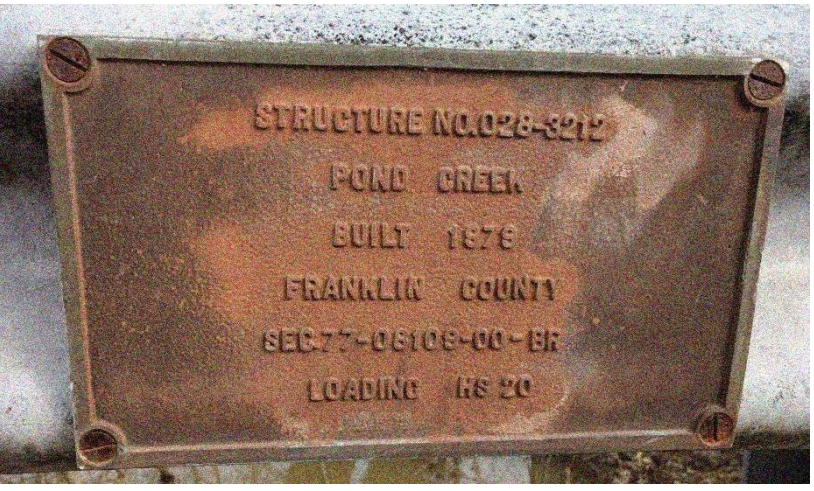
Pond Creek

Watershed-based Plan



Written and prepared by:

Tyler Carpenter, GIS & Environmental Planning Director
Ruth Ann Fowler, Planner
Ciara Nixon, Planner

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959
http://greateregypt.org/
(618) 997-9351

GERPDC-2019- 1130

Acknowledgements

Funding for this project provided, in part, by the Illinois Environmental Protection Agency through Section 604(b) of the Clean Water Act.

The authors would like to acknowledge the following individuals, groups and agencies for providing knowledge and materials for the completion of this report:

The Illinois Environmental Protection Agency (IEPA), U.S. Environmental Protection Agency, Illinois State Geological Survey, University of Illinois Extension, Franklin and Williamson County Soil and Water Conservation Districts, Franklin and Williamson County NRCS offices, Williamson County Farm Bureau, the City of West Frankfort, West Frankfort Aquatic and Activities Center, and Pond Creek Watershed landowners and businesses.

Pictured on cover (clockwise from top): Watershed Wetland, Pond Creek, Mach Mine, Pond Creek Farm, Pond Creek Bridge Identification Plate (photos by Greater Egypt)

Table of Contents

List of Figures

List of Tables

Acronyms and Abbreviations

ACS	American Community Survey
AISWCD	Association of Illinois Soil and Water Conservation Districts
ALMP	Ambient Lake Monitoring Program
AMA	Agricultural Management Assistance Program
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CSP	Conservation Stewardship Program
CTA	Conservation Technical Assistance Program
CWA	Clean Water Act
DOI	Department of the Interior
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives program
HUC	Hydrologic Unit Code
ICN	Illinois Climate Network
IDNR	Illinois Division of Natural Resources
IEPA	Illinois Environmental Protection Agency
ISGS	Illinois State Geological Survey
LAUS	Local Area Unemployment Statistics
LRR	Lateral Recession Rate
MCL	Maximum Contaminant Level
MLCG	Maximum Contaminant Level Goal
MRLC	Multi-Resolution Land Characteristics Consortium
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Agency
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
PCB	Polychlorinated Biphenyl
RMMS	Resource Management Mapping Service
SMU	Subwatershed Management Unit
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWCD	Soil and Water Conservation Districts
SWPPP	Stormwater Pollution Prevention Plan
TSS	Total Suspended Solids
USACE	Unites State Army Corps of Engineers
USDA	Unites State Department of Agriculture
USFWS	Unites State Fish and Wildlife Service
USGS	Unites States Geological Survey

Executive Summary

Beginning in the latter part 2017, the Greater Egypt Regional Planning and Development Commission (Greater Egypt) was contracted by the Illinois Environmental Protection Agency (IEPA) to develop a watershed-based plan for the Pond Creek Watershed (071401060501) under Clean Water Act Section 604(b) funding.

The Pond Creek watershed encompasses 21,192 acres, or roughly 33 square miles, and is located in Franklin and Williamson counties in Illinois. It is part of the larger Big Muddy River watershed. The only municipality in the planning area is the City of West Frankfort; which lies entirely in Franklin County (Figure 1).

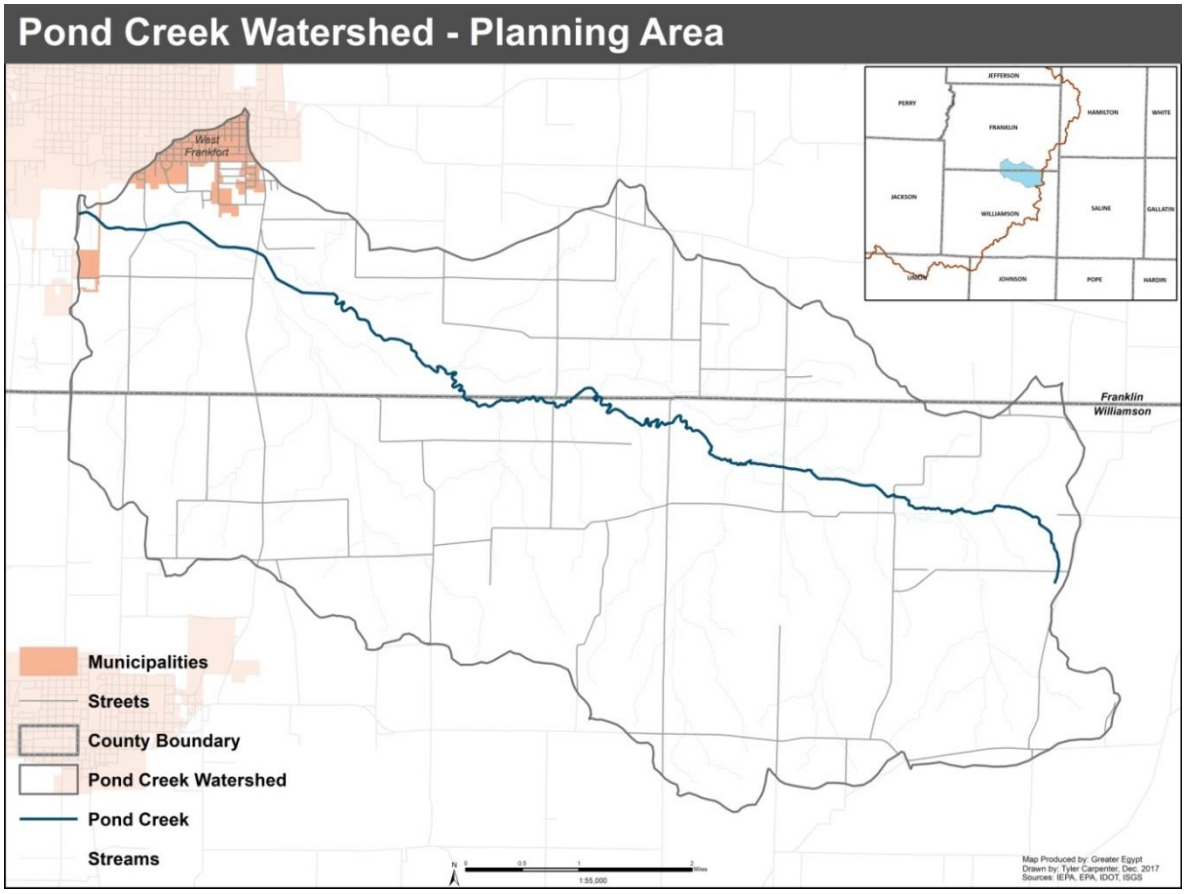
One waterbody in the watershed has been placed on the Illinois Environmental Protection Agency's 303(d) List of Impaired Waters. This list is comprised of waterbodies that do not meet water quality standards. Pond Creek (IL_NG-02) has been placed on the list for impairments of: chloride, dissolved oxygen and sedimentation/siltation. The impaired designated use for all three causes is aquatic life.

Following the submission of the *Pond Creek Watershed Inventory and Assessment*, an initial stakeholder meeting was held in 2018 to gain awareness of planning efforts, and to garner membership for the Pond Creek Watershed Planning Committee. The group convened on a quarterly basis and provided guidance throughout the plan. This included discussing existing knowledge of the watershed and suggesting best management practices (BMP) for the plan. The success of the plan relies heavily on the continuation of public involvement. This includes overseeing implementation of the plan and monitoring progress.

Land use in the watershed is represented by large areas of agriculture and forest. Agriculture in the watershed is composed of 35.37 percent of pasture and hay and 30.32 percent of cultivated crops. Forested areas represent 24.72 of the watershed. Remaining land uses in the watershed include: various categories of developed land (6.93), open water (1.09 percent) and wetlands (1.08 percent). With almost 66 percent of the watershed being classified as agriculture, there is a

high potential for nutrient runoff. This is exemplified by areas of cropland that are adjacent to Pond Creek.

Figure 1-Planning Area



While impervious surfaces in the watershed are low, the West Frankfort area constitutes the largest portion of the watershed's impervious network. The watershed exhibits around seven percent of imperviousness features (10 percent or more impervious surface).

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL) was utilized to generate existing pollutant loads for the Pond Creek watershed and its subwatersheds. While the program produces general estimates, the baseline data was generated from multiple factors including: land use, climatic indicators, agriculture, septic rates, urban runoff, and streambank erosion using lateral recession rates. In the Pond Creek Watershed, estimated pollutant loads are influenced heavily by agricultural areas (see Table 1).

Table 1- Existing Pollutant Loads

Source	N Load (lb/yr)	Percent of Total Load	P Load (lb/yr)	Percent of Total Load	Sediment Load (tons/yr)	Percent of Total Load
Urban	13226.85	5.89%	2044.62	4.67%	303.61	1.14%
Cropland	88475.27	39.37%	25491.76	58.21%	15854.41	59.69%
Pastureland	81533.71	36.28%	9785.49	22.34%	3700.06	13.93%
Forest	2510.17	1.12%	1183.7	2.70%	193.97	0.73%
Groundwater	28589.45	12.72%	1278.18	2.92%	0	0.00%
Streambank	10415.9	4.63%	4010.12	9.16%	6509.94	24.51%
Total	**224751.4**		**43793.88**		**26561.99**	

Pollutant load reduction targets were also generated for major pollutants. A reduction of nitrogen at 15 percent, phosphorus at 25 percent, and sediment reduction of 25 percent were calculated for the plan. Target goals are consistent with the Illinois Nutrient Loss Reduction Strategy (ILNLRS).

To achieve the target goals, BMPs were suggested in regards to the major nutrient contributor in the watershed, agricultural practices. While the plan addresses watershed-wide practices, site-specific BMPs have also been established to manage agricultural pollutants and other impairments on a localized level.

These management efforts confront the impairments of the various waterbodies in the Pond Creek watershed. Some of the measures include: streambank stabilization, agricultural filter strips, and grassed waterways. They have also been categorized by priority based on feasibility, cost, and pollutant load reductions.

The plan incorporates the nine minimum elements required of a watershed-based plan. These elements include: a characterization of the watershed through a resource inventory and assessment to identify nonpoint source pollution, identification of management measures to address those pollutants, identifying funding and technical assistance, an educational component, and a monitoring and evaluation component to track progress and monitor accomplishments.

Funding will mainly come through EPA Clean Water Act Section 319 grants. Most of the BMPs in the plan are eligible to receive funding through these grants since their focus is reducing nonpoint source pollution.

Outreach and education of watershed-related activities are important in promoting awareness of the plan and progression of plan implementation. Some of the outreach components include: holding public meetings, distributing flyers about the plan and agricultural activities, and locating volunteers for litter and debris cleanups.

Implementation of the plan is divided into three phases. Phase I represents the first two years of the plan where most educational and outreach component are implemented; along with selecting site-specific BMPs for grant funding. Phase II will require the watershed action committee to continue submitting grants and starting implementation of BMPs. Phase III represents the last four years of the planning period in which BMP implementation will continue and evaluating the plan will begin.

Interim measurable milestones, water quality benchmarks, and a monitoring component have also been established to track progress and evaluate the success of the plan. Table 2 represents the water quality benchmarks in the plan which focuses on nitrogen, phosphorus, and sediment.

Table 2- Water Quality Benchmarks

	Benchmark Reduction Target					
Benchmark Period	Nitrogen (percent)	Nitrogen (lbs)	Phosphorus (percent)	Phosphorus (lbs)	Sediment (percent)	Sediment (tons)
2 Year (Phase I)	-	-	-	-	-	-
6 Year (Phase II)	6	134,850	10	43,794	10	26,562
10 Year (Phase III)	15	337,127	25	109,484	25	66,405

The monitoring component of the plan features programs offered by IEPA and the Illinois Department of Natural Resources (IDNR). The Ambient Water Quality Monitoring Network (AWQMN) and the Intensive River Basin Surveys are both ways in which water quality can be tested. Results will be analyzed by the watershed action committee to determine success of BMP implementation and the plan itself.

1. Introduction

A watershed is a drainage basin where all water flows into from surrounding elevated lands. Precipitation and runoff drain to a waterbody, usually a lake or stream, which centralizes all flow of the watershed. Watersheds can range from regional land areas that span states to smaller basins that are encompassed within counties. Watershed size is classified by Hydrologic Unit Codes (HUC) which range from 2 (regional) to 12 (subwatershed).

Watershed-based plans provide a framework for improving water quality in a specific watershed. They are often designed to reduce pollutants from nonpoint sources and identify other components that impair water quality. These plans include a characterization of the watershed through a resource inventory and assessment to identify nonpoint source pollution, identification of best management practices (BMPs) to address those sources, and a monitoring and evaluation component to track progress and monitor accomplishments.

One waterbody in the Pond Creek watershed has been placed on Illinois Environmental Protection Agency's 303(d) List of Impaired Waters. This list is comprised of waterbodies that do not meet water quality standards. In particular, Pond Creek (IL_NG-02) has been placed on the list because of impairments from chloride, dissolved oxygen and sedimentation/siltation.

Watershed-based planning focuses on collaboration among stakeholders and local decision makers. Early in the planning process, an initial stakeholders meeting took place to explain the process of watershed-based planning and gather members for the Pond Creek Watershed Planning Committee. This group met on a quarterly basis to oversee the planning process.

Watershed-based plans must follow guidelines set forth by the U.S. Environmental Protection Agency (EPA). To be successful, watershed-based plans need to include the Nine Minimum Elements of a Watershed-based Plan.[1] The components, information and location within this plan are as follows:

[1] U.S. Environmental Protection Agency, "Appendix C- Minimum Elements of a Watershed-based Plan," in *Nonpoint Source Program and Grants Guidelines for States and Territories* (Washington D.C., 2013.), 63-68.

1. **Element A-** ***Identify causes and sources of pollution.***

   This was completed through an inventory and assessment of the Pond Creek Watershed. The inventory includes a characterization of the watershed including details on: boundaries, geology and climate, soils, jurisdictions, demographics, and land use. It also includes an assessment of waterbodies and water quality which identifies sources of pollution in the watershed. (Chapter 2)

2. **Element B-** ***Estimate load reductions expected from best management practices.***

   Pollutant load reduction targets were created to meet water quality goals. The load reduction goals for the Pond Creek Watershed-based Plan follow the statewide goals established in the Illinois Nutrient Loss Reduction Strategy. (Chapters 2 & 3)

3. **Element C-** ***Describe the nonpoint source best management practices that meet pollutant load reductions.***

   To achieve the load reduction targets, BMPs have to be implemented. A description of each BMP type has been provided in the plan. Information for watershed-wide and site-specific BMPs has also been provided. This includes: location, load reductions, amount, unit, and priority. (Chapter 3)

4. **Element D-** ***Identify the technical and financial assistance needed to implement the plan.***

   Costs and work associated with the technical and financial assistance have been calculated for each management measure in the plan. Grant funding opportunities and cost match notes for each BMP have also been identified. (Chapter 4)

5. **Element E-** ***Develop an information and education component.***

   An outreach and educational component was created to gain public involvement which can promote the strategies and implementation measures in the plan. Various activities have been included to inform the public on: watershed planning, BMPs, and nonpoint source pollution. (Chapter 5)

6. **Element F-** ***Develop a schedule for implementing the nonpoint source best management practices in the plan.***

   A schedule was developed that outlines the BMPs, educational components, and other strategies in the plan. (Chapter 6.1)

7. **Element G-** ***Describe interim measurable milestones to monitor management measures in the plan.***

   Milestones are to be addressed for each BMP in the plan. These milestones are also developed for the outreach components and other strategies. Milestones were separated by phases throughout the planning period. (Chapter 6.2)

8. **Element H-** ***Develop criteria to measure progress of loading reductions through management measures.***

   These benchmarks signify whether BMP and other management measures are successful in reducing pollutant loads and are leading to water quality standards. (Chapter 7.1)

9. **Element I-** ***Develop a monitoring component that evaluates the efficacy of management measures.***

   Elements in the monitoring component determine whether loading reductions are being met and water quality standards are being achieved. (Chapter 7.2)

The Pond Creek Watershed-based Plan incorporates all of these elements in an effort to reduce pollutant loads and improve water quality within the watershed. The success of the plan largely depends on the collaboration of stakeholders and local officials to implement and oversee the plan's development.

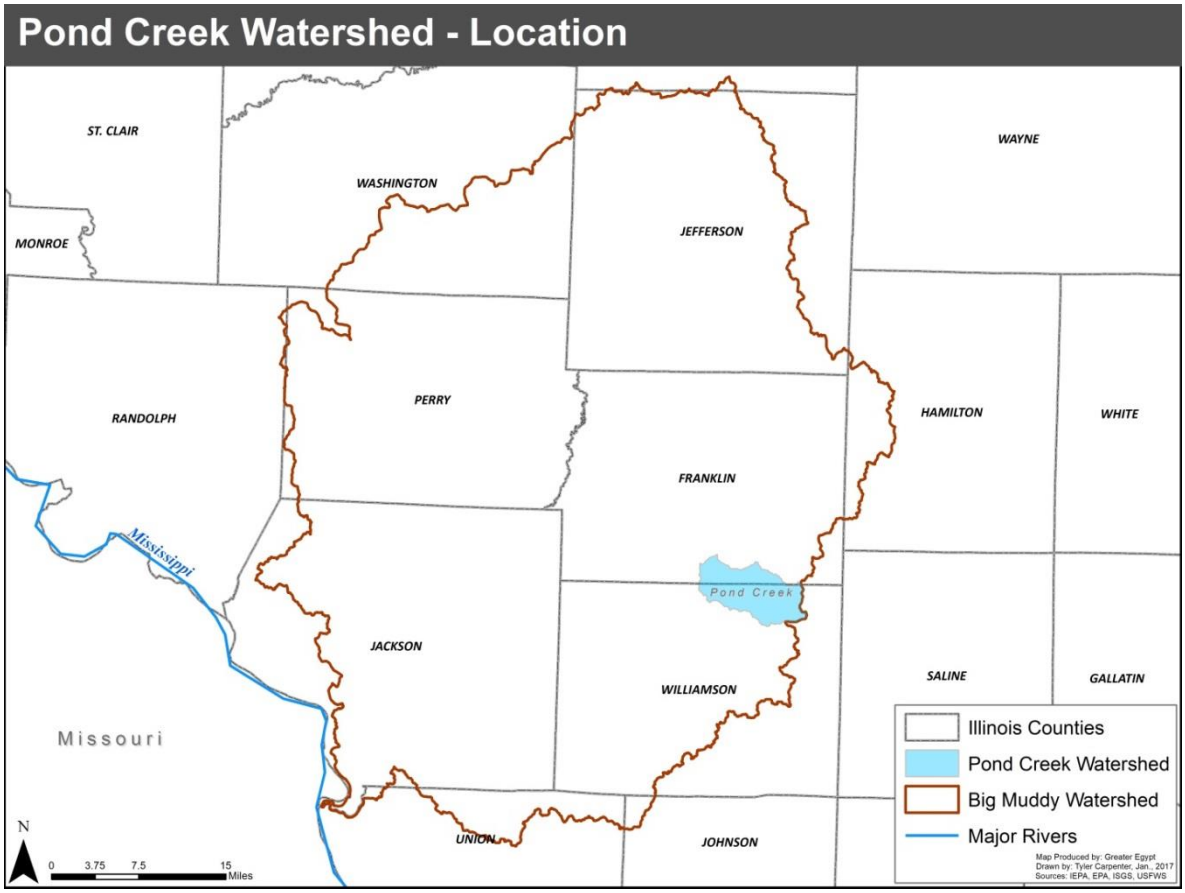
Figure 2- Pond Creek, North-facing South of West Frankfort

2. Pond Creek Watershed Inventory and Assessment

2.1 Watershed Geography & Climate

The Town of West Frankfort-Pond Creek watershed encompasses 21,192 acres, or 33 square miles, and has been assigned Hydrologic Unit Code (HUC)-071401060501. For this report, the watershed will be abbreviated as Pond Creek watershed. It is located in Franklin and Williamson Counties in Illinois, and is a sub-basin of the larger Big Muddy River Watershed (Figure 3)

Figure 3- Location

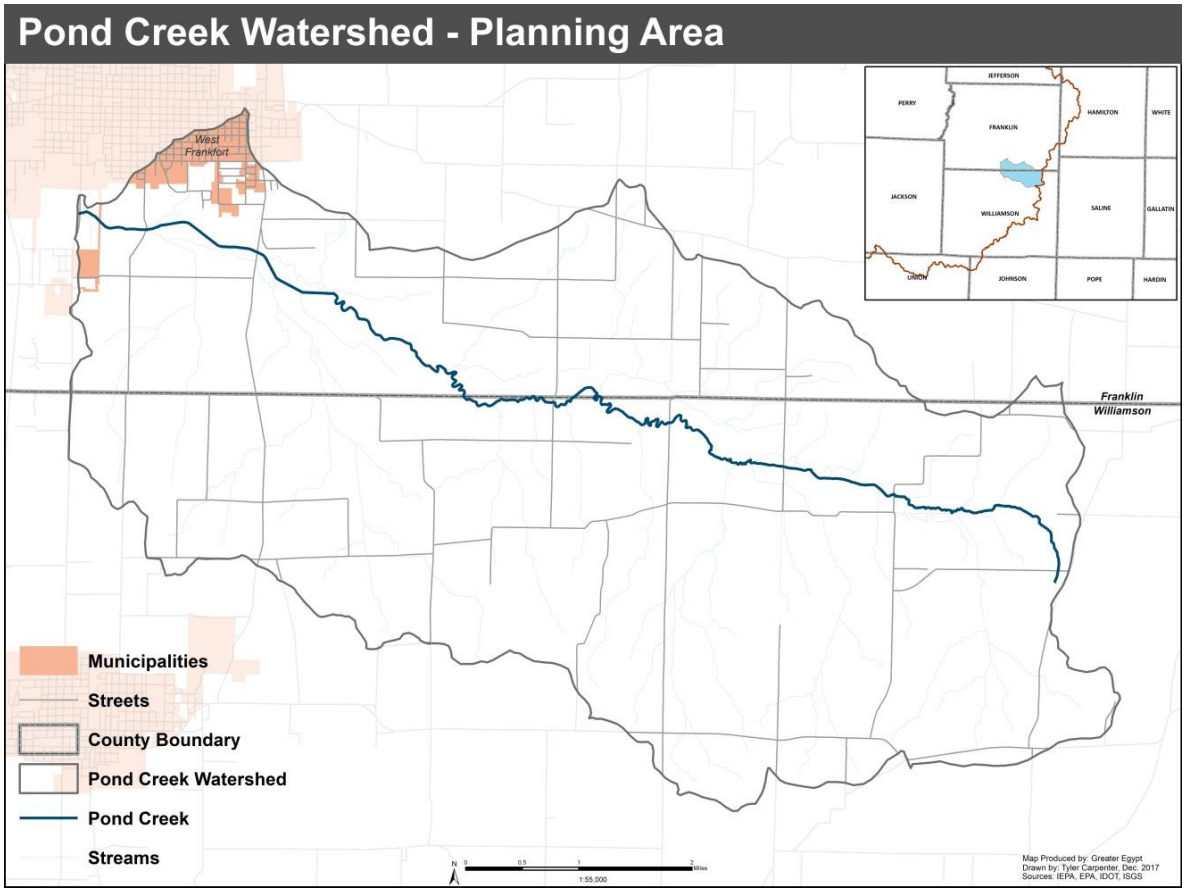


The headwaters of Pond Creek originate near the intersection of Thorn Road and Thompsonville Road in Williamson County, Illinois. The only municipality in the subject area is the City of West Frankfort; which lies entirely in Franklin County. The Pond Creek Watershed is roughly bound to the north by Franklin County

Highway 10, to the east by Thompsonville Road, to the west by the State Highway 37, and to the south by Corinth Road (Figure 4).

With a population of 8,182, according to the 2010 Census, the City of West Frankfort is mostly outside of the watershed. State Highway 37 runs North and South on the most western edge of the watershed. There are no other primary roads in the watershed.

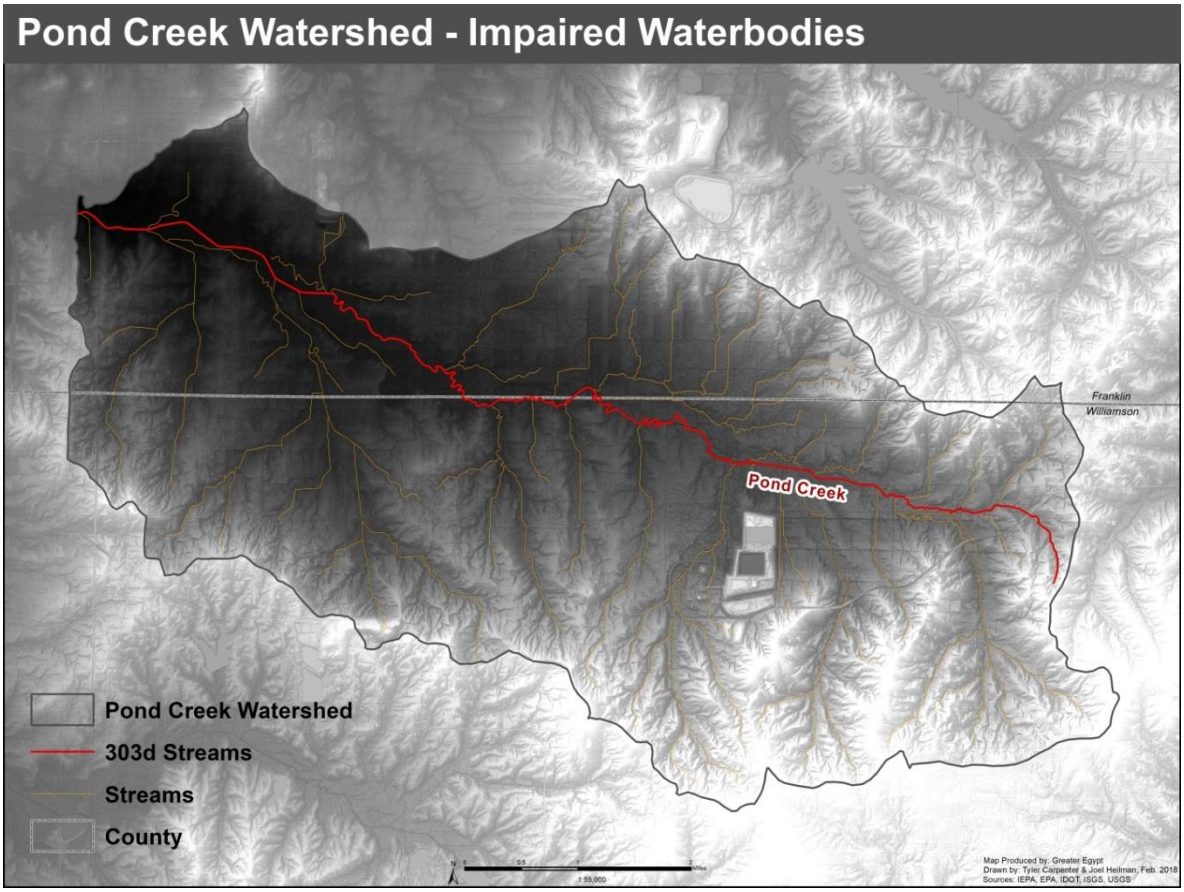
Figure 4- Planning Area



2.1.1 Location of Water Bodies

The Pond Creek watershed lies on the divide between the Ohio and Upper Mississippi River basins. Pond Creek spans 23.52 miles; passing through the town of West Frankfort Pond Creek watershed and the town of Chittyville Pond Creek watershed. 12.02 miles of Pond Creek is within the Pond Creek watershed, as identified in the National Hydrography Dataset (NHD). Pond Creek is the only named creek in the watershed (Figure 5), and it is on the Illinois Environmental Protection Agency's (IEPA) 303(d) List of Impaired Waters. Pond Creek (IL_NG-02) meanders 12.04 miles in a westerly/northwesterly direction through the center of the watershed before reaching Highway 37 in the northwestern portion of the watershed. Other smaller, unnamed streams run throughout the watershed in various directions, all flowing directly or indirectly into Pond Creek.

Figure 5- Impaired Waterbodies



While there are no major lakes in the watershed, small ponds constitute a rather small area of the watershed; approximately 106 acres, according to the US Fish and Wildlife's National Wetland Inventory (NWI).

Wetlands are also a prominent feature throughout the target area. According to the NWI, there are four classifications of wetlands identified in the Pond Creek watershed: freshwater emergent, freshwater forested/ shrub, freshwater ponds, and riverine.

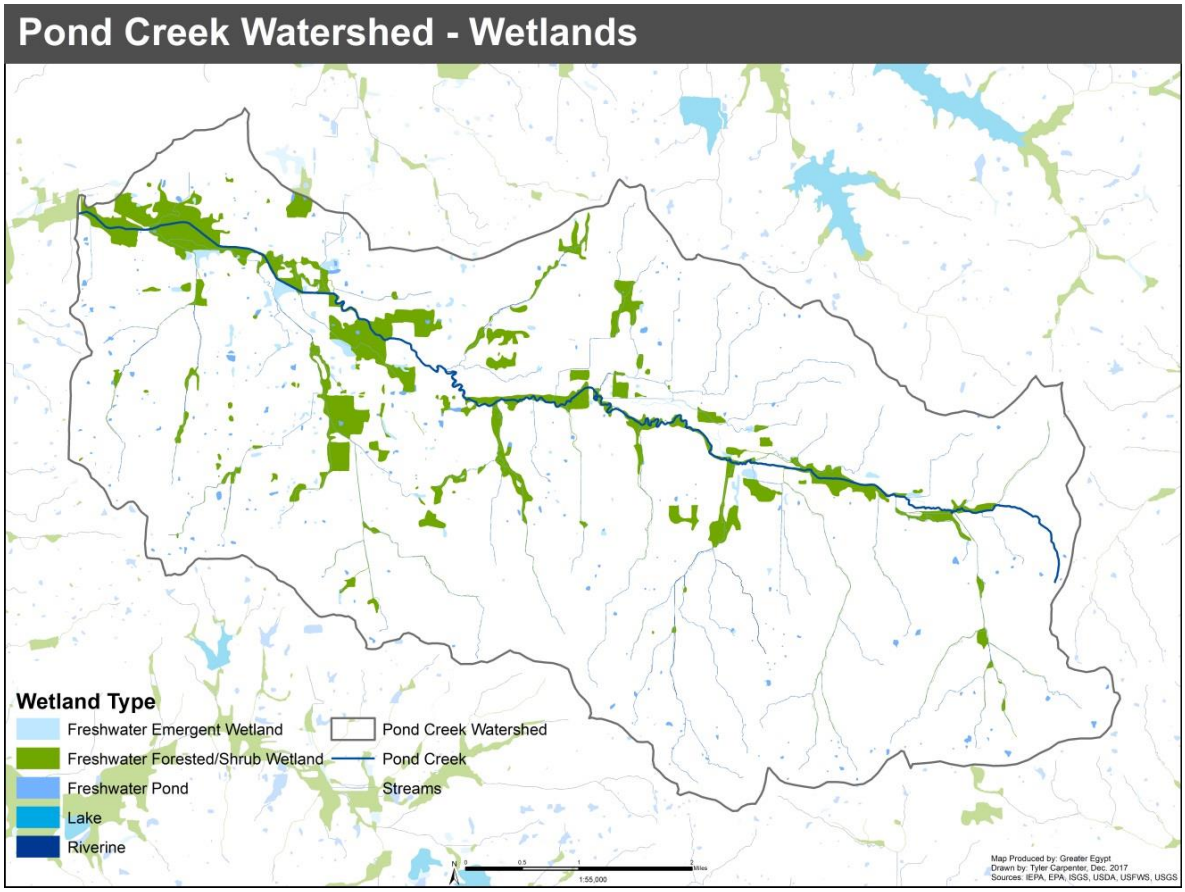
Table 3 contains information of the distribution of wetlands. Freshwater forested and shrub wetland is the most apparent wetland classification in the watershed consisting of 1,460 acres, or accounting for nearly seven percent of the watershed. Wetlands have also been spatially displayed in Figure 6.

Table 3- Distribution of Wetlands

Wetland Type	Acres	Percent of Wetland Total	Percent of Watershed
Freshwater Emergent	145.89	7.92%	0.69%
Freshwater Forested/ Shrub	1460.4	79.30%	6.89%
Freshwater Pond	106.28	5.77%	0.50%
Lake	0	0.00%	0.00%
Riverine	129.1	7.01%	0.61%

Source: US Fish and Wildlife Service National Wetlands Inventory

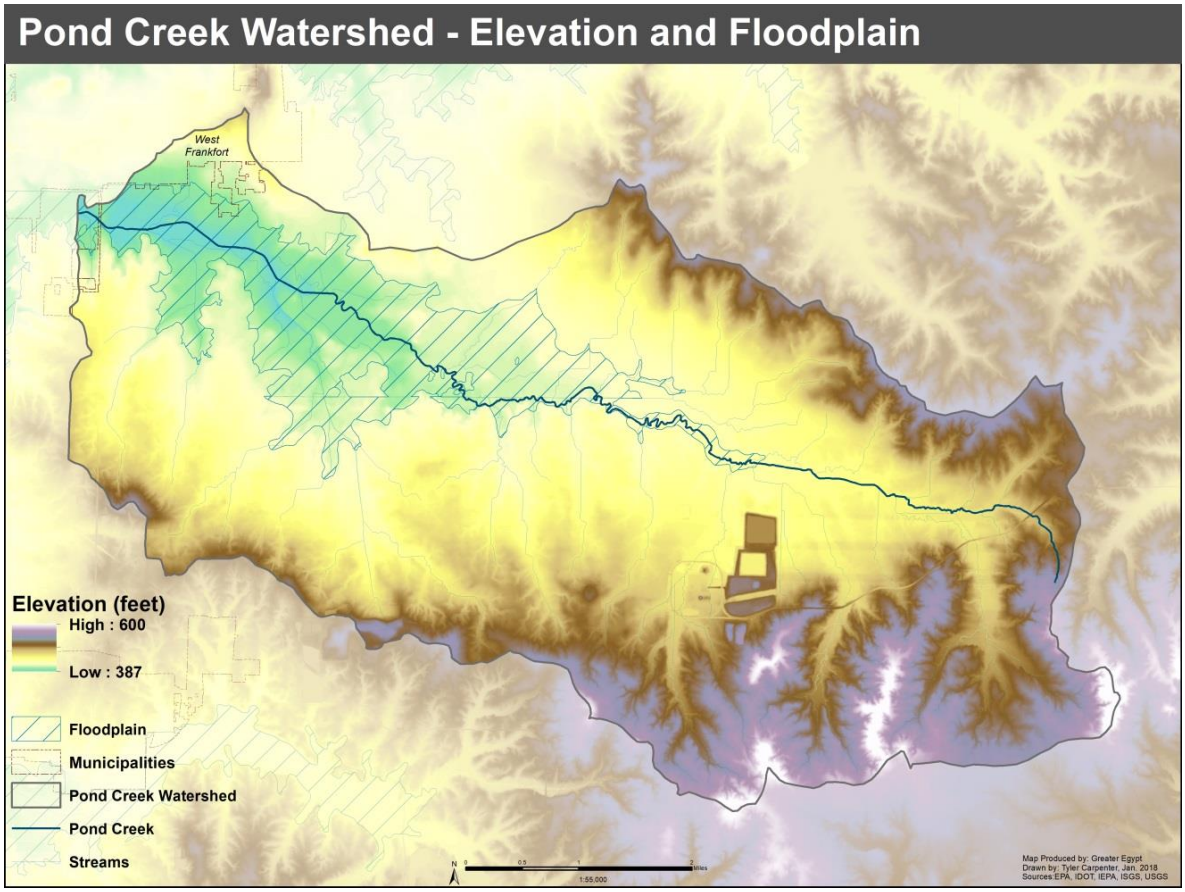
Figure 6- Wetlands



2.1.2 Topography

The Pond Creek watershed is located roughly ten miles north of the southern limit of the glacial till from the Illinoisan age. The watershed is generally flat, with gentle slopes near the headwaters and the southeastern border. The topography is consistent with the surrounding watersheds of Southern Illinois. Figure 7 displays the elevation and floodplain of the watershed. The lowest elevations in the watershed are found in the northwest section near State Highway 37. The elevation is roughly 387 feet. The highest elevation in the watershed, around 600 feet, occurs at the southeastern corner of the watershed. The watershed features an elongated shape with a mainly dendritic drainage pattern. Other areas in the watershed feature a parallel drainage pattern.

Figure 7- Elevation and Floodplain



Around 14.42 percent (3,056 acres) of the watershed is in the floodplain. This area is mainly along Pond Creek, especially in the lower, northeastern portion of the watershed. While most of this area is agricultural and woodland, there are small areas in West Frankfort within the floodplain. Flooding in these areas tends to be localized.

2.1.3 Subwatershed Management

The Pond Creek watershed has been delineated further into 14 smaller subwatershed management units (SMU). Along with the Pond Creek watershed, each SMU will be examined individually in this inventory. Each SMU was delineated based on the drainage patterns and the direction of flow of Pond

Creek and other hydrologic features in the watershed. The subwatersheds are illustrated in Figure 8.

A unique identifier (HUC 14 code) was assigned to each subwatershed management unit for classification. Each SMU was also given a name. This information can be found in Table 4. This table also provides acreage and major waterbodies found within each SMU. Detailed information for the SMU can be found in later chapters.

2.1.4 Characteristics of the SMU

The Upper Pond Creek subwatershed (SMU 1) represents the headwaters of Pond Creek. The creek in this section has a low flow. With a total acreage of 901, this SMU features a low impervious network, and land use is mainly composed of cultivated crops, pasture/hay, and deciduous forest.

The Lincoln subwatershed (SMU 2) is in the southeastern portion of the watershed. The unincorporated community of Corinth lies just within the southern border of the SMU near Lincoln Elementary School, for which the SMU is named. Although the SMU is mostly agricultural, it also has the second highest percentage of deciduous forest.

The Jordan's Fort subwatershed (SMU 3) contains nearly an equal mixture of pasture/hay and cultivated crops. There is also a considerable amount of deciduous forest. Pond Creek runs through the center of the SMU.

The Mach-East and Mach-West subwatersheds (SMU 4 and 5) are most noted for the Pond Creek Mine No. 1 (Mach Mine) which straddles the two SMUs. The two watersheds also have a considerable amount of deciduous forests, especially Mach-East which is 58 percent deciduous forest.

The Davis subwatershed (SMU 6) is the second largest SMU in the watershed. It is mostly agricultural. Outside the Mach (4 and 5) SMU, it has the most open water at 20 acres.

Figure 8- Subwatersheds

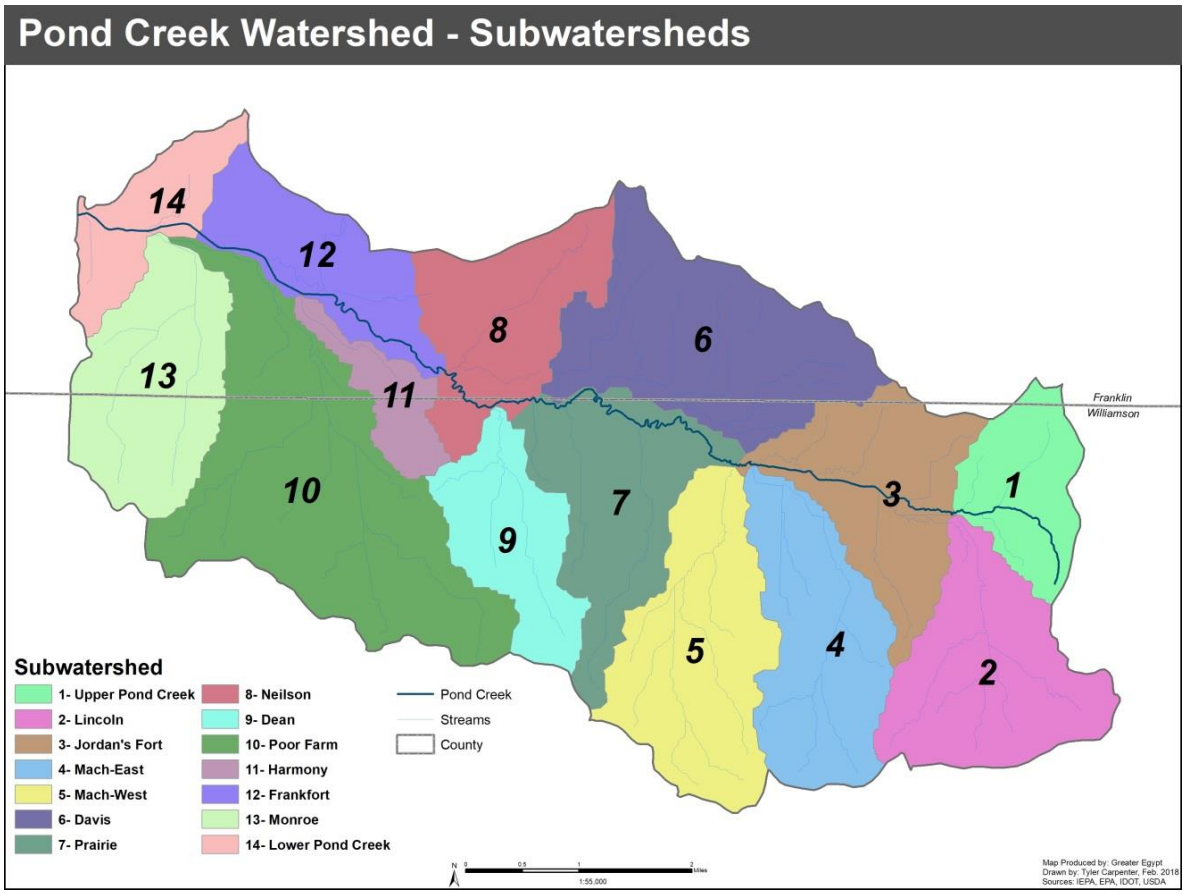


Table 4- SMU Information

MAP ID	NAME	ACRES	HUC 14 CODE	MAJOR WATERBODY
1	Upper Pond Creek	901.49	07140106050101	Pond Creek
2	Lincoln	1731.05	07140106050102	-
3	Jordan's Fort	1511.43	07140106050103	Pond Creek
4	Mach-East	1636.80	07140106050104	-
5	Mach-West	1907.02	07140106050105	-
6	Davis	2194.77	07140106050106	-
7	Prairie	1612.09	07140106050107	Pond Creek
8	Neilson	1374.65	07140106050108	Pond Creek
9	Dean	1065.17	07140106050109	-
10	Poor Farm	3294.05	07140106050110	-
11	Harmony	479.43	07140106050111	-
12	Frankfort	1130.11	07140106050112	Pond Creek
13	Monroe	1595.19	07140106050113	-
14	Lower Pond Creek	758.74	07140106050114	Pond Creek

The Prairie and Dean subwatersheds (SMU 7 and 9) are mostly agricultural. There are a few isolated areas of high imperviousness due to farmsteads in the area.

The Neilson subwatershed (SMU 8) has the highest percentage of cultivated crops and the lowest percentage of pasture/hay. It also contains an Ameren Illinois Company electric substation, which contributes to a small area of high imperviousness.

The Poor Farm subwatershed (SMU 10) is the largest in the watershed at 3,294 acres. It is mostly agricultural with wetlands towards the north.

The Harmony subwatershed (SMU 11) is the smallest at just 479 acres. It is mostly cultivated crops, but it also has the highest amount of emergent herbaceous wetlands at 14 acres.

The Frankfort and Lower Pond Creek subwatersheds (SMU 12 and 14) represent the final length of Pond Creek in the northwestern portion of the entire watershed. Most of the wetlands in the Pond Creek watershed can be found in

these two SMU. The city of West Frankfort reaches into these SMU representing the highest concentration of developed land in the watershed. While Frankfort has 371 acres of cultivated crops, mostly to the east, Lower Pond Creek is the only SMU in the watershed to have no cultivated crops.

The Monroe subwatershed (SMU 13) has the highest percentage of Pasture/hay and the second lowest percentage of cultivated crops.

2.2 Climate

The climate in the Pond Creek watershed borders the Humid Subtropical and Humid continental climates. David Muir explains the climate in the area by stating, "The incursion of air masses from different directions results in quite variable weather patterns. Warm moist air from the gulf, cold dry air from Canada, and dry continental air from the southwest are the major influences on weather. Landform and topography have a negligible impact on climate in this area."[2]

Temperatures in the region can vary significantly due to the effects of warm gulf air from the south and cold Canadian air. Local temperature data was taken from the NOAA weather observation station located roughly five miles south of the watershed just northeast of Marion, Illinois. The average temperature between 1981 and 2010 was 53.9 degrees Fahrenheit.[3] The average daily high and low were 64.2 and 43.6. Table 5 summarizes temperature information for the area between 1981 and 2010.

Table 5- 2016 Monthly Average Temperatures

1981-2010 MONTHLY AVERAGE TEMPERATURES (degrees Farenheit)													
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average High	38.4	43.7	53.8	65.6	74.5	81.6	85.9	85.4	78.5	66.7	54.6	41.4	64.2
Average	29.8	34.1	43.4	54.1	63.6	71.7	75.8	74.4	66.7	55.1	44.6	32.9	53.9
Average Low	21.2	24.5	33.1	42.6	52.7	61.7	65.7	63.5	55	43.6	34.7	24.4	43.6

Source: NOAA- National Climatic Data Search

The Pond Creek watershed is subject to considerable rainfall throughout the year. Local precipitation data was taken from the NOAA weather observation station located in West Frankfort. The average annual precipitation was 43.49 inches between 1981 and 2010. The wettest months are typically from March to June; however, precipitation can also be high in November and December. Average snowfall amounts in the region are around 14 inches annually. Table 6 displays the monthly average precipitation between 1981 and 2010.

[2] David Muir, et al., "Upper Crab Orchard Creek: A Watershed Inventory," Greater Egypt Regional Planning and Development Commission, 1988, 6.
[3] NOAA/National Climatic Data Search, "Climate Data Online Search," https://www.ncdc.noaa.gov/cdo-web/search. Accessed 22 February 2018.

Table 6- 1981-2010 Monthly Average Precipitation

1981-2010 MONTHLY AVERAGE PRECIPITATION (in inches)													
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Total	2.71	2.91	3.99	4.14	4.82	3.93	3.43	3.09	2.75	3.57	4.41	3.74	43.49

Source: NOAA- National Climatic Data Search

During the spring and summer months, damaging storms and heavy rainfall can be expected. Heavy rainfall usually leads to regional and localized flooding. More severe occurrences of flooding take place along the Big Muddy River and larger tributaries that flow into the Mississippi River. Like most areas in the Midwest, the watershed is also susceptible to tornadoes, especially in the spring.

Table 7- Wind Data

Month	Average Wind Speed (mph)	Max Speed (mph)	Average Direction
Jan	7.2	45.4	209.8
Feb	7.7	36.9	218.7
Mar	8.2	41.6	200.3
Apr	7.5	39.3	178.6
May	6.4	50.7	216.6
Jun	4.7	32.3	203.8
Jul	4.3	33.8	211.4
Aug	3.5	40.8	188.5
Sep	3.8	24.3	189.7
Oct	5.8	30.3	205.6
Nov	6.7	55.2	188.2
Dec	6.9	40.7	209.0
AVG	6.1	39.3	201.7

Source: Illinois Climate Network

Wind data was obtained from the Illinois Climate Network (ICN) Carbondale Station, located on SIU farm. [4] Table 7 displays the average wind data from the ICN. Wind speed generally ranges from 3 to 8 miles per hour throughout the year with an average of 6.1 miles per hour. However, wind gusts can average 24 to 55 miles per hour in any particular month. From the data, there seems to be a prevalent pattern of wind SSW (south/southwest). Considering the region is fairly flat, wind direction is caused by incoming weather patterns.

[4] ICN, "Water and Atmospheric Resources Monitoring Program," http://www.isws.illinois.edu/warm/datatype.asp. Accessed 26 February 2018.

2.3 Geology

The Pond Creek watershed is located in the Central Lowland Province, Tills Plains Section. It is also in close proximity to the Interior Low Plateau to the south, and the Ozark Plateaus to the southwest. The physiographic provinces are further partitioned into divisions. The watershed rests just above the southern border of the Mt. Vernon Hill Country Division. [5]

Figure 10 shows the geologic units of the Pond Creek watershed and the surrounding area. The Pennsylvania System includes the uppermost bedrock in the Pond Creek watershed. It is overlain by relatively thin layers of glacial drift, loess, and alluvial deposits in river valleys. The Pennsylvanian surface is eroded by action of pre-glacial streams. System series, group, and underlying geologic formations can be seen in Figure 9.

Sometimes paired as a single formation, the Shelburn-Patoka Formation primarily consists of shale and sandstone. Other deposits include coal and limestone. General thickness of the Shelburn Formation is 100 to 275 feet. While it is mainly comprised of sandstone, the Shelburn Formation also exhibits deposits of black shale, coal and limestone.[6]

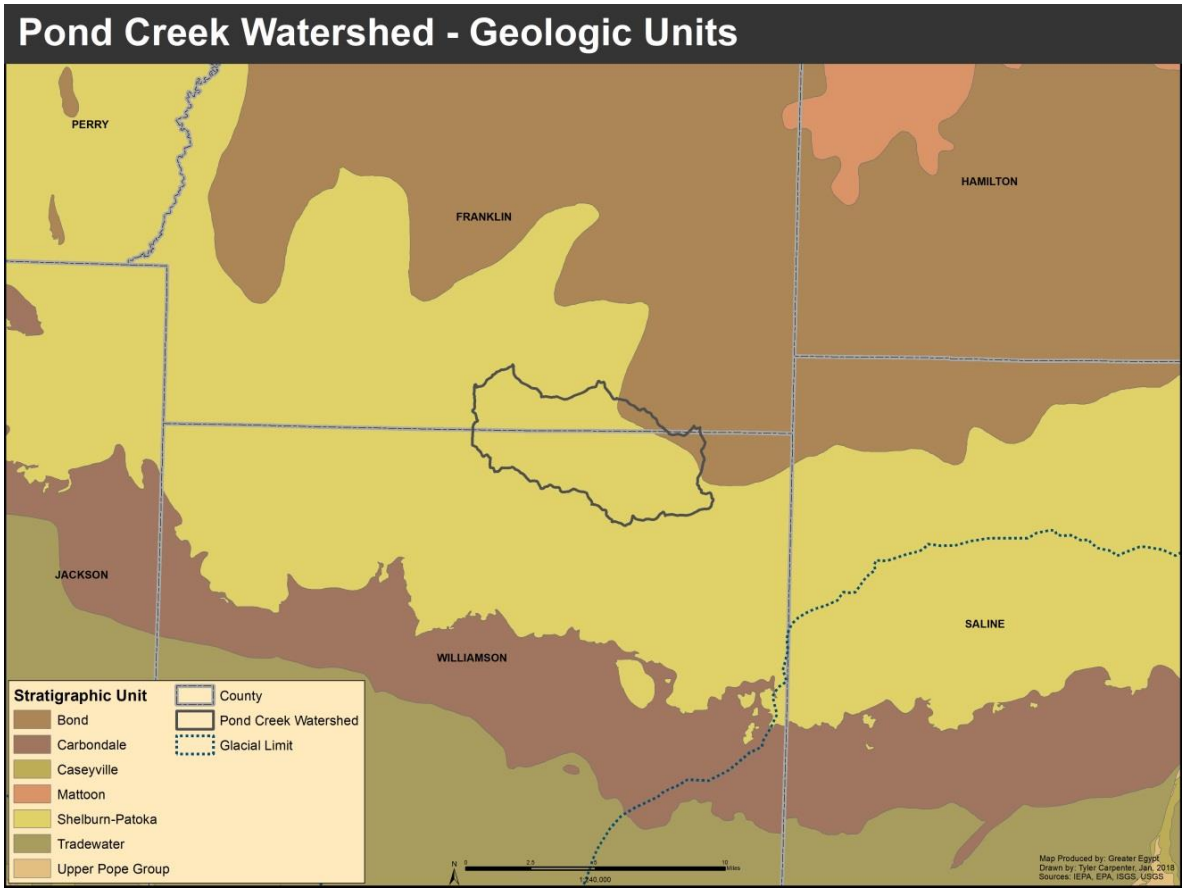
The Patoka Formation reaches a thickness of around 300 feet. Shale and sandstone compose around 85 percent of the Patoka Formation. The Shelburn-Patoka Formation constitutes 93.5% of the geologic structure of the Pond Creek watershed. The Bond formation makes up the other 6.5% of the watershed. This formation is characterized by a high percentage of limestone and calcareous clays and shales.[7]

Figure 9- Generalized Stratigraphic Column of the Pennsylvanian in Illinois

Source: ISGS (modified)

[5] Willman, H. B., Elwood Atherton, T. C. Buschbach, Charles Collinson, John C. Frye, M. E. Hopkins, Jerry A. Lineback, and Jack A. Simon, "Handbook of Illinois Stratigraphy," *Illinois State Geological Survey Bulletin* 95, no. 261 (1975).
[6] Tri-State Committee on Correlation of the Pennsylvanian System in the Illinois Basin, *Toward a More Uniform Stratigraphic Nomenclature for Rock Units of the Pennsylvanian System in the Illinois Basin.* (Bloomington: Illinois Basin Consortium, 2001), 16.
[7] Willman, H. B., Elwood Atherton, T. C. Buschbach, Charles Collinson, John C. Frye, M. E. Hopkins, Jerry A. Lineback, and Jack A. Simon, "Handbook of Illinois Stratigraphy," *Illinois State Geological Survey Bulletin* 95, no. 261 (1975).

Figure 10- Geologic Units

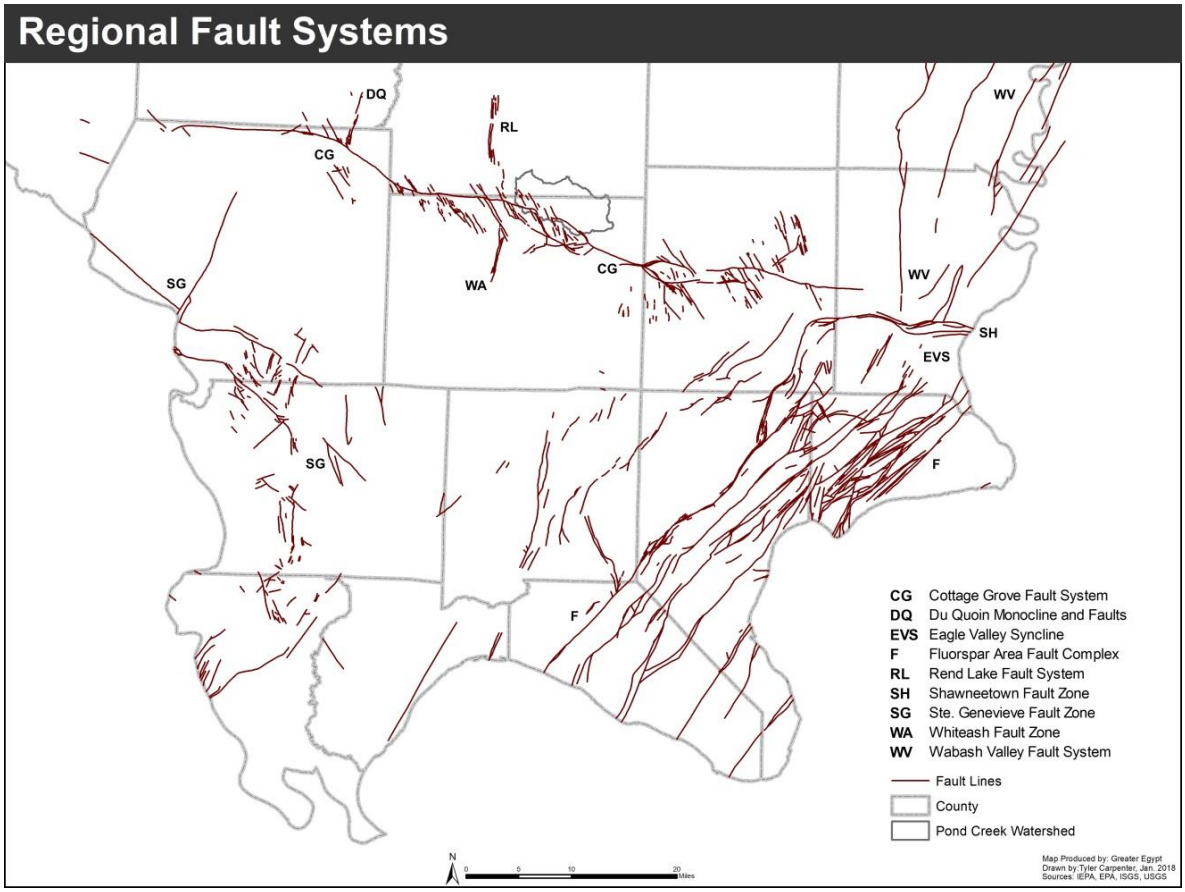


Source: ISGS (modified)

2.3.1 Geologic Faults

Regionally, the area exhibits a complex network of fault systems uncommon to most of the Midwestern United States. These zones are displayed in Figure 11 . Southern Illinois lies just north of the most seismically active area of the Midwest being the New Madrid Seismic Zone that lies along the border of Missouri, Arkansas, Kentucky and Tennessee. It also encompasses much of the Wabash Valley Fault Zone.

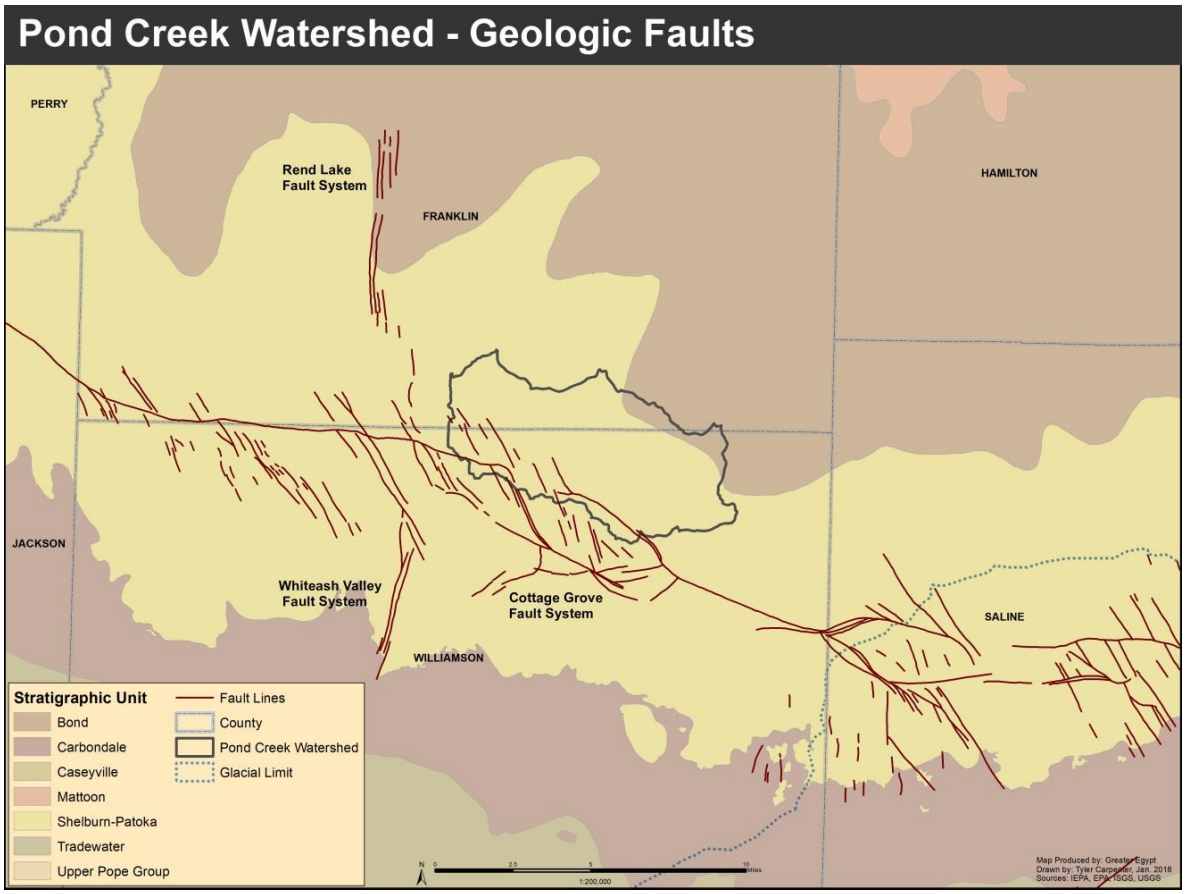
Figure 11- Regional Fault Systems



The Pond Creek watershed lies near the convergence of three separate fault zones (Figure 12). The Cottage Grove Fault System runs in an easterly-westerly direction extending from Gallatin to Randolph County. The southern border of the Pond Creek watershed marks the mid-section of this system. This system is intersected by the Whiteash Fault Zone to the south, and the Rend Lake Fault System to the north. Other than possessing strictly geologic impacts, the fault zone (specifically Cottage Grove) also has other significance. According to the ISGS, "Several discoveries have been made in structural traps along the system. The zone of faults generally marks the southern limit of petroleum production in Illinois. The fault also crosses one of the main coal-producing areas in Illinois and adds considerably to the danger and expense of mining there."[8]

[8] Nelson, John W., H.F. Krausse, *The Cottage Grove Fault System in Southern Illinois.* (Champaign, IL: Illinois State Geological Society, 1981, 1.

Figure 12- Geologic Faults



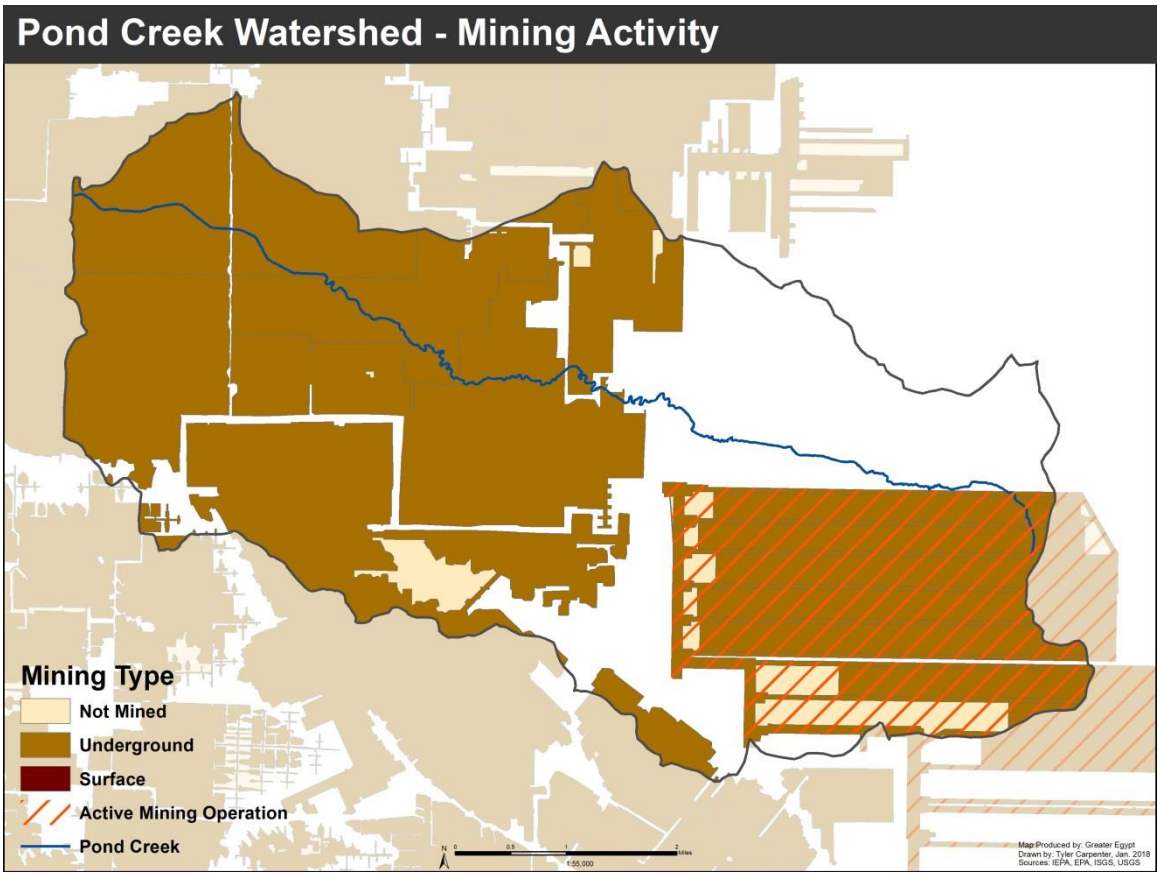
2.3.2 Mining

Although most mining companies have ceased operations in the area since 1987, there is one active mine in the southeastern part of the watershed. Williamson Energy, LLC's Pond Creek No. 1 Mine is located in Williamson and Franklin Counties. Development of the mine began in 2005 and operations started in 2008. The mine was the most productive underground coal mine in the United States for its first five years based on clean tons produced per man hour worked. [9]

Mining in the watershed accounts for 14,600.8 acres; all of which is underground mining. The active underground mine is 3,911.1 acres or 18.45 percent of the watershed. Figure 13 displays the location of mining activity in the watershed by type.

[9] Foresight Energy, "Operations," http://www.foresight.com/operations/.Accessed 28 February 2018.

Figure 13- Mining Activity



2.4 Soil Conditions

The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soils mapping data (Web Soil Survey) and the Soil Survey of Williamson County (USDA-NRCS) were utilized for the examination of soils within the Pond Creek watershed. This data was utilized to summarize the soil types, soil erodibility, hydric status, soil drainage, and hydrologic soil groups.

2.4.1 Hydrologic Soil Groups

There are 23 dominant soil types within the Pond Creek watershed. Each soil is placed in a certain hydrologic group depending on the rate of water infiltration. These factors include whether the soil is protected by vegetation, consistently wet, or receives precipitation from storms.[10] The USDA defines the hydrologic soil groups by the following:

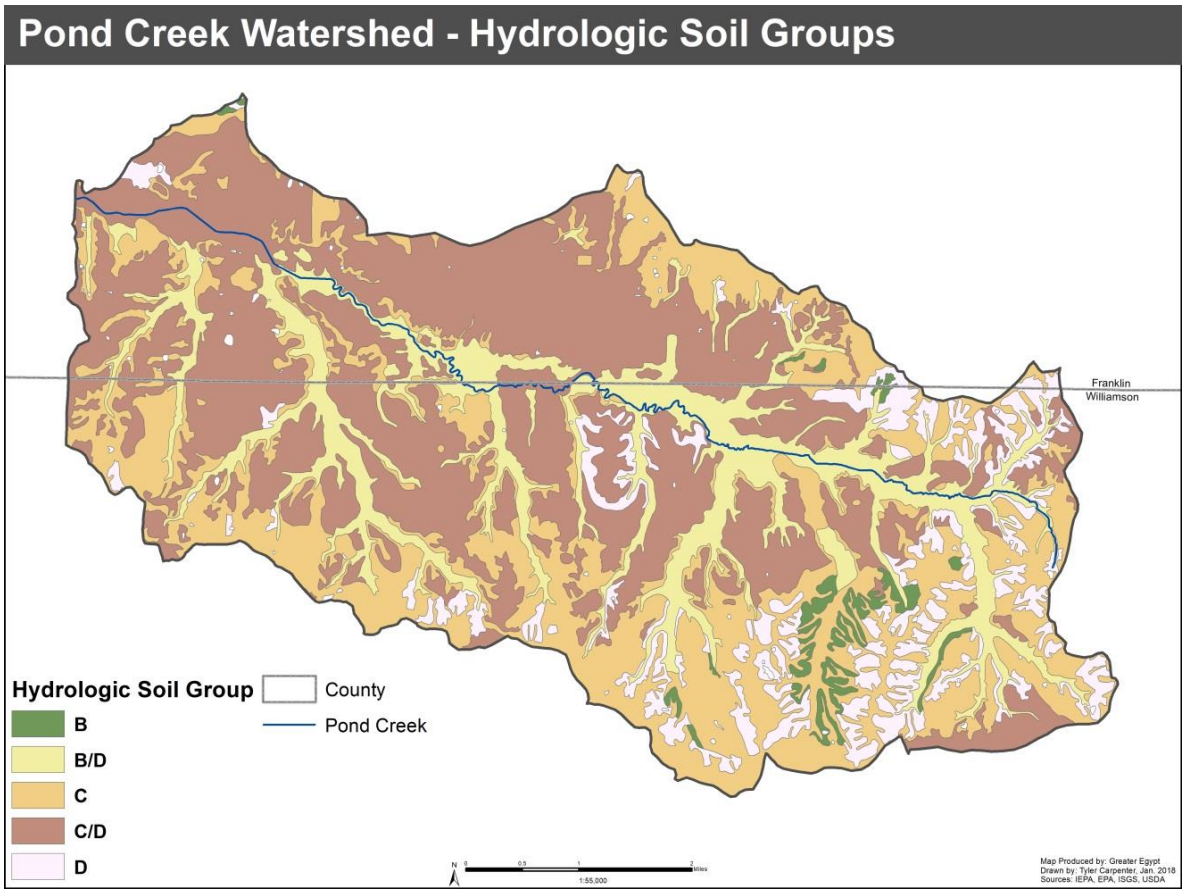
> **Group A**: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
>
> **Group B**: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
>
> **Group C:** Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
>
> **Group D:** Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a

[10] USDA, NRCS. "Web Soil Survey." http://websoilsurvey.sc.egov.usda.gov/. Accessed: January, 2018.

claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.[11]

Soils can also be assigned to a dual hydrologic group (A/D, B/D, or C/D). The first letter represents drained areas while the latter represents undrained areas. Information on the hydrologic soil groups and relative information can be seen in Table 8. These groupings are also spatially depicted in Figure 14.

Figure 14- Hydrologic Soil Groups



[11] Ibid.

Table 8- Hydrologic Soil Groups

Hydrologic Group	Soil Texture	Drainage	Infiltration	Transmission Rate
A	Sand or Gravel	Deep, Well Drained to Excessivley Drained	High	High
B	Moderately Fine to Moderatley Coarse	Moderately Deep or Deep, Moderately Well Drained or Well Drained	Moderate	Moderate
C	Moderatley Fine to Fine	Layer that Impedes the Downward Movement of Water	Slow	Slow
D	Clays	High Shrink-Swell Potential, High Water Table, Claypan Layer Near Surface, Shallow Over Nearly Impervious Surfaces	Very Slow (High Runoff)	Very Slow

Source: USDA-NRCS

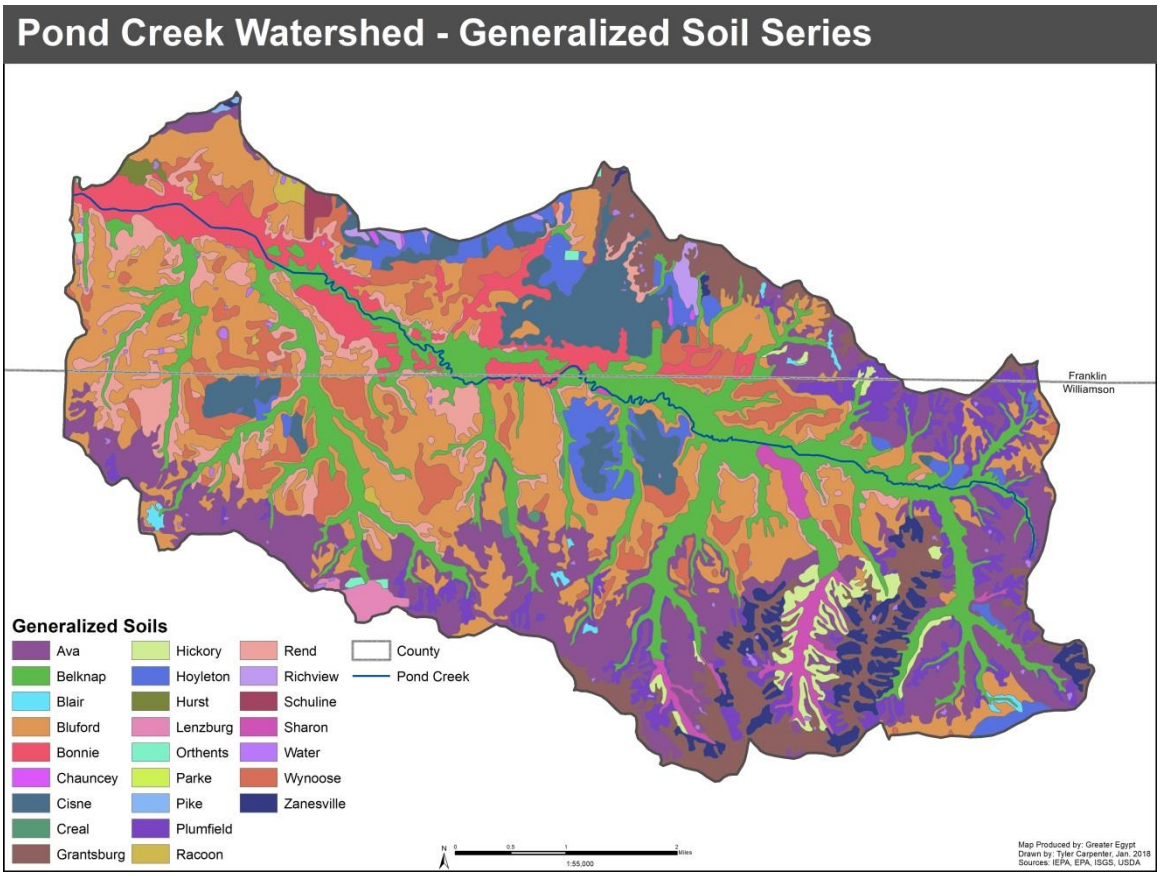
Covering approximately 4,765 acres in the Pond Creek watershed, Bluford is the predominant soil series among the 23 soil types. This also accounts for 22 percent of the watershed. The Belknap soil type is the second most dominant soil type encompassing around 3,327.4 acres, or around sixteen percent of the watershed. The Ava soil type is only slightly less prevalent at 3,259 acres, or fifteen percent of the watershed. Information regarding the Pond Creek watershed general soil series can be found in Table 9.

Soils in the watershed vary within the hydrologic group classification. Only three soils fall under group B. These are the Hickory, Pike, and Sharon soils. They account for three percent of the watershed. Group C contains eight soils: Ava, Creal, Grantsburg, Lenzburg, Orthents, Rend, Richview, and Schuline. These soils make up 29 percent of the Pond Creek watershed. The Hurst, Plumfield, and Zanesville soils are categorized as group D and account for nine percent of the watershed.

Dual hydrologic soil groups account for a third of the watershed. The Belknap soil type is the only soil representing group B/D and makes up sixteen percent of the watershed. The remaining eight soils are associated with soil group C/D. These include: Blair, Bluford, Bonnie, Chauncey, Cisne, three subsets of Hoyleton, Racoon, and Wynoose. This group makes up nearly 43 percent of the watershed.

Soils are displayed in Table 9 with their respective hydrologic groups. Figure 15 displays the names and locations of all dominant soil types.

Figure 15- Generalized Soil Series



2.4.2 Hydric Soils

The USDA-NRCS defines hydric soils as a "soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part".[12] Of the 23 soils that comprise the Pond Creek watershed, only five are defined as hydric soils. Table 10 contains the hydric soils with acreage and percent of watershed. These soils account for 3,704 acres, or seventeen percent of the watershed.

At 1,471.2 acres, the Wynoose soil series is the largest hydric soil in the watershed. This also covers just almost seven percent of the entire watershed.

[12] Ibid.

The Bonnie and Cisne soils cover about five percent of the watershed each. The Chauncey and Racoon soils make up less than one percent. Hydric soils in the watershed are depicted in Figure 16.

Table 9- Soils and Classifications

Soil Series	Hydric Y/N	Erodibility K Factor	Hydrologic Soil Group	Drainage	Acres	Percent of Watershed
Ava	N	.37- .43	C	MWD	3259.0	15.38%
Belknap	N	.43	B/D	SPD	3327.4	15.70%
Blair	N	.43	C/D	SPD	64.5	0.30%
Bluford	N	.49	C/D	SPD	4765.6	22.49%
Bonnie	Y	.43	C/D	PD	1085.4	5.12%
Chauncey	Y	.37	C/D	PD	15.0	0.07%
Cisne	Y	.49	C/D	PD	1063.2	5.02%
Creal	N	.43	C	SPD	22.9	0.11%
Grantsburg	N	.43	C	MWD	1400.9	6.61%
Hickory	N	.32-.43	B	WD	318.4	1.50%
Hoyleton	N	.37-.49	C/D,D	SPD	693.9	3.27%
Hurst	N	.43	D	SPD	40.2	0.19%
Lenzburg	N	.20	C	WD	92.9	0.44%
Orthents	N	.43	C	WD	27.0	0.13%
Pike	N	.37	B	WD	8.1	0.04%
Plumfield	N	.49	D	MWD	1164.1	5.49%
Racoon	Y	.43	C/D	PD	69.2	0.33%
Rend	N	.43	C	MWD	1270.4	5.99%
Richview	N	.43	C	MWD	80.7	0.38%
Schuline	N	.43	C	WD	46.4	0.22%
Sharon	N	.43	B	MWD	309.5	1.46%
Wynoose	Y	.49	C/D	PD	1471.2	6.94%
Zanesville	N	.43	D	MWD	524.9	2.48%

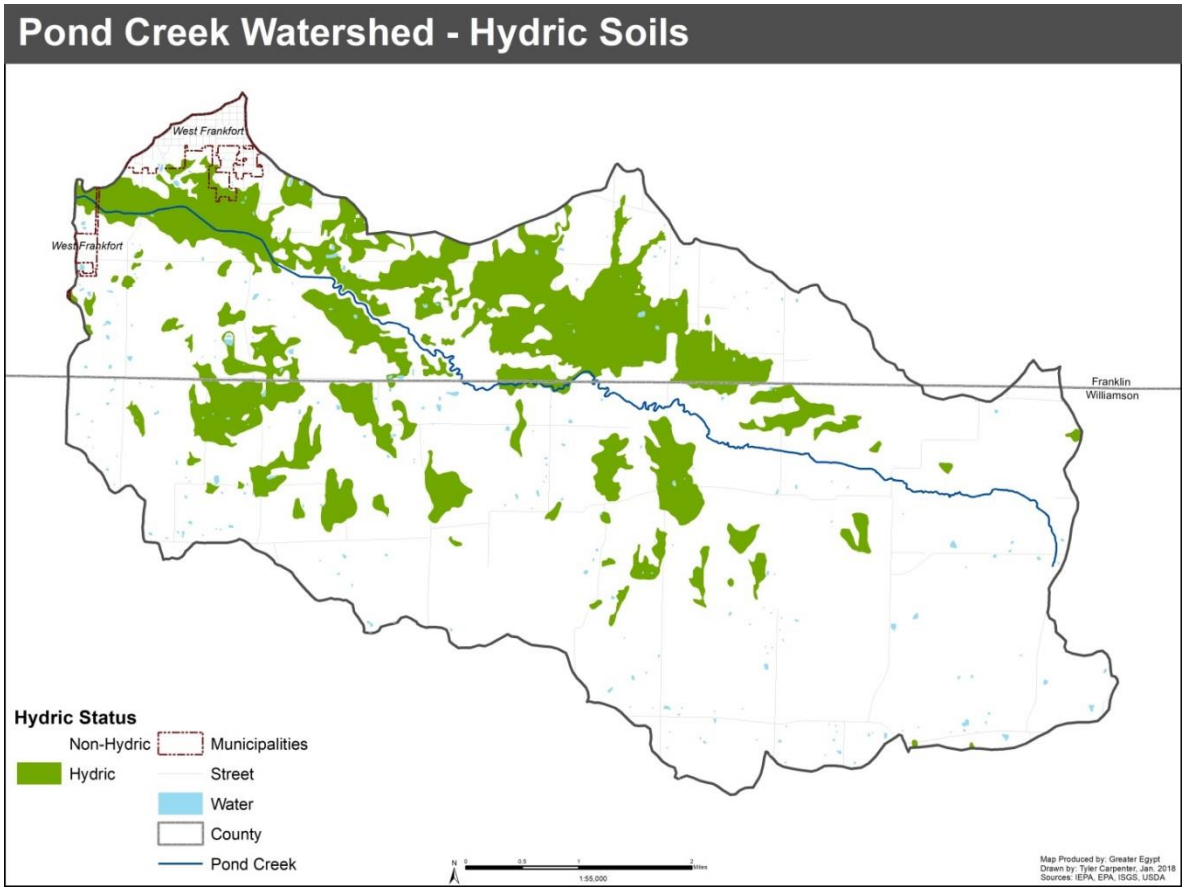
Source: USDA-NRCS

Table 10- Hydric Soils

Hydric Soils	Acres	Percent of Watershed
Bonnie	1085.3	5.12%
Chauncey	15	0.07%
Cisne	1063	5.02%
Racoon	69.2	0.33%
Wynoose	1471	6.94%
Totals	**3703.5**	**16.69%**

Source: USDA NRCS

Figure 16- Hydric Soils



2.4.3 Soil Erodibility

Soil erodibility in the Pond Creek varies by location. The soil erodibility factor (K-factor) was utilized to delineate erodibility. The USDA-NRCS defines K-factor as the following:

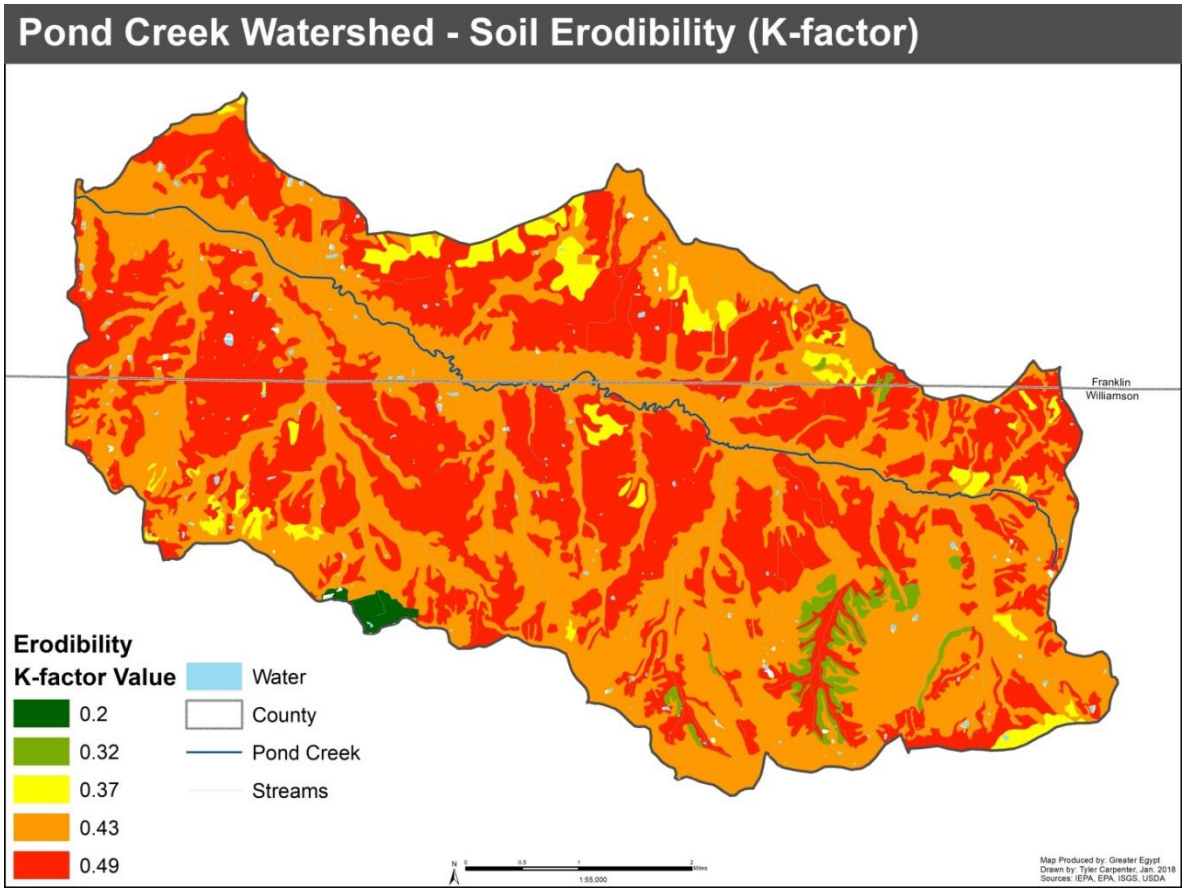
> Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.[13]

Erodibility correlates with the gradual increase in the K-factor value. The K-factor for soils in the Pond Creek watershed ranges from .20 to .49. These values usually correlate with other features of the soils including hydric status and drainage classification.

K-factor values can be seen in Figure 9. The Lenzburg series has the lowest K-factor value at .20. While the majority of soils have a K-factor value of .43, five soils consist of a K-factor value of .49: Bluford, Cisne, Plumfield, Wynoose and subsets of the Hoyleton soil series. These represent the highest erodible soils in the Pond Creek watershed. Soils and their K-factor values are depicted in Figure 17.

[13] Ibid.

Figure 17- Soil Erodibility (K-factor)



2.4.4 Soil Drainage

The USDA also provides information regarding the drainage classifications of each soil type. In this case, these classes are meant to describe the natural drainage characteristics. There are seven classifications ranging from "Excessively drained," to "Very poorly drained." Of the seven, four classes represent the soil drainage classes located in the Pond Creek watershed. The USDA defines the classes by the following:

> **Well drained:** Water is removed from the soil readily but not rapidly. Internal free water occurrence commonly is deep or very deep; annual duration is not specified. Water is available to plants throughout most of the growing season in humid regions. Wetness does not inhibit growth of roots for significant periods during most growing seasons. The soils are

mainly free of the deep to redoximorphic features that are related to wetness.

Moderately well drained: Water is removed from the soil somewhat slowly during some periods of the year. Internal free water occurrence commonly is moderately deep and transitory through permanent. The soils are wet for only a short time within the rooting depth during the growing season, but long enough that most mesophytic crops are affected. They commonly have a moderately low or lower saturated hydraulic conductivity in a layer within the upper 1 m, periodically receive high rainfall, or both.

Somewhat poorly drained: Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. The occurrence of internal free water commonly is shallow to moderately deep and transitory to permanent. Wetness markedly restricts the growth of mesophytic crops, unless artificial drainage is provided. The soils commonly have one or more of the following characteristics: low or very low saturated hydraulic conductivity, a high water table, additional water from seepage, or nearly continuous rainfall.

Poorly drained: Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present. This water table is commonly the result of low or very low saturated hydraulic conductivity of nearly continuous rainfall, or of a combination of these.[14]

These four classifications constitute all of the watershed total acreage, not including the less than half a percent of water. Table 11 displays these values. Most of the soils are somewhat poorly drained at 8,914.5 acres, or 42.07 percent

[14] USDA. "Soil Survey Manual." (USDA 1993)

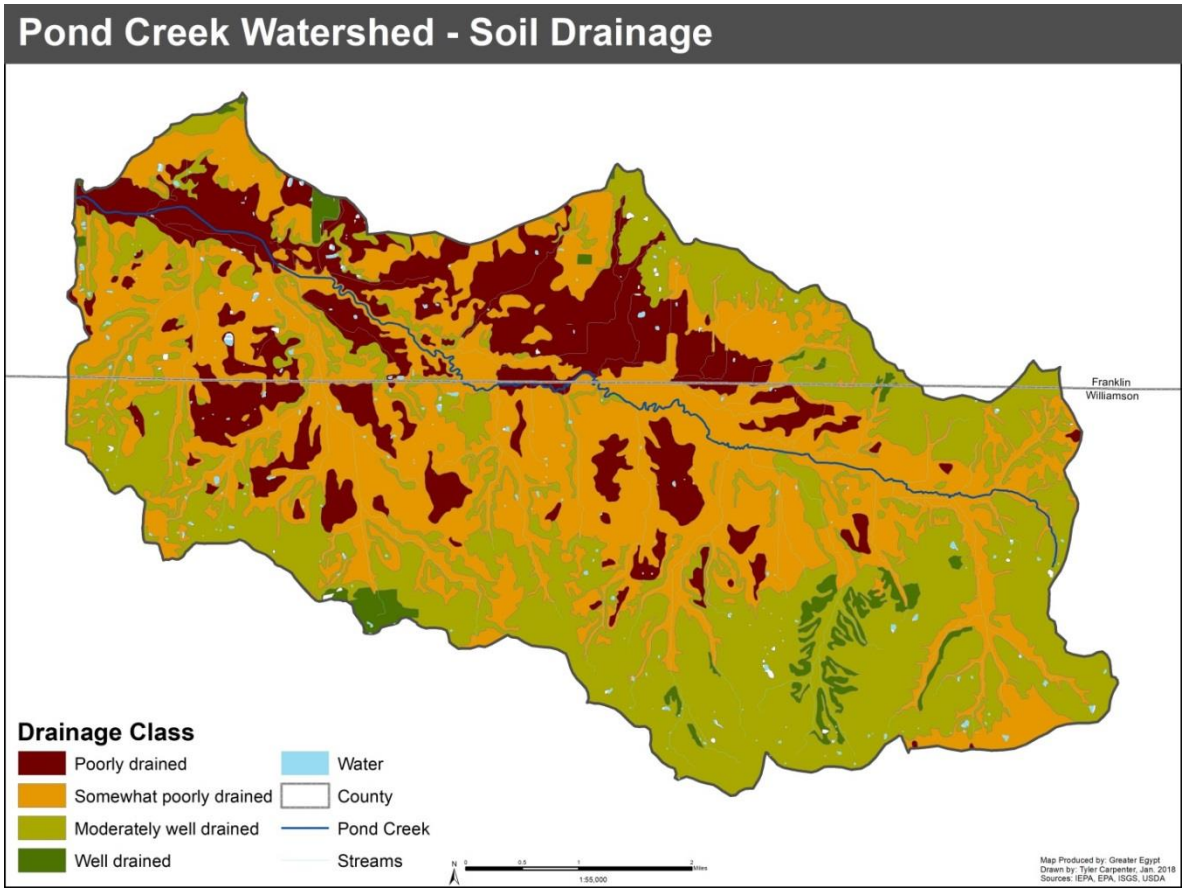
of the watershed or moderately well drained at 8,009.5 acres or 37.79 percent. Some of the soils are poorly drained at 3,704 acres or 17.48 percent. The group with the least representation is well drained; being 492.8 acres, or 2.33 percent of the watershed. These results are also displayed in Figure 18.

Table 11- Drainage Classifications

Drainage Class	Acres	Percent of Watershed
Poorly Drained	3704	17.48%
Somewhat Poorly Drained	8914.5	42.07%
Moderately Well Drained	8009.5	37.79%
Well Drained	492.8	2.33%
Water	73.6	.35%

Source: USDA-NRCS

Figure 18- Soil Drainage



2.5 Watershed Jurisdictions

While the Pond Creek watershed rests within Williamson and Franklin Counties, there is only one municipality within its border; The City of West Frankfort. While it constitutes 3,210 acres, only 317 acres are within the borders of the Pond Creek watershed.

Although civil townships are absent in Williamson County, there is a presence of survey townships, or congressional townships. In contrast, Franklin County is divided into civil townships.

Table 12 displays these townships and their size relative to the watershed. The municipality of West Frankfort is also depicted. The townships and precincts are also depicted in Figure 19.

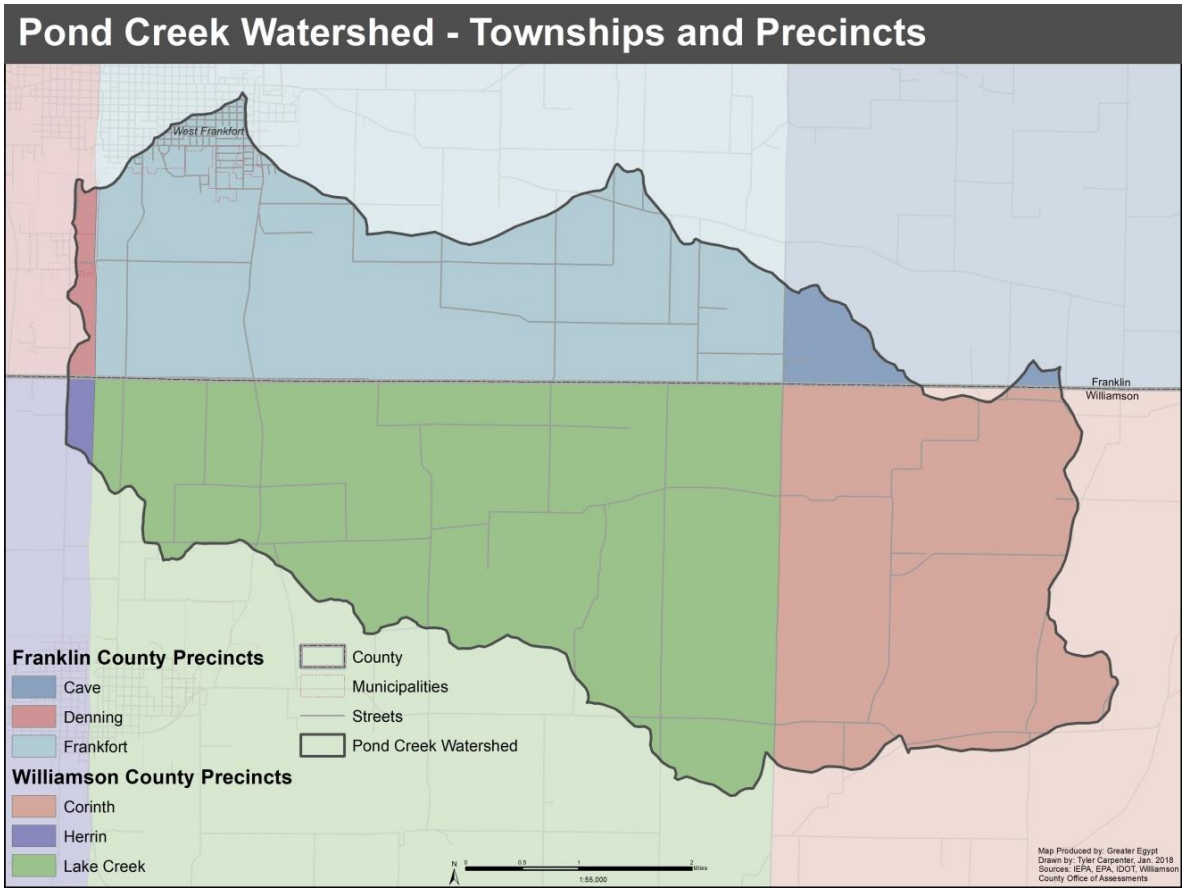
In Williamson and Franklin Counties, municipalities generally operate wastewater treatment plants. The City of West Frankfort operates a treatment plant, but the discharge is outside of the watershed boundary. Currently, there are no existing watershed planning initiatives in the Pond Creek watershed, but a few entities conduct programs related to water quality.

Table 12- Jurisdictional Areas

Jurisdiction	Total Acres	Acres in Watershed	Percent of Watershed
County	**545,973**	**21,192**	**100%**
Williamson	284,213	14,268	67.3%
Franklin	261,760	6924	32.7%
Municipality	**3,210**	**317**	**1.5%**
West Frankfort	3,210	317	1.5%
Townships	**141,296**	**21,192**	**100%**
Cave	23,366	446	2.1%
Corinth	23,313	5382	25.4%
Denning	23,680	188	0.9%
Frankfort	23,616	6254	29.5%
Herrin	23,873	101	0.5%
Lake Creek	23,448	8822	41.6%

Source: US Census Bureau

Figure 19- Townships and Precincts



2.5.1. Municipal Ordinances

Counties and municipalities in the Pond Creek watershed have adopted ordinances in regards to flooding which includes elements of stormwater and erosion control. The communities have used the Williamson County Flood Damage Prevention Ordinance as a model for their specific codes. Information on these ordinances has been retrieved through the 2009 Franklin and Williamson County Multi-Hazard Mitigation Plans. [15][16] The information has been verified by contacting each municipal department. This ensures that information has not been edited since the adoption of the 2009 Williamson County Multi-Hazard Mitigation Plan and the 2015 update.

[15] Greater Egypt Regional Planning and Development Commission, et al. "Franklin County Multi-Hazard Mitigation Plan," Greater Egypt, 2009, 99-101.
[16] Greater Egypt Regional Planning and Development Commission, et al. "Williamson County Multi-Hazard Mitigation Plan," Greater Egypt, 2009, 101-104.

Franklin and Williamson Counties, along with the municipality in the Pond Creek watershed, participate in the National Flood Insurance Program (NFIP). This program allows homeowners and businesses to purchase flood insurance as long as the community has adopted and enforced ordinances that reduce the potential for flooding.

Ordinance No. 08-70-31-05 is the Flood Damage Prevention Ordinance for Williamson County. In addition to many other purposes, it serves to preserve the natural characteristics and functions of watercourses and floodplains in order to moderate flood and stormwater impacts, improve water quality, reduce soil erosion, protect aquatic and riparian habitat, provide recreational opportunities, provide aesthetic benefits and enhance community and economic development.[17]

Counties and municipalities have also implemented programs and policies that target erosion. Under the Illinois Administrative Code Title 35 (Illinois Environmental Protection Act), Franklin County is required to submit a Stormwater Pollution Prevention Plan (SWPPP).[18] There are erosion and sediment controls under Subdivision Ordinance, Section 7 for Williamson County. To prevent or reduce erosion, subdividers are required to sod or reseed turf of exposed areas.[19]

The City of West Frankfort has a code of ordinances which contains regulations related to flood damage prevention.[20] It also prohibits the discharge of pollutants into stormwater drains and the use of groundwater as a potable water supply.

2.5.2 Local, State and Federal Responsibilities

In the Pond Creek watershed, there are a few local, state and federal agencies that implement programs related to watershed planning, water quality, and nonpoint source pollution. While some of these agencies have applied programs that target water related resources specifically for the Pond Creek watershed, other agencies have programs designated for these purposes, but have not been established for the Pond Creek watershed.

[17] Williamson County, IL. "Flood Damage Prevention Ordinance," Williamson County, 2008, 2.
[18] Greater Egypt Regional Planning and Development Commission, et al. "Franklin County Multi-Hazard Mitigation Plan," Greater Egypt, 2009, 101.
[19] Ibid., 104.
[20] West Frankfort, Illinois. "Code of Ordinances," https://library.municode.com/il/west_frankfort/codes/code_of_ordinances. Accessed 6 March 2018.

The following agencies have been described by their roles related to watershed planning, water quality, and nonpoint source pollution prevention within and outside the Pond Creek watershed.

Franklin-Williamson Bi-County Health Department

Since Williamson County has a considerable municipal water program, the aim of the Franklin-Williamson Bi-County Health Department is to protect the water sources from private sources. According to their online information, the Health Department conducts inspections that follow the guidelines set by the Illinois Water Well Construction Code and the Illinois Water Well Pump Installation Code (Environmental Health).[21]

Greater Egypt Regional Planning and Development Commission

Since the 1960s, the Greater Egypt Regional Planning and Development Commission (Greater Egypt) has played an important role in regional water-related issues such as: watershed planning, water quality, and nonpoint source pollution. Greater Egypt has produced watershed inventories and plans for: Rend Lake, Cedar Lake, Atchison Creek, Pinckneyville Reservoir, Upper Crab Orchard, and the Upper Big Muddy watershed. These reports involved describing watershed characteristics and water quality in the particular watershed.

Most recently, the Lake Creek Watershed-based Plan was approved by the IEPA in 2018. This is also located in the larger Big Muddy watershed. The plan consisted of an inventory and assessment and identified best management practices to control impairments in the watershed. The plan followed the *Nine Minimum Elements of a Watershed Plan* outlined by the EPA.

In 1981, the Illinois Environmental Protection Agency established the Volunteer Lake Monitoring Program. This program was established to gather fundamental

[21] Franklin-Williamson Bi-County Health Department. "Private Water Supply Program," http://www.bicountyhealth.org/index.php/potable-water-program.html. Accessed Various Dates 2018.

information on Illinois inland lakes. Greater Egypt coordinates the program for Southern Illinois for the fifteen-county region. Volunteers gather the data on water transparency and water quality.

Greater Egypt coordinated the Regional Water Quality Coordinating Council (RWQCC) which served as a public forum that reviewed facility plans and domestic wastewater National Pollutant Discharge Elimination System (NPDES) permits. The council covered the ten-county region until January of 2015.

Illinois Department of Natural Resources (IDNR)

The Illinois Department of Natural Resources is responsible for many programs regarding water related activities. The IDNR Division of Resource Management is responsible for various activities such as: regulating public waters, regulating construction and maintenance of dams, National Flood Insurance Program coordination, and Flood Mitigation Program (nonstructural) administration. [22]

The Division also has an extensive permitting program in which they are responsible for permits for work along Illinois waterbodies. The four main components of the permitting program are: Floodway/Floodplain Management, Public Water Management, Dam Safety, and Lake Michigan Management. [23]

Illinois Environmental Protection Agency (IEPA)

The IEPA oversees and implements many programs that target watershed planning, water quality, and nonpoint source pollution. Through the National Pollutant Discharge Elimination System (NPDES), the IEPA handles stormwater and wastewater discharges to waterbodies. NPDES permits are required for discharges of: treated municipal effluents, treated industrial effluents, and stormwater discharged through separate municipal storm sewer systems (MS4s) and construction sites. The IEPA Bureau of Water characterizes NPDES and other stormwater regulations by the following:

[22] IDNR. "Division of Resource Management," https://www.dnr.illinois.gov/WaterResources/Pages/ResMan.aspx. Accessed January 2018..
[23] IDNR, "Permit Program," https://www.dnr.illinois.gov/WaterResources/Pages/PermitPrograms.aspx. Accessed June 2018.

Under Phase I of the NPDES Storm Water program, operators were required to obtain permit coverage for construction activity that resulted in a total land disturbance of 5 acres or more or less than 5 acres if they were part of a "larger common plan of development or sale" with a planned land disturbance of 5 acres or greater. Phase II reduced that project size to 1 acre or more.

Phase I of the NPDES Storm Water program began in 1990 and required medium and large municipal separate storm sewer systems (MS4s) to obtain NPDES coverage. The expanded Phase II program began in March 2003 and required small MS4s in urbanized areas to obtain NPDES permits and implement six (6) minimum control measures. An urbanized area as delineated by the Bureau of Census is defined as a central place or places and the adjacent densely settled surrounding area that together have a residential population of at least 50,000 people and an overall population density of at least 500 people per square miles.[24]

Three permitted dischargers of wastewater exist in the Pond Creek watershed. These are displayed in Table 13. The NPDES Facility locations are also depicted in Figure 20. More information on existing and discontinued NPDES facilities can be found in the Water Quality section of this report (Section 2.9.5).

Table 13- NPDES Facilities

Facility	NPDES Permit ID
Russell Minerals West Frankfort Inc.	IL0070912
Williamson Energy LLC	IL0077666
Lincoln Grade School STP	IL0042544

Sources: US EPA

United States Fish and Wildlife Service (USFWS)

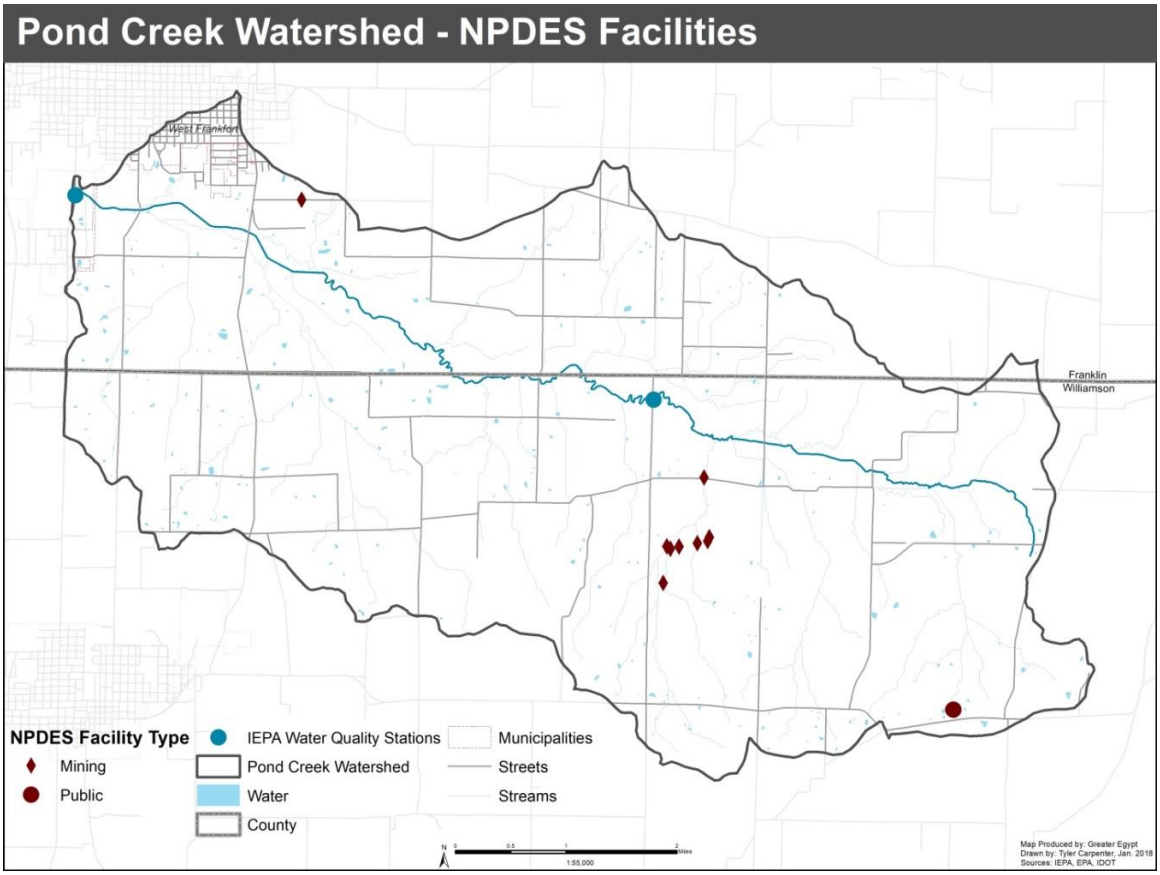
The USFWS works with many facets of government to oversee projects in water resource development, conservation planning, and natural resource damage assessment. In coordination with the United States Army Corps of Engineers (USACE) and other state agencies, the USFWS assists in developing resource

[24] Scott Ristau, e-mail message to author, September 9, 2015.

projects for federal waters. These projects consist of dams, harbor development, flood control, and water storage. Under a collection of policies, the USFWS and the USACE collaborate to conserve the habitats of fish and wildlife during resource development. [25]

Along with water resource development, the agency also collaborates with multiple agencies by providing conservation planning assistance. USFWS staff assists organizations with developing plans of conservation and restoration that accompany their specific objectives of development. [26]

Figure 20- NPDES Facilities



[25] USFWS. "Water Resource Development- Ecological Services," https://www.fws.gov/ecological-services/energy-development/water.html. Accessed Various Dates 2018.
[26] USFWS. "Ecological Services- Conservation Planning," https://www.fws.gov/ecological-services/about/what-we-do.html. Accessed Various Dates 2018.

United States Army Corps of Engineers (USACE)

The United States Army Corps of Engineers St. Louis District is responsible for the preservation and maintenance of waterways within its jurisdiction. Their jurisdiction covers an area which covers eastern Missouri and southwestern Illinois. The Corps is responsible for maintaining the data associated with the waterbodies within its district. Stations in closest proximity to the Pond Creek watershed include Murphysboro and Plumfield which are located along the Big Muddy River.[27]

The Corps is also responsible for water control operations which consist of four Mississippi River navigation structures and five multi-purpose reservoirs within the district which include Rend Lake located north of the Pond Creek watershed.[28]

United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS)

The NRCS is a branch of the USDA that provides assistance to landowners by financial and technical means. Financial assistance programs provided by the agency include: Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP) and Agricultural Management Assistance Program (AMA). These programs assist landowners with agricultural and environmental improvements on their land.[29]

Technical assistance through the department is provided through the Conservation Technical Assistance Program (CTA). The CTA covers a variety of components and includes utilizing land management technology and improving and protecting water quality and fish habitat.[30]

[27] USACE. "St. Louis District- Water Management USACE," http://mvs-wc.mvs.usace.army.mil/. Accessed Various Dates 2018.
[28] Ibid.
[29] USDA Natural Resources Conservation Service. "2014 Farm Bill- Financial Assistance Programs-NRCS," https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/farmbill/?cid=stelprdb1237774. Accessed 20 September 2017.
[30] USDA Natural Resources Conservation Service. "Technical Assistance," https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/. Accessed 20 September 2017.

Williamson and Franklin County Soil & Water Conservation Districts (SWCD)

The Williamson and Franklin Count Soil and Water Conservation Districts implement several programs in relation to conserving natural resources. Some of their programs include implementing conservation practices for farming that reduce soil loss, and environmental sustainability. [31] Duties related to water resources include the conservation and restoration of wetlands, the protection of groundwater resources and surface water quality, and the prevention of soil erosion.

Duties related to water resources include the protection of groundwater resources, the protection of surface water quality, and the prevention of soil erosion. Their mission is "to provide leadership and administer programs to help conserve, improve, and sustain our natural resources and environment as well as reducing soil erosion and improving water quality."[32]

[31] AISWCD. "Association of Illinois Soil and Water Conservation Districts AISWCD," http://www.aiswcd.org/. Accessed 14 July 2015.
[32] Franklin County Soil and Water Conservation District. "Welcome," http://www.franklincountyswcd.webs.com/. Accessed 5 March 2018.

2.6 Watershed Demographics

To assess the demographics of the Pond Creek watershed, each entity was individually examined. Because there is only one municipality in the entire watershed, an evaluation of Williamson and Franklin Counties is also included.

The only municipality in the watershed, the City of West Frankfort, has a population of 8,182 according to the 2010 Census. Only ten percent of West Frankfort is located within the watershed. The population amounts of West Frankfort and both counties from the 2000 and 2010 Censuses are depicted in Table 14.

Table 14- Population Change (2000-2010)

Municipality/County	Population 2000	Population 2010	Population Change	Population Change as %
West Frankfort	8,196	8,182	-14	-0.2%
Franklin County	39,018	39,561	543	1.4%
Williamson County	61,296	66,357	5,061	8.3%

Source: US Census Bureau

Table 15 shows the population estimate for 2016 and a forecast for 2022. According to the forecast, West Frankfort will see a small decline in population. The data used in these tables reflect the municipality as a whole and may not represent the sections represented only in the Pond Creek watershed. While Williamson County is projected to grow slightly, Franklin County is projected to decline slightly.

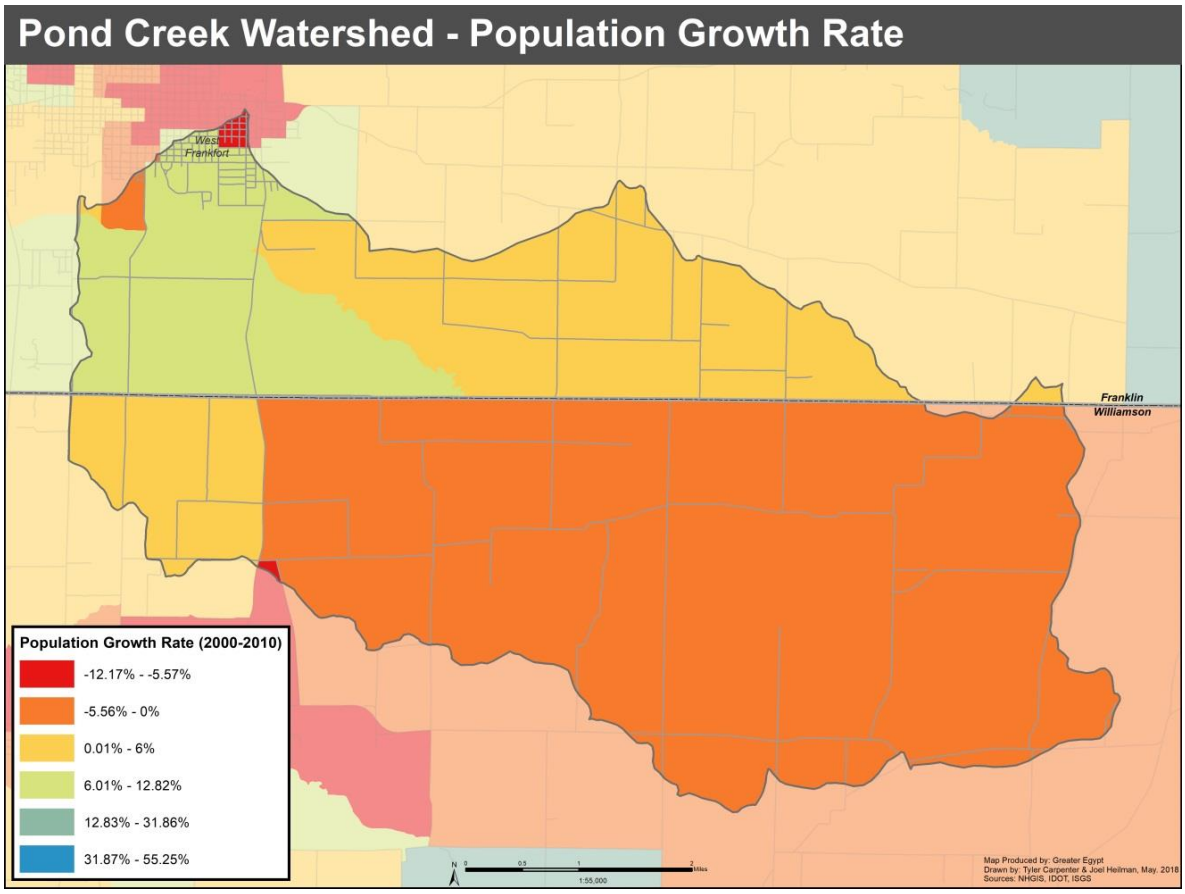
Table 15- Population Estimate and Forecast

Municipality/County	2016 Estimate	Population Growth 2010-2016	2022 Forecast	Forecasted Population Growth 2016-2022
West Frankfort	8,001	-2.2%	7,824	-2.2%
Franklin County	39,156	-1.0%	38,755	-1.0%
Williamson County	67,560	1.7%	68,785	1.7%

Source: US Census Bureau

Along with these estimates, individual Census Block Groups have been analyzed to display the population growth from the period of 2000 to 2010. Figure 21 displays the growth by Census Block Groups. This data shares similarities with the previous growth forecast. Population is relatively stagnant with different areas experiencing a small decline and small growth in other areas.

Figure 21- Population Growth Rate



According to the American Community Survey (ACS), the median age for West Frankfort was 40.8 years of age in 2016. These numbers are similar to the median age of Williamson and Franklin Counties which were around 41 and 42 years of age, respectively. The median age, per capita income, and the median household income are displayed in Table 16.

Median household income in the Pond Creek watershed varies. Corresponding to the numbers provided by the 2016 ACS, West Frankfort has a lower median

income than Franklin County as a whole, while Williamson County has a higher median income than Franklin County. Median household income and median age have been depicted by block group in Figure 22 and Figure 23, respectively.

Table 16- Median Age, Per Capita Income, and Median Household Income

Municipality/ County	Median Age	Per Capita Income	Median Household Income
West Frankfort	40.8	$19,383	$30,211
Franklin County	41.9	$21,625	$39,507
Williamson County	40.9	$24,669	$45,902

Source: US Census Bureau, American Community Survey

Figure 22- Median Household Income

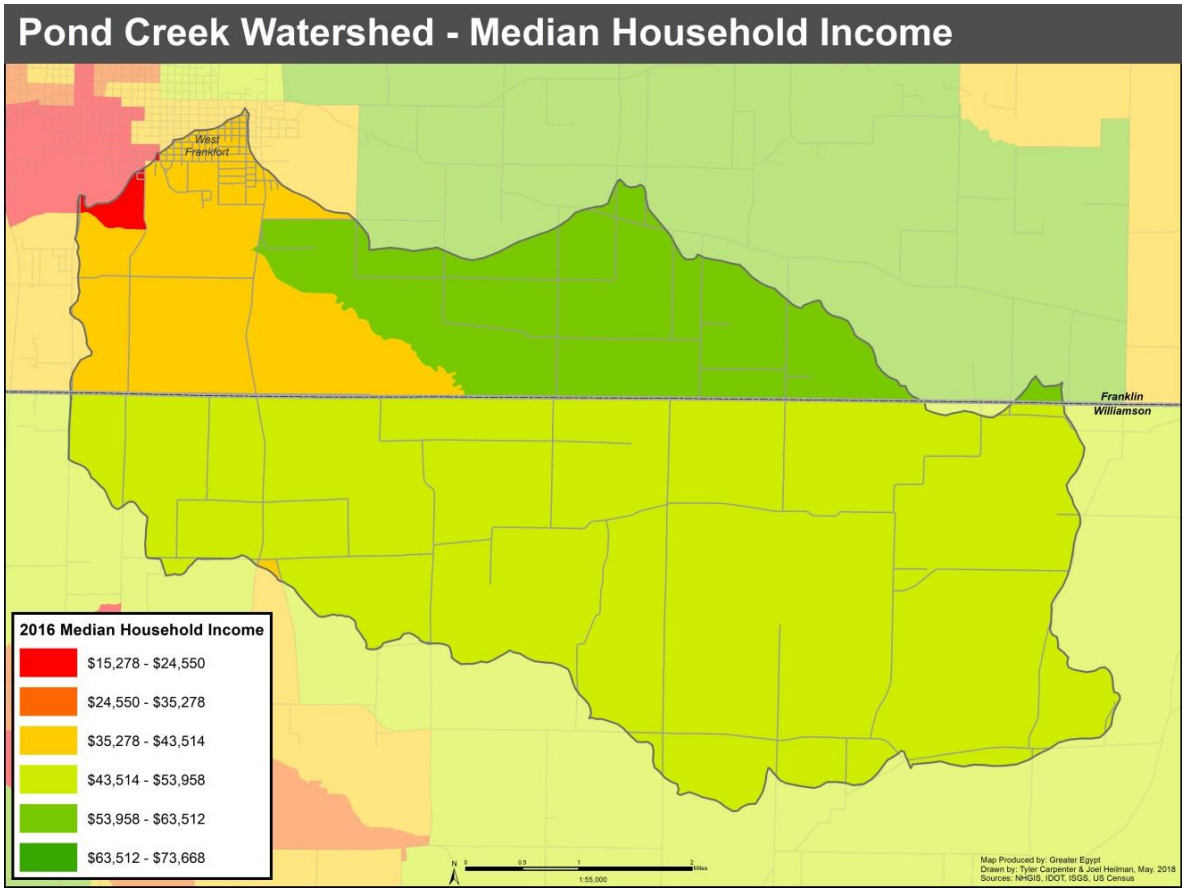
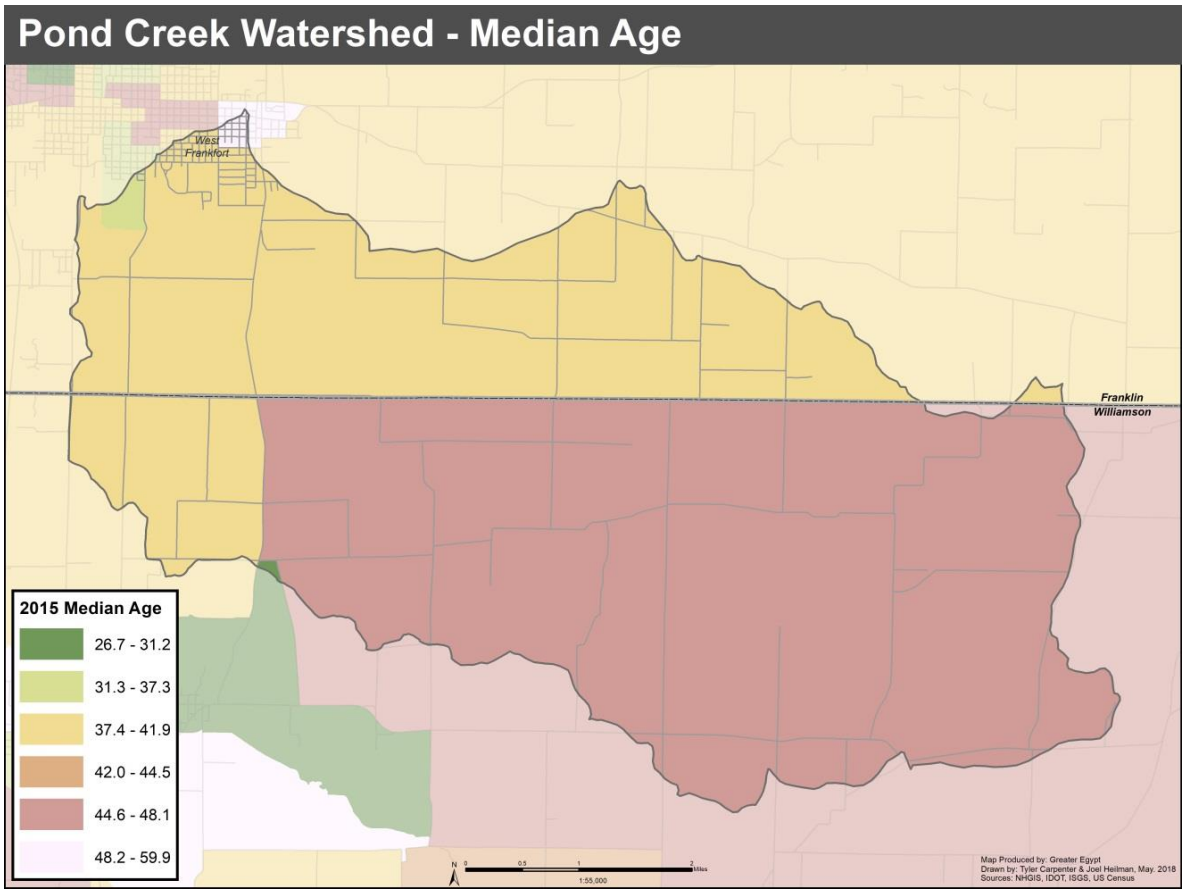


Figure 23- Median Age



The Illinois Department of Employment Security's Annual Average Unemployment Rate for 2017 was at 5.1 percent for Williamson County, and 6.4 percent for Franklin County. This is compared to 5.0 percent for the state of Illinois as a whole, and 4.4 percent for the United States as a whole.[33]

With the Pond Creek watershed possessing a limited urban landscape and population, employment opportunities are often found outside of the watershed. Data was retrieved through the JobsEQ software developed by Chmura Economics and Analytics. Table 17 and Table 18 display the current employment breakdown of occupations for Franklin and Williamson Counties, respectively. Table 19 displays the current employment breakdown fort West Frankfort. Employment is similar across the two counties and in West Frankfort.

[33] Illinois Department of Employment Security. "Illinois Unemployment Rate by County Annual Average 2017," http://www.ides.illinois.gov/. Accessed 3 April 2018.

All three share the same top three job classifications by employment: Office and Administrative Support Occupations; Sales and Related Occupations; and Food Preparation and Serving Related Occupations. Farming, Fishing, and Forestry

Table 17- Franklin County Employment Information

Title	Number of Employees	Average Annual Salary	Location Quotient	Unemployment Numbers	Unemployment Rate
Management Occupations	743	$73,500	1.27	20	2.0%
Business and Financial Operations Occupations	307	$59,700	0.62	21	4.4%
Computer and Mathematical Occupations	83	$71,700	0.29	8	4.8%
Architecture and Engineering Occupations	90	$70,000	0.55	7	4.3%
Life, Physical, and Social Science Occupations	56	$70,400	0.70	3	3.9%
Community and Social Service Occupations	256	$44,700	1.65	10	3.3%
Legal Occupations	61	$69,800	0.77	2	3.1%
Education, Training, and Library Occupations	717	$41,200	1.32	24	2.8%
Arts, Design, Entertainment, Sports, and Media Occupations	163	$37,800	0.94	9	4.4%
Healthcare Practitioners and Technical Occupations	440	$70,100	0.80	26	3.1%
Healthcare Support Occupations	235	$30,200	0.86	33	6.8%
Protective Service Occupations	356	$51,000	1.71	29	5.7%
Food Preparation and Serving Related Occupations	1,012	$21,300	1.22	174	10.3%
Building and Grounds Cleaning and Maintenance Occupations	422	$27,100	1.24	54	8.4%
Personal Care and Service Occupations	401	$27,600	1.06	35	6.0%
Sales and Related Occupations	1,048	$33,400	1.05	109	6.7%
Office and Administrative Support Occupations	1,322	$33,000	0.92	139	6.1%
Farming, Fishing, and Forestry Occupations	33	$26,900	0.52	8	10.9%
Construction and Extraction Occupations	520	$51,600	1.19	75	9.2%
Installation, Maintenance, and Repair Occupations	422	$44,700	1.14	38	5.5%
Production Occupations	452	$36,800	0.77	63	6.0%
Transportation and Material Moving Occupations	551	$33,000	0.84	97	8.7%
Total - All Occupations	9,691	$40,000	1.00	n/a	n/a

Occupations, and Food Preparation and Serving Related Occupations have the highest unemployment rates in all three entities. Williamson County also has a significant amount of people occupied in healthcare related occupations.

Table 18- Williamson County Employment Information

Title	Number of Employees	Average Annual Salary	Location Quotient	Unemployment Numbers	Unemployment Rate
Management Occupations	1,657	$75,300	0.90	30	1.7%
Business and Financial Operations Occupations	1,083	$60,800	0.69	39	3.4%
Computer and Mathematical Occupations	463	$62,200	0.52	18	3.7%
Architecture and Engineering Occupations	462	$69,500	0.90	14	3.2%
Life, Physical, and Social Science Occupations	138	$38,100	0.55	4	2.5%
Community and Social Service Occupations	440	$35,200	0.90	12	2.3%
Legal Occupations	155	$59,400	0.62	4	2.2%
Education, Training, and Library Occupations	1,700	$43,800	0.99	40	2.0%
Arts, Design, Entertainment, Sports, and Media Occupations	479	$28,700	0.88	17	3.6%
Healthcare Practitioners and Technical Occupations	2,766	$74,600	1.60	59	2.2%
Healthcare Support Occupations	1,159	$27,800	1.36	61	5.4%
Protective Service Occupations	712	$36,800	1.09	34	4.4%
Food Preparation and Serving Related Occupations	2,898	$22,100	1.11	245	8.1%
Building and Grounds Cleaning and Maintenance Occupations	1,014	$25,900	0.95	68	6.6%
Personal Care and Service Occupations	968	$23,100	0.82	47	4.7%
Sales and Related Occupations	2,931	$31,300	0.94	159	5.2%
Office and Administrative Support Occupations	4,568	$30,300	1.01	229	4.9%
Farming, Fishing, and Forestry Occupations	96	$23,300	0.48	11	8.6%
Construction and Extraction Occupations	1,377	$48,900	1.00	98	6.9%
Installation, Maintenance, and Repair Occupations	1,178	$38,600	1.01	52	4.3%
Production Occupations	2,381	$32,500	1.29	107	4.8%
Transportation and Material Moving Occupations	1,796	$31,900	0.87	130	6.8%
Total - All Occupations	30,419	$40,100	1.00	n/a	n/a

Source: JobsEQ

Table 19- West Frankfort Employment Information

Title	Number of Employees	Average Annual Salary	Location Quotient	Unemployment Numbers	Unemployment Rate
Management Occupations	277	$73,500	1.40	6	2.0%
Business and Financial Operations Occupations	123	$59,700	0.73	6	4.4%
Computer and Mathematical Occupations	30	$71,700	0.31	2	4.8%
Architecture and Engineering Occupations	37	$70,000	0.66	2	4.3%
Life, Physical, and Social Science Occupations	12	$70,400	0.44	1	3.9%
Community and Social Service Occupations	108	$44,700	2.05	3	3.4%
Legal Occupations	20	$69,800	0.74	1	3.1%
Education, Training, and Library Occupations	220	$41,200	1.19	7	2.8%
Arts, Design, Entertainment, Sports, and Media Occupations	93	$37,800	1.58	3	4.4%
Healthcare Practitioners and Technical Occupations	128	$70,100	0.68	7	3.2%
Healthcare Support Occupations	85	$30,200	0.92	10	6.9%
Protective Service Occupations	39	$51,000	0.55	7	5.8%
Food Preparation and Serving Related Occupations	337	$21,300	1.19	53	10.4%
Building and Grounds Cleaning and Maintenance Occupations	143	$27,100	1.23	16	8.4%
Personal Care and Service Occupations	178	$27,600	1.39	12	6.1%
Sales and Related Occupations	343	$33,400	1.02	35	6.8%
Office and Administrative Support Occupations	439	$33,000	0.90	40	6.1%
Farming, Fishing, and Forestry Occupations	11	$26,900	0.52	2	10.8%
Construction and Extraction Occupations	106	$51,600	0.71	20	9.1%
Installation, Maintenance, and Repair Occupations	153	$44,700	1.21	11	5.5%
Production Occupations	229	$36,800	1.14	18	6.0%
Transportation and Material Moving Occupations	179	$33,000	0.80	27	8.8%
Total - All Occupations	3,290	$40,000	1.00	n/a	n/a

Source: JobsEQ

2.7. Watershed Land Use

For the land use portion of this inventory, the USGS Multi-Resolution Land Characteristics Consortium (MRLC) land cover and impervious datasets were used to complete the analyses. Land use categories include: development, forest, waterbodies/wetlands, and agricultural types.

2.7.1 Existing Land Use

The largest land use category in the Pond Creek watershed is agriculture. This includes both pasture and hay and cultivated crops, which comprise 35 and 30 percent of the watershed, respectively. The breakdown of classifications is available in Table 20. Figure 24 shows the land use map of the watershed. These estimations are based off of the MRLC 2011 data.

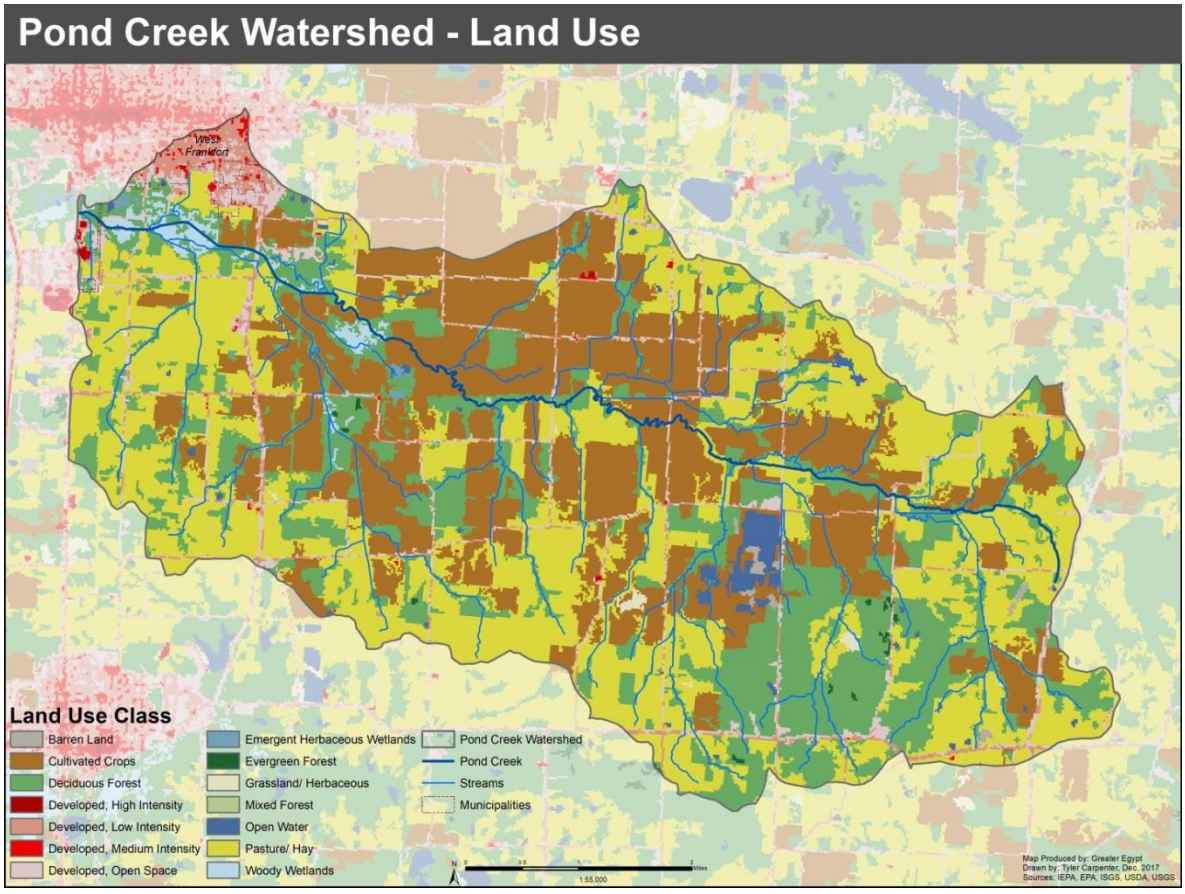
Table 20- Land Use Classification

Classification	Acreage	Percent of Watershed
Open Water	231.9	1.09%
Developed, Open Space	771.3	3.64%
Developed, Low Intensity	641.9	3.03%
Developed, Medium Intensity	47.4	0.22%
Developed, High Intensity	9.4	0.04%
Barren Land	52.5	0.25%
Deciduous Forest	5212.4	24.60%
Evergreen Forest	26.5	0.12%
Mixed Forest	1.1	0.01%
Grassland/ Herbaceous	47.8	0.23%
Pasture/ Hay	7496.5	35.37%
Cultivated Crops	6424.4	30.32%
Woody Wetlands	200.1	0.94%
Emergent Herbaceous Wetlands	28.9	0.14%

Source: USGS Multi-Resolution Land Characteristics Consortium (MRLC)

Forests and developed areas comprise 24.7 and 6.9 percent of the watershed, respectively. The remaining land uses in the watershed are barren land (0.25 percent), grassland/herbaceous (0.23 percent), open water (1.09 percent), and wetlands (1.08 percent). There are no major lakes in the watershed; however, the Pond Creek Mine No. 1 is incorrectly classified as open water. There is significantly less open water than the data depicts.

Figure 24- Land Use



With 65 percent of the watershed being agricultural, there is a high potential for erosion. This is especially true for the areas of cropland that run along Pond Creek, and other larger tributaries in the watershed.

According to the NRCS Soil Survey of Williamson County, "the main concerns affecting the management of cropland in Williamson County include crusting, flooding, ponding, poor tilth, water erosion, and wetness. Equipment limitations,

high pH, limited available water capacity, limited rooting depth, low pH, and restricted permeability are additional concerns."[34]

Along with problems affecting cropland, there are also concerns regarding pastureland. These concerns are "…low pH, water erosion, and wetness. Additional management concerns include equipment limitations, flooding, high pH, limited available water capacity, ponding, and restricted trafficability."[35]

According to the 2012 Census of Agriculture (USDA), farming in Williamson and Franklin consists mainly of soybeans, corn, and, to a much lesser extent, winter wheat. Farmers in the both Franklin and Williamson Counties have an average age of 59 years and are predominately white males.[36] Cultivation within the Pond Creek watershed follows the same pattern.

Based on the USDA's 2017 National Agriculture Statistics Service CropScape[37], the watershed contains approximately 13,667 acres of agricultural land. This includes the 4,922 acres of grass and pasture land classifications. Table 21 displays the types of cultivation found within the watershed. Figure 25 shows the location of the various crops. Accounting for about 5,107 acres, soybeans are the largest form of cultivation in the Pond Creek watershed. Corn is also heavily cultivated at about 3,178 acres. Winter Wheat/Soybeans cropland constitutes the next highest form of cultivation at 382 acres.

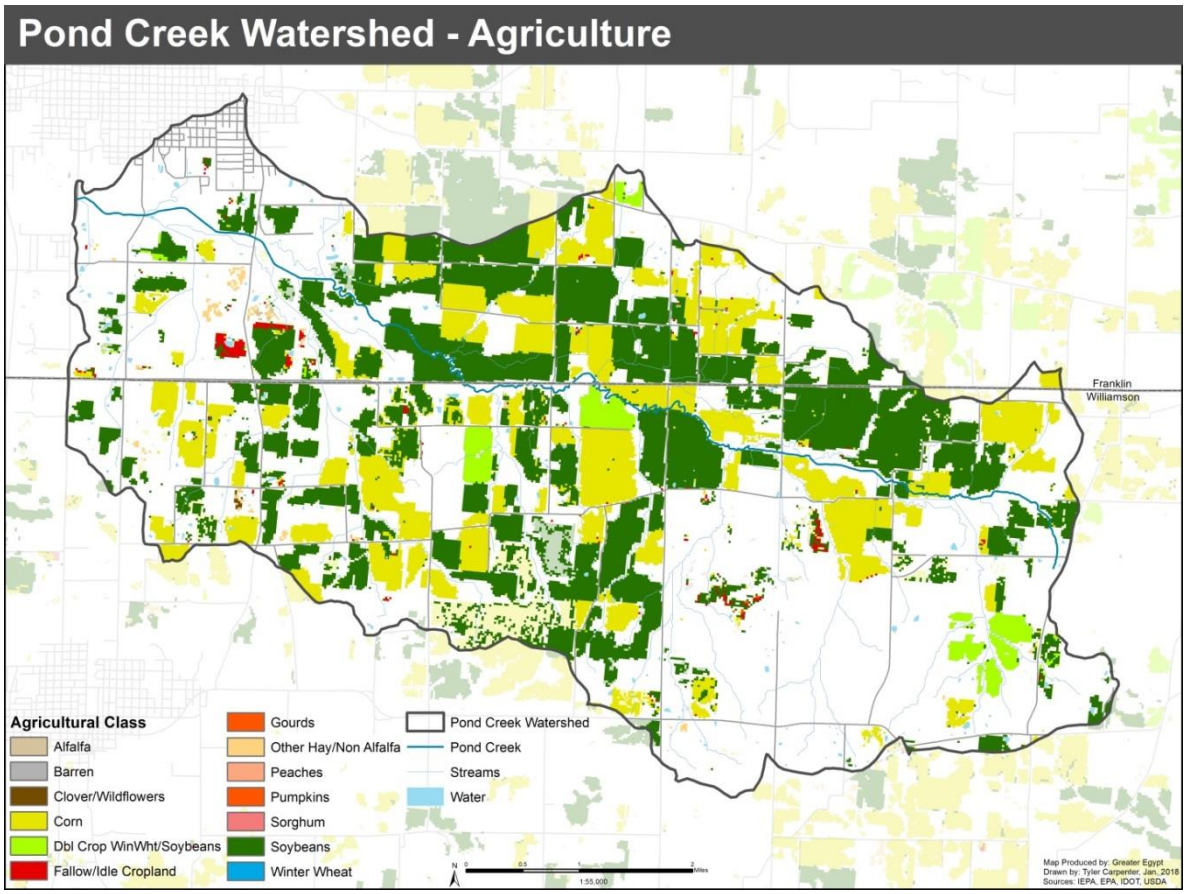
Table 21- Agricultural Diversity

Agricultural Classification	Acreage	Percentage of Agriculture	Percentage of Watershed
Corn	3178.47	23.26%	15.00%
Sorghum	3.34	0.02%	0.02%
Soybeans	5107.08	37.37%	24.10%
Winter Wheat	0.89	0.01%	0.00%
Winter Wheat/ Soybeans	382.07	2.80%	1.80%
Alfalfa	5.78	0.04%	0.03%
Other Hay/Non Alfalfa	52.71	0.39%	0.25%
Clover/Wildflowers	0.67	0.00%	0.00%
Fallow/Idle Cropland	13.79	0.10%	0.07%
Grassland/Pasture	4921.82	36.01%	23.22%

Source: USDA National Agricultural Statistics Service Cropland Data Layer

[34] USDA NRCS. "Soil Survey of Williamson County, Illinois," Published Soil Surveys for Illinois, 2006, 120.
[35] Ibid., 123.
[36] Census of Agriculture. "2012 Census Publications," USDA, 2012, 1-2.
[37] *CropScape* (2017). USDA. National Agricultural Statistics Service, 2017.

Figure 25- Agriculture



Source: USDA National Agricultural Statistics Service Cropland Data Layer

2.7.2 Projected Future Land Use

To estimate the future land cover for the Pond Creek watershed, land cover from past datasets has been analyzed. Land cover from 2001, 2006, and the 2011 datasets were used to compare past changes in land use. Because the classifications were not labeled consistently with the other years, and to prevent skewing of the data, the 1992 land cover dataset could not be utilized during this analysis.

The period from 2001 to 2011 is also a better representation of current land use change within the Pond Creek watershed. This is due to consistent farming practices and development within the target area. Table 22 displays the acreage and percent of watershed of each land use classification for 2001 and 2011. The

percent of change from those years, projected acreage, and percent change of each classification are also displayed.

Assuming development in the area will remain constant, the percent of change from 2001 to 2011 was used to calculate the 2021 projected acreage and projected percent change of each classification. Although little change occurs in the watershed, three notable contrasts in the projected land use change occur within the grassland/herbaceous, barren land, and open water classifications. All are projected to see a significant increase.

The MRLC defines the grassland/ herbaceous land cover dataset as, "areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing."[38] The projected increase is 66.5 percent. This may seem like a striking increase, but the land use only constitutes around 48 acres of the watershed. There was no barren land in 2001, so a 100% increase is projected for 2021. The land use with the highest decrease in percentage is the evergreen forest classification. The projected change of this land cover designation is a decrease of 12.6 percent, but accounts for only 3.3 acres lost. The land use with the highest total acres lost is cultivated crops at 188 acres, but is only a 2.9 percent decrease.

Open water is projected to see an increase of 75 percent. This accounts for an increase of about 174 acres. Most of this increase is the mine, which is incorrectly classified as open water. The actual change in open water is likely negligible. Since 2011, operations at the Pond Creek Mine No. 1 have expanded, and it is the most likely candidate for significant land use change in the watershed.

[38] Department of Interior (DOI) and USGS. "National Land Cover Database 2011 Product Legend," http://www.mrlc.gov/nlcd11_leg.php. Accessed: June 19, 2017.

Table 22- Existing and Projected Land Cover

Land Use Classification	2001		2011		2001-2011	2011-2021		
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Change (Acres)
Open Water	57.81	0.27%	231.9	1.09%	301.14%	405.99	75.07%	174.09
Developed, Open Space	773.09	3.65%	771.31	3.64%	-0.23%	769.53	-0.23%	-1.78
Developed, Low Intensity	642.13	3.03%	641.91	3.03%	-0.03%	641.69	-0.03%	-0.22
Developed, Medium Intensity	46.47	0.22%	47.36	0.22%	1.92%	48.25	1.88%	0.89
Developed, High Intensity	8.23	0.04%	9.36	0.04%	13.73%	10.49	12.07%	1.13
Barren Land	0	0.00%	52.47	0.25%	100.00%	104.94	100.00%	52.47
Deciduous Forest	5356.7	25.28%	5212.4	24.60%	-2.69%	5068.1	-2.77%	-144.3
Evergreen Forest	29.79	0.14%	26.46	0.12%	-11.18%	23.13	-12.59%	-3.33
Mixed Forest	1.11	0.01%	1.11	0.01%	0.00%	1.11	0.00%	0
Grassland/Herbaceous	16.01	0.08%	47.8	0.23%	198.56%	79.59	66.51%	31.79
Hay/Pasture	7419.16	35.01%	7496.53	35.37%	1.04%	7573.9	1.03%	77.37
Cultivated Crops	6612.49	31.20%	6424.39	30.32%	-2.84%	6236.29	-2.93%	-188.1
Woody Wetlands	200.11	0.94%	200.11	0.94%	0.00%	200.11	0.00%	0
Emergent Herbaceous Wetlands	28.9	0.14%	28.9	0.14%	0.00%	28.9	0.00%	0

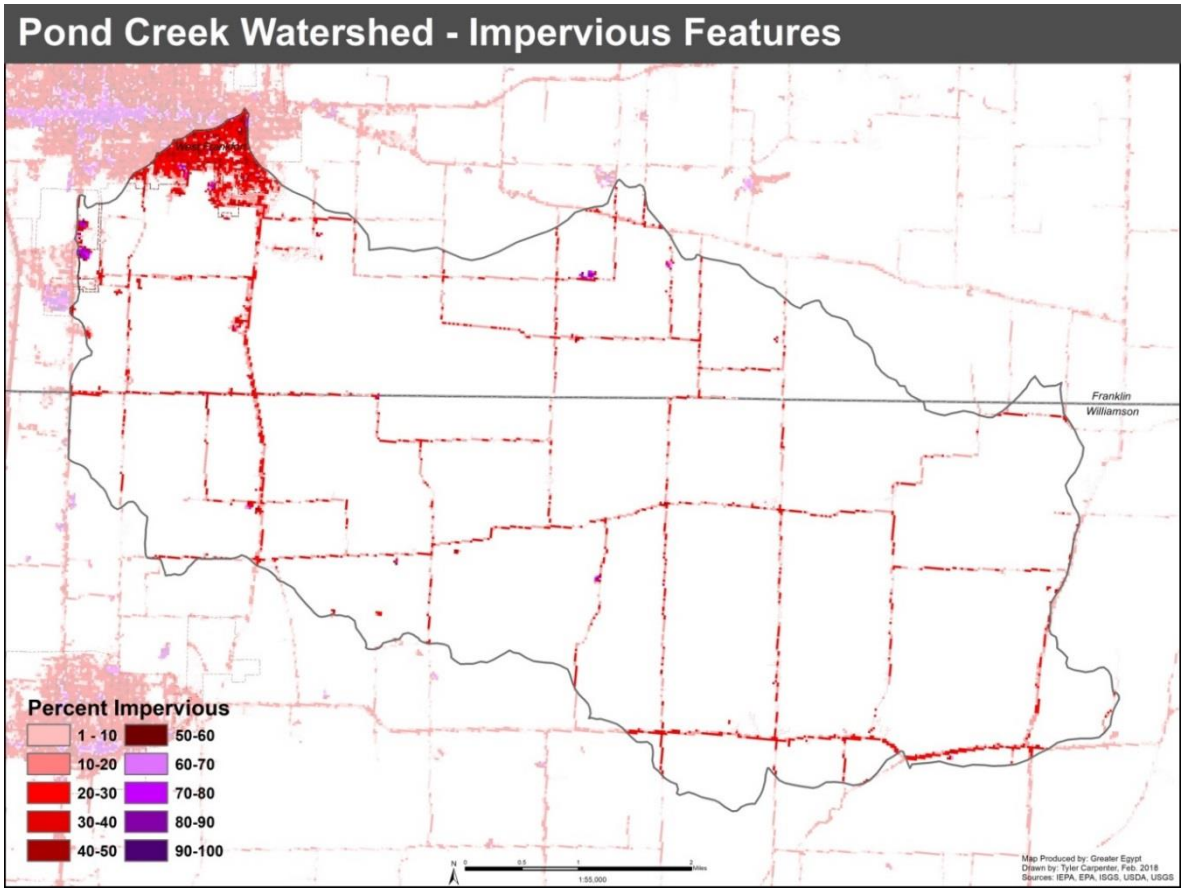
Source: USGS MRLC

2.7.3 Existing and Projected Imperviousness

As a whole, the Pond Creek watershed has a rather low level of imperviousness with 93 percent of the watershed being categorized as zero percent impervious. This is mainly due to low levels of development with West Frankfort being the only urbanized area in the watershed. Imperviousness in the watershed has been characterized by acreage and percent of the watershed by intervals of ten percent in Table 23. These intervals have also been depicted spatially in Figure 26.

As stated previously, 19,722 acres, or 93 percent, of the watershed consist of non-existing impervious cover. This is a major contrast to the 90-100 percent impervious cover, which constitutes less than one tenth of a percent (0.01 percent) and only two acres. The majority of impervious locations in the Pond Creek watershed occur in West Frankfort in the Frankfort and Lower Pond Creek subwatersheds (SMU 12 & 14).

Figure 26- Impervious Features



Other areas that exhibit imperviousness are the road networks throughout the watershed. This is particularly evident near Corinth Road in the southern part of the watershed. Another area of high imperviousness is the Ameren Illinois Company electric substation on Dorris Road.

Following the same method to project future land use, impervious land cover from past and existing datasets has been analyzed. Impervious land cover from the 2001 and 2011 datasets were utilized to compare past and present variations in imperviousness. Table 23 also displays the projected percent of change and acreage to the year 2021.

According to the analysis, levels of imperviousness will continue to rise; however, these levels are hardly noticeable. The only impervious levels set to decline are at the 0-10, 10-20, and 30-40 percent levels. They are set to decline less than one percent over the ten-year period (2 acres total). The largest increase in impervious cover in regards to acreage is the 80-90 percent cover at 0.67 acres. The largest increase by percentage is the 90-100 level at 28.21 percent. Since this level only accounted for a miniscule portion of the watershed, it will only see a rise of about 0.56 acres.

Table 23- Existing and Projected Imperviousness

Percent Imperviousness	2001		2011		2001-2011		2011-2021	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acres)	Percent Change	Projected Acreage (2021)	Projected Percent Change
0%	19722.09	93.06%	19722.09	93.06%	0	0.00%	19722.09	0.00%
0-10%	325.07	1.53%	323.95	1.53%	-1.12	-0.34%	322.83	-0.34%
10-20%	448.02	2.11%	447.36	2.11%	-0.66	-0.15%	446.7	-0.15%
20-30%	361.98	1.71%	361.98	1.71%	0	0.00%	361.98	0.00%
30-40%	174.76	0.82%	174.54	0.82%	-0.22	-0.13%	174.32	-0.13%
40-50%	105.39	0.50%	105.39	0.50%	0	0.00%	105.39	0.00%
50-60%	30.02	0.14%	30.24	0.14%	0.22	0.73%	30.46	0.73%
60-70%	9.78	0.05%	10.23	0.05%	0.45	4.60%	10.68	4.60%
70-80%	6.67	0.03%	6.89	0.03%	0.22	3.30%	7.11	3.30%
80-90%	6.67	0.03%	7.34	0.03%	0.67	10.04%	8.01	10.04%
90-100%	1.56	0.01%	2	0.01%	0.44	28.21%	2.44	28.21%

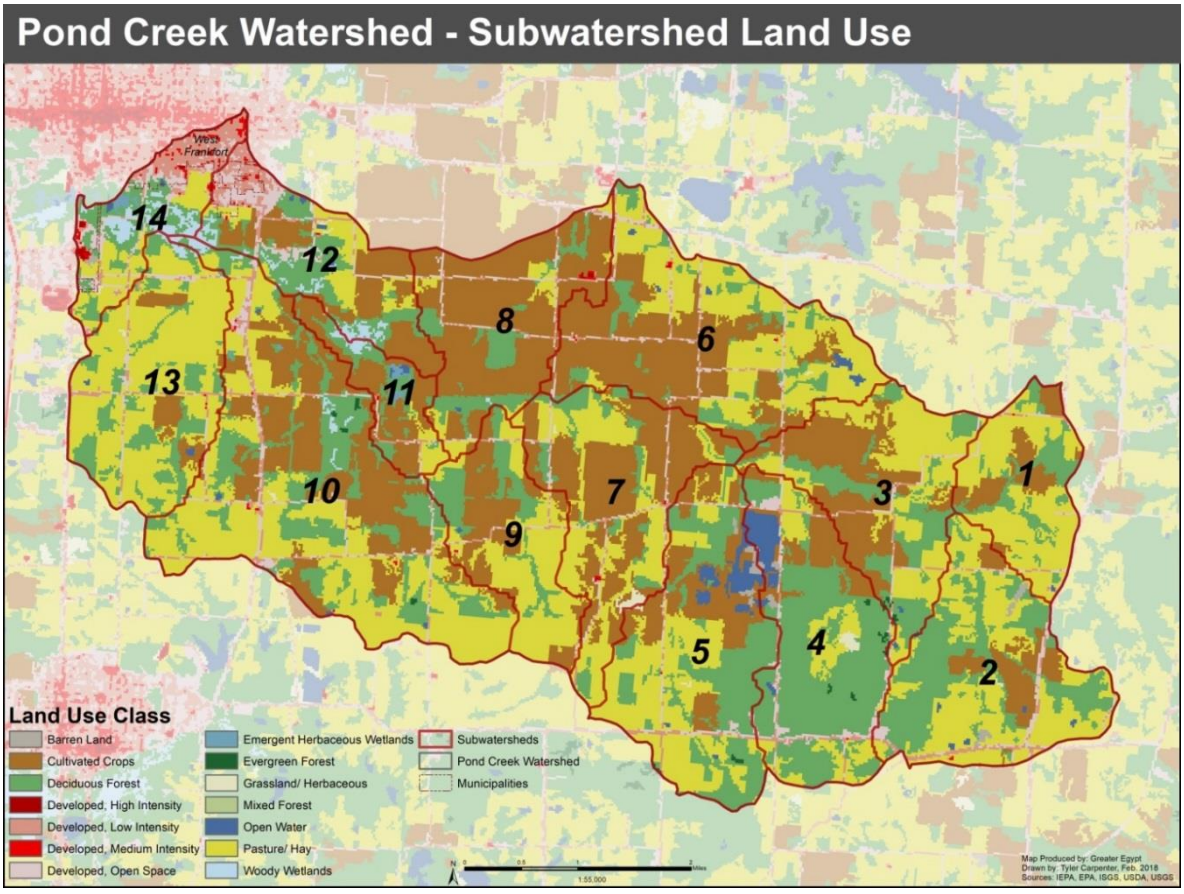
Source: USGS MRLC

2.7.4 Land Cover and Imperviousness of the Subwatersheds

Each subwatershed management unit has been delineated by land cover and imperviousness. Table 24 displays both the acreage and percentage of each SMU by the land use classification. Table 25 presents the impervious cover of each subwatershed. Table 26 displays the 2021 projected values and percent change in land use of each subwatershed.

The Mach-East and Mach-West subwatersheds (SMU 4 and 5) have the highest percentage of open water at 86.5 and 83.7 acres, respectively. This is mostly due to the presence of the mine, which is incorrectly classified as open water. This accounts for over 160 acres being wrongly assigned open water. Disregarding this data, the Harmony subwatershed (SMU 11) would have the highest percentage of open water at 4.68 acres. There are no major lakes in the Pond Creek watershed and therefore, little open water.

Figure 27- Subwatershed Land Use



Because of the location of West Frankfort, the Frankfort and Lower Pond Creek subwatersheds (SMU 12 & 14) exhibit the highest percentage of all developed land classifications. The Lower Pond Creek subwatershed contains the highest concentrations of all developed land use including open space, low, medium, and high intensity. Together, this makes up around 303 acres, or about 40 percent of the subwatershed. The Lower Pond Creek subwatershed also exhibits the most acreage of woody wetlands at 78 acres and is the only subwatershed to have no recorded acreage of cultivated crops.

Most of the forests in the watershed can be found in the southeastern part of the watershed and along Pond Creek. The Mach-East subwatershed (SMU 4) has the highest concentration of both deciduous and evergreen forest at 953 acres (58.2%) and nine acres (0.56%) acres, respectively. In contrast, the Prairie sub watershed (SMU 7) is mostly pasture/hay and cultivated crops and has the lowest concentration of deciduous forest at just 11 percent.

The Monroe subwatershed (SMU 13) has the highest concentration of pasture/hay at almost 66 percent of the SMU, or 1,045 acres. Most of the cultivated crops land use is in the north central part of the watershed. The Neilson subwatershed (SMU 8) contains the highest concentration of cultivated crops at 73 percent, or more than 1,000 acres. Neilson also has the lowest concentration of pasture/hay at less than seven percent.

Although the acreage is rather low, the Lincoln subwatershed (SMU 2) has the highest concentration of barren land at just 18 acres. The Prairie subwatershed (SMU 7) has the highest percentage of grassland/herbaceous land at 16 acres. The Harmony subwatershed (SMU 11) has the most emergent herbaceous wetland at 14 acres.

According to the estimations (see Table 26), the projected changes to land use in the subwatersheds are extremely low. Seven of the 14 watersheds experienced no change in land use between 2001 and 2011 and are thus projected to have no change between 2011 and 2021. There is a small increase in development in the Lower Pond Creek and Frankfort subwatersheds due to a slight expansion of the City of West Frankfort.

Table 24- Existing Subwatershed Land Use

Subwatershed Land Use Classification	Upper Pond Creek		Lincoln		Jordan's Fort		Mach-East		Mach-West		Davis		Prairie	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
Open Water	1.11	0.12%	8.89	0.51%	3.12	0.21%	86.53	5.29%	83.69	4.39%	20.24	0.92%	0	0.00%
Developed, Open Space	16.47	1.83%	50.46	2.92%	28.53	1.89%	77.86	4.76%	37.39	1.96%	74.72	3.40%	41.82	2.59%
Developed, Low Intensity	10.02	1.11%	40.68	2.35%	20.06	1.33%	38.71	2.36%	30.94	1.62%	38.69	1.76%	20.69	1.28%
Developed, Medium Intensity	0.22	0.02%	0.67	0.04%	0	0.00%	0.22	0.01%	0.22	0.01%	2.22	0.10%	1.78	0.11%
Developed, High Intensity	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0.22	0.01%	0.44	0.03%
Barren Land	0	0.00%	18.01	1.04%	0	0.00%	10.68	0.65%	19.36	1.02%	0	0.00%	0	0.00%
Deciduous Forest	175.4	19.46%	617.1	35.65%	351.95	23.29%	953.21	58.24%	619.87	32.50%	246.16	11.22%	180.63	11.20%
Evergreen Forest	0	0.00%	0	0.00%	5.8	0.38%	9.12	0.56%	4.23	0.22%	0	0.00%	0	0.00%
Mixed Forest	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Grassland/ Herbaceous	0	0.00%	1.33	0.08%	0	0.00%	13.35	0.82%	4.67	0.25%	1.11	0.05%	16.46	1.02%
Pasture/ Hay	522.2	57.93%	773.6	44.69%	553.66	36.63%	253.37	15.48%	668.84	35.07%	852.78	38.86%	537.22	33.32%
Cultivated Crops	176.07	19.53%	220.3	12.73%	548.31	36.28%	193.76	11.84%	437.8	22.96%	958.63	43.68%	813.05	50.43%
Woody Wetlands	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Emergent Herbaceous Wetlands	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Subwatershed Land Use Classification	Neilson		Dean		Poor Farm		Harmony		Frankfort		Monroe		Lower Pond Creek	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
Open Water	1.12	0.08%	1.11	0.10%	5.12	0.16%	4.68	0.98%	6.45	0.57%	5.35	0.34%	4.49	0.59%
Developed, Open Space	48.27	3.51%	12.43	1.17%	110.62	3.36%	8.69	1.81%	122.33	10.82%	41.23	2.58%	98.63	13.00%
Developed, Low Intensity	22.57	1.64%	14.65	1.38%	86.58	2.63%	8.02	1.67%	102.54	9.07%	36.99	2.32%	170.08	22.42%
Developed, Medium Intensity	2.23	0.16%	0.44	0.04%	3.34	0.10%	0.45	0.09%	6.67	0.59%	0.67	0.04%	28.08	3.70%
Developed, High Intensity	2.23	0.16%	0	0.00%	0	0.00%	0	0.00%	0.22	0.02%	0	0.00%	6.07	0.80%
Barren Land	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	4.49	0.59%
Deciduous Forest	200.69	14.60%	210.15	19.73%	741.61	22.51%	111.17	23.19%	284.25	25.15%	336.96	21.12%	186.26	24.55%
Evergreen Forest	0	0.00%	0	0.00%	7.34	0.22%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Mixed Forest	0	0.00%	0	0.00%	0	0.00%	0.45	0.09%	0.67	0.06%	0	0.00%	0	0.00%
Grassland/ Herbaceous	0	0.00%	0	0.00%	2	0.06%	0	0.00%	5.12	0.45%	1.56	0.10%	2.25	0.30%
Pasture/ Hay	95.87	6.97%	481.99	45.25%	1317.84	40.01%	46.12	9.62%	170.37	15.08%	1045.19	65.52%	168.06	22.15%
Cultivated Crops	1000.54	72.78%	344.4	32.33%	983.54	29.86%	269.57	56.23%	371.44	32.87%	114.77	7.19%	0	0.00%
Woody Wetlands	1.12	0.08%	0	0.00%	33.61	1.02%	16.26	3.39%	60.05	5.31%	12.48	0.78%	77.74	10.25%
Emergent Herbaceous Wetlands	0	0.00%	0	0.00%	2.45	0.07%	14.04	2.93%	0	0.00%	0	0.00%	12.58	1.66%

Source: USGS MRLC

Imperviousness in the subwatersheds follows the same characteristics as the Pond Creek watershed as a whole. Table 25 displays the 2011 values of imperviousness in the subwatersheds. The majority of the subwatersheds are non-impervious. Only two of the fourteen subwatersheds (SMU 12 and 14) exhibit under 90 percent of areas with zero percent imperviousness. Because of the proximity of West Frankfort and the Ameren Illinois Company electric substation, SMU 8 and 14 are the only subwatersheds that have values for all levels of imperviousness. SMU 12 has every level except the highest level. The existing impervious features can be seen in Figure 28. SMU 14 can be classified as the most impervious subwatershed in the Pond Creek watershed.

Projections have also been made for future imperviousness in the subwatersheds. These estimates are displayed in Table 27.

Figure 28- Subwatershed Impervious Features

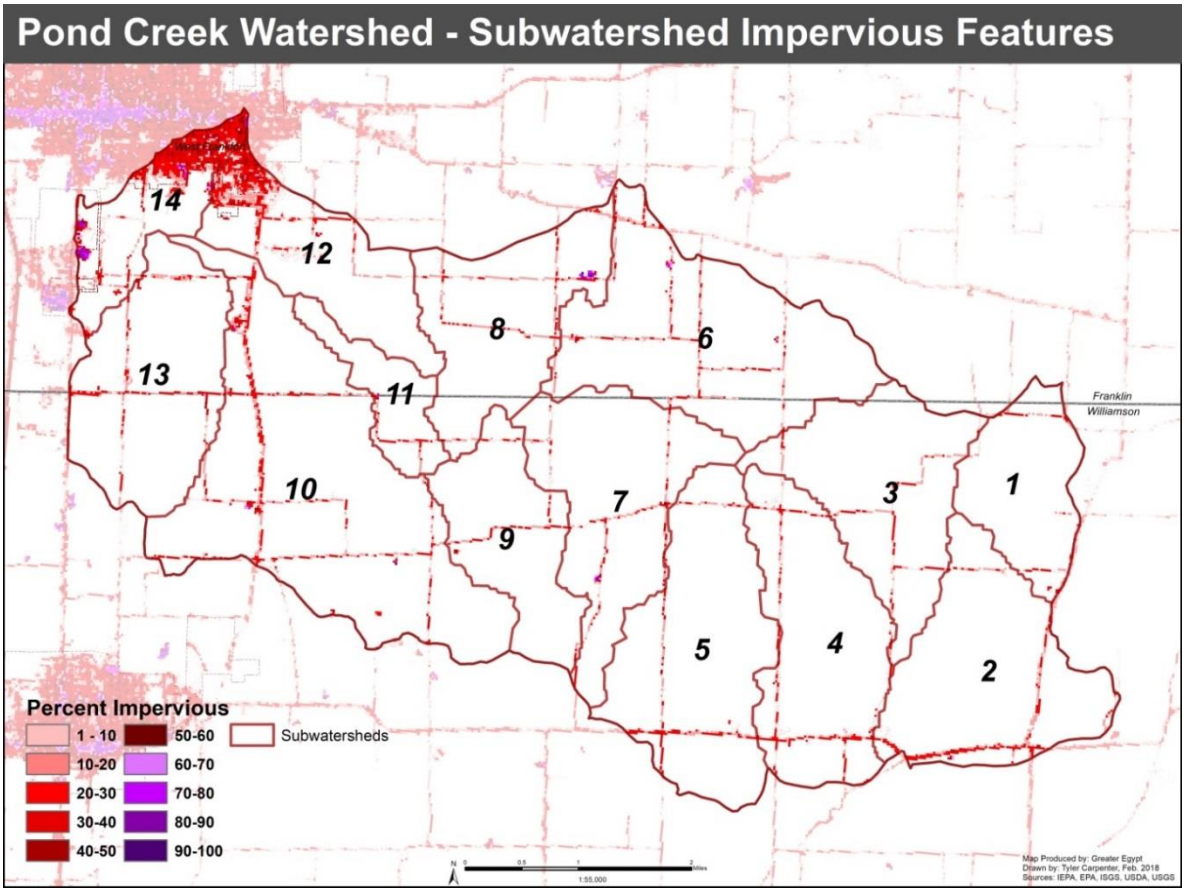


Table 25- Existing Subwatershed Imperviousness

2011 Percent Impervious	Upper Pond Creek		Lincoln		Jordan's Fort		Mach-East		Mach-West		Davis		Prairie	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
0	874.63	97.02%	1639.29	94.70%	1462.86	96.79%	1520.01	92.86%	1838.49	96.41%	2078.82	94.72%	1547.37	95.99%
0-10	5.99	0.66%	22.44	1.30%	10.03	0.66%	57.39	3.51%	16.69	0.88%	22.43	1.02%	15.12	0.94%
10-20	10.66	1.18%	28.00	1.62%	18.49	1.22%	20.47	1.25%	20.69	1.09%	52.20	2.38%	26.69	1.66%
20-30	7.10	0.79%	26.88	1.55%	16.49	1.09%	24.47	1.49%	21.14	1.11%	33.76	1.54%	15.57	0.97%
30-40	2.22	0.25%	10.22	0.59%	3.56	0.24%	12.68	0.77%	8.01	0.42%	4.00	0.18%	3.34	0.21%
40-50	0.67	0.07%	3.55	0.21%	0.00	0.00%	1.56	0.10%	1.78	0.09%	1.11	0.05%	1.78	0.11%
50-60	0.22	0.02%	0.22	0.01%	0.00	0.00%	0.22	0.01%	0.22	0.01%	0.67	0.03%	0.44	0.03%
60-70	0.00	0.00%	0.44	0.03%	0.00	0.00%	0.00	0.00%	0.00	0.00%	1.55	0.07%	0.89	0.06%
70-80	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.44	0.03%
80-90	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.22	0.01%	0.22	0.01%
90-100	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.22	0.01%
2011 Percent Impervious	Neilson		Dean		Poor Farm		Harmony		Frankfort		Monroe		Lower Pond Creek	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
0	1299.42	94.53%	1037.66	97.42%	13913.00	93.92%	462.28	96.42%	898.58	79.51%	1513.58	94.89%	452.84	59.68%
0-10	10.46	0.76%	2.66	0.25%	186.00	1.26%	1.56	0.33%	52.44	4.64%	16.89	1.06%	50.46	6.65%
10-20	37.84	2.75%	9.76	0.92%	311.00	2.10%	7.13	1.49%	69.77	6.17%	25.56	1.60%	47.80	6.30%
20-30	18.47	1.34%	13.53	1.27%	263.00	1.78%	6.46	1.35%	49.77	4.40%	26.45	1.66%	43.13	5.68%
30-40	3.12	0.23%	0.89	0.08%	97.00	0.65%	1.34	0.28%	34.66	3.07%	8.45	0.53%	62.69	8.26%
40-50	0.89	0.06%	0.22	0.02%	29.00	0.20%	0.22	0.05%	18.00	1.59%	3.56	0.22%	67.14	8.85%
50-60	0.22	0.02%	0.44	0.04%	11.00	0.07%	0.22	0.05%	4.89	0.43%	0.44	0.03%	19.79	2.61%
60-70	0.89	0.06%	0.00	0.00%	0.00	0.00%	0.00	0.00%	1.33	0.12%	0.22	0.01%	5.56	0.73%
70-80	1.11	0.08%	0.00	0.00%	4.00	0.03%	0.22	0.05%	0.44	0.04%	0.00	0.00%	3.33	0.44%
80-90	1.56	0.11%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.22	0.02%	0.00	0.00%	4.89	0.64%
90-100	0.67	0.05%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	1.11	0.15%

Source: USGS MRLC

Table 26- Projected Subwatershed Land Use

Subwatershed Land Use Classification	Upper Pond Creek		Lincoln		Jordan's Fort		Mach-East		Mach-West		Davis		Prairie	
	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change
Open Water	1.11	0.00%	8.89	0.00%	3.12	0.00%	2244.11	2493.34%	3146.74	3660.08%	38.36	89.58%	0.00	0.00%
Developed, Open Space	16.47	0.00%	50.46	0.00%	28.53	0.00%	77.86	0.00%	37.39	0.00%	74.72	0.00%	41.82	0.00%
Developed, Low Intensity	10.02	0.00%	40.68	0.00%	20.06	0.00%	38.71	0.00%	30.94	0.00%	38.69	0.00%	20.69	0.00%
Developed, Medium Intensity	0.22	0.00%	0.67	0.14%	0.00	0.00%	0.22	0.00%	0.22	0.00%	2.22	0.00%	1.78	0.00%
Developed, High Intensity	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.22	0.00%	0.44	0.02%
Barren Land	0.00	0.00%	18.01	0.00%	0.00	0.00%	10.68	0.00%	19.36	0.00%	0.00	0.00%	0.00	0.00%
Deciduous Forest	175.40	0.00%	607.91	-1.49%	351.95	0.00%	846.53	-11.19%	607.44	-2.01%	246.16	0.00%	180.63	0.00%
Evergreen Forest	0.00	0.00%	0.00	0.00%	5.80	0.00%	6.68	-26.79%	4.23	0.00%	0.00	0.00%	0.00	0.00%
Mixed Forest	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Grassland/ Herbaceous	0.00	0.00%	1.33	0.00%	0.00	0.00%	13.35	0.00%	14.02	200.00%	1.11	0.00%	243.64	1380.06%
Pasture/ Hay	522.20	0.00%	765.03	-1.11%	553.66	0.00%	379.99	49.97%	668.84	0.00%	849.68	-0.36%	537.22	0.00%
Cultivated Crops	176.07	0.00%	220.30	0.00%	548.31	0.00%	139.59	-27.96%	362.29	-17.25%	952.22	-0.67%	797.99	-1.85%
Woody Wetlands	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Emergent Herbaceous Wetlands	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Subwatershed Land Use Classification	Neilson		Dean		Poor Farm		Harmony		Frankfort		Monroe		Lower Pond Creek	
	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change
Open Water	1.12	0.00%	1.11	0.00%	5.12	0.00%	4.68	0.00%	6.45	0.00%	5.35	0.00%	4.49	0.00%
Developed, Open Space	48.27	0.00%	12.43	0.00%	110.62	0.00%	8.69	0.00%	122.11	-0.18%	41.23	0.00%	97.09	-1.57%
Developed, Low Intensity	22.57	0.00%	14.65	0.00%	86.58	0.00%	8.02	0.00%	102.54	0.00%	36.99	0.00%	169.86	-0.13%
Developed, Medium Intensity	2.23	0.00%	0.44	0.00%	3.34	0.00%	0.45	0.00%	6.90	3.45%	0.67	0.00%	28.78	2.46%
Developed, High Intensity	2.23	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.22	0.00%	0.00	0.00%	7.45	22.73%
Barren Land	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	4.49	0.00%
Deciduous Forest	200.69	0.00%	210.15	0.00%	741.61	0.00%	111.17	0.00%	284.25	0.00%	336.96	0.00%	184.04	-1.19%
Evergreen Forest	0.00	0.00%	0.00	0.00%	7.34	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Mixed Forest	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.45	0.00%	0.67	0.00%	0.00	0.00%	0.00	0.00%
Grassland/ Herbaceous	0.00	0.00%	0.00	0.00%	2.00	0.00%	0.00	0.00%	5.12	0.00%	1.56	0.00%	2.25	0.00%
Pasture/ Hay	95.87	0.00%	481.99	0.00%	1317.84	0.00%	46.12	0.00%	170.37	0.00%	1045.19	0.00%	165.84	-1.32%
Cultivated Crops	1000.54	0.00%	344.40	0.00%	983.54	0.00%	269.57	0.00%	371.44	0.00%	114.77	0.00%	0.00	0.00%
Woody Wetlands	1.12	0.00%	0.00	0.00%	33.61	0.00%	16.26	0.00%	60.05	0.00%	12.48	0.00%	77.74	0.00%
Emergent Herbaceous Wetlands	0.00	0.00%	0.00	0.00%	2.45	0.00%	14.04	0.00%	0.00	0.00%	0.00	0.00%	12.58	0.00%

Source: USGS MRLC

Table 27- Projected Subwatershed Imperviousness

Percent Imperviousness	Upper Pond Creek SMU 1		Lincoln SMU 2		Jordan's Fort SMU 3		Mach-East SMU 4		Mach-West SMU 5		Davis SMU 6		Prairie SMU 7	
	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change
0%	875.3	0.07%	1639.7	0.02%	1463.7	0.05%	1519.4	-0.04%	1838.3	-0.01%	2077.5	-0.06%	1547.0	-0.03%
0-10%	4.6	-23.43%	20.2	-9.97%	8.5	-14.94%	55.4	-3.56%	16.2	-2.70%	20.9	-6.67%	12.8	-15.05%
10-20%	10.8	1.37%	27.7	-0.95%	17.3	-6.58%	20.2	-1.16%	18.7	-9.80%	49.8	-4.66%	27.4	2.51%
20-30%	7.8	9.53%	28.2	5.04%	17.7	7.44%	26.5	8.12%	23.6	11.65%	39.4	16.69%	17.6	12.84%
30-40%	2.8	24.08%	10.7	4.37%	5.2	45.71%	23.1	82.44%	8.2	2.75%	4.8	19.76%	4.2	24.93%
40-50%	0.5	-25.55%	4.4	22.87%	0.0	0.00%	1.8	14.23%	2.4	33.19%	1.1	-0.20%	1.8	-0.06%
50-60%	0.4	0.00%	0.2	-0.17%	0.0	0.00%	0.2	-0.07%	0.2	-0.11%	0.7	-0.20%	0.3	-33.37%
60-70%	0.0	0.00%	0.4	-0.17%	0.0	0.00%	0.0	0.00%	0.0	0.00%	1.6	-0.20%	1.2	33.26%
70-80%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.4	-0.06%
80-90%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.2	-0.20%	0.2	-0.06%
90-100%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.2	-0.06%
Percent Imperviousness	Nielson SMU 8		Dean SMU 9		Poor Farm SMU 10		Harmony SMU 11		Frankfort SMU 12		Monroe SMU 13		Lower Pond Creek SMU 14	
	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change	Projected Acreage (2021)	Projected Percent Change
0%	1300.4	0.07%	1038.5	0.08%	3092.4	-0.04%	462.4	0.02%	897.3	-0.14%	1508.0	-0.37%	447.4	-1.20%
0-10%	8.8	-15.91%	1.9	-29.75%	38.9	-6.06%	1.4	-11.89%	46.6	-11.06%	17.5	3.82%	44.8	-11.22%
10-20%	36.6	-3.22%	9.5	-2.69%	65.6	-5.18%	6.4	-10.49%	69.6	-0.19%	23.4	-8.26%	47.1	-1.51%
20-30%	19.7	6.62%	13.9	2.89%	63.0	7.79%	7.3	12.32%	52.8	6.12%	32.0	21.09%	43.6	1.03%
30-40%	4.9	55.86%	0.9	-0.48%	24.3	12.79%	1.6	20.84%	34.5	-0.51%	10.7	26.31%	64.5	2.96%
40-50%	0.9	0.19%	0.0	0.00%	6.9	7.41%	0.2	0.70%	20.7	15.12%	4.7	32.96%	70.1	4.48%
50-60%	0.2	0.19%	0.4	-0.48%	3.4	37.50%	0.2	0.70%	5.1	4.23%	0.4	-0.28%	26.0	31.44%
60-70%	0.9	0.19%	0.0	0.00%	0.0	-100.00%	0.0	-100.00%	2.7	98.98%	0.2	-0.28%	8.6	54.60%
70-80%	1.1	0.19%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.3	-33.67%	0.0	0.00%	2.9	-12.70%
80-90%	1.4	-12.33%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	5.3	8.84%
90-100%	1.0	50.29%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	5.5	394.73%

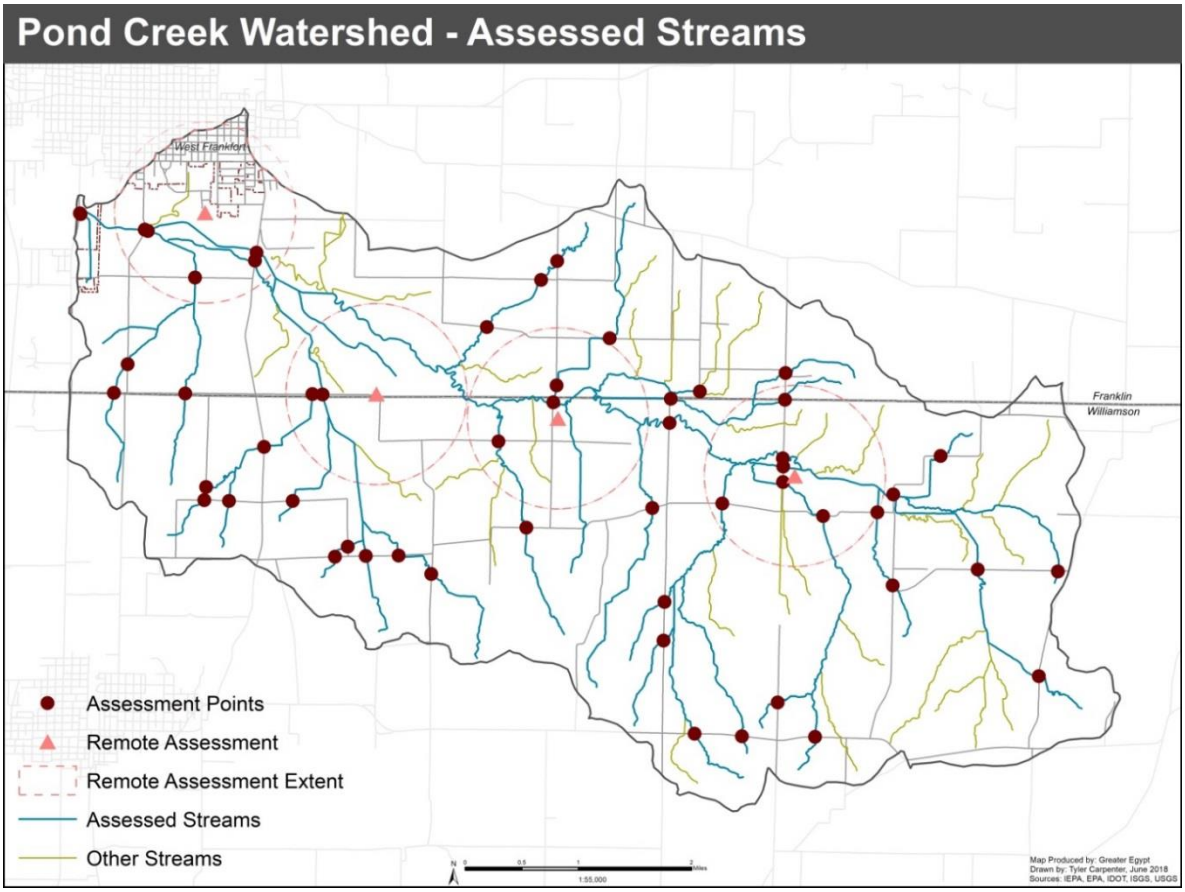
Source: USGS MRLC

2.8 Watershed Drainage and Assessment

To further characterize the waterbodies in the Pond Creek watershed, an assessment has been included to identify certain impairments of streams. Components assessed are channelization, condition of riparian area, and degree of streambank erosion. Since there are no identifiable lakes in the watershed, an assessment was not included.

Assessment methods include actual field evaluations, analyses of aerial photography from 1938 to 2017, and remote analysis utilizing an unmanned aircraft system (UAS). Not all the reaches were assessed due to inaccessibility or low flow. Figure 29 displays the assessed streams, as well as the location of ground field assessment points. Less accessible reaches were assessed with UAS (remote assessment).

Figure 29- Assessed Streams



For each component, the assessed streams were delineated by their individual reach code. These reach codes identify certain portions of the stream, and represent varying degrees of stream length. Appendix B displays the stream name with its corresponding reach code and length. Streams and tributaries were then categorized by their subwatershed.

2.8.1 Streambank Erosion

Erosion is the degradation of a streambank or shoreline by natural and non-natural processes. While natural activity can erode a streambank over time, changes to hydrology and land use can escalate this process. Factors such as channelization and loss of riparian habitat can also lead to eroded banks.

Erosion was assessed as none, or low (0-33 percent) of banks displaying erosion), moderate (33-66 percent), or high (66-100 percent). These designations also correspond to the lateral recession rate category in the pollutant load reduction section of this report (Section 2.9.6). This characterizes erosion classes as: slight (none or low), moderate (moderate), severe (high), and very severe (high). The field evaluation included capturing photos from each of the assessment points. Figure 30 displays the various levels of erosion in different assessment points throughout the watershed. Results for the streambank erosion assessment by subwatershed are summarized in Table 28. A separate examination of Pond Creek and assessed components is displayed in Table 31.

Figure 30- Levels of Eroded Streambanks

Levels of Eroded Streambanks: A-None or Low (slight); B- Moderate (moderate); C- Severe (high); D- Very Severe (high)

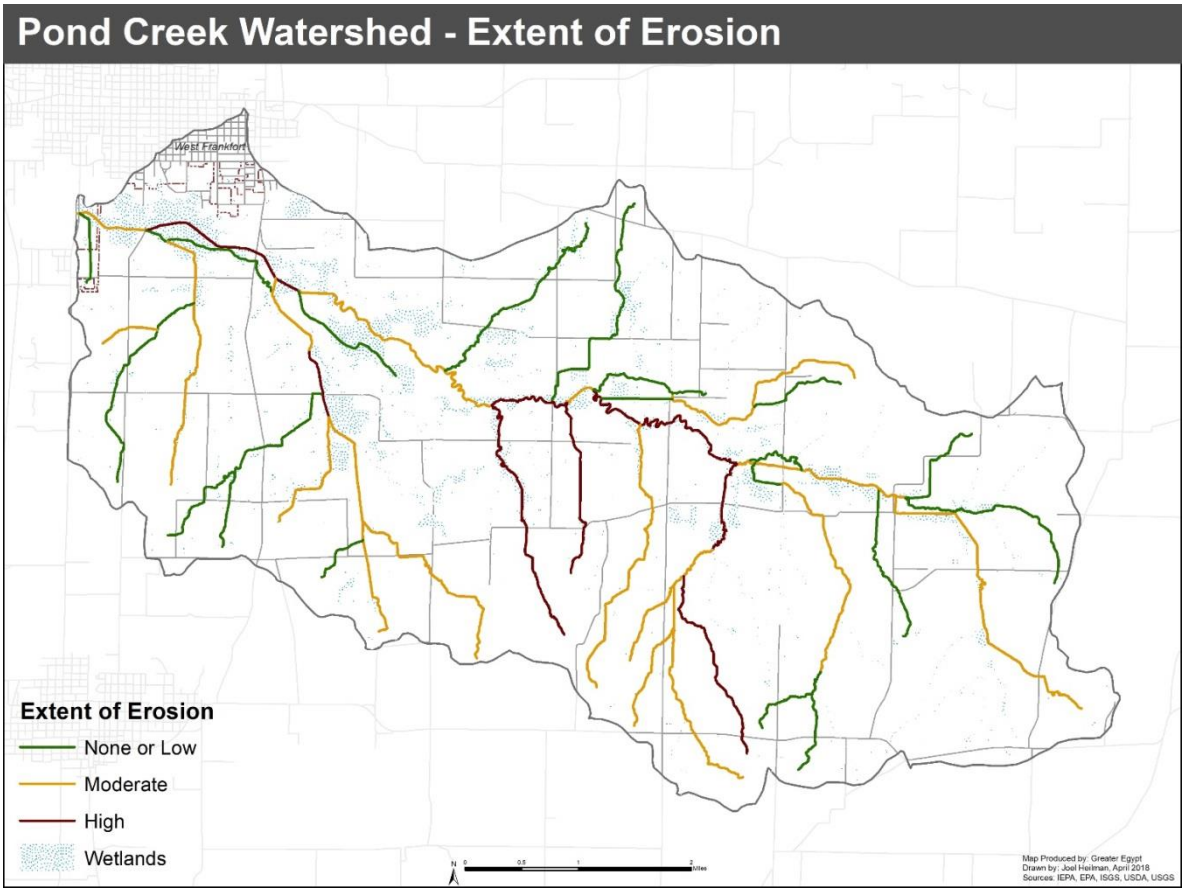
Table 28- Streambank Erosion by Subwatershed

Subwatershed	None or Low		Moderate		High	
	Reaches	%	Reaches	%	Reaches	%
Upper Pond Creek	4	100.0%	0	0.0%	0	0.0%
Lincoln	0	0.0%	2	100.0%	0	0.0%
Jordan's Fort	5	45.5%	6	54.5%	0	0.0%
Mach-East	4	80.0%	1	20.0%	0	0.0%
Mach-West	0	0.0%	5	71.4%	2	28.6%
Davis	4	80.0%	1	20.0%	0	0.0%
Prairie	1	14.3%	2	28.6%	4	57.1%
Neilson	1	33.3%	1	33.3%	1	33.3%
Dean	0	0.0%	0	0.0%	1	100.0%
Poor Farm	4	33.3%	6	50.0%	2	16.7%
Harmony	1	100.0%	0	0.0%	0	0.0%
Frankfort	0	0.0%	1	33.3%	2	66.7%
Monroe	2	40.0%	3	60.0%	0	0.0%
Lower Pond Creek	1	50.0%	1	50.0%	0	0.0%

The majority of streams and tributaries in the Pond Creek watershed exhibit some degree of streambank erosion. While there are areas of high erosion, they may be classified as moderate because other parts of that particular reach exhibit less erosion. These results are also presented in Figure 31.

Areas of increased erosion occur along Pond Creek, near the Pond Creek Mine No. 1, and in agricultural areas near the center of the watershed and south of West Frankfort. High levels of erosion occur in the Mach-West, Prairie, Dean, Poor Farm, and Frankfort subwatersheds.

Figure 31- Extent of Erosion



2.8.2 Channelization

Channelization refers to the reduction of a natural meandering stream channel. While this straightening can sometimes limit the impact of flooding, it can have impacts on erosion and loss of habitat.

Since channelization encourages a non-sinuous course, water flows much faster, resulting in an increase of sediment transport and decrease of riffles and pools that can hold off heavy flow. The degree of channelization by subwatershed is summarized in Table 29.

The method of assessing erosion is similar to the degree of channelization; however, no channelization has its own category. Streams where one to 33 percent of banks are channelized are considered low, 33 to 66 percent of reach

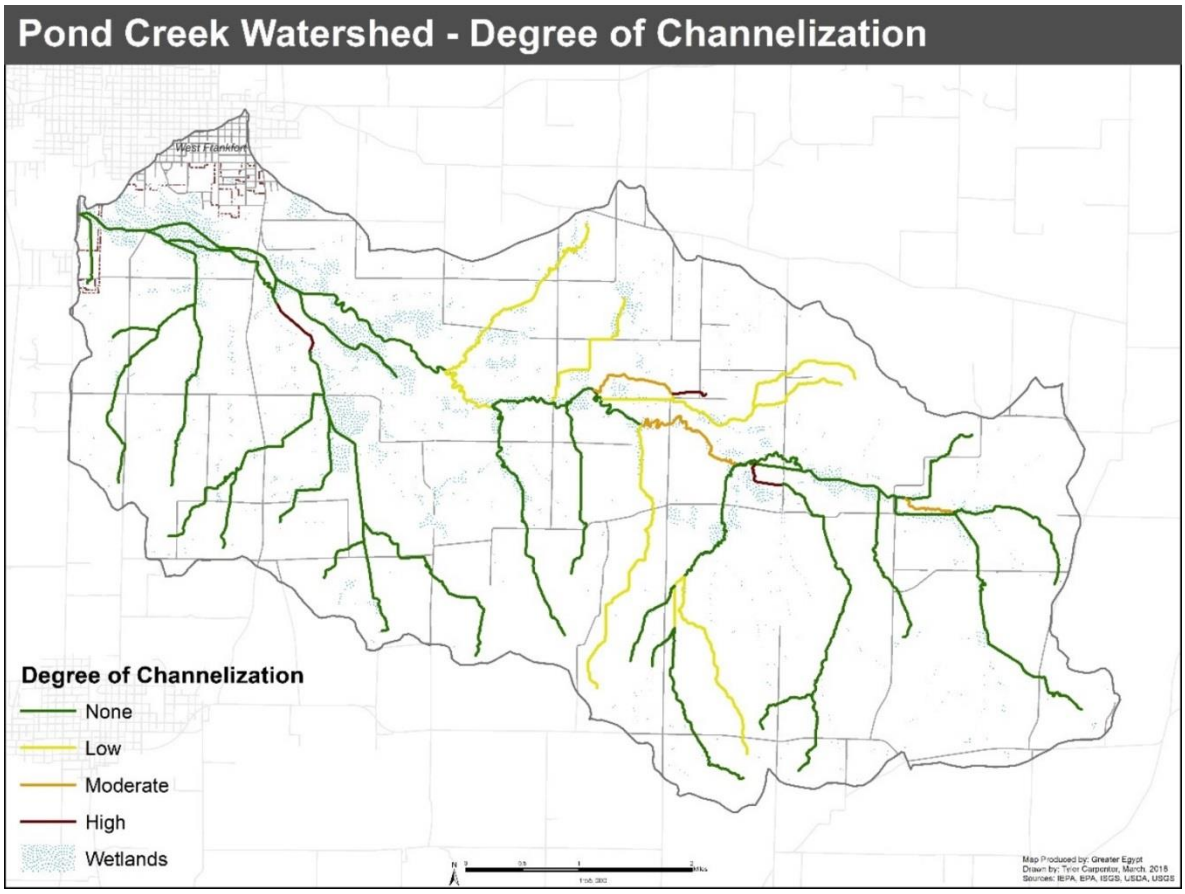
channelized is moderate, and a high degree of channelization is expressed as exhibiting 66 percent or more channelized features.

Table 29- Degree of Channelization by Subwatershed

Subwatershed	None		Low		Moderate		High	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%
Upper Pond Creek	4	100.0%	0	0.0%	0	0.0%	0	0.0%
Lincoln	2	100.0%	0	0.0%	0	0.0%	0	0.0%
Jordan's Fort	10	90.9%	0	0.0%	1	9.1%	0	0.0%
Mach-East	4	80.0%	0	0.0%	0	0.0%	1	20.0%
Mach-West	4	57.1%	3	42.9%	0	0.0%	0	0.0%
Davis	0	0.0%	3	60.0%	1	20.0%	1	20.0%
Prairie	4	57.1%	2	28.6%	1	14.3%	0	0.0%
Neilson	1	33.3%	2	66.7%	0	0.0%	0	0.0%
Dean	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Poor Farm	11	91.7%	0	0.0%	0	0.0%	1	8.3%
Harmony	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Frankfort	3	100.0%	0	0.0%	0	0.0%	0	0.0%
Monroe	5	100.0%	0	0.0%	0	0.0%	0	0.0%
Lower Pond Creek	2	100.0%	0	0.0%	0	0.0%	0	0.0%

The Pond Creek watershed is prone to all degrees of channelization. However, since the watershed experiences very little development, these features are at a minimum compared to other regional HUC 12 watersheds. Channelization is most prevalent in cropland areas. Figure 32 displays the degree of channelization for the assessed streams and tributaries.

Figure 32- Degree of Channelization



2.8.3 Riparian Areas

Riparian corridors provide a buffer for streams and tributaries by filtering pollutants from runoff. Buffers also provide beneficial wildlife habitat. This assessment classifies riparian zones, or buffers, as the area up to 150 feet from the stream on either bank. The one-third method from the previous components has also been utilized for riparian buffers. Stream reaches that have 33 percent, or fewer areas with degraded riparian areas have been classified as good, 33-66 percent as fair, and 66 percent or more as poor. The condition of riparian area by subwatershed is summarized in Table 30.

Table 30- Condition of Riparian Area by Subwatershed

Subwatershed	Good		Fair		Poor	
	Reaches	%	Reaches	%	Reaches	%
Upper Pond Creek	4	100.0%	0	0.0%	0	0.0%
Lincoln	2	100.0%	0	0.0%	0	0.0%
Jordan's Fort	10	90.9%	0	0.0%	1	9.1%
Mach-East	4	80.0%	1	20.0%	0	0.0%
Mach-West	4	57.1%	3	42.9%	0	0.0%
Davis	1	20.0%	2	40.0%	2	40.0%
Prairie	5	71.4%	2	28.6%	0	0.0%
Neilson	2	66.7%	1	33.3%	0	0.0%
Dean	1	100.0%	0	0.0%	0	0.0%
Poor Farm	11	91.7%	1	8.3%	0	0.0%
Harmony	1	100.0%	0	0.0%	0	0.0%
Frankfort	3	100.0%	0	0.0%	0	0.0%
Monroe	2	40.0%	3	60.0%	0	0.0%
Lower Pond Creek	1	50.0%	1	50.0%	0	0.0%

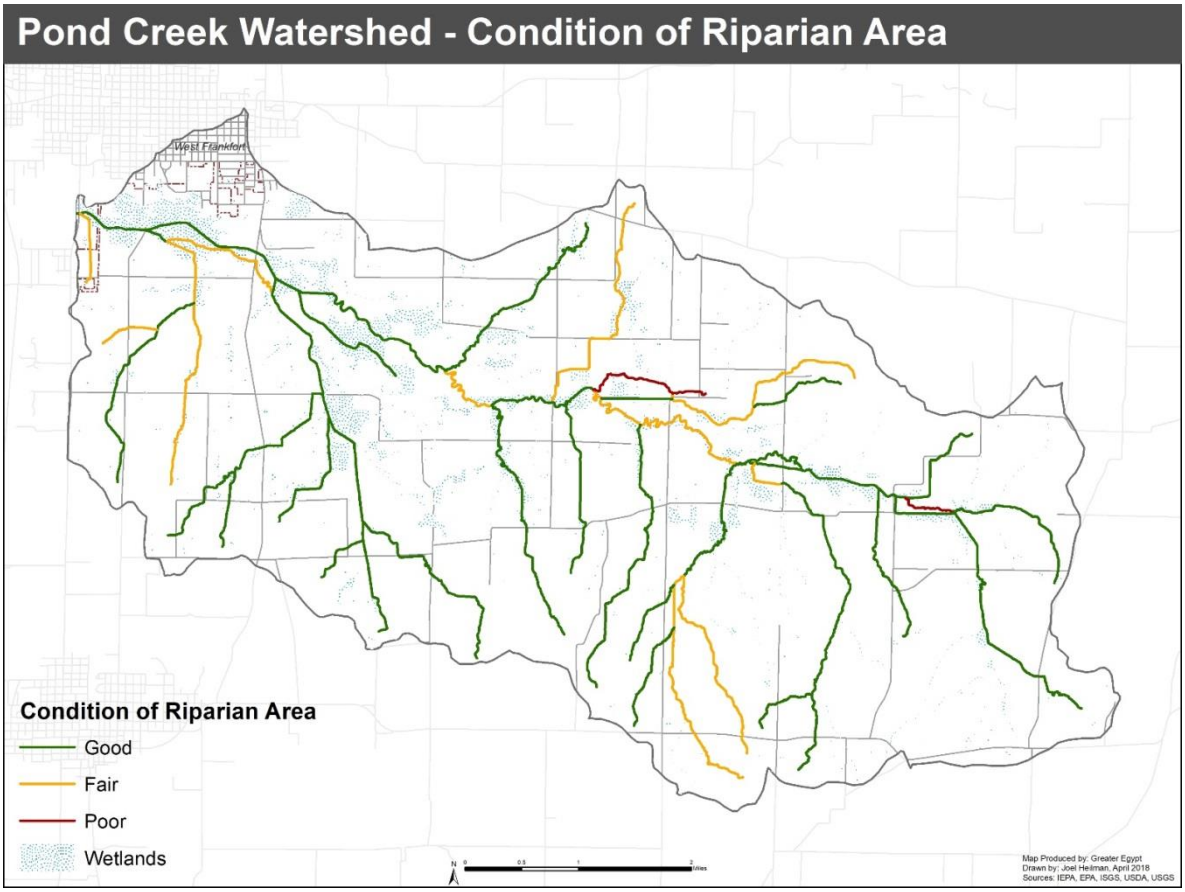
In general, development in riparian zones is minimal in the Pond Creek watershed, although some riparian areas are impacted by cropland and other areas of agricultural practices. Subwatersheds affected by channelization are: Jordan's Fort, Mach-West, Davis, Nielsen, Poor Farm, Monroe, and Lower Pond Creek.

While most of the Pond Creek riparian area is forested, many portions of the creek exhibit erosion, debris blockages, and areas of limited biodiversity. Figure 33 displays the condition of riparian area for the assessed streams and tributaries.

Table 31- Pond Creek Assessment

Pond Creek (IL_NG-02)				
REACHCODE	Length	Extent of Erosion	Degree of Channelization	Condition of Riparian Area
07140106001253	4628.77	Moderate	None	Good
07140106001267	1574.69	High	None	Good
07140106001268	12367.76	Moderate	None	Good
07140106001269	5612.24	Moderate	Low	Fair
07140106001270	4269.83	High	None	Good
07140106001274	1121.10	High	None	Good
07140106001275	2119.35	Moderate	None	Good
07140106001276	5314.26	High	None	Fair
07140106001277	9858.52	High	Moderate	Fair
07140106001278	1501.74	Moderate	None	Good
07140106001279	7782.66	Moderate	None	Good
07140106001304	8939.05	High	None	Good
07140106008369	602.09	Moderate	None	Good
07140106008370	1270.96	Moderate	None	Good
07140106008371	1211.22	Low	None	Good
07140106008372	1075.05	Low	None	Good
07140106008373	955.12	Low	None	Good
07140106008374	3412.23	Low	Moderate	Poor
07140106008376	6929.23	Low	None	Good

Figure 33- Condition of Riparian Area



2.8.4 Basins and Blockages

Although the Pond Creek watershed is one of the larger HUC 12 watersheds in the greater Big Muddy Watershed, only seven percent of the land use is characterized as developed, with half of that number being represented by open space. With this limited amount of developed land, there are currently no detention or retention areas present. Some areas around the reclaimed mine at Russell Minerals have a depression, but do not represent an intended basin.

Since heavy rainfall can produce flooding in and around the West Frankfort area, development of these basins could provide relief and mitigate the impact of these events.

Debris Blockages

Many areas in the Pond Creek watershed exhibit different types of debris blockages. These impediments are both natural and synthetic. Beaver dams and downed vegetation represent the majority of the blockages. This is most evident along the middle section of Pond Creek. Figure 34 displays some of the obstructions in the northwestern portion of the watershed. Residents near the area have expressed concerns over flooding and other impairments related to the occurrences.

Figure 34- Pond Creek Obstructions

Dumping and litter is also prevalent in many portions of the watershed. This is typically evident around stream crossings and rural areas. Figure 35 reveals some areas where dumping has occurred at crossings of Pond Creek.

Figure 35- Pond Creek Dumping Sites

2.9 Water Quality Assessment

For this assessment, water quality of Pond Creek and those waterbodies with available data have been analyzed. A water quality assessment has also been completed for West Frankfort, the only municipality in the Pond Creek watershed.

In conforming to the regulations of the federal Clean Water Act (CWA) sections 303(d) and 305(b), the Illinois Environmental Protection Agency (IEPA) is required to inform the U.S. Environmental Protection Agency on water quality of Illinois waterbodies. While Section 303(d) requires the IEPA to provide a list of waterbodies whose designated uses are considered impaired, Section 305(b) entails an inventory of water quality for Illinois waterbodies and groundwater sources.

While there are seven designated uses in Illinois, only five apply within the Pond Creek planning area. These are Aquatic Life, Fish Consumption, Primary Contact, Secondary Contact, and Aesthetic Quality. Those not designated in the area are Public and Food Processing Water Supplies and Indigenous Aquatic Life.

2.9.1 Water Quality Impairments and Monitoring

303(d) and 305(b) Streams

Pond Creek (IL_NG-02) has been assessed for water quality impairments under Section 303(d). It is the sole waterbody in the watershed to appear on the list. A depiction of 303(d) waterbodies and IEPA monitoring stations can be viewed in Figure 36.

Water quality assessments for Pond Creek have been detailed for this report. Data provided from the IEPA, municipalities, and other sources have been utilized for this assessment.

Table 32 outlines the designated uses and assessment status of Pond Creek as identified in the Illinois Integrated Water Quality Report and Section 303(d) List for 2016.[39]

The Illinois Integrated Water Quality Report categorizes Pond Creek as having three designated uses; aquatic life, which is not supported, and primary and secondary contact, which are both fully supporting. All other categories were not assessed for the 2016 water quality report.

Table 32- Assessment Status of Pond Creek (IL_NG-02)

Designated Use	Use ID	Assessed in 2016 Integrated Report	Use Attainment
Aquatic Life	582	Yes	Not Supporting
Fish Consumption	583	No	Not Assessed
Primary Contact	585	Yes	Fully Supporting
Secondary Contact	586	Yes	Fully Supporting
Aesthetic Quality	590	No	Not Assessed

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

Because Pond Creek has been placed on the IEPA's 303(d) list of impaired waters, there are several impairments to the waterbody. Information from the 305(b) Assessment (Appendix B-3) can be found in Table 33.

Pond Creek experiences impairments from changes in stream depth and velocity patterns, alteration in stream-side or littoral vegetative covers, and loss of instream cover. The assessment also labels Pond Creek as being impaired by a lack of dissolved oxygen, chloride, and sedimentation/siltation.

The information contained in the 303(d) section also lists the impaired designated use and cause of impairment. This information is summarized for Pond Creek in Table 34 as identified in the 303(d) list (Appendix A-1) of the 2016 Integrated Report.

[39] IEPA. *Integrated Water Quality Report and 303d Lists.* Springfield: IEPA, 2016.

Figure 36- 303(d) Waterbodies

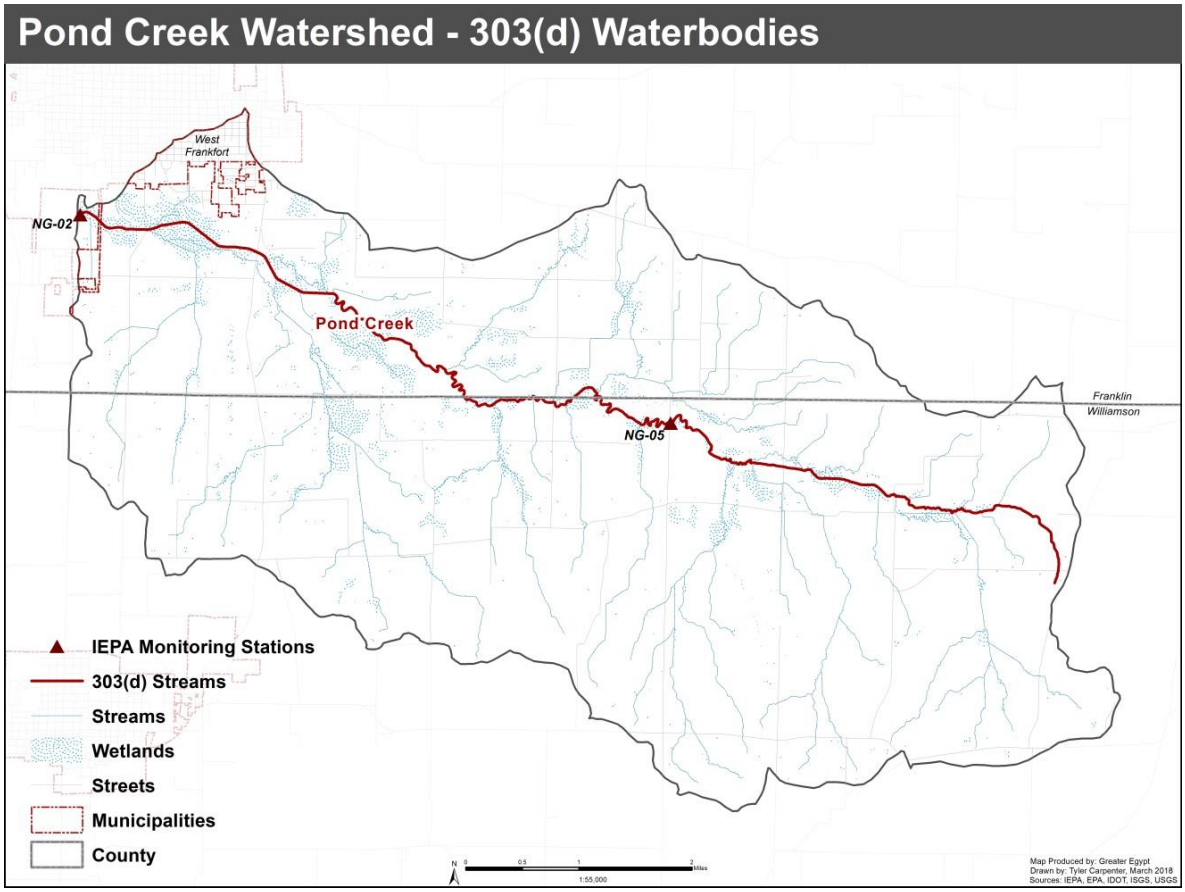


Table 33- 305(b) Assessment Information for Streams

Waterbody	Assessment Unit ID	Size	Causes of Impairment(s)	Sources of Impairment(s)
Pond Creek	IL_NG-02	12.04 miles _____ 23.53 miles (total)	Alteration in stream-side or littoral vegetative covers, Chloride, Dissolved Oxygen, Sedimentation/ Siltation, Changes in stream depth and velocity patterns, Loss of instream cover	Channelization, Impacts from abandoned mine lands (inactive), Loss of Riparian Habitat, Streambank modifications/destabilization, Unknown source, Crop production, Agriculture, Urban runoff/Storm Sewers

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

Table 34- 303(d) Information for Streams

Waterbody	Assessment Unit ID	Size	Impaired Designated Use(s)	Causes of Impairment(s)
Pond Creek	IL_NG-02	23.53 miles	Aquatic Life	Chloride
Pond Creek	IL_NG-02	23.53 miles	Aquatic Life	Dissolved Oxygen
Pond Creek	IL_NG-02	23.53 miles	Aquatic Life	Sedimentation/ Siltation

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

Pond Creek has been listed for chloride and sedimentation/siltation impairments since 2010, and dissolved oxygen since 2012. In 2008, the stream was listed for iron, manganese, pH, total suspended solids (TSS), and fecal coliform.

Supplementary Monitoring and Strategies

In accordance with the Clean Water Act, impaired waterbodies are required to have a Total Maximum Daily Load (TMDL) be developed for each pollutant. Beginning in 2013, Limnotech, Inc began developing a TMDL for the Upper Big Muddy Watershed. This is a 313,435 acre watershed that encompasses the smaller Pond Creek watershed. The *Upper Big Muddy Watershed Total Maximum Daily Load Stage One & Stage Two Reports*[40][41] were designed to provide detailed information for HUC 12 watersheds within the planning area. These reports include addressing the impairments within the Pond Creek watershed including Pond Creek (IL_NG-02). Information from these reports will be utilized to develop TMDLs and Load Reduction Strategies (LRS).

The *Illinois Nutrient Loss Reduction Strategy (ILNLRS)* is a collaborative effort between the Illinois Water Resources Center, IEPA, and the Illinois Department of Agriculture. The strategy prioritizes watersheds that are expected to have the greatest capacity to reduce high volumes of nutrient loss annually. The Pond Creek watershed is located in the Big Muddy River watershed (HUC 07140106), which is an IEPA priority watershed for addressing total phosphorus losses from

[40] Limnotech, Inc. *Upper Big Muddy River Watershed Total Maximum Daily Load Stage One Report.* Ann Arbor, MI, 2014. PDF File
[41] Limnotech, Inc. *Stage 2 Report for TMDL Sampling Activities in the Upper Big Muddy River Watershed, Illinois* . Ann Arbor, MI, 2016. PDF File

nonpoint sources. Further information about the ILNLRS can be found in Section 2.9.8.

In 1996, the USDA-NRCS, with the assistance of the Franklin and Williamson County Soil and Water Conservation Districts, developed the *Preliminary Investigation Report- Pond Creek Watershed.*[42] This study examined the practicality of flooding mitigation measures in the larger Pond Creek basin. Other concerns raised in the report included: erosion, water pollution, mine subsidence, and dumping, debris and odors.

The study group determined six alternatives to the watershed's flooding issues. This included: taking no action, various floodproofing dikes, and floodproofing individual structures. The report included costs and impacts of these management measures as well.

[42] USDA, NRCS. *Preliminary Investigation Report- Pond Creek Watershed.* Franklin County, Illinois. 1997.

2.9.2 Water Quality of Impaired Streams

Pond Creek (IL_NG-02)

The 2016 Illinois Integrated Water Quality Report states the designated use of Pond Creek as aquatic life, in which it does not support. Causes for impairments include: dissolved oxygen, chloride, and sedimentation/siltation. Potential sources of these impairments include: channelization, impacts from abandoned mine lands (inactive), loss of riparian habitat, streambank modification/ destabilization, crop production, agriculture, urban runoff/storm sewers, and other unknown sources.

The IEPA has established two monitoring stations along Pond Creek, which are displayed in Table 35. Locations of these sites are detailed in the following table.

Table 35- Pond Creek IEPA Monitoring Stations

Station Code	County	Station Location
IL_NG-02	Franklin	RT 37 BR S EDGE OF WEST FRANKFORT
IL_NG-05	Williamson	LIBERTY SCHOOL ROAD 4.7 MI SE OF WEST FRANKFORT

Source: RMMS (IEPA)

The most recent available data was taken from various sources including: Limnotech, Inc. (Stage 1 & 2 Reports- Upper Big Muddy River Watershed), Prairie Analytical, and available IEPA datasets.[43] The majority of the data was taken in 2003 to 2008, while other smaller datasets were sampled in 2014 and 2015. While a variety of analytes were tested, focus will be directed towards nutrients causing the impairments in the waterbodies.

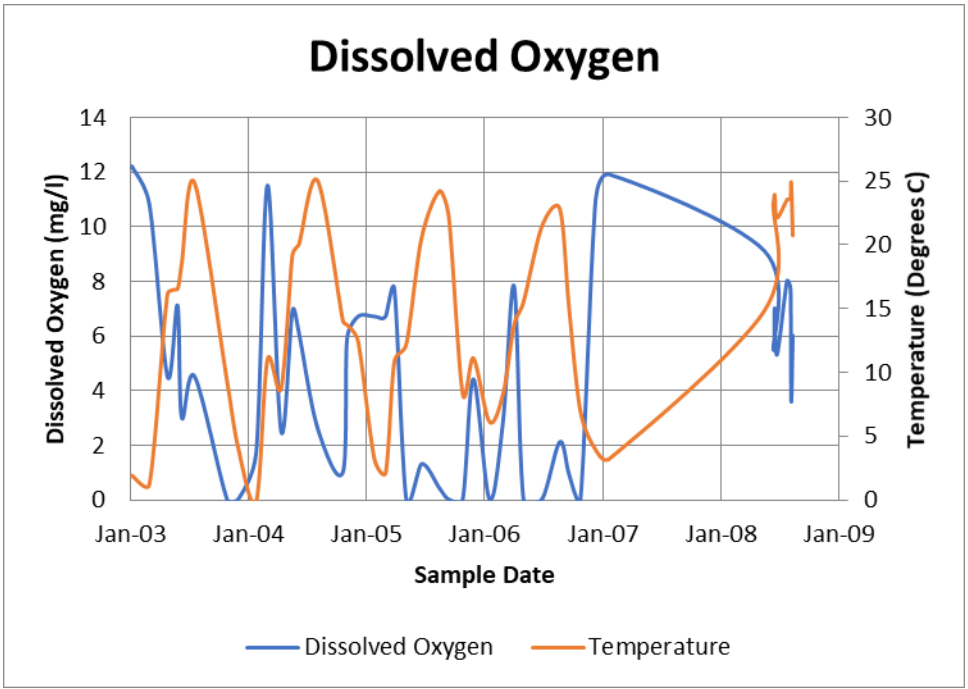
Samples were taken from both IEPA monitoring stations, although some were only taken at NG-02. Figure 37 and Figure 38 display the results of dissolved oxygen and chloride from NG-02 from 2003 to 2008.

[43] Dowson, Sharon. 'Illinois EPA FOIA Response: Water Quality Data for the Pond Creek Watershed. Email. Feb. 27 2018.

The IEPA recommends that dissolved oxygen levels should not be less than the following:

1) During the period of March through July,
    a. 5.0 mg/L at any time; and
    b. 6.0 mg/L as a daily mean averaged over 7 days.
2) During the period of August through February,
    a. 3.5 mg/L at any time;
    b. 4.0 mg/L as a daily minimum averaged over 7 days; and
    c. 5.5 mg/L as a daily mean averaged over 30 days.[44]

Figure 37- NG-02 Dissolved Oxygen (2003-2008)



Source: IEPA, Surface Water Section

Four dissolved oxygen measurements were also taken on 09/24/2015 at NG-02 and ranged from 7.54 mg/L to 14.77 mg/L. One sample was taken from NG-05 the same day and recorded a dissolved oxygen measurement of 15.33 mg/L. These results can be seen in Table 36. While dissolved oxygen levels appeared to be acceptable in 2015, they were frequently below standards in the earlier 2003 to 2008 samples.

[44] Illinois Pollution Control Board. *Title 35: Environmental Protection-Subtitle C: Water Pollution-Part 302 Water Quality Standards, Subpart A: General Water Quality Provisions.* PDF. Accessed February 2018.

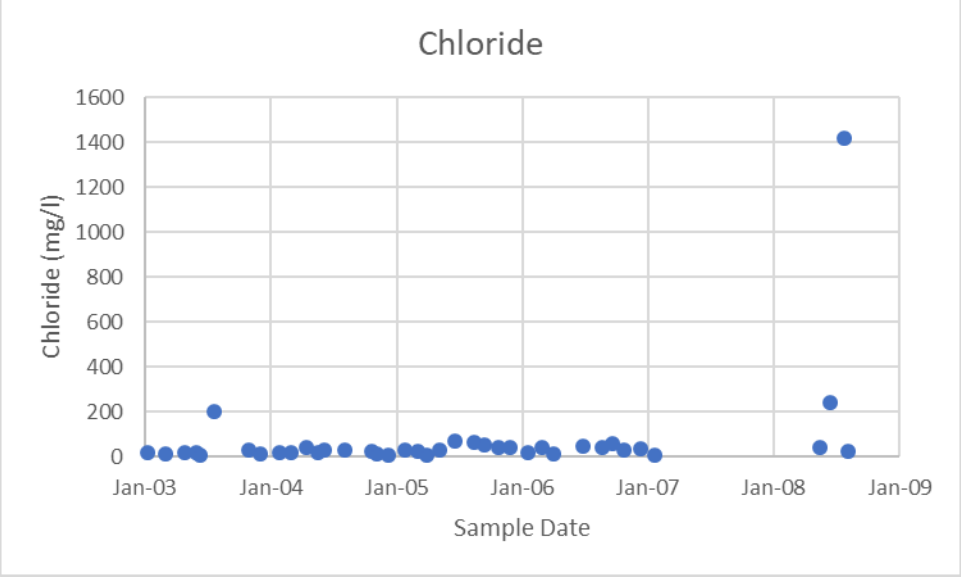
Table 36- 2015 Dissolved Oxygen Levels

9/24/2015		Dissolved Oxygen	Water Temperature
Location	Time	(mg/L)	(deg C)
NG-02	8:44 AM	7.54	17.7
NG-02	8:45 AM	7.35	17.7
NG-02	9:27 AM	7.08	17.65
NG-02	2:19 PM	14.77	25.65
NG-05	4:47 PM	15.33	20.65

Source: Limnotech, Inc.

The Illinois Water Quality Standard for Chloride is 500 mg/L. The range for the 2003 to 2008 data is 8.07 mg/L to 1,420 mg/L with only one sample being over the reporting limit and the majority of the samples being well below the limit.

Figure 38- NG-02 Chloride (2003-2008)



Source: IEPA, Surface Water Section

Table 37- 2015 Sample Results

9/24/2015		Carbonaceous Biochemical Oxygen Demand	Chlorophyll a	Ammonia Nitrogen	Total Kjeldahl Nitrogen	ortho Phosphorus	Total Phosphorus
Location	Time	CBOD5	Chla	NH3	TKN	oP	TP
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
NG-02	9:20 AM	5	0.03452	<0.05	0.84	<0.01	0.132
NG-02	9:20 AM	5.4	0.03874	<0.05	1.1	<0.01	0.132
NG-05	4:40 PM	2.6	0.02832	1.4	2	<0.01	0.0565

Source: Limnotech, Inc.

Other analytes were sampled in 2015 including those in Table 37. Phosphorus levels exceed the recommended 0.05 mg/L in all three samples. Ammonia nitrogen is well below the recommended 15 mg/L.

2.9.3 Local Water Quality Assessment

To address water quality at the local level, an assessment has been completed for the municipalities within the Pond Creek watershed. Since there is only one municipality, this assessment was designed to review the latest annual water quality reports submitted by West Frankfort. All districts in the watershed purchase treated water through the Rend Lake Inter-City Water System. The Rend Lake report has also been utilized for this assessment.

Each municipality is required to test certain organic and inorganic contaminants. Regulated contaminants consist of: Lead, Copper, Chloramines, Haloacetic Acids, and Total Trihalomethanes. The following key represents the factors used in each water quality report:

> **Action Level (AL):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
>
> **Maximum Contaminant Level Goal (MCLG)**: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
>
> **Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
>
> **ppb:** Micrograms per liter or parts per billion- or one ounce in 7,350,000 gallons of water.
>
> **ppm:** Milligrams per liter or parts per million- or one ounce in 7,350 gallons of water[45]

Table 38 displays the water quality reports for lead and copper. Entities have a MCLG of 1.3 ppm. Action Levels are also set at 1.3 ppm for each municipality and jurisdiction. While the reports for Rend Lake and West Frankfort are for

[45] Leonard Killman. *Rend Lake Inner-City Water System.* Rend Lake Conservancy District, 2016. PDF File.

2016, Rend Lake was sampled for copper and lead on 8/6/15, and West Frankfort was sampled for copper in 2014. According to the water quality reports, no jurisdiction was in violation of lead or copper levels. Likely sources of lead consist of corrosion of household plumbing systems, and erosion of natural deposits. Sources of copper include erosion of natural deposits, leaching from wood preservatives, and corrosion of household plumbing materials.

Table 38- Lead and Copper Information

Municipality	Contaminants	MCLG	Action Level (AL)	90th percentile	Sites Over Lead AL	Units	Violation	Likely Source of Contamination
West Frankfort	Copper	1.3	1.3	0.063	0	ppm	N	Erosion of Natural Deposits, Leaching from wood preservatives, corrosion of household plumbing materials
	Lead	0	15	-	o	ppb	N	Corrosion of Household plumbing systems; erosion of natural deposits
Rend Lake ICWS	Copper	1.3	1.3	0	0	ppm	N	Erosion of Natural Deposits, Leaching from wood preservatives, corrosion of household plumbing materials
	Lead	0	15	9.3	0	ppb	N	Corrosion of Household plumbing systems; erosion of natural deposits

Source: City of West Frankfort, Rend Lake Conservancy District

Along with lead and copper, other regulated contaminants that are reported are chloramines, haloacetic acids and total trihalomethanes. The source of chloramines is likely a water additive used to control microbes. Haloacetic acids and trihalomethanes are by-products of drinking water disinfection. Information of these contaminants can be found in Table 39. West Frankfort is within the limits for each contaminant, and no violations have occurred.

While each municipality tests for these certain contaminants individually, they also include a copy of the Rend Lake Inter-City Water System Water Quality Report with their annual report. This is detailed in the following section.

Table 39- Municipal Water Quality: Regulated Contaminants

Municipality	Contaminants	Highest Level Detected	Range of Levels Detected	MCLG	MCL	Units	Violation	Likely Source of Contamination
West Frankfort	Chloramines	1.9	1.5-3	MRDLG=4	MRDL=4	ppm	N	Water additive used to control microbes
	Halocetic Acids	21	0-22	N/A	60	ppb	N	By-product of drinking water chlorination
	Total Trihalomethanes	37	18.3-46	N/A	80	ppb	N	By-product of drinking water chlorination

Source: City of West Frankfort

2.9.4 Rend Lake Inter-City Water System

As stated previously, West Frankfort purchases water through the Rend Lake Inter-City Water System. According to the Source Water Assessment of the Rend Lake Annual Drinking Water Quality Report, the system provides drinking water to approximately 173,000 persons. The area served includes 67 communities in an eight-county region.[46]

The water report includes the parameters from the previous municipal water quality reports identified as regulated contaminants. In addition, inorganic contaminants were also reported. This category includes substances such as: barium, arsenic, fluoride, nitrate (measured as nitrogen), and sodium. Radioactive contaminants and synthetic organic contaminants are also measured. Elements tested in these categories are radium and atrazine. Results are displayed in Table 40.

The contaminants in all categories are within the regulated range designated by the EPA; therefore, no violations have occurred. Similar to the municipal sources of contamination, the regulated contaminants are likely caused by by-products of drinking water chlorination and water additives used to control microbes.

The sources of contamination of the inorganic contaminants differ somewhat. Possible causes of barium include: discharge of drilling waste, discharge from metal refineries, and erosion of natural deposits. While arsenic, fluoride and sodium are also characterized by erosion of natural deposits, there are a few differences. Likely sources of arsenic also include runoff from orchards and runoff from electronics production waste. Possible sources of fluoride include erosion of natural deposits, water additive which promotes strong teeth, and fertilizer discharge.

The presence of the synthetic organic substance atrazine is possibly due to runoff from fertilizer used on row crops.

[46] Killman, *Rend Lake,* 2016.

Table 40- Rend Lake Inter-City Water System 2016 Water Quality Report

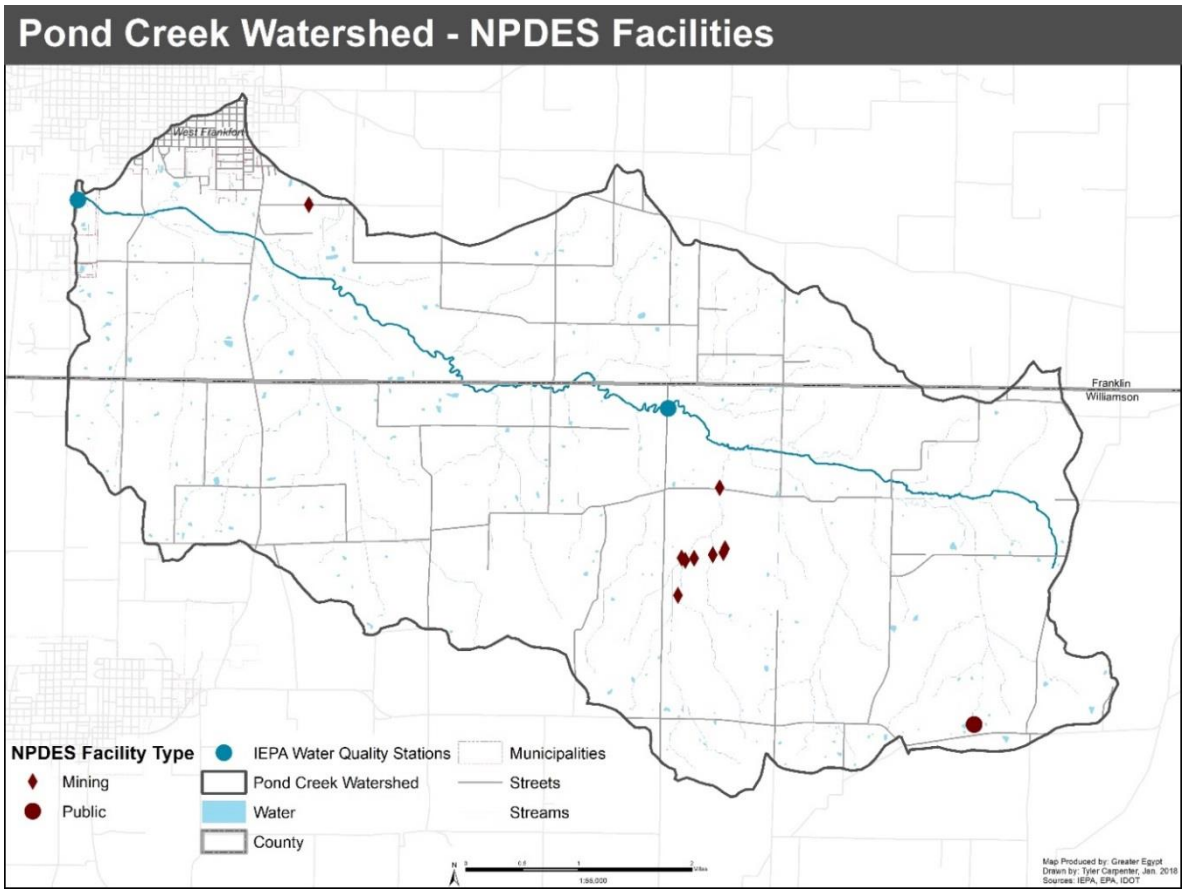
Contaminant		Highest Level Detected	Range of Levels Detected	MCLG	MCL	Units	Violation	Likely Source of Contamination
Regulated	Total Haloacetic Acids	23	16.8-28.8	N/A	60	ppb	N	By-product of drinking water chlorination
	Total Trihalomethanes	45	3.1-47.6	N/A	80	ppb	N	By-product of drinking water chlorination
	Chlorite	0.42	.18-.42	0.8	1	ppm	N	By-product of drinking water chlorination
	Chloramines	3.5	2.6-3.5	MRDLG=4	MRDL=4	ppm	N	Water additive used to control microbes
Inorganic	Barium	0.0209	0.0209-0.0209	2	2	ppm	N	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
	Arsenic	1	.959-.959	0	10	ppb	N	Erosion of natural deposits; runoff from orchards; runoff from electronics production wastes
	Fluoride	0.6	.572-.572	4	4	ppm	N	Erosion of natural deposits; water additive which promotes strong teeth; fertilizer discharge
	Sodium	19	19.0-19.0	-	-	ppm	N	Erosion from naturally occurring deposits
Radioactive	Combined Radium 226/228	0.26	.26-.26	0	5	pCi/L	N	Erosion of naturally occurring deposits
Synthetic Organic	Atrazine	0.53	0-0.53	3	3	ppb	N	Runoff from fertilizer used on row crops
	Di (2-ethylhexyl) phthalate	2.5	0-2.5	0	6	ppb	N	Discharge from rubber and chemical factories

Source: Rend Lake Conservancy District

2.9.5 National Pollutant Discharge Elimination Systems (NPDES) Outfall Locations

There are two existing NPDES outfall locations, and one expired permit within the Pond Creek watershed. These are outfalls from a school and mining operations that are both active and reclaimed. NPDES outfalls are spatially displayed in Figure 39. The outfall for the Lincoln Grade School STP (Il0042544) rests in the most southeastern reach of the Pond Creek watershed. The receiving water is listed as Prairie Creek, but could be innacurate due to its location in the Pond Creek watershed.

Figure 39- NPDES Facilities



Located southeast of West Frankfort, the Russell Minerals (IL0070912) outfall represents a non-existing mining operation that has been reclaimed. The remaining eight discharges in the watershed are operated by Williamson Energy, LLC (IL0077666). These represent active outfalls from the mining operations of Pond Creek Mine No. 1 near the middle portion of the Pond Creek watershed. Receiving waters for all mining outfalls are tributaries to Pond Creek.

Effluent Limit Exceedance

Information on effluent data was taken from the EPA Enforcement and Compliance History Online (ECHO) database.[47] The data reveals all three dischargers have been in violation of effluent limits for various pollutants. These contaminants include: BOD, chloride, manganese, nitrogen, pH, solids (settleable), sulfate, and TSS.

With only a single outfall location, the Lincoln Grade School STP and Russell Minerals outfall both had violations. Lincoln Grade School STP had four violations with an exceedance in nitrogen, and a single violation of BOD. Russell Minerals had a single violation of manganese; although, the permitting for this outfall has expired.

Table 41- Outfall Effluent Violations

Facility Name	Outfall	QTR 1 01/01-03/31/15	QTR 2 04/01-06/30/15	QTR 3 07/01-09/30/15	QTR 4 10/01-12/31/15	QTR 5 01/01-03/31/16	QTR 6 04/01-06/30/16	QTR 7 07/01-09/30/16	QTR 8 10/01-12/31/16	QTR 9 01/01-03/31/17	QTR 10 04/01-06/30/17	QTR 11 07/01-09/30/17	QTR 12 10/01-12/31/17
Lincoln Grade School STP	001	N	BOD			N			N		N		
Russell Minerals	001		Mn										
Williamson Energy, LLC	001				Cl SO4	SOL							
Williamson Energy, LLC	002	SOL		Cl SO4	Cl SO4	Cl SO4 SOL	SO4 Cl				SO4 Cl		
Williamson Energy, LLC	003					SOL							
Williamson Energy, LLC	004					SOL							
Williamson Energy, LLC	005					SOL							
Williamson Energy, LLC	006			Cl SO4 TSS		Cl SO4 SOL TSS							
Williamson Energy, LLC	007			Cl SO4	pH	Cl SO4 TSS	Cl SO4	pH			pH		pH
Williamson Energy, LLC	008							pH			pH		pH

Pollutant KEY	
BOD, carbonaceous	BOD
Chloride	Cl
Manganese	Mn
Nitrogen	N
pH	pH
Solids, settleable	SOL
Sulfate	SO4
Total Suspended Solids	TSS

Source: EPA- ECHO

Williamson Enery, LLC (Pond Creek Mine No. 1) discharges from eight separate outfalls. Pollutants from these outfalls include: chloride, pH, solids (settleable), sulfate, and TSS. The majority of violations are located at the second, sixth, and seventh outfalls.

These outfalls drain into tributaries of Pond Creek roughly one mile south of the confluence of the two waterbodies. While pH, sulfate, and TSS are not designated causes of impairments to Pond Creek, chloride is listed as an impairment to aqautic life in the waterbody. The mine also had a number of single event violations including: improper operation and maintenance, numeric effluent, unapproved bypass, and an unauthorized discharge.

[47] United States Environmental Protection Agency, "Enforcement and Compliance History Online," https://echo.epa.gov. Accessed 3 April- 6 June 2018.

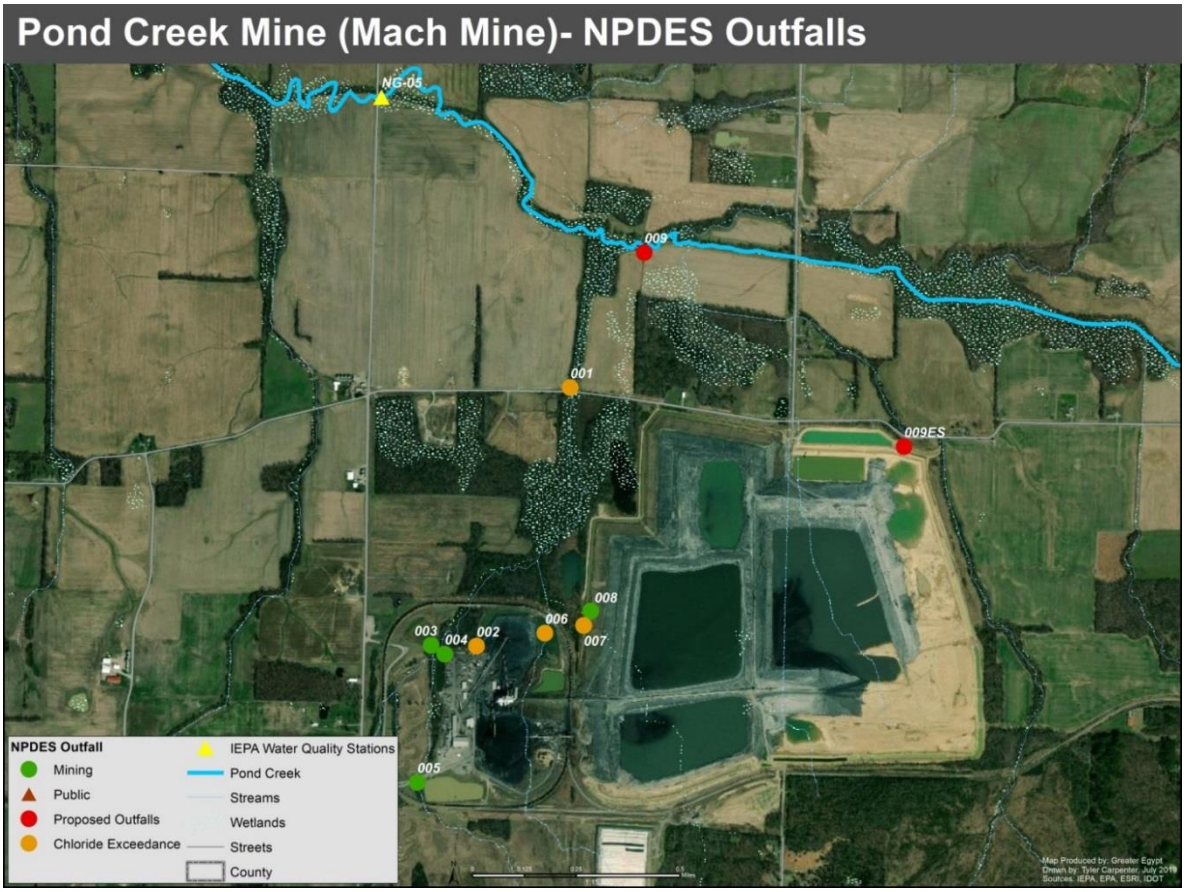
Pond Creek Mine

In 2019, IEPA made a tentative determination to issue a NPDES permit to Williamson County Energy, LLC. [48] Key modifications to their existing NPDES coverage would include:

- Three new outfalls: Outfall Nos. 009, 009ES, and 011(See Figure 40)
- Refuse Disposal Area (RDA) No.3 utilizing 229.78 acres
- Pipeline to the Big Muddy River utilizing 70.7 acres and mixing zone

Outfall 009 would be received by Pond Creek, while an unnamed tributary to Pond Creek would receive the discharges from 009ES. Not listed in Figure 40 is Outfall 011 being received by the Big Muddy River. Discharge parameters for Chloride are generally 500 mg/L with various special conditions.

Figure 40- Mach Mine- NPDES Outfalls



[48] Illinois Environmental Protection Agency. *NPDES Permit No. IL0077666*. PDF File. July 12, 2019.

According to the NPDES Public Notice, the newly constructed RDA No. 3 would connect with the existing RDAs 1 and 2. To mitigate chloride increases from the construction of RDA No.3, the mine would reclaim or eliminate outslopes of RDA 1 and 2.

The newly proposed Outfall No. 011, which would discharge into the Big Muddy River, would travel nearly 12 miles to the point of discahrge. This outfall is recommended in response to the abundance of on-site water. The permit mentions the outfall structure will include a multi-port diffuser and a mixing zone. A mixing zone is also included in the permit for the waters associated with RDA No.3 being discharged into Pond Creek. IEPA concludes that this activity will result in temporary pollutant loading increases, and no long-term impacts will result from this practice.

2.9.6 Pollutant Load Analysis

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) modeling tool developed by Tetra Tech, Incorporated for the U.S. Environmental Protection Agency Office of Water was used to estimate the existing nonpoint source nutrient loads (nitrogen & phosphorus) and sediment loads for the Pond Creek watershed at the HUC 12 level, and by individual subwatershed management units.

STEPL utilizes land cover category types, precipitation data, soils information, existing best management practices, stream and lake erosion, and other data input for calculating pollutant loads. The program does not incorporate land uses such as water (232 acres), barren land (53 acres), and wetlands (229 acres). These classes have been excluded from the STEPL models.

To calculate the sediment load, or degree of streambank erosion, the STEPL model utilizes: streambank length, height, soil type, and lateral recession rate (LRR). Table 42 characterizes these classifications for the LRR. Four categories reflect the degree of streambank erosion in the model: slight, moderate, severe, and very severe.

Table 42- LRR Categories and Values

Category	Description	Lateral Recession Rate (ft/yr)	Medium Value
Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.	0.01 - 0.05	0.03
Moderate	Bank is predominantly bare with some rills and vegetative overhang.	0.06 - 0.2	0.13
Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.	0.3 - 0.5	0.4
Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and stream course or gully may be meandering.	0.5+	0.5

Source: EPA-STEPL

LRR categories have been applied to the assessed values from the erosion assessment in chapter seven. For the purpose of continuity between data, all streams have been assigned the medium value for LRR rates. Table 43 represents the correlation between assessed streams and assigned LRR value.

Table 43- LRR and Assessment Values

Assessment Criteria	LRR Category	LRR (ft/yr)	Medium Value
None or Low	Slight	0.01 - 0.05	0.03
Moderate	Moderate	0.06 - 0.2	0.13
High	Severe	0.3 - 0.5	0.4
High	Very Severe	0.5+	0.5

Source: EPA-STEPL

Table 44 represents the STEPL model for watershed-wide existing pollutant loads. The model estimations suggest cropland and pastureland account for nearly 76 percent of the total nitrogen load, while cropland individually constitutes the largest portion at approximately 39 percent. Groundwater accounts for 12.72 percent of the nitrogen load. Urban land use is the next highest percent of nitrogen loading and calculates to be almost 6 percent of the total load.

The majority of the phosphorus load stems from agriculture (cropland), accounting for nearly 60 percent of the phosphorus load (58.21 percent). Pastureland contributes the second largest amount of the nutrient load at 22.34 percent. Streambank also presents a sizeable portion of the total load at 9.16 percent.

The model suggests cropland is responsible for producing the majority of the sediment load at nearly 60 percent. Other major contributors include streambank (24.51 percent), and pastureland (13.93 percent).

Table 44- Pond Creek Watershed Existing Pollutant Loads

Source	N Load (lb/yr)	Percent of Total Load	P Load (lb/yr)	Percent of Total Load	Sediment Load (tons/yr)	Percent of Total Load
Urban	13226.85	5.89%	2044.62	4.67%	303.61	1.14%
Cropland	88475.27	39.37%	25491.76	58.21%	15854.41	59.69%
Pastureland	81533.71	36.28%	9785.49	22.34%	3700.06	13.93%
Forest	2510.17	1.12%	1183.70	2.70%	193.97	0.73%
Groundwater	28589.45	12.72%	1278.18	2.92%	0.00	0.00%
Streambank	10415.90	4.63%	4010.12	9.16%	6509.94	24.51%
Total	**224751.35**		**43793.88**		**26561.99**	

Source: EPA-STEPL

2.9.7 Subwatershed Pollutant Loads

Subwatersheds were also individually modeled in STEPL. Pollutant loads reflect the dominant land use categories and size of each subwatershed. Results of the subwatershed STEPL model can be viewed in Table 45. Percentages of total pollutant loads by Subwatershed are displayed in Table 46.

Table 45- Subwatershed Existing Pollutant Loads

Subwatershed	SMU ID	Size (acres)	N Load (lb/yr)	N Load (lb/yr)/ Acre	P Load (lb/yr)	P Load (lb/yr)/ Acre	Sediment Load (t/yr)	Sediment Load (t/yr)/ Acre
Upper Pond Creek	**1**	900.19	9829.29	10.92	1524.64	1.69	714.28	0.79
Lincoln	**2**	1701.81	14974.54	8.80	2374.89	1.40	1178.79	0.69
Jordan's Fort	**3**	1508.67	16649.06	11.04	3245.36	2.15	1811.90	1.20
Mach-East	**4**	1528.03	8484.89	5.55	1700.29	1.11	931.93	0.61
Mach-West	**5**	1799.44	18240.47	10.14	3623.78	2.01	2542.60	1.41
Davis	**6**	2168.32	27433.08	12.65	5377.58	2.48	2978.79	1.37
Prairie	**7**	1596.63	22989.89	14.40	5178.28	3.24	3917.18	2.45
Nielson	**8**	1372.85	18118.84	13.20	4468.72	3.26	2743.64	2.00
Dean	**9**	1063.71	13103.67	12.32	2591.52	2.44	1811.79	1.70
Poor Farm	**10**	3250.77	36174.57	11.13	6834.39	2.10	4051.07	1.25
Harmony	**11**	444.41	5082.01	11.44	1216.93	2.74	711.52	1.60
Frankfort	**12**	1062.5	11489.01	10.81	2527.81	2.38	1683.18	1.58
Monroe	**13**	1576.32	16537.35	10.49	2255.46	1.43	1063.67	0.67
Lower Pond Creek	**14**	657.18	5644.67	8.59	874.24	1.33	421.65	0.64
Total		**20630.83**	**224751.35**	**10.89**	**43793.88**	**2.12**	**26561.99**	**1.29**

Source: EPA-STEPL

Because of its large size (3,250 acres), the Poor Farm subwatershed (SMU 10) produces the majority of the pollutant loads amongst all subwatershed management units. The nitrogen load for the Poor Farm accounts for 16 percent of the overall watershed load. With 6,834 pounds of phosphorus annually, SMU 10 makes up approximately 16 percent of the total load. The subwatershed also contributes the greatest amount of the sediment load at 4,051 pounds per year, or around 15 percent of the total load.

The model also suggests that the Prairie and Davis subwatersheds are responsible for the second and third highest rates of nutrient loads. At 12.21 percent, the Davis subwatershed contributes the second highest rate of nitrogen loading. This is followed by 10.23 percent being contributed by the Prairie subwatershed. The Davis subwatershed exhibits 12.28 of the Pond Creek watershed's total phosphorus load while Prairie constitutes 11.82 percent of the total load. 14.75 percent of the total load of sediment is produced by Prairie. Davis produces about 3.5 percent lower sediment volume at 11.21 percent.

Table 46- Percentage of Total Pollutant Load by Subwatershed

Subwatershed	SMU ID	Size (acres)	N Percent of Total Load	P Percent of Total Load	Sediment Percent of Total Load
Upper Pond Creek	**1**	900.19	4.37%	3.48%	2.69%
Lincoln	**2**	1701.81	6.66%	5.42%	4.44%
Jordan's Fort	**3**	1508.67	7.41%	7.41%	6.82%
Mach-East	**4**	1528.03	3.78%	3.88%	3.51%
Mach-West	**5**	1799.44	8.12%	8.27%	9.57%
Davis	**6**	2168.32	12.21%	12.28%	11.21%
Prairie	**7**	1596.63	10.23%	11.82%	14.75%
Nielson	**8**	1372.85	8.06%	10.20%	10.33%
Dean	**9**	1063.71	5.83%	5.92%	6.82%
Poor Farm	**10**	3250.77	16.10%	15.61%	15.25%
Harmony	**11**	444.41	2.26%	2.78%	2.68%
Frankfort	**12**	1062.50	5.11%	5.77%	6.34%
Monroe	**13**	1576.32	7.36%	5.15%	4.00%
Lower Pond Creek	**14**	657.18	2.51%	2.00%	1.59%

Source: EPA-STEPL

2.9.8 Pollutant Load Reduction Targets

The Pond Creek Watershed-based Plan will address the problematic areas in the watershed by proposing best management practices (BMPs) to limit the nutrient runoff and other impairments. In order to better plan for these measures, pollutant load reduction targets are set to offer a benchmark for BMP effectiveness. While BMPs can be site-specific and cover a wide range of techniques, they should target the major impairments in the watershed.

According to the 2016 Illinois Integrated Water Quality Report, there are several known and potential causes and sources of water pollution in the Pond Creek watershed. Table 47 summarizes the causes and sources based on the Illinois Integrated Water Quality Report and other factors identified in this inventory and assessment.

Table 47- Causes Sources of Watershed Impairments

Waterbody	Causes of Impairment	Potential Sources of Impairment
Pond Creek	**Alteration in stream-side or littoral vegetative covers, Chloride, Dissolved Oxygen, Sedimentation/ Siltation, Changes in stream depth and velocity patterns, Loss of instream cover**	Channelization
		Impacts from abandoned mine lands (inactive)
		Loss of Riparian Habitat
		Streambank Modifications/ Destabilization
		Unknown Source
		Crop Production
		Agriculture
		Urban Runoff/ Storm Sewers

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

As described in Section 2.9.1, the Illinois Nutrient Loss Reduction Strategy (ILNLRS) was designed to provide a framework for BMP implementation and reduction of nitrogen and phosphorus in Illinois waterbodies. The plan sets a Phase 1 milestone of state-wide nutrient reduction of nitrate-nitrogen at 15

percent. The target for phosphorus is 25 percent. These targets are to be met by 2025, with an overall target of 45 percent for both nutrients. [49]

Pollutant load reduction targets for the Pond Creek watershed will conform to the targets presented in the ILNLRS. Table 48 provides a summary of the pollutant load reduction targets for the Pond Creek watershed and subwatersheds for a ten-year period. While the plan provides information on limiting sediment in waterbodies, it does not provide a target. However, a target of 25 percent has been assigned for the Pond Creek watershed. These targets are also presented in the following tables.

Table 48- Summary of Pollutant Load Reduction Targets

Watershed	SMU ID	Nitrogen (percent reduction)	Nitrogen Load Reduction Target (lbs)	Phosphorus (percent reduction)	Phosphorus Load Reduction Target (lbs)	Sediment (percent reduction)	Sediment Load Reduction Target (tons)
Pond Creek	**-**	**15.00%**	**337126.80**	**25.00%**	**109484.60**	**25.00%**	**66404.70**
Subwatershed Load Reduction Targets							
Upper Pond Creek	**1**	4.37%	14743.94	3.48%	3811.61	2.69%	1785.70
Lincoln	**2**	6.66%	22461.82	5.42%	5937.23	4.44%	2946.97
Jordan's Fort	**3**	7.41%	24973.58	7.41%	8113.39	6.82%	4529.76
Mach-East	**4**	3.78%	12727.33	3.88%	4250.73	3.51%	2329.82
Mach-West	**5**	8.12%	27360.71	8.27%	9059.45	9.57%	6356.51
Davis	**6**	12.21%	41149.62	12.28%	13443.96	11.21%	7446.97
Prairie	**7**	10.23%	34484.83	11.82%	12945.71	14.75%	9792.94
Nielson	**8**	8.06%	27178.26	10.20%	11171.79	10.33%	6859.11
Dean	**9**	5.83%	19655.51	5.92%	6478.79	6.82%	4529.49
Poor Farm	**10**	16.10%	54261.64	15.61%	17085.84	15.25%	10127.44
Harmony	**11**	2.26%	7623.02	2.78%	3042.32	2.68%	1778.80
Frankfort	**12**	5.11%	17233.52	5.77%	6319.52	6.34%	4207.94
Monroe	**13**	7.36%	24806.02	5.15%	5638.64	4.00%	2659.17
Lower Pond Creek	**14**	2.51%	8467.01	2.00%	2185.59	1.59%	1054.13
TOTAL			**337126.81**		**109484.57**		**66404.75**

The summary suggests that with a 15 percent reduction target, watershed-wide nitrogen loading will be reduced by 33,712.68 pounds per a ten-year period. At a 25 percent reduction, phosporus loads will be reduced by 10,948.46 pounds. The

[49] IEPA. *NLRS- Executive Summary.* PDF. Accessed March 2018.

summary also includes a reduction in sediment of 6,640.47 tons (25 percent). Results have also been categorized by annual pollutant load reductions. These are displayed in Table 49.

To meet these reduction targets, BMPs will have to be suggested and implemented in the watershed. This will be the next phase in the Pond Creek Watershed-based planning process.

Table 49- Annual Pollutant Load Reductions Targets

Watershed	SMU ID	Nitrogen (percent reduction)	Nitrogen Load Reduction Target (lbs)	Phosphorus (percent reduction)	Phosphorus Load Reduction Target (lbs)	Sediment (percent reduction)	Sediment Load Reduction Target (tons)
Pond Creek	**-**	**15.00%**	**33712.68**	**25.00%**	**10948.46**	**25.00%**	**6640.47**
Subwatershed Load Reduction Targets							
Upper Pond Creek	**1**	4.37%	1474.39	3.48%	381.16	2.69%	178.57
Lincoln	**2**	6.66%	2246.18	5.42%	593.72	4.44%	294.70
Jordan's Fort	**3**	7.41%	2497.36	7.41%	811.34	6.82%	452.98
Mach-East	**4**	3.78%	1272.73	3.88%	425.07	3.51%	232.98
Mach-West	**5**	8.12%	2736.07	8.27%	905.94	9.57%	635.65
Davis	**6**	12.21%	4114.96	12.28%	1344.40	11.21%	744.70
Prairie	**7**	10.23%	3448.48	11.82%	1294.57	14.75%	979.29
Nielson	**8**	8.06%	2717.83	10.20%	1117.18	10.33%	685.91
Dean	**9**	5.83%	1965.55	5.92%	647.88	6.82%	452.95
Poor Farm	**10**	16.10%	5426.16	15.61%	1708.58	15.25%	1012.74
Harmony	**11**	2.26%	762.30	2.78%	304.23	2.68%	177.88
Frankfort	**12**	5.11%	1723.35	5.77%	631.95	6.34%	420.79
Monroe	**13**	7.36%	2480.60	5.15%	563.86	4.00%	265.92
Lower Pond Creek	**14**	2.51%	846.70	2.00%	218.56	1.59%	105.41
TOTAL			**33712.68**		**10948.46**		**6640.47**

With these measures, estimations for nutrient load reductions account for: nitrogen (46,550 lbs/yr), phosphorus (24,549 lbs/yr), and sediment (24,150 tons/yr). Other load reductions have been calculated for TSS, BOD, and COD.

3. Best Management Practices and Pollutant Load Reductions

For the Pond Creek Watershed-based Plan, BMPs have been separated into watershed-wide and site-specific classes. There are a variety of practices in the plan that focus on issues regarding agricultural practices due to the watershed being primarily agriculturally based. Several other BMPs were recommended to address ongoing hydrological issues within the watershed. BMPs were suggested based on several factors including: reduction loads, need, feasibility, cost, and labor.

Pollutant load reductions have been calculated for each site-specific practice by implementing the Region 5 Model. Reductions were also estimated for watershed-wide BMPs. However, estimations for site-specific BMPs may be more accurate considering the variables used for those calculations pertain to a particular area.

BMPs have been arranged by general area in the following section. Along with the general location, they have also been classified by: subwatershed management unit, amount, unit, and priority ranking.

3.1 BMP Descriptions and Methodology

Each BMP suggested in the plan has been characterized and described further by methodology. As previously stated, management measures address the major pollutants in the watershed derived from the original pollutant loads outlined in the watershed resource inventory. Further information on the recommended BMPs can be found in the Illinois Urban Manual, as well as the NRCS Field Office Technical Guide. The Illinois Urban Manual outlines specifications about the purpose of the BMPs, as well as guidance for construction. [50] The NRCS Field Office Technical Guide is state specified guidance that covers general

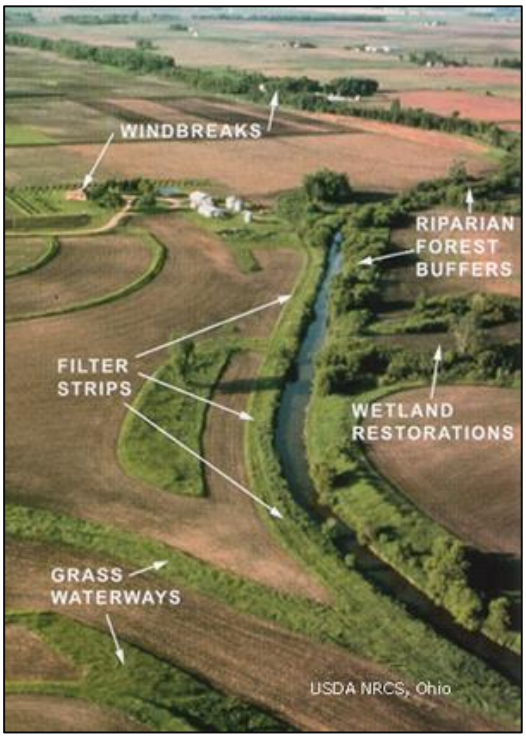
[50] *Illinois Urban Manual. Association of Illinois Soil & Water Conservation, 2013. PDF File.*

information on the area, natural resources, conservation management systems, practice standards and specifications, and conservation effects. [51]

3.1.1 Agricultural BMPs

According to the existing pollutant loads derived from the STEPL model, agricultural practices (cropland/pastureland) account for nearly 76 percent of the nitrogen load, 81 percent of the total phosphorus load, and 74 percent of the total sediment load in the watershed. With the agricultural pollutant loading being so substantial, many of the BMPs are focused on addressing load reductions from these land uses. Figure 41 displays various agricultural BMPs presented in this plan.

Figure 41- Example of Agricultural BMPs



Source: USDA NRCS, Ohio

Agricultural Filter Strips

Figure 42- Agricultural Filter Strip

Agricultural filter strips protect water quality by naturally filtering nutrients and sediment. Since Pond Creek is impaired by sedimentation, this BMP is effective in reducing these pollutant loads into the waterbody. With the amount of agricultural runoff taking place within the watershed, agricultural filter strips are particularly effective in

[51] *NRCS and USDA. "Field Office Technical Guide," https://efotg.sc.egov.usda.gov/#/. Accessed August 16, 2019.*

reducing pollutant loads. Pollutant load reductions were generated in the Region 5 Model assuming BMP efficiencies of: 65 percent sediment reduction; 75 percent phosphorus reduction; and 70 percent nitrogen reduction. The model also takes Universal Soil Loss Equation (USLE) or the Revised USLE (RUSLE) parameters into consideration. These are specific for the geographic area. Unless otherwise noted, all agricultural BMPs follow the same efficiency percentages.

Conservation Tillage

Conversation tillage can include mulch-till, no-till, and strip-till practices. These forms of conservation tillage usually leave a residual of the previous layer of crops. Each method varies in practice, but the benefits are typically consistent with the others. Any form of conservation tillage paired with contour farming brings added benefit. Major benefits of implementing some form of conservation tillage includes reduction in soil erosion and improved water quality.

Cover Crops

Cover crops provide benefits to agricultural land by improving water quality and reducing erosion. These are usually planted following seasonal harvests. Some landowners in the Pond Creek watershed already plant some form of cover crops, but this number is relatively small compared to the overall acreage of agricultural practices.

Critical Area Planting

Critical Area Planting involves establishing permanent vegetation on land that is currently eroded or expected to erode in the near future. Usually these are areas that are highly eroded and are unable to be farmed. Establishing permanent cover helps to stabilize the soil structure, therefore reducing runoff and

improving water quality.[52] Several areas of farm land in Pond Creek are highly eroded and could benefit from this practice.

Crop Rotation

Crop rotation involves cycling two or more crops on the same ground over a period of time. The changing sequence of crops between years allows for increased soil health, as well as reducing sheet, rill and wind erosion. Rotating another crop into the cycle with a larger rooting depth will support further intake of excess nutrients the previous crop could not reach. The outcome is enhanced water quality due to nutrients being used for their intended purpose of crop production instead of running off into nearby waterways. Using cover crops during fallow seasons provides additional nutrient retention. Crop rotation can be combined with many other conservation efforts for enhanced benefits to land and streams. [53]

Drainage Water Management

Drainage water management (DWM) is a practice used in conjunction with existing tile drained fields on flatter landscapes. A water control structure is installed which allows for control of water level by draining excess water or retaining it for future use. This allows for seasonal variation of the crops water needs. By retaining water for future use, crops are given the opportunity to capture water and nutrients for their benefit; thus, decreasing direct flow of nutrients into surrounding waterbodies. This aids in crop production, as well as improved water quality. [54]

[52] *USDA-NRCS, "Critical Planting Area," Conservation Practice Standard, Code 342 (September, 2010)*
[53] *USDA-NRCS," Conservation Crop Rotation," Conservation Practice Standard, Code 328 (October, 2015)*
[54] *USDA-NRCS, "Drainage Water Management Fact Sheet". (Accessed July, 2019).*

Grassed Waterways

Figure 43- Grassed Waterway

Grassed waterways prevent erosion in areas prone to consistent water flow. They can also serve as a filtering mechanism for nutrients. Compared to surrounding areas, the Pond Creek Watershed has very few landowners that implement this practice. The parameters used in the STEPL model for grassed waterways include: soil type, top and bottom width of existing gully, depth, length, and number of years to form.

Since grassed waterways are very effective in addressing erosion and nutrients, the BMP efficiency used in the pollutant load reduction models was set at 1 (100 percent efficiency). Implementation of grassed waterways is assuming at least a 60-foot width per gully.

Livestock Crossings

Figure 44- Location in Need of Livestock Crossing Structure

Livestock frequently crossing through a stream can cause erosion to the streambank and impair the water via increased sedimentation and nutrient loading. Livestock crossings can be constructed by various means, but with the purpose in mind to stabilize the stream. In many cases, farmers will fence off a portion of the stream to help minimize disturbance. Several locations along Pond Creek are in need of livestock crossings.

Pasture/ Hayland Planting

Converting cropland into pasture or hay production not only benefits local wildlife, but improves water quality as well. The hay/pasture fields filter out nutrients and sediment before entering the stream.[55] Since Pond Creek is impaired by sedimentation, implementing pasture/hay fields would be a beneficial BMP.

Riparian Buffers

Riparian buffers are similar to filter strips, and have additional benefits. Like filter strips, buffers reduce sediment and nutrients by filtering the water that flows through it. Since buffers are generally larger than agricultural filters, they can reduce the flow of water at a higher pace. This is beneficial for the riparian buffers along Pond Creek. Since implementation of buffers can be more expensive than normal filter strips, they were suggested sparingly for the Pond Creek Watershed-based Plan.

Figure 45- Riparian Buffer

[55] *USDA- NRCS, "Pasture and Hayland Planting," NRCS Job Sheet. (December, 2009).*

Terraces

Terraces aid in erosion control along moderate to steep slopes by intercepting runoff and allowing sediment to remain on the cropland instead of washing into nearby streams. Terraces combined with other BMPs, such as conservation tillage, would increase their effectiveness.[56] Portions of cropland within Pond Creek are mildly sloped with evidence of sheet and rill erosion, therefore suggesting terrace implementation would be a suitable BMP.

Water & Sediment Control Basins

Water and Sediment Control Basins (WASCOB) function quite similar to terraces, but are more geared towards irregular topography where farmers cannot easily plow on the contours. An earth embankment is constructed perpendicular to a gently sloped waterway in order to trap runoff. The sediment is allowed to settle within the basin, while the remaining runoff slowly releases into a stable outlet. The WASCOB prevents rill erosion and increased sedimentation in waterways by slowing down runoff, especially after a heavy rain. [57]

[56] *USDA- NRCS, "Terraces," Iowa Job Sheet. (May, 2001).*
[57] *USDA-NRCS, "Water and Sediment Control Basin" Conservation Practice Standard, Code 638. (October, 2017)*

3.1.2 Hydrologic BMPs

Infiltration/Detention Basins

For the purpose of reducing flooding and other water quality issues, infiltration basins have been proposed for the plan. Development of these basins will mitigate future flooding occurrences in areas prone to the back-up of water flow. They should also provide relief of stormwater runoff issues specifically in West Frankfort.

Figure 46- Example of Detention Area in Nearby Watershed

Dikes

Dikes help to mitigate areas prone to flooding by controlling the water level of the area. They can also be included in cropland water management plans to retain water for agricultural purposes.[58] Mention of floodproofing earthen dikes is included in the 1997 Preliminary Investigation Report for Pond Creek Watershed. The south side of West Frankfort, specifically near the Frankfort Community Park, has been impacted regularly from issues related to flooding.

[58] *USDA-NRCS, "Dike" Practice Introduction, Code 356 (December, 2008)*

Figure 47- Flooding Along Pond Creek at Frankfort Community Park

Photo by Jason Gresham

Mixing Zone

NPDES permit facilities may apply for a mixing zone permit, which allows the facility to discharge affluent into a nearby waterbody based upon several factors. A thorough analysis of nearby habitat and water use is completed prior to authorization of the mixing zone. The concentration of discharge cannot impede designated use of the receiving stream nor cause harm to aquatic life.[59] This BMP may be helpful for Pond Creek Mine to implement due to the impairment of high Chloride levels within Pond Creek.

Figure 48- Mach Mine

[59] *EPA," Chapter 5: General Policies," Water Quality Standards Handbook. (September, 2014)*

Wetland Conversion

Converting frequently flooded cropland into wetlands proves to be highly beneficial for improving water quality, as well as reducing soil erosion. Wetlands capture water and filter out excess nutrients before slowly releasing it back into the waterways. This action helps mitigate flooding downstream. Hydric soil near Pond Creek in the western half of the watershed indicates that wetlands existed in that area previously. Most of that land now is for agricultural usage. Converting the land back to wetlands would be extremely beneficial for improved water quality in Pond Creek, especially with reducing sedimentation.

Figure 49- Wetland Adjacent to Cropland.

3.1.3 Waterbody BMPs

While other BMPs previously suggested have focused solely on agriculture and flood prone areas, it is important to recommend management measures that can immediately affect waterbodies. These management practices deal with both agriculture and urban environments.

Debris Removal

Many areas in the Pond Creek Watershed exhibit some form of blockages. This is certainly evident in some segments of Pond Creek. While this is sometimes overlooked, it can be detrimental to the health of a stream or lake. Depending on the flow, a blockage can alter the stream channel and cause erosion on the streambank. Areas with major blockages can also exhibit flooding.

Figure 50- Large Woody Debris in Stream

Streambank Stabilization

Varying degrees of erosion occur on all waterbodies. This is particularly evident in Pond Creek. Stabilization of shorelines and streambanks is important to reduce the progress of erosion and mitigate any future occurrences. Stabilization measures can also reduce nutrient loads from runoff.

The Region 5 Model uses various parameters to estimate load reductions for shoreline and streambank stabilization. Soil, length and height are components included in the model. Lateral recession rates (LRR) are also used in determining the effectiveness of stabilization. Table 50 displays the modified LRR characterization used in the STEPL Region 5 Model.

Table 50- Modified Lateral Recession Rate Diagram in STEPL Region 5 Model

LRR (ft/yr)	Category	Median Value	Description
0.01 - 0.05	Slight	0.03	Some bare bank but active erosion not readily apparent
0.06 - 0.2	Moderate	0.13	Bank is predominantly bare with some rills and vegetative overhang
0.3 - 0.5	Severe	0.4	Bank is bare with rills and severe vegetative overhang
0.5+	Very Severe	0.5	Bank is bare with gullies and severe vegetative overhang

Source: EPA, IEPA

For consistency, LRRs used for streambank and shoreline stabilization were set at median values: Slight (0.03), Moderate (0.13), Severe (0.4). Efficiency parameters were set at 1 (100 percent efficiency). In most cases, this strategy was used for both banks of a reach unless otherwise noted.

3.3 BMP Recommendations

Best management practices for the Pond Creek watershed have been proposed by agricultural and waterbody categories. BMP previously described are further subdivided by watershed-wide and site-specific areas.

3.3.1 Watershed-wide BMPs

As previously stated, BMP suggested in the plan are separated into watershed-wide and site-specific categories. Table 51 displays the watershed-wide BMP, amount, and their estimated load reductions.

Watershed-wide BMP include: contour farming, cover crops, critical area planting, crop rotation, debris removal, drainage water management, livestock crossings, no-till, nutrient management plan, pasture/hayland planting, streambank stabilization, strip-till, terraces, and wetland creation. Load reductions are symbolized by N (Nitrogen), P (Phosphorus), TSS (Total Suspended Solids), BOD (Biological Oxygen Demand), and COD (Chemical Oxygen Demand).

For the agricultural watershed-wide BMP, a suggestion of a ten percent of land to implement conservation, cover crops, no-till, and strip-till has been suggested. The ten percent constitutes nearly 642 acres of agricultural land. A suggestion of five percent of land to implement contour farming, critical planting, crop rotation, pasture/hayland planting, and terraces is recommended. The five percent constitutes nearly 321 acres of agricultural land. In regards to nutrient load reductions, these practices seem to provide the most benefits considering the small application size.

Watershed-wide streambank stabilization was based on the extent of erosion. Proposed total stabilized stream length by subwatershed is displayed in Table 52. In general, load reductions are based on both sides of banks being stabilized for watershed-wide and site-specific categories. Low extent of erosion leads to 20 percent of the reach becoming eligible for stabilization, moderate at 30 percent,

and high being 50 percent of the reach. The percent of streambank stabilization by individual reach can be found in Appendix A.

With these measures, estimations for nutrient load reductions account for: nitrogen (16,958 lbs/yr), phosphorus (8,895 lbs/yr), and sediment (10,220 tons/yr). Other load reductions have been calculated for TSS, BOD, and COD.

Table 51- Watershed-wide BMP and Load Reductions

BMP	Amount	Unit	Load Reductions- lbs/ yr (N, P) ton/yr-(Sediment)		
			N	P	Sediment
Contour Farming	321	acre	270	135	161
Cover Crops	642	acre	504	252	295
Critical Area Planting	321	acre	270	135	161
Crop Rotation	321	acre	270	135	161
Debris Removal	-	-	-	-	-
Dikes	-	-	-	-	-
Drainage Water Management	1,285	acre	918	459	528
Livestock Crossing	-	-	-	-	-
No-Till	642	acre	504	252	295
Nutrient Management Plan	1,285	acre	918	459	528
Pasture/Hayland Planting	321	acre	270	135	161
Streambank Stabilization*	105,652	feet	10,239	5,120	5,120
Strip Cropping	321	acre	270	135	161
Strip-Till	642	acre	504	252	295
Terrace	321	acre	270	135	161
Water and Sediment Control Basin	25	unit	833	833	1,665
Wetland Creation	-	-	-	-	-
		TOTALS:	**16,040**	**8,436**	**9,692**
			N	P	Sediment

*Streambank is listed under this table as a watershed-wide practice. Load reductions for individual reaches have also been established as site-specific practices. These reductions are based on both sides of the streambank.

Table 52- Streambank Stabilization by Subwatershed

SMU ID	Subwatershed	Total Stream Length (ft.)	Total Proposed Streambank Stabilization
1	Upper Pond Creek	10,170.6	1,017.1
2	Lincoln	16,839.6	4,209.9
3	Jordan's Fort	37,269.1	6,044.3
4	Mach-East	28,263.5	4,913.8
5	Mach-West	49,780.0	17,279.2
6	Davis	45,224.0	6,536.7
7	Prarie	52,141.8	19,251.6
8	Neilson	24,975.2	5,047.3
9	Dean	16,795.1	8,397.6
10	Poor Farm	62,440.9	14,156.0
11	Harmony	8,462.1	846.2
12	Frankfort	22,881.5	8,348.8
13	Monroe	50,162.4	7,996.4
14	Lower Pond Creek	9,126.7	1,607.0
	Total:	**434,532.6**	**105,651.7**

3.3.2 Site-specific BMPs

Many of the watershed-wide BMPs have also been suggested at site-specific areas. Other BMPs such as streambank stabilization, grassed waterways, and agricultural filter strips have been recommended. Figure 51 illustrates the locations of site-specific BMPs for the Pond Creek Watershed by map code. Map codes are also available on the site-specific BMP load reductions in the following section.

Table 53- BMP Priority Index

Priority	Description
L	Low Priority
M	Medium Priority
H	High Priority

Site- Specific BMPs and load reductions are displayed by SMU. Load reductions follow the same layout as the watershed-wide diagram. A priority ranking has also been established for each BMP. Rankings were based on various factors including elements that were previously used in establishing BMP: load reductions, need, feasibility, cost, labor, and other benefits from the BMP. Table 53 illustrates the priority ranking IDS. These are congruent with the phases outlined in Element F of the plan.

Figure 51- Site Specific BMP Locations

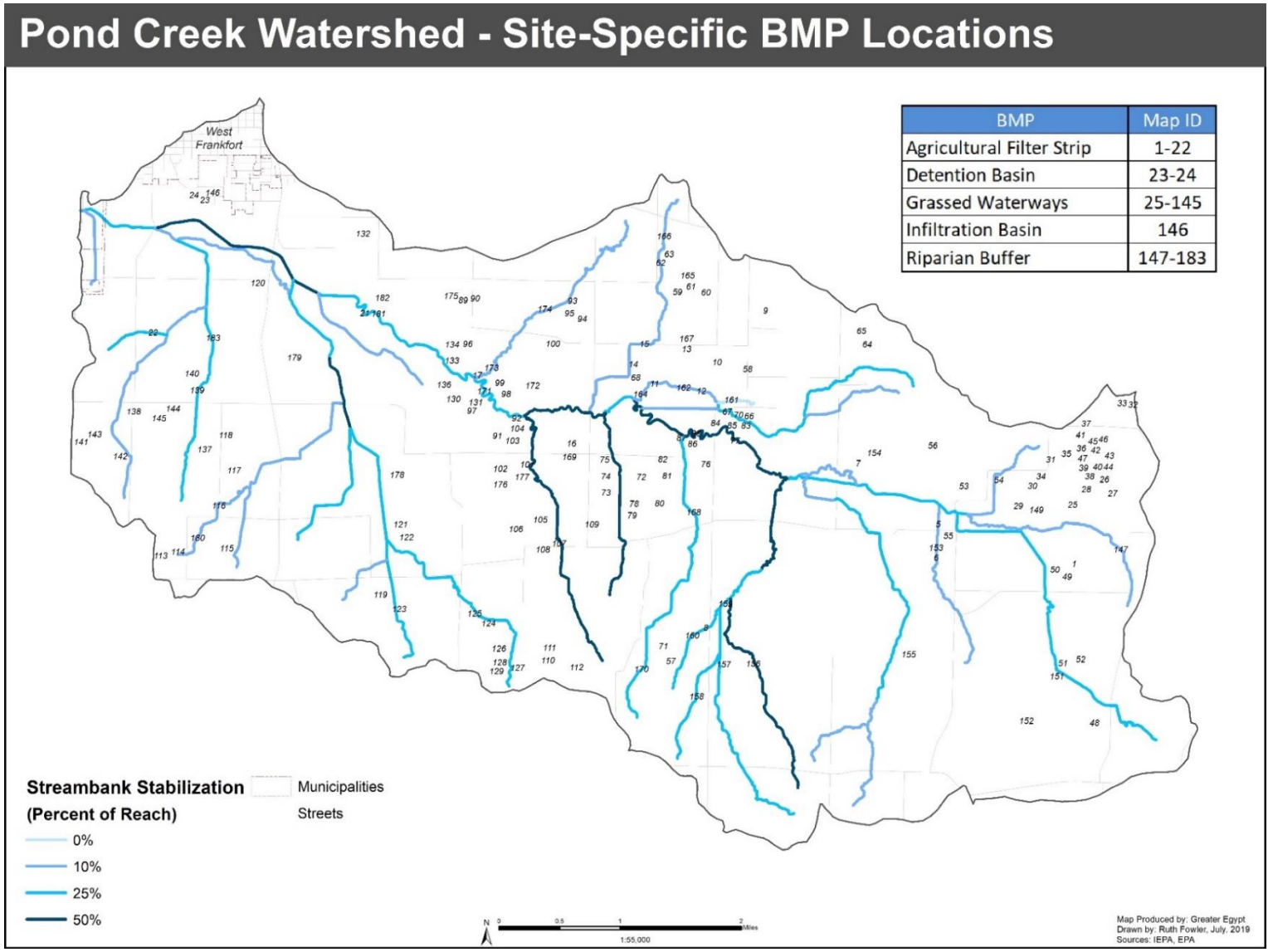


Table 54- Upper Pond Creek (SMU 1) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Upper Pond Creek	Agricultural Filter Strip	1	07140106008376	0.6	acre	62	33	31	-	-	-	L
		2	07140106008376	0.9	acre	172	92	84	-	-	-	M
		3	07140106008373	1.4	acre	139	74	68	-	-	-	M
	Grassed Waterway	25	07140106008371	1.4	acre	66.8	33.4	33.4	-	-	-	H
		26	07140106008376	0.9	acre	56.9	28.4	28.4	-	-	-	H
		27	07140106008376	0.5	acre	24.2	12.1	12.1	-	-	-	M
		28	07140106008376	0.6	acre	20.3	10.2	10.2	-	-	-	M
		29	07140106008373	1.3	acre	86.3	43.1	43.1	-	-	-	H
		30	07140106008373	1.3	acre	424.2	212.1	212.1	-	-	-	H
		31	07140106008372	0.7	acre	50.6	25.3	25.3	-	-	-	H
		32	07140106008376	0.7	acre	25.8	12.9	12.9	-	-	-	M
		33	07140106008376	0.6	acre	10.8	5.4	5.4	-	-	-	L
		34	07140106008372	1.0	acre	269.8	134.9	134.9	-	-	-	H
		35	07140106008376	0.4	acre	15.7	7.8	7.8	-	-	-	M
		36	07140106008376	0.7	acre	12.7	6.3	6.3	-	-	-	L
		37	07140106008376	0.7	acre	38.1	19.1	19.1	-	-	-	H
		38	07140106008376	0.2	acre	3.7	1.9	1.9	-	-	-	L
		39	07140106008376	0.3	acre	8.3	4.2	4.2	-	-	-	L
		40	07140106008376	0.3	acre	12.3	6.1	6.1	-	-	-	L
		41	07140106008376	0.2	acre	5.6	2.8	2.8	-	-	-	L
		42	07140106008376	0.3	acre	6.1	3.1	3.1	-	-	-	L
		43	07140106008376	0.4	acre	8.6	4.3	4.3	-	-	-	L
		44	07140106008376	0.3	acre	3.5	1.7	1.7	-	-	-	L
		45	07140106008376	0.2	acre	7.3	3.6	3.6	-	-	-	L
		46	07140106008376	0.4	acre	11.6	5.8	5.8	-	-	-	L
		47	07140106008376	0.6	acre	6.4	3	3	-	-	-	L
	Riparian Buffer	147	07140106008376	2.8	acre	419	224	198	-	-	-	H
		148	07140106008376	0.9	acre	135	72	66	-	-	-	L
		149	07140106008373	1.4	acre	154	83	75	-	-	-	M
	Streambank Stabilization	184	07140106008371	121.1	feet	1	0.4	0.4	-	-	-	L
		185	07140106008372	107.5	feet	0.8	0.4	0.4	-	-	-	L
		186	07140106008373	95.5	feet	0.8	0.4	0.4	-	-	-	L
		187	07140106008376	692.9	feet	1.6	0.8	0.8	-	-	-	L
					TOTALS:	**2260.8**	**1167.5**	**1111.5**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 55- Lincoln (SMU 2) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Lincoln	Agricultural Filter Strip	4	07140106001297	0.85	acre	72	39	36	-	-	-	L
	Grassed Waterway	48	07140106001297	1.30	acre	34.5	17.3	17.3	-	-	-	H
		49	07140106001297	0.75	acre	167.7	83.8	83.8	-	-	-	H
		50	07140106001297	0.53	acre	58.3	29.1	29.1	-	-	-	H
		51	07140106001295	0.28	acre	29	14.5	14.5	-	-	-	M
		52	07140106001297	0.44	acre	21.5	10.8	10.8	-	-	-	M
	Riparian Buffers	150	07140106001297	0.69	acre	106	57	52	-	-	-	L
		151	07140106001297	0.97	acre	81	44	40	-	-	-	L
		152	07140106001297	1.41	acre	584	313	274	-	-	-	H
	Streambank Stabilization	189	07140106001295	2046.61	feet	45.2	22.6	22.6	-	-	-	M
		190	07140106001297	2163.28	feet	167.4	83.6	83.6	-	-	-	M
					TOTALS:	**1366.6**	**714.7**	**663.7**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 56- Jordan's Fort (SMU 3) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Jordan's Fort	Agricultural Filter Strip	5	07140106001294	1.2	acre	261	140	125	-	-	-	H
		6	07140106001294	3.1	acre	672	360	314	-	-	-	H
		7	07140106006761	5.2	acre	1501	804	685	-	-	-	H
	Grassed Waterway	53	07140106006780	1.5	acre	123.6	61.8	61.8	-	-	-	H
		54	07140106006780	0.7	acre	24.1	12	12	-	-	-	M
		55	07140106001294	0.5	acre	10	5	5	-	-	-	L
		56	07140106001279	0.7	acre	35.5	17.7	17.7	-	-	-	H
	Riparian Buffer	153	07140106001294	4.6	acre	924	495	428	-	-	-	H
		154	07140106006761	5.1	acre	1332	714	611	-	-	-	H
	Streambank Stabilization	191	07140106001278	375.434	feet	20.8	10.4	10.4	-	-	-	M
		192	07140106001279	1945.66	feet	86	43	43	-	-	-	M
		193	07140106001294	1006.63	feet	10.2	5.2	5.2	-	-	-	L
		194	07140106006761	372.558	feet	2.8	1.4	1.4	-	-	-	L
		195	07140106006766	102.733	feet	0.6	0.2	0.2	-	-	-	L
		196	07140106006780	700.071	feet	1.8	0.8	0.8	-	-	-	L
		197	07140106006788	311.063	feet	10.4	5.2	5.2	-	-	-	M
		198	07140106008369	150.5	feet	5	2.4	2.4	-	-	-	M
		199	07140106008370	317.7	feet	17.6	8.8	8.8	-	-	-	M
		200	07140106008374	341	feet	0.8	0.4	0.4	-	-	-	L
		201	07140106008375	761.9	feet	33.6	16.8	16.8	-	-	-	M
					TOTALS:	**5072.8**	**2704.1**	**2354.1**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 57- Mach-East (SMU 4) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	
Mach-East	Riparian Buffer	155	07140106001292	5.4	acre	315	169	150	-	-	-	H
	Streambank Stabilization	202	07140106001291	281.794	feet	4.4	2.2	2.2	-	-	-	L
		203	07140106001292	3479.15	feet	230.6	115.4	115.4	-	-	-	M
		204	07140106006887	164.305	feet	0.8	0.4	0.4	-	-	-	L
		205	07140106006912	455.271	feet	5.8	3	3	-	-	-	L
		206	07140106006932	533.3	feet	4	2	2	-	-	-	L
					TOTALS:	**560.6**	**292**	**273**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 58- Mach-West (SMU 5) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Mach-West	Agricultural Filter Strip	8	07140106006876	1.8	acre	408	218	193	-	-	-	H
	Grassed Waterway	57	07140106006876	0.3	acre	11.7	5.8	5.8	-	-	-	L
	Riparian Buffer	156	07140106001289	7.1	acre	579	310	271	-	-	-	H
		157	07140106001287	5.1	acre	231	124	111	-	-	-	M
		158	07140106001288	0.7	acre	96	52	48	-	-	-	L
		159	07140106001286	1.4	acre	33	17	17	-	-	-	L
		160	07140106006876	2.9	acre	351	188	167	-	-	-	H
	Streambank Stabilization	207	07140106001284	3306.11	feet	786.8	393.4	393.4	-	-	-	H
		209	07140106001285	718.0	feet	31.8	15.8	15.8	-	-	-	M
		209	07140106001286	835.6	feet	27.6	13.8	13.8	-	-	-	M
		210	07140106001287	2916.6	feet	64.4	32.2	32.2	-	-	-	M
		211	07140106001288	1726.4	feet	76.4	38.2	38.2	-	-	-	M
		212	07140106001289	6362.3	feet	865.2	432.6	432.6	-	-	-	H
		213	07140106006876	1414.2	feet	78.2	39	39	-	-	-	M
					TOTALS:	**3640.1**	**1879.8**	**1777.8**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 59- Davis (SMU 6) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Davis	Agricultural Filter Strip	9	07140106001298	0.2	acre	27	14	14	-	-	-	L
		10	07140106001298	3.1	acre	444	238	210	-	-	-	H
		11	07140106001298	3.1	acre	489	262	231	-	-	-	H
		12	07140106001298	2.3	acre	560	300	263	-	-	-	H
		13	07140106001298	4.4	acre	575	308	270	-	-	-	H
		14	07140106001271	5.0	acre	620	332	290	-	-	-	H
		15	07140106001271	2.2	acre	259	139	124	-	-	-	H
	Grassed Waterway	58	07140106001299	0.5	acre	23.1	11.5	11.5	-	-	-	M
		59	07140106001271	0.9	acre	49.7	24.8	24.8	-	-	-	H
		60	07140106001271	0.4	acre	54.8	27.4	27.4	-	-	-	H
		61	07140106001271	0.4	acre	17	8.5	8.5	-	-	-	M
		62	07140106001271	0.4	acre	11.9	6	6	-	-	-	L
		63	07140106001271	0.3	acre	6.1	3.1	3.1	-	-	-	L
		64	07140106001299	0.4	acre	17.8	8.9	8.9	-	-	-	M
		65	07140106001299	0.5	acre	16.9	8.4	8.4	-	-	-	M
		66	07140106001299	1.4	acre	250.7	125.4	125.4	-	-	-	H
		67	07140106001299	1.0	acre	115.6	57.8	57.8	-	-	-	H
		68	07140106001298	0.8	acre	22.1	11.1	11.1	-	-	-	M
		69	07140106001299	0.3	acre	5.3	2.7	2.7	-	-	-	L
		70	07140106001299	0.8	acre	8.1	4	4	-	-	-	L
	Riparian Buffer	161	07140106001298	3.0	acre	212	114	102	-	-	-	M
		162	07140106001298	3.9	acre	483	259	228	-	-	-	H
		163	07140106001298	1.3	acre	106	57	52	-	-	-	L
		164	07140106001298	3.1	acre	446	239	211	-	-	-	H
		165	07140106001271	1.8	acre	233	125	112	-	-	-	M
		166	07140106001271	3.7	acre	320	172	153	-	-	-	H
		167	07140106001271	4.3	acre	304	163	145	-	-	-	H
	Streambank Stabilization	214	07140106001271	1611.62	feet	8.2	4.2	4.2	-	-	-	L
		2315	07140106001298	600.172	feet	6.2	3	3	-	-	-	L
		216	07140106001299	3718.58	feet	123.2	61.6	61.6	-	-	-	M
		217	07140106006727	606.301	feet	4.6	2.4	2.4	-	-	-	L
					TOTALS:	**5819.3**	**3092.8**	**2775.8**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 60- Prairie (SMU 7) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Prairie	Agricultural Filter Strip	16	07140106001270	0.9	acre	74	40	37	-	-	-	L
	Grassed Waterway	71	07140106001283	0.6	acre	12.3	6.1	6.1	-	-	-	L
		72	07140106001282	1.7	acre	197.6	98.8	98.8	-	-	-	H
		73	07140106001282	0.9	acre	32.2	16.1	16.1	-	-	-	H
		74	07140106001282	0.8	acre	24.2	12.1	12.1	-	-	-	M
		75	07140106001282	0.8	acre	105.9	52.9	52.9	-	-	-	H
		76	07140106001283	2.1	acre	24.3	12.1	12.1	-	-	-	M
		77	07140106001277	1.6	acre	49.5	24.7	24.7	-	-	-	H
		78	07140106001282	0.8	acre	82.1	41	41	-	-	-	H
		79	07140106001282	0.7	acre	20.5	10.3	10.3	-	-	-	M
		80	07140106001283	1.3	acre	25.5	12.7	12.7	-	-	-	M
		81	07140106001283	1.0	acre	17.6	8.8	8.8	-	-	-	M
		82	07140106001283	0.9	acre	47.3	23.7	23.7	-	-	-	H
		83	07140106001277	0.8	acre	55.9	28.8	28.8	-	-	-	H
		84	07140106001277	0.8	acre	11.9	5.9	5.9	-	-	-	L
		85	07140106001277	0.4	acre	6	3	3	-	-	-	L
		86	07140106001277	0.5	acre	5.4	2.7	2.7	-	-	-	L
		87	07140106001277	0.6	acre	5.9	2.9	2.9	-	-	-	L
		88	07140106001277	0.5	acre	1.9	1	1	-	-	-	L
	Riparian Buffer	168	07140106001283	2.7	acre	252	135	121	-	-	-	M
		169	07140106001270	6.6	acre	980	525	453	-	-	-	H
		170	07140106001283	0.6	acre	22	12	11	-	-	-	L
	Streambank Stabilization	218	07140106001274	560.6	feet	190.6	95.4	95.4	-	-	-	H
		219	07140106001275	529.8	feet	23.4	11.8	11.8	-	-	-	M
		220	07140106001276	2657.1	feet	542	271	271	-	-	-	H
		221	07140106001277	4929.3	feet	1005.6	502.8	502.8	-	-	-	H
		222	07140106001282	5538.1	feet	753.2	376.6	376.6	-	-	-	H
		223	07140106001283	4619.2	feet	306.2	153.2	153.2	-	-	-	M
		224	07140106006730	417.6	feet	3.2	1.6	1.6	-	-	-	L
					TOTALS:	**4878.2**	**2488**	**2398**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 61-Neilson (SMU 8) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Neilson	Agricultural Filter Strip	17	07140106001303	3.2	acre	105	56	52	-	-	-	L
		18	07140106001303	1.2	acre	79	42	39	-	-	-	L
		19	07140106001303	3.1	acre	636	341	297	-	-	-	H
	Grassed Waterway	89	07140106001303	0.5	acre	20.7	10.4	10.4	-	-	-	M
		90	07140106001303	0.8	acre	47.5	23.7	23.7	-	-	-	H
		91	07140106001269	0.4	acre	19.3	9.7	9.7	-	-	-	M
		92	07140106001269	0.4	acre	29.3	14.6	14.6	-	-	-	H
		93	07140106001303	0.8	acre	7.9	3.9	3.9	-	-	-	L
		94	07140106001303	1.6	acre	23.6	11.8	11.8	-	-	-	M
		95	07140106001303	0.5	acre	37.8	18.9	18.9	-	-	-	H
		96	07140106001303	0.6	acre	17.6	8.8	8.8	-	-	-	M
		97	07140106001269	0.4	acre	22.3	11.2	11.2	-	-	-	M
		98	07140106001269	0.7	acre	15.9	8	8	-	-	-	M
		99	07140106001269	0.9	acre	16.1	8.1	8.1	-	-	-	M
		100	07140106001303	1.1	acre	15.7	7.8	7.8	-	-	-	M
	Riparian Buffer	171	07140106001303	0.9	acre	27	14	14	-	-	-	L
		172	07140106001303	12.4	acre	1841	986	836	-	-	-	H
		173	07140106001303	1.2	acre	75	40	37	-	-	-	L
		174	07140106001303	3.5	acre	500	268	236	-	-	-	H
		175	07140106001303	5.1	acre	843	452	391	-	-	-	H
	Streambank Stabilization	225	07140106001269	1403.1	feet	62	31	31	-	-	-	M
		226	07140106001270	2134.9	feet	290.4	145.2	145.2	-	-	-	H
		227	07140106001303	1509.3	feet	15.4	7.6	7.6	-	-	-	L
					TOTALS:	**4747.5**	**2519.7**	**2222.7**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 62- Dean (SMU 9) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Dean	Grassed Waterway	101	07140106001273	0.7	acre	17.7	8.8	8.8	-	-	-	M
		102	07140106001273	0.9	acre	71.8	35.9	35.9	-	-	-	H
		103	07140106001273	0.7	acre	14.3	7.1	7.1	-	-	-	L
		104	07140106001273	0.5	acre	14.4	7.2	7.2	-	-	-	L
		105	07140106001273	1.2	acre	25.4	12.7	12.7	-	-	-	M
		106	07140106001273	0.6	acre	32.6	16.3	16.3	-	-	-	H
		107	07140106001273	0.4	acre	27	13.5	13.5	-	-	-	M
		108	07140106001273	0.5	acre	17.4	8.7	8.7	-	-	-	M
		109	07140106001273	0.2	acre	9.4	4.7	4.7	-	-	-	L
		110	07140106001273	0.9	acre	90.9	45.5	45.5	-	-	-	H
		111	07140106001273	1.2	acre	159.4	79.7	79.7	-	-	-	H
		112	07140106001273	0.6	acre	83.9	42	42				H
	Riparian Buffer	176	07140106001273	1.3	acre	88	47	44	-	-	-	L
		177	07140106001273	1.1	acre	501	268	236	-	-	-	H
	Streambank Stabilization	228	07140106001273	8397.56	feet	1427.6	713.8	713.8	-	-	-	H
					TOTALS:	**2580.8**	**1310.9**	**1275.9**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 63- Poor Farm (SMU 10) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Poor Farm	Agricultural Filter Strip	20	07140106001264	2.0	acre	584	313	274	-	-	-	H
		21	07140106001263	1.4	acre	537	288	253	-	-	-	H
	Grassed Waterway	113	07140106001262	0.9	acre	19.5	9.7	9.7	-	-	-	M
		114	07140106001262	0.6	acre	24.4	12.2	12.2	-	-	-	M
		115	07140106001262	0.4	acre	30.1	15	15	-	-	-	H
		116	07140106001262	0.3	acre	41.2	20.6	20.6	-	-	-	H
		117	07140106001262	0.4	acre	15.9	8	8	-	-	-	M
		118	07140106001262	0.4	acre	49.8	24.9	24.9	-	-	-	H
		119	07140106001265	0.9	acre	58.5	29.2	29.2	-	-	-	H
		120	07140106001264	0.7	acre	84	42	42	-	-	-	H
		121	07140106001264	1.1	acre	66.1	33.1	33.1	-	-	-	H
		122	07140106001264	0.3	acre	9.5	4.8	4.8	-	-	-	L
		123	07140106001265	0.9	acre	24.4	12.2	12.2	-	-	-	M
		124	07140106001264	0.6	acre	57.5	28.7	28.7	-	-	-	H
		125	07140106001264	0.5	acre	13.7	6.8	6.8	-	-	-	L
		126	07140106001264	0.7	acre	24.4	12.2	12.2	-	-	-	M
		127	07140106001264	0.9	acre	95.6	47.8	47.8	-	-	-	H
		128	07140106001264	0.6	acre	30.8	15.4	15.4	-	-	-	H
		129	07140106001264	1.2	acre	119.2	59.6	59.6	-	-	-	H
	Riparian Buffer	178	07140106001263	1.4	acre	277	148	132	-	-	-	M
		179	07140106006719	4.1	acre	818	438	380	-	-	-	H
		180	07140106001262	2.0	acre	223	119	107	-	-	-	M
	Streambank Stabilization	229	07140106001255	823.216	feet	6.2	3.2	3.2	-	-	-	L
		230	07140106001257	719.346	feet	244.6	122.2	122.2	-	-	-	H
		231	07140106001258	2033.19	feet	134.8	67.4	67.4	-	-	-	M
		232	07140106001263	1731.91	feet	114.8	57.4	57.4	-	-	-	M
		233	07140106001264	3428.9	feet	189.4	94.8	94.8	-	-	-	M
		234	07140106001265	1836.5	feet	81.2	40.6	40.6	-	-	-	M
		235	07140106006691	414.4	feet	18.4	9.2	9.2	-	-	-	M
		236	07140106006719	938.5	feet	41.4	20.8	20.8	-	-	-	M
		237	07140106006750	1383.0	feet	282.2	141	141	-	-	-	H
		238	07140106006840	471.0	feet	4.8	2.4	2.4				L
		239	7140106006848	376.1	feet	4.8	2.4	2.4	-	-	-	L
					TOTALS:	**4326.2**	**2249.6**	**2089.6**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 64- Harmony (SMU 11) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Harmony	Grassed Waterway	130	07140106001272	0.5	acre	35.3	17.6	17.6	-	-	-	H
		131	07140106001272	0.3	acre	18.9	9.5	9.5	-	-	-	M
	Streambank Stabilization	240	07140106001272	846.215	feet	6.1	3	3	-	-	-	L
					TOTALS:	**60.3**	**30.1**	**30.1**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 65- Frankfort (SMU 12) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Frankfort	Agricultural Filter Strip	22	07140106001268	1.5	acre	43	23	21	-	-	-	L
	Grassed Waterway	132	07140106001268	0.2	acre	12.3	6.1	6.1	-	-	-	L
		133	07140106001268	0.8	acre	226.4	113.2	113.2	-	-	-	H
		134	07140106001268	0.7	acre	114.9	57.4	57.4	-	-	-	H
		135	07140106001268	0.4	acre	32.8	16.4	16.4	-	-	-	H
		136	07140106001268	1.0	acre	73.4	36.7	36.7	-	-	-	H
	Riparian Buffer	181	07140106001268	1.1	acre	170	91	82	-	-	-	M
		182	07140106001268	5.1	acre	939	503	434	-	-	-	H
	Stream Stabalization	241	07140106001267	787.347	feet	107	53.6	53.6	-	-	-	H
		242	07140106001268	3091.94	feet	170.8	85.4	85.4	-	-	-	M
		243	07140106001304	4469.52	feet	1215.6	607.8	607.8	-	-	-	H
					TOTALS:	**3105.2**	**1593.6**	**1513.6**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 66-Monroe (SMU 13) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Monroe	Agricultural Filter Strip	23	07140106006725	2.0	acre	283	151	135	-	-	-	H
	Grassed Waterway	137	07140106001260	0.7	acre	18.8	9.4	9.4	-	-	-	M
		138	07140106001260	0.5	acre	21.5	10.7	10.7	-	-	-	M
		139	07140106001260	0.3	acre	3.7	1.9	1.9	-	-	-	L
		140	07140106001260	0.4	acre	26.3	13.1	13.1	-	-	-	M
		141	07140106001260	0.5	acre	36.3	18.2	18.2	-	-	-	H
		142	07140106001261	0.4	acre	46.6	23.3	23.3	-	-	-	H
		143	07140106001261	0.3	acre	16.7	8.4	8.4	-	-	-	M
		144	07140106001261	0.6	acre	20.5	10.2	10.2	-	-	-	M
		145	07140106001261	0.5	acre	46.1	23.1	23.1	-	-	-	H
	Riparian Buffer	183	07140106001260	6.7	acre	1538	824	702	-	-	-	H
	Streambank Stabilization	244	07140106001254	148.269	feet	1.2	0.6	0.6	-	-	-	L
		245	07140106001259	1183.28	feet	52.4	26.2	26.2	-	-	-	M
		246	07140106001260	2889.25	feet	127.8	63.8	63.8	-	-	-	M
		247	07140106001261	1365.84	feet	17.4	8.8	8.8	-	-	-	L
		248	07140106001262	1515.38	feet	11.6	5.8	5.8	-	-	-	L
		249	07140106006725	894.4	feet	9.8	5	5	-	-	-	M
					TOTALS:	**2277.7**	**1203.5**	**1065.5**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 67- Lower Pond Creek (SMU 14) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Lower Pond Creek	Detention Basin	23	07140106001304	6.4	acres	-	-	-	7676	157	1226	-
		24	07140106001304	1.2	acres	-	-	-	7791	158	1256	-
	Infiltration Basin	146	07140106001304	5.2	acres	-	-	-	10163	0	4082	-
	Streambank Stabilization	250	07140106001253	1157.2	feet	51.2	25.6	25.6	-	-	-	M
		251	07140106006688	449.8	feet	2.2	1.2	1.2	-	-	-	L
					TOTALS:	**53.4**	**26.8**	**26.8**	**25630**	**315**	**6564**	
						N	P	Sediment	TSS	BOD	COD	

Total load reductions exceed the annual load reduction targets found in Section 2.9.8. Pollutant load reduction totals are displayed in the table below.

Table 68- Total BMP Load Reductions

	Load Reductions- lbs/yr (N,P,TSS,BOD,COD), ton/yr (Sediment)					
	N	P	Sediment	TSS	BOD	COD
Total Load Reduction:	46,550	24,549	24,150	25,630	315	6,564
Percent of Pollutant Load:	20.7%	56.1%	90.9%	-	-	-
Load Reduction Target	15%	25%	25%	-	-	-

Implementation of every BMP in the plan would result in a nearly 21 percent reduction in nitrogen; 56 percent reduction in phosphorus; and a sediment total reduction that exceeds the target by more than three times.

Since total suspended solids (TSS), biological oxygen demand (BOD), and chemical oxygen demand (COD) were not calculated in the watershed pollutant loading, pollutant load percentages and load reduction targets were not generated.

4. Summary of Technical and Financial Assistance

Each BMP in the plan has also been described by the technical and financial assistance needed to implement each measure. While technical assistance comes from a few select groups, the financial assistance for management measures comes from a variety of different sources. Table 69 summarizes the cost, technical assistance, and possible funding source for each BMP. The diagram also characterizes the elements associated with the educational component that will be discussed in Chapter 5.

4.1 Technical Assistance

The labor to execute the BMPs will largely come from local municipalities, public works, landowners, and Greater Egypt Regional Planning and Development Commission (Greater Egypt). State and federal agencies such as the USDA/NRCS and the Williamson and Franklin County Soil and Water Conservation Districts will also be utilized.

The type of technical assistance largely depends on which type of BMP is being implemented. For agricultural BMPs, the USDA and Soil and Conservation Districts will be able to provide their services. If the BMP is municipal, local public works can offer their support. However, for most management measures, drawings and surveys will likely be required by an engineer.

Greater Egypt could also provide technical assistance for some of the BMPs. This includes: GIS services, site plans and drawings, and grant writing and administration.

4.2 Funding Sources

A majority of the management measures described in Chapter 3 will require funding. The major source of funding will be through the Clean Water Act Section 319 Grant Program. This would be granted through the IEPA. Section 319 grants can cover up to 60 percent of the costs. The other 40 percent would be met through a local match (municipal, landowner, etc.)

While 319 funding covers most BMPs in the plan, other funding sources have to be considered for the remaining measures. The USDA Natural Resource Conservation Service offers many funding and easement opportunities through programs such as: Agriculture Management Assistance (AMA), Conservation Stewardship Program (CSP), Environmental Quality Incentives Program (EQIP), and Agricultural Conservation Easement Program (ACEP).[60] Through the USDA Farm Service Agency (FSA), funding is offered through programs such as: Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), and Farmable Wetlands Program (FWP).[61] Emergency Conservation and Emergency Forest Restoration Programs offer funding and technical assistance, also through USDA FSA, to restore lands that have been damaged by natural disasters.

The Illinois Department of Agriculture offers funding such as: Conservation Practices Program (CPP), Well Decommissioning Program (WDP), Streambank Stabilization and Restoration (SSRP), Nutrient Management Program (NMP), Soil and Water Conservation District Grants Program, and Vegetative Filter Strip Assessment Law.[62] Another funding source aimed particularly at reducing soil loss and protecting water quality is offered through the Bureau of Land and Water Resources through the Partners for Conservation Program.[63]

Other grants offered through the Illinois Department of Natural Resources include: Open Space Lands Acquisition & Development and Land & Water Conservation Programs, Park and Recreational Facility Construction Grant Program, Federal Recreational Trails Program, Bike Path Grant Program,

[60] USDA/Natural Resource Conservation Services, "Financial Assistance," https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ Accessed 19 July 2019
[61] USDA/Farm Service Agenct, "Conservation Programs," https://www.fsa.usda.gov/programs-and-services/conservation-programs/index Accessed 19 July 2019
[62] Illinois Department of Agriculture, "Sustainacle Agriculture Grants Program," https://www2.illinois.gov/sites/agr/Resources/Conservation/Pages/default.aspx Accessed 19 July 2019
[63] Illinois Department of Agriculture, "Land and Water Resources," https://www2.illinois.gov/sites/agr/Resources/LandWater/Pages/default.aspx Accessed 19 July 2019

Schoolyard Wildlife Habitat Grant Program, and the Illinois Biodiversity Field Trip Grant Program.[64]

Illinois EPA provides multiple funding opportunities to finance the design and construction of both, wastewater and nonpoint source pollution projects through grants and low-interest loan programs that include: Illinois Green Infrastructure Grant Program for Stormwater Management (IGIG), Nonpoint source Grants, Wastewater/Stormwater and Drinking Water Loans, Driving a Cleaner Illinois, and Illinois Clean Energy Community Foundation.[65]

In most cases, these programs will not cover the entire cost of the selected BMPs. The remaining costs would have to be funded by landowners, municipalities, businesses, and other entities.

[64] IDNR "Grant Opportunities" https://www.dnr.illinois.gov/Grants/Pages/default.aspx Accessed 19 July 2019
[65] IEPA "Grants and Loans," https://www2.illinois.gov/epa/topics/grants-loans/Pages/default.aspx Accessed 19 July 2019

Table 69- Technical and Financial Assistance for BMPs

BMP	Cost	Unit	Technical Assistance	Funding Source(s)
Agricultural Filter Strip	$176.23	acre	Farm Bureau, Landowner, NRCS, SWCD	IEPA 319, NRCS, USDA
Agricultural Management Workshop	$1,950.00	workshop	Planning Commission, Farm Bureau, NRCS, USDA, SWCD	IEPA 319
Contour Farming	$7.44	acre	NRCS, USDA	IEPA 319, NRCS, USDA
Cover Crops	$85.24	acre	Farm Bureau, NRCS, USDA, SWCD	IEPA 319, NRCS, USDA
Critical Area Planting	$184.95	acre	NRCS, USDA	IEPA 319, NRCS, USDA
Crop Rotation	$14.90	acre	Farm Bureau, NRCS, USDA	NRCS, USDA
Debris Removal	$486.00	site	Volunteers, landowners, public works, contractor	Volunteers, landowners, public works, contractor
Detention Basin	$0.74	cubic foot	Landowner, IDOT, contractor, municipality, public works	Landowners, municipality
Dike Creation	$4.97	cubic yard	NRCS, USDA	NRCS, USDA
Drainage Water Management	$9.55	acre	Farm Bureau, NRCS, USDA	NRCS, USDA
Field Border	$245.08	acre	Farm Bureau, Landowner, NRCS, SWCD	IEPA 319, NRCS, USDA
Grassed Waterways	$3,252.00	acre	Farm Bureau, Landowner, NRCS, SWCD	IEPA 319, NRCS, USDA
Infiltration Basin	$6.00	cubic feet	Landowner, public works, business	IEPA 319 Grant
Infiltration Trench	$4-$13	cubic feet	Landowner, public works, business	IEPA 319 Grant
Litter Cleanup	$0.00	acre	Volunteers	-
No-Till Farming	$20.81	acre	NRCS, USDA	IEPA 319, NRCS, USDA
Nutrient Management Planning	$4.00	acre	Farm Bureau, NRCS, USDA, SWCD	IEPA, NRCS, USDA
Pasture and Hayland Planting	$393.00	acre	Farm Bureau, NRCS, USDA	NRCS, USDA
Public Education on Fertilizer Use	$0.50 each / $150.00 per 300	flyer/brochure	Planning Commission	IEPA 319 Grant, Planning Commission
Public Education on Stormwater/Agricultural	$0.50 each / $150.00 per 300	flyer/brochure	Planning Commission	IEPA 319 Grant, Planning Commission
Riparian Buffer	$330.00	acre	Landowner, public works, NRCS	IEPA 319 Grant, FSA CRP
Streambank Stabilization	$75.30	linear feet	Landowner, volunteer, contractor	IEPA 319 Grant
Strip Cropping	$4.47	acre	Farm Bureau, NRCS, USDA, SWCD	NRCS, USDA
Strip-Till Farming	$20.81	acre	NRCS, USDA	IEPA 319, NRCS, USDA
Terrace Farming	$3.89	linear feet	Farm Bureau, NRCS, USDA, SWCD	NRCS, USDA
Water and Sediment Control Basin	$2.51	linear feet	Farm Bureau, NRCS, USDA	IEPA, NRCS, USDA
Wetland Creation	$10,226.00	acre	NRCS, USDA, SWCD	IEPA, NRCS, USDA

4.3 Implementation Costs

The associated cost of each BMP is displayed in Table 70. Costs largely depend on which BMP is being implemented. To implement all BMPs suggested in the plan, the total would be $42,546,862.43. Costs generally take into account the technical and financial assistance needed along with the maintenance following implementation. Infiltration Basin and streambank stabilization are the top two most costly BMPs, with detention basin being the third, respectively. Conservation cover, grassed waterways, and pasture/hayland planting are the following largest costs.

The cost for filter strips (agricultural, urban vegetated) is dependent on whether the entity is using existing or natural vegetation compared to planting new vegetation.

Table 70- Implementation Costs

BMP	Cost	Unit	Total Units	Total Cost Per Unit
Agricultural Filter Strip	$176.23	acre	50	$8,811.50
Agricultural Management Workshop	$1,950.00	workshop	5	$9,750.00
Contour Farming	$7.44	acre	321	$2,388.24
Cover Crops	$85.24	acre	640	$54,553.60
Critical Area Planting	$184.95	acre	320	$59,184.00
Crop Rotation	$14.90	acre	321	$4,782.90
Debris Removal	$486.00	site	6	$2,916.00
Detention Basin	$0.74	cubic foot	3,305,670	$2,446,195.80
Drainage Water Management	$9.55	acre	1,280	$12,224.00
Field Border	$245.08	acre	1,285	$314,927.80
Grassed Waterways	$3,252.00	acre	82	$266,664.00
Infiltration Basin	$6.00	cubic feet	2,285,660	$13,713,960.00
Litter Cleanup	$0.00	acre	-	$0.00
No-Till Farming	$20.81	acre	642	$13,360.02
Nutrient Management Planning	$4.00	acre	1,280	$5,120.00
Pasture and Hayland Planting	$393.00	acre	320	$125,760.00
Public Education on Fertilizer Use	$0.50 each / $150.00 per 300	flyer/brochure	1,500	$750.00
Public Education on Stormwater/Agricultural Management	$0.50 each / $150.00 per 300	flyer/brochure	1,500	$750.00
Riparian Buffer	$330.00	acre	117.5	$38,775.00
Streambank Stabilization	$120.00	linear feet	211,986	$25,438,320
Strip Cropping	$4.47	acre	321	$1,434.87
Strip-Till Farming	$20.81	acre	640	$13,318.40
Terrace Farming	$3.89	linear feet	320	$1,244.80
Water and Sediment Control Basin	$2.51	linear feet	320	$803.20
Wetland Creation	$10,226.00	acre	1	$10,226.00
			Total:	**$42,546,862.43**

5. Public Outreach and Education

The success of the Pond Creek Watershed-based Plan is largely dependent on public outreach and educational measures. During the planning phase, public meetings, Watershed Planning Committee meetings, and other events were held to provide guidance and raise awareness of the plan. These activities will continue after the plan is approved and will support the success of the plan.

Early in the planning phase, an initial stakeholders meeting was held to gather local knowledge of the watershed and define preliminary goals including identifying key areas of watershed impairments. Another goal of the initial meeting was to gather members for the Pond Creek Watershed Planning Committee. Meetings were usually held quarterly, and were designed to provide guidance for the plan. Committee members provided local knowledge of water-related activities and identified BMPs that were suggested in the plan.

5.1 Outreach and Educational Components

The Pond Creek Watershed-based Plan has several public awareness and educational components. The recommendations are as follows:

1. **Establish a Pond Creek Watershed Action committee.**

   This assembly would serve much like the planning committee during the development of the plan. The goal of a steering committee would be to promote awareness of the watershed plan and monitor and oversee the progress of plan implementation. Committee members would also be in charge of making revisions to the plan if:

   a) Implementation schedule is not meeting expectations;
   b) Interim measurable milestones are not being met;
   c) Benchmarks for load reduction targets are not satisfactory.

2. **Hold public meetings.**

   An initial public meeting would serve to inform the public on implementation of the plan and garner membership for the steering committee. Like the public meetings during the planning phase, flyers, newspaper ads, and PSAs could be used to inform the public of meeting dates.

3. **Create a website for watershed activities.**

   This would include posting key dates for meetings, events, and other watershed-related activities.

4. **Post Pond Creek watershed signs.**

   Signs will be posted informing the public about the watershed and activities. Placement of the signs would be in areas most visible to the public: parks, schools, libraries, or even government buildings. Signs for best management practices will also be posted at BMP implementation sites.

5. **Enlist volunteers for litter cleanup days.**

   Local volunteer groups were contacted throughout the planning phase to gain interest in these events. Groups such as 4H, Boy Scouts of America, Girl Scouts of USA, and other local volunteer groups would likely be implemented in these events.

6. **Create and distribute brochures for agricultural and stormwater management efforts.**

   These flyers would contain information about the watershed-based plan and management efforts. Along with the stormwater management and similar workshops, distributing flyers on the importance of agricultural and residential measures to limit nonpoint source pollution would be critical in lowering the nutrient loads.

7. **Hold and electronics recycling drive or similar drop off event.**

   During the watershed assessment of the planning phase, large amounts of litter and electronics were observed in the waterbodies; specifically, various stream segments. An electronics drive directed towards rural areas would be beneficial by limiting the amount of large debris in the Pond Creek waterbodies.

8. **Hold public Agricultural Management Workshops and similar events to educate and promote the best management practices in the plan.**

   These workshops would raise awareness for agricultural BMPs and stormwater runoff measures. Agricultural activities would likely be a collaborative effort with the local USDA-NRCS Office, or the Williamson and Franklin County Farm Bureaus.

The schedule for implementing the educational and informational components of the plan is further detailed in the following chapter.

6. Implementation Schedule and Interim Milestones

To be successful, watershed-based plans require designing a thorough monitoring and evaluation component. These elements include: an implementation schedule which identifies key intervals for management measures (Element F), a description of interim measurable milestones for nonpoint source management (Element G), benchmarks to monitor the effectiveness of BMP load reductions (Element H), and the overall monitoring component to evaluate the progress of implementation (Element I). Elements H and I will be discussed in Chapter 7 of this plan.

6.1 Implementation Schedule

The implementation schedule reflects the general goals in the Pond Creek Watershed-based plan. Components of the schedule have been classified into three separate phases as seen in Table 71.

Phase I signifies the short-term actions to be taken in the first two years of the plan. These goals include establishing a watershed action council which would serve to implement the plan and track progress. The other educational and informational components of the plan largely fall under this phase.

Phase II constitutes the mid-term implementation of the plan. Components in this phase should be completed within the sixth year of plan implementation. Key elements of this phase include the continuation of public involvement, and submitting grant applications for BMPs suggested in the plan. The implementation and execution of BMPs will also fall under this segment of the plan.

Phase III indicates the final stage of the plan. This is characterized by continuing efforts in BMP implementation and evaluating accomplishments throughout the plan.

Site-specific BMPs have been characterized by a priority ranking in Chapter 3. These priority rankings follow the phases of the implementation schedule.

Generally, BMPs with a high priority ranking will be the first to have grant submissions written for them. Grant submissions, implementation, and execution of high priority BMPs will be considered mainly Phase II components. Subsequently, medium and low priority BMPs will be implemented in the latter part of Phase II and beginning of Phase III depending on available funding.

Table 71- Implementation Schedule

Implementation Schedule										
Target	Phase I		Phase II				Phase III			
	Short-term (2 yr)		Mid-term (3-6 yr)				Long-term (7-10 yr)			
	1	2	3	4	5	6	7	8	9	10
Establish watershed action committee	X									
Hold public meetings to gain input	X	X	X	X	X	X				
Post watershed signage for public awareness and BMP implementation	X	X	X	X	X	X	X	X	X	X
Create a website for watershed activities and key dates		X								
Enlist volunteers for litter cleanup days		X	X	X	X	X	X	X	X	X
Hold Electronic Recycling Drives			X			X			X	
Distribute educational brochures for stormwater and agricultural management	X		X		X		X		X	
Hold workshops to inform public on agricultural management		X		X		X		X		
Continue researching funding and technical assistance	X	X	X							
Select site-specific BMP for preliminary designs	X	X	X							
Submit grant applications based on BMP in plan		X	X	X	X	X	X	X		
Meet with landowners to review BMP in plan	X	X	X	X	X	X	X	X		
Implement and execute BMP			X	X	X	X	X	X	X	X
Monitor BMP implementation				X	X	X	X	X	X	X
Announce success of plan implementation					X	X	X	X	X	X

6.2 Interim Measurable Milestones

To determine whether nonpoint source best management practices are being implemented, interim measurable milestones have been designed to monitor success. The educational and outreach components have also utilized the milestone matrix. These milestones follow the same phases as the implementation schedule with three phases distinguishing varying degrees of BMP implementation. Interim measurable milestones are displayed in Table 72.

Table 72- Interim Measurable Milestones

Interim Measurable Milestones				
Goal	**Indicator**	**Short (2-year)**	**Mid (6-yr)**	**Long (10-yr)**
Address Impairments from Agricultural Practices/ Improve Water Quality	Linear Feet of Streambank Stabilized	-	6,500	12,500
	Agricultural Strips Created	-	8	16
	Acres to Implement Critical Planting	-	160	240
	Acres Converting to Conservation Tillage	-	320	480
	Acres Converting to No-Till	-	320	480
	Acres Converted to Pasture/Hayland	-	160	240
	Acres Converting to Strip-Till	-	320	480
	Acres Converting to Terracing	-	160	240
	Acres to Implement Cover Crops	-	300	450
	Nutrient Management Planning Partnerships	2	5	10
	Grassed Waterways Created	-	12	24
	Drainage Water Management Partnerships	2	5	10
	Riparian Buffers Created	-	5	10

Table 73- Interim Measurable Milestones (Cont'd)

Interim Measurable Milestones				
Goal	Indicator	Short (2-year)	Mid (6-yr)	Long (10-yr)
Outreach and Education	Educational Brochures for Stormwater Management	500	1000	1500
	Educational Brochures for Agricultural Management	500	1000	1500
	Electronics Drive	1	2	3
	Number of Litter Cleanup Days	3	6	9
	Public Meetings Held	4	10	14
	Agricultural Management Workshops Held	1	3	5
Reduce/Mitigate Flooding	Detention Basin	-	-	1
	Infiltration Basins	-	1	1

Understanding that every BMP in the plan may not be implemented is important in identifying the measurable milestones. Feasibility of each BMP has to be considered when distinguishing milestones. If BMP implementation is progressive throughout the plan, the interim measurable milestones in this plan are attainable over a ten-year implementation period.

Progress in achieving the milestone goals will be evaluated periodically by the Pond Creek Watershed Action Committee. If milestones are not being met, there may be need for adjustments. Adjustments may come in the form of establishing new BMPs, or adjusting the interim measurable milestones to adhere to current progress. Since these milestones are originally established to document progress, any changes should not be significant.

7. Evaluation Criteria and Monitoring Component

Along with the implementation schedule and interim measurable milestones, water quality benchmarks (Element H) and a monitoring component (Element I) are required to evaluate the implementation and the overall success of the plan.

7.1 Evaluation Criteria (Water Quality Benchmarks)

The benchmarks provided in Table 74 are based on the implementation of all BMPs in the plan over the ten-year implementation period. Practices that were ranked as high priority, as seen in Chapter 3, will be completed by the sixth year; or Phase II of the planning period. Those with a medium or low priority ranking will be implemented by the tenth year. This characterizes Phase III. Determining success and achieving these benchmarks will be dependent on the number of BMPs that are actually implemented in the planning period.

Benchmarks in this plan target nitrogen, phosphorus, and sediment. This is largely due to the availability of data from models and nutrient loading information, and the impairments from the 303(d) waterbodies in the Pond Creek Watershed.

Since Phase I of the plan extends to the end of the second year, benchmarks have not been assigned. This is due partly to the activities in that phase not having an immediate impact on nutrient load reductions (workshops, flyers, etc.). Load reductions that do occur in this period will be minimal.

Table 74- Benchmarks for Determining Plan Progress

	Benchmark Reduction Target					
Benchmark Period	Nitrogen (percent)	Nitrogen (lbs)	Phosphorus (percent)	Phosphorus (lbs)	Sediment (percent)	Sediment (tons)
2 Year (Phase I)	-	-	-	-	-	-
6 Year (Phase II)	6	134,850	10	43,794	10	26,562
10 Year (Phase III)	15	337,127	25	109,484	25	66,405

While many of the high-priority BMPs will be implemented in Phase II, benchmarks have been set to around half of the overall nutrient load reduction targets. Considering Phase II ends at the sixth year of the planning period, effects of some BMPs implementation may not be apparent until Phase III of the plan.

Phase III benchmarks account for the total reductions of nutrients in the plan. Phase III BMPs should be implemented by the tenth year of the plan. These include any remaining high-priority BMPs and the medium and low BMPs according to the priority index.

7.2 Monitoring Component

A monitoring component is essential to a watershed-based plan in order to determine progress in achieving water quality. Several elements represent the monitoring component for the plan. These items will provide water quality data that can be used to assess the efficacy of the Pond Creek Watershed-based Plan. The monitoring strategy components are as follows:

1. **Ambient Water Quality Monitoring Network (AWQMN) –** 146 fixed stations are set up along streams throughout Illinois to routinely collect water quality data.[66] This includes two stations along Pond Creek (IL-NG-02, IL-NG-05). [67] Samples of water are collected in 6-week intervals and are analyzed for a variety of parameters, including temperature and dissolved oxygen. Since Pond Creek experiences various impairments including dissolved oxygen, the AWQMN would be an important component in monitoring the progress of water quality in the watershed.

[66] IEPA. *River and Stream Monitoring:* Springfield, IL: IEPA. https://www2.illinois.gov/epa/topics/water-quality/monitoring/Pages/river-and-stream.aspx Accessed: June, 2019

[67] University of Illinois. *AWQMN – Data:* Champaign, IL: University of Illinois. https://opensource.ncsa.illinois.edu/confluence/display/GLGVO/IL+EPA+Ambient+Water+Quality+Monitoring+Network+%28AWQMN%29+data?preview=/97190385/98074990/epa_20161028_162329.zip

2. **Dissolved Oxygen Monitoring-** Because Pond Creek is impaired by dissolved oxygen, measuring and monitoring the level of this feature is crucial in evaluating the effectiveness of the plan. Dissolved oxygen measurements would likely come from IEPA, Illinois State Water Survey, the Planning Commission, or a local consultant.

3. **Intensive River Basin Surveys-** Every five years IEPA and IDNR conduct intensive basin surveys of various watersheds in Illinois. IDNR completes testing of aquatic species while the IEPA monitors instream habitats and water quality. The TMDL for the Upper Big Muddy Watershed was completed in 2018.[68]

4. **Litter Monitoring Reports-** Groups or individuals volunteering for the litter cleanup events would be advised to complete a litter monitoring report that would detail: location, type of debris, and other simple environmental observations.

5. **National Pollutant Discharge Elimination Systems Permit Reviews-** Reviewing NPDES Permits from discharges in the watershed would assist in examining effluent limit exceedance of harmful pollutants. Pond Creek Mine (Mach Mine) has exceeded the standard limits of pollutants in the past. This includes chloride, which is an impairment of Pond Creek. See Chapter 2.9.5 for more information regarding the NPDES facilities in the Pond Creek Watershed.

These monitoring components will be utilized throughout the ten-year planning period. The schedule for monitoring is displayed in Table 75. The information from these components will have to be reviewed by the Pond Creek Watershed Action Committee to measure the effectiveness of plan implementation.

[68] Fertaly, Margaret. IEPA. Personal Correspondence to the Author (phone). June, 2019.

Table 75- Schedule for Monitoring Components

Implementation Schedule										
Monitoring Component	Phase I		Phase II				Phase III			
	1	2	3	4	5	6	7	8	9	10
Ambient Water Quality Monitoring Network		X					X			
Dissolved Oxygen Monitoring			X	X	X	X	X	X	X	X
Intensive River Basin Surveys				X					X	
Litter Monitoring Reports	X	X	X	X	X	X	X	X	X	X
NPDES Permit Reviews	X	X	X	X	X	X	X	X	X	X

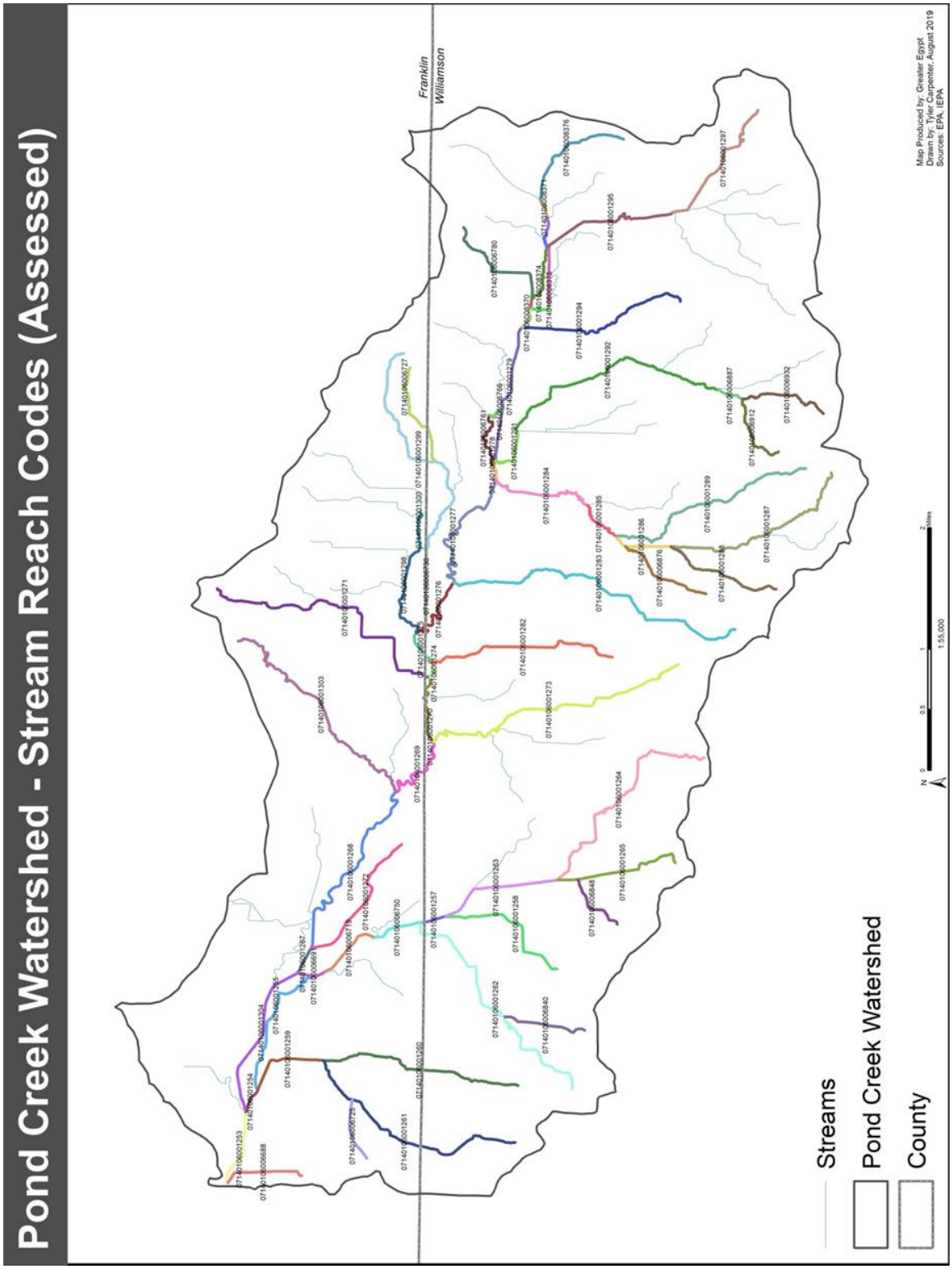
Appendix A – Streambank Stabilization by Reach

Stream or Tributary Name	Reach Code	Stream Length (ft.)	Proposed Streambank Stabilization	Percent of Reach
Upper Pond Creek	07140106008371	1211.22	121.122	10%
Upper Pond Creek	07140106008372	1075.05	107.505	10%
Upper Pond Creek	07140106008373	955.12	95.5124	10%
Upper Pond Creek	07140106008376	6929.23	692.923	10%
Lincoln	07140106001295	8186.45	2046.61	25%
Lincoln	07140106001297	8653.12	2163.28	25%
Jordan's Fort	07140106001278	1501.74	375.434	25%
Jordan's Fort	07140106001279	7782.66	1945.66	25%
Jordan's Fort	07140106001294	10066.30	1006.63	10%
Jordan's Fort	07140106006761	3725.58	372.558	10%
Jordan's Fort	07140106006766	1027.33	102.733	10%
Jordan's Fort	07140106006780	7000.71	700.071	10%
Jordan's Fort	07140106006788	1244.25	311.063	25%
Jordan's Fort	07140106008369	602.09	150.523	25%
Jordan's Fort	07140106008370	1270.96	317.741	25%
Jordan's Fort	07140106008374	3412.23	341.223	10%
Jordan's Fort	07140106008375	3047.43	761.857	25%
Mach-East	07140106001291	2817.94	281.794	10%
Mach-East	07140106001292	13916.62	3479.15	25%
Mach-East	07140106006887	1643.05	164.305	10%
Mach-East	07140106006912	4552.71	455.271	10%
Mach-East	07140106006932	5333.16	533.316	10%
Mach-West	07140106001284	6612.22	3306.11	50%
Mach-West	07140106001285	2871.91	717.978	25%
Mach-West	07140106001286	3342.59	835.646	25%
Mach-West	07140106001287	11666.25	2916.56	25%
Mach-West	07140106001288	6905.65	1726.41	25%
Mach-West	07140106001289	12724.52	6362.26	50%
	Totals:	**140078.10**	**32391.25**	

Stream or Tributary Name	Reach Code	Stream Length (ft.)	Proposed Streambank Stabilization	Percent of Reach
Mach-West	07140106006876	5656.84	1414.21	25%
Davis	07140106001271	16116.23	1611.62	10%
Davis	07140106001298	6001.72	600.172	10%
Davis	07140106001299	14874.32	3718.58	25%
Davis	07140106006727	6063.01	606.301	10%
Prairie	07140106001274	1121.10	560.552	50%
Prairie	07140106001275	2119.35	529.836	25%
Prairie	07140106001276	5314.26	2657.13	50%
Prairie	07140106001277	9858.52	4929.26	50%
Prairie	07140106001282	11076.14	5538.07	50%
Prairie	07140106001283	18476.76	4619.19	25%
Prairie	07140106006730	4175.66	417.566	10%
Neilson	07140106001269	5612.24	1403.06	25%
Neilson	07140106001270	4269.83	2134.92	50%
Neilson	07140106001303	15093.14	1509.31	10%
Dean	07140106001273	16795.13	8397.56	50%
Poor Farm	07140106001255	8232.16	823.216	10%
Poor Farm	07140106001257	1438.69	719.346	50%
Poor Farm	07140106001258	8132.77	2033.19	25%
Poor Farm	07140106001263	6927.62	1731.91	25%
Poor Farm	07140106001264	13715.67	3428.92	25%
Poor Farm	07140106001265	7346.10	1836.53	25%
Poor Farm	07140106006691	1657.46	414.366	25%
Poor Farm	07140106006719	3753.88	938.471	25%
Poor Farm	07140106006750	2765.99	1383	50%
Poor Farm	07140106006840	4709.65	470.965	10%
Poor Farm	07140106006848	3760.89	376.089	10%
Harmony	07140106001272	8462.15	846.215	10%
Frankfort	07140106001267	1574.69	787.347	50%
Frankfort	07140106001268	12367.76	3091.94	25%
	Totals:	**227469.76**	**59528.84**	

Stream or Tributary Name	Reach Code	Stream Length (ft.)	Proposed Streambank Stabilization	Percent of Reach
Frankfort	07140106001304	8939.05	4469.52	50%
Monroe	07140106001254	1482.69	148.269	10%
Monroe	07140106001259	4733.10	1183.28	25%
Monroe	07140106001260	11557.01	2889.25	25%
Monroe	07140106001261	13658.35	1365.84	10%
Monroe	07140106001262	15153.83	1515.38	10%
Monroe	07140106006725	3577.45	894.362	25%
Lower Pond Creek	07140106001253	4628.77	1157.19	25%
Lower Pond Creek	07140106006688	4497.96	449.796	10%
	Totals:	**68228.22**	**14072.89**	

Appendix B – Stream Reach Code Map



Appendix C – Site-specific BMP Costs

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Upper Pond Creek	Agricultural Filter Strip	1	07140106008376	0.64	acre	$112.92
		2	07140106008376	0.86	acre	$152.19
		3	07140106008373	1.39	acre	$244.67
	Grassed Waterway	25	07140106008371	1.37	acre	$4,448.20
		26	07140106008376	0.90	acre	$2,912.53
		27	07140106008376	0.50	acre	$1,617.57
		28	07140106008376	0.61	acre	$1,989.94
		29	07140106008373	1.31	acre	$4,253.79
		30	07140106008373	1.28	acre	$4,152.11
		31	07140106008372	0.69	acre	$2,247.05
		32	07140106008376	0.67	acre	$2,174.19
		33	07140106008376	0.59	acre	$1,909.23
		34	07140106008372	0.99	acre	$3,206.75
		35	07140106008376	0.41	acre	$1,340.86
		36	07140106008376	0.67	acre	$2,163.31
		37	07140106008376	0.72	acre	$2,350.95
		38	07140106008376	0.17	acre	$547.45
		39	07140106008376	0.30	acre	$991.61
		40	07140106008376	0.34	acre	$1,089.79
		41	07140106008376	0.24	acre	$787.38
		42	07140106008376	0.27	acre	$864.29
		43	07140106008376	0.41	acre	$1,330.35
		44	07140106008376	0.28	acre	$902.09
		45	07140106008376	0.21	acre	$682.67
		46	07140106008376	0.37	acre	$1,203.47
		47	07140106008376	0.58	acre	$1,893.24
	Riparian Buffer	147	07140106008376	2.83	acre	$934.39
		148	07140106008376	0.90	acre	$296.64
		149	07140106008373	1.40	acre	$463.06
	Streambank Stabilization	184	07140106008371	121.12	feet	$29,069.28
		185	07140106008372	107.51	feet	$25,801.20
		186	07140106008373	95.51	feet	$22,922.98
		187	07140106008376	692.92	feet	$166,301.52
					TOTALS:	**$291,357.70**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Lincoln	Agricultural Filter Strip	4	07140106001297	0.85	acre	$149.17
	Grassed Waterway	48	07140106001297	1.30	acre	$4,216.33
		49	07140106001297	0.75	acre	$2,426.34
		50	07140106001297	0.53	acre	$1,711.62
		51	07140106001295	0.28	acre	$917.78
		52	07140106001297	0.44	acre	$1,432.88
	Riparian Buffers	150	07140106001297	0.69	acre	$227.57
		151	07140106001297	0.97	acre	$321.17
		152	07140106001297	1.41	acre	$465.70
	Streambank Stabilization	189	07140106001295	2046.61	feet	$491,186.40
		190	07140106001297	2163.28	feet	$519,187.20
					TOTALS:	$1,022,242.15

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Unit
Jordan's Fort	Agricultural Filter Strip	5	07140106001294	1.18	feet	$208.10
		6	07140106001294	3.11	feet	$548.19
		7	07140106006761	5.17	feet	$910.55
	Grassed Waterway	53	07140106006780	1.46	feet	$4,746.35
		54	07140106006780	0.66	feet	$2,138.92
		55	07140106001294	0.51	feet	$1,669.03
		56	07140106001279	0.68	feet	$2,214.14
	Riparian Buffer	153	07140106001294	4.63	feet	$1,528.94
		154	07140106006761	5.09	feet	$1,678.79
	Streambank Stabilization	191	07140106001278	375.43	feet	$90,104.16
		192	07140106001279	1945.66	feet	$466,958.40
		193	07140106001294	1006.63	feet	$241,591.20
		194	07140106006761	372.56	feet	$89,413.92
		195	07140106006766	102.73	feet	$24,655.92
		196	07140106006780	700.07	feet	$168,017.04
		197	07140106006788	311.06	feet	$74,655.12
		198	07140106008369	150.52	feet	$36,125.52
		199	07140106008370	317.74	feet	$76,257.84
		200	07140106008374	341.22	feet	$81,893.52
		201	07140106008375	761.86	feet	$182,845.68
					TOTALS:	$1,548,161.33

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Mach-East	Riparian Buffer	155	07140106001292	5.38	acre	$1,775.53
	Streambank Stabilization	202	07140106001291	281.79	feet	$67,630.56
		203	07140106001292	3479.15	feet	$834,996.00
		204	07140106006887	164.31	feet	$39,433.20
		205	07140106006912	455.27	feet	$109,265.04
		206	07140106006932	533.32	feet	$127,995.84
					TOTALS:	$1,181,096.17

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Mach-West	Agricultural Filter Strip	8	07140106006876	1.83	acre	$322.95
	Grassed Waterway	57	07140106006876	0.33	acre	$1,078.68
	Riparian Buffer	156	07140106001289	7.07	acre	$2,331.97
		157	07140106001287	5.07	acre	$1,672.05
		158	07140106001288	0.72	acre	$236.14
		159	07140106001286	1.38	acre	$454.48
		160	07140106006876	2.94	acre	$970.98
	Streambank Stabilization	207	07140106001284	3306.11	feet	$793,466.40
		209	07140106001285	717.98	feet	$172,314.72
		209	07140106001286	835.65	feet	$200,555.04
		210	07140106001287	2916.56	feet	$699,974.40
		211	07140106001288	1726.41	feet	$414,338.40
		212	07140106001289	6362.26	feet	$1,526,942.40
		213	07140106006876	1414.21	feet	$339,410.40
					TOTALS:	$4,154,069.02

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Davis	Agricultural Filter Strip	9	07140106001298	0.18	acre	$31.85
		10	07140106001298	3.11	acre	$547.87
		11	07140106001298	3.15	acre	$554.41
		12	07140106001298	2.32	acre	$409.17
		13	07140106001298	4.37	acre	$770.22
		14	07140106001271	4.99	acre	$878.74
		15	07140106001271	2.17	acre	$382.79
	Grassed Waterway	58	07140106001299	0.49	acre	$1,601.31
		59	07140106001271	0.94	acre	$3,062.81
		60	07140106001271	0.42	acre	$1,351.33
		61	07140106001271	0.36	acre	$1,181.99
		62	07140106001271	0.41	acre	$1,322.03
		63	07140106001271	0.28	acre	$904.23
		64	07140106001299	0.41	acre	$1,318.05
		65	07140106001299	0.46	acre	$1,498.84
		66	07140106001299	1.37	acre	$4,450.79
		67	07140106001299	0.99	acre	$3,205.39
		68	07140106001298	0.75	acre	$2,454.57
		69	07140106001299	0.34	acre	$1,103.69
		70	07140106001299	0.75	acre	$2,448.63
	Riparian Buffer	161	07140106001298	3.01	acre	$993.41
		162	07140106001298	3.94	acre	$1,300.83
		163	07140106001298	1.28	acre	$421.66
		164	07140106001298	3.12	acre	$1,029.62
		165	07140106001271	1.82	acre	$599.36
		166	07140106001271	3.70	acre	$1,221.29
		167	07140106001271	4.30	acre	$1,417.95
	Streambank Stabilization	214	07140106001271	1611.62	feet	$386,788.80
		2315	07140106001298	600.17	feet	$144,041.28
		216	07140106001299	3718.58	feet	$892,459.20
		217	07140106006727	606.30	feet	$145,512.24
					TOTALS:	$1,605,264.34

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Prairie	Agricultural Filter Strip	16	07140106001270	0.91	acre	$161.25
	Grassed Waterway	71	07140106001283	0.60	acre	$1,943.18
		72	07140106001282	1.74	acre	$5,658.52
		73	07140106001282	0.88	acre	$2,855.14
		74	07140106001282	0.83	acre	$2,685.78
		75	07140106001282	0.83	acre	$2,685.47
		76	07140106001283	2.07	acre	$6,732.85
		77	07140106001277	1.59	acre	$5,167.59
		78	07140106001282	0.84	acre	$2,731.89
		79	07140106001282	0.65	acre	$2,099.82
		80	07140106001283	1.34	acre	$4,347.63
		81	07140106001283	1.00	acre	$3,244.58
		82	07140106001283	0.86	acre	$2,799.13
		83	07140106001277	0.84	acre	$2,732.40
		84	07140106001277	0.76	acre	$2,470.94
		85	07140106001277	0.44	acre	$1,421.69
		86	07140106001277	0.49	acre	$1,585.83
		87	07140106001277	0.58	acre	$1,890.44
		88	07140106001277	0.50	acre	$1,622.93
	Riparian Buffer	168	07140106001283	2.69	acre	$889.17
		169	07140106001270	6.62	acre	$2,184.85
		170	07140106001283	0.61	acre	$201.89
	Streambank Stabilization	218	07140106001274	560.55	feet	$134,532.48
		219	07140106001275	529.84	feet	$127,160.64
		220	07140106001276	2657.13	feet	$637,711.20
		221	07140106001277	4929.26	feet	$1,183,022.40
		222	07140106001282	5538.07	feet	$1,329,136.80
		223	07140106001283	4619.19	feet	$1,108,605.60
		224	07140106006730	417.57	feet	$100,215.84
					TOTALS:	$4,678,497.91

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Neilson	Agricultural Filter Strip	17	07140106001303	3.25	acre	$572.14
		18	07140106001303	1.19	acre	$208.85
		19	07140106001303	3.08	acre	$542.72
	Grassed Waterway	89	07140106001303	0.51	acre	$1,642.84
		90	07140106001303	0.81	acre	$2,634.35
		91	07140106001269	0.37	acre	$1,192.23
		92	07140106001269	0.42	acre	$1,367.63
		93	07140106001303	0.81	acre	$2,625.77
		94	07140106001303	1.61	acre	$5,247.37
		95	07140106001303	0.49	acre	$1,599.72
		96	07140106001303	0.58	acre	$1,889.33
		97	07140106001269	0.44	acre	$1,445.10
		98	07140106001269	0.72	acre	$2,356.52
		99	07140106001269	0.92	acre	$2,977.67
		100	07140106001303	1.07	acre	$3,481.22
	Riparian Buffer	171	07140106001303	0.93	acre	$307.24
		172	07140106001303	12.37	acre	$4,083.18
		173	07140106001303	1.18	acre	$390.26
		174	07140106001303	3.47	acre	$1,144.92
		175	07140106001303	5.08	acre	$1,676.29
	Streambank Stabilization	225	07140106001269	1403.06	feet	$336,734.40
		226	07140106001270	2134.92	feet	$512,380.80
		227	07140106001303	1509.31	feet	$362,234.40
					TOTALS:	$1,248,734.95

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Dean	Grassed Waterway	101	07140106001273	0.69	acre	$2,239.88
		102	07140106001273	0.93	acre	$3,036.19
		103	07140106001273	0.71	acre	$2,303.14
		104	07140106001273	0.49	acre	$1,592.52
		105	07140106001273	1.16	acre	$3,756.10
		106	07140106001273	0.62	acre	$2,007.29
		107	07140106001273	0.44	acre	$1,424.02
		108	07140106001273	0.45	acre	$1,472.05
		109	07140106001273	0.17	acre	$556.75
		110	07140106001273	0.89	acre	$2,881.52
		111	07140106001273	1.21	acre	$3,929.99
		112	07140106001273	0.58	acre	$1,880.81
	Riparian Buffer	176	07140106001273	1.30	acre	$429.33
		177	07140106001273	1.11	acre	$365.19
	Streambank Stabilization	228	07140106001273	8397.56	feet	$2,015,414.40
					TOTALS:	$2,043,289.19

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Poor Farm	Agricultural Filter Strip	20	07140106001264	1.98	acre	$349.32
		21	07140106001263	1.40	acre	$247.50
	Grassed Waterway	113	07140106001262	0.93	acre	$3,026.17
		114	07140106001262	0.58	acre	$1,898.03
		115	07140106001262	0.44	acre	$1,430.75
		116	07140106001262	0.33	acre	$1,088.21
		117	07140106001262	0.44	acre	$1,444.30
		118	07140106001262	0.39	acre	$1,255.55
		119	07140106001265	0.95	acre	$3,073.57
		120	07140106001264	0.69	acre	$2,236.64
		121	07140106001264	1.06	acre	$3,451.23
		122	07140106001264	0.33	acre	$1,057.62
		123	07140106001265	0.91	acre	$2,951.36
		124	07140106001264	0.62	acre	$2,028.21
		125	07140106001264	0.47	acre	$1,517.16
		126	07140106001264	0.67	acre	$2,168.86
		127	07140106001264	0.87	acre	$2,828.47
		128	07140106001264	0.60	acre	$1,955.50
		129	07140106001264	1.20	acre	$3,916.54
	Riparian Buffer	178	07140106001263	1.43	acre	$472.58
		179	07140106006719	4.14	acre	$1,364.92
		180	07140106001262	1.98	acre	$654.02
	Streambank Stabilization	229	07140106001255	823.22	feet	$197,571.84
		230	07140106001257	719.35	feet	$172,643.04
		231	07140106001258	2033.19	feet	$487,965.60
		232	07140106001263	1731.91	feet	$415,658.40
		233	07140106001264	3428.92	feet	$822,940.80
		234	07140106001265	1836.53	feet	$440,767.20
		235	07140106006691	414.37	feet	$99,447.84
		236	07140106006719	938.47	feet	$225,233.04
		237	07140106006750	1383.00	feet	$331,920.00
		238	07140106006840	470.97	feet	$113,031.60
		239	7140106006848	376.09	feet	$90,261.36
					TOTALS:	$3,437,857.24

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Harmony	Grassed Waterway	130	07140106001272	0.46	acre	$1,490.93
		131	07140106001272	0.32	acre	$1,049.85
	Streambank Stabilization	240	07140106001272	846.22	feet	$203,091.60
					TOTALS:	**$205,632.38**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Frankfort	Agricultural Filter Strip	22	07140106001268	1.47	acre	$259.47
	Grassed Waterway	132	07140106001268	0.21	acre	$682.26
		133	07140106001268	0.84	acre	$2,745.04
		134	07140106001268	0.67	acre	$2,178.89
		135	07140106001268	0.43	acre	$1,385.27
		136	07140106001268	0.95	acre	$3,103.03
	Riparian Buffer	181	07140106001268	1.09	acre	$360.17
		182	07140106001268	5.11	acre	$1,685.23
	Stream Stabalization	241	07140106001267	787.35	feet	$188,963.28
		242	07140106001268	3091.94	feet	$742,065.60
		243	07140106001304	4469.52	feet	$1,072,684.80
					TOTALS:	**$2,016,113.05**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Monroe	Agricultural Filter Strip	23	07140106006725	2.02	acre	$355.41
	Grassed Waterway	137	07140106001260	0.72	acre	$2,352.76
		138	07140106001260	0.49	acre	$1,586.92
		139	07140106001260	0.29	acre	$942.13
		140	07140106001260	0.42	acre	$1,372.59
		141	07140106001260	0.48	acre	$1,567.38
		142	07140106001261	0.40	acre	$1,286.94
		143	07140106001261	0.25	acre	$824.47
		144	07140106001261	0.58	acre	$1,893.67
		145	07140106001261	0.52	acre	$1,705.76
	Riparian Buffer	183	07140106001260	6.68	acre	$2,204.74
	Streambank Stabilization	244	07140106001254	148.27	feet	$35,584.56
		245	07140106001259	1183.28	feet	$283,987.20
		246	07140106001260	2889.25	feet	$693,420.00
		247	07140106001261	1365.84	feet	$327,801.60
		248	07140106001262	1515.38	feet	$363,691.20
		249	07140106006725	894.36	feet	$214,646.88
					TOTALS:	$1,935,224.22

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Lower Pond Creek	Detention Basin	23	07140106001304	2783610.00	cubic foot	$2,059,871.40
		24	07140106001304	522060.00	cubic foot	$386,324.40
	Infiltration Basin	146	07140106001304	2285660.00	cubic foot	$13,713,960.00
	Streambank Stabilization	250	07140106001253	1157.19	feet	$277,725.60
		251	07140106006688	449.80	feet	$107,952.00
					TOTALS:	**$16,545,833.40**

Appendix D- Meeting and Planning Correspondence

WATERSHED PLANNING MEETING

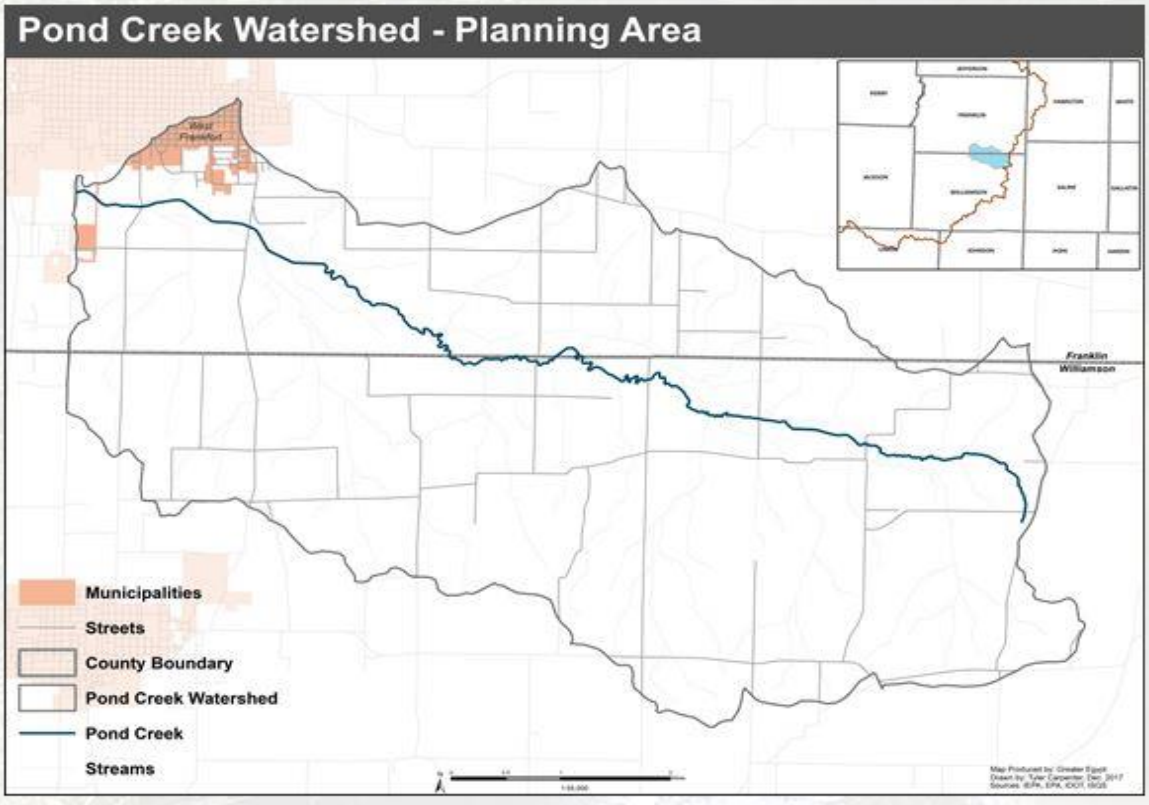
West Frankfort Aquatic & Activities Center
August 23, 2018 - 6:00PM
1100 East Cleveland St.
West Frankfort, IL 62896

The Greater Egypt Regional Planning and Development Commission will be holding an initial public information meeting for the Pond Creek Watershed-based Plan.

This meeting will help to address the community's concerns regarding water quality issues in the watershed. The purpose of the workshop is to explain watershed basics and the planning process.

Citizens and businesses of the watershed are encouraged to attend the meeting and provide comments about their experiences involving water quality and other issues regarding water resources.

The meeting will be held on **Thursday, August 23, 2018 at 6:00 PM**. The location is the **West Frankfort Aquatic and Activities Center**. If you have questions or comments, please contact Tyler Carpenter at the Greater Egypt Office: **618-997-9351** or **tylercarpenter@greateregypt.org**.



Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

Pond Creek Watershed Planning Committee
AGENDA

December 13, 2018
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Review of Initial Stakeholders Meeting

3.) Nine Elements of a Watershed-based Plan
- a. Review
- b. Status

4.) Synopsis of the Pond Creek Watershed- Inventory
- a. Boundaries
- b. Soils
- c. Land Use
- d. Pollutant Loads/ Pollutant Loading
- e. Assessment

5.) Concerns within the Watershed
- a. EPA 303d List: Impairments
- b. EPA 305b List: Inventory Report to Congress

6.) 1997 Pond Creek Investigation Report

7.) Preliminary Goals

8.) Needs from the Council

9.) Meeting Schedule

10.) Adjourn

Greater Egypt Regional Planning and Development Commission
5000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

Pond Creek Watershed Planning Committee
AGENDA

February 28, 2019
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Review of Initial Stakeholders Meeting

3.) Completed Elements of the Plan

- a.) Element A: Identification of Impairments and Pollutants Sources (Inventory)
- b.) Estimate Load Reductions and Load Reduction Targets

4.) Element C: Best Management Practices to Achieve Load Reduction Targets

- a.) General BMP Overview
- b.) Watershed-wide Practices
- c.) Site-Specific Practices

5.) Element D: Technical and Financial Assistance

6.) Element E: Outreach Measures/ Public Involvement

7.) Elements F-I: Implementation and Monitoring Strategy Components

8.) Needs from the Council

9.) Meeting Schedule

10.) Adjourn

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

Pond Creek Watershed Planning Committee
AGENDA

June 13, 2019
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Review of Previous Meeting (February 28, 2019)
   a. Planning Meetings
   b. Public Meeting (July)

3.) Pollutant Load Reduction Target Summary

4.) Element C: Best Management Practices to Achieve Load Reduction Targets
   a.) General BMP Overview
   b.) Watershed-wide Practices
   c.) Site-Specific Practices
   d.) Load Reductions

5.) Element D: Technical and Financial Assistance
   a.) Funding/ Grants

6.) Element E: Education/Outreach

7.) Elements F-I: Implementation and Monitoring Strategy Components

8.) Projected Meeting Schedule

9.) Adjourn

WATERSHED PLANNING MEETING

West Frankfort Aquatic & Activities Center
July 17, 2019- 6:00PM
1100 East Cleveland St.
West Frankfort, IL 62896

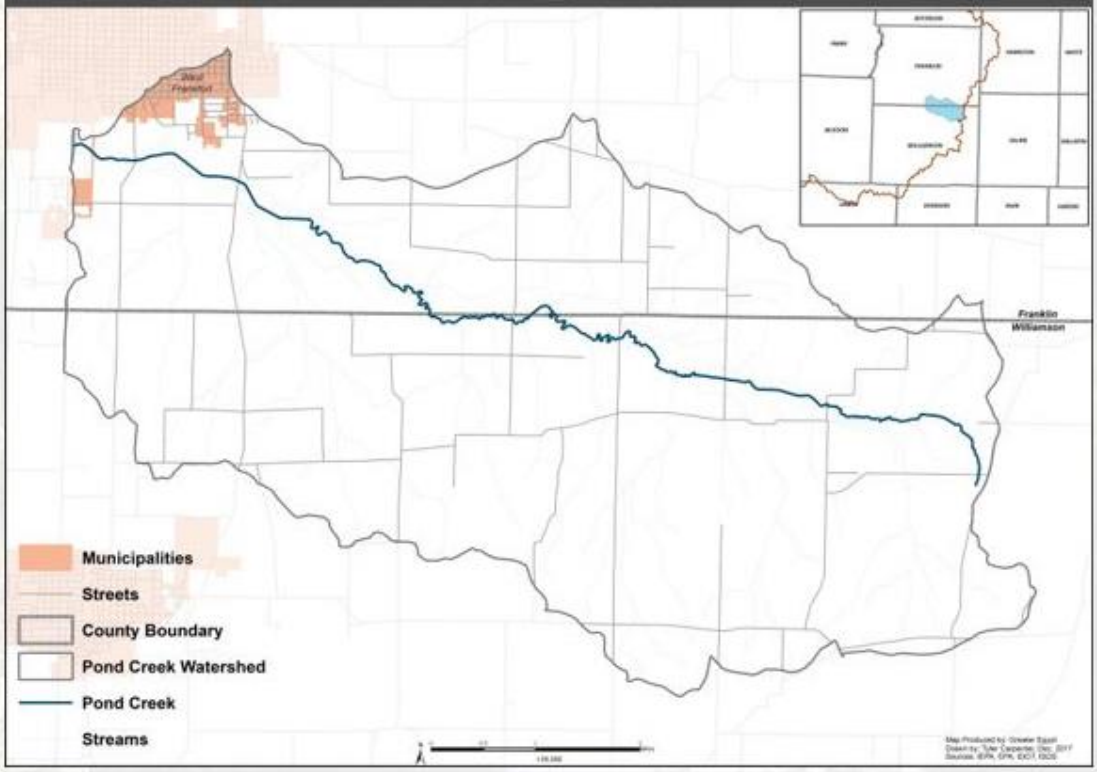
The Greater Egypt Regional Planning and Development Commission will be holding a public information meeting for the Pond Creek Watershed-based Plan.

This meeting will help to address the community's concerns regarding water quality issues in the watershed. The purpose of the workshop is to determine approaches that encourage sustainability of water resources.

Citizens and businesses of the watershed are encouraged to attend the meeting and provide comments about their experiences involving water quality and other issues regarding water resources.

The meeting will be held on **Wednesday, July 17, 2019 at 6:00 PM**. The location is the **West Frankfort Aquatic and Activities Center**. If you have questions or comments, please contact Tyler Carpenter at the Greater Egypt Office: **618-997-9351** or **tylercarpenter@greateregypt.org**.

Pond Creek Watershed - Planning Area



Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

Pond Creek Watershed Planning Committee
AGENDA

August 20, 2019
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Review of Planning Meetings

3.) Watershed-based Plan Draft- IEPA Comments

4.) Nine Minimum Elements Review

5.) Projected Schedule and Future Events

6.) Adjourn


POND CREEK
FRANKLIN COUNTY