filters along major and minor drainages and sinkholes in the watershed helps reduce the nutrient and sediment loads reaching surface and subsurface waterbodies. Buffers provide many benefits including restoring hydrologic connectivity, reducing nutrient and sediment transport, improving recreational opportunities and aesthetics, and providing wildlife habitat. Sediment, phosphorus, nitrogen, and E. coli are at least partly removed from water passing through a naturally vegetated buffer. The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff, and the character of the buffer area. The most effective buffer width can vary along the length of a channel. Adjacent land uses, topography, runoff velocity, and soil and vegetation types are all factors used to determine the optimum buffer width.

Many researchers have verified the effectiveness of filter strips in removing sediment from runoff with reductions ranging from 56-97% (Arora et al., 1996; Mickelson and Baker, 1993; Schmitt et al., 1999; Lee et al, 2000; Lee et al., 2003). Most of the reduction in sediment load occurs within the first 15 feet of installed buffer. Smaller additional amounts of sediment are retained and infiltration is increased by increasing the width of the strip (Dillaha et al., 1989). Filter strips have been found to reduce sediment-bound nutrients like total phosphorus but to a lesser extent than they reduce sediment load itself. Phosphorus predominately associates with finer particles like silt and clay that remain suspended longer and are more likely to reach the strip's outfall (Hayes et al., 1984). Filter strips are least effective at reducing dissolved nutrients like those of nitrate and phosphorus, and atrazine and alachlor, although reductions of dissolved phosphorus, atrazine, and alachlor of up to 50% have been documented (Conservation Technology Information Center, 2000). Simpkins et al. (2003) demonstrated 20-93% nitrate-nitrogen removal in multispecies riparian buffers. Short groundwater flow paths, long residence times, and contact with fine textured sediments favorably increased nitrate-nitrogen removal rates. Additionally, up to 60% of pathogens contained in runoff may be effectively removed. Computer modeling also indicates that over the long run (30 years), filter strips significantly reduce amounts of pollutants entering waterways.

Both filter strips and buffer strips should be designed as permanent plantings to treat runoff and should not be considered part of the annual rotation of adjacent cropland. Filter strips should receive only sheet flow, and they should be installed on stable banks. A mixture of grasses, forbs, and herbaceous plants should be used. In more permanent plantings, shrubs and trees should be intermingled to form a stable riparian community.

Conservation Tillage

Conservation tillage refers to several different tillage methods or systems that leave at least 30% of the soil covered with crop residue after planting (Holdren et al., 2001). Tillage methods encompassed by conservation tillage include no-till, mulch-till, ridge-till, zero till, slot plant, row till, direct seeding, or strip till. The purpose of conservation tillage is to reduce sheet and rill erosion, maintain or improve soil organic matter content, conserve soil moisture, increase available moisture, reduce plant damage, and provide habitat and cover for wildlife. The remaining crop residue helps reduce soil erosion and runoff volume.

Several researchers have demonstrated the benefits of conservation tillage in reducing pollutant loading to streams and lakes. A comprehensive comparison of tillage systems showed that no-till results in 70% less herbicide runoff, 93% less erosion, and 69% less water runoff volume when compared to conventional tillage (Conservation Technology Information Center, 2000). Reductions in pesticide loading have also been reported (Olem and Flock, 1990).

Cover Crops

Cover crops include legumes, such as clover, hairy vetch, field peas, alfalfa, and soybean, and non-legumes, such as rye, oats, wheat, radishes, turnips, and buckwheat which are planted prior to or following crop harvest. Cover crops are typically grown for one season and are typically grown in non-cropping seasons. Cover crops are used to improve soil quality and future crop harvest by improving soil tilth, reducing wind and water erosion, increasing available nitrogen, suppressing weed cover, and encouraging beneficial insect growth. Cover crops reduce phosphorus transport by reducing soil erosion and runoff. Both wind and water erosion move soil particles that have phosphorus attached. Sediment that reaches water bodies may release phosphorus into the water. The cover crop vegetation recovers plant-available phosphorus in the soil and recycles it through the plant biomass for succeeding crops. Runoff water can wash soluble phosphorus from the surface soil and crop residue and carry it off the field. Cover crops are a familiar conservation practice throughout the watershed. Additional operators will likely consider this practice beneficial as information on benefits of reduced fertilizer use become available.

Drainage Water Management

Subsurface tile drainage is an essential water management practice on highly productive fields. As a result of tile drainage, nitrate carried in drainage water enters adjacent surface waterbodies. Drainage water management is necessary to reduce nitrate loads entering adjacent surface waterbodies from tile drainage networks. Drainage water management uses water control structures within lateral drains to vary the depth of tile outlets. Typically, the outlet is raised after harvest to limit outflow from the tile and reduce nitrate transport to adjacent waterbodies; lowered in the spring and fall to allow tile water to flow freely from the field to adjacent waterbodies; and raised in the summer to help store water making it available for crops (Frankenberger et al., 2006). Drainage water management can be used in concert with a suite of other conservation practices including cover crops and conservation tillage. This practice is only feasible in the watershed's flatter terrain where cropland is predominant. The main areas with tiled cropland are in Rush, northern Decatur, and Ripley counties.

Grassed Waterways

Grassed waterways are natural or constructed channels established for transport of concentrated flow at safe velocities using adequate channel dimensions and proper vegetation. They are generally broad and shallow by design to move surface water across farmland without causing soil erosion. Grassed waterways are used as outlets to prevent rill and gully formation. The vegetative cover slows the water flow, minimizing channel surface erosion. When properly constructed, grassed waterways can safely transport large water flows downslope. These waterways can also be used as outlets for water released from contoured and terraced systems and from diverted channels. This BMP can reduce sediment concentrations of nearby waterbodies and pollutants in runoff. The vegetation improves the soil aeration and water quality due to its nutrient removal through plant uptake and absorption by soil. The waterways can also provide wildlife corridors and allows more land to be natural areas.

Hay/Pasture Planting

This practice applies to all lands suitable to the establishment of annual, biennial or perennial species for forage or biomass production. This practice does not apply to the establishment of annually planted and harvested food, fiber, or oilseed crops. This practice has many benefits which includes: improve or maintain livestock nutrition and/or health, provide or increase forage supply during periods of low forage production, reduce soil erosion, improve soil and water quality, and produce feedstock for biofuel or energy production.

Livestock Restriction or Rotational Grazing – (Fencing)

Livestock that have unrestricted access to a stream or wetland have the potential to degrade the waterbody's water quality and biotic integrity. Livestock can deliver nutrients and pathogens directly to a waterbody through defecation. Livestock also degrade stream ecosystems indirectly. Trampling and removal of vegetation through grazing of riparian zones can weaken banks and increase the potential for bank erosion. Trampling can also compact soils in a wetland or riparian zone decreasing the area's ability to infiltrate water runoff. Removal of vegetation in a wetland or riparian zone also limits the area's ability to filter pollutants in runoff. The degradation of a waterbody's water quality and habitat typically results in the impairment of the biota living in the waterbody.

Restoring areas impacted by livestock grazing often involves several steps. First, the livestock in these areas should be restricted from the waterbody or stream to which they currently have access. If necessary, an alternate source of water should be created for the livestock. Second, the wetland or riparian zone where the livestock have grazed should be restored. This may include stabilizing or reconstructing the banks using bioengineering techniques. Minimally, it involves installing filter strips along banks or wetland edge and replanting any denuded areas. Finally, if possible, drainage from the land where the livestock are pastured should be directed to flow through a constructed wetland to reduce pollutant loading, particularly nitrate-nitrogen loading, to the adjacent waterbody. Complete restoration of aquatic areas impacted by livestock will help reduce pollutant loading, particularly nitrate-nitrogen, sediment, and pathogens.

A livestock exclusion system is a system of permanent fencing (board, barbed, etc) installed to exclude livestock from streams and areas, not intended for grazing. This will reduce erosion, sediment, and nutrient loading, and improve the quality of surface water. Education and outreach programs focusing on rotational grazing and exclusionary fencing are important in the success of this BMP.

Manure Management

Large volumes of manure are generated by both small, unregulated animal operations and by confined feeding operations located throughout the Salt-Pipe Creek Watershed. With new rules in place by Indiana State Chemist Office in 2012, manure management plans are required for anyone planning on spreading manure on fields. The new rules determine the need for waste utilization plans, use and length of staging areas, and setbacks for applications. Many entities have manure management plans in place and are currently using these plans to manage the volume of manure produced on their facility. Manure management planning includes consideration of the volume and type of manure produced annually, crop rotations by field, the volume of manure and nutrients needed for each crop, field slope, soil type and manure collection, transportation, storage, and distribution methods. Manure management planning uses similar techniques to nutrient management planning concerning nutrient budgets. Managing manure also includes facilities and proper storage of manure. Structures to assist with the protection of manure runoff may be offered to producers with a resource need.

Animal waste is a major source of pollution to waterbodies. To protect the health of aquatic ecosystems and meet water quality standards, manure must be safely managed. Good management of manure keeps livestock healthy, returns nutrients to the soil, improves pastures and gardens, and protects the environment, specifically water quality. Poor manure management may lead to sick livestock, unsanitary and unhealthy conditions for humans and other organisms, and increased insect and parasite populations. Proper management of animal waste can be done by implementing BMPs, through safe storage, by application as a fertilizer, and through composting. Proper manure management can effectively reduce E.coli concentrations, nutrient levels, and sedimentation. Manure management can also be addressed in education and outreach to encourage farmers to participate in this BMP.

Nutrient Management

Nutrient management is the management of the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments to minimize the transport of applied nutrients into surface water or groundwater. Nutrient management seeks to supply adequate nutrients for optimum crop yield and quantity, while also helping to sustain the physical, biological, and chemical properties of the soil. A nutrient budget for nitrogen, phosphorus, and potassium is developed considering all potential sources of nutrients including, but not limited to, animal manure, commercial fertilizer, crop residue, and legume credits. Realistic yields are based on soil productivity information, potential yield, or historical yield data based on a 5-year average. Nutrient management plans specify the form, source, amount, timing, and method of application of nutrients on each field in order to achieve realistic production levels while minimizing transport of nutrients to surface and/or groundwater. Nutrient management plans may consider the use of Nitrogen Stabilizers as a method to retain nitrogen in the fields for crop production and decrease the amount of nitrogen leaving fields through leaching and runoff to nearby surface or subsurface channels.

The advances in technology have made it possible to improve accuracy in planting and applying fertilizers, manure, and pesticides. Upgrading systems to these newer technologies would give the added benefit of reduced use of these products and would allow for the reduction of runoff of these products to the streams and sinkholes within the watershed. Upgrades to existing equipment would include variable rate technology system, GPS system upgrades or variable rate manure application upgrades. Other possible benefits would be from auto swath and auto steer equipment upgrades. These systems would prevent over applications and prevent applications from going in undesirable areas. Producers must follow regulations and setback requirements from sensitive areas like sinkholes and streams when applying fertilizer to the land.

Roof runoff and collection structures

Runoff from impervious surfaces like roofs can carry a significant amount of nonpoint source pollutants to nearby streams. It is recommended that structures that collect, control, and transport precipitation from roofs be installed to reduce this effect. A container that collects and stores rainwater from rooftops (via gutters and downspouts) for later use for irrigation, livestock watering, or slow release during dry periods is recommended. Rain is a naturally soft water and devoid of minerals, chlorine, fluoride, and other chemicals. Collection structures, like cisterns, help to reduce peak volume and velocity of stormwater runoff to streams.

As conservation practices are implemented throughout the watershed, a continuous pollutant load reduction total can be calculated using the StepL and Region5 load reduction tools. These pollutant loads can be recorded so that progress can be tracked for the purpose of verifying when watershed pollutant load reduction goals are achieved, both short-term and long-term. See the following figure for expected load reductions for agricultural bmps.

Heavy Use Area Protection

Heavy Use Area Protection is used to stabilize a ground surface that is frequently and intensively used by people, animals, or vehicles. Natural vegetation cannot withstand intense use so the area becomes unstable and vulnerable to erosion. These intensely used areas are very common in grazing systems around the water tanks and feeding areas, especially during the winter when all vegetation is dormant.

Access Roads

An access road is used to provide a fixed route for vehicular travel for resource activities involving the management of timber, livestock, agriculture, wildlife habitat, and other conservation enterprises. Access roads will be designed to serve the enterprise or planned use with the expected vehicular or equipment traffic. The type of vehicle or equipment, speed, loads, soil, climatic, and other conditions under which vehicles and equipment are expected to operate need to be considered.

Figure 114: Agricultural BMP Expected Load Reductions

Practices	Amount	Sediment (T/yr)	Phosphorus (lbs./yr)	Nitrogen (lbs./yr)	Target Amount to Install	Targeted Subwatersheds
Alternate Watering Systems	1 acre	3	4	8.5	3,750 acres (@75 systems)	**High Priority:** Headwaters Salt Creek – 050800030501 Righthand Fork – 050800030502 Bull Fork – 050800030503 Little Salt Creek – 050800030504 Fremont Branch – 050800030505 Headwaters Pipe Creek 050800030601 Duck Creek – 050800030603 **Medium Priority:** Clear Fork (partial) – 050800030602 Walnut Fork – 050800030604 Yellow Bank Creek (partial) – 050800030605
Buffer Strip (Shrub/Tree)	1 acre	9	9	17	2.3 acres	
Conservation Tillage/No till	1 acre	11	9	12	3,000 acres	
Cover Crop	1 acre	1.7	2.6	5.1	22,500 acres	
Drainage Water Management	1 acre	0.5	1.4	7.9	3,000 acres	
Filter Strip (grass)	1 acre	9	9	17	10 acres	
Livestock Restriction or Rotational Grazing (Fencing)	1 acre	3	4	8.5	3,750 acres	
Grassed Waterway	0.1 acre	18	18	36	75 acres	
Hay/Pasture Planting	1 acre	17.6	17.9	35.7	1,000 acres	
Manure Management	1 acre	NA	5	35.2	750 acres	
Nutrient Management	1 acre	4	0.7	NA	6,000 acres	
Roof Runoff & Structures	1 unit	NA	454	NA	20 units	
Heavy Use Area Protection	1 HUAP	90	67	134	60 HUAPs	
Access Road	100’	8.5	6.5	13.5	8,000 feet	

Urban Management Practices

The Salt-Pipe Creek watershed is mostly rural but contains the lake community of Lake Santee, as well as Oldenburg and the edges of Batesville, Brookville, and Sunman. In these areas, the installation of urban BMPs would be beneficial. These developed areas have impervious surfaces which can increase the volume and velocity of the stormwater entering the streams of the Salt-Pipe Creek watershed. The best way to mitigate stormwater impacts is to infiltrate, store, and treat stormwater onsite before it can run off into the streams in the area. Urban best management practices designed to complete these actions are as follows:

- Bioretention Practices
- Detention Basins
- Grass Swales
- Phosphorus-free Fertilizers
- Rain Barrels/ Cisterns
- Rain Gardens
- Trash Control and Removal
- Urban Wildlife Population Control

These practices would mainly be feasible for the subwatersheds of Righthand Fork, Fremont Branch, Yellow Bank Creek, and Headwaters of Pipe Creek, since they contain the watershed's urban areas.

Bioretention Practices

Bioretention practices use biofiltration or bioinfiltration to filter runoff by storing it in shallow depressions. Bioretention uses plant uptake and soil permeability mechanisms in a variety of manners typically in combination. Potential practices include sand beds, pea gravel, overflow structures, organic mulch layers, plant materials, gravel underdrains, and an overflow system to promote infiltration. Bioinfiltration can also be used to treat runoff from parking lots, roads, driveways and other areas in the urban environment. Bioretention should not be used in highly urbanized areas instead it should be used in areas where onsite storage space is available, and there is no risk of subsurface collapse.

Detention Basins

Detention basins are large, open, un-vegetated basins designed to hold water for short periods following a rain event (dry detention basin) or continuously (wet detention basin). Detention basins are designed to hold water for longer periods with the goal of reducing sediment flow from the basin or provide filtration of stormwater before it enters the basin through the use of urban pond buffers. Additionally, oils, grease, nutrients, and pesticides can also settle in the basin. The nutrients are then used by the plants for growth and development.

Grass Swales

Grass swales are used in urban areas and are often considered landscape features. Swales are graded to be linear with a shallow, open channel of a trapezoidal or parabolic shape. Vegetation that is water tolerant is planted within the channel which promotes the slowing of water flow through the system. Swales reduce sediment and nutrients as water moves through the swale and water infiltrates into the groundwater.

Phosphorus-free Fertilizers

Phosphorus-free fertilizers are those fertilizers that supply nitrogen and minor nutrients without the addition of phosphorus. Phosphorus increases algae and plant growth which can cause negative impacts on water quality within aquatic systems. The Clear Choices, Clean Water (2010) program estimates that a one acre lawn fertilized with traditional fertilizer supplies 7.8 pounds of phosphorus to local waterbodies annually. Established lawns take their nutrients from the soil in which they grow and need little additional nutrients to continue plant growth. Fertilizers are manufactured in a variety of forms including that without phosphorus. Phosphorus-free fertilizer should be considered for use in areas where grass is already established.

Rain Barrel/Cisterns

A rain barrel, or larger cistern, is a container that collects and stores rainwater from your rooftop (via your home's disconnected downspouts) for later use on your lawn, garden, or other outdoor uses. Rainwater stored in rain barrels can be useful for watering landscapes, gardens, lawns, and trees. Rain is a naturally soft water and devoid of minerals, chlorine, fluoride, and other chemicals. In addition, rain barrels help to reduce peak volume and velocity of stormwater runoff to streams and storm sewer systems. Although rain barrels do not specifically reduce nutrient or sediment loading to waterbodies, their presence can reduce the first flush of water reaching storm drains.

Rain Gardens

Rain gardens are small-scale bioretention systems that be can be used as landscape features and small-scale stormwater management systems like single-family homes, townhouse units, some small commercial development, and to treat parking lot or building runoff. Rain gardens provide a landscape feature for the site and reduce the need for irrigation, and can be used to provide stormwater depression storage and treatment near the point of generation. These systems can be integrated into the stormwater management system since the components can be optimized to maximize depression storage, pretreatment of the stormwater runoff, promote evapotranspiration, and facilitate groundwater recharge. The combination of these benefits can result in decreased flooding due to a decrease in the peak flow and total volume of runoff generated by a storm event.

Additionally, rain gardens can be designed to provide a significant improvement in the quality of the stormwater runoff. These systems should not be installed in or near sinkholes. Adding additional drainage to these features can cause further dissolution of limestone, which in turn may cause further collapse.

Trash Control and Removal

Trash and debris located throughout urban areas indicate that these materials can have a significant negative impact on water quality within the Salt-Pipe Creek watershed. A majority of trash observed occurs adjacent to streets, road right of ways, and streams in the watershed.

Urban Wildlife Population Control

To control urban wildlife populations, one must manipulate one of the four habitat factors described previously. Wildlife cannot survive unless their habitat needs are met. If one of these habitat requirements is absent, wildlife will either migrate to another area capable of providing their needs or die. For long-term wildlife management, habitat manipulation is far more effective than direct population reduction. In areas that meet a species' habitat needs, an animal population's birth and survival rates will increase, ultimately replenishing losses caused by direct population reduction.

The types, amounts, and forms of habitat attributes required by individual species differ. To effectively manage an individual species, one must consider the specific habitat requirements of that species. Understanding the biology and ecology of a species will increase your chances of either improving conditions for the animals or deterring them from increasing their numbers. To gain insight into the requirements of an individual species, consult local wildlife biologists and wildlife enthusiasts. See the following figure for expected load reductions for urban bmps.

Figure 115: Urban BMP Expected Load Reductions

Practices	Amount	Sediment (T/yr)	Phosphorus (lbs./yr)	Nitrogen (lbs./yr)	Target Amount to Install	Targeted Subwatersheds
Bioretention Practices	1 acre	5.9	8	48	5 acres	**High Priority:** Righthand Fork – 050800030502 Bull Fork – 050800030503 Fremont Branch – 050800030505 **Medium Priority:** Yellow Bank Creek – 050800030605
Detention Basin	1 unit	0.1	0.1	5.6	5 units	
Grass Swale	1 acre	1.4	3.3	14.9	5 acres	
Phosphorus-free Fertilizers	1 acre	0	2	0	100 acres	
Rain Barrels/ Cisterns	1 unit	0.2	0.2	0.8	50 units	
Rain Garden	1 unit	1.4	1.8	12.6	30 units	
Trash Control and Removal	-	NA	NA	NA	NA	
Urban Wildlife Population Control	-	NA	NA	NA	NA	

Miscellaneous Best Management Practices

Other practices that may be beneficial to the water quality and aquatic life that are not specific to agricultural, urban, or forestry land uses are included here. These other best management practices are as follows:

- Live Stakes
- Riparian Buffers
- Septic System Care and Maintenance
- Streambank Stabilization
- Stream Crossings
- Threatened and Endangered Species Protection

Live Stakes

Live stakes are live shrub or woody plant cuttings driven into the channel bank as stakes. Their purpose is to protect streambanks from the erosive forces of flowing water and to stabilize the soils along the channel bank. This technique is applicable along streambanks of moderate slope, (usually 4:1 or less), in original bank soil (not on fill), and where active erosion is light and washout is not likely. This technique is often applicable in combination with other vegetative or structural stabilization methods. This can be used on all sizes of channels and all character types. It is an economical practice, especially when cuttings are available locally, that can be done quickly with minimum labor. It results in a permanent, natural installation that improves riparian habitat.

Riparian Buffers

Riparian buffers are important for good water quality. Riparian zones help to prevent sediment, nitrogen, phosphorus, pesticides, and other pollutants from reaching a stream. Riparian buffers are most effective at improving water quality when they include a native grass or herbaceous filter strip along with deep-rooted trees and shrubs along the stream.

Herbaceous Riparian cover includes grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils, established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats. Benefits include:

- Provide or improve food and cover for fish, wildlife and livestock,
- Improve and maintain water quality.
- Establish and maintain habitat corridors.
- Increase water storage on floodplains.
- Reduce erosion and improve stability to stream banks and shorelines.
- Increase net carbon storage in the biomass and soil.
- Enhance pollen, nectar, and nesting habitat for pollinators.
- Restore, improve, or maintain the desired plant communities.
- Dissipate stream energy and trap sediment.
- Enhance stream bank protection as part of stream bank soil bioengineering practices.

Forested Riparian Cover is an area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies. The benefits include:

- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms.
- Create or improve riparian habitat and provide a source of detritus and large woody debris.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Reduce pesticide drift entering the water body.
- Restore riparian plant communities.
- Increase carbon storage in plant biomass and soils.

Septic System Care and Maintenance

Septic, or on-site waste disposal systems, are the primary means of sanitary flow treatment outside of incorporated areas. Because of the prohibitive cost of providing centralized sewer systems to many areas, septic tank systems will remain the primary means of treatment into the future. Annual maintenance of septic systems is crucial for their operation, particularly the annual removal of accumulated sludge. The cost of replacing failed septic tanks is about $5,000-$15,000 per unit based on industry standards.

Property owners are responsible for their septic systems under the regulation of the County Health Department. When septic systems fail, untreated sanitary flows are discharged into open watercourses that pollute the water and pose a potential public health risk. Septic systems discharging to the ground surface are a risk to public health directly through body contact or contamination of drinking water sources. Additionally, septic systems can contribute significant amounts of nitrogen and phosphorus to the watershed. Therefore, it is imperative for homeowners not to ignore septic failures. If plumbing fixtures back up and/or will not drain then the system is failing. Funding for this practice is limited.

Streambank Stabilization

Streambank stabilization or stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. The most feasible restoration options return the stream to natural stream conditions without restoring the stream to its original condition. Restoration and stabilization options are limited by available floodplain, modifications to natural flows, and development structure locations. Reestablishment of riparian buffers, restoration of stream channels, stabilization of eroding stream banks, installation of riffle-pool complexes, and general maintenance can all improve stream function while reducing sediment and nutrient transport into and within the system.

Stream Crossings

Stream crossings are a stabilized area or structure (temporary or permanent) constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles. Streams are long, linear ecosystems. The processes that nourish these ecosystems are interrelated and dependent on "continuity" of the stream corridor. Our transportation and access needs often result in fragmentation of streams. Many stream crossings, such as bridges and culverts, act as barriers to fish and wildlife. Awareness of the effects of stream crossings plays an important role in maintaining stream continuity.

The design and condition of stream crossings determines whether a stream can function naturally and whether animals can move unimpeded along the stream corridor. These are key elements in assuring the overall health of the system.

Properly constructed stream crossings should be made available for agricultural equipment crossings, recreational vehicle crossings, livestock crossings, and logging activities. Currently, several stream crossings in the watershed are disrupting aquatic habitat, wildlife migration, and stream hydrology. A standard stream crossing practice designed to limit these effects should be constructed in place of failing or improperly constructed crossings.

Figure 116: Miscellaneous BMP Expected Load Reductions

<table>
<tr><th>Practices</th><th>Amount</th><th>Sediment (T/yr)</th><th>Phosphorus (lbs./yr)</th><th>Nitrogen (lbs./yr)</th><th>Target Amount to Install</th><th>Targeted Subwatersheds</th></tr>
<tr><td>Live Stakes</td><td>1 ft.</td><td>0.4</td><td>0.5</td><td>2.9</td><td>500 ft.</td><td rowspan="5"><u>High Priority:</u>

Headwaters Salt Creek – 050800030501

Righthand Fork – 050800030502

Bull Fork – 050800030503

Little Salt Creek – 050800030504

Fremont Branch – 050800030505

Headwaters Pipe Creek 050800030601

Duck Creek – 050800030603

<u>Medium Priority:</u>

Clear Fork (partial) – 050800030602

Walnut Fork – 050800030604

Yellow Bank Creek (partial) – 050800030605</td></tr>
<tr><td>Riparian Buffers</td><td>1 ft.</td><td>5.4</td><td>5.4</td><td>9.1</td><td>2,000 ft.</td></tr>
<tr><td>Septic System Care and Maintenance</td><td>1 system</td><td>NA</td><td>6.5</td><td>55</td><td>75 systems</td></tr>
<tr><td>Streambank Stabilization</td><td>500 ft.</td><td>100</td><td>100</td><td>200</td><td>1,500 ft.</td></tr>
<tr><td>Stream Crossings</td><td>1 unit</td><td>32.4</td><td>32.4</td><td>64.8</td><td>15 units</td></tr>
</table>

Implementation and Management Strategy Summary

The target amount of BMPs proposed to be installed are not required to be implemented exactly as the quantities suggest. These targets are simply guidelines for achieving the goals. These BMPs were chosen based on landuse and windshield survey concerns identified, in addition to water quality data. The figure below lists the total expected load reductions for the target number of BMPs that are proposed to be installed. It also compares the expected load reduction with the load reduction that is required to meet the water quality targets. Based on these estimated BMPs and load reductions, the reductions needed to meet the sediment water quality target will be achieved and exceeded. The estimated reductions for phosphorous is very close to meeting the water quality target. When the true load reductions are calculated for the practices installed, the goal may be met. While additional reductions will be required to meet the nitrogen water quality target, the estimated reductions will meet and surpass the nitrogen reduction goal.

Figure 117: Summary of Expected BMP Load Reductions for Targeted Practice Installation

Practices	Target Amount to Install	Sediment (T/yr)	Phosphorus (lbs./yr)	Nitrogen (lbs./yr)
Alternate Watering Systems	7,500 acres (@ 75 systems)	22,500	30,000	63,750
Buffer Strip (Shrub/Tree)	2.3 acres	21	21	39
Conservation Tillage/No till	3,000 acres	33,000	27,000	36,000
Cover Crop	22,500 acres	38,250	58,500	114,750
Drainage Water Management	3,000 acres	1,500	4,200	23,700
Filter Strip (grass)	10 acres	90	90	170
Livestock Restriction or Rotational Grazing (Fencing)	7,500 acres	22,500	30,000	63,750
Grassed Waterway	75 acres	13,500	13,500	27,000
Hay/Pasture Planting	1,000 acres	17,600	17,900	35,700
Manure Management	750 acres	NA	3,750	26,400
Nutrient Management	6,000 acres	24,000	4,200	NA
Roof Runoff & Structures	20 units	NA	9,080	NA
Heavy Use Area Protection	60 HUAPs	5,400	4,020	8,040
Access Road	8,000 ft.	680	520	1,080
Use Exclusion	750 head	NA	44,250	54,750
Live Stakes	500 ft.	200	250	1,450
Riparian Buffers	2,000 ft.	10,800	10,800	18,200
Septic System Care and Maintenance	75 systems	NA	488	4,125
Streambank Stabilization	1,500 ft.	300	300	600
Stream Crossings	15 units	486	486	972
Bioretention Practices	5 acres	30	40	240
Detention Basin	5 units	0.5	0.5	28
Grass Swale	5 acres	7	17	75
Phosphorus-free Fertilizers	100 acres	0	200	0
Rain Barrels/ Cisterns	50 units	10	10	40
Rain Garden	30 units	42	54	378
Trash Control and Removal	NA	NA	NA	NA
Urban Wildlife Population Control	NA	NA	NA	NA
Load reduction from target amount of BMPs		190,916.5	259,676.5	481,237
Load reduction needed to meet water quality targets		39,973	260,763	3,650,389
Load Reduction still needed to meet target		Exceeds	1,086.5	3,169,237

Action Plan for Implementation

Next, the steering committee developed an action plan as a guide to move forward and start working to achieve the water quality goals set in the watershed management plan. It includes specific and measurable objectives and strategies the project wishes to implement. In it you will find objectives, their milestones, their cost estimates, possible partners, and technical assistance. Some of the objectives and milestones for the different goals list the same or very similar activities. For example, publications and workshop/field days listed can cover many topics and would apply to multiple goals. Many BMPs also can address more than one resource concern, so one BMP can help meet different goals of the watershed management plan. The same workshop/field day, publication, and BMPs may be listed for different goals when it is relevant. The repeated items are marked with an * in the action plan below.

Figure 118: Action Plan and Strategies for the Salt-Pipe Creek Watershed

Goal	Objective	Target Audience	Milestones	Cost	Potential Partners/ Technical Assistance
Reduce soil erosion and amount of sedimentation entering the streams. Of the water samples collected, 22% (36/164) exceeded the TSS target. The load reduction needed to meet the <25 mg/L target is 39,973 tons/yr.	Educate and promote installation of BMPs through field days/workshops	Producers, Landowners, Residents, and County Agencies	Hold 2 field days/workshops annually	$2,450,000	SWCD NRCS Purdue ISDA US Fish & Wildlife IDEM
	Education through publications		Develop 4 publications annually		
	Provide financial assistance to convert tillage to no-till systems		Convert 600 acres to no-till every 3 years		
	Provide financial assistance to plant cover crops		Plant 1,500 acres annually		
	Provide financial assistance to establish grassed waterways		Establish 5 acres of grassed waterways annually		
	Provide financial assistance to establish filter strips		Establish 2 acres of filter strips every 3 years		
	Provide financial assistance to implement prescribed grazing plans		Implement 2 prescribed grazing plans annually		
	Provide financial assistance for fencing and watering systems		Install 5 systems of fence and watering systems annually		
	Provide financial assistance to establish riparian buffers		Establish 400 ft. of riparian buffers every 3 years		
	Provide financial assistance to establish HUAPs and Access Roads		Install 35,000 sq ft of HUAPs/Access Roads annually		

Goal	Objective	Target Audience	Milestones	Cost	Potential Partners/ Technical Assistance
	Promote the use of urban BMPs		Develop 2 publications annually		
			Hold 1 workshop annually		
Nitrogen needs to be reduced within the watershed. Of the water samples collected, 49% (76/156) exceeded the target for NO3-NO2. The load reduction needed to meet the <1.0 mg/L target is 3,650,389 lbs/yr. Phosphorous needs to be reduced within the watershed. Of the water samples collected, 33% (51/156) exceeded the target. The load reduction needed to meet the <0.06 mg/L target for TP is 260,763 lbs/yr.	Educate and promote installation of BMPs through field days/workshops	Producers, Landowners, Residents, and County Agencies	*Hold 2 field days/workshops annually	$900,000	SWCD NRCS Purdue ISDA US Fish & Wildlife IDEM
	Education through publications		*Develop 4 publications annually		
	Provide financial assistance to plant cover crops		*Plant 1,500 acres annually		
	Provide financial assistance to farmers for the development and implementation of nutrient management plan		Implement 1 new nutrient management plan every 5 years		
	Provide financial assistance to implement improved pasture management systems		Implement 5 improved pasture management systems annually		
	Provide financial assistance to farmers for the development and implementation of manure management plans		Implement 1 new manure management plan every 5 years		
	Educate and promote proper nutrient management to the general public		Develop 1 publication annually		
Reduce E. coli concentrations throughout the watershed not only to meet water the quality target but to have the impaired stream segments delisted (382.6 miles). Of the water	Educate livestock owners on the importance of pasture management & access control through field days/workshop	Producers, Landowners, Contractors, Realtors, and Residents	*Hold 1 field day/workshop annually	$475,000	SWCD NRCS Purdue ISDA US Fish & Wildlife
	Educate livestock owners on the importance of pasture management & access control through publications		*Develop 2 publications annually		

Goal	Objective	Target Audience	Milestones	Cost	Potential Partners/ Technical Assistance
samples collected, 48% (101/210) exceeded the E. coli single sample max. target of < 235 cfu/100mL and 77% (20/26) of the testing sites exceeded the geomean E. coli target of <125 cfu/100mL. E. coli reductions needed based on maximum value range from 31.84 to 99.03%.	Provide financial assistance to exclude livestock from sensitive areas		Exclude 50 head of cattle annually from sensitive areas		IDEM Health Departments Consultants
	Provide financial assistance to implement improved pasture management systems		*Implement 5 improved pasture systems annually		
	Educate and promote proper septic maintenance		Develop 2 publications annually	$13,000	
	Hold workshop for contractors and realtors on proper septic system sites and installation		Hold 1 contractor/realtor workshops every 3 years		
	Hold workshop on proper septic maintenance for landowners in the watershed		Hold 1 landowner workshop every 3 years		
	Share data and support to local sewer districts on extending service to problem areas with failing systems		Make contact with local sewer districts to share information and give assistance if needed by 2033	$500	
Increase public awareness and provide education on how individual choices and activities impact the watershed	Create a "Friends of the Salt-Pipe Creek Watershed" signage program	Producers, Landowners, Residents, and County Agencies	Develop signage and criteria by 2021	$87,000	Environmental Groups Residents Government Agencies IDEM
	Educate landowners, operators, and public on BMPs		*Hold 6 educational events/workshops annually		
			*Develop and distribute 10 publications biannually		

Goal	Objective	Target Audience	Milestones	Cost	Potential Partners/ Technical Assistance
	Obtain funds and resources to conduct water testing to determine the species source of E. coli throughout the watershed		Conduct E.coli testing every 7-8 years	$50,000	
Partner with government agencies and landowners on decreasing streambank erosion	Educate partners and landowners on the importance of buffers, increasing infiltration, and streambank stabilization.	Producers, Landowners, Residents, Environmental groups, and County Agencies	Hold 1 workshop on streambank stabilization, infiltration, and/or buffers every 3 years	$6,500	SWCD NRCS Purdue ISDA US Fish & Wildlife IDEM Consultants
			Develop and distribute 1 publication annually		
	Seek out programs and funds to assist with efforts of goal		Find partners and resources annually	$500	

Future Activities

In moving forward, the next step for the project is to start implementing this management plan for the Salt-Pipe Creek Watershed. The Steering Committee, along with the local county SWCDs, have already submitted a grant application for implementation, which would provide funds for a cost-share program to install best management practices (BMPs) and an education and outreach program. If the grant is awarded, the steering committee will develop a cost-share program that will include steps to meeting the goals and management strategies of this plan.

Tracking Goals and Effectiveness of Implementation

In order to track the project's progress in reaching its goals and improving water quality, information and data will need to be continually collected during implementation. The steering committee developed strategies for tracking the progress toward its watershed management goals and its education and outreach effectiveness.

Figure 119: Strategies for Tracking Goals and Effectiveness of Implementation

Tracking Strategy	Frequency	Total Estimated Cost	Partners	Technical Assistance
BMP Load Reductions	Continuous	NA	SWCDs & NRCS	Staff and Partners
Water Monitoring	Every 7-8 years	$50,000	SWCDs & IDEM	Staff and Partners
Attendance at Workshop/Field Days	Yearly	NA	NA	NA
Post Workshop Surveys for Effectiveness	Yearly	$1,000	SWCDs & Purdue Extension	NA
Number of Educational Publications	Yearly	NA	NA	NA
Windshield Survey	Every 5-6 years	NA	NA	Staff and Committee
Aerial Surveillance	Every 5-6 years	NA	NA	Staff and Committee
Number of cost-share participants	Yearly	NA	NA	Staff, Partners, & Committee

The tracking strategies above will be used to document changes and aid in the plan re-evaluation. Work completed towards each goal/objective will be documented in a tracking database, which will include scheduled and completed activities, numbers of individuals attending, or efforts completed toward each objective, as well as load calculations or monitoring results for each goal, objective, and strategy. Overall project progress will be tracked by measurable items such as workshops held, BMPs installed, meetings held, etc. Load reductions will be calculated for each BMP installed. These values and associated project details, including BMP type, location, size, cost, installer, etc. will be tracked over time. Individual landowner contacts and information will be tracked for both identified and installed BMPs. The Salt-Pipe Creek Watershed Coordinator is responsible for updating and maintaining the tracking database. The Decatur County SWCD will be responsible for the long-term housing of the tracking database. And if there is a time when the watershed does not have a coordinator, both the watershed coordinator and the Decatur County SWCD representative will be able to share all tracking information with the steering committee.

Future Water Monitoring Efforts

It is also anticipated that additional water quality monitoring will be completed by IDEM's Watershed Assessment and Planning Branch through their Performance Monitoring program. Performance monitoring is conducted to identify changes in areas where there is reason to believe improvements may have occurred as a result of activities that may have a mitigating effect on water quality impairments identified on the state's 303(d) List of Impaired Waters.

Generally, study areas are selected based on where watershed management plans have been implemented and where best management practices applied are most likely to have had sufficient time to have a measurable effect on water quality. The specific parameters to be monitored and the number of sampling sites will vary depending on the type and spatial extent of the original impairment. Additional data could potentially be provided through the Probabilistic Monitoring program. Sites involved with this program would be the P sites mentioned in the water monitoring section. These sites are tested on a nine year rotation.

Adaptive Management Strategy

Due to the uncertainty of what the future holds, adaptive management of the Salt-Pipe Creek WMP may be needed to have a successful project. While much thought and expertise has been put into the planning process and the WMP, changes can occur, such as a shift in community attitude/behavior, funding, changes in resource concerns, development of new information, or accomplishing a goal sooner or later than expected. By implementing an adaptive management strategy, the Salt-Pipe Creek Watershed project and steering committee can adjust the course of the watershed management plan to ensure project success.

The four-step adaptive management strategy is outlined below.

Step 1: Planning- IDEM's 2009 Watershed Management Checklist was used as a guide to develop the Salt-Pipe Creek WMP. The watershed coordinator, guided by the steering committee, developed the WMP using knowledge of the watershed, inputs from stakeholders, new data from water monitoring and windshield surveys, and historical data. This plan includes goals, an action register, and a schedule outlining milestones to achieve the goals.

Step 2: Implementation- The action register and schedule will be implemented to achieve the project's objectives and goals. The project along with its partnering agencies, such as SWCD, Purdue Extension, NRCS, ISDA, and IDEM will carry out the implementation. Implementation will include a cost-share program and education and outreach events. Practices implemented through the cost-share program will follow the NRCS Field Office Technical Guide (FOTG) Practice Standards and will include, but is not limited to, practices such as cover crops, heavy use area protection, pipeline, watering facilities, fencing, filter strips, grassed waterways, and nutrient management plans. Cost-share funding will be implemented in priority areas, addressing high priority areas before the medium priority areas. A ranking system will be used to prioritize applications with the greatest impact on water quality improvement. Factors such as location within watershed (priority areas), distance from streams, number of resource concerns addressed, and number of practices planned will be considered as part of the ranking process.

Step 3: Evaluate & Learn- Evaluations will occur often to check the progress being made toward the project goals. The steering committee will annually review progress and determine if the project is on track to meet interim and project end goals outlined in the Action Plan and WMP goals. Factors evaluated will include, but are not limited to, numbers of BMPs installed, calculated/estimated load reductions of installed BMPs, number of individuals reached through education and outreach, etc. The evaluations will be conducted by the watershed coordinator and the steering committee. The group will then provide recommendations that will improve project success.

Step 4: Alter Strategy- The project's implementation and management strategy will be adjusted to improve the project's success. If progress is not made proportionate to the time into the project (i.e. annually, at the end of year 3, and year 5) the steering committee will have the opportunity to alter their strategy in order to meet the goals of the project. Adjustments will be based off of recommendations from Step 3. Once the adjustments are agreed upon by the steering committee, the project will revert back to Implementation (Step 2) to continue with the Adaptive Management strategy (steps 2-4) until all goals have been met or all conservation opportunities have been exhausted.

The Decatur County SWCD will be responsible for maintaining all records for the project.

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