KINKAID LAKE AREA
AVA

KINKAID LAKE
KINKAID CREEK
LITTLE KINKAID CREEK

KINKAID CREEK

WATERSHED-BASED PLAN
INVENTORY AND ASSESSMENT

GREATER EGYPT
REGIONAL PLANNING & DEVELOPMENT COMMISSION

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

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Pictured on cover: Kinkaid Lake Spillway (photo by Greater Egypt)

Table of Contents

List of Figures

List of Tables

Acronyms and Abbreviations

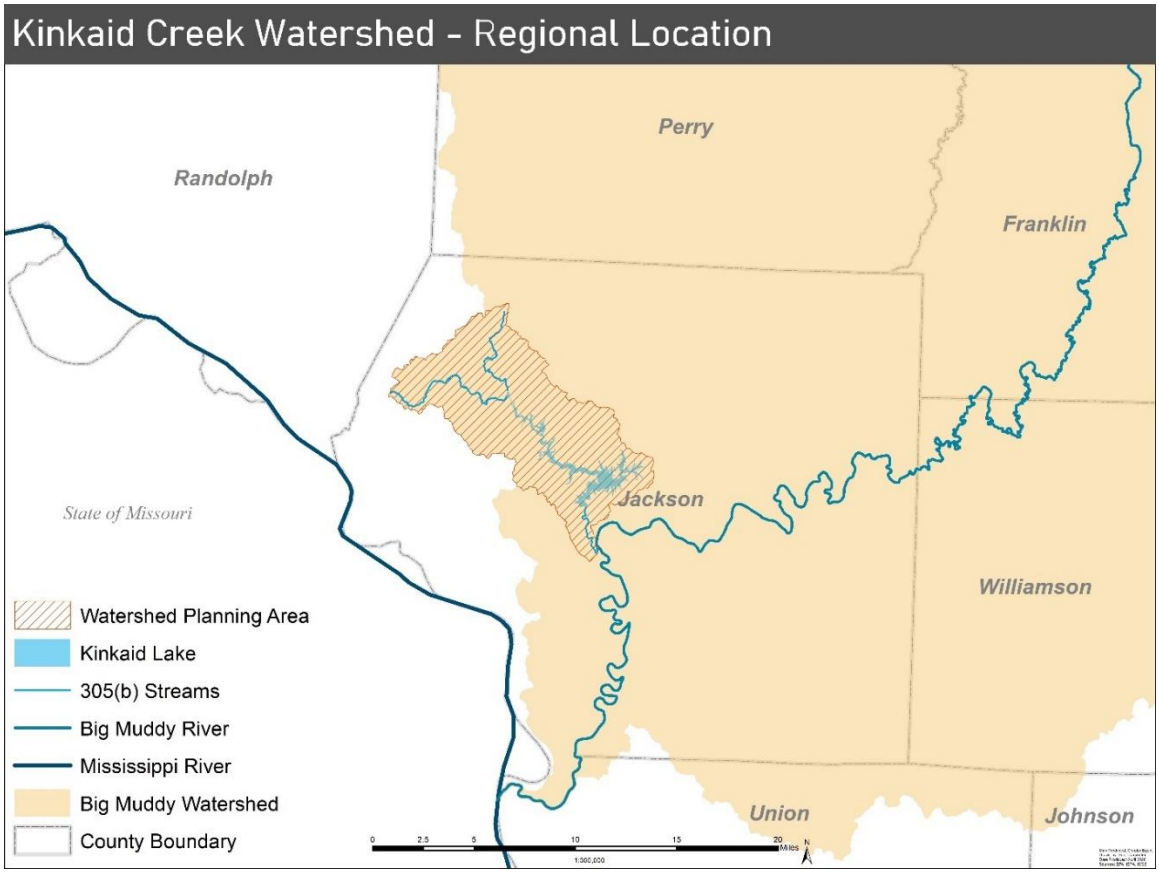
ACS	American Community Survey
AISWCD	Association of Illinois Soil and Water Conservation Districts
AMA	Agricultural Management Assistance Program
BOD	Biochemical Oxygen Demand
CSP	Conservation Stewardship Program
CTA	Conservation Technical Assistance Program
CWA	Clean Water Act
DOI	Department of the Interior
EPA	Environmental Protection Agency
EMA	Emergency Management Agency
EQIP	Environmental Quality Incentives program
HAB	Harmful Algal Bloom
HUC	Hydrologic Unit Code
ICN	Illinois Climate Network
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILNLRS	Illinois Nutrient Loss Reduction Strategy
ISGS	Illinois State Geological Survey
JCHD	Jackson County Health Department
LRR	Lateral Recession Rate
MCL	Maximum Contaminant Level
MLCG	Maximum Contaminant Level Goal
MRLC	Multi-Resolution Land Characteristics Consortium
MS4	Municipal Separate Storm Sewer Systems
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
RUSLE	Revised Universal Soil Loss Equation
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
UAS	Unmanned Aircraft System
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
VLMP	Volunteer Lake Monitoring Program

1. Watershed Geography & Climate

1.1 Geography

The Kinkaid Creek watershed is a collective area encompassing two individual Hydrologic Unit Code (HUC) 12 subwatersheds. This includes Little Kinkaid Creek-Kinkaid Creek (071401061101) and Kinkaid Lake- Kinkaid Creek (071401061102). The two subwatersheds comprise the HUC 10- Kinkaid Creek watershed (0714010611). This report will reference the cumulative watershed as the Kinkaid Creek watershed, and planning, or study area. The planning area encompasses 41,225 acres, or around 64 square miles. Figure 1.1 displays the study area and major regional waterbodies.

Figure 1.1



The planning area is located in Jackson County, Illinois. The headwaters of Kinkaid Creek watershed, which is represented by Drury Creek to the south, originates roughly four miles northeast of the Village of Rockwood in Randolph County, Illinois. Kinkaid Creek, converging with Little Kinkaid Creek and discharging through the spillway at Kinkaid Lake, meets at the confluence of the Big Muddy River to the south. The planning area is located approximately 4.5 miles west of the City of Murphysboro.

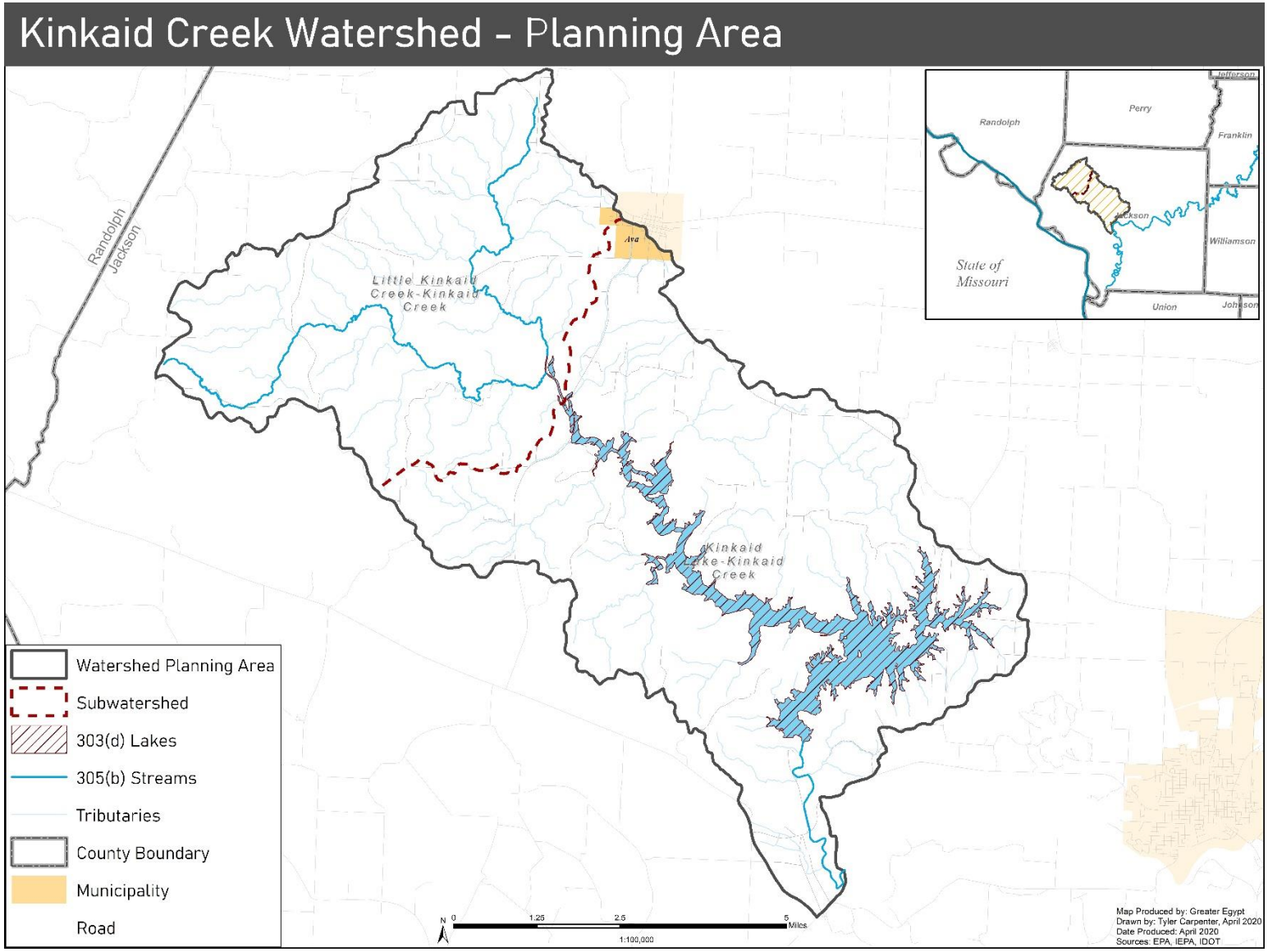
All waterbodies in the planning area eventually flow to the Big Muddy River. This river makes a winding course through Jackson County in a southwest direction eventually discharging into the Mississippi River.

The Kinkaid Creek watershed is generally bound to the north by the Village of Campbell Hill, to the east by Lake Murphysboro State Park, to the south by the Big Muddy River, and to the west by Hog Hill Road.

Only one municipality is located in the watershed planning area: the City of Ava. With a population of 650, the city is similar to other smaller municipalities in southern Illinois. Figure 1.3 displays the planning area.

Figure 1.2- Kinkaid Lake Spillway- North Facing

Figure 1.3


Kinkaid Creek Watershed – Planning Area
Randolph
Jackson
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Jefferson
Perry
Randolph
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Watershed Planning Area
Subwatershed
303(d) Lakes
305(b) Streams
Tributaries
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter, April 2020
Date Produced: April 2020
Sources: EPA, IEPA, IDOT

1.2 Location of Water Bodies

The Kinkaid Creek watershed lies on the divide between the Ohio and Mississippi River basins. There are three major waterbodies in the watershed, as identified in the National Hydrography Dataset (NHD). This includes two streams and a single Lake.

Kinkaid Creek and Little Kinkaid Creek are listed on the Illinois Environmental Protection Agency's (IEPA) 305(b) Report which outlines uses and designations for the waterbodies. While being on the 305(b) List, Kinkaid Lake is also listed on IEPA's 303(d) List of Impaired Waters as identified in the 2016 Integrated Water Quality Report. [1] These waterbodies are displayed in Figure 1.3.

Kinkaid Creek (IL_NB) meanders 9.7 miles in an easterly direction; flowing into the western point of Kinkaid Lake. The creek continues its course beyond the Kinkaid Lake spillway, traveling another 3.4 miles in a southerly direction before converging with the Big Muddy River. This reach of Kinkaid Creek is referred to as IL_NB-01. According to the 2016 Integrated Report, this reach fully supports aquatic life, primary, and secondary contact.[2] Little Kinkaid Creek (IL_NBA) runs 6.4 miles in a southerly direction before ending at the confluence of Kinkaid Creek and Kinkaid Lake.

Kinkaid Lake (IL_RNC) is one of the largest lakes in Illinois and is listed as an IEPA 303(d) impaired waterbody for mercury. While Kinkaid Lake is a large source of recreation, it also serves as a water source for local communities through the Kinkaid Area Water System.

Wetlands are also a prominent feature throughout the study area. According to the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI), there are five classifications of wetlands identified in the Kinkaid Creek watershed: freshwater emergent, freshwater forested/ shrub, freshwater pond, lake, and riverine. Table 1.1 contains information on the distribution of wetlands for the planning area and subwatershed. The lake classification is the most apparent wetland type in the planning area consisting of 2,355 acres, or accounting for nearly six percent of the entire watershed. Wetlands have also been displayed in Figure 1.4.

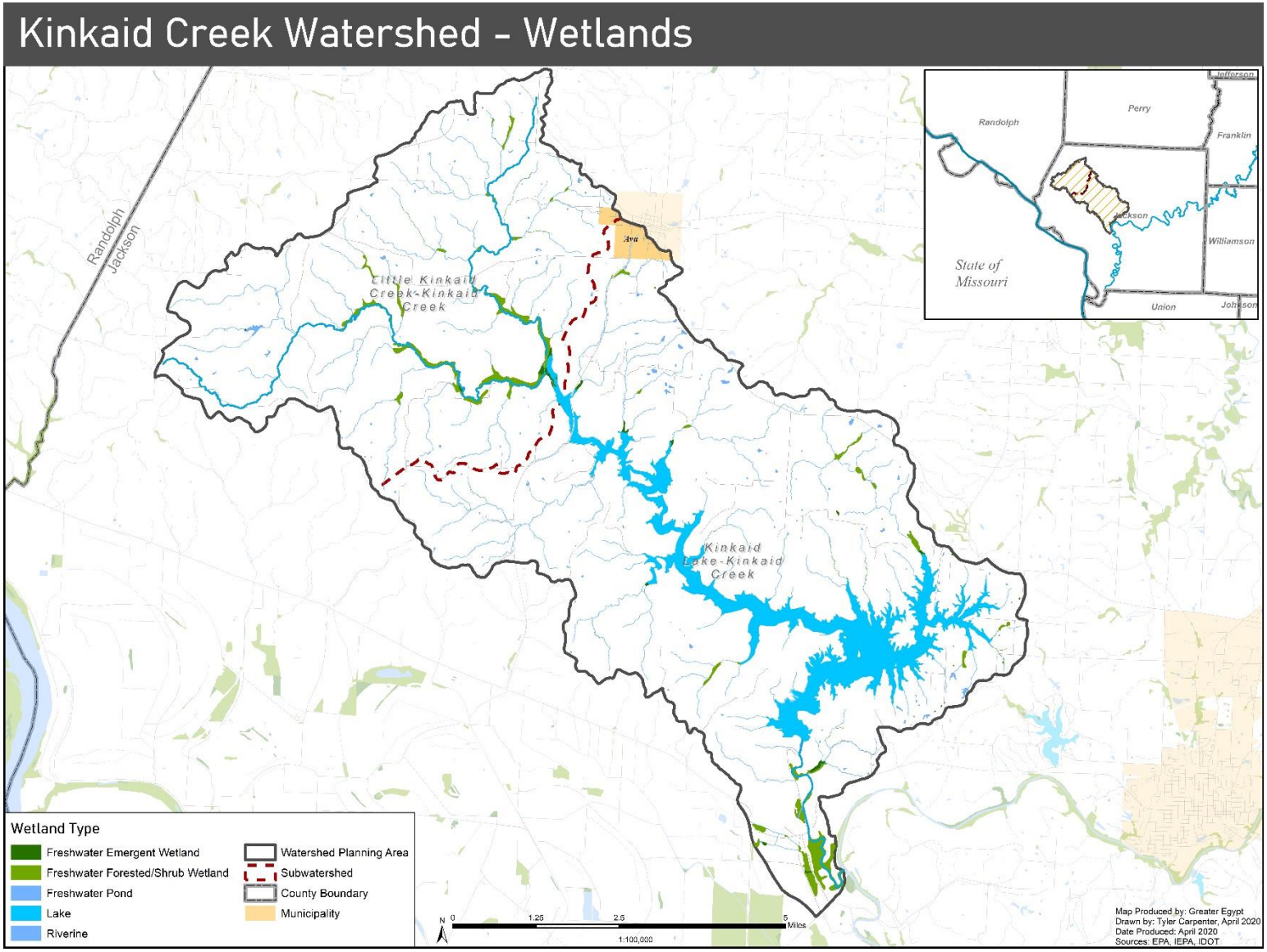
[1] Illinois Environmental Protection Agency. *Illinois Integrated Water Quality Report and Section 303(d) List- Volume1: Surface Water- 2-16, Appendix B-2. Specific Assessment Information for Streams, 2016.* PDF. Accessed 2019-2020.
[2] Ibid.

Table 1.1- Distribution of Wetlands

Kinkaid Creek Watershed			
Wetland Type	**Acres**	**Percent of Wetland Total**	**Percent of Total Watershed Area**
Freshwater Emergent	48.63	1.40%	0.12%
Freshwater Forested/ Shrub	603.34	17.40%	1.46%
Freshwater Pond	121.45	3.50%	0.29%
Lake	2354.64	67.91%	5.71%
Riverine	339.40	9.79%	0.82%
Little Kinkaid Creek- Kinkaid Creek Subwatershed (071401061101)			
Freshwater Emergent	19.97	0.58%	0.05%
Freshwater Forested/ Shrub	302.36	8.72%	0.73%
Freshwater Pond	40.41	1.17%	0.10%
Lake	37.96	1.09%	0.09%
Riverine	165.68	4.78%	0.40%
Kinkaid Lake- Kinkaid Creek Subwatershed (071401061102)			
Freshwater Emergent	28.66	0.83%	0.07%
Freshwater Forested/ Shrub	300.98	8.68%	0.73%
Freshwater Pond	81.04	2.34%	0.20%
Lake	2316.68	66.81%	5.62%
Riverine	173.72	5.01%	0.42%

Source: US Fish and Wildlife Service National Wetlands Inventory

Figure 1.4


Kinkaid Creek Watershed - Wetlands
Randolph
Jackson
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Jefferson
Perry
Randolph
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Wetland Type
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Riverine
Watershed Planning Area
Subwatershed
County Boundary
Municipality
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter, April 2020
Date Produced: April 2020
Sources: EPA, IEPA, IDOT

1.3 Topography

The Kinkaid Creek watershed is situated approximately three miles north of the southern limit of the glacial till from the Illinoisan age. The planning area features a major variance in slope. This is most evident in the Kinkaid Lake subwatershed. The subwatershed exhibits the most elevated terrain at 785 feet. Its highest elevation occurs at the western reach of Johnson Creek.

The general topography of the planning area is consistent with the surrounding watersheds of southern Illinois. Figure 1.5 displays the elevation and floodplain of the watershed. The lowest elevation is found in the southern section below the spillway of Kinkaid Lake subwatershed at the confluence of the Big Muddy River; approximately 330 feet. The watershed features an elongated shape with a mostly dendritic drainage pattern.

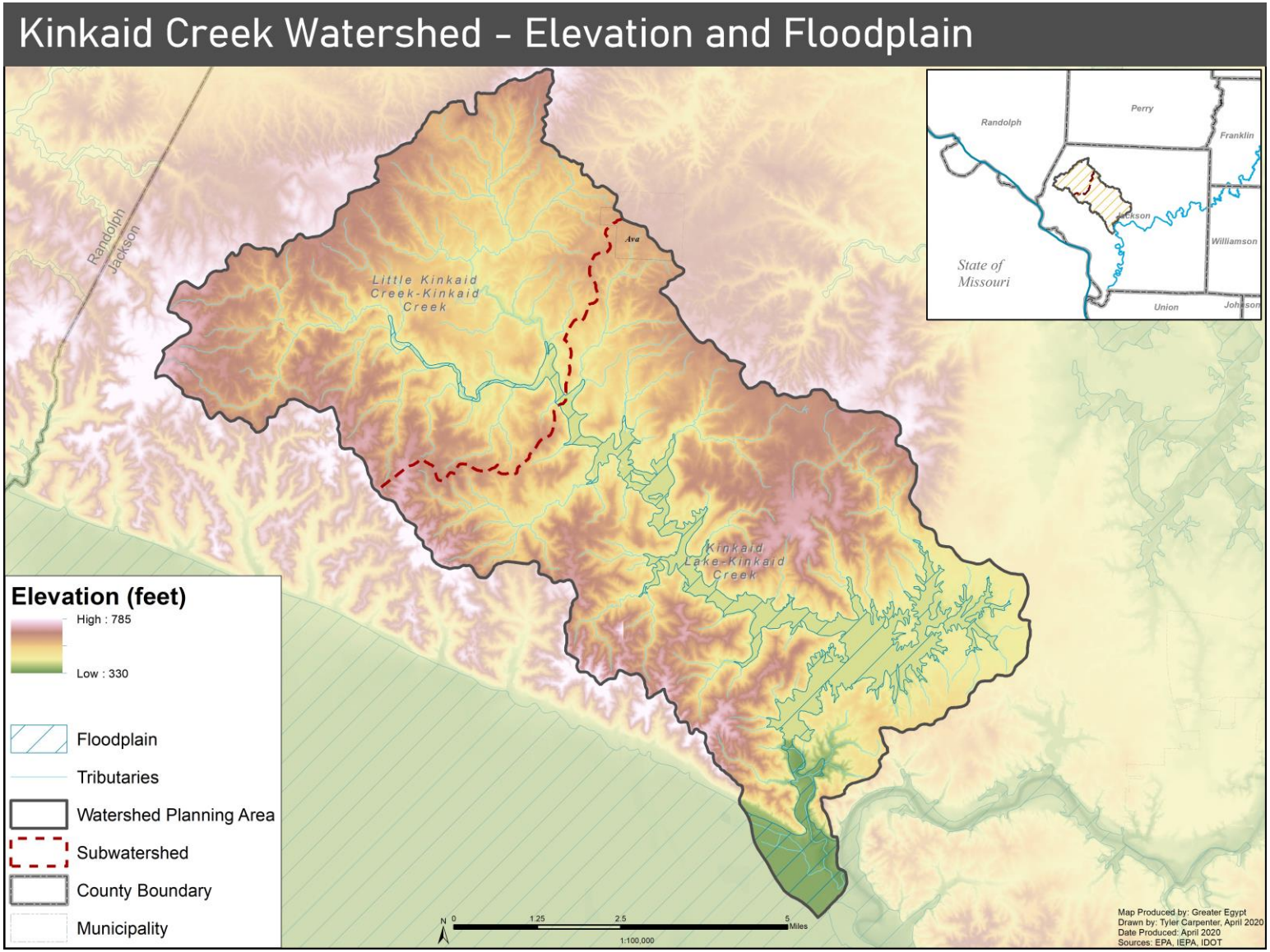
Approximately 9.4 percent (3,894 acres) of the watershed is in the floodplain. Floodplain information can be found in Table 1.2. Most of the floodplain is located in the Kinkaid Lake subwatershed (95 percent); being represented by Kinkaid Lake.

Table 1.2- Floodplain Distribution by Subwatershed

Kinkaid Floodplain Distribution				
Watershed	Acres	Percent of Total Floodplain	Percent of Subwatershed	Percent of Total Watershed
Kinkaid Creek Watershed	3893.5	100.00%	-	9.44%
Little Kinkaid Creek	210.32	5.40%	1.35%	0.51%
Kinkaid Lake	3683.18	94.60%	14.33%	8.93%

Source: ISWS, ISGS

Figure 1.5


Kinkaid Creek Watershed - Elevation and Floodplain
Randolph
Jackson
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Elevation (feet)
High : 785
Low : 330
Floodplain
Tributaries
Watershed Planning Area
Subwatershed
County Boundary
Municipality
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter, April 2020
Date Produced: April 2020
Sources: EPA, IEPA, IDOT

1.4 Subwatersheds and Subwatershed Management Units (SMU)

Kinkaid Creek watershed, specifically the HUC 12 subwatersheds, have been delineated further into 19 smaller subwatershed management units (SMU). Along with the HUC 12 subwatersheds, each SMU will be examined individually in this inventory and assessment. Each subbasin was delineated based on the drainage patterns and the direction of flow of tributaries in the watershed.

A unique identifier (HUC 14 code) was assigned to each subwatershed management unit for classification. Each SMU was also assigned a name. This information can be found in Table 1.3 and illustrated in Figure 1.6. This table also provides acreage and the major tributary found within each unit. Detailed information for the subwatersheds can be found in later chapters.

Little Kinkaid Creek- Kinkaid Creek Subwatershed (071401061101)

With 15,534 acres, the Little Kinkaid Creek- Kinkaid Creek subwatershed (Little Kinkaid Creek) is the smaller of the two subwatersheds in the planning area. Four SMUs are located within the Little Kinkaid Creek subwatershed boundary. At 5,466 acres, the Upper Kinkaid Creek SMU is the largest in area. Kinkaid Creek (IL_NB) originates in this SMU and runs in an easterly direction through the Middle Kinkaid Creek SMU.

The subwatershed mainly consists of deciduous forest (54.6 percent) and pasture/hay (26.5 percent) land use classifications. Developed areas only account for approximately 3.5 percent of the subwatershed total. Since development in the Little Kinkaid Creek subwatershed is limited, the amount of impervious surfaces is also lower than other HUC 12 subwatersheds in the planning area. Ninety-six percent of the Little Kinkaid Creek subwatershed exhibits no impervious features.

While there are no impairments in the subwatershed, Kinkaid and Little Kinkaid Creeks have been assessed through the 305(b) program. These waterbodies are also examined in the assessment and water quality sections of this report.

Table 1.3- Subwatershed Management Unit Information

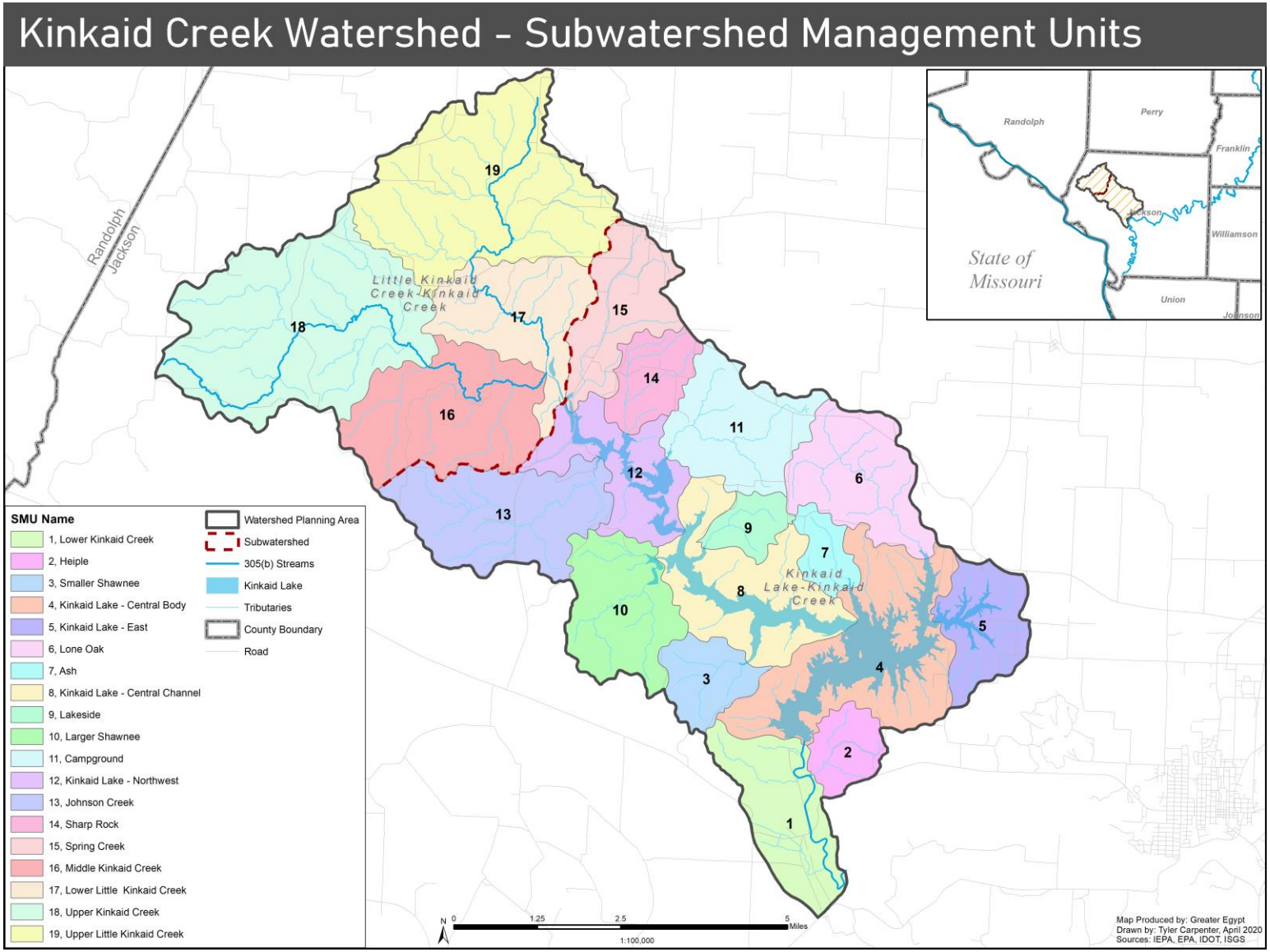
MAP ID	SUBWATERSHED MANAGEMENT UNIT NAME	ACRES	HUC 14 CODE	MAJOR WATERBODY
Kinkaid Lake- Kinkaid Creek Subwatershed (071401061102)				
1	Lower Kinkaid Creek	1,946.19	07140106110201	Kinkaid Creek
2	Heiple	743.05	07140106110202	Unnamed Tributary
3	Smaller Shawnee	938.4	07140106110203	Unnamed Tributary
4	Kinkaid Lake - Central Body	3,722.04	07140106110204	Kinkaid Lake
5	Kinkaid Lake - East	1,349.20	07140106110205	Kinkaid Lake
6	Lone Oak	2,028.28	07140106110206	Unnamed Tributary
7	Ash	540.66	07140106110207	Unnamed Tributary
8	Kinkaid Lake - Central Channel	2,679.94	07140106110208	Kinkaid Lake
9	Lakeside	566.94	07140106110209	Unnamed Tributary
10	Larger Shawnee	2,014.95	07140106110210	Unnamed Tributary
11	Campground	2,086.01	07140106110211	Unnamed Tributary
12	Kinkaid Lake - Northwest	1,716.22	07140106110212	Kinkaid Lake
13	Johnson Creek	2,727.65	07140106110213	Johnson Creek
14	Sharp Rock	953.54	07140106110214	Unnamed Tributary
15	Spring Creek	1,695.18	07140106110215	Spring Creek
Little Kinkaid Creek- Kinkaid Creek Subwatershed (071401061101)				
16	Middle Kinkaid Creek	2,979.79	07140106110101	Kinkaid Creek
17	Lower Little Kinkaid Creek	2,166.74	07140106110102	Little Kinkaid Creek
18	Upper Kinkaid Creek	5,466.30	07140106110103	Kinkaid Creek
19	Upper Little Kinkaid Creek	4,921.14	07140106110104	Little Kinkaid Creek

Kinkaid Lake - Kinkaid Creek Subwatershed (071401061102)

At 25,708 acres, the Kinkaid Lake- Kinkaid Creek subwatershed (Kinkaid Lake) is represented by fifteen subwatershed management units. The subwatershed features Kinkaid Lake which is located on the IEPA 303(d) List of impaired Waters for mercury. Kinkaid Creek also continues past the lake's spillway, ending at the confluence of the Big Muddy River.

The Kinkaid Lake subwatershed features a similar land use composition to the Kinkaid Creek subwatershed with the exception of open water. Because of its large size, Kinkaid Lake accounts for most of the open water category at nine percent of the subwatershed. Deciduous forest accounts for 60 percent of the total land use acreage, or 15,322 acres.

Figure 1.6


Kinkaid Creek Watershed – Subwatershed Management Units
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
State of Missouri
Randolph
Perry
Franklin
Jackson
Williamson
Union
Johnson
SMU Name
1, Lower Kinkaid Creek
2, Heiple
3, Smaller Shawnee
4, Kinkaid Lake - Central Body
5, Kinkaid Lake - East
6, Lone Oak
7, Ash
8, Kinkaid Lake - Central Channel
9, Lakeside
10, Larger Shawnee
11, Campground
12, Kinkaid Lake - Northwest
13, Johnson Creek
14, Sharp Rock
15, Spring Creek
16, Middle Kinkaid Creek
17, Lower Little Kinkaid Creek
18, Upper Kinkaid Creek
19, Upper Little Kinkaid Creek
Watershed Planning Area
Subwatershed
305(b) Streams
Kinkaid Lake
Tributaries
County Boundary
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
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Sources: IEPA, EPA, IDOT, ISGS

1.5 Climate

The climate in the Kinkaid Creek Watershed Planning area borders the humid subtropical and humid continental climates. Weather in the region is influenced by warm air from the gulf, cold dry air from Canada, and eastward air from the southwest. The terrain has little impact on the climate.[3]

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 station located at the Carbondale Sewage Plant. The average temperature between 2000 and 2019 was 56.1 degrees Fahrenheit.[4] The average daily high and low was 63.4 and 49.3. Table 1.4 summarizes temperature information for the area between 2000 and 2019.

Table 1.4- 2000-2019 Monthly Average Temperatures

2000-2019 MONTHLY AVERAGE TEMPERATURES (degrees Fahrenheit)													
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average High	42.7	44.4	58.8	62.3	72.3	79.1	84.3	83.1	75	62.1	50.6	45.8	63.4
Average	32.6	35.8	45.9	54.1	66.5	75	77.8	76.5	69.1	57.5	45.7	36.2	56.1
Average Low	25.1	24	38.1	48.8	63	69.6	70.7	71.7	65.4	53.7	37.6	23.4	49.3

Source: NOAA-National Climatic Data Search

The planning area is subject to considerable rainfall throughout the year. Local precipitation data was taken from the NOAA weather station located at the Carbondale Sewage Plant. The average annual precipitation was 50.94 inches between 2000 and 2019. The wettest months are typically from March to June. Average snowfall amounts in the region are around eleven inches annually. Table 1.5 displays the monthly average precipitation between 2000 and 2019.

[3] David Muir, et al., "Upper Crab Orchard Creek: A Watershed Inventory," Greater Egypt Regional Planning and Development Commission, 1988, 6.
[4] NOAA. "Monthly Mean Avg Temperature for Carbondale Sewage Plant, IL" https://w2.weather.gov /Climate/xmacis.php?wfo=pah. Accessed 20 March 2020.

Table 1.5- 2000-2019 Monthly Average Precipitation

2000-2019 MONTHLY AVERAGE PRECIPITATION (in inches)													
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Total	2.84	3.38	4.51	5.09	5.53	4.5	4.7	3.48	2.92	3.86	4.31	4.08	50.94

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 feed into the waterbody. Like most areas in the Midwest, the watershed is susceptible to tornadoes. Winters can occasionally bring accumulations of snow and ice.

Wind data was obtained from the Illinois Climate Network (ICN) Carbondale Station, located on the SIU farm[5]. Wind speed generally ranges from 3 to 8 miles per hour throughout the year with an average of 5.8 miles per hour in 2019. However, gusts can be 29 to 46 miles per hour in any certain month. From the data, there seems to be a prevalent pattern of wind SSW (south/ southwest). Table 1.6 displays the average wind data from the ICN.

Table 1.6- 2019 Wind Data

Month	Average Wind Speed (mph)	Max Speed (mph)	Average Direction
Jan	7.3	36.6	220.2
Feb	7.4	42.6	173.4
Mar	7.3	42.6	209.5
Apr	7.5	44.4	195.7
May	5.7	29.9	198.5
Jun	5.1	43.1	192.7
Jul	4.4	37.1	197.3
Aug	3.7	45.9	201.0
Sep	4.0	29.9	191.8
Oct	5.2	32.4	196.3
Nov	5.9	42.1	197.0
Dec	6.0	34.6	200.6
AVG	**5.8**	**38.4**	**197.8**

Source: Illinois Climate Network

[5] ICN, "Water and Atmospheric Resources Monitoring Program," http://www.isws.illinois.edu/warm/datatype.asp. Accessed 30 March 2020.

2. Geology

Kinkaid Creek watershed is located between the Shawnee Hills Section of the Interior Low Plateaus Province and the Central Lowland Province, Tills Plains Section. It is also in close proximity to the Ozark Plateaus to the west. The physiographic provinces are further partitioned into divisions. The northern portion of the watershed rests on the southern border of the Mt. Vernon Hill Country Division. [6]

The Pennsylvania System includes the uppermost bedrock in the planning area. 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 2.1.

The Kinkaid Creek watershed encompasses three types of underlying geologic formations. These include: Caseyville (65 percent), Tradewater (31 percent), and the Upper Pope Group (4 percent). Accounting for the majority of the underlying formations, Caseyville mainly consists of shale and siltstone. Other deposits include sandstone, coal, and limestone.

General thickness of the Tradewater formation is around 100 to 300 feet in southern Illinois and is abundant in coal.[7] The Upper Pope Group includes Kinkaid Limestone from 0 to 230 feet. Figure 2.2 displays the geologic units of the Kinkaid Creek watershed and the surrounding area.

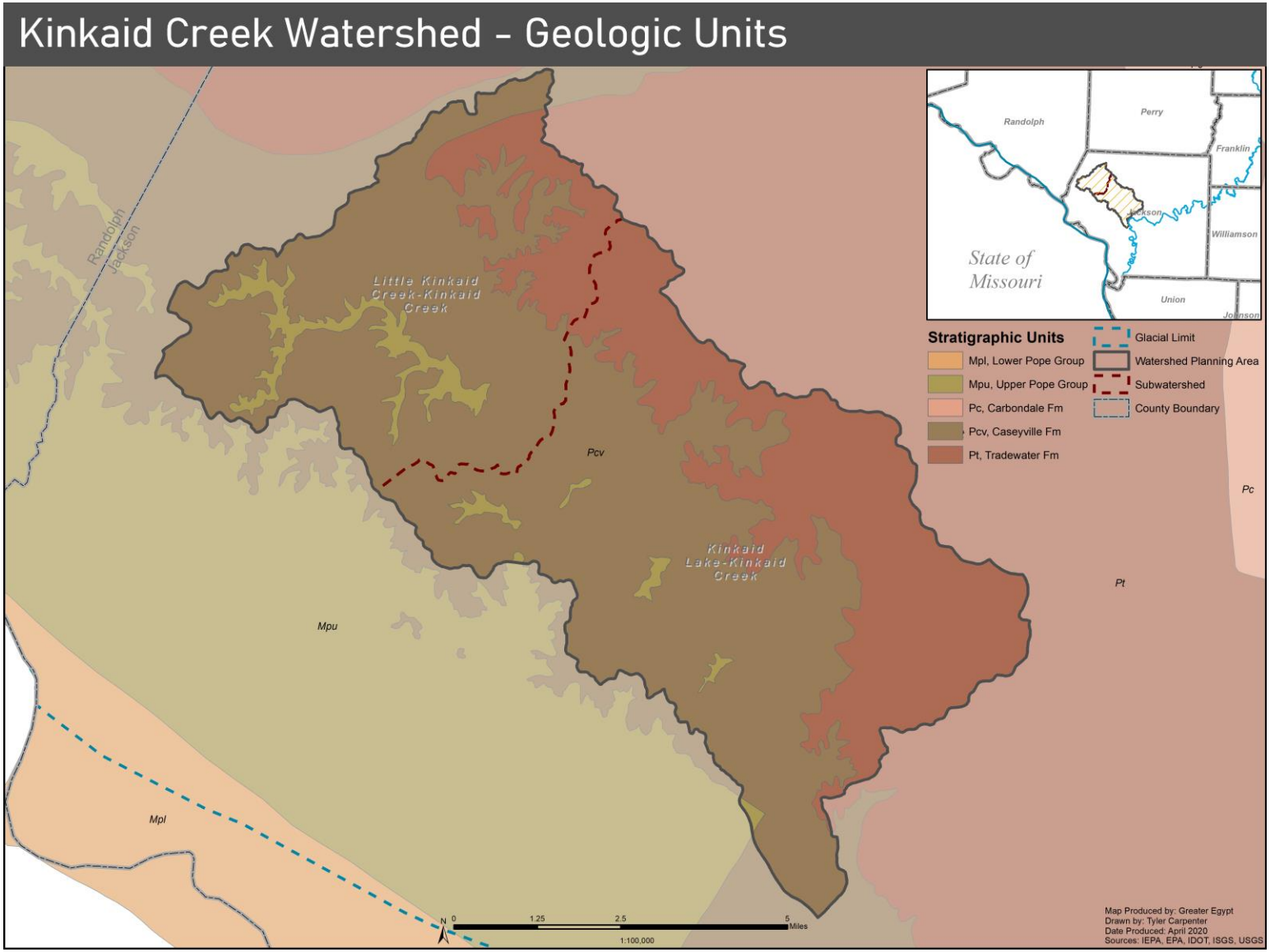
Figure 2.1- Generalized Stratigraphic Column of the Pennsylvanian in Illinois

PENNSYLVANIAN							SYSTEM
MORROWAN	ATOKAN	DESMOINESIAN			MISSOURIAN	VIRGILIAN	SERIES
Racoon Creek Group			McLeansboro				Group
Caseyville	Tradewater	Carbondale	Shelburn	Patoka	Bond	Mattoon	Formation

Source: ISGS (modified)

[6] 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).
[7] 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.

Figure 2.2


Kinkaid Creek Watershed – Geologic Units
Randolph
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Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Pcv
Mpu
Mpl
Pc
Pt
Randolph
Perry
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Stratigraphic Units
Mpl, Lower Pope Group
Mpu, Upper Pope Group
Pc, Carbondale Fm
Pcv, Caseyville Fm
Pt, Tradewater Fm
Glacial Limit
Watershed Planning Area
Subwatershed
County Boundary
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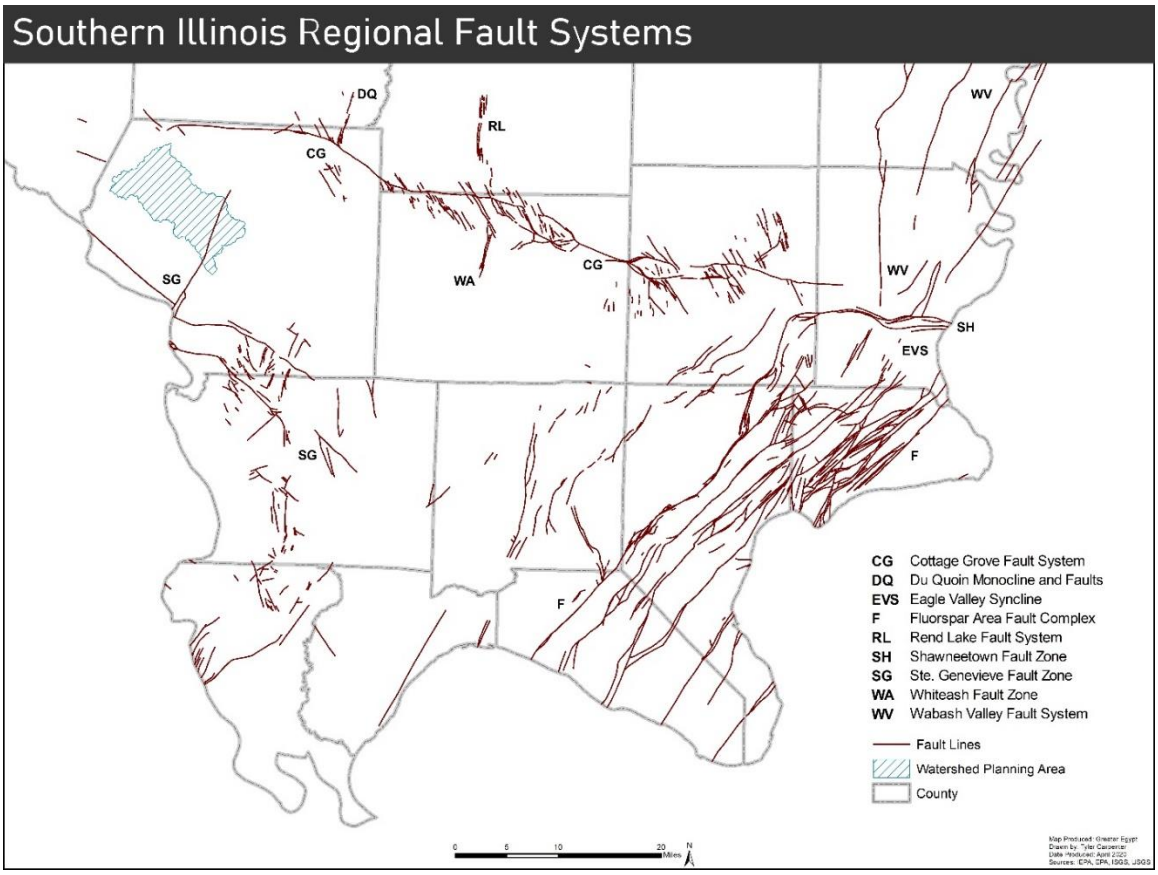
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter
Date Produced: April 2020
Sources: IEPA, EPA, IDOT, ISGS, USGS

2.1 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 2.3. Southern Illinois lies just north of the most seismically active area of the Midwest, being the New Madrid Seismic Zone, which lies along the border of Missouri, Arkansas, Kentucky and Tennessee. It also encompasses much of the Wabash Valley Fault Zone.

Figure 2.3

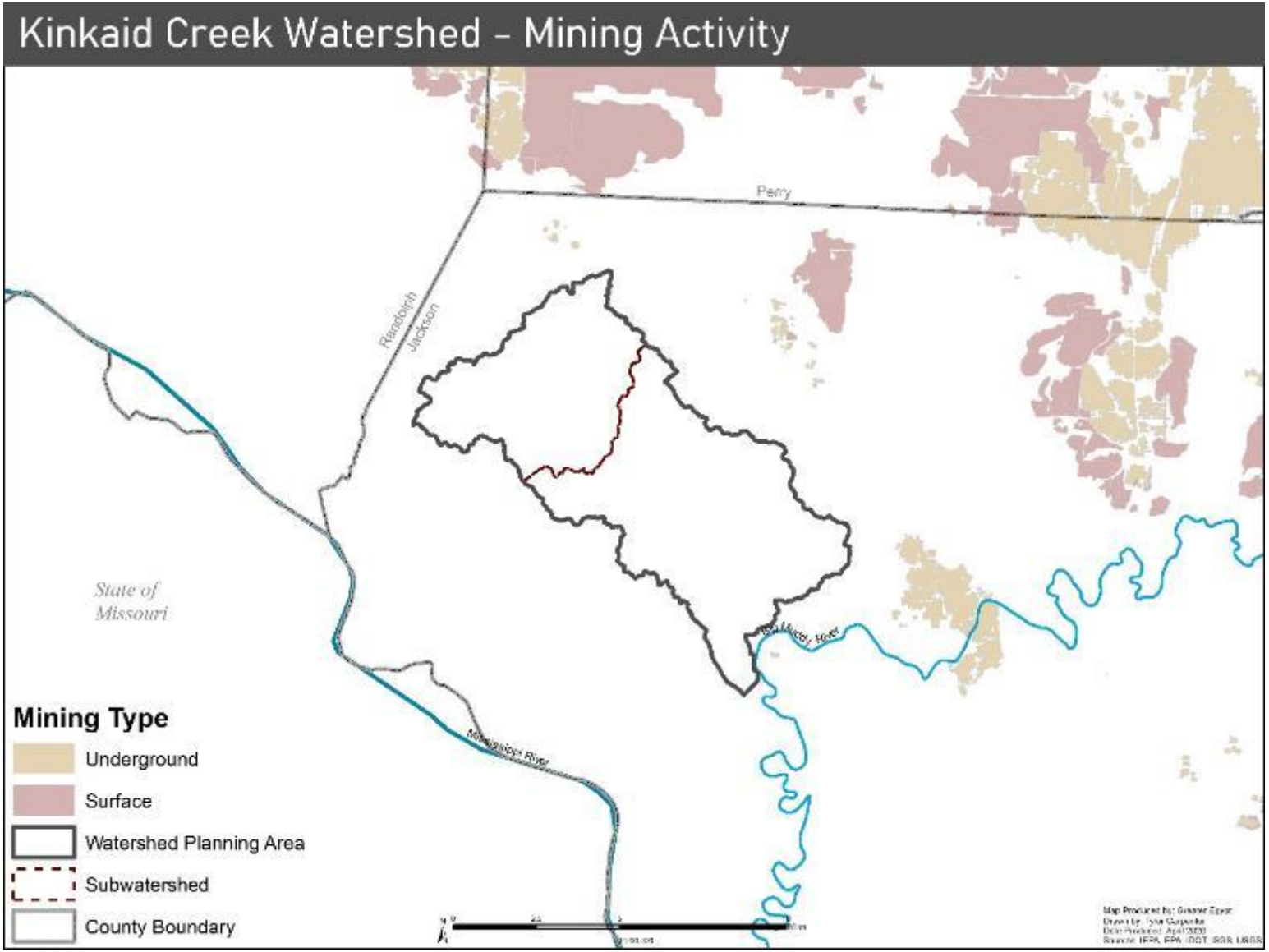


The Kinkaid Creek watershed lies in between the Ste. Genevieve and the Cottage Grove fault zones (Figure 2.3). The Ste. Genevieve fault system runs in a northerly direction extending from Alexander to Randolph County on the Illinois side of the Mississippi River. Part of this system runs through the planning area in a northerly direction.

2.2 Mining

While there has been no mining activity directly in the watershed boundaries, it has occurred in close proximity. This is exhibited by the underground mining to the north and east (Murphysboro seam). Mining operations in neighboring Perry County (two miles north) were some of the most active in the area. This included underground and surface mining from the Herrin seam. Mining areas have been displayed in Figure 2.4.

Figure 2.4


Kinkaid Creek Watershed – Mining Activity
Perry
Randolph
Jackson
State of
Missouri
Mining Type
Underground
Surface
Watershed Planning Area
Subwatershed
County Boundary

3. 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 Jackson County (USDA, NRCS) was utilized for the examination of soils within the Kinkaid Creek Watershed Planning Area. Soils data was utilized to summarize the hydrologic soil groups, hydric status of soils, soil erodibility by K-Factor value, soil drainage, and the generalized soil types. The planning area consists of 32 generalized soil series.

3.1. Hydrologic Soil Groups

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.[8] 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 high-water table, soils that have a claypan or clay

[8] USDA, NRCS. "Web Soil Survey." http://websoilsurvey.sc.egov.usda.gov/. Accessed: January-December 2019.

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.[9]

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. Within the planning area, few soils have a dual hydrologic group rating of either B/D, or C/D. None of the soils within the planning area are grouped with the dual rating A/D. Information on the hydrologic soil groups can be seen in Table 3.1.

Table 3.1- Hydrologic Soil Groups

Hydrologic Group	Soil Texture	Drainage	Infiltration	Transmission Rate
A	Sand or Gravel	Deep, Well Drained to Excessively Drained	High	High
B	Moderately Fine to Moderately Coarse	Moderately Deep or Deep, Moderately Well Drained or Well Drained	Moderate	Moderate
C	Moderately 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

Soils in the planning area vary within all of the hydrologic group classifications. Group A consists of 1,845.1 acres (4.5 percent) in the planning area. 24,119.7 acres (58.5 percent) make up Group B, the largest group of hydrologic soils. Group C makes up the second largest rating with 9,450 acres (22.9 percent), while Group D make up the smallest portion of hydrologic soils with 733 acres (1.8 percent) in the Kinkaid Creek Watershed Planning Area.

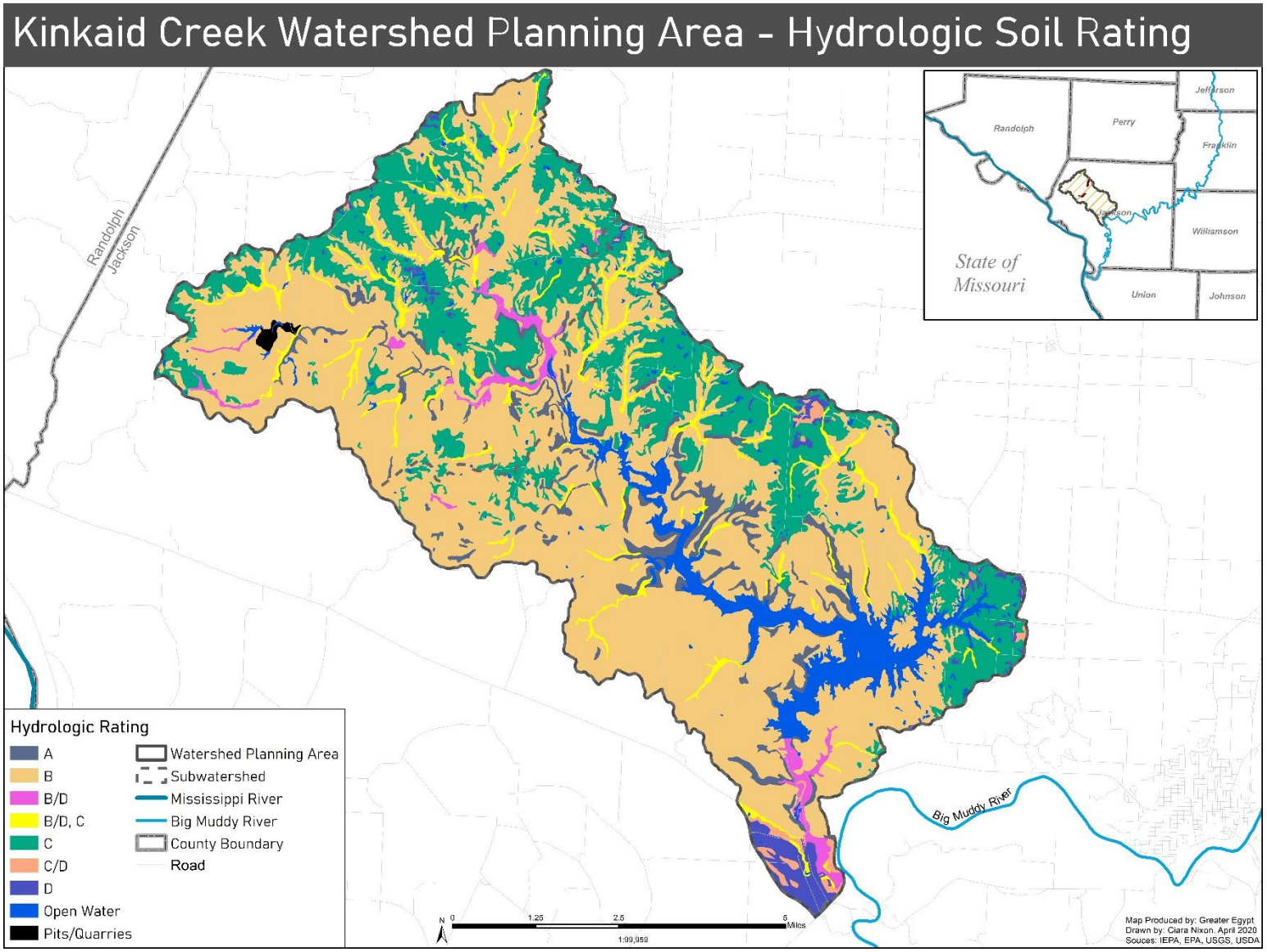
Dual hydrologic soil groups account for 2,453.6 acres, or 5.9 percent of the hydrologic soils in the planning area. Eleven general soils have been assigned a dual hydrologic code. Four soils, Belknap, Burnside, Drury, and Wakeland, compose the group B/D, which together make up 2,180.9 acres, or 5.2 percent of the entire planning area. Belknap, Burnside, and Drury soils also include the hydrologic group C. Group C/D is

[9] Ibid.

composed of seven soils. Combined, these soils cover 272.7 acres, or 0.7 percent within the Kinkaid Creek Watershed Planning Area.

These groupings are also spatially depicted in Figure 3.1. Table 3.4 summarizes the hydrologic soil groups by general soil name and provides other information regarding soils within the Kinkaid Creek Watershed Planning Area.

Figure 3.1


Kinkaid Creek Watershed Planning Area - Hydrologic Soil Rating
Randolph
Jackson
Jefferson
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Hydrologic Rating
A
B
B/D
B/D, C
C
C/D
D
Open Water
Pits/Quarries
Watershed Planning Area
Subwatershed
Mississippi River
Big Muddy River
County Boundary
Road
Big Muddy River
N
0
1.25
2.5
5
Miles
1:99,959
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April 2020
Souces: IEPA, EPA, USGS, USDA

3.2 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".[10] Of the 32 general soils that comprise the Kinkaid Creek watershed, ten are defined as hydric soils. Table 3.2 summarizes the hydric soils with their respective acre and percent cover in the planning area. Hydric soils account for 557.4 acres, or 1.4 percent, of the entire planning area.

Table 3.2- Hydric Soils

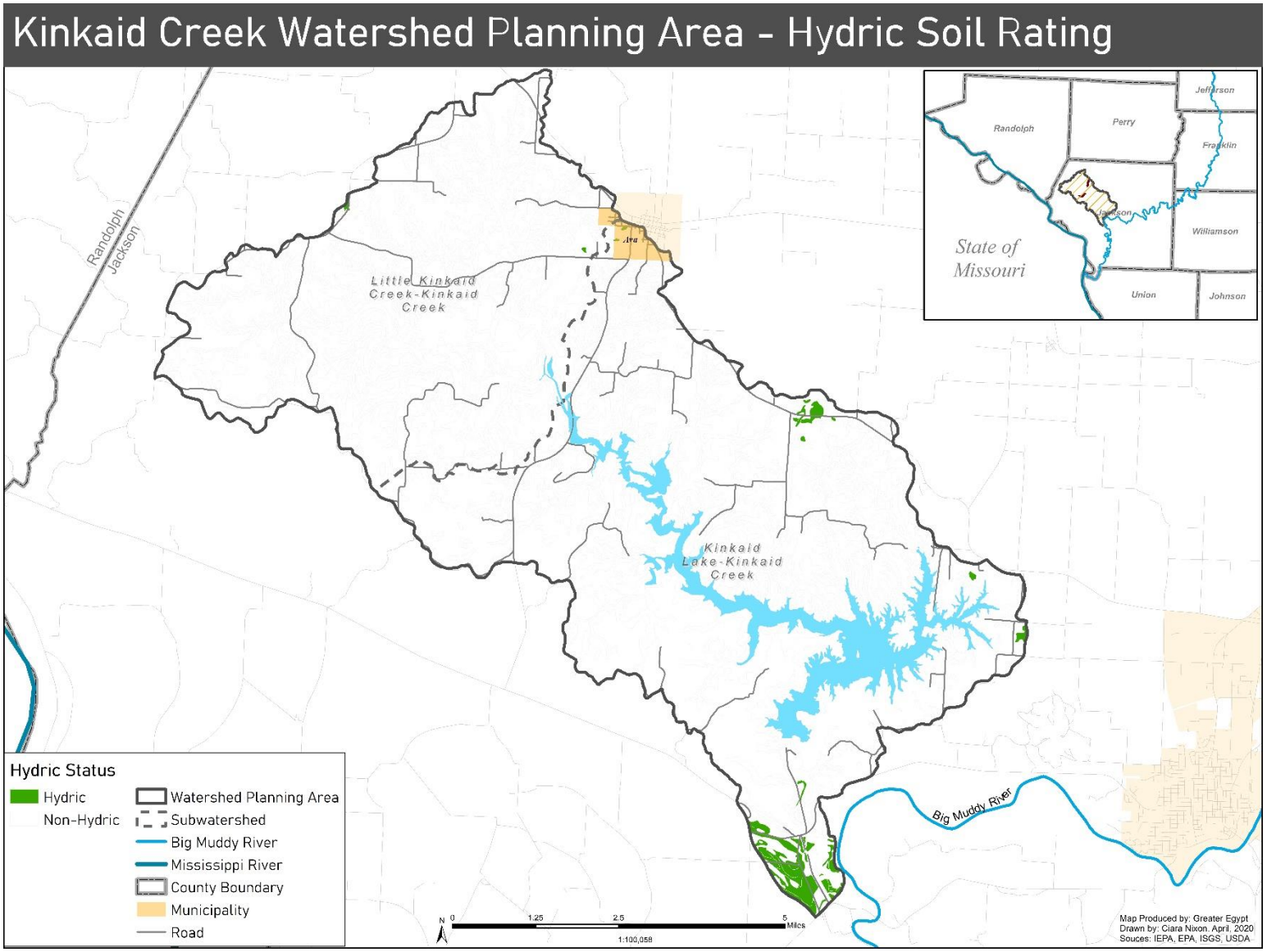
Hydric Soils	Acres	Percent of Planning Area
Birds	21	0.1%
Bonnie	10.4	0.0%
Bonnie and Petrolia	6.5	0.0%
Booker	69.2	0.2%
Darwin and Jacob	7.7	0.0%
Jacob	75.5	0.2%
Okaw	209.7	0.5%
Pierron	84	0.2%
Piopolis	2.5	0.0%
Sexton	70.9	0.2%
Total:	**557.4**	**1.4%**

Source: USDA NRCS

At 210 acres, the Okaw soil series is the most prominent hydric soil within the border of the Kinkaid Creek Watershed Planning Area. The Okaw soils cover just 0.5 percent of the entire area. The Pierron soil series covers the next largest area with 84 acres, or 0.2 percent of the planning area. Jacob soils cover 75.5 acres, or 0.2 percent, while Booker and Sexton soils cover almost equal acreage with 69.2 acres and 70.9 acres, respectively. The other five soils; Birds (21 acres), Bonnie (10.4 acres), Bonnie and Petrolia (6.5acres), Darwin and Jacob (7.7 acres), and Piopolis (2.5 acres) soils cover less than 0.2 percent of the planning area. Hydric soils in the Kinkaid Creek watershed planning area are depicted in Figure 3.2.

[10] Ibid.

Figure 3.2


Kinkaid Creek Watershed Planning Area - Hydric Soil Rating
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
Ava
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
Hydric Status
Hydric
Non-Hydric
Watershed Planning Area
Subwatershed
Big Muddy River
Mississippi River
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,058
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April. 2020
Souces: IEPA, EPA, ISGS, USDA

3.3 Soil Erodibility

Soil erodibility in the Kinkaid Creek Watershed Planning Area varies by location. The soil erodibility factor (K-factor value) 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.[11]

Erodibility correlates with the gradual increase in the K-factor value. The K-factor values for soils in this planning area have 8 different values between the ratings of 0.15 and 0.55. These values usually correlate with other features of the soils, including hydric status and drainage classification. K-factor values and other information are listed in Table 3.4.

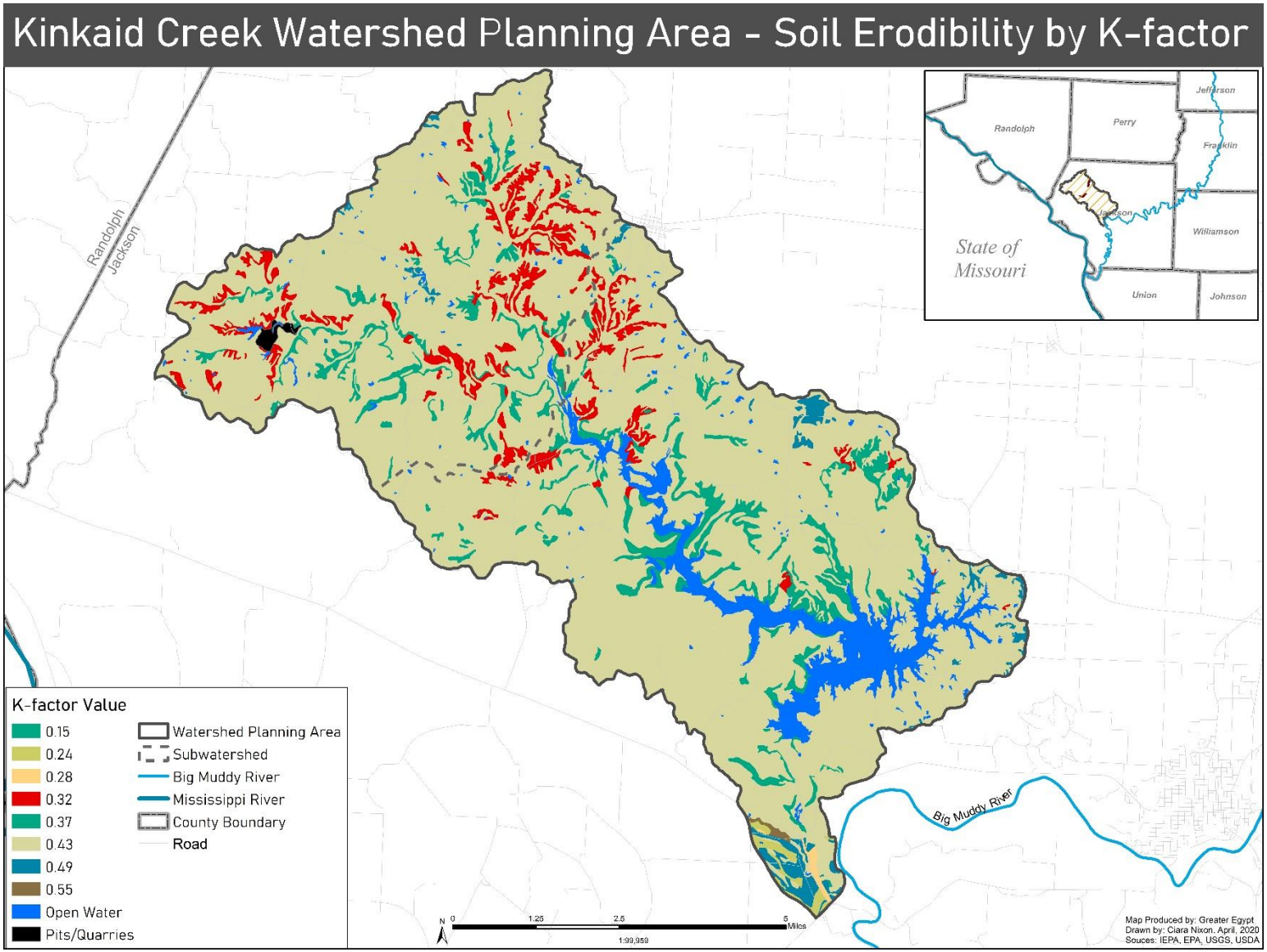
The least erodible soil, having a K-factor value of 0.15, is the Neotoma soil series. Neotoma-Rock soils cover 402.6 acres, or less than one percent of the planning area. Neotoma-Wellston soils cover 1,429.9 acres, or 0.035 percent of the planning area. The following four soil series fall within a rating of 0.24. The Alvin series cover 12.6 acres, or just 0.03 percent of the planning area. Booker soils cover 69.2 acres, or 0.2 percent of the planning area. The Darwin-Jacob series cover 7.7 acres, or just 0.02 percent. The last series with a K-factor value of 0.24 is the Jacob soils, which cover 75.5 acres, or 0.2 percent of the entire watershed planning area. Orthents soil series cover 62.5 acres, only 0.2 percent, and is the only soil series with a K-factor value of 0.3. Two soil series have a drainage rating of 0.32, Hickory and Kell-Hickory. These soil series cover 1,637.2 and 319.3 acres respectively, or roughly 4 percent and 0.8 percent. Hickory Menfro, Piopolis, and Wellston-Neotoma soil series fall with the 0.4 drainage rating. Hickory Menfro cover 1,201 acres, or 2.9 percent of the planning area.

[11] Ibid.

The majority of the soils in the Kinkaid Creek Watershed Planning Area are rated with a 0.43 K-factor value. Combined, these soils cover 32,684.8 acres, or 79.3 percent of the entire planning area. The series rated with a 0.4 value are Belknap (391.5 acres), Birds (21 acres), Bonnie (10.4 acres), Bonnie-Petrolia (6.5 acres), Burnside (1,072 acres), Drury (36 acres), Geff (42 acres), Haymond (661.8 acres), Hickory-Homen (388 acres), Homen (9,130.7 acres), Hurst (12 acres), Menfro (14,566 acres), Menfro-Hickory (807.6 acres), Menfro-Wellston (4,856.5 acres), and Wakeland (681.5 acres) soil series. 658.3 acres, or 1.6 percent of the soils in the planning area have a value of 0.49. These soils include Okaw (2.9.8 acres), Pierron (84 acres), Sexton (70.9 acres), and Stoy (293.6 acres). The soil that is rated as having the highest erodibility value is the Dupo soil series, with 37.8 acres, or just 0.1 percent of cover in the planning area and is rated with a K-factor value of 0.55.

Soil erodibility, measured by K-factor value, is displayed in Figure 3.3.

Figure 3.3


Kinkaid Creek Watershed Planning Area - Soil Erodibility by K-factor
Randolph
Jackson
Perry
Franklin
Williamson
Union
Johnson
State of Missouri
Big Muddy River
K-factor Value
0.15
0.24
0.28
0.32
0.37
0.43
0.49
0.55
Open Water
Pits/Quarries
Watershed Planning Area
Subwatershed
Big Muddy River
Mississippi River
County Boundary
Road
N
0
1.25
2.5
5
Miles
1:99,959
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April, 2020
Souces: IEPA, EPA, USGS, USDA

3.4 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, five classes represent the soil drainage classifications located within the Kinkaid Creek watershed planning area. Listed below is the USDA's definition of the soil drainage ratings within the planning area:

> **Well drained (WD):** 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 (MWD):** 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 (SPD):** 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 (PD):** 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

Very Poorly Drained (VPD): Water is removed from the soils so slowly that free water remains at or very near the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded. If rainfall is high or nearly continuous, slope gradients may be greater.[12]

These five classifications constitute most of the planning area, excluding the 2,562 acres (6.2 percent) of water, and 77.2 acres (0.2 percent) of the pits and quarries classification. Table 3.4 displays the general soil series with their respective drainage class rating, along with the acreage and percent of coverage within the Kinkaid Creek watershed planning area.

Most of the soils within the planning area's border are rated as being well drained. This drainage class consists of 11 different soils. When combined, the well-drained soils make up 27,382 acres (66.4 percent) of the planning area. The Homen soil series is the only rating that falls into the moderately well drainage class with 9,127 acres (22.1 percent). 1,520.4 acres (3.7 percent) are placed in the somewhat poorly drained class, which consists of seven combined soils. 549.7 acres (1.3 percent), between eight combined soil series, are rated as poorly drained. Only one soil series, the Darwin and Jacob series, fall into the very poorly drainage class and constitute only 7.7 acres of the Kinkaid Creek watershed planning area.

Drainage class ratings are summarized in the following table, and spatially displayed in Figure 3.4.

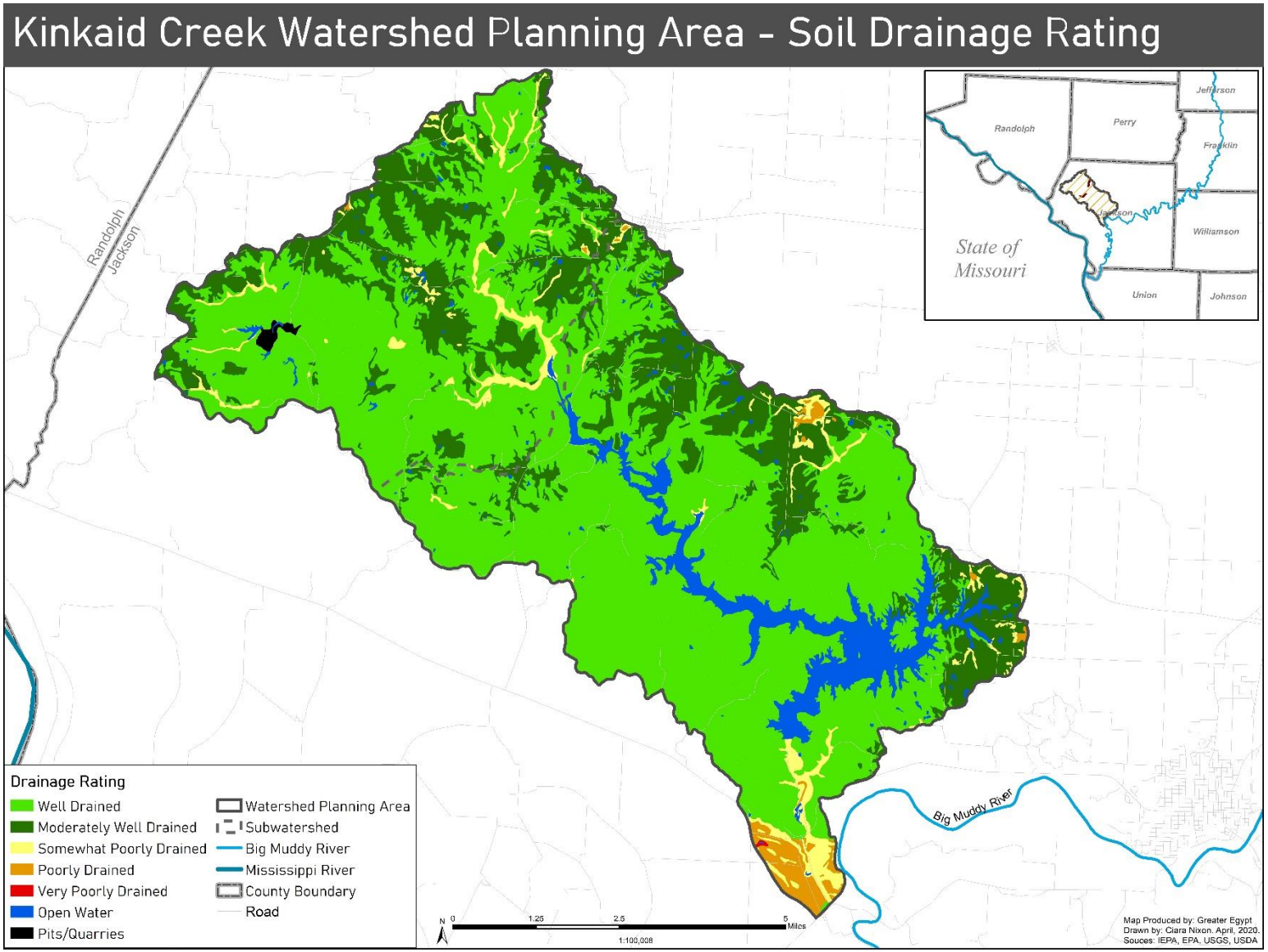
[12] USDA. "Soil Survey Manual." (USDA 1993)

Table 3.3- Drainage Classifications

Drainage Class Rating	Acres	Percent of Planning Area
Well Drained	27,382	66.4%
Moderately Well Drained	9,127	22.1%
Somewhat Poorly Drained	1,520.4	3.7%
Poorly Drained	549.7	1.3%
Very Poorly Drained	7.7	0.0%

Source: USDA NRCS

Figure 3.4


Kinkaid Creek Watershed Planning Area - Soil Drainage Rating
Randolph
Jackson
Perry
Jefferson
Franklin
Williamson
Union
Johnson
State of Missouri
Drainage Rating
Well Drained
Moderately Well Drained
Somewhat Poorly Drained
Poorly Drained
Very Poorly Drained
Open Water
Pits/Quarries
Watershed Planning Area
Subwatershed
Big Muddy River
Mississippi River
County Boundary
Road
Big Muddy River
N
0
1.25
2.5
5
Miles
1:100,008
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April, 2020.
Souces: IEPA, EPA, USGS, USDA

3.5 Generalized Soils Information

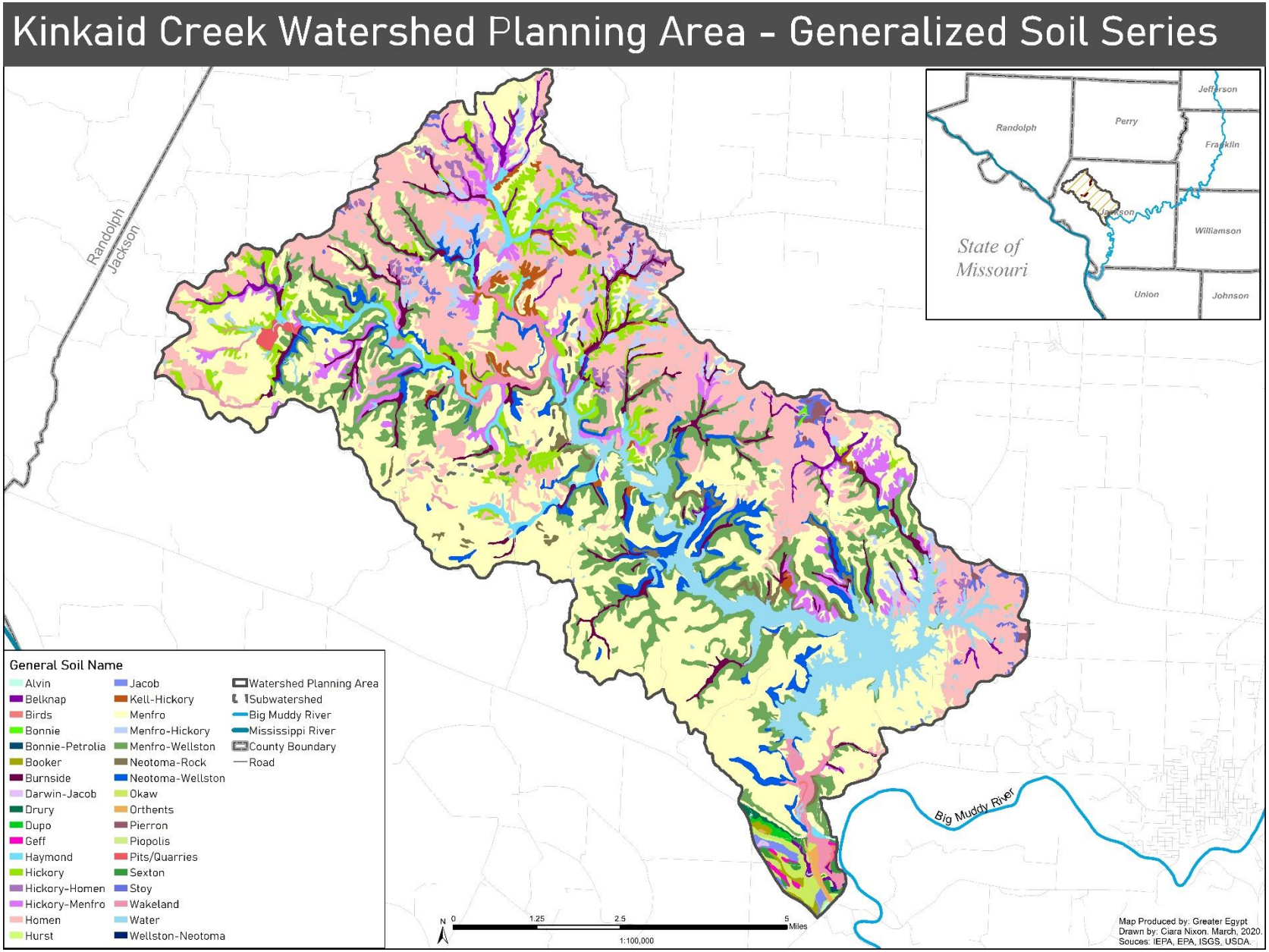
As previously mentioned, the Kinkaid Creek watershed consists of 32 generalized soil series. Generalized soil series are depicted inFigure 3.5. Original data from the Jackson County Web Soil Survey consists of 50 different soil descriptions within the planning area. However, some descriptions have been combined to fall under a general soil name. Detailed information regarding individual soil subset data can be found in Appendix A. More information regarding whole soil descriptions can be found within the Soil Survey of Jackson County, Illinois.

The Menfro soil series cover 14,566.7 acres, or 35.3 percent of the planning area, making this series the most predominant soil within the planning area. This general name consist of seven different discriptions of silt loam soils that range from two to twenty-five percent slopes that differ between having no erosion or being severely eroded. The second predominant soils fall under the Homen series. Homen soils make up 9,130 acres in the area, or 22.1 percent, and consists of four descriptions. Homen soils can consist of silt or silty clay loams, range between two to eighteen percent slopes, and have no or severely eroded areas.

Following the Homen soils, the Menfro-Wellston soils cover 4,856.5 acres within the watershed planning area, or 11.77 percent. This general soil encompasses two descriptions of silt loam soils that range from 18 to 70 percent slopes. Hickory soil series constitute the next largest portion of the planning area, covering 1,637.2 acres, or 3.97 percent, and has two soil descriptions of silt loam soils that range between 18 to 35 percent slopes and differ from having either low or severely eroded areas.

The Hickory-Menfro soil series consist of 1,201.4 acres, or 2.91 percent of the planning area. This general soil has two descriptions, one of silt loams that range between 18 and 35 percent slopes with no erosion level, and a second description of complex soils that range between 18 to 35 percent slopes with severely eroded areas. The Menfro-Hickory soil series covers 807.6 acres, or 1.95 percent of the Kinkaid Creek watershed planning area. This general soil has two soil descriptions. Menfro-Hickory soils are silt loams or complex soils that range between 10 to 18 percent slopes with areas of low or severe erosion.

Figure 3.5


Kinkaid Creek Watershed Planning Area - Generalized Soil Series
Randolph
Jackson
Jefferson
Perry
Franklin
Randolph
Jackson
Williamson
State of Missouri
Union
Johnson
General Soil Name
Alvin
Belknap
Birds
Bonnie
Bonnie-Petrolia
Booker
Burnside
Darwin-Jacob
Drury
Dupo
Geff
Haymond
Hickory
Hickory-Homen
Hickory-Menfro
Homen
Hurst
Jacob
Kell-Hickory
Menfro
Menfro-Hickory
Menfro-Wellston
Neotoma-Rock
Neotoma-Wellston
Okaw
Orthents
Pierron
Piopolis
Pits/Quarries
Sexton
Stoy
Wakeland
Water
Wellston-Neotoma
Watershed Planning Area
Subwatershed
Big Muddy River
Mississippi River
County Boundary
Road
Big Muddy River
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. March, 2020.
Souces: IEPA, EPA, ISGS, USDA.

Following the Menfro-Hickory soils, the Wakeland soil series cover 681.4 acres, or 1.65 percent of the planning area. This general soil has two descriptions. Wakeland soils are silt loams with 0 to 2 percent slopes, that are frequently flooded or occasionally flooded. Haymond series cover 661 acres, or 1.60 percent of the watershed planning area and the general name also consist of two descriptions. Haymond soils are silt loam soils with either 0 to 2 percent slopes that are frequently flooded, or 0 to 3 percent slopes that are occasionally flooded.

The Belknap series cover 391.3 acres, or 0.95 percent of the Kinkaid Creek Watershed Planning Area. The general name has two descriptions of silt loam soils that range between 0 to 2 percent slopes. These frequently, or occassionaly flood. The Stoy series cover 293.6 acres, or 0.71 percent of the planning area. The general name has two descriptions of silt loam soils with 0 to 2 percent slopes, or 0 to 5 percent slopes.

The smallest of the soil series within the watershed planning area that was generalized is the Alvin soil series. This series cover 12.6 acres, or 0.03 percent of the entire planning area. The Alvin soils within the watershed planning area has two soil descriptions of sandy loam soils with either 2 to 5 percent slopes, or 15 to 25 percent slopes that rarely flood.

Each soil series within the Kinkaid Creek watershed that was generalized has the same hydric soils rating, erodibility factor, hydrologic group, and drainage rating.

Table 3.4- Generalized Soil Information

General Soil Series Name	Hydric Y/N	Erodibility K factor	Hydrologic Soil Group	Drainage Rating	Acres	Percent of Watershed
Alvin	No	0.24	A	WD	12.6	0.03%
Belknap	No	0.43	B/D, C	SPD	391.3	0.95%
Birds	Yes	0.43	C/D	PD	21	0.05%
Bonnie	Yes	0.43	C/D	PD	10.4	0.03%
Bonnie and Petrolia	Yes	0.43	C/D	PD	6.5	0.02%
Booker	Yes	0.24	D	PD	69.2	0.16%
Burnside	No	0.43	B/D, C	WD	1,071.5	2.59%
Darwin and Jacob	Yes	0.24	D	VPD	7.7	0.01%
Drury	No	0.43	B/D, C	WD	36	0.08%
Dupo	No	0.55	C/D	SPD	37.8	0.09%
Geff	No	0.43	C/D	SPD	42	0.10%
Haymond	No	0.43	B	WD	661.8	1.60%
Hickory	No	0.32	B	WD	1,637.2	3.97%
Hickory-Homen	No	0.43	B	WD	388.3	0.94%
Hickory-Menfro	No	0.37	B	WD	1,201.4	2.91%
Homen	No	0.43	C	MWD	9,130.7	22.14%
Hurst	No	0.43	D	SPD	12.3	0.03%
Jacob	Yes	0.24	D	PD	75.5	0.18%
Kell-Hickory	No	0.32	C	WD	319.2	0.77%
Menfro	No	0.43	B	WD	14,566.7	35.32%
Menfro-Hickory	No	0.43	B	WD	807.6	1.95%
Menfro-Wellston	No	0.43	B	WD	4,856.5	11.77%
Neotoma-Rock	No	0.15	A	WD	402.7	0.98%
Neotoma-Wellston	No	0.15	A	WD	1,430.4	3.47%
Okaw	Yes	0.49	D	PD	209.8	0.51%
Orthents	No	0.28	D	SPD	62.5	0.20%
Pierron	Yes	0.49	C/D	PD	84	0.20%
Piopolis	Yes	0.37	D	PD	2.5	0.0%
Pits and Quarries	No	-	-	-	77.2	0.19%
Sexton	Yes	0.49	C/D	PD	70.9	0.17%
Stoy	No	0.49	D	SPD	293.6	0.71%
Wakeland	No	0.43	B/D	SPD	681.4	1.65%
Water	-	-	-	-	2,562.9	6.21%
Wellston-Neotoma	No	0.37	B	WD	0.1	0.0%
Totals:					**41,242.25**	**100.0%**

4. Watershed Jurisdictions

The Kinkaid Creek watershed planning area lies within six townships and one municipality. The City of Ava is the only municipality, with 259.2 of its 682.5 acres being within the borders of the planning area, covering just below one percent of the entire planning area.

The six townships that are within the planning area are: Bradley, Degognia, Kinkaid, Levan, Sand Ridge, and small portion of Ora Township. Levan Township constitutes the most area. The township has a total area of 23,507.6 acres; with 14,537.6 acres inside the Kinkaid Lake watershed. This accounts for 35 percent of the total planning area. Kinkaid Township makes up the second largest acreage, with 13,249.1 acres, of its 23,264.6 total acres. This area covers 32.1 percent of the entire planning area. Bradley Township consists of 28,812.50 acres, and 9,460.36 acres are inside the planning area.

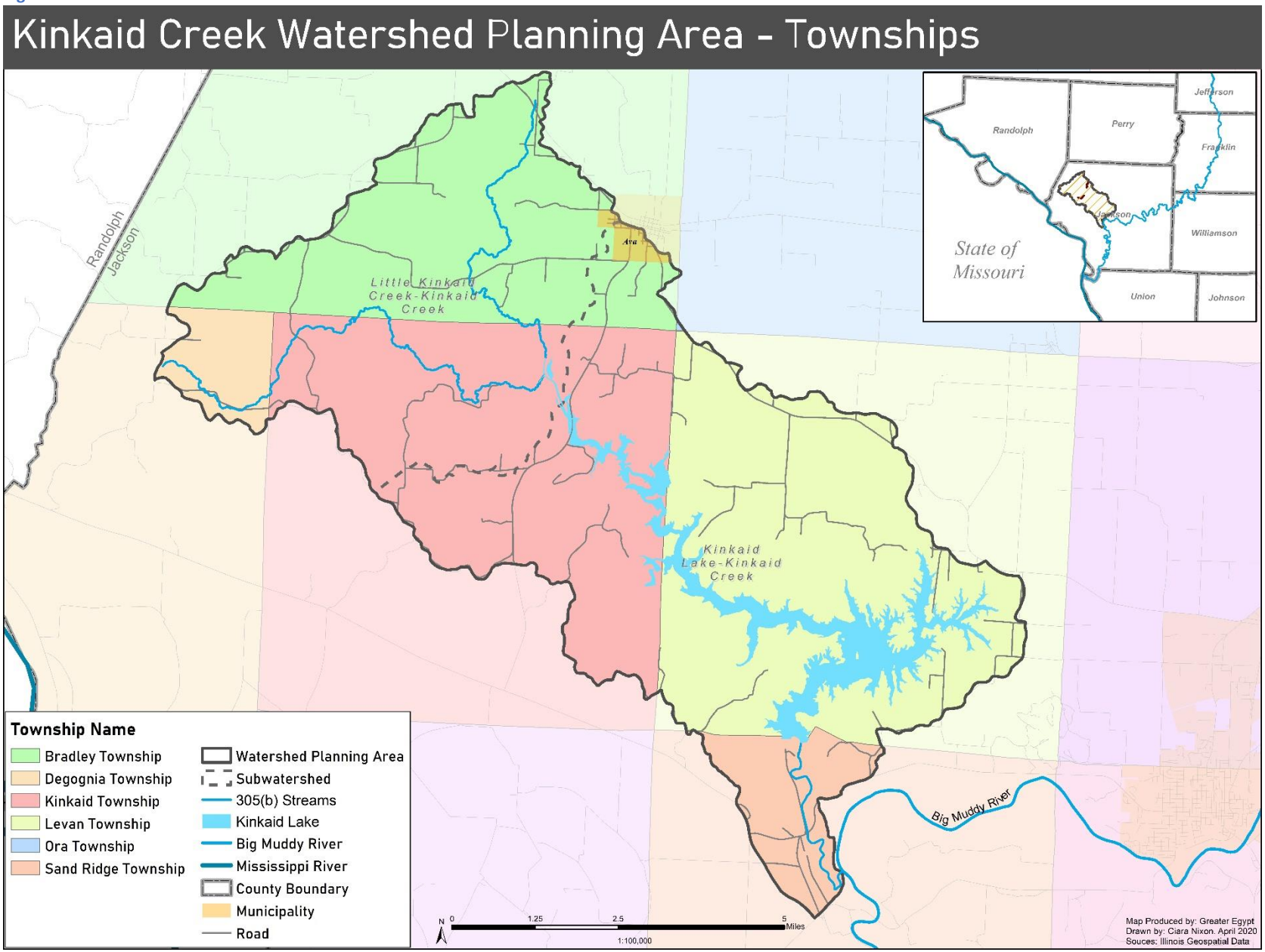
Sand Ridge Township consists of 23,419.4 acres; 2,464.83 acres of which are inside the Kinkaid Creek watershed. Degognia Township has a total acreage of 19,621.8; of which, 1,521.52 acres are within the borders of Kinkaid Creek watershed and make up 3.6 percent of the entire planning area. Ora Township consists of 23,538.9 acres in total, and only 8.7 acres are within the borders. Table 4.1 summarizes the six townships and their size relative to the Kinkaid Creek watershed. The City of Ava (municipality) and Jackson County are also summarized.

Table 4.1 - Jurisdictional Areas

Jurisdiction	Total Acres	Acres in Planning Area	Percent of Planning Area
County			
Jackson	385,280.00	41,225.90	-
Township			
Bradley	28,812.50	9,460.36	22.90
Degognia	19,621.80	1,521.52	3.69
Kinkaid	23,264.60	13,249.10	32.13
Levan	23,507.60	14,537.60	35.24
Ora	23,538.90	8.70	0.02
Sand Ridge	23,419.40	2,464.83	5.97
Municipality			
Ava	682.59	259.22	0.63

Sources: US Census Bureau

Figure 4.1


Kinkaid Creek Watershed Planning Area - Townships
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Ora
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
Township Name
Bradley Township
Degognia Township
Kinkaid Township
Levan Township
Ora Township
Sand Ridge Township
Watershed Planning Area
Subwatershed
305(b) Streams
Kinkaid Lake
Big Muddy River
Mississippi River
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April 2020
Souces: Illinois Geospatial Data

4.1. Municipal Ordinances

County representatives within the state of Illinois adopt municipal ordinances to further protect their residents. Information regarding water related ordinances within the Kinkaid Creek watershed planning area, data was obtained from previous Kinkaid Lake plans and by contacting local agencies in or around the planning area.

In Jackson County, A flood damage prevention ordinance has been adopted. The ordinance includes stormwater and erosion control, laying out requirements needed for participation in the National Flood Insurance Plan (NFIP). This program allows homeowners and businesses to purchase flood insurance, if the community has adopted and enforced ordinances that reduce the potential for flooding.

Jackson County participates in the NFIP; however, Ava is not a listed participant on the Federal Emergency Management Agency Community Status Book Report.[13] The Jackson County Flood Damage Prevention Ordinance outlines the requirements to be followed regarding new and existing developments in the county in order to mitigate and prevent future flood hazards.[14] Jackson County ranks 7th out of 102 counties statewide on a Flood Vulnerability Index (FVI), making it's flood risk amongst the highest in the state.

The City of Ava does not currently have any ordinances related to storm water or flood prevention.

4.2 Local, State and Federal Responsibilities

In the Kinkaid Creek Watershed Planning Area, there are 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 planning area, other agencies have programs designated for these purposes, but have not been established for the planning area.

[13] FEMA, "Federal Emergency Agency Community Status Book Report-Illinois: Communities Participating in the Nation Flood Insurance Program," https://www.fema.gov/cis/IL.html Accessed January, 2020
[14] Jackson County, IL "Flood Damage Prevention Ordinance" Accessed November, 2019

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

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 each particular watershed. Regarding the Kinkaid Creek watershed planning area, Greater Egypt has participated on the Technical Advisory Committee for previous water quality planning initiatives.

Currently, Greater Egypt is working to compile the Western Crab Orchard Creek Watershed-based Plan. This planning area consists of three HUC 12 watersheds that are also part of the larger Big Muddy watershed. Recently, the Western Crab Orchard Creek Watershed- Inventory and Assessment was completed. The inventory and assessment consists of data and other relative information to identify water quality issues in the initial phase of the planning process. The Western Crab Orchard Creek Watershed-based Plan will follow the *Nine Minimum Elements of a Watershed Plan* outlined by the EPA. In doing so, it will recommend best management practices to water quality within the Western Crab Orchard Creek Watershed planning area.

In 1981, the Illinois Environmental Protection Agency established the Volunteer Lake Monitoring Program. This program was established to gather fundamental information on Illinois inland lakes. Greater Egypt coordinates the program for southern Illinois for the ten-county region. Volunteers gather the data on water transparency and water quality.

Illinois Department of Natural Resources (IDNR)

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. [15]

In the Kinkaid Lake Watershed Planning Area, IDNR owns and manages approximately 4,000 acres of surrounding land. The division has assisted with numerous planning and mitigation initiatives that include erosion control measures around Kinkaid Lake.[16]

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. [17]

Illinois Environmental Protection Agency (IEPA)

The IEPA oversees and implements many programs that target watershed planning, water quality, and nonpoint source pollution. Throughout the years, IEPA has assisted with management initiatives in the Kinkaid Creek Watershed Planning Area through the Priority Lake and Implementation Program grant, the Clean Water Act, and the Nonpoint Source Pollution Control Program.

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:

[15] IDNR. "Division of Resource Management," https://www.dnr.illinois.gov/WaterResources/Pages/ResMan.aspx. Accessed 11 August 2015.
[16] IDNR "Kinkaid Lake SFWA" https://www2.illinois.gov/dnr/Parks/Pages/KinkaidLake.aspx
[17] Ibid.

> 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.[18]

Kinkaid Creek Watershed Planning Area has only one outfall location. The Kinkaid-Reed's Creek Conservation District, also known at the Kinkaid Water Plant, holds a permit that is located on the eastern side of Lake Kinkaid. This outfall is summarized in Table 4.2. The NPDES Facility location is also depicted in Figure 4.2.

Table 4.2 – NPDES Outfalls

NPDES Facility Name	NPDES ID
Kinkaid-Reeds Creek Cons. Dist.	ILG640136

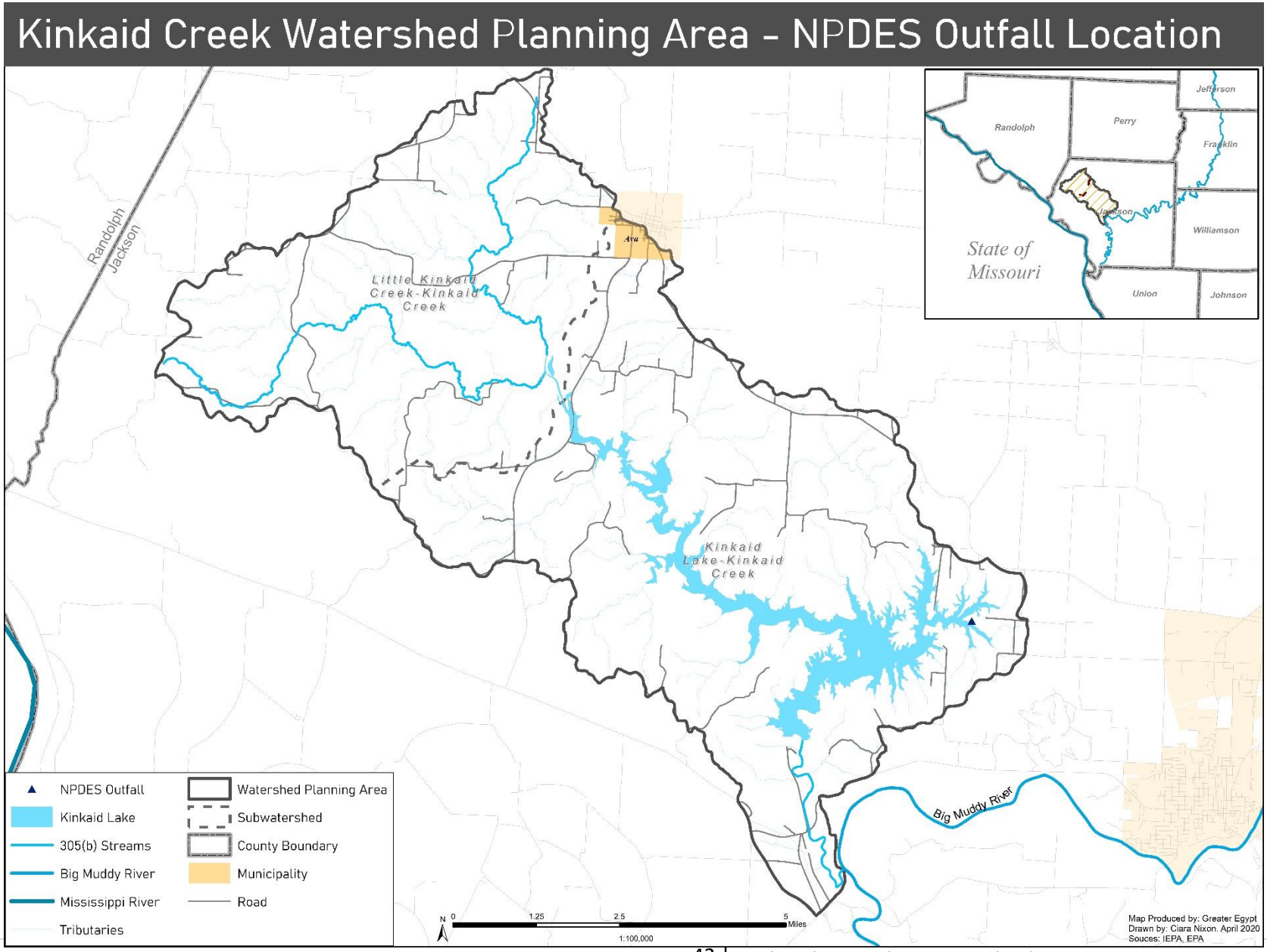
Sources: US EPA

Jackson County Emergency Management Agency (JCEMA)

JCEMA was established to implement programs that work to reduce community vulnerability to natural hazards. The JCEMA oversees creating and implementing mitigation and informational frameworks to prevent or lower the impact of natural hazards, such as flooding. Actions carried out by the agency have made federal flood insurance available for the public while outlining important building codes to reduce flood damage and hazards. The agency also works to improve the water quality in Jackson County by reducing soil erosion and protecting aquatic and riparian habitat. Other goals of the agency are to provide recreational opportunities and aesthetic benefits to enhance the community and economic development.[19]

[18] Scott Ristau, e-mail message to author, September 9, 2015.
[19] "Flood Damage Prevention Ordinance," http://www.jacksoncounty-il.gov/home/showdocument?id=474 Accessed September 2019

Figure 4.2


Kinkaid Creek Watershed Planning Area - NPDES Outfall Location
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Ava
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
NPDES Outfall
Kinkaid Lake
305(b) Streams
Big Muddy River
Mississippi River
Tributaries
Watershed Planning Area
Subwatershed
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April 2020
Souces: IEPA, EPA

Jackson County Health Department (JCHD)

The Jackson County Health Department has provided a variety of public health services to the residents of Jackson County since 1950. One of their main focuses is to protect the environment. The health department has held recycling drop-off services and collaborated with other agencies to form a Climate and Health Plan to help the Jackson County community prepare for the health effects of climate change.[20]

Jackson County Soil and Water Conservation District (JCSWCD)

The Soil and Water Conservation Districts within Jackson County 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. [21] Duties related to water resources include the conservation and restoration of wetlands, the protection of groundwater resources, and the prevention of soil erosion.

In the Kinkaid Creek watershed planning area, JCSWCD assisted with an in-depth study of the watershed to identify and map locations of critical erosive areas and sources of sediment. *"Component 1-6 of a Watershed Plan for Kinkaid Lake"* provides a list of structures that JCSWCD assisted with, both technical and financial.

In previous years, JCSWCD sponsored annual programs and workshops that brought students and the community to learn about watershed management along Kinkaid Lake. These programs were discontinued in the area due to the annual Du Quoin State Conservation Fair.[22]

Kinkaid-Reed's Creek Conservation District (KRCCD)

The Kinkaid-Reed's Creek Conservancy District oversees 300 acres of land around Kinkaid Lake. The District participates in IEPA's Volunteer Lake Monitoring Program, contributing water quality planning and management initiatives within the area.

[20] "Jackson County Health Department," http://www.jchdonline.org/ Accessed September 2019
[21] AISWCD. "Association of Illinois Soil and Water Conservation Districts AISWCD," http://www.aiswcd.org/. Accessed 14 July 2015.
[22] "Components 1-6 of a Watershed Plan for Kinkaid Lake" Accessed December, 2019

Throughout the years, KRCCD has assisted with numerous projects, both financially and technically, to evaluate and mitigate siltation and shoreline erosion along Lake Kinkaid. Efforts include, but are not limited to, mapping out erosive areas, utilizing multiple forms of shoreline stabilization techniques, creating an erosion control demonstration area, hosting lake clean-up days, and even purchasing farmland within the surrounding area that was previously a contributor of silt deposition. KRCCD continues their part in improving the water quality of Kinkaid Lake.

On a day-to-day basis, the District oversees operations for the Kinkaid Marina and Campground, Johnson Creek Recreation Area and Paul Ice Recreation Area, dealing closely with erosion and pollution control within these areas. The District administers permits for camping, horseback riding, and ATV use within designated areas around Kinkaid Lake.

Kinkaid Area Watershed Project (KAWP)

The Kinkaid Area Watershed Project was created in 1998 with a goal solely set on improving the water quality of Lake Kinkaid, specifically by combating siltation. KAWP has previously focused on critical areas that have been significantly altered by degradation, such as the Port of Ava. An inventory on the Kinkaid Watershed was published in November of 2000, "*Components 1-6 of a Watershed Plan for Kinkaid Lake"*, with a large contribution from the Project's Planning Committee.[23] This plan was then followed by a Final Report, published in May of 2003. "*The Upper Kinkaid Lake Watershed Evaluation- Final Report*" includes a full review of the water quality reports of Kinkaid Lake as well as "Alternatives for Reducing Soil erosion and Sediment Delivery to the Lake".[24]

The KAWP contributed largely to these two reports, and continues to work towards these planning initiatives today by participating in water sampling, watershed planning initiatives, such as forming a Planning Committee and hosting informative workshops, and recommending technical and structural management practices, as well as

[23] Ibid. 10
[24] "Upper Kinkaid Lake Watershed Evaluation – Final Report (May 3, 2003)" Accessed December, 2019

contributing to receive funding for these projects. Much of the work done by the KAWP is volunteer contribution.[25]

United States Forest Service- Shawnee National Forest (USFS- SNF)

The U.S. Forest Service (USFS) has worked to sustain forests and grasslands of the nation for 115 years. The USFS provides management for a variety of land types to support multiple land uses, including water quality. Grants through the Service are available to assist with financial needs, while agreements are also provided to assist with technical projects.

The U.S. Forest Service- Shawnee National Forest manages approximately 5,000 acres of land within the Kinkaid Creek Watershed Planning Area. The USFS- SNF manages the Johnson Creek Recreation Area, located along the northwest section of Kinkaid Lake. Areas within the USFA- SNF jurisdiction offer designated picnicking, camping, hiking and swimming areas in and around Kinkaid Lake.[26]

Management initiatives completed by the USFS within the planning area include: maintaining trail systems, thinning tree stands, tree harvesting and replanting, site preparation, and prescribed burns. More recently, the Forest Service has continued surveying Kinkaid Lake for troublesome areas that are contributing siltation in the lake.[27]

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 projects for federal waters. These projects consist of dams, harbor development, flood control, and water

[25] Ibid. 10
[26] Ibid. 4
[27] USDA-NRCS. "Joint Chiefs' Landscape Restoration Partnership-Illinois" https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/initiatives/?cid=nrcseprd1455463 Accessed December, 2019.

storage. Under a collection of policies, the USFWS and the USACE collaborate to conserve the habitats of fish and wildlife during resource development. [28]

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. [29]

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 includes 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 Kinkaid Creek Watershed Planning Area include Murphysboro and Plumfield which are located along the Big Muddy River.[30]

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 that include Rend Lake, located northeast of the Kinkaid Creek Watershed Planning Area.[31]

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.[32]

[28] USFWS. "Water Resource Development- Ecological Services," https://www.fws.gov/ecological-services/energy-development/water.html. Accessed Various Dates 2018.
[29] USFWS. "Ecological Services- Conservation Planning," https://www.fws.gov/ecological-services/about/what-we-do.html. Accessed Various Dates 2018.
[30] USACE. "St. Louis District- Water Management USACE," http://mvs-wc.mvs.usace.army.mil/. Accessed September 2019.
[31] Ibid.

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.[33]

In the past, the NRCS has assisted with mapping the shorelines of Kinkaid Lake to form an erosion inventory for the area and locate sources of sedimentation. Recently, the department has partnered up USDA's Forest Service under the Joint Chief's Landscape Restoration Partnership. This grant provided funding for projects aimed at aiding erosion around Kinkaid Lake.[34] This grant has made possible the most recent siltation study available on the area. Recent studies have continued to prioritize problematic areas in preparation for future planning and management initiatives.

[33]USDA-NRCS. "Technical Assistance," https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/. Accessed May, 2019.
[34] USDA-NRCS. "Joint Chiefs' Landscape Restoration Partnership-Illinois" https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/initiatives/?cid=nrcseprd1455463 Accessed December, 2019.

5. Watershed Demographics

To assess the demographics of the Kinkaid Creek watershed planning area, each entity was individually examined. The planning area lies entirely within Jackson County. There are six townships within the borders of the watershed planning area, and just one municipality. The City of Ava is the only municipality within the planning area, and is located in the northern section of the watershed planning area.

5.1 Population

According to the 2010 Census, the population of Jackson County is 60,218.[35] Less than half, or 37.9 percent of the municipality, is within the border of the planning area. The city of Ava has a population of 654 people based on the 2010 Census.[36] There is a possible margin of error of 154 people within the municipality. The 2010 population counts and the 2018 American Community Survey 5-Year Estimate are depicted in Table 5.1.

Table 5.1- Population Change (2010-2018)

County/Municipality	Population 2010	Population Est. 2018	Population Change	Population Change (%)
County				
Jackson	60,218	58,551	-1,667	-2.8%
Municipality				
Ava	654	602	-52	-7.9%

Source: US Census Bureau

The Illinois Department of Public Health (IDPH) projects the population by state and county in 5-year intervals. Table 5.2 shows the population projection for Jackson County for the years 2015, 2020 and 2025. According to the forecast, Jackson County may see a slight increase in populations until 2025.[37] IDPH and the US Census Bureau estimations differ slightly, due to having slightly different methods of gathering this data. The data

[35] US Census Bureau "Explore Census Data" https://data.census.gov/cedsci/ Accessed March 30, 2020.
[36] Ibid.
[37] IDPH "Population Projections" http://dph.illinois.gov/sites/default/files/publications/population-projections-report-final-2014-041516.pdf Accessed March, 2020.

used in these tables reflect Jackson County as a whole and does not represent the sections only within the Kinkaid Creek Watershed Planning Area.

The 2010 population estimate from IDPH was 60,355 people within Jackson County. The 2010 census counted 60,218 people. IDPH estimated that the county population would increase to 61,025, or by 807 people between 2010 and 2015. The 2020 estimation was 62,031 people, a 1,006 person increase between 2015 and 2020. Between 2020 and 2025, IDPH estimates that the population of Jackson County will increase by 787 people, with a total population of 62,818 people.[38]

Table 5.2- Population Forecast

County	April 1st, 2010 Census	2010 Estimate	2015 Forecast	2020 Forecast	2025 Forecast
Jackson	60,218	60,355	61,025	62,031	62,818

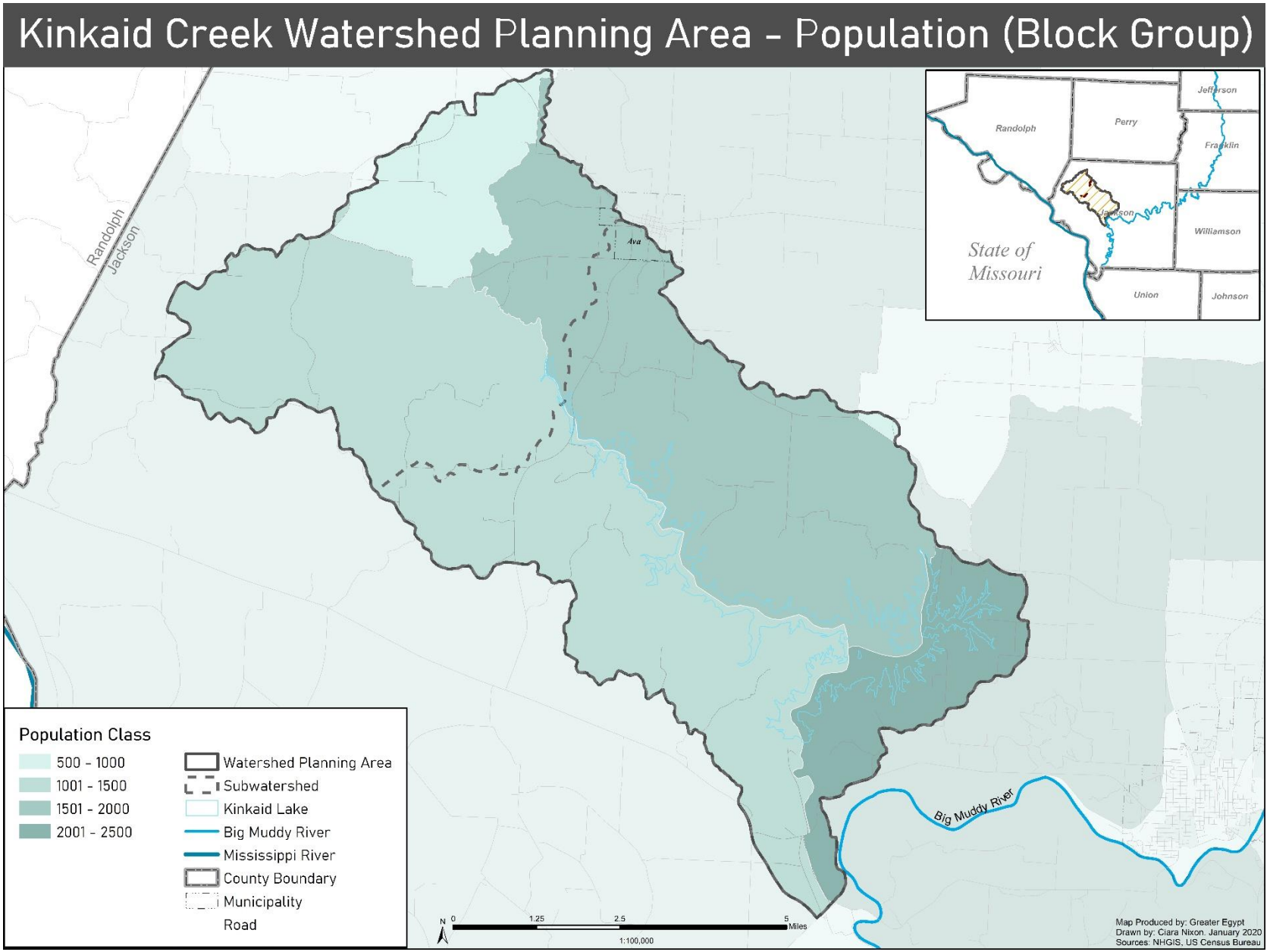
Source: IDPH

Individual Census Block Group data has been analyzed to display the 2010 population and the population growth from the period of 2000 to 2010. Figure 5.1 displays the population in 2010, relative to the census block group.

Block Group 1, Census Tract 104 of Jackson County Illinois had a population of 2,071 people during the 2010 census, making this block group the most populated within the watershed planning area. Block Group 2, Census Tract 101 of Jackson County had a population of 1,723 people in 2010. The 2010 Census counted 1,185 people in Block Group 2, Census Tract 103 of Jackson County. Block Group 3, Census Tract 101 had a count of 964 people during the 2010 census. The smallest populated block group within the Kinkaid Creek Watershed Planning Area is Block Group 1, Census Tract 101 of Jackson County with a count of 852 people during the 2010 census.[39]

[38] Ibid. 3
[39] Ibid. 1

Figure 5.1

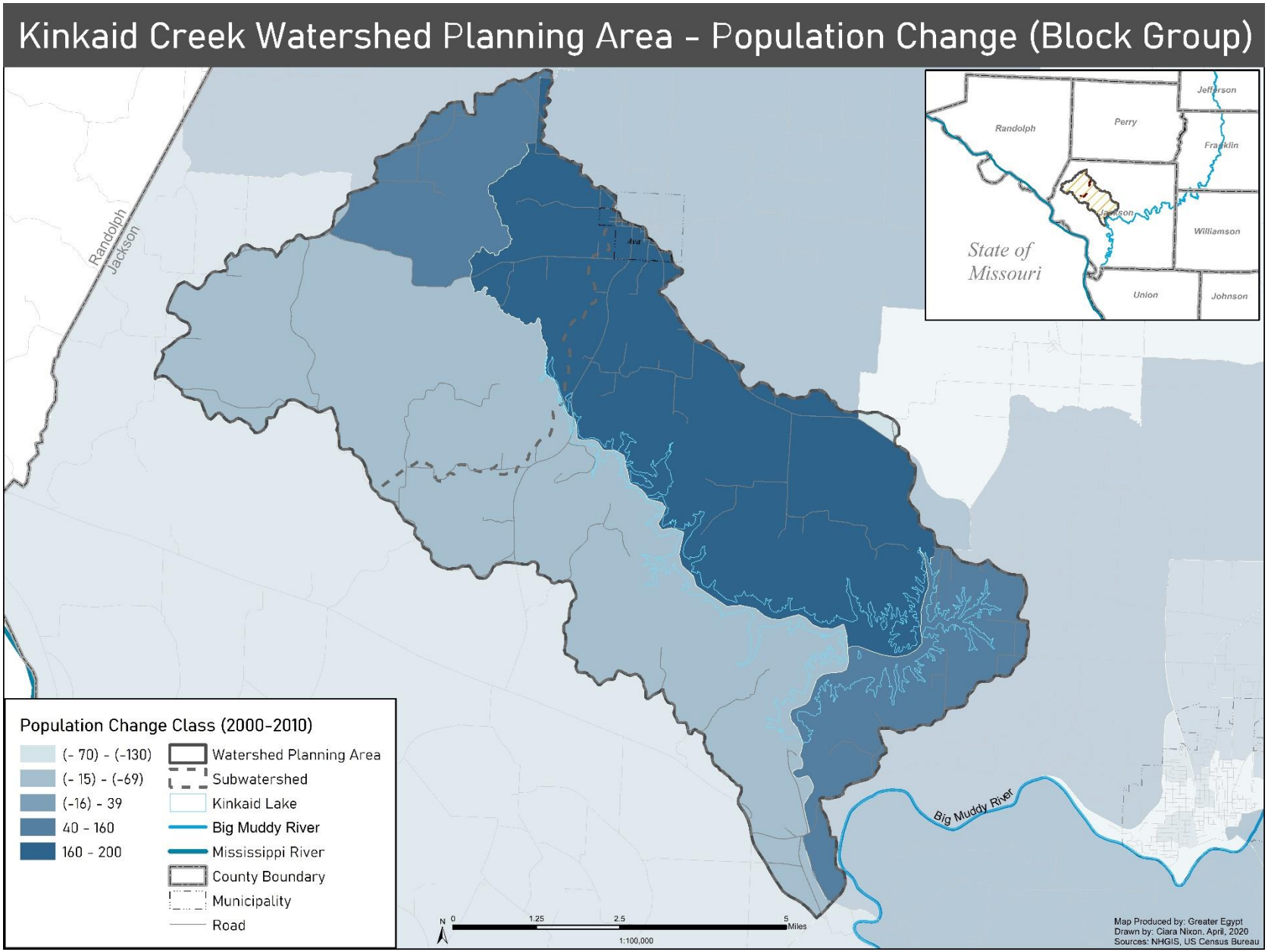

Kinkaid Creek Watershed Planning Area - Population (Block Group)
Randolph
Jackson
Ava
State of Missouri
Jefferson
Perry
Franklin
Williamson
Union
Johnson
Big Muddy River
Population Class
500 - 1000
1001 - 1500
1501 - 2000
2001 - 2500
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
Mississippi River
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. January 2020
Sources: NHGIS, US Census Bureau

Data was also gathered from the 2000 Census to determine the population change between 2000 and 2010. Block Group 1, Census Tract 104 of Jackson County Illinois increased by 95 people, or from a population of 1,976 people in 2000, to a population of 2,071 people in 2010. Block Group 2, Census Tract 101 of Jackson County had a population increase of 185 people, or from 1,538 people to 1,723. The 2000 census counted 1,242 people in Block Group 2, Census Tract 103 of Jackson County, where the population decreased to 1,185, or by 57 people, during the 2010 census. Block Group 3, Census Tract 101 had a population of 1,094 people in 2000, and then the population decreased by 130 people, to a population of 964 during the 2010 census. The smallest populated block group within the Kinkaid Creek Watershed Planning Area is Block Group 1, Census Tract 101 of Jackson County increased by 129 people between the 2000 and 2010 census, going from 723 people to a count of 852 people.[40]

Figure 5.2 displays the population growth by census block group from 2000 to 2010.

[40] Ibid. 1

Figure 5.2


Kinkaid Creek Watershed Planning Area - Population Change (Block Group)
Randolph
Jackson
Ava
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Big Muddy River
Population Change Class (2000-2010)
(- 70) - (-130)
(- 15) - (-69)
(-16) - 39
40 - 160
160 - 200
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
Mississippi River
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April, 2020
Sources: NHGIS, US Census Bureau

5.2 Median Age and Income

Information regarding median age, median income, and income per capita (IPC) for the planning area was also analyzed. The 2018 American Community Survey 5-Year Estimate provides data for the last twelve months and was utilized through the US Census Bureau's data site.

Jackson County has a median age of 31.6, according the 2018 ACS 5-Year Estimate. The median household income of the entire county is $37,802.00. The IPC falls to $24,521.00. The City of Ava has an older estimated median age of 40.3. The 2018 ACS 5-Year Estimate projects that the median household income of the city is higher than the median income of Jackson County, at $43,750.00, The IPC falls just under Jackson County at $23,787.00. Table 5.3 summarizes this data.[41]

Table 5.3- Median Age, Median Household Income, and IPC

Area of Interest	Median Age	Median Household Income	Per Capita Income
County			
Jackson	31.6	$ 37,802.00	$ 24,521.00
Municipality			
Ava	40.3	$ 43,750.00	$ 23,787.00

Source: US Census Bureau

Median age has been analyzed by township. According to US Census Bureau's 2018 ACS 5-Year Estimate, Degognia Township has the oldest median age of 55.5 years. Levan Township follows with a median age of 51.2 years. Kinkaid Township has an estimated median age of 49.7, while Sand Ridge Township follows closely with a median age estimate of 48.6 years. Bradley Township has a median age estimate of 42.5 years. Ora Township's median age estimate is the youngest at 18.3 years.[42]

The median income has also been analyzed using the 2018 ACS 5-Year Estimate. Degognia Township is the highest median income of $90,000.00 per year. Levan Township follows closely with a median income estimate of $89,911.00 per year. Ora Township and Bradley Township have a similar median income estimate of $54,375.00

[41] Ibid. 1
[42] Ibid. 1

and $51,447.00 per year, respectively. Kinkaid Township has an estimated median income of $43,971.00 per year. Sand Ridge Township has the lowest estimated median income of $30,052.00 per year.[43]

The table below summarizes the median age and income by township, while the following maps depict this data.

Table 5.4- 2018 5-Year Estimate for Median Age and Median Income by Township

Township	2018 5-Year Median Age Estimate	2018 5-Year Median Household Income Estimate
Bradley	42.5	$51,447
Degognia	55.5	$90,000
Kinkaid	49.7	$43,971
Levan	51.2	$89,911
Ora	18.3	$54,375
Sand Ridge	48.6	$30,052

Source: US Census Bureau

[43] Ibid. 1

Figure 5.3

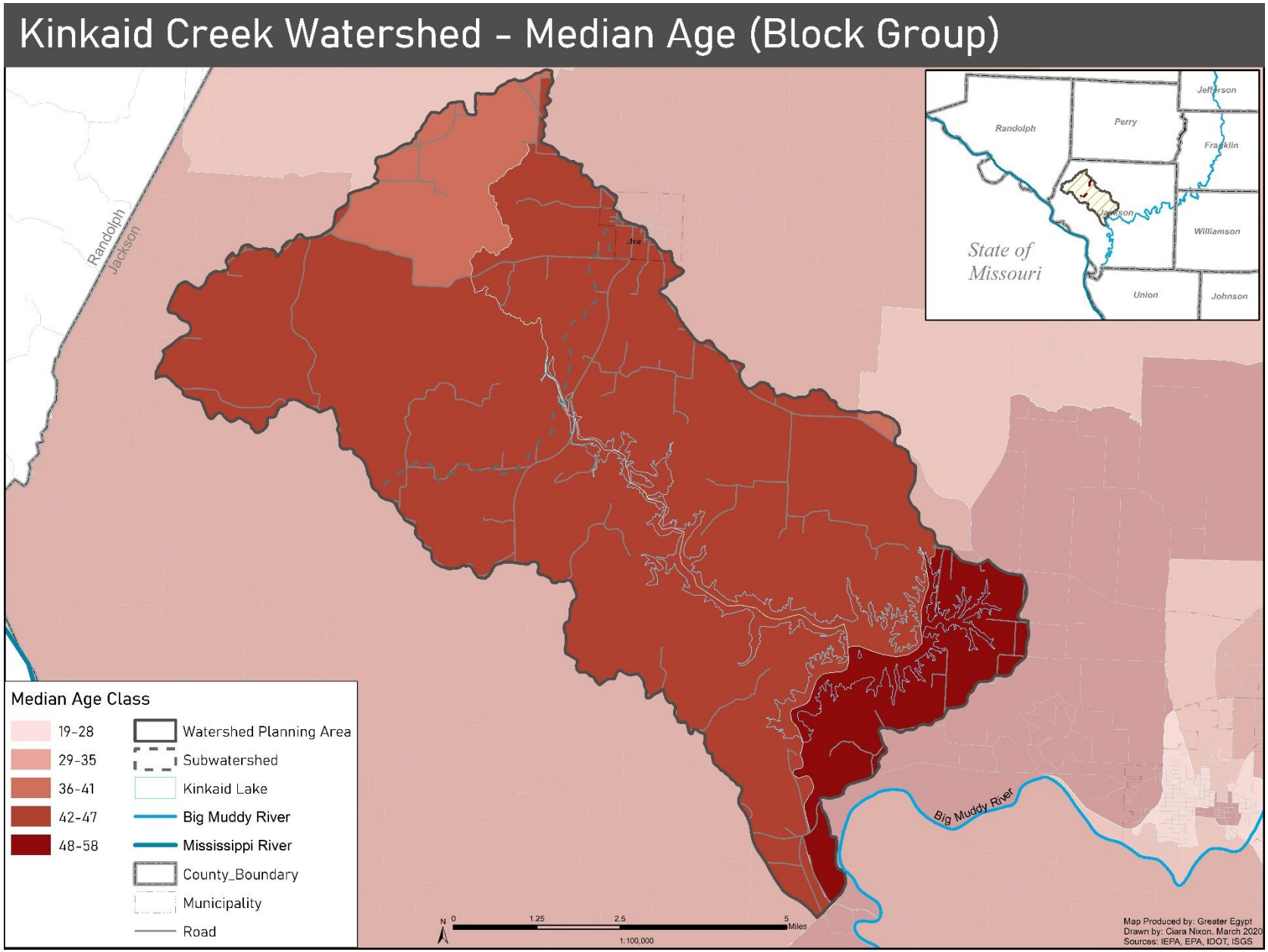
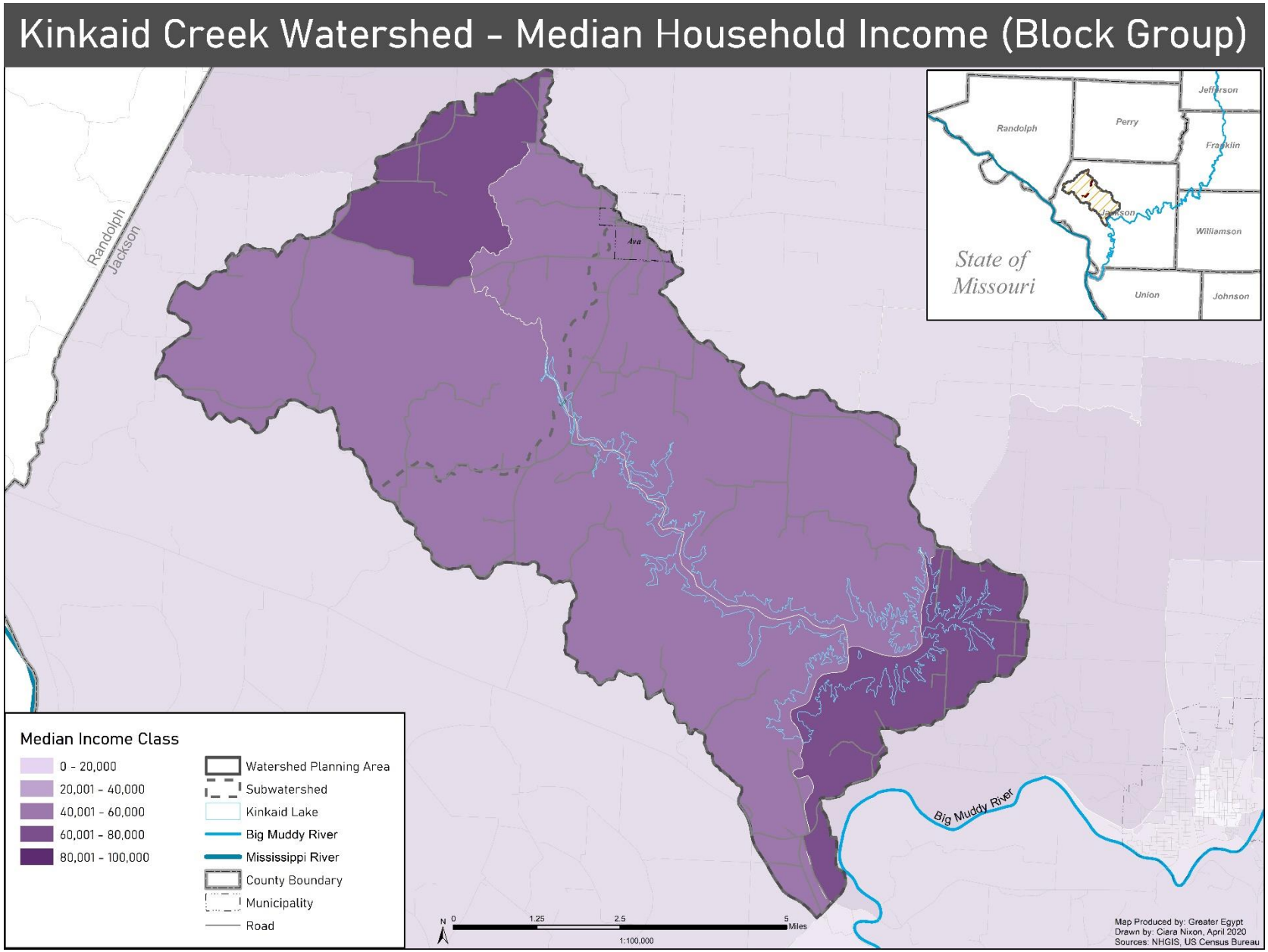

Kinkaid Creek Watershed - Median Age (Block Group)
Randolph
Jackson
Perry
Jefferson
Franklin
Williamson
Union
Johnson
State of Missouri
Big Muddy River
Median Age Class
19-28
29-35
36-41
42-47
48-58
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
Mississippi River
County_Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon, March 2020
Sources: IEPA, EPA, IDOT, ISGS

Figure 5.4


Kinkaid Creek Watershed - Median Household Income (Block Group)
Randolph
Jackson
Ava
Jefferson
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Median Income Class
0 - 20,000
20,001 - 40,000
40,001 - 60,000
60,001 - 80,000
80,001 - 100,000
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
Mississippi River
County Boundary
Municipality
Road
Big Muddy River
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon, April 2020
Sources: NHGIS, US Census Bureau

5.3 Employment

In January 2020, Illinois Department of Employment Security's Unemployment Rate was at 3.5 percent rate for Jackson County. This is compared to the 3.5 percent rate for the state of Illinois, and 3.6 percent rate for the United States.[44]

JobsEQ database was used to gather employment information for Jackson County. In 2019, the county had a total of 26,766 employed persons between 22 occupations. That is 1,181 more employed persons than in 2018, when only 25,585 people were employed between 23 jobs. The top three occupations that employ the most people are: Office and Administrative Support, employing 3,752 people, Education, Training and Library, which employs 3,249 people, and Food Preparation and Serving Related occupations, which employ 2,597 people. The top three jobs in regards to annual salary are: Management, with an average annual salary of $76,600, Architect and Engineering, which only employs 234 people with an annual salary of $75,200, Healthcare Practitioners and Technical occupations come in third with an annual salary of $74,700. Employment information for Jackson County, IL has also been provided in Table 5.5.

The City of Ava, with a population of just over 600, does not meet JobsEQ population minimum to form a complete occupation review.

[44] Illinois Department of Employment Security "Illinois Unemployment Rate by County," Accessed March 31, 2020

Table 5.5- Jackson County Employment Information

Title	Number of Employees	Average Annual Salary	Location Quotient	Unemployment Numbers	Unemployment Rate
Office and Administrative Support	3,752	$34,100	0.98	145	4.20%
Education, Training, and Library	3,249	$56,600	2.17	135	3.80%
Food Preparation and Serving Related	2,597	$23,900	1.13	151	6.70%
Sales and Related	2,514	$30,300	0.96	131	5.60%
Healthcare Practitioners and Technical	2,184	$74,700	1.42	37	1.70%
Management	1,864	$76,600	1.12	40	2.00%
Transportation and Material Moving	1,313	$36,200	0.7	56	4.80%
Construction and Extraction	1,105	$57,500	0.9	42	4.80%
Business and Financial Operations	1,088	$62,800	0.77	41	3.30%
Installation, Maintenance, and Repair	916	$42,800	0.89	17	2.40%
Healthcare Support	900	$29,500	1.22	27	3.40%
Production	843	$36,200	0.53	28	3.80%
Building and Grounds Cleaning and Maintenance	768	$31,200	0.83	37	5.40%
Personal Care and Service	750	$27,600	0.64	34	4.90%
Protective Service	581	$46,700	1.01	17	2.90%
Computer and Mathematical	565	$64,700	0.72	18	2.90%
Community and Social Service	549	$41,200	1.21	19	2.40%
Arts, Design, Entertainment, Sports, and Media	377	$50,100	0.78	19	4.60%
Life, Physical, and Social Science	330	$53,800	1.55	10	3.10%
Architecture and Engineering	234	$75,200	0.51	6	2.20%
Legal	172	$72,900	0.78	2	1.30%
Farming, Fishing, and Forestry	116	$27,200	0.68	7	7.60%
Total - All Occupations	**26,766**	**$46,100**	**1**	**1,018**	**3.90%**

Source: JobsEQ

6. 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, as well as USDA's 2019 National Agricultural Statistics Service CropScape for the agricultural portion of the review.

6.1 Existing Land Use

The largest land use category in the Kinkaid Creek planning area is forest. This category consists of three distinct classifications including deciduous, evergreen, and mixed forest, which in total span 25,278 acres, or 61.3 percent of the watershed. Deciduous forest has the largest land area of 23,796 acres, or 57.7 percent of the watershed. The breakdown of classifications is available in Table 6.1. Definitions for these land type classifications can be found in Appendix C.

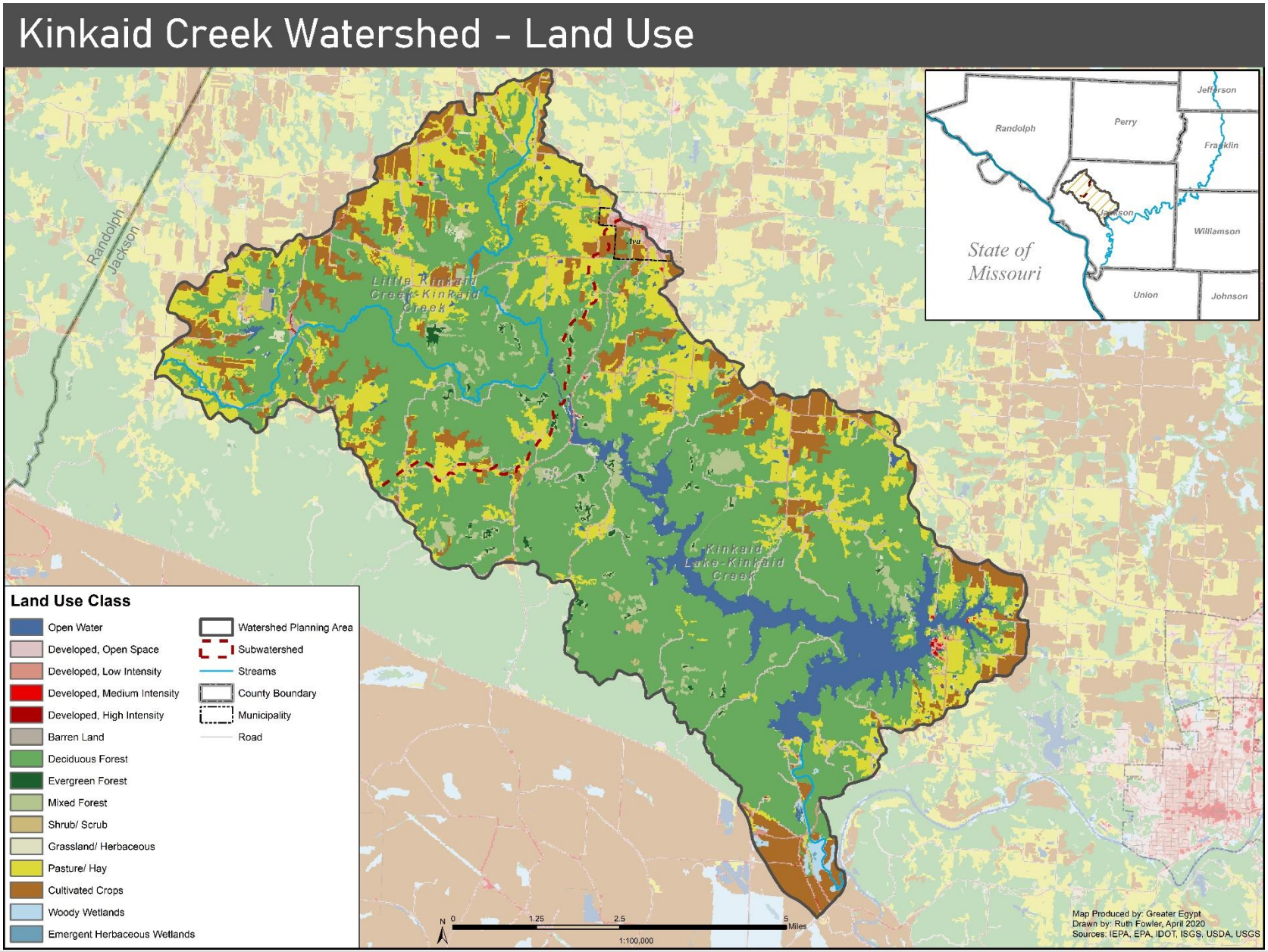
The remaining land uses in the watershed are: developed areas (4 percent), open water (6.1 percent), barren land (0.19 percent), grassland/herbaceous (0.38 percent), pasture/hay (17.6 percent), cultivated crops (9.8), and wetlands (0.38 percent).

Table 6.1- Land Use Classification for Kinkaid Creek Watershed

Classification	Acreage	Percent of Watershed
Open Water	2,500.7	6.1%
Developed, Open Space	1,075.0	2.6%
Developed, Low Intensity	576.9	1.4%
Developed, Medium Intensity	33.4	<1%
Developed, High Intensity	5.3	<1%
Barren Land	77.6	<1%
Deciduous Forest	23,795.8	57.7%
Evergreen Forest	164.3	<1%
Mixed Forest	1,318.1	3.2%
Shrub/Scrub	61.6	<1%
Grassland/ Herbaceous	155.0	<1%
Pasture/ Hay	7,258.4	17.6%
Cultivated Crops	4,047.1	9.8%
Woody Wetlands	140.8	<1%
Emergent Herbaceous Wetlands	16.0	<1%

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

Figure 6.1


Kinkaid Creek Watershed - Land Use
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
L. Kinkaid Lake-Kinkaid Creek
Jefferson
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Land Use Class
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/ Scrub
Grassland/ Herbaceous
Pasture/ Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
Watershed Planning Area
Subwatershed
Streams
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, April 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

According to the NRCS Soil Survey of Jackson County, "the main concerns affecting the management of cropland in Jackson 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."[45]

Along with problems affecting cropland, there are also concerns regarding pastureland. These concerns are, "low fertility, low pH, water erosion, and wetness. Additional management concerns include equipment limitations, excessive permeability, flooding, frost heave, high pH, limited available water capacity, ponding, poor tilth, root-restrictive layers, and wind erosion."[46]

According to the 2017 Census of Agriculture (USDA), farming in Jackson County consists mainly of soybeans, corn, wheat, forage-land used for all haulage, and sorghum for grain. Farmers in Jackson County are predominately middle-aged white males. [47]

Cultivation within the Kinkaid Creek planning area follows a very similar pattern. Based on the USDA's National Agriculture Statistics Service CropScape [48], the planning area contains approximately 5,704 acres of agricultural land. Table 6.2 displays the types of cultivation found within the planning area. Figure 6.2 shows the location of the various crops. Accounting for about 2,335 acres, soybeans are the largest form of cultivation. Corn is also heavily cultivated at about 1,887 acres.

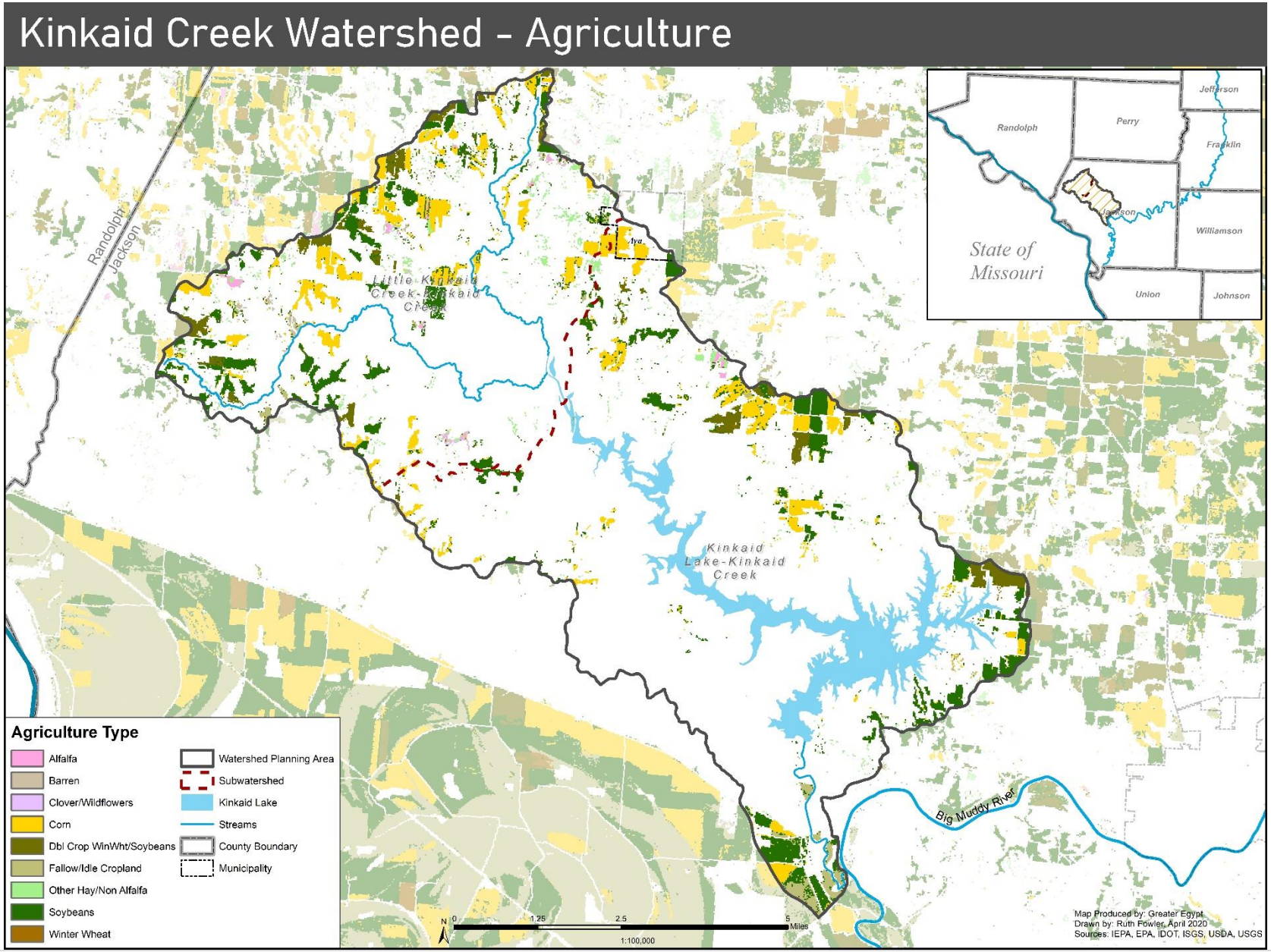
Table 6.2- Agricultural Diversity in Watershed Planning Area

Agricultural Classification	Acreage	Percent of Agriculture	Percent of Watershed
Corn	1,887.7	33.1%	4.58%
Soybeans	2,335.4	40.9%	5.66%
Winter Wheat	20.2	<1%	0.05%
Dbl Crop WinWht/Soybeans	668.3	11.7%	1.62%
Alfalfa	88.3	1.5%	0.21%
Other Hay/Non Alfalfa	346.3	6.1%	0.84%
Clover/Wildflowers	12.0	<1%	0.03%
Fallow/ Idle Cropland	299.3	5.2%	0.73%
Barren	46.7	<1%	0.11%

Source: USDA CropScape

[45] USDA NRCS. "Soil Survey of Jackson County, Illinois," Published Soil Surveys for Illinois, 2009, 146
[46] Ibid., 149.
[47] Census of Agriculture. "2017 Census Publications," USDA, 2017, 1-2.
[48] *CropScape* (2019). USDA. National Agricultural Statistics Service, 2019.

Figure 6.2


Kinkaid Creek Watershed - Agriculture
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
Agriculture Type
Alfalfa
Barren
Clover/Wildflowers
Corn
Dbl Crop WinWht/Soybeans
Fallow/Idle Cropland
Other Hay/Non Alfalfa
Soybeans
Winter Wheat
Watershed Planning Area
Subwatershed
Kinkaid Lake
Streams
County Boundary
Municipality
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, April 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

6.2 Projected Future Land Use

To estimate the future land cover for the Kinkaid Creek planning area, land cover from past datasets have been analyzed. Land cover datasets from 2006 and 2016 were used to compare past changes in land use.

The USGS Multi-Resolution Land Characteristics Consortium (MRLC) has land use data for the year 2008, 2011, and 2013, but for the purpose of this analysis, the period from 2006 to 2016 gives the most accurate representation of current land use change within the watershed. Table 1 displays the acreage and percent of watershed of each land use classification for 2006 and 2016.

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

Assuming development in the area will remain constant, the raw change from 2006 to 2016 was used to calculate the 2026 predicted acreage and predicted percent change of each classification. The most notable change in the watershed involves the increase of cultivated crops and decrease in pastureland. Cultivated crops are projected to increase by 356.7 acres, or 9.7 percent, whilst pastureland is projected to decrease by 441 acres, or 5.7 percent.

Table 6.3- Past and Projected Land Cover for the Planning Area

Land Use Classification	Kinkaid Creek Watershed Planning Area							
	2006		2016		2006-2016		2016-2026	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acreage)	Percent Change	Projected Acreage (2026)	Projected Percent Change
Open Water	2,464.2	6.0%	2,500.7	6.1%	36.5	1.5%	2,537.2	1.5%
Developed, Open Space	1,075.2	2.6%	1,075.0	2.6%	-0.2	0.0%	1,074.8	0.0%
Developed, Low Intensity	577.1	1.4%	576.9	1.4%	-0.2	0.0%	576.6	0.0%
Developed, Medium Intensity	33.6	<1%	33.4	<1%	-0.2	-0.7%	33.1	-0.7%
Developed, High Intensity	4.7	<1%	5.3	<1%	0.7	14.3%	6.0	12.5%
Barren Land	78.1	<1%	77.6	<1%	-0.4	-0.6%	77.2	-0.6%
Deciduous Forest	23,803.6	57.7%	23,795.8	57.7%	-7.8	0.0%	23,788.0	0.0%
Evergreen Forest	143.0	<1%	164.3	<1%	21.3	14.9%	185.7	13.0%
Mixed Forest	1,316.5	3.2%	1,318.1	3.2%	1.6	0.1%	1,319.6	0.1%
Shrub/Scrub	47.6	<1%	61.6	<1%	14.0	29.4%	75.6	22.7%
Grassland/ Herbaceous	134.3	<1%	155.0	<1%	20.7	15.4%	175.7	13.3%
Pasture/ Hay	7,699.1	18.7%	7,258.4	17.6%	-440.7	-5.7%	6,817.6	-6.1%
Cultivated Crops	3,690.4	9.0%	4,047.1	9.8%	356.7	9.7%	4,403.8	8.8%
Woody Wetlands	141.0	<1%	140.8	<1%	-0.2	-0.2%	140.5	-0.2%
Emergent Herbaceous Wetlands	17.6	<1%	16.0	<1%	-1.6	-8.9%	14.5	-9.7%

Source: USGS MRLC

6.3 Existing and Projected Imperviousness

As a whole, the Kinkaid Creek planning area has an extremely low level of imperviousness with 96 percent of the total land area being categorized as zero percent impervious. Imperviousness has been characterized by acreage and percent of the planning area by intervals of ten percent (See Table 6.4). These intervals have also been depicted spatially in Figure 6.3. As stated previously, 39,535 acres, or 96 percent, consists of non-existing impervious cover. This is a major contrast to the amount land characterized as 90-100 percent impervious, which is less than an acre. The more impervious locations in the Kinkaid Creek planning area occur near the town of Ava.

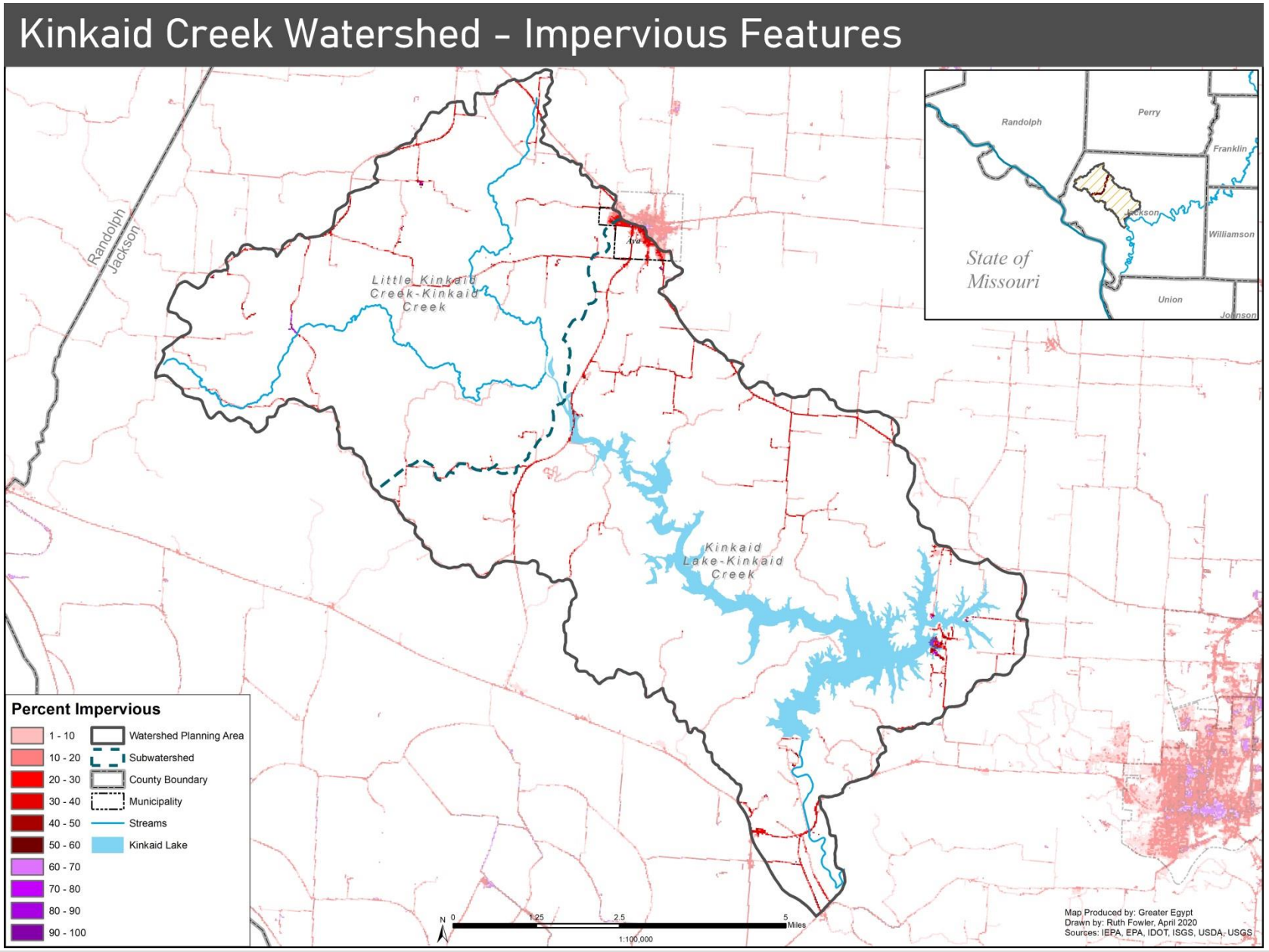
Following the same method to predict future land use, impervious land cover from past and existing datasets was analyzed. Impervious land cover from the 2006 and 2016 datasets were utilized to compare past and present variations in imperiousness. Table 6.4 also displays the predicted percent of change and acreage to the year 2026. Levels of imperviousness are projected to minimally change by 2026. Projected change will not be noticeable, as no change in imperviousness is projected to be greater than an acre.

Table 6.4- Existing and Projected Imperviousness in the Watershed Planning Area

Percent Imperviousness	Kinkaid Creek Watershed							
	2006		2016		2006-2016		2016-2026	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acres)	Percent Change	Projected Acreage (2026)	Projected Percent Change
0%	39,535.4	95.9%	39,535.4	95.9%	0.0	0.0%	39,535.4	0.0%
0-10%	763.4	1.9%	763.2	1.9%	-0.2	0.0%	763.0	0.0%
10-20%	353.4	<1%	353.4	<1%	0.0	0.0%	353.4	0.0%
20-30%	350.5	<1%	350.5	<1%	0.0	0.0%	350.5	0.0%
30-40%	149.9	<1%	149.4	<1%	-0.4	-0.3%	149.0	-0.3%
40-50%	37.4	<1%	37.6	<1%	0.2	0.6%	37.8	0.6%
50-60%	16.7	<1%	16.5	<1%	-0.2	-1.3%	16.2	-1.4%
60-70%	9.1	<1%	9.1	<1%	0.0	0.0%	9.1	0.0%
70-80%	6.0	<1%	6.2	<1%	0.2	3.7%	6.4	3.6%
80-90%	3.8	<1%	4.0	<1%	0.2	5.9%	4.2	5.6%
90-100%	0.4	<1%	0.7	<1%	0.2	50.0%	0.9	33.3%

Source: USGS MRLC

Figure 6.3


Kinkaid Creek Watershed – Impervious Features
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Percent Impervious
1 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Watershed Planning Area
Subwatershed
County Boundary
Municipality
Streams
Kinkaid Lake
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, April 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

6.4 Existing and Projected Land Use of the Subwatersheds (HUC 12)

6.4.1 Little Kinkaid Creek- Kinkaid Creek Subwatershed (071401061101)

Land use has been further analyzed by HUC 12 subwatershed. Table 6.5 displays past, present, and projected land use cover by classification. The projected land cover values are based on the change from 2006 to 2016. Table 6.5 displays the 2026 predicted values and percent change in land use in Little Kinkaid Creek- Kinkaid Creek subwatershed. Figure 6.4 displays the name and location of the SMUs geographically.

The most prevalent land use classifications in Kinkaid Creek subwatershed are forest and agriculture. Forested land accounts for almost fifty-five percent of the subwatershed and agriculture (includes pasture/hay and cultivated crops) accounts for nearly thirty-seven percent of land cover.

Forested land is most abundant in Middle Kinkaid Creek SMU and Upper Kinkaid Creek SMU. This is largely due to the presence of the Shawnee National Forest in the southern portion of Kinkaid Creek subwatershed. Agriculture land is most abundant in Upper Kinkaid Creek SMU and Upper Little Kinkaid Creek SMU, especially near the perimeter of the watershed boundary. Further analysis of each SMU can be found in Appendix B.

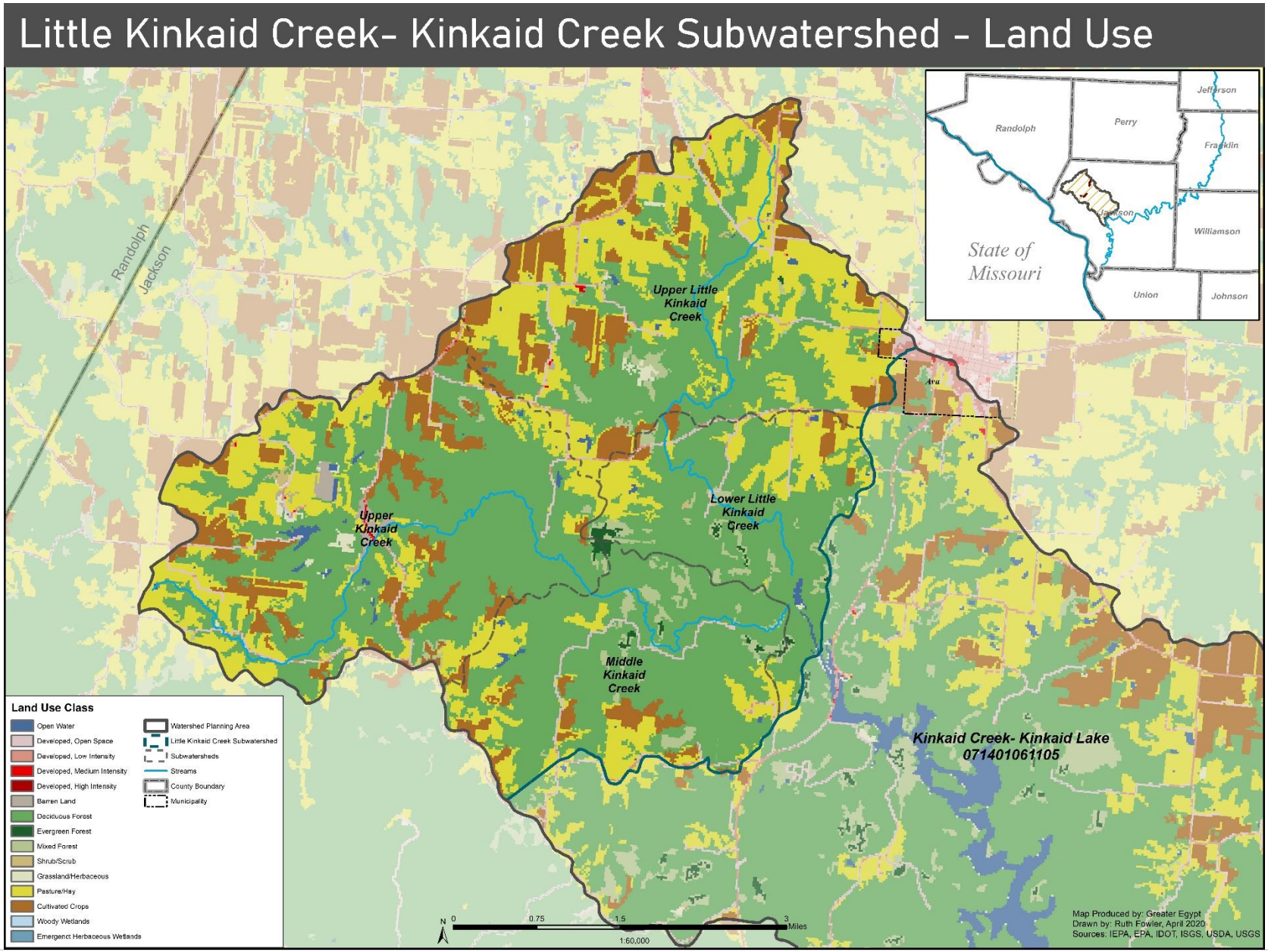
Little Kinkaid Creek subwatershed is projected to experience low levels of change throughout the subwatershed. The largest land use changes will occur among agriculture land use. Pasture/Hay is projected to decrease by almost four percent, or 153 acres, while cultivated crops are projected to increase by seven percent, or 126 acres. The largest change by SMU is projected to take place in Upper Kinkaid Creek SMU. Pasture/Hay is projected to decrease by almost 70 acres, while cultivated crops are projected to increase by nearly 50 acres.

Table 6.5- Existing and Projected Subwatershed Land Use

Land Use Classification	Little Kinkaid Creek-Kinkaid Creek Subwatershed							
	2006		2016		2006-2016		2016-2026	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acreage)	Percent Change	Projected Acreage (2026)	Projected Percent Change
Open Water	90.07	0.58%	100.52	0.65%	10.45	11.60%	110.98	10.40%
Developed, Open Space	369.40	2.38%	369.41	2.38%	0.00	0.00%	369.41	0.00%
Developed, Low Intensity	171.47	1.10%	171.47	1.10%	0.00	0.00%	171.47	0.00%
Developed, Medium Intensity	10.23	0.07%	10.23	0.07%	0.00	0.00%	10.23	0.00%
Developed, High Intensity	1.78	0.01%	1.78	0.01%	0.00	0.00%	1.78	0.00%
Barren Land	77.17	0.50%	76.51	0.49%	-0.67	-0.86%	75.84	-0.87%
Deciduous Forest	8,481.41	54.62%	8,480.29	54.62%	-1.12	-0.01%	8,479.17	-0.01%
Evergreen Forest	55.82	0.36%	55.82	0.36%	0.00	0.00%	55.82	0.00%
Mixed Forest	383.19	2.47%	383.86	2.47%	0.67	0.17%	384.53	0.17%
Shrub/Scrub	15.12	0.10%	18.68	0.12%	3.56	23.53%	22.24	19.05%
Grassland/ Herbaceous	55.82	0.36%	69.39	0.45%	13.57	24.30%	82.95	19.55%
Pasture/ Hay	4,114.60	26.50%	3,961.81	25.52%	-152.79	-3.71%	3,809.02	-3.86%
Cultivated Crops	1,700.24	10.95%	1,826.57	11.76%	126.33	7.43%	1,952.90	6.92%
Woody Wetlands	0.22	0.00%	0.22	0.00%	0.00	0.00%	0.22	0.00%
Emergent Herbaceous Wetlands	0.44	0.00%	0.44	0.00%	0.00	0.00%	0.44	0.00%

Source: USGS MRLC

Figure 6.4


Little Kinkaid Creek- Kinkaid Creek Subwatershed - Land Use
Randolph
Jackson
Upper Little Kinkaid Creek
Upper Kinkaid Creek
Lower Little Kinkaid Creek
Middle Kinkaid Creek
Kinkaid Creek- Kinkaid Lake 071401061105
Ava
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Land Use Class
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergenct Herbaceous Wetlands
Watershed Planning Area
Little Kinkaid Creek Subwatershed
Subwatersheds
Streams
County Boundary
Municipality
N
0
0.75
1.5
3
Miles
1:60,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, April 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

6.4.2 Kinkaid Lake- Kinkaid Creek Subwatershed (071401061102)

Table 6.6 displays past, present, and projected land use cover by classification. The projected land cover values are based on the change from 2006 to 2016. Table 6.6 also displays the 2026 predicted values and percent change in land use in Kinkaid Lake-Kinkaid Creek subwatershed. Figure 6.5 displays the name and location of the SMUs geographically.

The most prevalent land use classifications in Kinkaid Creek subwatershed are forest, agriculture, and open water. Forested land accounts for almost sixty- four percent of the subwatershed and agriculture (includes pasture/hay and cultivated crops) accounts for nearly twenty-two percent of land cover. Open water covers over nine percent of the subwatershed due to the presence of Kinkaid Lake. The majority of Kinkaid Lake is within the boundaries of Kinkaid Lake subwatershed.

Forested land is most abundant in Johnson Creek, Larger Shawnee, Kinkaid Lake-Central Channel, and Kinkaid Lake- Central Body SMU. This is largely due to the presence of the Shawnee National Forest in the southern portion of Kinkaid Lake subwatershed. Agriculture land is concentrated more in the northern portion of the subwatershed and is most abundant in Sharp Rock, Lone Oak, and Campground SMU. Further analysis of each SMU can be found in Appendix B.

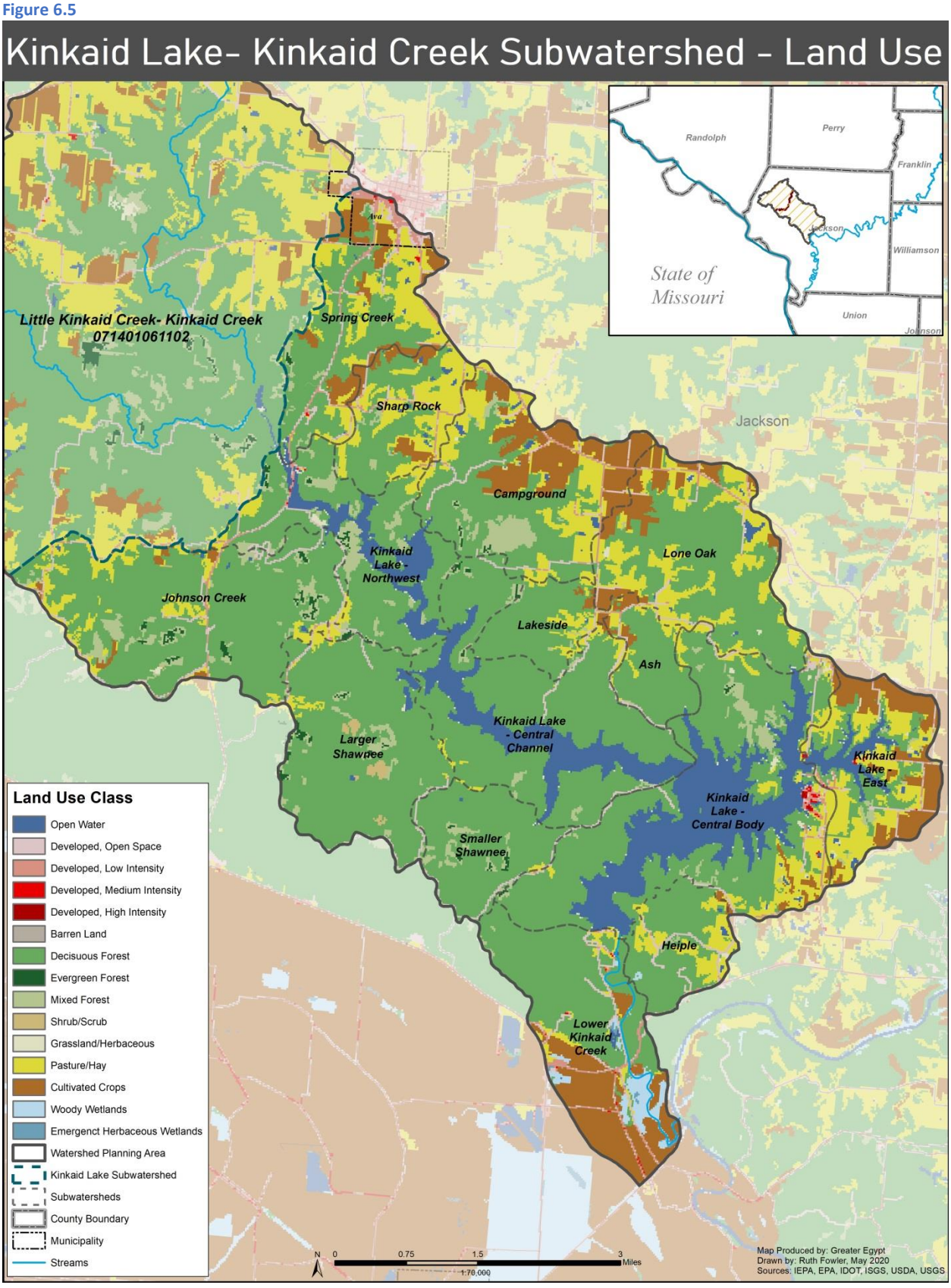
Kinkaid Lake subwatershed is projected to experience low levels of change throughout the subwatershed. Like Kinkaid Creek subwatershed, the largest land use changes will occur among agricultural land use. Pasture/Hay is projected to decrease by around 288 acres, or eight percent, while cultivated crops are projected to increase by around 230 acres, or a change of twelve percent. The largest change by SMU is projected to take place in Campground and Lone Oak SMU.

Table 6.6- Existing and Projected Subwatershed Land Use

Land Cover Classification	Kinkaid Lake- Kinkaid Creek Watershed							
	2006		2016		2006-2016		2016-2026	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acreage)	Percent Change	Projected Acreage (2026)	Projected Percent Change
Open Water	2,374.05	9.24%	2,400.06	9.34%	26.01	1.10%	2,426.07	1.08%
Developed, Open Space	705.81	2.75%	705.59	2.75%	-0.22	-0.03%	705.36	-0.03%
Developed, Low Intensity	405.61	1.58%	405.39	1.58%	-0.22	-0.05%	405.16	-0.05%
Developed, Medium Intensity	23.35	0.09%	23.13	0.09%	-0.22	-0.95%	22.90	-0.96%
Developed, High Intensity	2.89	0.01%	3.56	0.01%	0.67	23.08%	4.23	18.75%
Barren Land	0.89	0.00%	1.11	0.00%	0.22	25.00%	1.33	20.00%
Deciduous Forest	15,322.11	59.62%	15,315.40	59.60%	-6.71	-0.04%	15,308.69	-0.04%
Evergreen Forest	87.17	0.34%	108.52	0.42%	21.35	24.49%	129.87	19.67%
Mixed Forest	933.30	3.63%	934.19	3.64%	0.89	0.10%	935.07	0.10%
Shrub/Scrub	32.47	0.13%	42.92	0.17%	10.45	32.19%	53.37	24.35%
Grassland/ Herbaceous	78.50	0.31%	85.61	0.33%	7.12	9.07%	92.73	8.31%
Pasture/ Hay	3,584.64	13.95%	3,296.68	12.83%	-287.96	-8.03%	3,008.72	-8.73%
Cultivated Crops	1,990.23	7.74%	2,220.61	8.64%	230.38	11.58%	2,450.99	10.37%
Woody Wetlands	140.76	0.55%	140.54	0.55%	-0.22	-0.16%	140.32	-0.16%
Emergent Herbaceous Wetlands	17.12	0.07%	15.57	0.06%	-1.56	-9.09%	14.01	-10.00%

Source: USGS MRLC

Figure 6.5


Kinkaid Lake- Kinkaid Creek Subwatershed - Land Use
Randolph
Perry
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Ava
Little Kinkaid Creek- Kinkaid Creek 071401061102
Spring Creek
Sharp Rock
Jackson
Campground
Kinkaid Lake - Northwest
Lone Oak
Johnson Creek
Lakeside
Ash
Kinkaid Lake - Central Channel
Larger Shawnee
Kinkaid Lake - East
Kinkaid Lake - Central Body
Smaller Shawnee
Heiple
Lower Kinkaid Creek
Land Use Class
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Decisuous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergenct Herbaceous Wetlands
Watershed Planning Area
Kinkaid Lake Subwatershed
Subwatersheds
County Boundary
Municipality
Streams
N
0
0.75
1.5
3
Miles
1:70,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, May 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

6.5 Existing and Projected Imperviousness of the Subwatersheds (HUC 12)

6.5.1 Little Kinkaid Creek- Kinkaid Creek Subwatershed (071401061101)

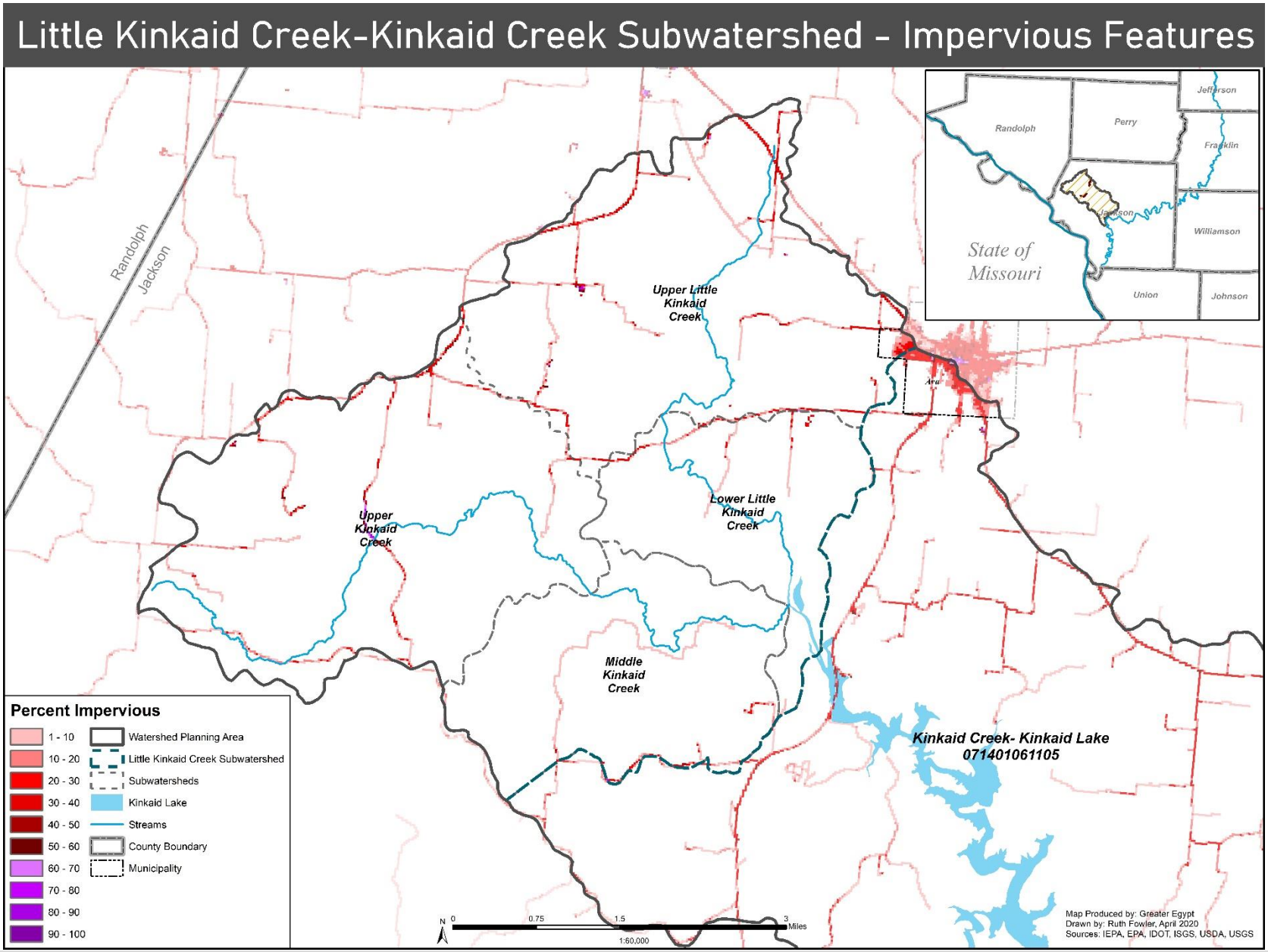
Little Kinkaid Creek- Kinkaid Creek has extremely low levels of imperviousness. A total of 14, 974 acres, or 96.4 percent of the subwatershed is classified as permeable, or 0 percent impervious. This is largely attributed to the vast amount of forested land in the subwatershed. The remaining 3.6 percent of the subwatershed ranges from 1 to 50 percent impervious. High levels of impervious land cover are completely absent from the subwatershed. Table 6.7 displays acreage and percent of the subwatershed by intervals of ten percent. Figure 6.5 displays the current level of imperviousness in the subwatershed.

Following the same method to project future land use, impervious land cover from past and existing datasets was analyzed. Impervious land cover from the 2006 and 2016 datasets were utilized to compare past and present variations in imperviousness. Table 6.7 also displays the projected percent of change and acreage to the year 2026. According to the analysis, levels of impervious will not change by the year 2026.

Table 6.7- Existing and Projected Imperviousness

Percent Imperviousness	Little Kinkaid Creek Subwatershed							
	2006		2016		2006-2016		2016-2026	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acres)	Percent Change	Projected Acreage (2026)	Projected Percent Change
0%	14,974.1	96.4%	14,974.1	96.4%	0.0	0.0%	14,974.1	0.0%
0-10%	265.5	1.7%	265.5	1.7%	0.0	0.0%	265.5	0.0%
10-20%	118.1	0.8%	118.1	0.8%	0.0	0.0%	118.1	0.0%
20-30%	107.9	0.7%	107.9	0.7%	0.0	0.0%	107.9	0.0%
30-40%	40.0	0.3%	40.0	0.3%	0.0	0.0%	40.0	0.0%
40-50%	10.0	0.1%	10.0	0.1%	0.0	0.0%	10.0	0.0%
50-60%	3.8	0.0%	3.8	0.0%	0.0	0.0%	3.8	0.0%
60-70%	3.6	0.0%	3.6	0.0%	0.0	0.0%	3.6	0.0%
70-80%	2.4	0.0%	2.4	0.0%	0.0	0.0%	2.4	0.0%
80-90%	1.6	0.0%	1.6	0.0%	0.0	0.0%	1.6	0.0%
90-100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

Figure 6.6


Little Kinkaid Creek-Kinkaid Creek Subwatershed - Impervious Features
Randolph
Jackson
Upper Little Kinkaid Creek
Upper Kinkaid Creek
Lower Little Kinkaid Creek
Middle Kinkaid Creek
Kinkaid Creek- Kinkaid Lake
071401061105
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
Percent Impervious
1 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Watershed Planning Area
Little Kinkaid Creek Subwatershed
Subwatersheds
Kinkaid Lake
Streams
County Boundary
Municipality
N
0
0.75
1.5
3
Miles
1:60,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, April 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

6.5.2 Kinkaid Lake- Kinkaid Creek Subwatershed (071401061102)

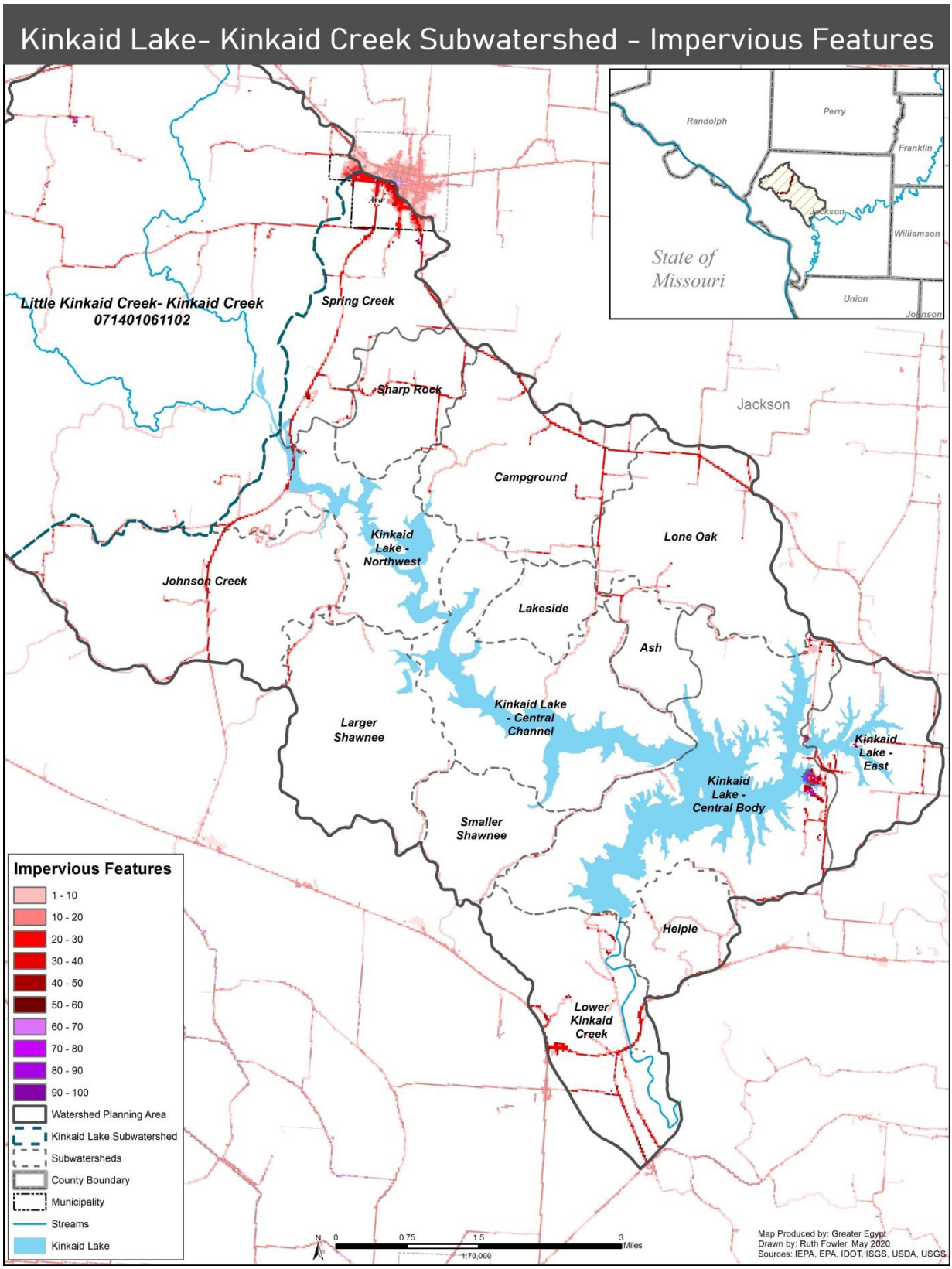
Following the same pattern as Little Kinkaid Creek subwatershed, Kinkaid Lake-Kinkaid Creek subwatershed also has extremely low levels of imperviousness. A total of 24, 561 acres, or 95.6 percent of the subwatershed is classified as permeable, or 0 percent impervious. This is largely attributed to the vast amount of forested land in the subwatershed, as well as the presence of Kinkaid Lake. The remaining 4.4 percent of the subwatershed ranges from 1 to 50 percent impervious. High levels of impervious land cover only amount to 11.8 acres. Table 6.7 displays acreage and percent of the subwatershed by intervals of ten percent. Figure 6 .6 displays the current level of imperviousness in the subwatershed.

Following the same method to project future land use, impervious land cover from past and existing datasets were analyzed. Impervious land cover from the 2006 and 2016 datasets were utilized to compare past and present variations in imperviousness. Table 6.7 also displays the projected percent of change and acreage to the year 2026. According to the analysis, levels of impervious will minimally change by the year 2026. The largest change in imperviousness will be a reduction of 0.4 acres of 30 to 40 percent impervious land cover.

Table 6.8- Kinkaid Lake Subwatershed Existing and Projected Imperviousness

Percent Imperviousness	Kinkaid Lake Subwatershed							
	2006		2016		2006-2016		2016-2026	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Change (Acres)	Percent Change	Projected Acreage (2026)	Projected Percent Change
0%	24,561.2	95.6%	24,561.2	95.6%	0.0	0.0%	24,561.2	0.0%
0-10%	497.9	1.9%	497.7	1.9%	-0.2	0.0%	497.4	0.0%
10-20%	235.3	0.9%	235.3	0.9%	0.0	0.0%	235.3	0.0%
20-30%	242.6	0.9%	242.6	0.9%	0.0	0.0%	242.6	0.0%
30-40%	109.9	0.4%	109.4	0.4%	-0.4	-0.4%	109.0	-0.4%
40-50%	27.4	0.1%	27.6	0.1%	0.2	0.8%	27.8	0.8%
50-60%	12.9	0.1%	12.7	0.0%	-0.2	-1.7%	12.5	-1.8%
60-70%	5.6	0.0%	5.6	0.0%	0.0	0.0%	5.6	0.0%
70-80%	3.6	0.0%	3.8	0.0%	0.2	6.3%	4.0	5.9%
80-90%	2.2	0.0%	2.4	0.0%	0.2	10.0%	2.7	9.1%
90-100%	0.4	0.0%	0.7	0.0%	0.2	50.0%	0.9	33.3%

Figure 6.7


Kinkaid Lake- Kinkaid Creek Subwatershed - Impervious Features
Randolph
Perry
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Ava
Little Kinkaid Creek- Kinkaid Creek 071401061102
Spring Creek
Sharp Rock
Jackson
Campground
Kinkaid Lake - Northwest
Lone Oak
Johnson Creek
Lakeside
Ash
Kinkaid Lake - Central Channel
Larger Shawnee
Kinkaid Lake - East
Kinkaid Lake - Central Body
Smaller Shawnee
Heiple
Lower Kinkaid Creek
Impervious Features
1 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Watershed Planning Area
Kinkaid Lake Subwatershed
Subwatersheds
County Boundary
Municipality
Streams
Kinkaid Lake
N
0
0.75
1.5
3
Miles
1:70,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler, May 2020
Sources: IEPA, EPA, IDOT, ISGS, USDA, USGS

7. Watershed Drainage and Assessment

To further characterize the waterbodies in the Kinkaid Creek planning area, an assessment was conducted to identify certain impairments of waterbodies. Components assessed are: extent of channelization, condition of riparian and littoral areas, and extent of streambank and shoreline erosion.

Assessment methods include physical field evaluations and analyses of aerial photography from 1938 to 2019. Figure 7.1 displays the assessed waterbodies, as well as the location of assessment points. Appendix D includes the field form that was used for assessments.

For each assessment component, the waterbodies were delineated by their individual reach code. These reach codes identify certain portions of the stream, and represent varying degrees of stream length. Each assessment point was assigned an Assessment ID. Appendix E displays the stream name with its corresponding Assessment ID, reach code and length. Streams and tributaries were then categorized by their subwatershed. Kinkaid Lake was assigned shoreline codes for assessment. The planning area was also reviewed for the presence of retention and detention basins. Detailed information regarding each shoreline code can also be viewed in Appendix E. Each HUC 12 watershed in the study area will be examined individually.

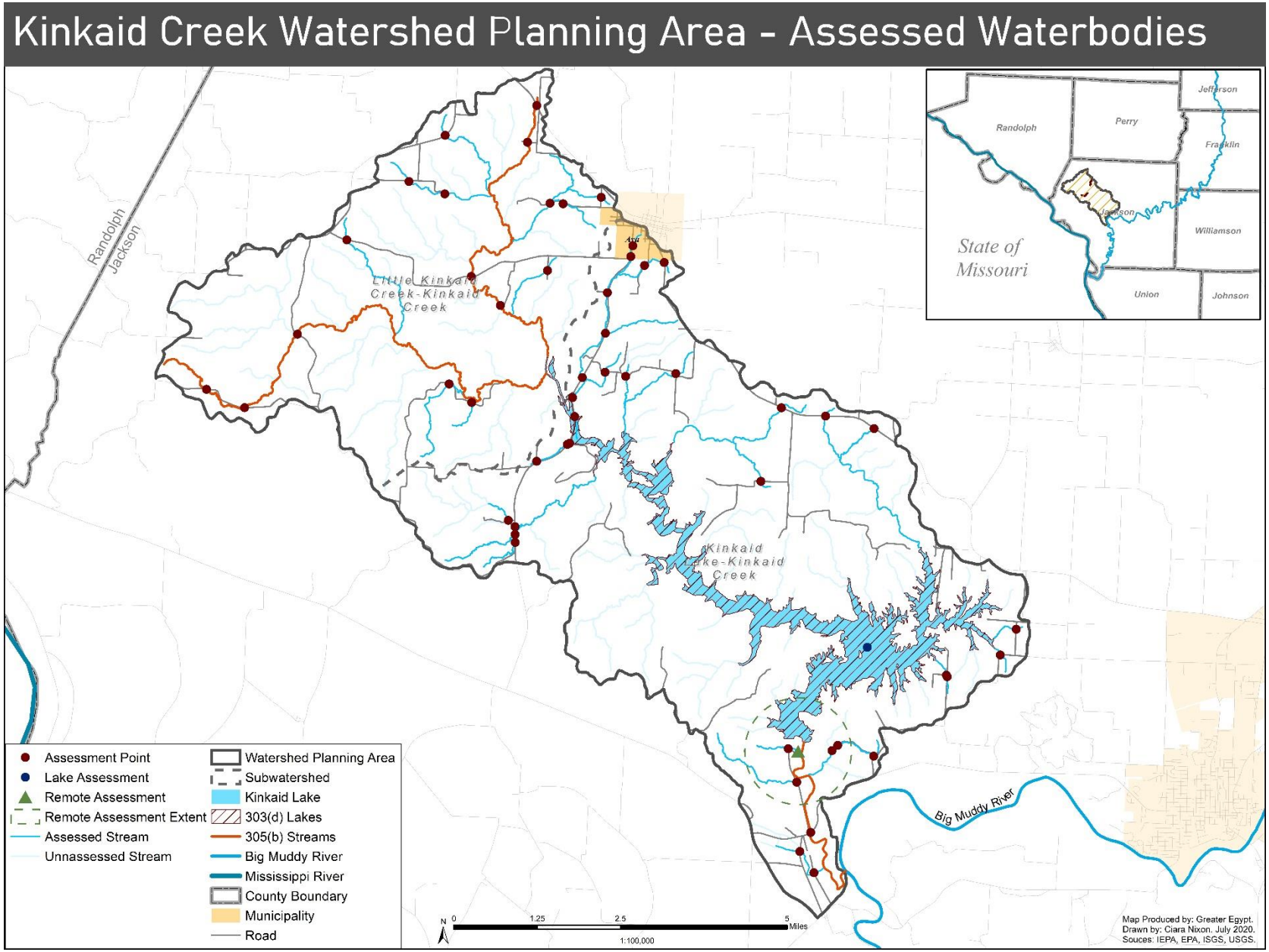
7.1 Assessment Components

Extent of 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, moderate, and high. In some cases, erosion may also be described as severe if the extent of erosion is extreme. These designations correspond to the lateral recession rate (LRR) category. LRR also correlates to the pollutant load reduction section of this report (Section 8.7). This characterizes erosion classes as: slight (none or low), moderate (moderate), severe (high), and very severe

Figure 7.1


Kinkaid Creek Watershed Planning Area - Assessed Waterbodies
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
Assessment Point
Lake Assessment
Remote Assessment
Remote Assessment Extent
Assessed Stream
Unnassessed Stream
Watershed Planning Area
Subwatershed
Kinkaid Lake
303(d) Lakes
305(b) Streams
Big Muddy River
Mississippi River
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS.

(severe). Figure 7.2 displays examples of the various levels of erosion at different assessment points throughout the watershed. Physical assessments included an environmental evaluation for each of the assessment points. Samples evaluations can be viewed in Appendix D.

Figure 7.2- Levels of Eroded Streambank

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

If a particular stream reach indicated a large variance in streambank erosion, a new reach identification was created. This includes a unique ID and Reach Code. Results for the streambank and shoreline erosion assessment are summarized in the following section. These results have been delineated by Subwatershed (HUC 12).

Condition of Riparian and Littoral Areas

Riparian areas provide a buffer for streams and other waterbodies by filtering pollutants from runoff. These 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 or shoreline.

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. Lake shores have also been classified with these percentages for the condition of littoral areas.

Generally, the amount of natural habitat is the most critical component in assessing riparian areas. Consideration is also given to development, debris (synthetic), and other environmental factors. Debris, blockages, and other obstructions have also been assessed.

Field assessments and other aerial imagery were used in determining the condition of riparian areas. The figure below represents the various conditions of riparian areas.

Figure 7.3- Conditions of Riparian and Littoral Areas

Conditions of Riparian Areas: A- Good B- Fair; C- Poor

Degree of 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 prevent heavy flow. 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.

Physical assessments, historical photography and GIS were mainly utilized for the degree of channelization assessment. Comparitive aerial images to highlight channelization are displayed in the figure below.

Figure 7.4- Historical and Current Aerial of Channelized Stream

7.2 Little Kinkaid Creek-Kinkaid Creek Subwatershed Stream Assessment (071401061101)

The Little Kinkaid Creek-Kinkaid Creek subwatershed experiences varying levels of erosion. With a majority of the SMU being forested, riparian areas within the subwatershed are generally in good condition, with the exception of the area surrounded by the Kinkaid Stone Company. No reaches exhibit poor riparian conditions. Since the subwatershed is fairly rural, channelization has a minimal impact.

Extent of Erosion

The majority of streams within the Little Kinkaid Creek-Kinkaid Creek subwatershed are rated as having a moderate degree of erosion. Out of the 21 streams that were assessed throughout the area, seven streams, or 33 percent of the streams in the area are rated as having a moderate degree of erosion. Streams rated as having none or low amounts of erosion total to six of of the twenty-one streams assessed, or 29 percent of the streams within the subwatershed. Five streams within the area have a high erosion rating, which accounts for 24 percent of the streams within the subwatershed. Only three streams, or 14 percent, of streams within the Little Kinkaid Creek-Kinkaid Creek subwatershed have a severe erosion rating.

The level of erosion that each reach is classified as is decided by what the majority of that reach exhibits. Therefore, one reach may exhibit severe levels of erosion in some areas, but is classified as having a high level of erosion, due to the majority of the reach being high.

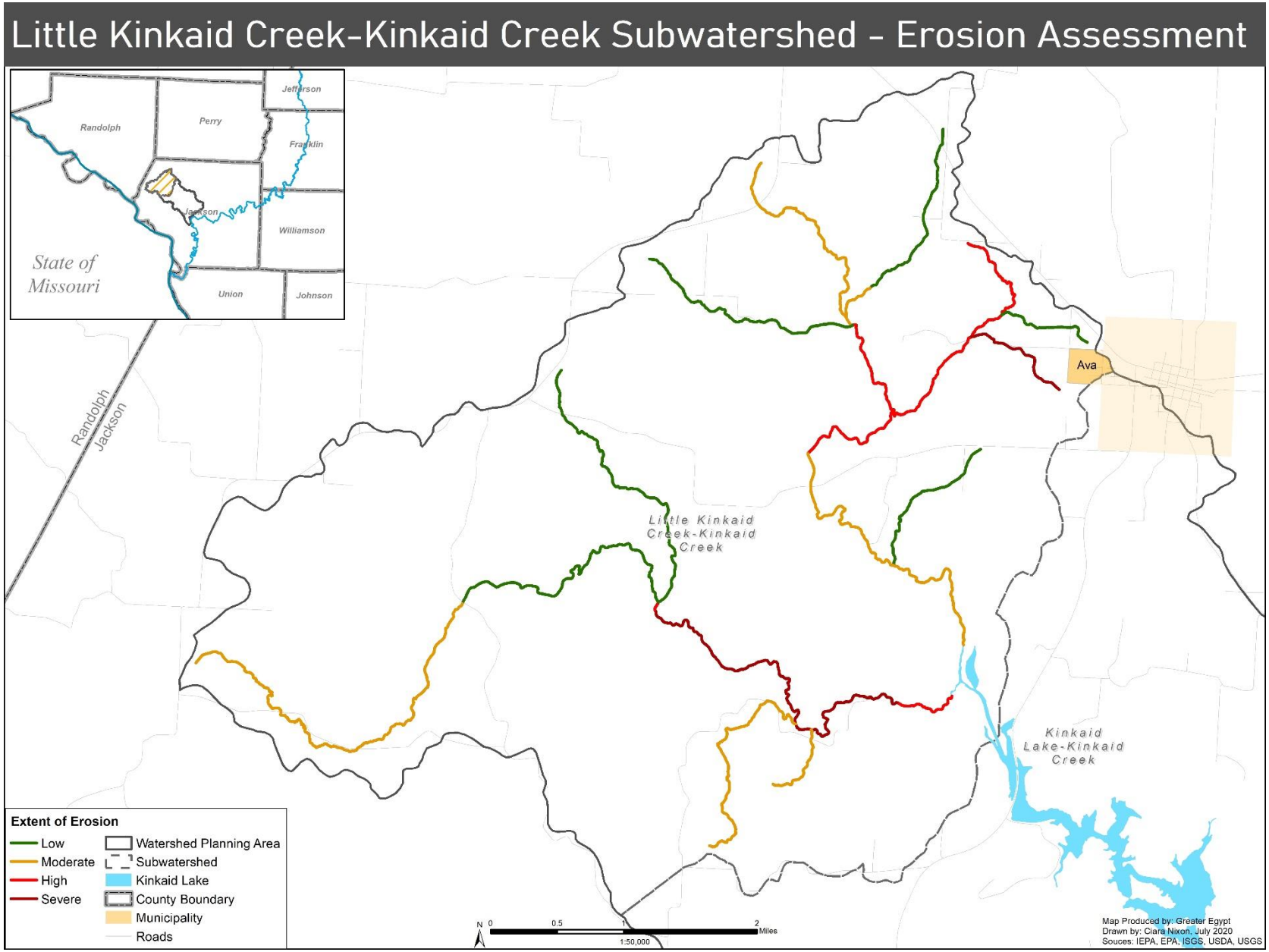
Table 7.1 summarizes the extent of erosion throughout the Little Kinkaid Creek-Kinkaid Creek subwatershed.

Table 7.1 – Little Kinkaid Creek-Kinkaid Creek Subwatershed Extent of Erosion

Little Kinkaid Creek-Kinkaid Creek Subwatershed								
Extent of Erosion	None or Low		Moderate		High		Severe	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%
Middle Kinkaid Creek SMU	0	0%	2	10%	1	5%	1	5%
Upper Kinkaid Creek SMU	2	10%	1	5%	1	5%	1	5%
Lower Little Kinkaid Creek SMU	1	5%	1	5%	0	0%	0	0%
Upper Little Kinkaid Creek SMU	3	14%	3	14%	3	14%	1	5%
Total:	**6**	**29%**	**7**	**33%**	**5**	**24%**	**3**	**14%**

Areas of increased erosion occur in every SMU to some degree. The three reaches throughout the Little Kinkaid Creek-Kinkaid Creek subwatershed that exhibit severe levels of erosion occur near land that was farmed sometime throughout the history of the area. Although these areas are no longer agricultural today, the impacts of the historical land use are apparent. Figure 7.5 spatially depicts the levels of erosion by reach code.

Figure 7.5


Little Kinkaid Creek-Kinkaid Creek Subwatershed – Erosion Assessment
Jefferson
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Randolph
Jackson
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Extent of Erosion
Low
Moderate
High
Severe
Watershed Planning Area
Subwatershed
Kinkaid Lake
County Boundary
Municipality
Roads
N
0
0.5
1
2
Miles
1:50,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon, July 2020
Souces: IEPA, EPA, ISGS, USDA, USGS

Condition of Riparian Areas

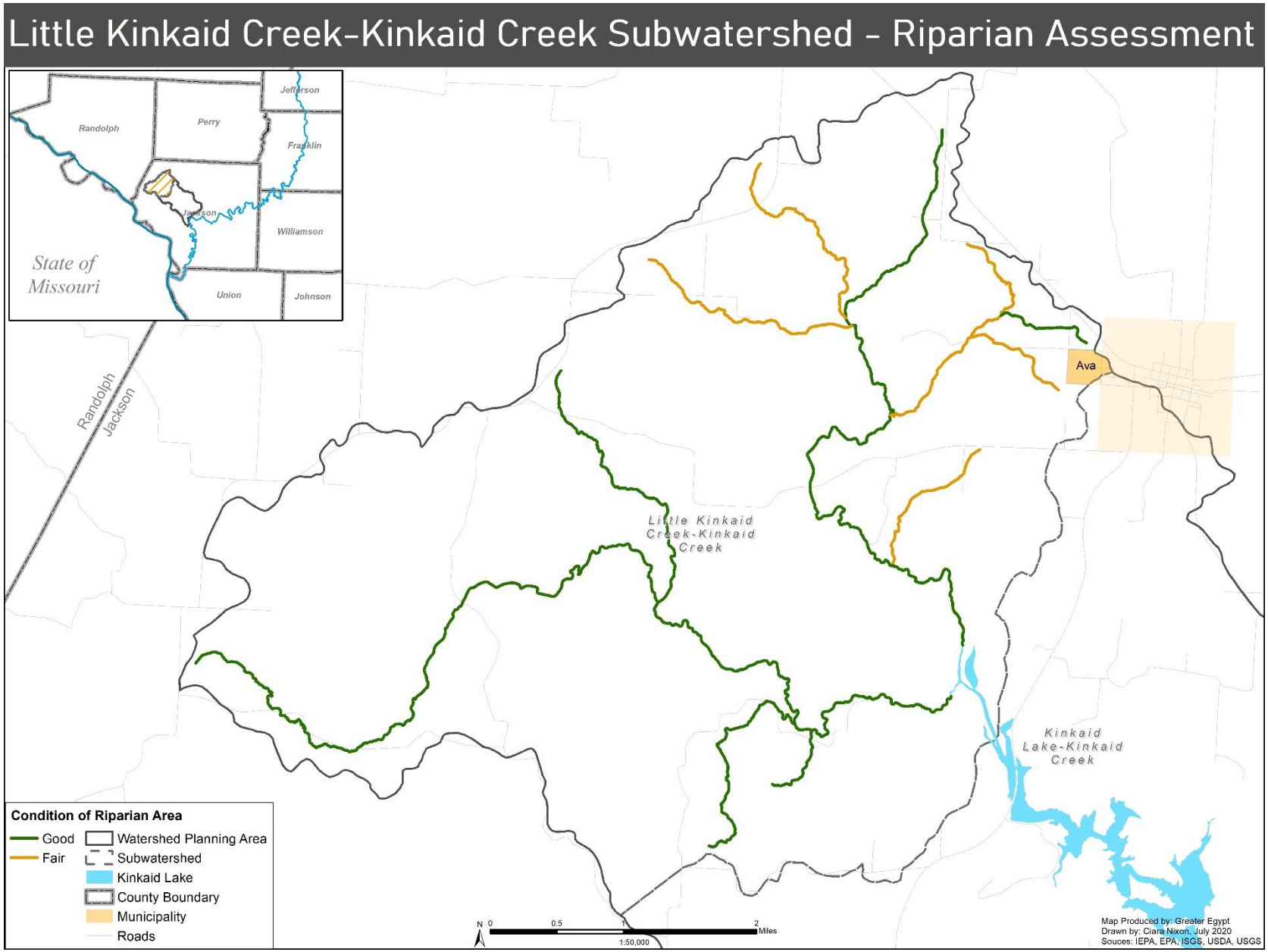
In general, riparian areas within the Little Kinkaid Creek-Kinkaid Creek subwatershed exhibit good riparian conditions. Since forested areas in the entire watershed account for 57.45 percent, while developed and cropland account for only 15.32 percent of the land area, riparian areas throughout the subwatershed have generally been preserved.

Twenty-one reaches were assessed throughout the subwatershed. Of those, 16 reaches are in good riparian condition, accounting for 76 percent of the assessed streams within the subwatershed. The remaining five assessed reaches were rated as being in fair condition, and account for 24 percent of the assessed reaches within the Little Kinkaid Creek-Kinkaid Creek subwatershed. Table 7.2 summarizes this data. It is also illustrated in Figure 7.6.

Table 7.2 – Little Kinkaid Creek-Kinkaid Creek Subwatershed Condition of Riparian Area

Little Kinkaid Creek-Kinkaid Creek Subwatershed						
Condition of Riparian Area	Good		Fair		Poor	
	Reaches	%	Reaches	%	Reaches	%
Middle Kinkaid Creek	4	19%	0	0%	0	0%
Upper Kinkaid Creek	5	24%	0	0%	0	0%
Lower Little Kinkaid Creek	1	5%	1	5%	0	0%
Upper Little Kinkaid Creek	6	29%	4	19%	0	0%
Total:	**16**	**76%**	**5**	**24%**	**0**	**0%**

Figure 7.6


Little Kinkaid Creek-Kinkaid Creek Subwatershed - Riparian Assessment
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Randolph
Jackson
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Condition of Riparian Area
Good
Fair
Watershed Planning Area
Subwatershed
Kinkaid Lake
County Boundary
Municipality
Roads
N
0
0.5
1
2
Miles
1:50,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon, July 2020
Souces: IEPA, EPA, ISGS, USDA, USGS

Degree of Channelization

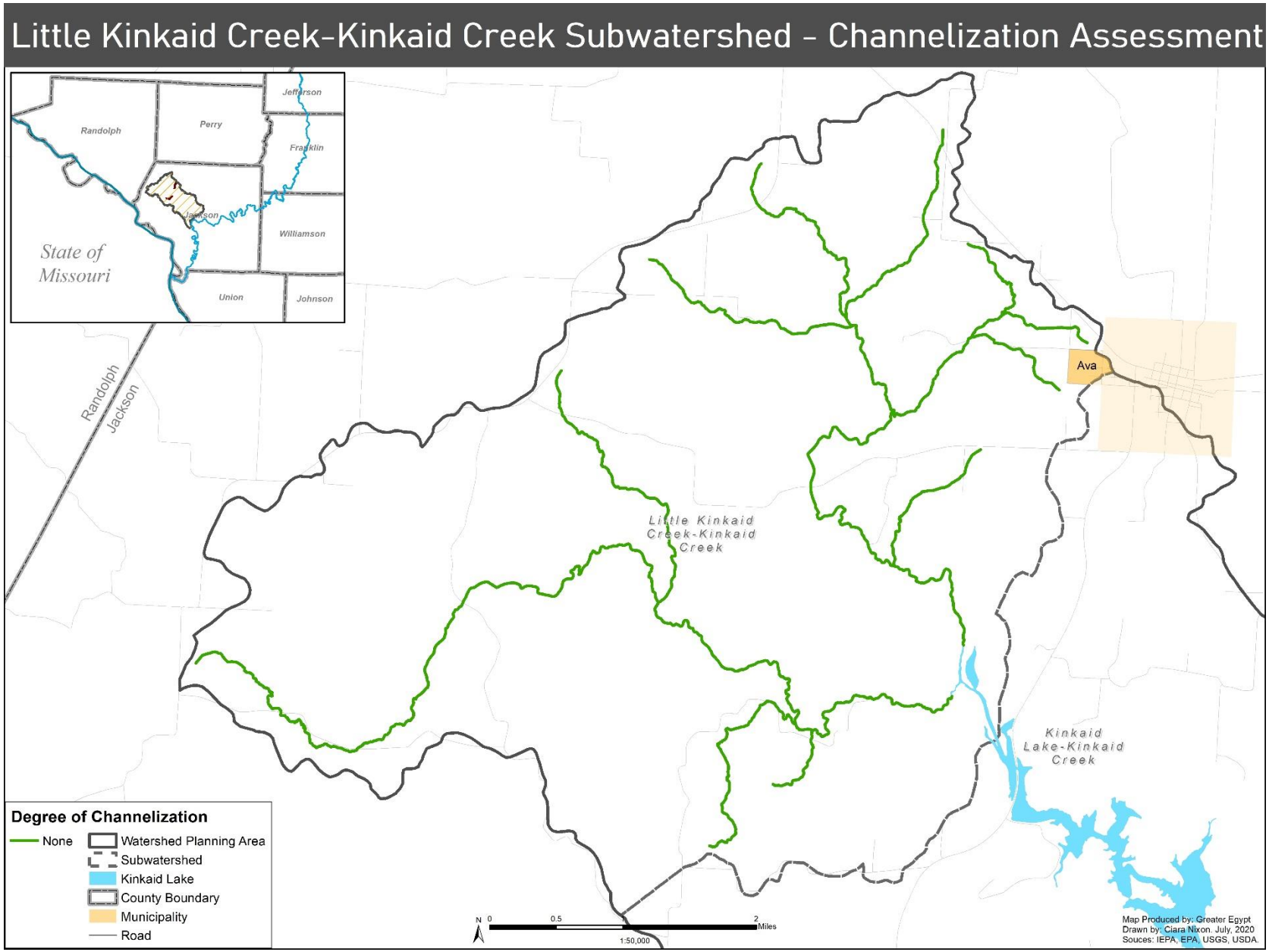
The Little Kinkaid Creek-Kinkaid Creek subwatershed consists of rural and forested land, leaving no channelized features throughout the area. All of the assessed streams within the subwatershed, or all 21 assessed streams, have no degree of channelization. To analyze this, an aerial image from 1938 was observed and compared to a 2017 aerial image of the land. No streams appear to have been channelized.

Table 7.3 summarizes the degree of channelization within the Little Kinkaid Creek-Kinkaid Creek subwatershed, while Figure 7.7 spatially displays this data.

Table 7.3 – Little Kinkaid Creek-Kinkaid Creek Subwatershed Degree of Channelization

Little Kinkaid Creek-Kinkaid Creek Subwatershed								
Degree of Channelization	None		Low		Moderate		High	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%
Middle Kinkaid Creek	4	19%	0	0%	0	0%	0	0%
Upper Kinkaid Creek	5	24%	0	0%	0	0%	0	0%
Lower Little Kinkaid Creek	2	10%	0	0%	0	0%	0	0%
Upper Little Kinkaid Creek	10	48%	0	0%	0	0%	0	0%
Total:	**21**	**100%**	**0**	**0%**	**0**	**0%**	**0**	**0%**

Figure 7.7


Little Kinkaid Creek-Kinkaid Creek Subwatershed - Channelization Assessment
Jefferson
Randolph
Perry
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Randolph
Jackson
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Degree of Channelization
None
Watershed Planning Area
Subwatershed
Kinkaid Lake
County Boundary
Municipality
Road
N
0
0.5
1
2
Miles
1:50,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. July, 2020
Souces: IEPA, EPA, USGS, USDA.

7.3 Little Kinkaid Lake-Kinkaid Creek Subwatershed Stream Assessment (071401061102)

The Kinkaid Lake-Kinkaid Creek subwatershed exhibits all levels of erosion. The subwatershed is 63.66 percent forest and only 13.07 percent of land is considered developed and crop lands. Therefore, it is expected that the riparian areas are in majority good condition. Channelization also has minimal impact throughout the mostly undeveloped subwatershed.

Extent of Erosion

All degrees of erosion are seen throughout the Kinkaid Lake-Kinkaid Creek subwatershed. However, there are a few SMU's that do not exhibit any erosion levels. Of the 15 SMUs that form the subwatershed, five do not exhibit streams with erosion.

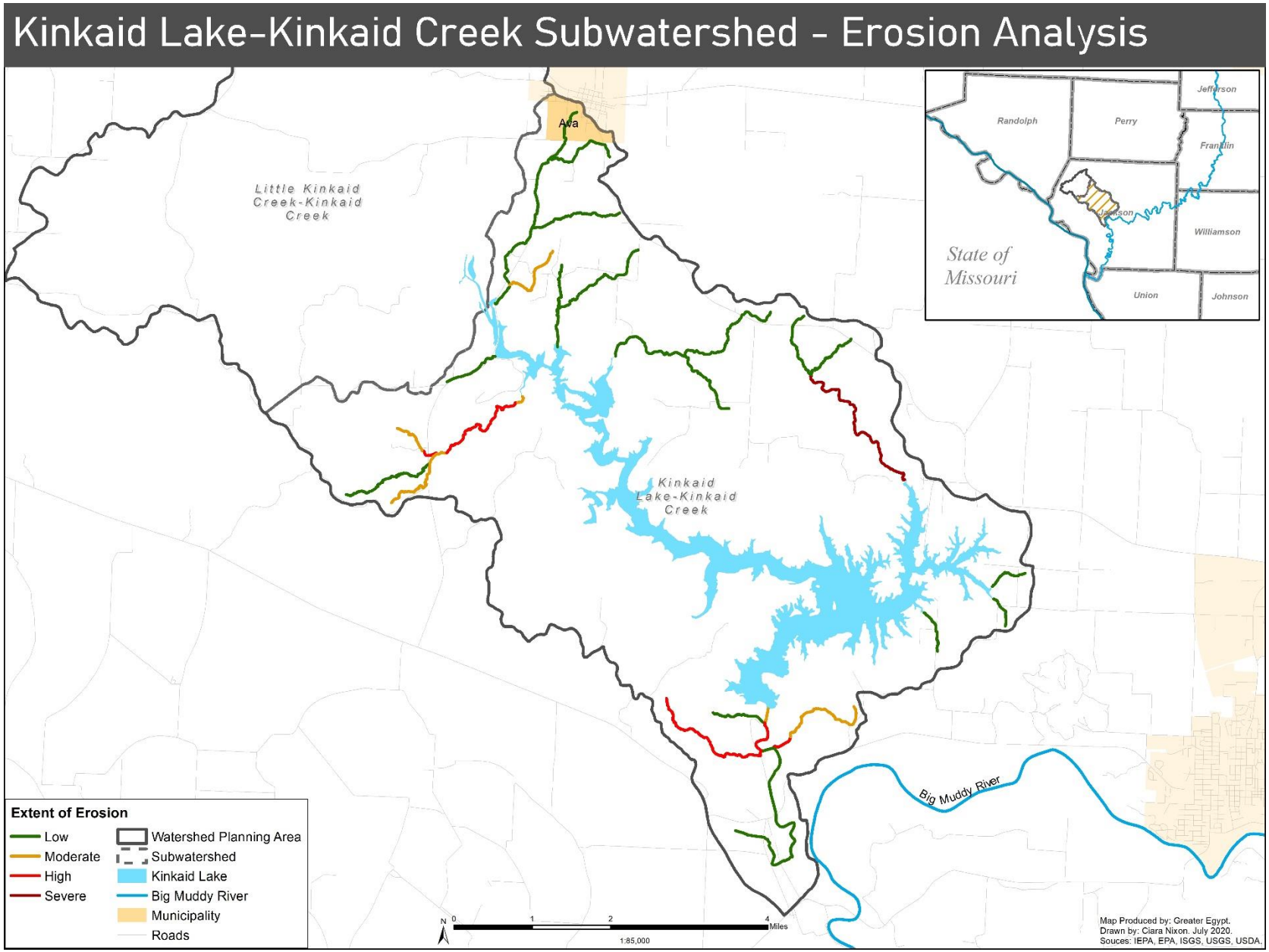
There is a total of 36 stream reaches that were assessed within the subwatershed. Of those 36 streams, 21 stream reaches, or 58 percent of the streams that were assessed exhibit none or low levels of erosion. Nine stream reaches, or 25 percent of the streams that were assessed have a moderate level of erosion. Few streams exhibit high and severe levels of erosion. Five out of the thirty-six, or 14 percent of the assessed streams within the subwatershed exhibit high levels of erosion, while only one out of the thirty-six streams is rated as having severe erosion.

Table 7.4 summarizes the erosion analyses for the Kinkaid Lake-Kinkaid Creek subwatershed. Figure 7.8 depicts this information.

Table 7.4 – Kinkaid Lake-Kinkaid Creek Subwatershed Extent of Erosion

Kinkaid Lake-Kinkaid Creek subwatershed								
Extent of Erosion	None or Low		Moderate		High		Severe	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%
Lower Kinkaid Creek	5	14%	1	3%	2	6%	0	0%
Heiple	0	0%	2	6%	1	3%	0	0%
Smaller Shawnee	0	0%	0	0%	0	0%	0	0%
Kinkaid Lake - Central Body	1	3%	0	0%	0	0%	0	0%
Kinkaid Lake - East	2	6%	0	0%	0	0%	0	0%
Lone Oak	2	6%	0	0%	0	0%	1	3%
Ash	0	0%	0	0%	0	0%	0	0%
Kinkaid Lake - Central Channel	0	0%	0	0%	0	0%	0	0%
Lakeside	0	0%	0	0%	0	0%	0	0%
Larger Shawnee	0	0%	0	0%	0	0%	0	0%
Campground	2	6%	0	0%	0	0%	0	0%
Kinkaid Lake - Northwest	1	3%	0	0%	0	0%	0	0%
Johnson Creek	1	3%	5	14%	2	6%	0	0%
Sharp Rock	4	11%	0	0%	0	0%	0	0%
Spring Creek	3	8%	1	3%	0	0%	0	0%
Total:	**21**	**58%**	**9**	**25%**	**5**	**14%**	**1**	**3%**

Figure 7.8


Kinkaid Lake-Kinkaid Creek Subwatershed - Erosion Analysis
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Extent of Erosion
Low
Moderate
High
Severe
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
Municipality
Roads
N
0
1
2
4
Miles
1:85,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

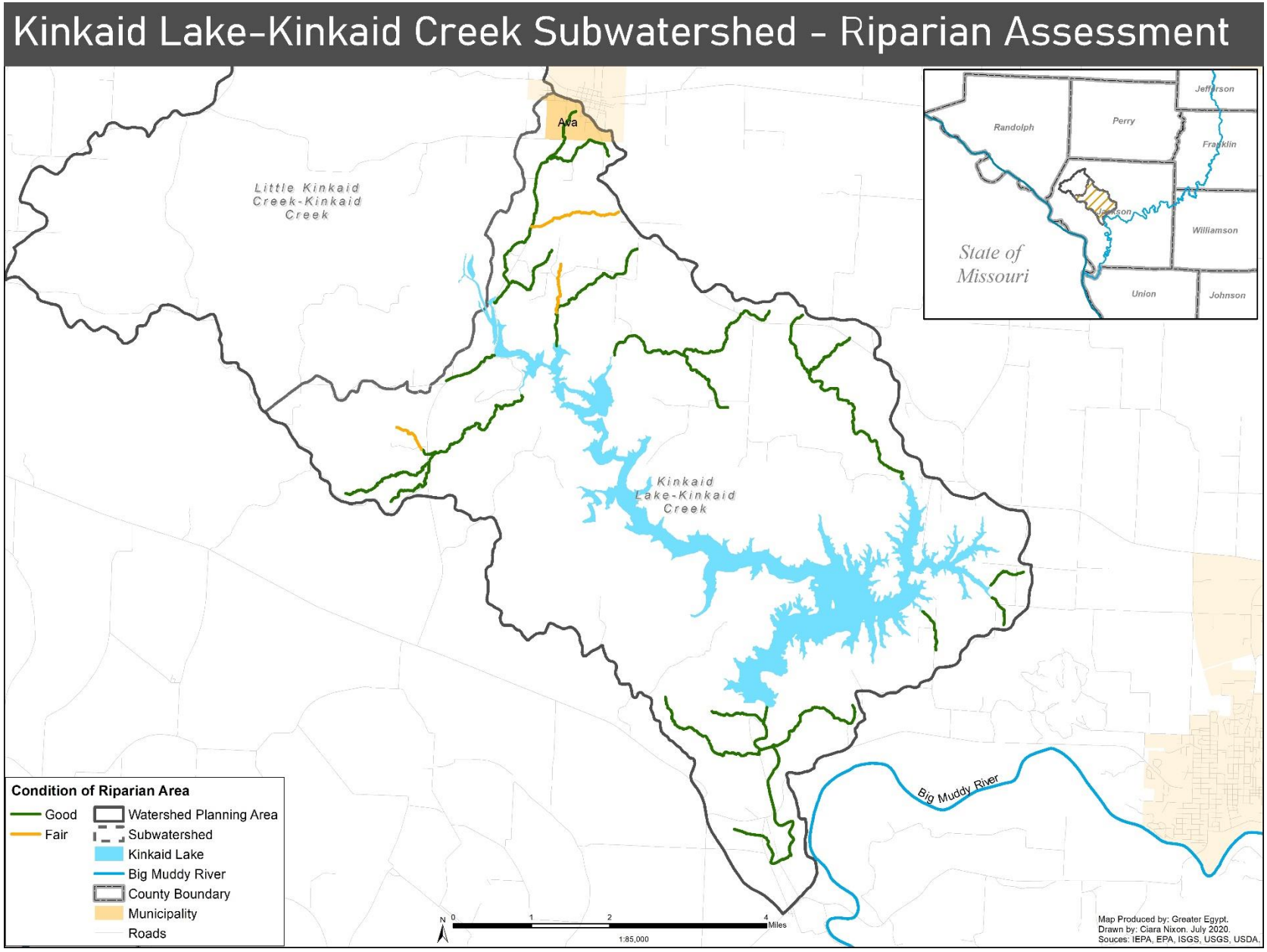
Condition of Riparian Areas

Since the majority of the Kinkaid Lake-Kinkaid Creek subwatershed is forested, it is expected that the majority of the riparian areas throughout the subwatershed are in good condition. No areas within the subwatershed exhibit a poor riparian condition. Out of the 36 streams that were assessed, 33 streams, or 92 percent of the assessed streams exhibit a good riparian area. Only three streams were assessed as having a fair riparian area. These streams are mostly surrounded by either farmland or housing developments. Table 7.5 summarizes the riparian area conditions. Figure 7.9 displays this data.

Table 7.5 – Kinkaid Lake-Kinkaid Creek Subwatershed Condition of Riparian Area

Little Kinkaid Creek-Kinkaid Creek Subwatershed						
Condition of Riparian Area	Good		Fair		Poor	
	Reaches	%	Reaches	%	Reaches	%
Lower Kinkaid Creek	8	22%	0	0%	0	0%
Heiple	3	8%	0	0%	0	0%
Smaller Shawnee	1	3%	0	0%	0	0%
Kinkaid Lake - Central Body	2	6%	0	0%	0	0%
Kinkaid Lake - East	0	0%	0	0%	0	0%
Lone Oak	3	8%	0	0%	0	0%
Ash	0	0%	0	0%	0	0%
Kinkaid Lake - Central Channel	0	0%	0	0%	0	0%
Lakeside	0	0%	0	0%	0	0%
Larger Shawnee	0	0%	0	0%	0	0%
Campground	2	6%	0	0%	0	0%
Kinkaid Lake - Northwest	1	3%	0	0%	0	0%
Johnson Creek	7	19%	1	3%	0	0%
Sharp Rock	3	8%	1	3%	0	0%
Spring Creek	3	8%	1	3%	0	0%
Total:	**33**	**92%**	**3**	**8%**	**0**	**0%**

Figure 7.9


Kinkaid Lake-Kinkaid Creek Subwatershed - Riparian Assessment
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Condition of Riparian Area
Good
Fair
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
County Boundary
Municipality
Roads
N
0
1
2
4
Miles
1:85,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

Degree of Channelization

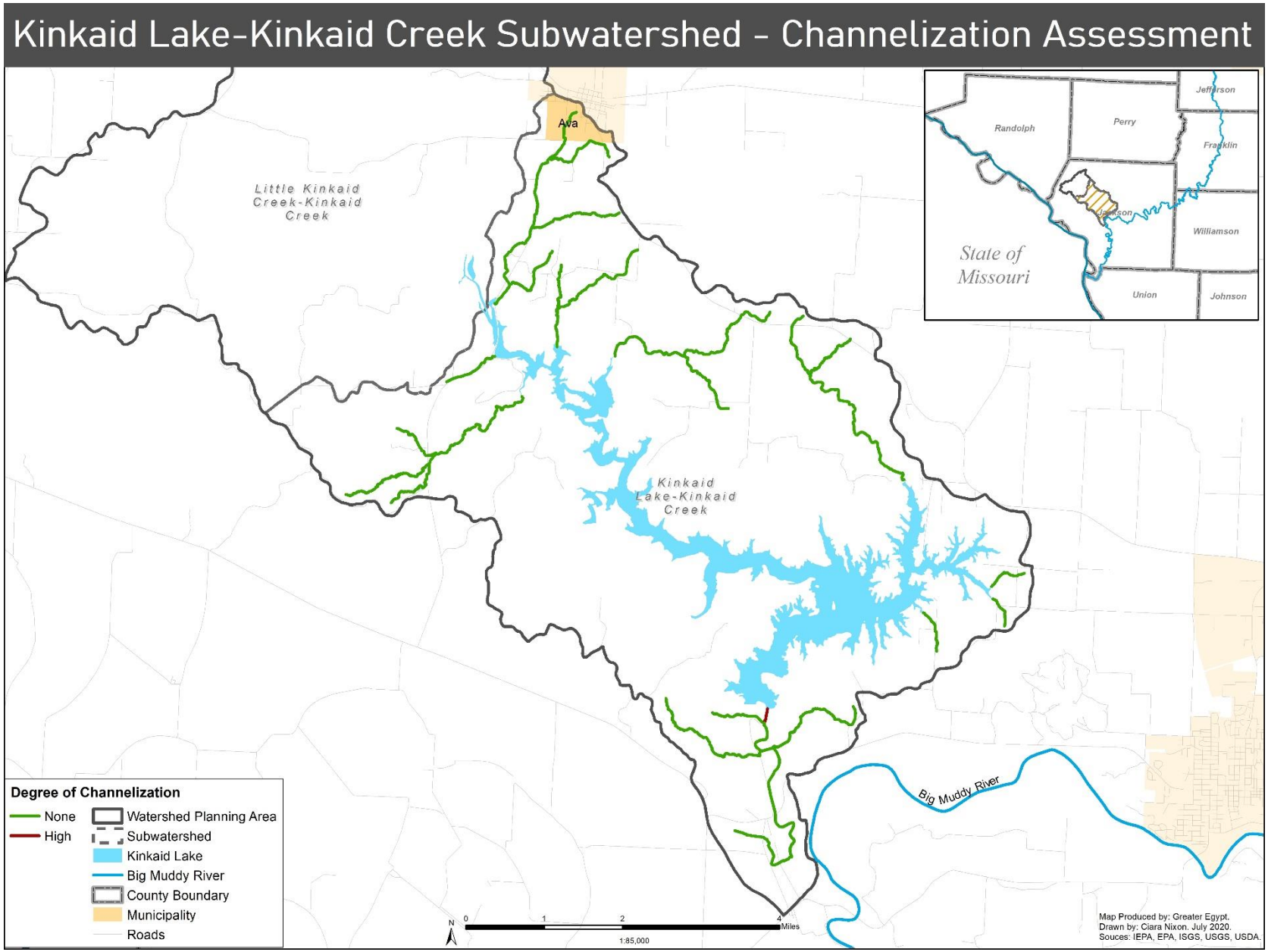
It can also be expected that there are little impacts of stream channelization throughout the Kinkaid Lake-Kinkaid Creek subwatershed. Of the 36 streams assessed, 35 streams, or 97 percent of the streams exhibit no degree of channelization. The one assessed stream that is rated a high degree of channelization is located at the Kinkaid Lake Spillway. This stream did not exist until after the lake was formed.

Table 7.6 summarized the channelization data for the Kinkaid Lake-Kinkaid Creek subwatershed. Figure 7.10 displays this data.

Table 7.6 – Kinkaid Lake-Kinkaid Creek Subwatershed Degree of Channelization

Kinkaid Lake-Kinkaid Creek Subwatershed								
Degree of Channelization	None		Low		Moderate		High	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%
Lower Kinkaid Creek	7	19%	0	0%	0	0%	1	3%
Heiple	3	8%	0	0%	0	0%	0	0%
Smaller Shawnee	0	0%	0	0%	0	0%	0	0%
Kinkaid Lake - Central Body	1	3%	0	0%	0	0%	0	0%
Kinkaid Lake - East	2	6%	0	0%	0	0%	0	0%
Lone Oak	3	8%	0	0%	0	0%	0	0%
Ash	0	0%	0	0%	0	0%	0	0%
Kinkaid Lake - Central Channel	0	0%	0	0%	0	0%	0	0%
Lakeside	0	0%	0	0%	0	0%	0	0%
Larger Shawnee	0	0%	0	0%	0	0%	0	0%
Campground	2	6%	0	0%	0	0%	0	0%
Kinkaid Lake - Northwest	1	3%	0	0%	0	0%	0	0%
Johnson Creek	8	22%	0	0%	0	0%	0	0%
Sharp Rock	4	11%	0	0%	0	0%	0	0%
Spring Creek	4	11%	0	0%	0	0%	0	0%
Total:	**35**	**97%**	**0**	**0%**	**0**	**0%**	**1**	**3%**

Figure 7.10


Kinkaid Lake-Kinkaid Creek Subwatershed - Channelization Assessment
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Degree of Channelization
None
High
Watershed Planning Area
Subwatershed
Kinkaid Lake
Big Muddy River
County Boundary
Municipality
Roads
N
0
1
2
4
Miles
1:85,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

7.4 Kinkaid Creek Watershed Lake Assessment

Kinkaid Lake (IL_RNC)

Kinkaid Creek Watershed contains one lake listed on the IEPA 305(b) List which is assessed as part of Illinois and Federal EPA standards. Kinkaid Lake is almost entirely located within the Kinkaid Lake-Kinkaid Creek subwatershed, with a very small portion of its shoreline reaching west into the Little Kinkaid Creek-Kinkaid Creek subwatershed. For this section, Kinkaid Lake will be discussed in its entirety, and not by subwatershed. Kayaks were used to assess the majority of the lake's shoreline, while a fishing boat was used to assess areas that were further away from a docking area.

The lake is mostly surrounded by forested land, leaving the littoral area primarily in good condition. Kinkaid Lake is heavily trafficked, causing substantial turbulence that directly effects shoreline erosion and stability.

Extent of Erosion

To analyze the erosion level along the entire Kinkaid Lake shoreline, 396,629 feet of shoreline was split up into four sections. Each section was further classified by shore code, or reach. Each shore segment was individually assessed. Prior Kinkaid Lake management initiatives have focused on stabilizing the banks by using rocked barriers in areas that need to be stabilized. For this analysis, the bank was rated for the erosion level that was observed. However, most of the higher erosive areas have bank stabilization where the shoreline is improving.

Kinkaid Lake-East Section - Extent of Erosion

The East section of the lake consists of 49,571 feet. Fourteen shore codes have been created. This section exhibits mostly moderate levels of erosion, with other areas exhibiting low levels of erosion. None of the reaches within the eastern section of shoreline exhibit high or severe levels of erosion.

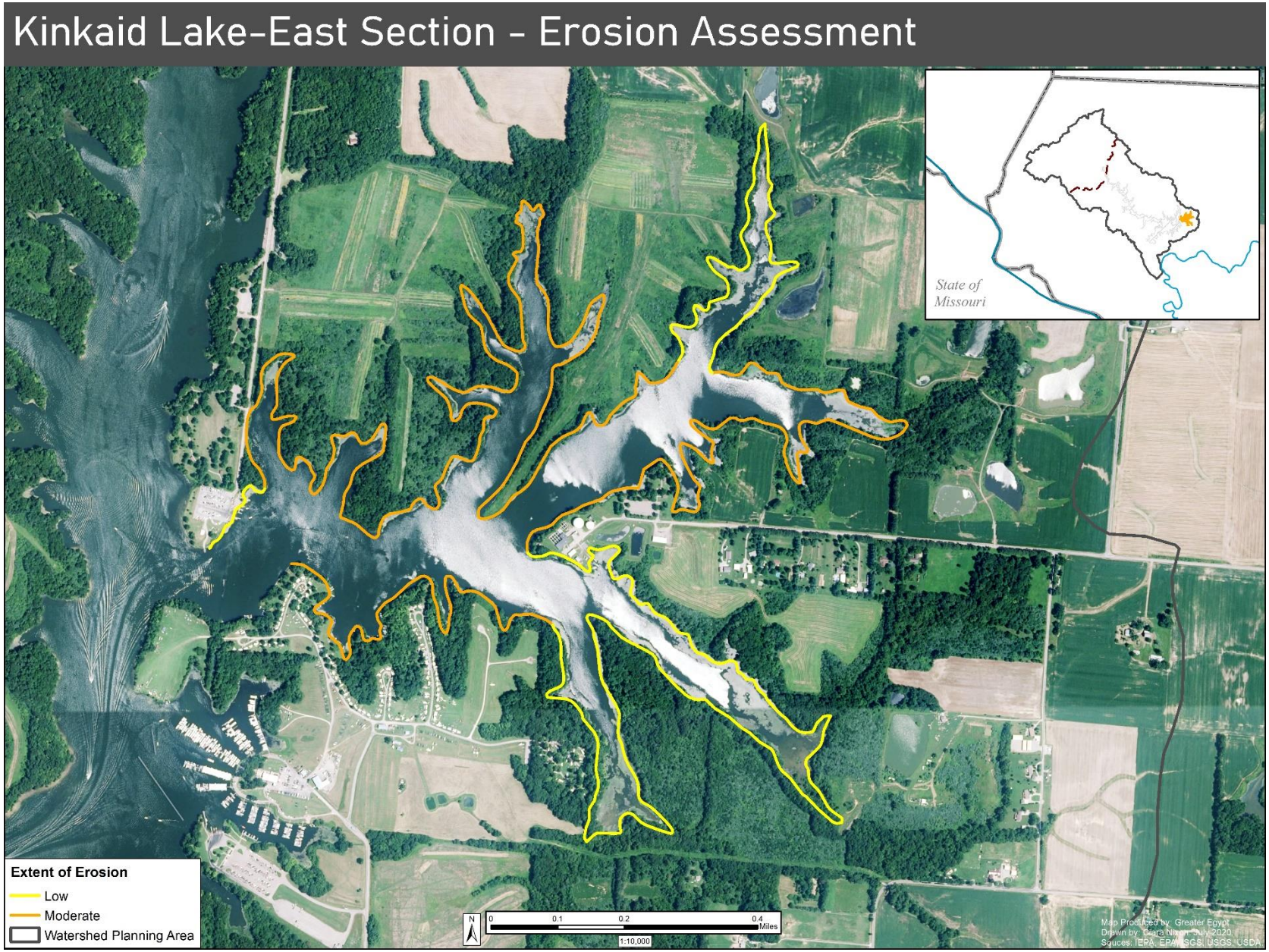
Within the east section of Kinkaid Lake, five shore codes, or 38 percent of the area's shoreline, exhibit low levels of erosion. Of the 14 shore codes assessed, 9 reaches, or 62

percent of the area's shoreline, exhibit moderate levels of erosion. Table 7.7 summarizes this information. The information is also depicted in Figure 7.11.

Table 7.7 – Kinkaid Lake-East Section Extent of Erosion

Kinkaid Lake - East Section			
Kinkaid Lake-Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Extent of Erosion**
IL_RNC_205-01	2,409	5%	Moderate
IL_RNC_205-02	2,157	4%	Moderate
IL_RNC_205-03	4,886	10%	Low
IL_RNC_205-04	6,153	12%	Low
IL_RNC_205-05	1,340	3%	Low
IL_RNC_205-06	3,387	7%	Moderate
IL_RNC_205-07	4,573	9%	Moderate
IL_RNC_205-08	5,504	11%	Low
IL_RNC_205-09	2,415	5%	Moderate
IL_RNC_205-10	9,869	20%	Moderate
IL_RNC_205-11	1,005	2%	Moderate
IL_RNC_205-12	1,989	4%	Moderate
IL_RNC_205-13	3,092	6%	Moderate
IL_RNC_205-14	792	2%	Low
Total:	**49,571**	**100%**	

Figure 7.11


Kinkaid Lake-East Section - Erosion Assessment
State of Missouri
Extent of Erosion
Low
Moderate
Watershed Planning Area
N
0
0.1
0.2
0.4
Miles
1:10,000
Map Produced by: Greater Egypt
Drawn by: Clara Nimon, July 2020
Sources: IEPA, EPA, USGS, USGS, USDA

Kinkaid Lake-Central Body Section - Extent of Erosion

The Central Body section of the lake consists of 161,139 feet of shoreline. Forty-six shore codes have been created. The erosion around the Central Body mostly ranges from moderate to high. One reach exhibits severe erosion.

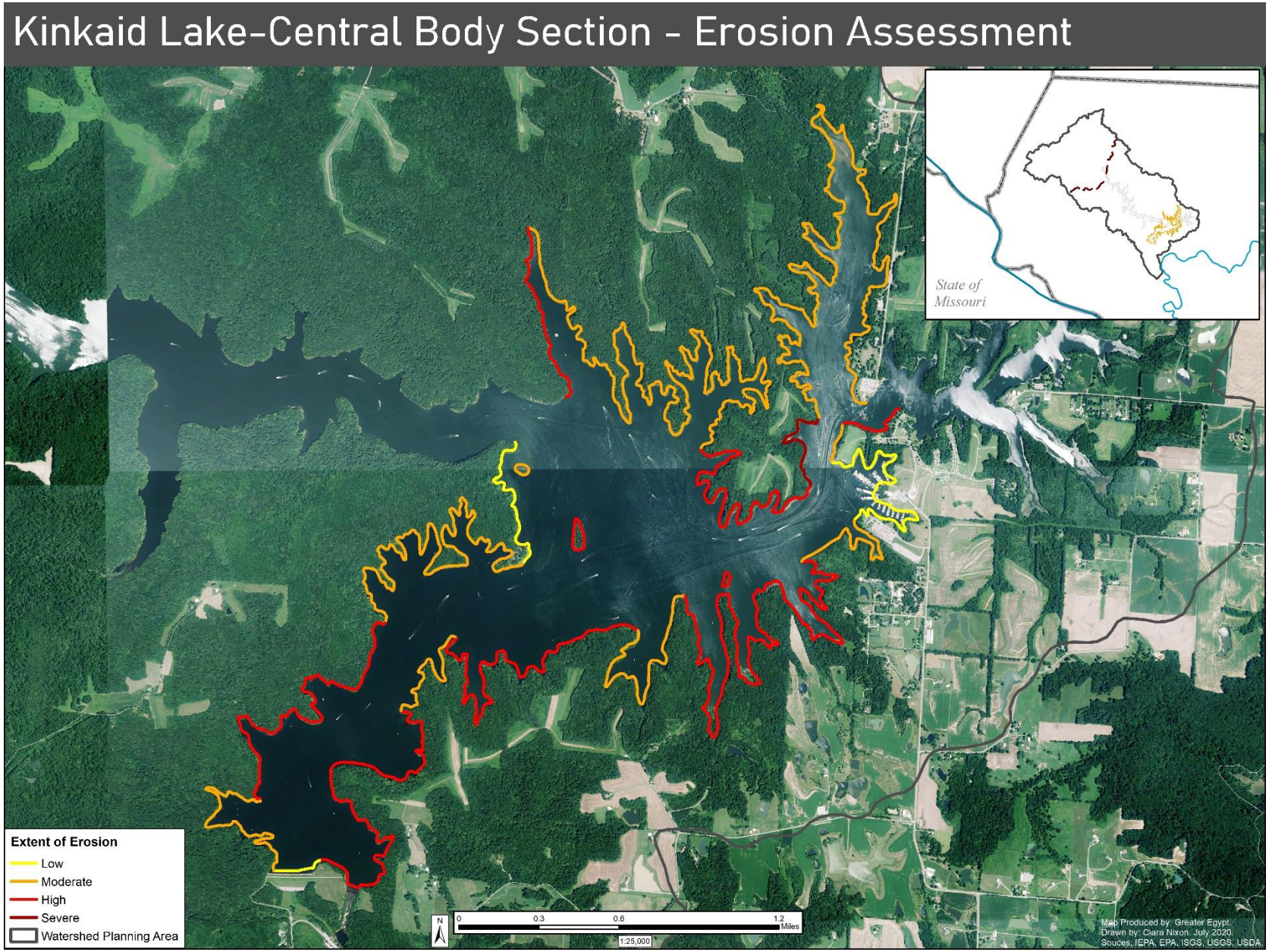
Within the Central Body section of Kinkaid Lake, five shore codes, or 7.5 percent of the area's shoreline, exhibits low levels of erosion. The majority of the shoreline, or 91 percent, exhibits moderate to high erosion. Table 7.7 summarizes this information, while Figure 7.12 displays the erosion assessment.

Table 7.8 – Kinkaid Lake-Central Body Section Extent of Erosion

Kinkaid Lake-Central Body Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Extent of Erosion**
IL_RNC_204-01	1,048	1%	Low
IL_RNC_204-02 (01)	758	0%	High
IL_RNC_204-02 (02)	1,035	1%	Low
IL_RNC_204-02 (03)	283	0%	High
IL_RNC_204-03	3,110	2%	High
IL_RNC_204-04	3,923	2%	High
IL_RNC_204-05	3,408	2%	Moderate
IL_RNC_204-06	4,984	3%	High
IL_RNC_204-07	3,823	2%	High
IL_RNC_204-08	5,597	3%	Moderate
IL_RNC_204-09	6,524	4%	High
IL_RNC_204-10	5,538	3%	High
IL_RNC_204-11	6,818	4%	High
IL_RNC_204-12	1,104	1%	Moderate
IL_RNC_204-13	2,650	2%	Moderate
IL_RNC_204-14	3,167	2%	Low
IL_RNC_204-15	3,328	2%	Low
IL_RNC_204-16	793	0%	Moderate
IL_RNC_204-17	1,467	1%	High
IL_RNC_204-18	3,271	2%	Moderate
IL_RNC_204-19	3,773	2%	Moderate
IL_RNC_204-20	5,945	4%	Moderate
IL_RNC_204-21	3,516	2%	Moderate
IL_RNC_204-22	2,881	2%	Moderate
IL_RNC_204-23	3,255	2%	Moderate

Kinkaid Lake-Central Body Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Extent of Erosion**
IL_RNC_204-24	2,152	1%	Moderate
IL_RNC_204-25	1,950	1%	Moderate
IL_RNC_204-26	2,470	2%	Severe
IL_RNC_204-27	5,042	3%	High
IL_RNC_204-28	2,963	2%	High
IL_RNC_204-29	7,865	5%	Moderate
IL_RNC_204-30	5,885	4%	Moderate
IL_RNC_204-31	6,773	4%	Moderate
IL_RNC_204-32	5,782	4%	Moderate
IL_RNC_204-33	3,837	2%	High
IL_RNC_204-34	3,478	2%	Low
IL_RNC_204-35	6,846	4%	Moderate
IL_RNC_204-36	7,761	5%	Moderate
IL_RNC_204-37	1,673	1%	High
IL_RNC_204-38	2,314	1%	High
IL_RNC_204-39	4,206	3%	High
IL_RNC_204-40	3,903	2%	Moderate
IL_RNC_204-41	1,296	1%	Moderate
IL_RNC_204-42	1,458	1%	High
IL_RNC_204-43	756	0%	Moderate
IL_RNC_204-44	729	0%	High
Total:	**161,139**	**100%**	

Figure 7.12


Kinkaid Lake-Central Body Section - Erosion Assessment
State of Missouri
Extent of Erosion
Low
Moderate
High
Severe
Watershed Planning Area
N
0
0.3
0.6
1.2
Miles
1:25,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

Kinkaid Lake-Central Channel Section – Extent of Erosion

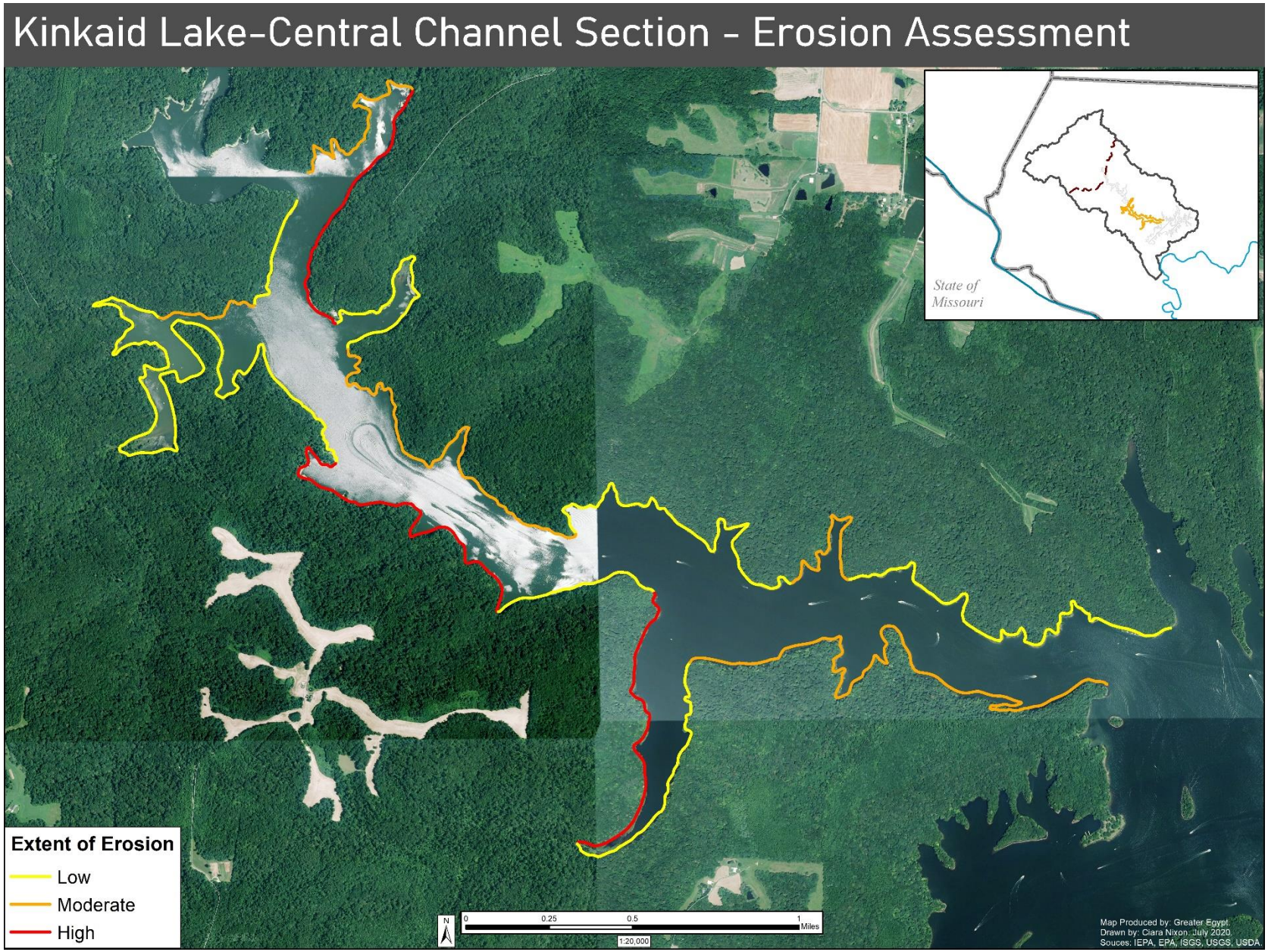
The Central Channel section of the lake consists of 88,884 feet of shoreline. Twenty-nine shore codes have been created. The majority of erosion around the Central Channel ranges from low to moderate.

Within the Central Channel section of Kinkaid Lake, 14 shore codes, or 46 percent of the area's shoreline, exhibits low levels of erosion. Ten shore codes, or 34 percent of the area's shoreline, exhibit moderate levels of erosion. The remaining ten shore codes, representing 20 percent of the shoreline, exhibit high erosion. Table 7.7 summarizes this information, while Figure 7.12 displays the erosion assessment geographically.

Table 7.9 – Kinkaid Lake-Central Channel Section Extent of Erosion

Kinkaid Lake-Central Channel Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Extent of Erosion**
IL_RNC_208-01 (01)	2,095	2%	Low
IL_RNC_208-01 (02)	915	1%	Moderate
IL_RNC_204-02 (01)	2,504	3%	Low
IL_RNC_208-02 (02)	2,053	2%	High
IL_RNC_208-03	3,294	4%	Moderate
IL_RNC_208-04	3,085	3%	Low
IL_RNC_208-05 (01)	2,342	3%	Low
IL_RNC_208-05 (02)	1,479	2%	Moderate
IL_RNC_208-06	3,993	4%	Moderate
IL_RNC_208-07	3,428	4%	Moderate
IL_RNC_208-08	4,221	5%	Low
IL_RNC_208-09	4,544	5%	High
IL_RNC_208-10	4,056	5%	Moderate
IL_RNC_208-11	1,950	2%	Low
IL_RNC_208-12	1,746	2%	Moderate
IL_RNC_208-13	3,288	4%	Low
IL_RNC_208-14	2,422	3%	Low
IL_RNC_208-15	2,820	3%	High
IL_RNC_208-16	3,356	4%	High
IL_RNC_208-17	2,743	3%	Low
IL_RNC_208-18 (01)	5,163	6%	High
IL_RNC_208-18 (02)	2,013	2%	Low
IL_RNC_208-19	4,421	5%	Low
IL_RNC_208-20	2,552	3%	Moderate
IL_RNC_208-21	3,210	4%	Moderate
IL_RNC_208-22	5,284	6%	Moderate
IL_RNC_210-01	3,799	4%	Low
IL_RNC_210-02	4,635	5%	Low
IL_RNC_210-03	1,470	2%	Low
Total:	88,884	100%	

Figure 7.13


Kinkaid Lake-Central Channel Section - Erosion Assessment
State of Missouri
Extent of Erosion
Low
Moderate
High
N
0
0.25
0.5
1
Miles
1:20,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

Kinkaid Lake-Northwest Section – Extent of Erosion

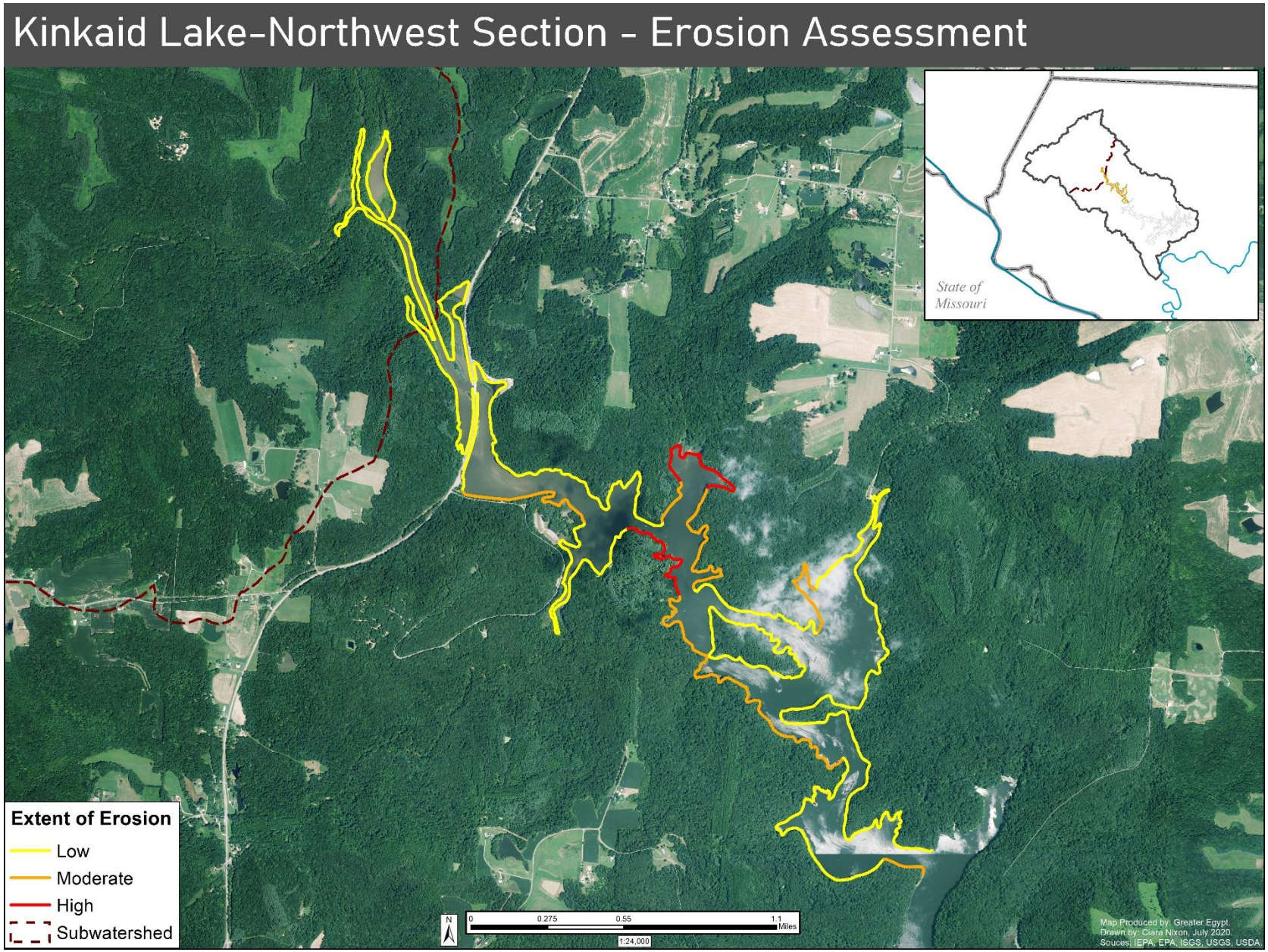
The Northwest section of the lake consists of 97,036 feet of shoreline. 3Thirty-two shore codes have been created. The erosion around the Central Channel ranges from low to moderate. The lower levels of erosion could be contributed to a majority of this area being a no wake zone. Only smaller fishing boats tend to explore this area due to more shallow water depths.

Within the Northwest section of Kinkaid Lake, 22 shore codes, or 75 percent of the area's shoreline, exhibits low levels of erosion. Eight shore codes, or 19 percent of the area's shoreline, exhibit moderate levels of erosion. The remaining two shore codes, representing six percent of the shoreline, exhibit high erosion. Table 7.10 summarizes this information, while Figure 7.13 displays the erosion assessment geographically.

Table 7.10- Kinkaid Lake-Northwest Section – Erosion Assessment

Kinkaid Lake-Northwest Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Extent of Erosion**
IL_RNC_102-01	12,805	13%	Low
IL_RNC_102-02	6,008	6%	Low
IL_RNC_212-01	757	1%	Low
IL_RNC_212-02	2,401	2%	Low
IL_RNC_212-03	2,774	3%	Low
IL_RNC_212-04	1,479	2%	Low
IL_RNC_212-05	2,467	3%	Low
IL_RNC_212-06	2,417	2%	Low
IL_RNC_212-07	4,812	5%	Low
IL_RNC_212-08	2,250	2%	Moderate
IL_RNC_212-09	3,121	3%	Low
IL_RNC_212-10	1,426	1%	Moderate
IL_RNC_212-11	2,342	2%	Moderate
IL_RNC_212-12	3,119	3%	High
IL_RNC_212-13	973	1%	Moderate
IL_RNC_212-14	561	1%	Low
IL_RNC_212-15	2,124	2%	Low
IL_RNC_212-16	2,503	3%	Low
IL_RNC_212-17	3,003	3%	Low
IL_RNC_212-18	5,924	6%	Low
IL_RNC_212-19	1,924	2%	Low
IL_RNC_212-20	3,258	3%	Moderate
IL_RNC_212-21	6,316	7%	Low
IL_RNC_212-22	2,805	3%	High
IL_RNC_212-23	4,478	5%	Moderate
IL_RNC_212-24	2,589	3%	Moderate
IL_RNC_212-25	941	1%	Low
IL_RNC_212-26	2,426	3%	Low
IL_RNC_212-27	2,201	2%	Low
IL_RNC_212-28	887	1%	Moderate
IL_RNC_212-29	3,092	3%	Low
IL_RNC_212-30	2,853	3%	Low
Total:	97,036	100%	

Figure 7.14


Kinkaid Lake-Northwest Section - Erosion Assessment
State of Missouri
Extent of Erosion
Low
Moderate
High
Subwatershed
N
0
0.275
0.55
1.1
Miles
1:24,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon, July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

Condition of Littoral Zones

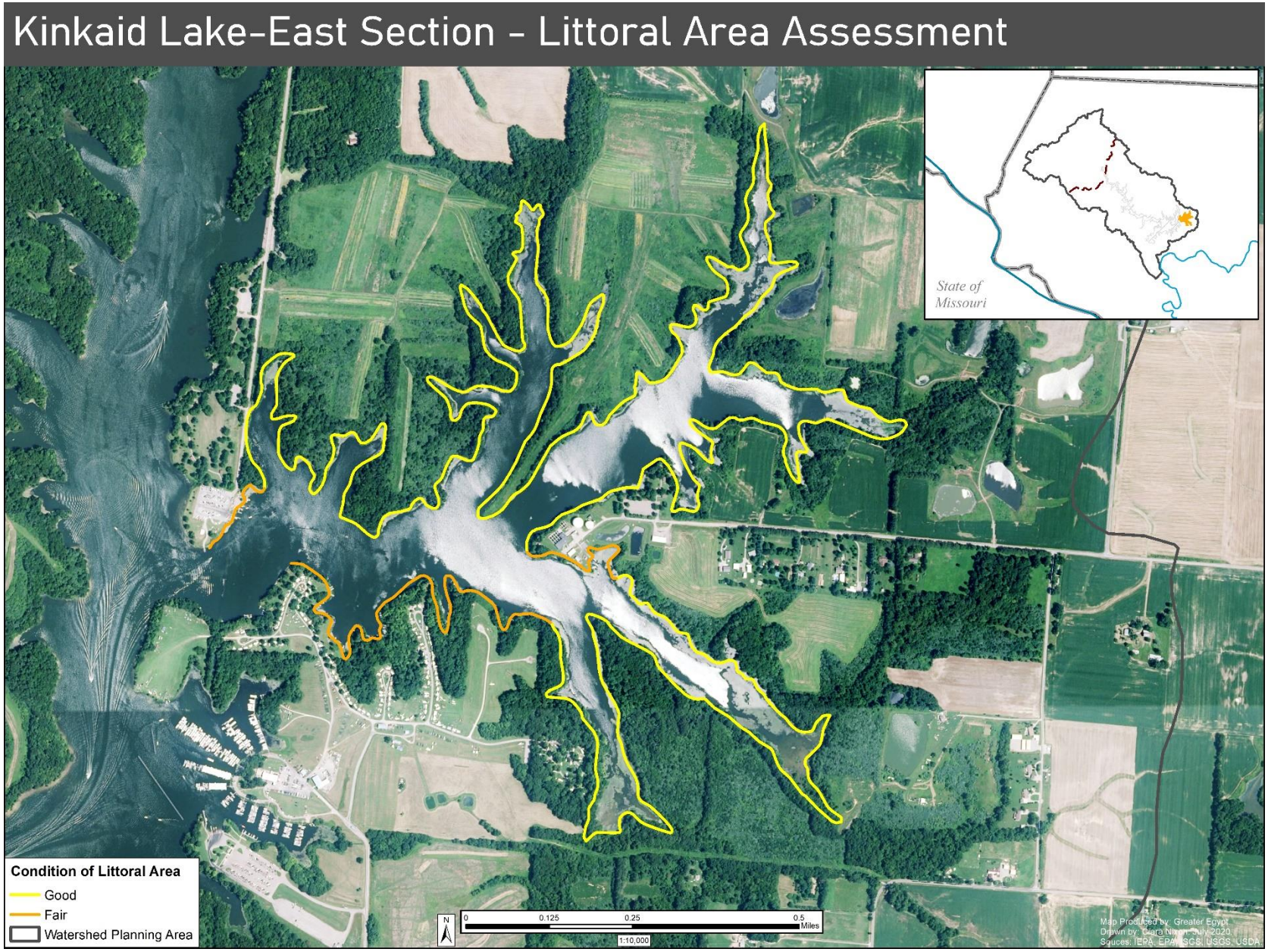
Kinkaid Lake-East – Condition of Littoral Zone

Since the majority of Kinkaid Lake- East is forested, the majority of the littoral areas are in good condition. A total of 49,571 feet of shoreline was assessed and no areas within Kinkaid Lake – East exhibit a poor littoral condition. Even in areas of residential or farmland, a vegetative buffer is present. Table 7.11 summarizes the littoral area conditions. Figure 7.14 displays this data.

Table 7.11- Kinkaid Lake-East Section – Condition of Littoral Area

Kinkaid Lake-East Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Condition of Littoral Area**
IL_RNC_205-01	2,409	5%	Fair
IL_RNC_205-02	2,157	4%	Fair
IL_RNC_205-03	4,886	10%	Good
IL_RNC_205-04	6,153	12%	Good
IL_RNC_205-05	1,340	3%	Fair
IL_RNC_205-06	3,387	7%	Good
IL_RNC_205-07	4,573	9%	Good
IL_RNC_205-08	5,504	11%	Good
IL_RNC_205-09	2,415	5%	Good
IL_RNC_205-10	9,869	20%	Good
IL_RNC_205-11	1,005	2%	Good
IL_RNC_205-12	1,989	4%	Good
IL_RNC_205-13	3,092	6%	Good
IL_RNC_205-14	792	2%	Fair
Total:	**49,571**	**100%**	

Figure 7.15


Kinkaid Lake-East Section - Littoral Area Assessment
State of Missouri
Condition of Littoral Area
Good
Fair
Watershed Planning Area
N
0
0.125
0.25
0.5
Miles
1:10,000
Map Produced by: Greater Egypt
Drawn by: Clara Nimz, July 2020
Sources: IEPA, EPA, USGS, USDA

Kinkaid Lake-Central Body - Condition of Littoral Zone

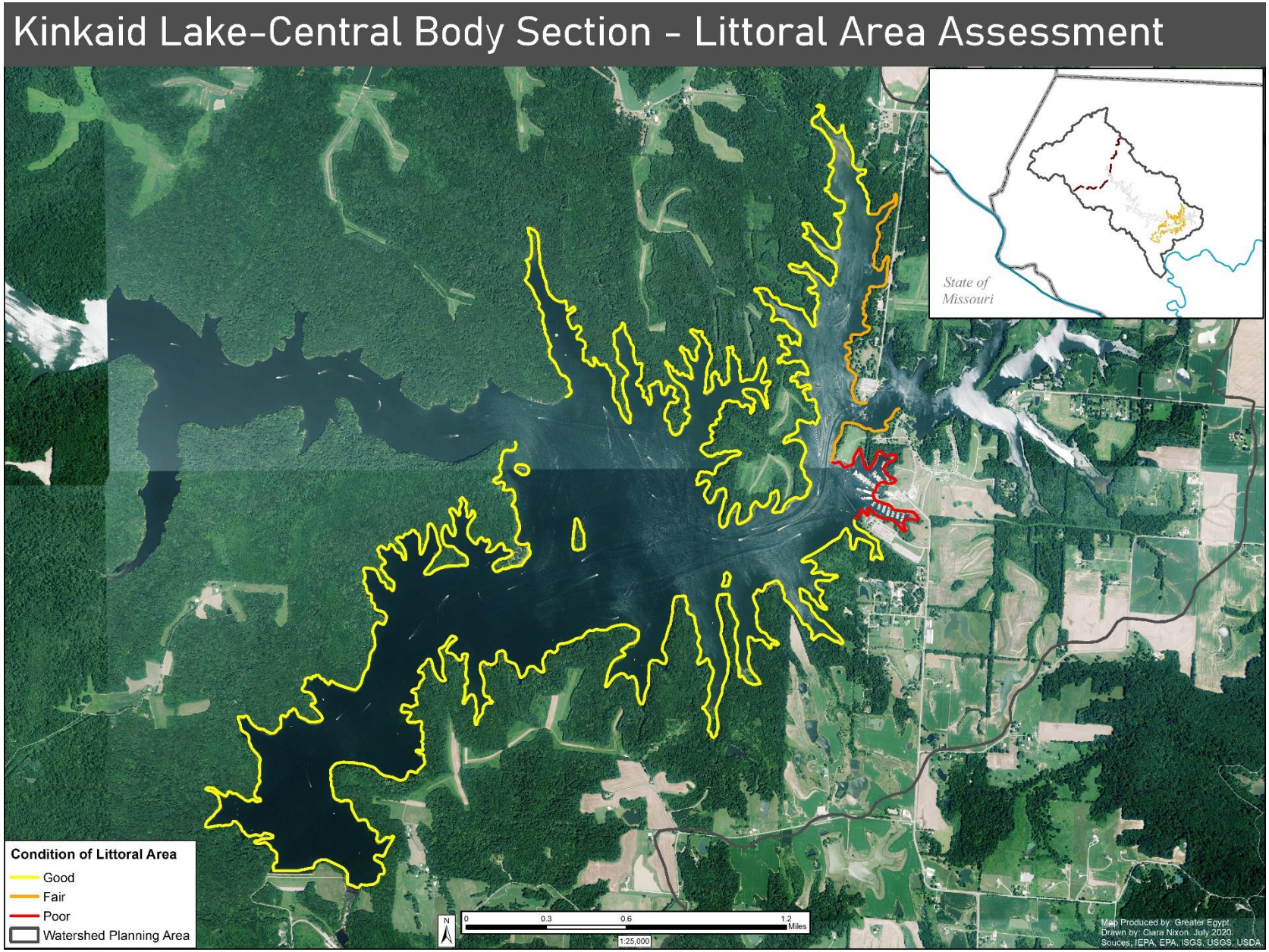
Since the majority of Kinkaid Lake- Central Body is also forested, the majority of the littoral areas are in good condition. A total of 161,139 feet of shoreline was assessed. Within the Central Body section of Kinkaid Lake, 41 shore codes, or 93 percent of the shoreline, exhibits good littoral vegetative buffer. Three shore codes, or three percent of the shoreline, exhibit fair littoral vegetation. The remaining two shore codes, which represent four percent of the shoreline, exhibit poor littoral conditions. Table 7.12 summarizes the riparian area conditions. Figure 7.15 displays this data.

Table 7.12- Kinkaid Lake-Central Body Section – Condition of Littoral Area

Kinkaid Lake-Central Body Section			
Kinkaid Lake Shore Code	Shoreline Length Assessed (ft)	% of Total Shoreline	Condition of Littoral Area
IL_RNC_204-01	1,048	1%	Good
IL_RNC_204-02 (01)	758	0%	Good
IL_RNC_204-02 (02)	1,035	1%	Good
IL_RNC_204-02 (03)	283	0%	Good
IL_RNC_204-03	3,110	2%	Good
IL_RNC_204-04	3,923	2%	Good
IL_RNC_204-05	3,408	2%	Good
IL_RNC_204-06	4,984	3%	Good
IL_RNC_204-07	3,823	2%	Good
IL_RNC_204-08	5,597	3%	Good
IL_RNC_204-09	6,524	4%	Good
IL_RNC_204-10	5,538	3%	Good
IL_RNC_204-11	6,818	4%	Good
IL_RNC_204-12	1,104	1%	Good
IL_RNC_204-13	2,650	2%	Good
IL_RNC_204-14	3,167	2%	Poor
IL_RNC_204-15	3,328	2%	Poor
IL_RNC_204-16	793	0%	Fair
IL_RNC_204-17	1,467	1%	Fair
IL_RNC_204-18	3,271	2%	Fair
IL_RNC_204-19	3,773	2%	Good
IL_RNC_204-20	5,945	4%	Good
IL_RNC_204-21	3,516	2%	Good
IL_RNC_204-22	2,881	2%	Good

Kinkaid Lake-Central Body Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Condition of Littoral Area**
IL_RNC_204-23	3,255	2%	Good
IL_RNC_204-24	2,152	1%	Good
IL_RNC_204-25	1,950	1%	Good
IL_RNC_204-26	2,470	2%	Good
IL_RNC_204-27	5,042	3%	Good
IL_RNC_204-28	2,963	2%	Good
IL_RNC_204-29	7,865	5%	Good
IL_RNC_204-30	5,885	4%	Good
IL_RNC_204-31	6,773	4%	Good
IL_RNC_204-32	5,782	4%	Good
IL_RNC_204-33	3,837	2%	Good
IL_RNC_204-34	3,478	2%	Good
IL_RNC_204-35	6,846	4%	Good
IL_RNC_204-36	7,761	5%	Good
IL_RNC_204-37	1,673	1%	Good
IL_RNC_204-38	2,314	1%	Good
IL_RNC_204-39	4,206	3%	Good
IL_RNC_204-40	3,903	2%	Good
IL_RNC_204-41	1,296	1%	Good
IL_RNC_204-42	1,458	1%	Good
IL_RNC_204-43	756	0%	Good
IL_RNC_204-44	729	0%	Good
Total:	161,139	100%	

Figure 7.16


Kinkaid Lake-Central Body Section - Littoral Area Assessment
State of Missouri
Condition of Littoral Area
Good
Fair
Poor
Watershed Planning Area
N
0 0.3 0.6 1.2 Miles
1:25,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

Kinkaid Lake-Central Channel – Condition of Littoral Zone

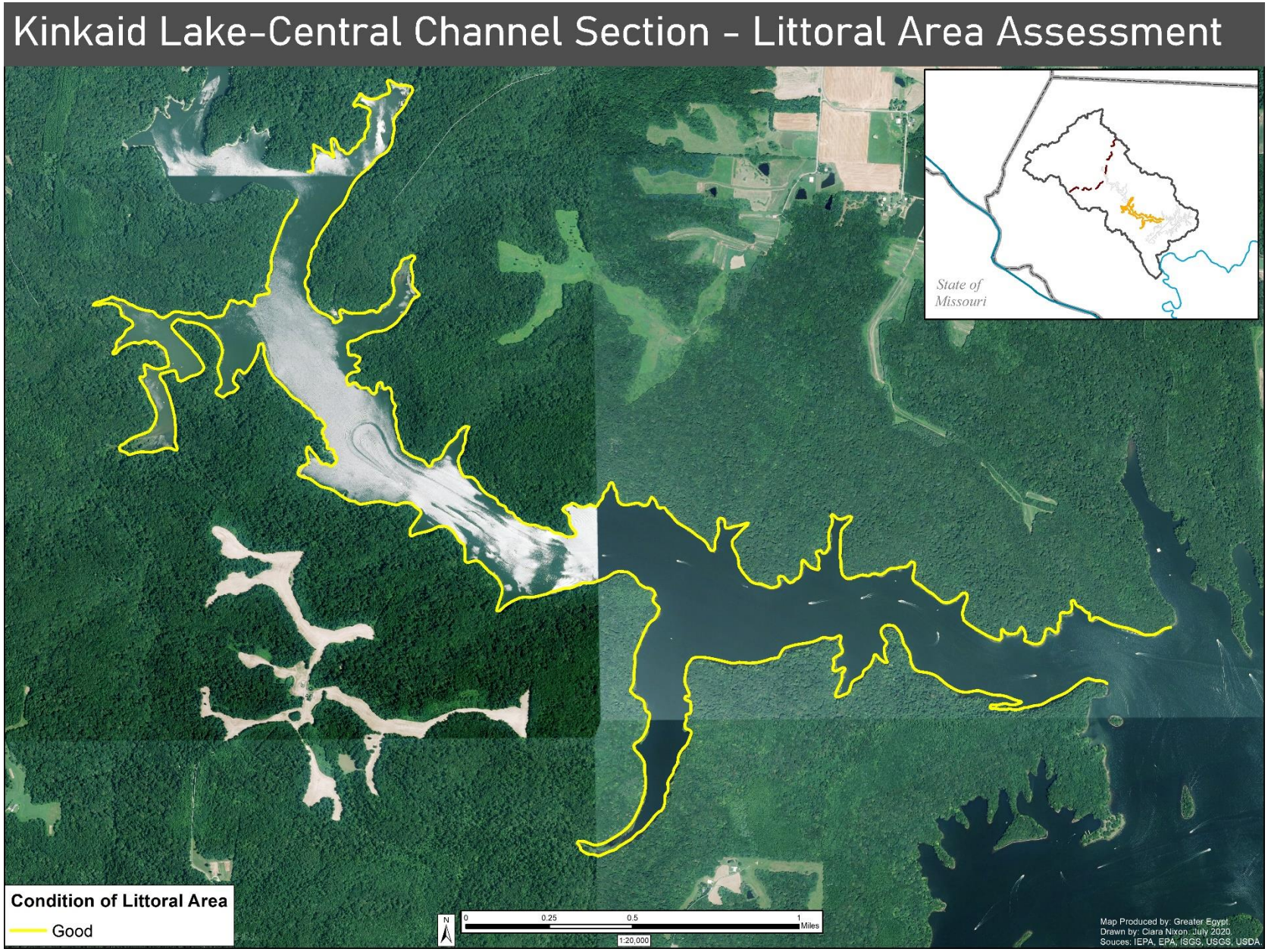
Since the majority of Kinkaid Lake- Central Channel is forested, it is expected that the majority of the littoral areas are in good condition. A total of 88,884 feet of shoreline was assessed and no areas within Kinkaid Lake – Central Channel exhibit fair or poor littoral condition. Table 7.13 summarizes the riparian area conditions. Figure 7.16 displays this data.

Table 7.13 Kinkaid Lake-Central Channel Section – Condition of Littoral Area

Kinkaid Lake-Central Channel Section			
Kinkaid Lake Shore Code	Shoreline Length Assessed (ft)	% of Total Shoreline	Condition of Littoral Area
IL_RNC_208-01 (01)	2,095	2%	Good
IL_RNC_208-01 (02)	915	1%	Good
IL_RNC_204-02 (01)	2,504	3%	Good
IL_RNC_208-02 (02)	2,053	2%	Good
IL_RNC_208-03	3,294	4%	Good
IL_RNC_208-04	3,085	3%	Good
IL_RNC_208-05 (01)	2,342	3%	Good
IL_RNC_208-05 (02)	1,479	2%	Good
IL_RNC_208-06	3,993	4%	Good
IL_RNC_208-07	3,428	4%	Good
IL_RNC_208-08	4,221	5%	Good
IL_RNC_208-09	4,544	5%	Good
IL_RNC_208-10	4,056	5%	Good
IL_RNC_208-11	1,950	2%	Good
IL_RNC_208-12	1,746	2%	Good
IL_RNC_208-13	3,288	4%	Good
IL_RNC_208-14	2,422	3%	Good
IL_RNC_208-15	2,820	3%	Good
IL_RNC_208-16	3,356	4%	Good
IL_RNC_208-17	2,743	3%	Good
IL_RNC_208-18 (01)	5,163	6%	Good
IL_RNC_208-18 (02)	2,013	2%	Good
IL_RNC_208-19	4,421	5%	Good
IL_RNC_208-20	2,552	3%	Good
IL_RNC_208-21	3,210	4%	Good
IL_RNC_208-22	5,284	6%	Good

Kinkaid Lake-Central Channel Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Condition of Littoral Area**
IL_RNC_210-01	3,799	4%	Good
IL_RNC_210-02	4,635	5%	Good
IL_RNC_210-03	1,470	2%	Good
Total:	**88,884**	**100%**	

Figure 7.17


Kinkaid Lake-Central Channel Section - Littoral Area Assessment
State of Missouri
Condition of Littoral Area
Good
N
0
0.25
0.5
1
Miles
1:20,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

Kinkaid Lake-Northwest - Condition of Littoral Zone

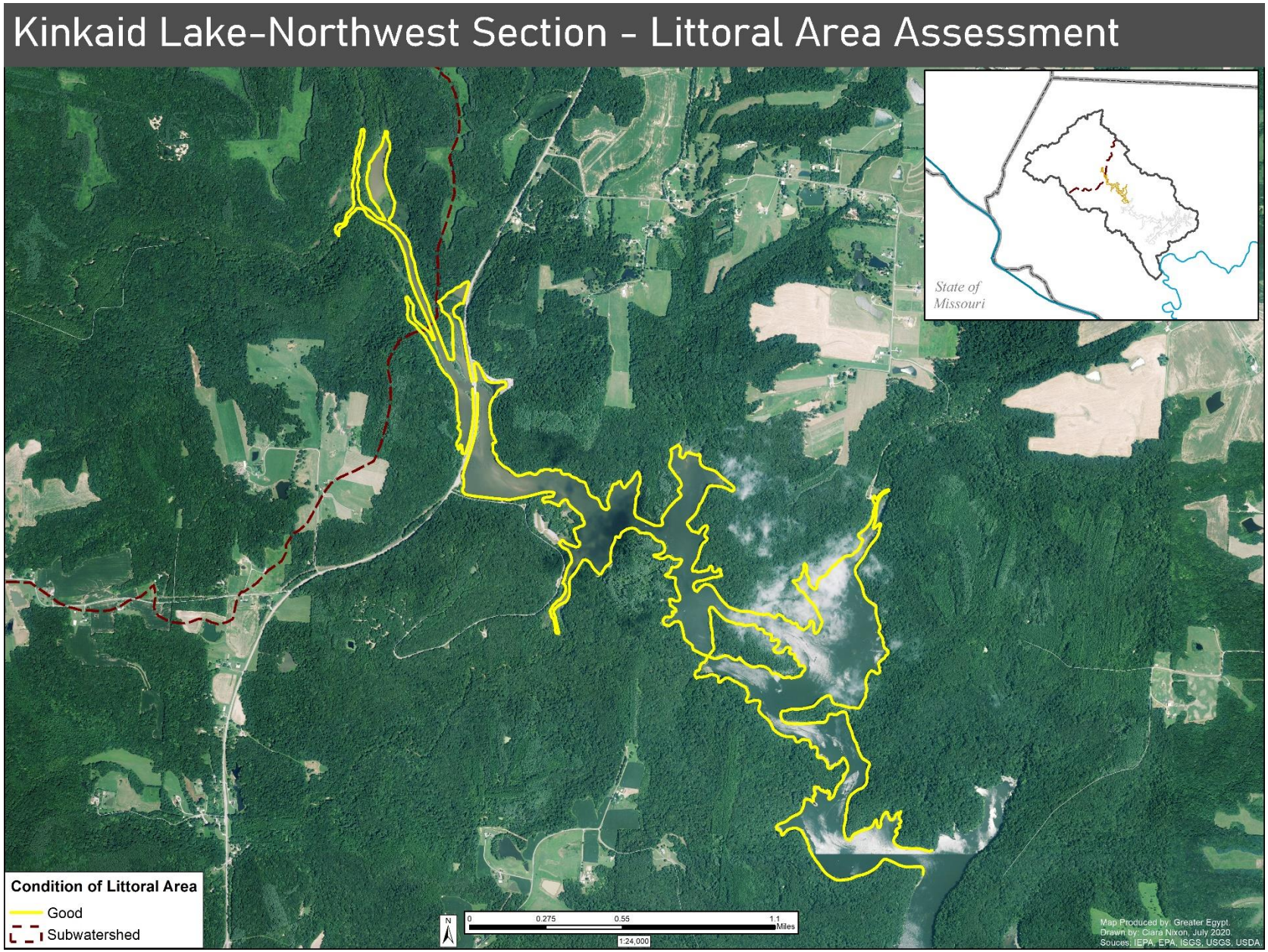
Since the majority of Kinkaid Lake- Northwest is forested, the majority of the littoral areas are in good condition. A total of 97,036 feet of shoreline was assessed and the entire length is classified as good littoral area. Table 7.14 summarizes the littoral area conditions. Figure 7.17 displays this data.

Table 7.14 Kinkaid Lake-Northwest Section – Condition of Littoral Area

Kinkaid Lake-Northwest Section			
Kinkaid Lake Shore Code	Shoreline Length Assessed (ft)	% of Total Shoreline	Condition of Littoral Area
IL_RNC_102-01	12,805	13%	Good
IL_RNC_102-02	6,008	6%	Good
IL_RNC_212-01	757	1%	Good
IL_RNC_212-02	2,401	2%	Good
IL_RNC_212-03	2,774	3%	Good
IL_RNC_212-04	1,479	2%	Good
IL_RNC_212-05	2,467	3%	Good
IL_RNC_212-06	2,417	2%	Good
IL_RNC_212-07	4,812	5%	Good
IL_RNC_212-08	2,250	2%	Good
IL_RNC_212-09	3,121	3%	Good
IL_RNC_212-10	1,426	1%	Good
IL_RNC_212-11	2,342	2%	Good
IL_RNC_212-12	3,119	3%	Good
IL_RNC_212-13	973	1%	Good
IL_RNC_212-14	561	1%	Good
IL_RNC_212-15	2,124	2%	Good
IL_RNC_212-16	2,503	3%	Good
IL_RNC_212-17	3,003	3%	Good
IL_RNC_212-18	5,924	6%	Good
IL_RNC_212-19	1,924	2%	Good
IL_RNC_212-20	3,258	3%	Good
IL_RNC_212-21	6,316	7%	Good
IL_RNC_212-22	2,805	3%	Good
IL_RNC_212-23	4,478	5%	Good
IL_RNC_212-24	2,589	3%	Good
IL_RNC_212-25	941	1%	Good

Kinkaid Lake-Northwest Section			
Kinkaid Lake Shore Code	**Shoreline Length Assessed (ft)**	**% of Total Shoreline**	**Condition of Littoral Area**
IL_RNC_212-26	2,426	3%	Good
IL_RNC_212-27	2,201	2%	Good
IL_RNC_212-28	887	1%	Good
IL_RNC_212-29	3,092	3%	Good
IL_RNC_212-30	2,853	3%	Good
Total:	97,036	100%	

Figure 7.18


Kinkaid Lake-Northwest Section - Littoral Area Assessment
State of Missouri
Condition of Littoral Area
Good
Subwatershed
N
0
0.275
0.55
1.1
Miles
1:24,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon, July 2020.
Souces: IEPA, EPA, ISGS, USGS, USDA.

7.5 Basins and Blockages

Basins have also been assessed as part of this report. Detention basins are usually dry structures that temporarily store water during a heavy period of stormwater runoff. These types of basins can also release the detained water at a controlled rate. Although their primary purpose is to store water, they can also be constructed in a manner that provides benefits to habitats and water quality.

Retention basins, also known as wet basins, also serve to manage stormwater runoff, but store water on a permanent basis. Like detention basins, retention areas can also reduce, or prevent flooding, and improve water quality.

Detention basins are more prevalent in the planning area. Basins in the Kinkaid Creek watershed are displayed in Figure 7.19 and 7.20.

The following tables summarize the basins by type and location (latitude/longitude). Basins were assigned an identification number. There are 105 basins in the watershed planning area. The majority of these features occur in the Little Kinkaid Creek- Kinkaid Creek watershed. Basins are also displayed in Table 7.15 with Basin IDs.

Table 7.15 Basin Identification

Basin Type	Basin ID	Latitude	Longitude
Detention	1	37.846197	-89.579082
Detention	2	37.846683	-89.573868
Detention	3	37.849044	-89.567071
Detention	4	37.852634	-89.570587
Detention	5	37.833976	-89.551712
Detention	6	37.835299	-89.547886
Detention	7	37.839439	-89.551429
Detention	8	37.844367	-89.524365
Detention	9	37.842766	-89.524275
Detention	10	37.842578	-89.529373
Detention	11	37.840772	-89.527447
Detention	12	37.843804	-89.570354
Detention	13	37.870488	-89.549174
Detention	14	37.872887	-89.559483
Detention	15	37.875793	-89.562336
Detention	16	37.890156	-89.574624
Detention	17	37.888988	-89.575734
Detention	18	37.885548	-89.57432
Detention	19	37.888622	-89.576303
Detention	20	37.879922	-89.568182
Detention	21	37.878384	-89.564591
Detention	22	37.877039	-89.564599
Detention	23	37.893435	-89.572118
Detention	24	37.897735	-89.567381
Detention	25	37.902716	-89.558456
Detention	26	37.897921	-89.557943
Detention	27	37.891839	-89.546423
Detention	28	37.878139	-89.538686
Detention	29	37.883794	-89.536542
Detention	30	37.873178	-89.510873
Detention	31	37.872738	-89.519869
Detention	32	37.880308	-89.519883
Detention	33	37.88089	-89.521419
Detention	34	37.882707	-89.526101
Detention	35	37.879756	-89.526253
Detention	36	37.889548	-89.528525
Detention	37	37.896939	-89.525619
Detention	38	37.906699	-89.528453
Detention	39	37.9051	-89.528317
Detention	40	37.903893	-89.533881
Detention	41	37.910444	-89.546005
Detention	42	37.909634	-89.542872
Detention	43	37.913181	-89.542127
Detention	44	37.855723	-89.627415
Detention	45	37.856724	-89.622108
Detention	46	37.85227	-89.623954
Detention	47	37.852178	-89.620166
Detention	48	37.856627	-89.618543
Detention	49	37.853732	-89.613765
Detention	50	37.865602	-89.619751
Detention	51	37.87331	-89.614457
Detention	52	37.901564	-89.54952
Detention	53	37.916598	-89.531769
Detention	54	37.83682	-89.572216
Detention	55	37.840398	-89.578127

Basin Type	Basin ID	Latitude	Longitude
Detention	56	37.833355	-89.545201
Detention	57	37.834652	-89.544741
Detention	58	37.831792	-89.526769
Detention	59	37.852495	-89.507499
Detention	60	37.847973	-89.486441
Detention	61	37.854494	-89.489857
Detention	62	37.858255	-89.487674
Detention	63	37.86065	-89.484368
Detention	64	37.862346	-89.486022
Detention	65	37.861885	-89.482136
Detention	66	37.863801	-89.491205
Detention	67	37.865051	-89.498374
Detention	68	37.86898	-89.499271
Detention	69	37.871198	-89.494504
Detention	70	37.868064	-89.487811
Detention	71	37.872228	-89.501919
Detention	72	37.879167	-89.504081
Detention	73	37.878991	-89.501845
Detention	74	37.880271	-89.502146
Detention	75	37.877708	-89.495338
Detention	76	37.875876	-89.494058
Detention	77	37.87607	-89.499494
Detention	78	37.822679	-89.461668
Detention	79	37.823825	-89.458881
Detention	80	37.824946	-89.458148
Detention	81	37.822364	-89.456668
Detention	82	37.821906	-89.45533
Detention	83	37.826721	-89.441505
Detention	84	37.827386	-89.451464
Detention	85	37.833892	-89.466596
Detention	86	37.835595	-89.458578
Detention	87	37.834268	-89.453462
Detention	88	37.846618	-89.466762
Detention	89	37.840313	-89.463762
Detention	90	37.840238	-89.451999
Detention	91	37.846916	-89.438631
Detention	92	37.781307	-89.430841
Detention	93	37.814379	-89.400579
Detention	94	37.812029	-89.399481
Detention	95	37.809928	-89.399608
Detention	96	37.809581	-89.394413
Detention	97	37.808302	-89.392238
Detention	98	37.806288	-89.393946
Detention	99	37.805693	-89.395037
Detention	100	37.821417	-89.515175
Detention	101	37.813979	-89.515185
Detention	102	37.812155	-89.511032
Detention	103	37.777473	-89.444965
Detention	104	37.772266	-89.43013
Detention	105	37.755082	-89.459811

Figure 7.19

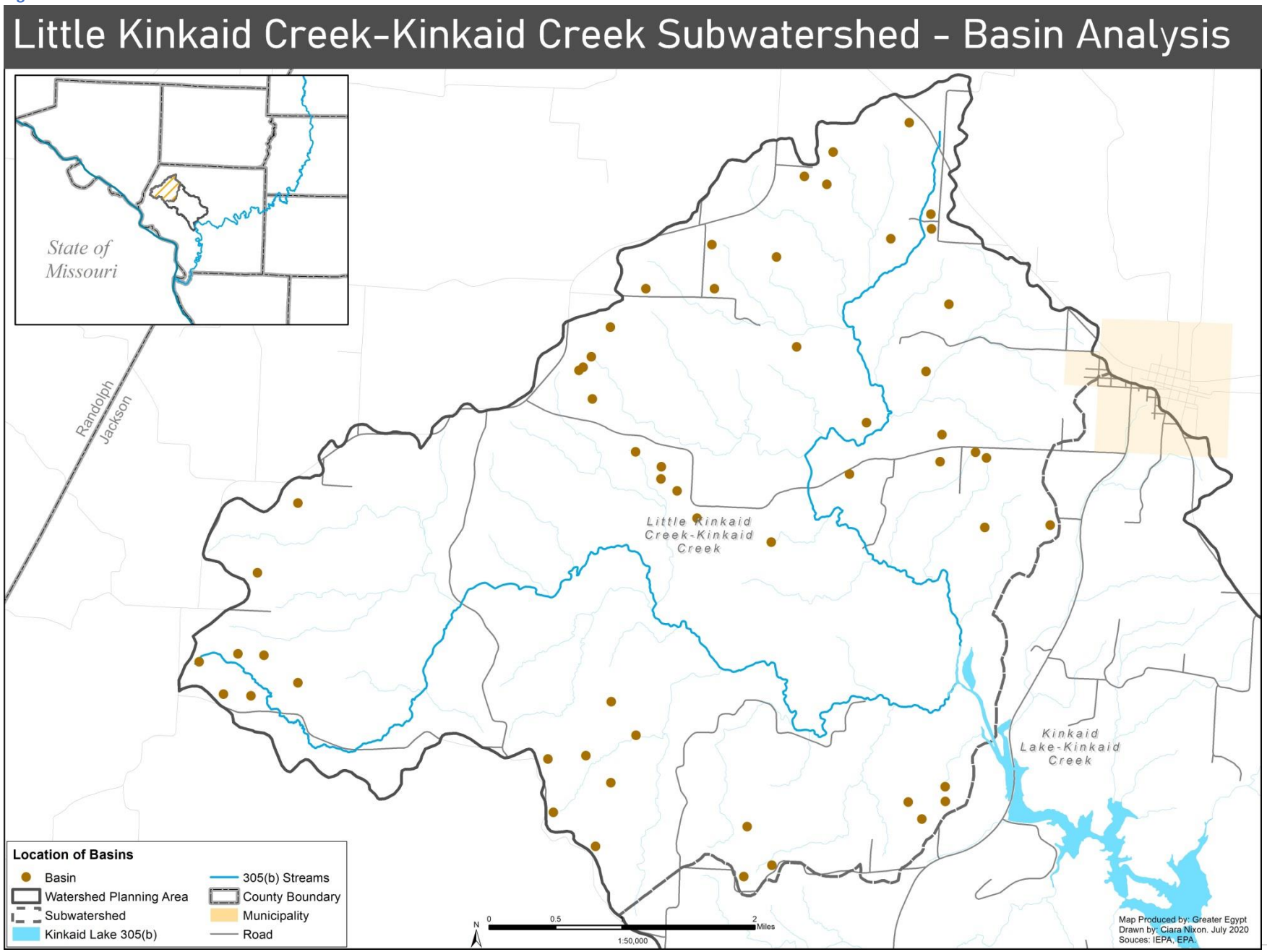
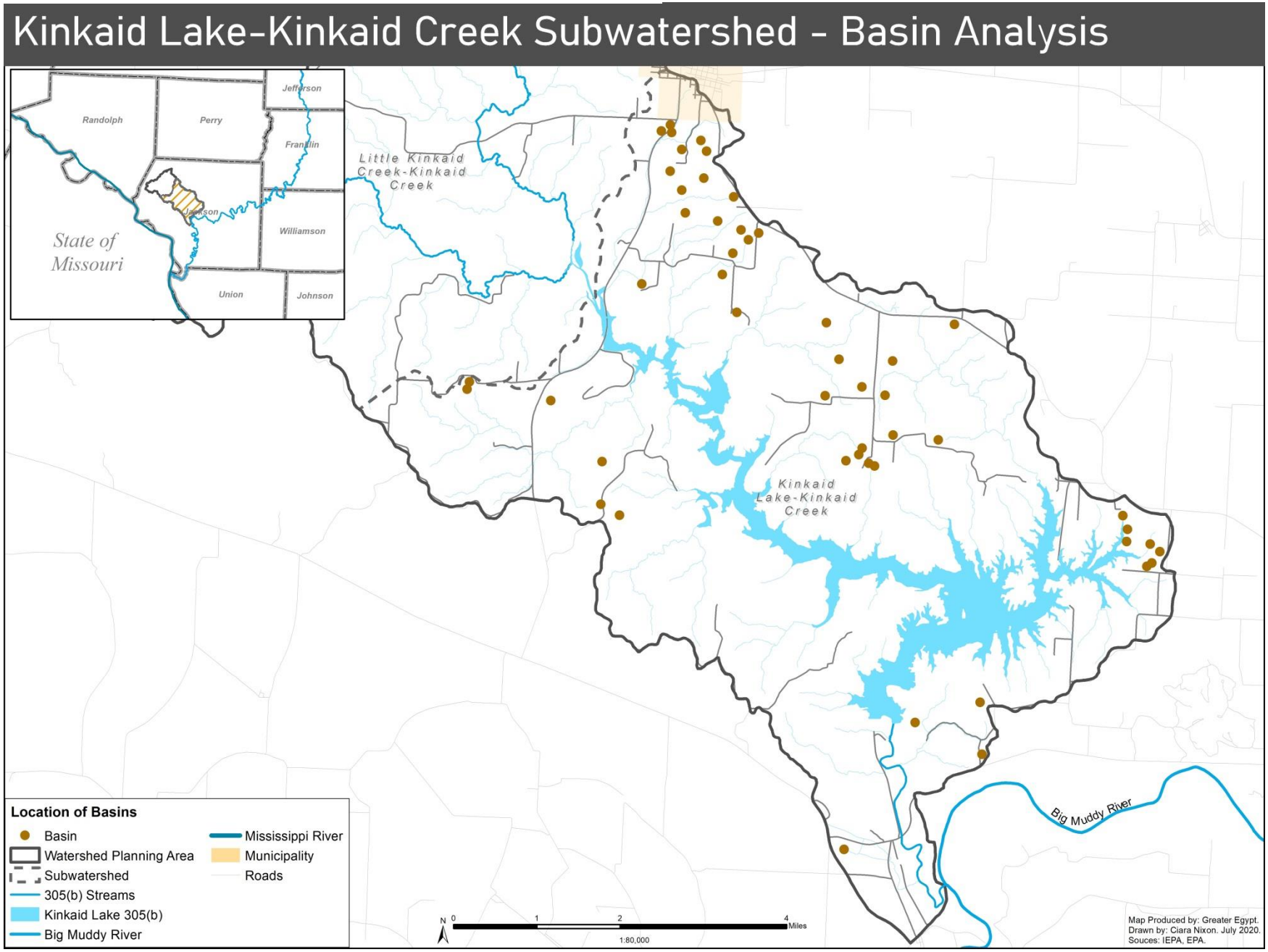

Little Kinkaid Creek-Kinkaid Creek Subwatershed - Basin Analysis
State of Missouri
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Location of Basins
Basin
Watershed Planning Area
Subwatershed
Kinkaid Lake 305(b)
305(b) Streams
County Boundary
Municipality
Road
N
0
0.5
2
Miles
1:50,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. July 2020
Souces: IEPA, EPA

Figure 7.20


Kinkaid Lake-Kinkaid Creek Subwatershed - Basin Analysis
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
Location of Basins
Basin
Watershed Planning Area
Subwatershed
305(b) Streams
Kinkaid Lake 305(b)
Big Muddy River
Mississippi River
Municipality
Roads
N
0
1
2
4
Miles
1:80,000
Map Produced by: Greater Egypt.
Drawn by: Ciara Nixon. July 2020.
Souces: IEPA, EPA.

Debris Blockages

Many areas in the Kinkaid Creek watershed planning area exhibit different types of debris blockages. These impediments are both natural and synthetic. Downed vegetation represents the majority of the blockages. Figure 7.21 displays some of the obstructions occurring in tributaries that flow into Kinkaid Lake.

Figure 7.21- Watershed Waterbody Obstructions

Dumping and litter is also prevalent in many portions of the watershed. This is typically evident around stream crossings and rural areas. Figure 7.22 reveals an area where dumping has occurred along a tributary that feeds into Kinkaid Creek.

Figure 7.22- Waterbody Dump Site

8. Water Quality Assessment

For this assessment, water quality of the waterbodies with available data that are within the Kinkaid Lake Watershed planning area have been analyzed. A water quality assessment has also been completed for Ava, the only municipality within the planning area.

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 of Illinois waterbodies and groundwater sources.

There are seven designated uses in Illinois, and six apply within the Kinkaid Creek planning area. These are: Aquatic Life, Fish Consumption, Primary Contact, Public and Food Processing Water Supplies, Secondary Contact, and Aesthetic Quality. Indigenous Aquatic Life is not a designated use for the planning area.

8.1 Water Quality Impairments and Monitoring

303(d) and 305(b) Waterbodies

The streams assessed for water quality impairments under Section 303(d) include Kinkaid Creek (IL_NB, IL_NB-01) and Little Kinkaid Creek (IL_NBA). Kinkaid Lake is the only lake within the planning area and was also assessed for impairments. A depiction of 303(d) waterbodies and IEPA monitoring stations can be viewed in Figure 8.1.

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

Figure 8.1

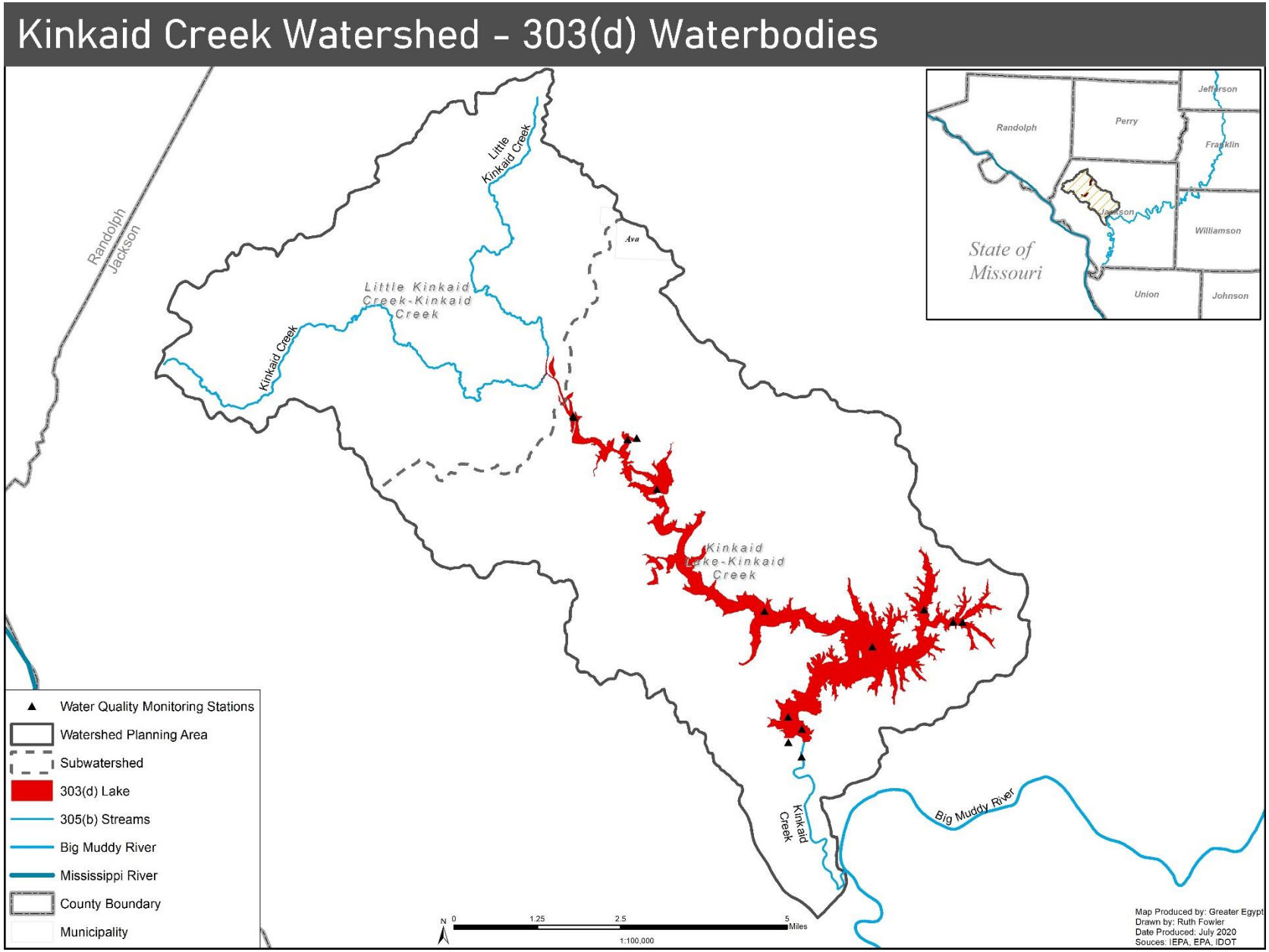

Kinkaid Creek Watershed – 303(d) Waterbodies
Randolph
Jackson
Little Kinkaid Creek
Ava
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Kinkaid Creek
Big Muddy River
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Water Quality Monitoring Stations
Watershed Planning Area
Subwatershed
303(d) Lake
305(b) Streams
Big Muddy River
Mississippi River
County Boundary
Municipality
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler
Date Produced: July 2020
Souces: IEPA, EPA, IDOT

Table 8.1 outlines the designated uses and assessment status of waterbodies within the Kinkaid Creek Watershed, as identified in the Illinois Integrated Water Quality Report and Section 303(d) List for 2016. This includes two streams and one lake.

The Illinois Integrated Water Quality Report categorizes Kinkaid Lake (IL_RNC) as having six designated uses: aquatic life, fish consumption, public and food processing water supplies, primary contact, secondary contact, and aesthetic quality. Primary and secondary contacts were not assessed in the 2016 report. The only designated use not being fully supported is fish consumption.

Kinkaid Creek (IL_NB and IL_NB-01) and Little Kinkaid Creek (IL_NBA) are categorized as having five designated uses: aquatic life, fish consumption, primary contact, secondary contact, and aesthetic quality. The only creek that was assessed in the 2016 report is Kinkaid Creek (IL_NB-01). The designated uses being fully supported are aquatic life, primary contact, and secondary contact. All other designated uses within the three creeks were not assessed in the IEPA's water quality report.

Table 8.1- Assessment Status of Kinkaid Lake (IL_RNC)

Waterbody Name & Assessment ID	Designated Use	Use ID	Assessed in 2016 Integrated Report	Use Attainment
Kinkaid Lake (IL_RNC)	Aquatic Life	582	Yes	Fully Supporting
	Fish Consumption	583	Yes	Not Supporting
	Public and Food Processing Water Supplies	584	Yes	Fully Supporting
	Primary Contact	585	No	N/A
	Secondary Contact	586	No	N/A
	Aesthetic Quality	590	Yes	Fully Supporting
Kinkaid Creek (IL_NB)	Aquatic Life	582	No	N/A
	Fish Consumption	583	No	N/A
	Primary Contact	585	No	N/A
	Secondary Contact	586	No	N/A
	Aesthetic Quality	590	No	N/A
Kinkaid Creek (IL_NB-01)	Aquatic Life	582	Yes	Fully Supporting
	Fish Consumption	583	No	N/A
	Primary Contact	585	Yes	Fully Supporting
	Secondary Contact	586	Yes	Fully Supporting
	Aesthetic Quality	590	No	N/A
Little Kinkaid Creek (IL_NBA)	Aquatic Life	582	No	N/A
	Fish Consumption	583	No	N/A
	Primary Contact	585	No	N/A
	Secondary Contact	586	No	N/A
	Aesthetic Quality	590	No	N/A

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

Kinkaid Lake is the only waterbody within the planning area that is impaired and has been placed on the IEPA's 303(d) List of Impaired Waters due to the presence of mercury. Sources of impairments are atmospheric deposition-toxins and other unknown sources. Information from the 305(b) Assessment (Appendix B-3) can be found in Table 8.2.

Table 8.2- Assessment Information for Waterbodies

Waterbody	Assessment Unit ID	Size	Causes of Impairment(s)	Sources of Impairment(s)
Kinkaid Lake	IL_RNC	3,475 ac	Mercury	Atmospheric Deposition-Toxics, Source Unknown
Little Kinkaid Creek	IL_NBA	16.9 mi	N/A	N/A
Kinkaid Creek	IL_NB	9.66 mi	N/A	N/A
Kinkaid Creek	IL-NB-01	3.38 mi	N/A	N/A

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

The information contained in the 303(d) section also lists the impaired designated use and cause of impairment. The following table summarizes the cause of impairment for Kinkaid Lake. The only impaired designated use is fish consumption, which is caused by mercury. The other waterbodies were not fully assessed in the 2016 report, and therefore information for the streams is not applicable.

Table 8.3- 303(d) Information for Waterbodies

Waterbody	Assessment Unit ID	Size	Impaired Designated Use	Causes of Impairment
Kinkaid Lake	IL_RNC	3,475 ac	Fish Consumption	Mercury
Kinkaid Creek	IL_NB	9.66 mi	N/A	N/A
Kinkaid Creek	IL_NB-01	3.38 mi	N/A	N/A
Little Kinkaid Creek	IL_NBA	6.41 mi	N/A	N/A

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

8.2 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. In other cases, a watershed-based plan must be created if a TMDL does not exist. That is the purpose of this planning process.

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. Both of the HUC 12 watersheds in the planning area are located within the larger Big Muddy River watershed (HUC 07140106), which is an IEPA priority watershed for addressing total phosphorus losses from nonpoint sources. Further information regarding the ILNLRS can be found in Section 8.8.

Volunteer Lake Monitoring Program

Since 1984, Greater Egypt has coordinated the VLMP for southern Illinois' ten-county region. This volunteer-based program is maintained by the IEPA. The monitoring season begins May 1st and concludes October 31st with volunteers monitoring their

lakes twice a month. Program participants are required to have access to a boat and anchor. Training is provided by the Regional Coordinator for southern Illinois.

Volunteers are divided into three tiers. Tier I is the most basic, while Tier II and III require previous participation in the program. Participation is dependent on funding and supplies from IEPA. The level of monitoring is dependent on the tier level of the volunteer.

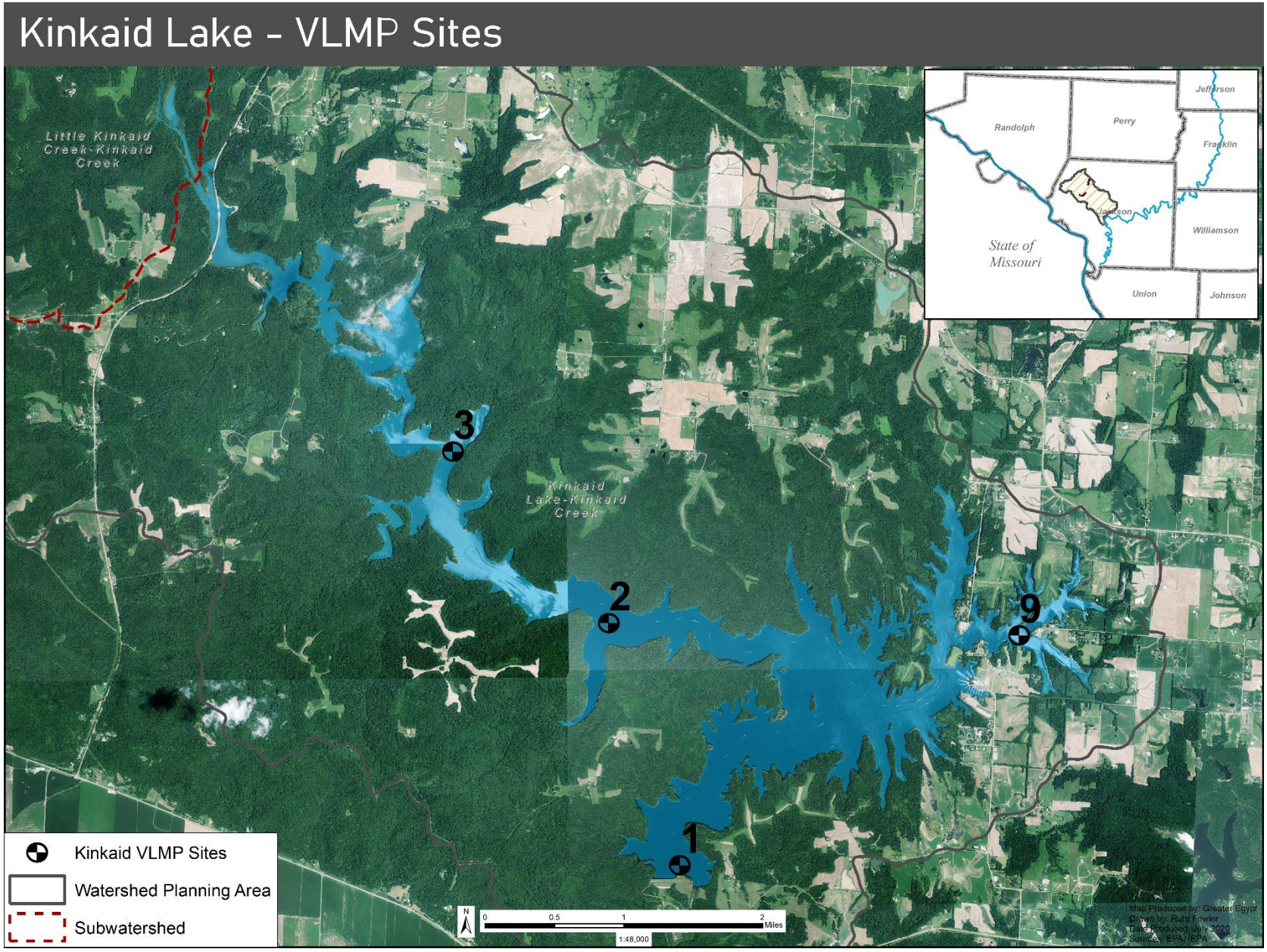
Tier I:
Basic lake monitoring. Volunteers measure lake water clarity with a Secchi Disk and make other basic lake observations. Volunteers record the level of aquatic plant growth, record the siting of any invasive species, the lake water level, weather, and watershed conditions at the time of monitoring.

Tier II:
After actively participating in Tier I, volunteers are eligible for Tier II monitoring. Tier II volunteers complete Tier I monitoring while also taking lake water samples.

Tier III:
In addition to collecting water samples, volunteers also collect chlorophyll samples as well as measure oxygen levels and water temperatures.

Kinkaid-Reed's Creek Conservancy District has been participating in the program with Tier III responsibilities. The VLMP Site map can be viewed in Figure 8.2.

Figure 8.2


Kinkaid Lake - VLMP Sites
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
3
2
9
1
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
State of Missouri
Union
Johnson
Kinkaid VLMP Sites
Watershed Planning Area
Subwatershed
N
0
0.5
1
2
Miles
1:48,000
Map Produced by: Greater Egypt
Drawn by: Ruth Fowler
Date Produced: July 2020
Sources: EPA, IEPA

8.3 Water Quality of Kinkaid Watershed Lakes and Streams

8.3.1 Lakes

Kinkaid Lake (IL_NA)

The 2016 Illinois Integrated Water Quality Report states the designated use of Kinkaid Lake to be aquatic life, fish consumption, public and food processing water supplies, primary contact, secondary contact, and aesthetic quality. Fish consumption is not being supported due to mercury. Potential sources of this impairment include atmospheric deposition-toxins and an unknown source. The IEPA has established twelve monitoring stations within Kinkaid Lake, which are displayed in Table 8.4. Locations of these sites are detailed in the following table.

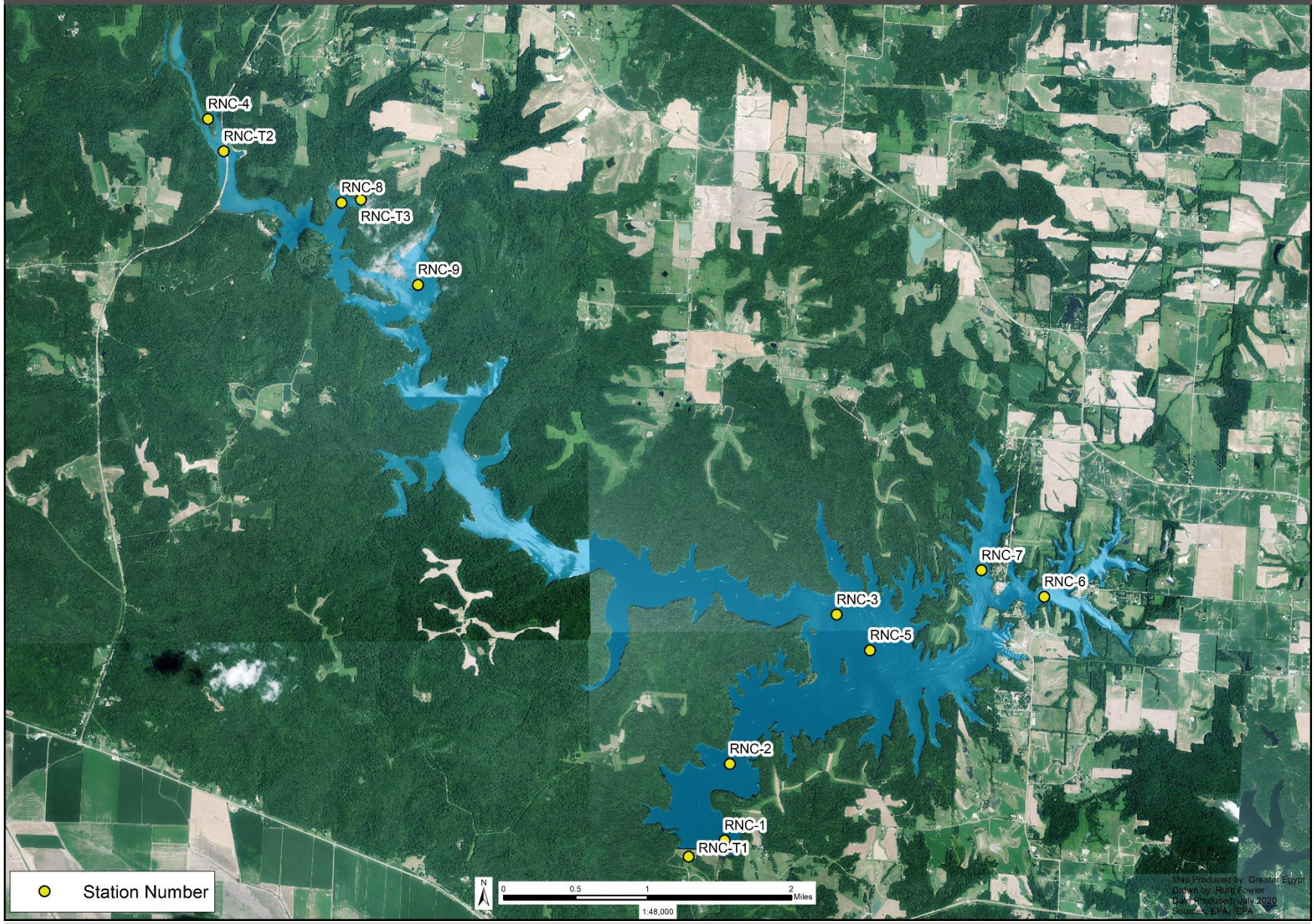
Table 8.4- Kinkaid Lake IEPA Monitoring Stations

Station Code	County	Station Location
RNC-1	Jackson	S. Extension by Spillway
RNC-2	Jackson	Directly N. and Above Site RNC-1
RNC-3	Jackson	N.W. of Site RNC-2
RNC-4	Jackson	Kinkaid Site 4
RNC-5	Jackson	Kinkaid Site 5
RNC-6	Jackson	Kinkaid Site 6
RNC-7	Jackson	Kinkaid Site 7
RNC-8	Jackson	Kinkaid Site 8
RNC-9	Jackson	Kinkaid Site 9 (1978)
RNC-T1	Jackson	Kinkaid Tributary 1
RNC-T2	Jackson	Kinkaid Tributary 2
RNC-T3	Jackson	Kinkaid Tributary 3

Source: 2018 IEPA integrated Water Quality Report and 303(d) Lists

Figure 8.3

Kinkaid Lake - Water Sample Locations



Water Quality data for Kinkaid Lake was provided by IEPA and includes data for the years 2008 through 2018. Mercury is the only impairment for Kinkaid Lake, but limited data is available for review. The following assessment will feature nutrients and other water quality parameters that have more available data.

Mercury

Mercury is the cause of impairment for fish consumption within Kinkaid Lake. The only available data for mercury is from years 2008 and 2011. The results are from three different stations around the lake. Results are displayed in Table 8.5. A technical support document published by the EPA in 2006 describes mercury as, "a toxic metal that is of significant concern as an environmental pollutant. It exists in the environment naturally and as a product of man-made processes, including waste incineration and fossil fuel combustion. Mercury is a persistent environmental contaminant, which cannot be degraded or destroyed".[49]

Table 8.5- Kinkaid Lake Mercury Results

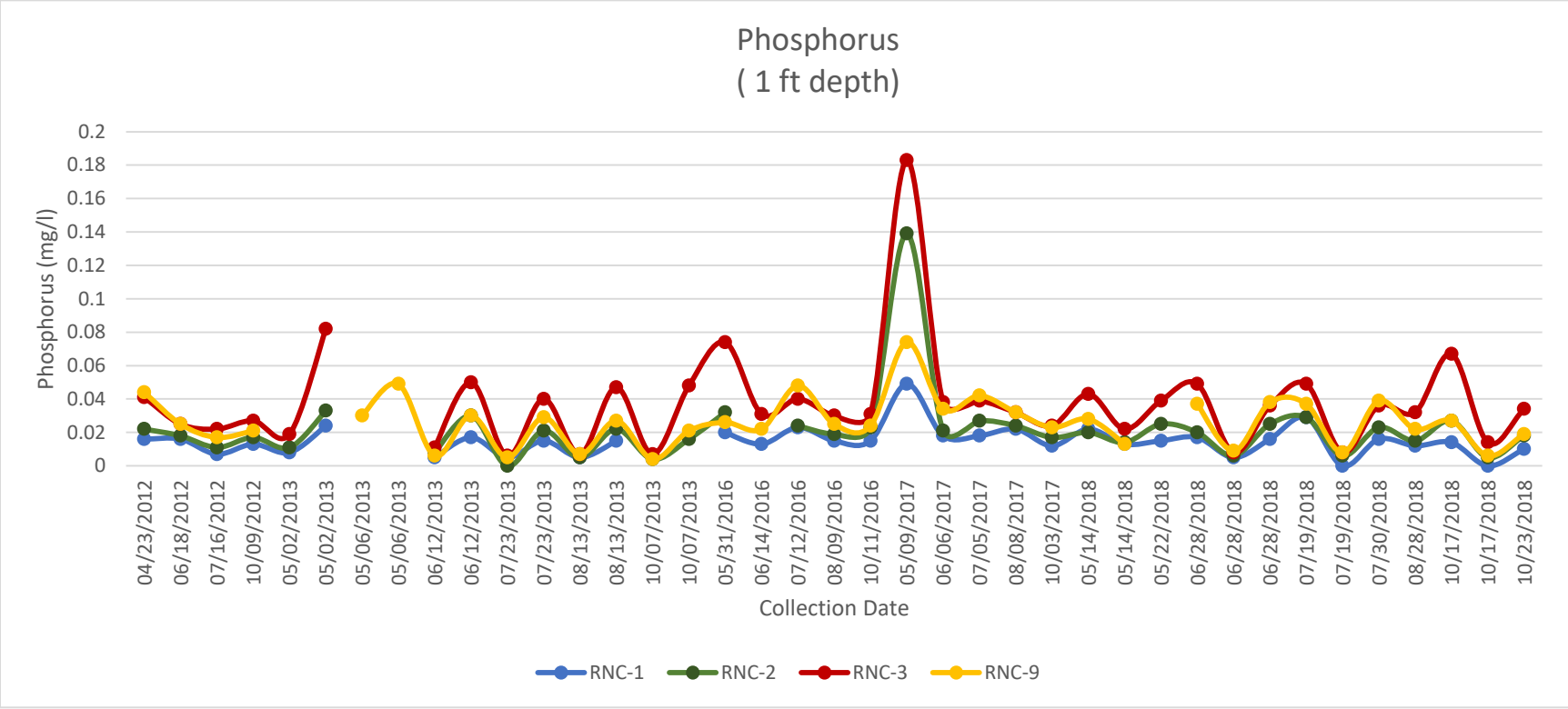
Station Code	Sample Depth (ft)	Collection Date	Results (mg/kg)	Weight Basis	Result Particle Size Basis
RNC-1	51	8/08/2008	0.05	dry	Unsieved
RNC-4	10	8/08/2008	0.01	dry	Unsieved
RNC-9	24	8/08/2008	0.04	dry	Unsieved
RNC-1	64	7/11/2011	0.1	dry	

[49] EPA. *Technical Support Document for Reducing Mercury Emissions from Coal-Fired Electric Generating Units.* Springfield, IL: EPA, March 14, 2006. PDF

Phosphorus

The Illinois Water Quality Standard for phosphorus is not the exceed 0.05 mg/L for any reservoir or lake with a surface area of 8.1 hectares (20 acres) or more.[50] Most phosphorus samples are below the water quality standard. These values in the graph are recorded at varying intervals based on available data. Some years are missing from the data. Samples were taken at Station Code: RNC-1, RNC-2, RNC-3, and RNC-9.

Table 8.6- Phosphorus

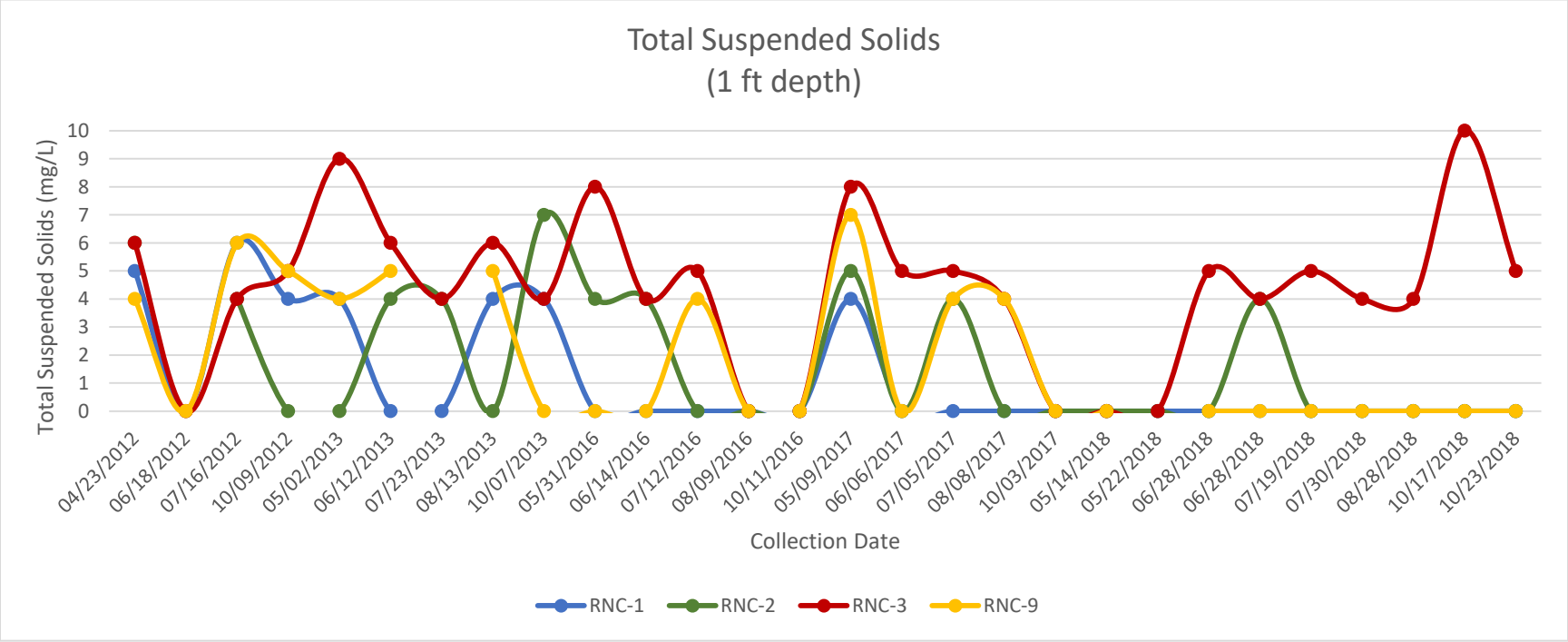


[50] Illinois Pollution Control Board. *Title 35: Environmental Protection- Subtitle C: Water Pollution- part 302 Water Quality Standards, Subpart A: General Water Quality Provisions.* PDF. Accessed March 2020.

Total Suspended Solids

Currently there is no numeric standard for total suspended solids. TSS values in the graphs are recorded at varying intervals and some years are missing from available data. Samples were taken at Station Code: RNC-1, RNC-2, RNC-3, and RNC-9. Samples were taken at varying depths, but for ease of comparison, all data is displayed at a 1 foot depth.

Table 8.7- Total Suspended Solids



Dissolved Oxygen

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.

Table 8.8- RNC-1 Dissolved Oxygen

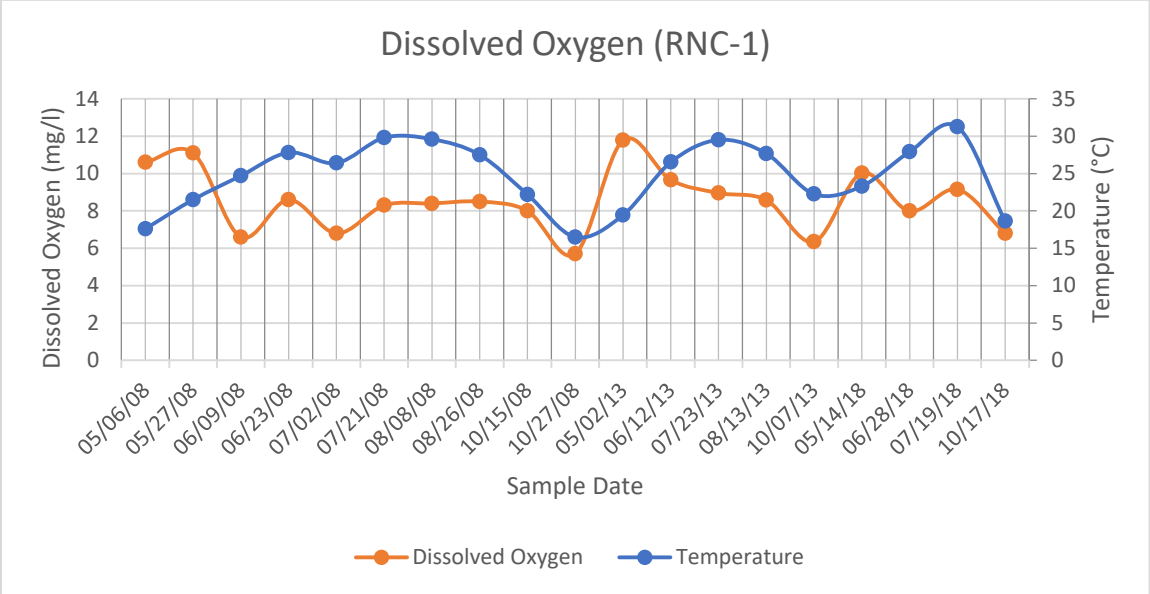


Table 8.9- RNC-2 Dissolved Oxygen

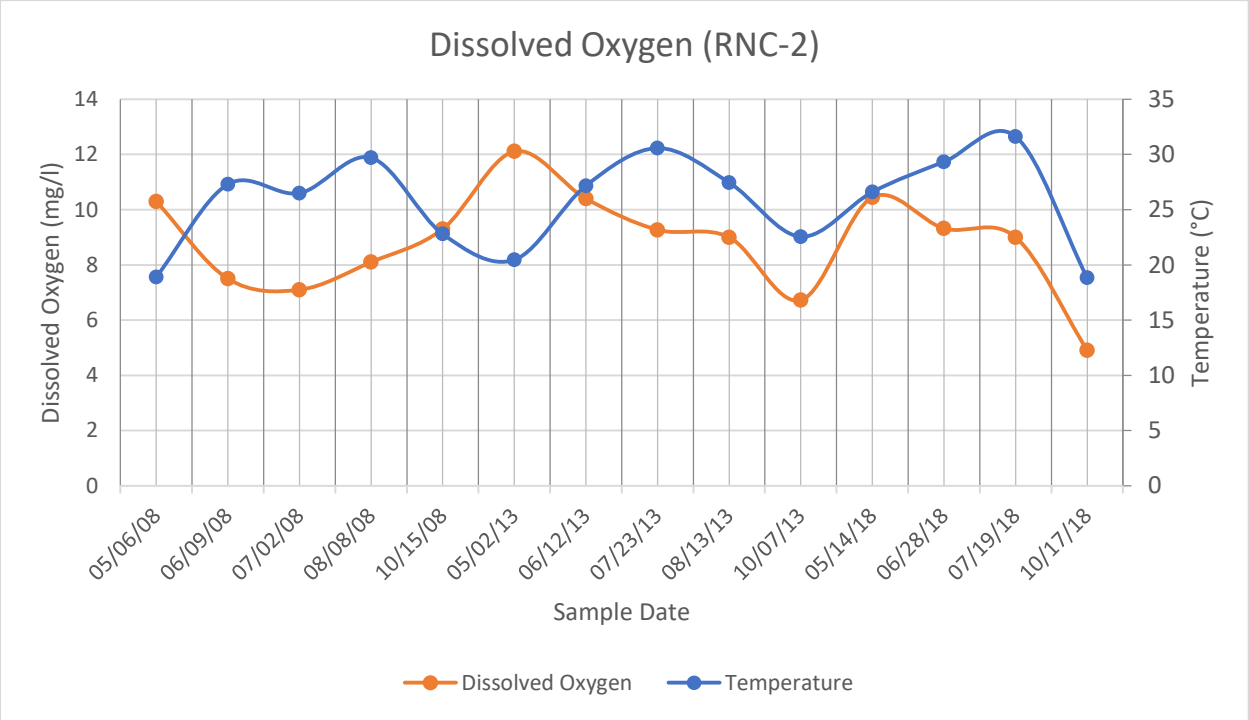


Table 8.10- RNC-3 Dissolved Oxygen

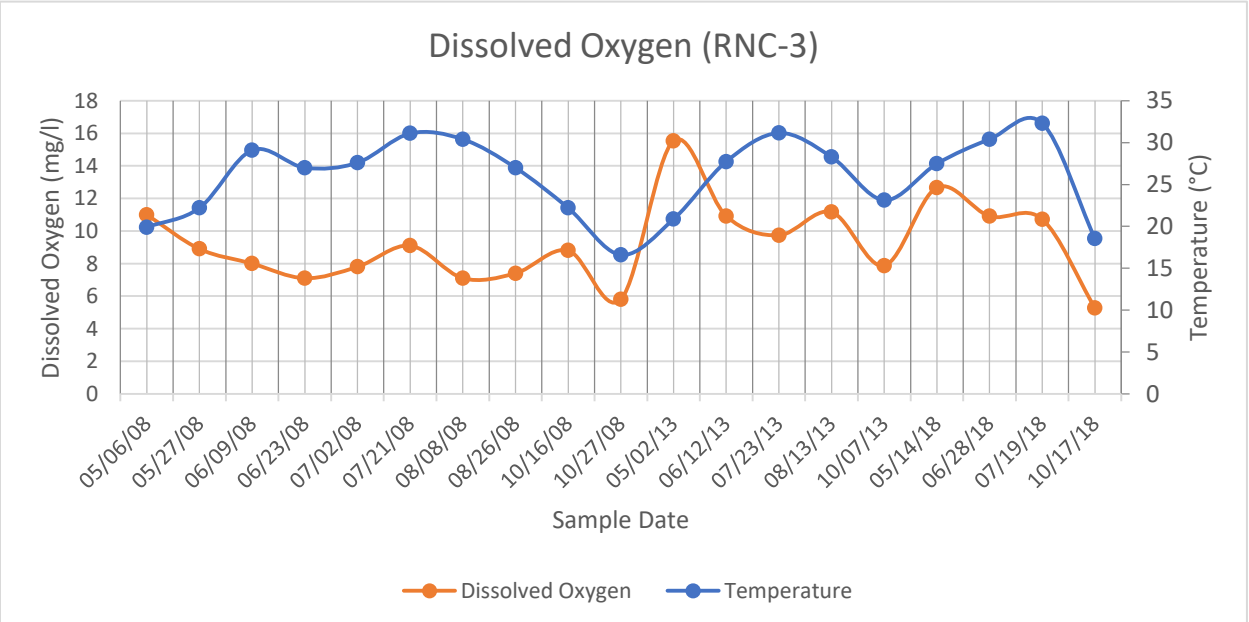
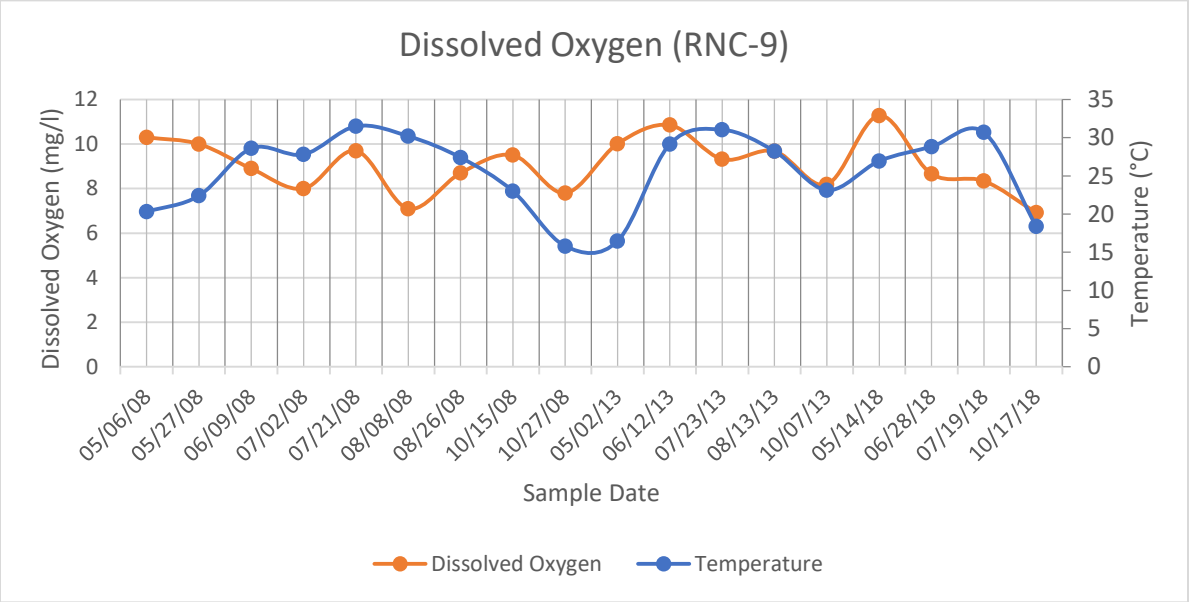


Table 8.11- RNC-9 Dissolved Oxygen



8.4 Local Water Quality Assessment

To address water quality at the local level, an assessment has been completed for Ava and the Kinkaid Area Water System. Kinkaid Lake is the local water source for Ava and the surrounding municipalities. This assessment was designed to review the latest water quality report submitted.

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 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.

ppm: Milligrams per liter or parts per million.

NTU: Nephelometric Turbidity Unit, used to measure cloudiness in drinking water.

Table displays the water quality report for lead and copper. Ava has a MCLG value of 1.3 ppm for copper and a MCLG value of 0 ppb for lead. Action levels are set at 1.3 ppm for copper and 15 ppb for lead. While the 2019 report was used for analysis, copper has not been tested since July 19, 2018, and lead has not been tested since August 15th, 2012.

According to the water quality report, there is no 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 systems.

Table 8.12- Lead and Copper Information

Municipality	Contaminants	Date Sampled	MCLG	Action Level (AL)	90th Percentile	Sites Over Lead AL	Units	Violation	Likely Source of Contaminaion
Ava	Copper	7/19/2018	1.3	1.3	0.23	0	ppm	No	Erosion of natural deposits; leaching from wood preservatives; corrosion of household plumbing systems
	Lead	8/15/2012	0	15	1.1	0	ppb	No	Corrosion of household plumbing systems; Erosion of natural deposits

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 the table below. Ava is within the limits for each contaminant, and no violations have occurred.

Table 8.13- Municipal Water Quality: Regulated Contaminants

Contaminant		Collection Date	Highest Level Detected	Range of Levels Detected	MCLG	MCL	Units	Violation	Typical Source
Disinfectants & Disinfection By-Products	Chloramines	2019	2.5	2.5 - 2.5	MRDLG = 4	MRDL = 4	ppm	N	Water additive used to control microbes
	Haloacetic Acids (HAA5)	2019	41	17 - 73.2	No goal for the total	60	ppb	N	By-product of drinking water disinfection
	Total Trihalomethanes (TTHM)	2019	38	4.9 - 54	No goal for the total	80	ppb	N	By-product of drinking water disinfection

8.4.1 Kinkaid Area Water System

As stated previously, Ava purchases their water from Kinkaid Area Water System, operated by Kinkaid Reed's Creek Conservancy District. The water report includes the parameters from Ava's water quality report identified as regulated contaminants. In addition, inorganic contaminants were also reported. This category includes substances such as fluoride, nitrate (as N), and sodium. The contaminants in all categories are within the regulated range designated by the EPA; therefore, no violations have occurred. Results are displayed in Table 8.14.

Table 8.14- Kinkaid Area Water System 2019 Report

Contaminant		Collection Date	Highest Level Detected	Range of Levels Detected	MCLG	MCL	Units	Violation	Likely Source of Contamination
Disinfectants & Disinfection By-Products	Chloramines	2019	3.3	3.3 - 3.3	MRDLG=4	MRDL=4	ppm	N	Water additive used to control microbes
	Chlorite	2019	0.83	0.29 - 0.83	0.8	1	ppm	N	By-product of drinking water disinfection
	Haloacetic Acids (HAA5)*	2019	22	21.5 - 21.5	No goal for the total	60	ppm	N	By-product of drinking water disinfection
	Total Trihalomethanes (TTHM)	2019	25	24.5 - 24.5	No goal for the total	80	ppb	N	By-product of drinking water disinfection
Inorganic	Fluoride	2019	0.7	0.73 - 0.73	4	4.0	ppm	N	Erosion of natural deposits; Water additive which promotes strong teeth: Discharge from fertilizer and aluminum factories
	Nitrate [measured as Nitrogen]	2019	0.08	0.08 - 0.08	10	10	ppm	N	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
	Sodium	2019	11	10.6 - 10.6			ppm	N	Erosion from naturall occurring deposits: Used in water softener regeneration
Radioactive	Combined Radium 226/228	11/16/2015	1.05	1.05 - 1.05	0	5	pCi/L	N	Erosion of natural deposits.
	Gross alpha excluding radon and uranium	11/16/2015	0.35	0.35 - 0.35	0	15	pCi/L	N	Erosion of natural deposits.
Synthetic organic contaminants including pesticides and herbicides	Atrazine	2019	0.7	0.2 - 0.7	3	3	ppb	N	Runoff from herbicide used on row crops
	Simazine	2019	0.14	0 - 0.14	4	4	ppb	N	Herbicide runoff

Turbidity	Limit (Treatment Technique)	Level Detected	Violation	Likely Source of Contamination
Highest single measurement	1 NTU	0.26 NTU	N	Soil runoff
Lowest Monthly % meeting limit	0.3 NTU	100%	N	Soil runoff

8.5 National Pollutant Discharge Elimination Systems (NPDES) Outfall Locations

The National Pollution Discharge Elimination System (NPDES) permit program is set in place to regulate point source pollutions that are being discharged into US waters.

Kinkaid Creek Watershed Planning Area has only one NPDES outfall location. The outfall is permitted for the Kinkaid Area Water System, and the discharge is located on the eastern side of Kinkaid Lake near the Water Conservancy District. This location is within the Kinkaid Lake – East SMU. Figure 8.4 displays the NPDES outfall location within the planning area. NPDES permits are active for five years from the effective date and facilities are required to reapply for an extension. They must do so within 180 days of the expiration date. The Kinkaid Area Water System NPDES permit is active. The expiration date given on ECHO is May 31 of 2022.

Effluent Exceedance

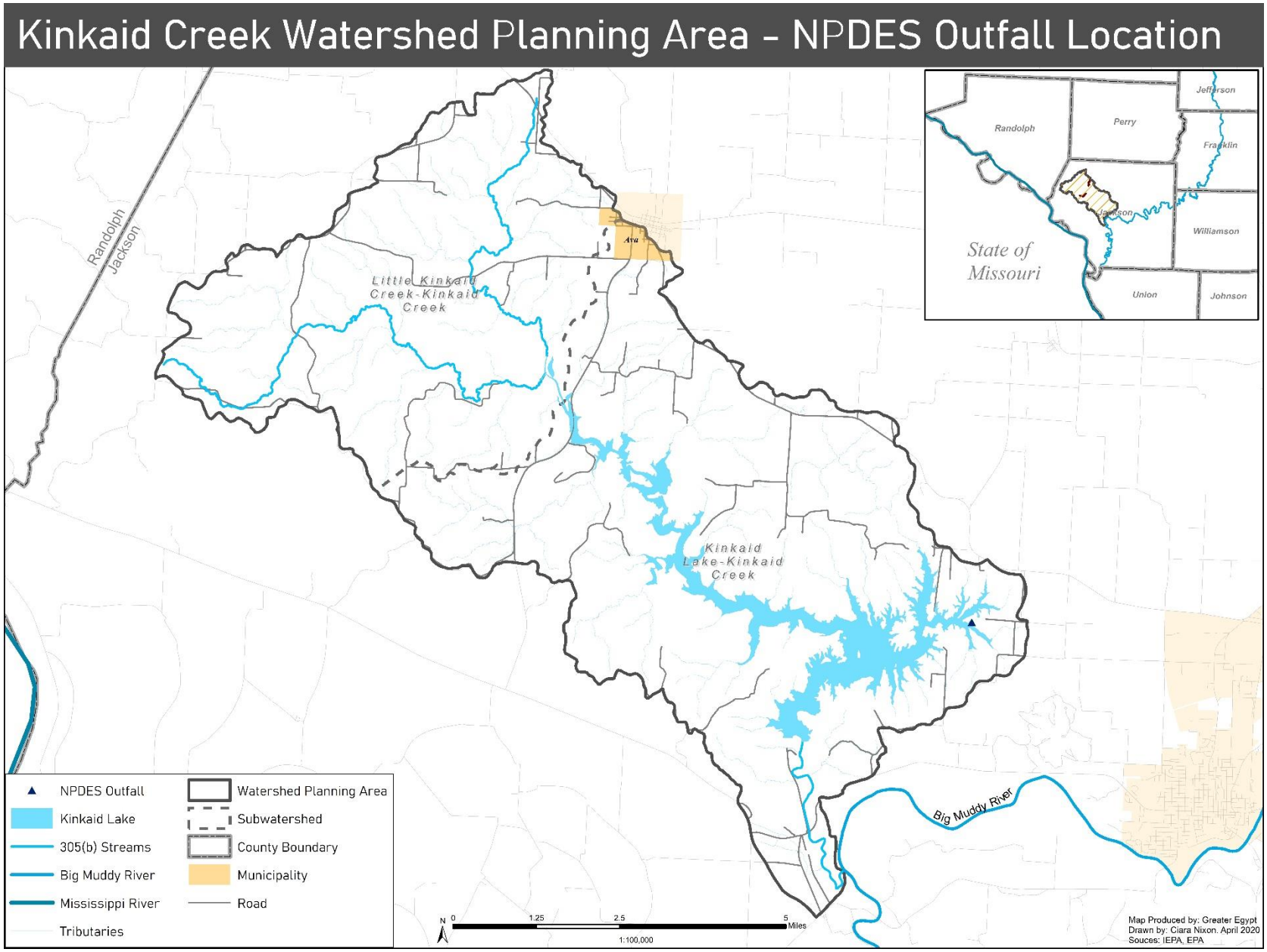
The Kinkaid Area Water System has recorded no violations since Quarter 1, 04/01-06/30/2017. Table 8.15 displays the information for the most recent 12 quarters.

Table 8.15- Outfall Effluent Violations

Facility Name	Outfall	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6
		04/01-0/30/17	07/01-09/30/17	10/01-12/31/17	01/01-03/31/18	04/01-06/30/18	07/01-09/30/18
Kinkaid Area Water System	001	NVI	NVI	NVI	NVI	NVI	NVI
Facility Name	**Outfall**	**QTR 7**	**QTR 8**	**QTR 9**	**QTR 10**	**QTR 11**	**QTR 12**
		10/01-12/31/18	01/01-03/31/19	04/01-06/30/19	07/01-09/30/19	10/01-12/31/19	01/01-03/31/20
Kinkaid Area Water System	001	NVI	NVI	NVI	NVI	NVI	NVI

Pollutant KEY	
No Violation Identified	NVI

Figure 8.4


Kinkaid Creek Watershed Planning Area - NPDES Outfall Location
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
NPDES Outfall
Kinkaid Lake
305(b) Streams
Big Muddy River
Mississippi River
Tributaries
Watershed Planning Area
Subwatershed
County Boundary
Municipality
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. April 2020
Souces: IEPA, EPA

8.6 Pollutant Load Analysis

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL) modeling tool was used to estimate the existing nonpoint source nutrient loads (nitrogen & phosphorus) and sediment loads for the Kinkaid Creek watershed. This includes an analysis of the watershed planning area, individual HUC 12 subwatersheds, and HUC 14 subwatershed management units.

STEPL utilizes land cover category types, precipitation data, soil 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 (2,500 acres), barren land (78 acres), and wetlands (156 acres). These classes have been excluded from this analysis.

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 8.16 characterizes these classifications for the LRR. Four categories reflect the degree of streambank and shoreline erosion in the model: slight, moderate, severe, and very severe.

Table 8.16-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 8.17 represents the correlation between assessed streams and assigned LRR values.

Table 8.17- 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
Severe	Vere Severe	0.5+	0.5

Source: EPA- STEPL

Table 8.18 represents the STEPL model for the Kinkaid Creek watershed-wide existing pollutant loads. The model estimations suggest groundwater accounts for nearly 28 percent of the nitrogen load for the entire planning area. Pastureland constitutes 24 percent of the nitrogen load, while cropland makes up the remaining highest percentage at 22 percent.

The majority of the phosphorus load in the planning area originates from cropland, at nearly 33 percent. Streambank erosion contributes the second largest amount of the nutrient load at 32 percent. Pastureland presents the third most contributing land class at 16 percent.

Because erosion from streambanks and shorelines is a prevalent issue in the planning area, the model suggests that 61 percent of the sediment load is due to these sources. Other source contributors include cropland (26 percent) and pastureland (9 percent).

Table 8.18- Kinkaid Creek Watershed-wide Existing Pollutant Loads

Source	N Load (lb/yr)	Percent of Total Load	P Load (lb/yr)	Percent of Total Load	Sediment Load (t/yr)	Percent of Total Load
Urban	11,832.9	5.95%	1,820.9	4.39%	272.0	0.77%
Cropland	43,772.4	22.02%	13,645.4	32.90%	9,266.0	26.36%
Pastureland	46,777.5	23.54%	6,789.5	16.37%	3,307.7	9.41%
Forest	7,371.0	3.71%	3,353.0	8.08%	903.6	2.57%
Streambank	34,245.3	17.23%	13,184.4	31.79%	21,405.9	60.89%
Groundwater	54,740.8	27.54%	2,681.4	6.47%	0.0	0.00%
Total	**198,739.8**	**-**	**414,74.6**	**-**	**35,155.1**	**-**

Source: EPA- STEPL

Table 8.19 breaks down the nutrient loads by HUC 12 subwatersheds. Because of its large size and various land uses, Kinkaid Lake- Kinkaid Creek subwatershed produces the majority of the nutrient loading in the planning area. This subwatershed accounts for 56 percent of the total nitrogen load, 60 percent of the total phosphorus load, and 63 percent of the sediment load in the Kinkaid Creek watershed planning area.

Table 8.19- HUC 12 Existing Pollutant Loads

Subwatershed	N Load	Percent of Total N Load	P Load	Percent of Total P Load	Sediment Load	Percent of Total Sediment Load
Little Kinkaid Creek- Kinkaid Creek	87,549.9	44.05%	16,604.6	40.04%	13,176.0	37.48%
Kinkaid Lake- Kinkaid Creek	111,189.9	55.95%	24,870.0	59.96%	21,979.1	62.52%
Total	**198,739.8**	**-**	**41,474.6**	**-**	**35,155.1**	**-**

Source: EPA- STEPL

8.7 Subwatershed Pollutant Load Analysis

Subwatersheds have also been individually modeled in STEPL. This includes the two HUC 12 subwatersheds and their corresponding subwatershed management units. The HUC 12 subwatersheds and SMUs will also be examined individually. Pollutant loads generally reflect the dominant land use categories and size of each subwatershed.

8.7.1 Little Kinkaid Creek- Kinkaid Creek Subwatershed Existing Pollutant Loads

Table 8.20 displays the STEPL model for Little Kinkaid Creek- Kinkaid Creek subwatershed. The majority of the nitrogen load in the subwatershed comes from the Upper Little Kinkaid Creek SMU (42 percent). This is followed by Upper Kinkaid Creek SMU at 32 percent.

Phosphorus totals follow a similar path with Upper Little Kinkaid Creek exhibiting 42 percent of the total phosphorus load and Upper Kinkaid Creek at 30 percent.

Table 8.20- Little Kinkaid Creek- Kinkaid Creek Subwatershed Existing Pollutant Loads by SMU

Subwatershed Management Unit	SMU ID	N Load	Percent of N Load	P Load	Percent of P Load	Sediment Load	Percent of Sediment Load
Middle Kinkaid Creek	16	12,495.1	14.3%	2,751.8	16.6%	2,588.3	19.6%
Lower Little Kinkaid Creek	17	9,242.8	10.6%	1,945.7	11.7%	1,874.2	14.2%
Upper Kinkaid Creek	18	28,341.2	32.4%	5,021.0	30.2%	3,171.5	24.1%
Upper Little Kinkaid Creek	19	37,470.8	42.8%	6,886.1	41.5%	5,542.1	42.1%
Total		**87,549.9**	**-**	**16,604.6**	**-**	**13,176.0**	**-**

Source: EPA- STEPL

Because erosion is a concern in the subwatershed, Upper Little Kinkaid Creek accounts for 42 percent of the sediment load while Upper Kinkaid Creek exhibits 24 percent of the total load.

8.7.2 Kinkaid Lake- Kinkaid Creek Subwatershed Existing Pollutant Loads

While this subwatershed is heavily forested, pastureland and cropland account for a majority of the remaining land use. The Kinkaid Lake- Central Body SMU exhibits the most nitrogen load at 14.2 percent. This is followed by the Campground and Spring Creek SMUs at 12.7 percent each.

The phosphorus loads in the subwatershed mainly stem from Kinkaid Lake- Central Body (17.9 percent), Spring Creek (13 percent), and Lower Kinkaid Creek (12 percent).

Table 8.21- Kinkaid Lake- Kinkaid Creek Subwatershed Existing Pollutant Loads

Subwatershed Management Unit	SMU ID	N Load	Percent of N Load	P Load	Percent of P Load	Sediment Load	Percent of Sediment Load
Lower Kinkaid Creek	1	12,363.3	11.1%	2,994.8	12.0%	2,245.8	10.2%
Heiple	2	3,042.0	2.7%	542.7	2.2%	424.0	1.9%
Smaller Shawnee	3	982.6	0.9%	228.3	0.9%	106.1	0.5%
Kinkaid Lake- Central Body	4	15,842.9	14.2%	4,456.8	17.9%	5,826.2	26.5%
Kinkaid Lake East	5	12,304.4	11.1%	2,527.6	10.2%	1,865.2	8.5%
Lone Oak	6	11,974.5	10.8%	2,326.5	9.4%	1,797.8	8.2%
Ash	7	1,799.1	1.6%	386.4	1.6%	242.5	1.1%
Kinkaid Lake- Central Channel	8	4,739.9	4.3%	1,464.7	5.9%	1,795.6	8.2%
Lakeside	9	1,556.7	1.4%	303.0	1.2%	184.6	0.8%
Larger Shawnee	10	2,050.7	1.8%	442.2	1.8%	180.9	0.8%
Campground	11	14,070.6	12.7%	2,784.6	11.2%	1,646.8	7.5%
Kinkaid Lake- Northwest	12	3,275.5	2.9%	817.4	3.3%	842.2	3.8%
Johnson Creek	13	6,941.4	6.2%	1,389.0	5.6%	1,055.7	4.8%
Sharp Rock	14	6,158.0	5.5%	994.5	4.0%	557.7	2.5%
Spring Creek	15	14,088.2	12.7%	3,211.5	12.9%	3,208.0	14.6%
Total		**111,189.9**	-	**24,870.0**	-	**21,979.1**	-

Source: EPA- STEPL

Sediment loading in the subwatershed is primarily from the Kinkaid Lake- Central Body SMU. This accounts for more than a quarter of the total load at nearly 27 percent. It is followed by Spring Creek (14.6 percent) and Lower Kinkaid Creek (10.2 percent). Results for the SMU pollutant loading are also displayed in the following figures.

Figure 8.5

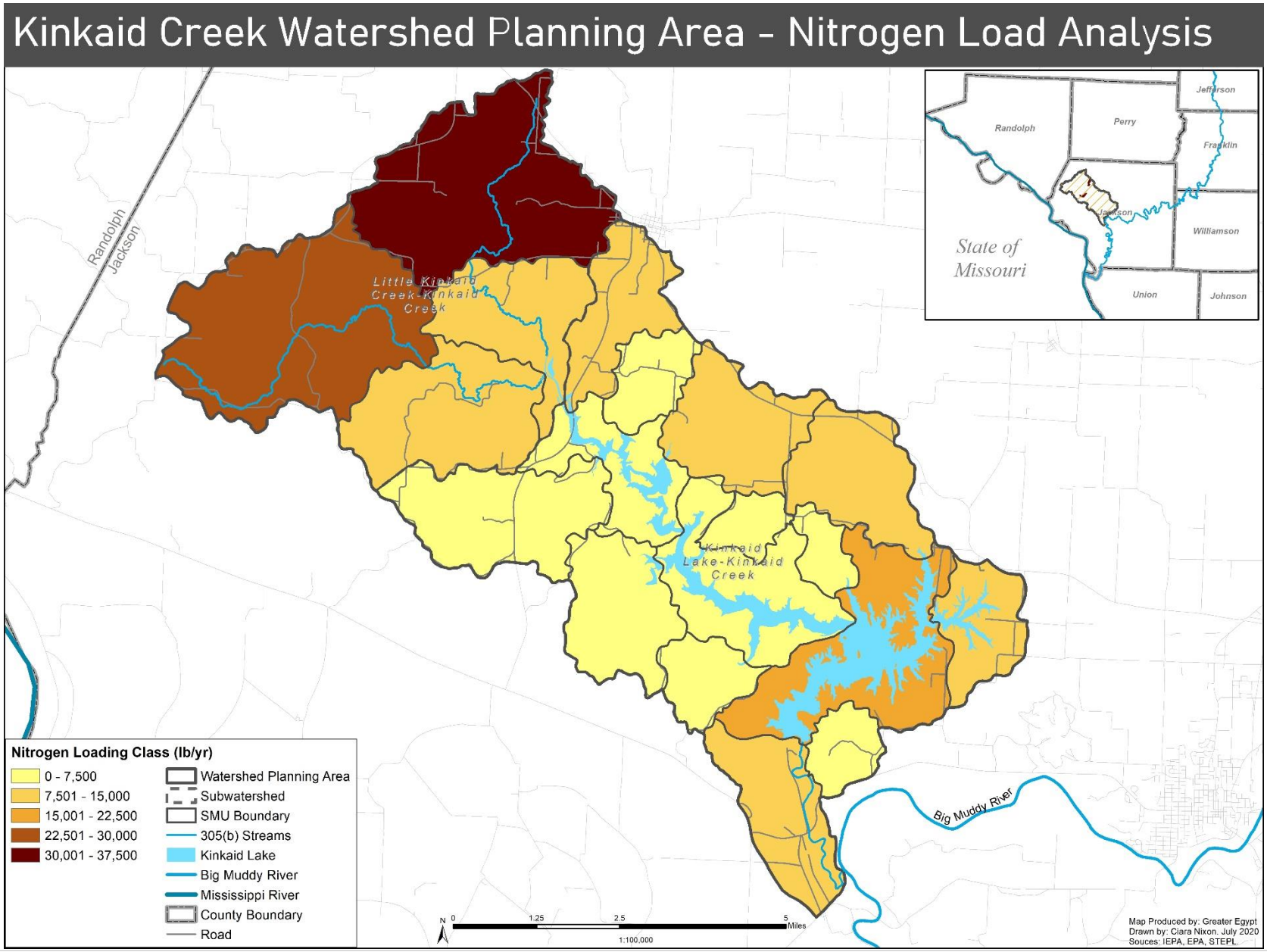

Kinkaid Creek Watershed Planning Area - Nitrogen Load Analysis
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Jefferson
Randolph
Perry
Franklin
Jackson
Williamson
Union
Johnson
Nitrogen Loading Class (lb/yr)
0 - 7,500
7,501 - 15,000
15,001 - 22,500
22,501 - 30,000
30,001 - 37,500
Watershed Planning Area
Subwatershed
SMU Boundary
305(b) Streams
Kinkaid Lake
Big Muddy River
Mississippi River
County Boundary
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. July 2020
Souces: IEPA, EPA, STEPL.

Figure 8.6

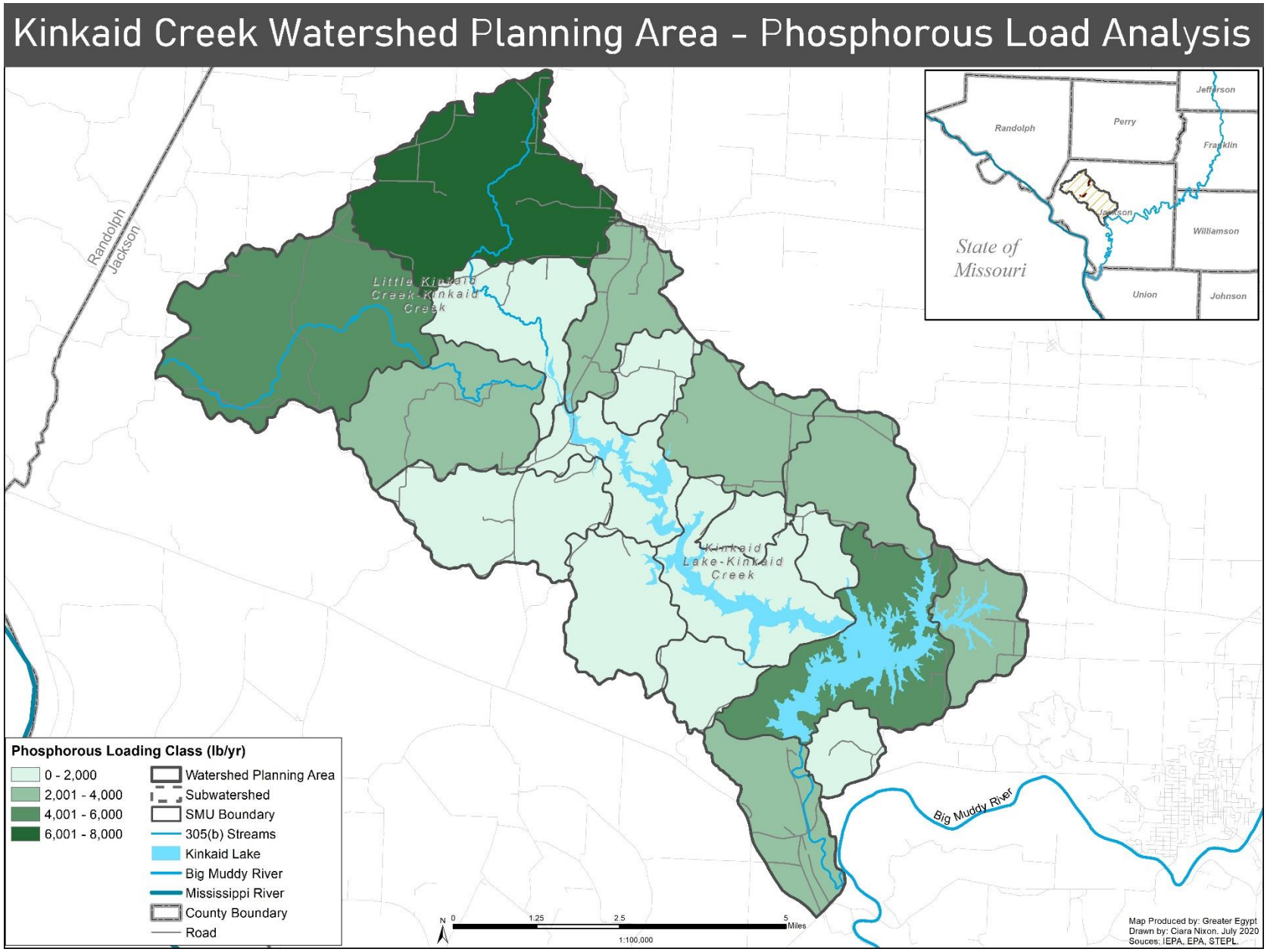
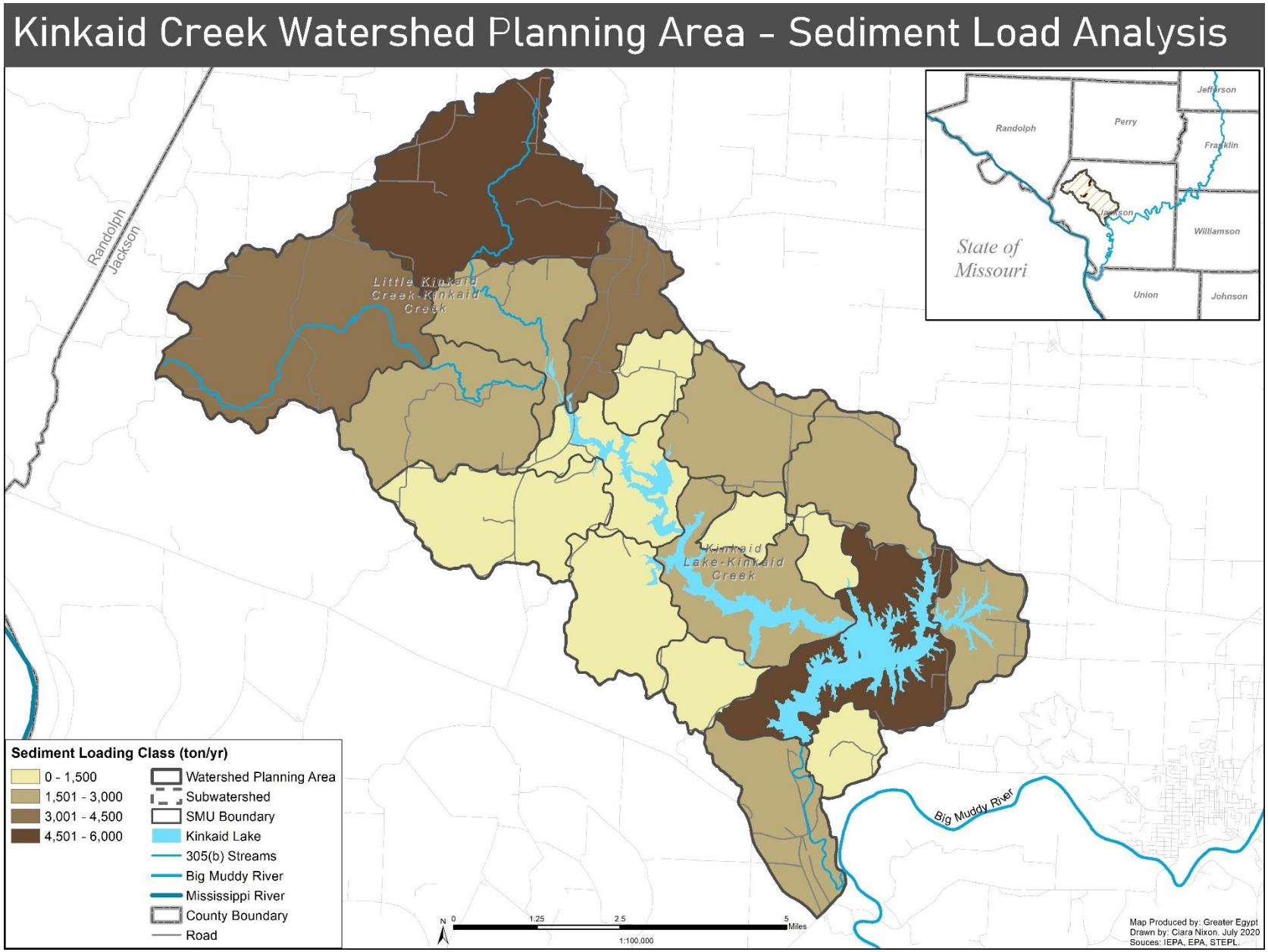

Kinkaid Creek Watershed Planning Area - Phosphorous Load Analysis
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
State of Missouri
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
Phosphorous Loading Class (lb/yr)
0 - 2,000
2,001 - 4,000
4,001 - 6,000
6,001 - 8,000
Watershed Planning Area
Subwatershed
SMU Boundary
305(b) Streams
Kinkaid Lake
Big Muddy River
Mississippi River
County Boundary
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. July 2020
Souces: IEPA, EPA, STEPL.

Figure 8.7


Kinkaid Creek Watershed Planning Area - Sediment Load Analysis
Randolph
Jackson
Little Kinkaid Creek-Kinkaid Creek
Kinkaid Lake-Kinkaid Creek
Big Muddy River
Randolph
Perry
Jefferson
Franklin
Jackson
Williamson
Union
Johnson
State of Missouri
Sediment Loading Class (ton/yr)
0 - 1,500
1,501 - 3,000
3,001 - 4,500
4,501 - 6,000
Watershed Planning Area
Subwatershed
SMU Boundary
Kinkaid Lake
305(b) Streams
Big Muddy River
Mississippi River
County Boundary
Road
N
0
1.25
2.5
5
Miles
1:100,000
Map Produced by: Greater Egypt
Drawn by: Ciara Nixon. July 2020
Souces: IEPA, EPA, STEPL.

8.8 Pollutant Load Reduction Targets

The Kinkaid Creek Watershed-based Plan will address the problematic areas in the watershed by proposing best management practices (BMP) 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 many known and potential causes and sources of water pollution in the planning area. The 303(d) and 305(b) information from Section 8.1 summarizes the causes and sources based on the Illinois Integrated Water Quality Report and other factors identified in this inventory and assessment.

As described in Section 8.1, 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 I milestone of state-wide nutrient reduction of nitrate-nitrogen of 15 percent. The reduction target for phosphorus is 25 percent. These targets are to be met by 2025, with an overall target of 45 percent for both nutrients. [51]

Pollutant load reduction targets for the Kinkaid Creek watershed will conform to the targets presented in the ILNLRS. Table 8.22 provides a summary of the pollutant load reduction targets for the planning area and subwatersheds for a ten-year period. While the plan provides information on limiting sediment in waterbodies, it does not provide a reduction target. However, a target of 25 percent has been assigned for the Kinkaid Creek watershed. These targets are also presented in the following tables.

The summary suggests that with a 15 percent reduction in nitrogen, the planning area's total load would be reduced by 29,811 pounds annually. At a 25 percent reduction, phosphorus loads will be reduced by 10,369 pounds per year. The summary also includes an annual reduction of sediment of 8,789 tons (25 percent).

[51] IEPA. *NLRS- Executive Summary.* PDF. Accessed: May 2019.

To meet these pollutant load reduction targets, best management practices will have to be suggested and implemented in the planning area. BMP considerations will be a component of the Kinkaid Creek Watershed-based Plan.

Table 8.22-Kinkaid Creek Watershed-Wide Pollutant Load Reduction Targets

Subwatershed	Nitrogen (percent of total)	Nitrogen Load Reduction Target	Phosphorus (percent of total)	Phosphorus Load Reduction Target	Sediment (percent of total)	Sediment Load Reduction Target
Kinkaid Creek	**15%**	**29,810.97**	**25%**	**10,368.65**	**25%**	**8,788.78**
Subwatershed Load Reduction Targets						
Little Kinkaid Creek- Kinkaid Creek	44.05%	13,132.49	40.04%	4,151.15	37.48%	3,294.01
Kinkaid Lake- Kinkaid Creek	55.95%	16,678.48	59.96%	6,217.51	62.52%	5,494.77
Total	-	**29,810.97**	**-**	**10,368.65**	**-**	**8,788.78**

Source: EPA- STEPL

8.9 Subwatershed Pollutant Load Reduction Targets

Reduction targets have also been assessed for the subwatershed management units within each HUC 12 subwatershed in the planning area. The following graphs illustrate the SMU reductions in nitrogen, phosphorus, and sediment.

Table 8.23- Little Kinkaid- Kinkaid Creek Subwatershed Pollutant Load Reduction Targets

Watershed	SMU ID	Nitrogen (percent of total)	Nitrogen Load Reduction Target	Phosphorus (percent of total)	Phosphorus Load Reduction Target	Sediment (percent of total)	Sediment Load Reduction Target
Little Kinkaid Creek- Kinkaid Creek	**-**	**15**	**13,132.49**	**25**	**4,151.15**	**25**	**3,294.00**
Subwatershed Management Unit Load Reduction Target							
Middle Kinkaid Creek	16	14.3%	1,874.27	16.6%	687.94	19.6%	647.08
Lower Little Kinkaid Creek	17	10.6%	1,386.42	11.7%	486.44	14.2%	468.54
Upper Kinkaid Creek	18	32.4%	4,251.18	30.2%	1,255.25	24.1%	792.86
Upper Little Kinkaid Creek	19	42.8%	5,620.62	41.5%	1,721.52	42.1%	1,385.52
Total		-	**13,132.49**	-	**4,151.15**	-	**3,294.01**

Source: EPA- STEPL

Table 8.24-Kinkaid Lake- Kinkaid Creek Subwatershed Pollutant Load Reduction Targets

Watershed	SMU ID	Nitrogen (percent of total)	Nitrogen Load Reduction Target	Phosphorus (percent of total)	Phosphorus Load Reduction Target	Sediment (percent of total)	Sediment Load Reduction Target
Kinkaid Lake- Kinkaid Creek	**-**	**15%**	**16,678.48**	**25%**	**6,217.51**	**25%**	**5,494.80**
Subwatershed Management Unit Load Reduction Target							
Lower Kinkaid Creek	1	11.1%	1,854.49	12.0%	748.70	10.2%	561.46
Heiple	2	2.7%	456.30	2.2%	135.68	1.9%	106.01
Smaller Shawnee	3	0.9%	147.39	0.9%	57.08	0.5%	26.52
Kinkaid Lake- Central Body	4	14.2%	2,376.44	17.9%	1,114.19	26.5%	1,456.54
Kinkaid Lake East	5	11.1%	1,845.66	10.2%	631.89	8.5%	466.30
Lone Oak	6	10.8%	1,796.17	9.4%	581.63	8.2%	449.45
Ash	7	1.6%	269.87	1.6%	96.59	1.1%	60.63
Kinkaid Lake- Central Channel	8	4.3%	710.99	5.9%	366.17	8.2%	448.89
Lakeside	9	1.4%	233.50	1.2%	75.75	0.8%	46.14
Larger Shawnee	10	1.8%	307.61	1.8%	110.56	0.8%	45.22
Campground	11	12.7%	2,110.59	11.2%	696.15	7.5%	411.69
Kinkaid Lake- Northwest	12	2.9%	491.33	3.3%	204.35	3.8%	210.56
Johnson Creek	13	6.2%	1,041.21	5.6%	347.26	4.8%	263.93
Sharp Rock	14	5.5%	923.71	4.0%	248.64	2.5%	139.43
Spring Creek	15	12.7%	2,113.22	12.9%	802.86	14.6%	802.00
Total		-	**16,678.50**	-	**6,217.50**	-	**5,494.80**

Source: EPA- STEPL

APPENDIX A- Soil Subset Data

Kinkaid Creek Watershed Planning Area-Jackson County				
Soil Symbol	Soil Name	Soil Description	Acres	Percent of Watershed
7131B	Alvin	Alvin fine sandy loam, 2 to 5 percent slopes, rarely flooded	10	0
7131E	Alvin	Alvin fine sandy loam, 18 to 25 percent slopes, rarely flooded	2.6	0
3382A	Belknap	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	10.8	0
8382A	Belknap	Belknap silt loam, 0 to 2 percent slopes, occasionally flooded	380.5	0.009
3334A	Birds	Birds silt loam, 0 to 2 percent slopes, frequently flooded	21	0.001
8108A	Bonnie	Bonnie silt loam, 0 to 2 percent slopes, occasionally flooded	10.4	0
1843A	Bonnie and Petrolia	Bonnie and Petrolia soils, undrained, 0 to 2 percent slopes, frequently flooded	6.5	0
8457A	Booker	Booker silty clay, 0 to 2 percent slopes, occasionally flooded	69.2	0.002
8427B	Burnside	Burnside silt loam, 1 to 4 percent slopes, occasionally flooded	1071.5	0.026
1845A	Darwin and Jacob	Darwin and Jacob silty clays, undrained, 0 to 2 percent slopes, frequently flooded	7.7	0
75B	Drury	Drury silt loam, 2 to 5 percent slopes	36	0.001
8180A	Dupo	Dupo silt loam, 0 to 2 percent slopes, occasionally flooded	37.8	0.001

Kinkaid Creek Watershed Planning Area-Jackson County				
Soil Symbol	Soil Name	Soil Description	Acres	Percent of Watershed
7432A	Geff	Geff silt loam, 0 to 2 percent slopes, rarely flooded	42	0.001
3331A	Haymond	Haymond silt loam, 0 to 2 percent slopes, frequently flooded	12.4	0
8331A	Haymond	Haymond silt loam, 0 to 3 percent slopes, occasionally flooded	649.1	0.016
8F	Hickory	Hickory silt loam, 18 to 35 percent slopes	1357.1	0.033
8F3	Hickory	Hickory clay loam, 18 to 35 percent slopes, severely eroded	279.4	0.007
797D3	Hickory-Homen	Hickory-Homen silty clay loams, 10 to 18 percent slopes, severely eroded	388.3	0.009
701F	Hickory-Menfro	Hickory-Menfro silt loams, 18 to 35 percent slopes	1161.8	0.028
701F3	Hickory-Menfro	Hickory-Menfro complex, 18 to 35 percent slopes, severely eroded	39.2	0.001
582B	Homen	Homen silt loam, 2 to 5 percent slopes	4706.7	0.114
582C2	Homen	Homen silt loam, 5 to 10 percent slopes, eroded	753.2	0.018
582C3	Homen	Homen silty clay loam, 5 to 10 percent slopes, severely eroded	2154.1	0.052
582D3	Homen	Homen silty clay loam, 10 to 18 percent slopes, severely eroded	1513	0.037
7338B2	Hurst	Hurst silt loam, 2 to 5 percent slopes, eroded, rarely flooded	12.3	0
8085A	Jacob	Jacob silty clay, 0 to 2 percent slopes, occasionally flooded	75.5	0.002
908G	Kell-Hickory	Kell-Hickory silt loams, 35 to 70 percent slopes	319.2	0.008
79B2	Menfro	Menfro silt loam, 2 to 5 percent slopes, eroded	4090.2	0.099

Kinkaid Creek Watershed Planning Area-Jackson County				
Soil Symbol	Soil Name	Soil Description	Acres	Percent of Watershed
79C2	Menfro	Menfro silt loam, 5 to 10 percent slopes, eroded	2485.6	0.06
79C3	Menfro	Menfro silt loam, 5 to 10 percent slopes, severely eroded	752.1	0.018
79D2	Menfro	Menfro silt loam, 10 to 18 percent slopes, eroded	891.5	0.022
79D3	Menfro	Menfro silt loam, 10 to 18 percent slopes, severely eroded	1893.8	0.046
79E	Menfro	Menfro silt loam, 18 to 25 percent slopes	4067.5	0.099
79E3	Menfro	Menfro silt loam, 18 to 25 percent slopes, severely eroded	386.2	0.009
701D	Menfro-Hickory	Menfro-Hickory silt loams, 10 to 18 percent slopes	371.8	0.009
701D3	Menfro-Hickory	Menfro-Hickory complex, 10 to 18 percent slopes, severely eroded	435.5	0.011
692F	Menfro-Wellston	Menfro-Wellston silt loams, 18 to 35 percent slopes	4398.8	0.107
692G	Menfro-Wellston	Menfro-Wellston silt loams, 35 to 70 percent slopes	455.8	0.011
976G	Neotoma-Rock	Neotoma-Rock outcrop complex, 35 to 70 percent slopes	402.6	0.01
977G	Neotoma-Wellston	Neotoma-Wellston complex, 35 to 70 percent slopes	1429.9	0.035
7084A	Okaw	Okaw silt loam, 0 to 2 percent slopes, rarely flooded	209.7	0.005
805D	Orthents	Orthents, clayey, sloping	62.5	0.002
31A	Pierron	Pierron silt loam, 0 to 2 percent slopes	84	0.002
3420A	Piopolis	Piopolis silty clay loam, 0 to 2 percent slopes, frequently flooded	2.5	0
864	Pits	Pits, quarries	77.2	0.002

Kinkaid Creek Watershed Planning Area-Jackson County				
Soil Symbol	Soil Name	Soil Description	Acres	Percent of Watershed
7208A	Sexton	Sexton silt loam, 0 to 2 percent slopes, rarely flooded	70.9	0.002
164A	Stoy	Stoy silt loam, 0 to 2 percent slopes	93.6	0.002
164B	Stoy	Stoy silt loam, 2 to 5 percent slopes	199.8	0.005
3333A	Wakeland	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded	283.9	0.007
8333A	Wakeland	Wakeland silt loam, 0 to 2 percent slopes, occasionally flooded	397.2	0.01
W	Water	Water	2562	0.062
977F	Wellston-Neotoma	Wellston-Neotoma complex, 18 to 35 percent slopes	0.1	0
Total:			**41,242.20**	**100%**

APPENDIX B- Subwatershed Land Use Data

Subwatershed Land Use Classification	Lower Kinkaid Creek		Lower Little Kinkaid Creek		Upper Kinkaid Creek		Upper Little Kinkaid Creek	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
Open Water	9.34	0.31%	22.48	1.04%	47.19	0.86%	21.57	0.44%
Developed, Open Space	64.30	2.16%	36.27	1.67%	127.99	2.34%	141.00	2.87%
Developed, Low Intensity	12.68	0.43%	12.46	0.57%	50.75	0.93%	95.63	1.94%
Developed, Medium Intensity	0.22	0.01%	0.00	0.00%	5.79	0.11%	4.23	0.09%
Developed, High Intensity	0.00	0.00%	0.00	0.00%	1.34	0.02%	0.44	0.01%
Barren Land	0.00	0.00%	0.00	0.00%	74.79	1.37%	1.78	0.04%
Deciduous Forest	2,077.59	69.72%	1,423.53	65.69%	3,023.58	55.32%	1,959.77	39.82%
Evergreen Forest	19.58	0.66%	27.59	1.27%	7.12	0.13%	1.56	0.03%
Mixed Forest	141.28	4.74%	132.63	6.12%	42.29	0.77%	67.83	1.38%
Shrub/Scrub	0.00	0.00%	2.23	0.10%	11.57	0.21%	4.89	0.10%
Grassland/Herbaceous	0.89	0.03%	3.56	0.16%	38.95	0.71%	26.02	0.53%
Pasture/Hay	460.55	15.45%	427.93	19.75%	1,263.83	23.12%	1,810.99	36.80%
Cultivated Crops	193.56	6.50%	77.66	3.58%	770.81	14.10%	785.29	15.96%
Woody Wetlands	0.00	0.00%	0.22	0.01%	0.00	0.00%	0.00	0.00%
Emergent Herbaceous Wetlands	0.00	0.00%	0.45	0.02%	0.00	0.00%	0.00	0.00%

Subwatershed Land Use Classification	Lower Kinkaid Creek		Heiple		Smaller Shawnee		Kinkaid Lake- Central Body		Kinkaid Lake - East	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
Open Water	10.23	0.53%	6.00	0.81%	1.78	0.19%	1,209.39	32.49%	149.91	11.11%
Developed, Open Space	76.02	3.91%	42.24	5.69%	33.17	3.53%	69.85	1.88%	39.65	2.94%
Developed, Low Intensity	67.80	3.48%	6.23	0.84%	0.22	0.02%	45.15	1.21%	20.49	1.52%
Developed, Medium Intensity	4.89	0.25%	0.00	0.00%	0.00	0.00%	8.23	0.22%	3.12	0.23%
Developed, High Intensity	0.00	0.00%	0.00	0.00%	0.00	0.00%	3.56	0.10%	0.00	0.00%
Barren Land	0.44	0.02%	0.00	0.00%	0.00	0.00%	0.22	0.01%	0.00	0.00%
Deciduous Forest	997.66	51.26%	505.37	68.01%	830.43	88.49%	1,842.45	49.50%	286.90	21.26%
Evergreen Forest	0.00	0.00%	0.00	0.00%	9.80	1.04%	3.78	0.10%	0.00	0.00%
Mixed Forest	7.11	0.37%	4.67	0.63%	56.10	5.98%	126.34	3.39%	27.40	2.03%
Shrub/Scrub	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Grassland/Herbaceous	0.22	0.01%	3.34	0.45%	0.67	0.07%	27.36	0.74%	11.36	0.84%
Pasture/Hay	61.58	3.16%	168.31	22.65%	6.23	0.66%	328.54	8.83%	437.04	32.39%
Cultivated Crops	567.74	29.17%	3.34	0.45%	0.00	0.00%	57.17	1.54%	373.33	27.67%
Woody Wetlands	136.93	7.04%	3.56	0.48%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Emergent Herbaceous Wetlands	15.56	0.80%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%

Subwatershed Land Use Classification	Lone Oak		Ash		Kinkaid Lake- Central Channel		Lakeside		Larger Shawnee	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
Open Water	21.35	1.05%	1.78	0.33%	579.12	21.61%	0.67	0.12%	27.12	1.35%
Developed, Open Space	46.25	2.28%	17.57	3.25%	43.13	1.61%	5.36	0.95%	39.35	1.95%
Developed, Low Intensity	28.24	1.39%	4.00	0.74%	0.22	0.01%	2.46	0.43%	2.89	0.14%
Developed, Medium Intensity	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	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%
Barren Land	0.22	0.01%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Deciduous Forest	1,142.78	56.34%	423.68	78.36%	1,950.54	72.78%	457.53	80.70%	1,739.07	86.31%
Evergreen Forest	0.00	0.00%	0.00	0.00%	7.56	0.28%	0.67	0.12%	24.23	1.20%
Mixed Forest	7.12	0.35%	2.45	0.45%	48.69	1.82%	9.38	1.65%	96.48	4.79%
Shrub/Scrub	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	39.13	1.94%
Grassland/Herbaceous	8.01	0.39%	0.22	0.04%	4.67	0.17%	0.45	0.08%	2.00	0.10%
Pasture/Hay	528.58	26.06%	50.26	9.30%	41.13	1.53%	72.12	12.72%	44.68	2.22%
Cultivated Crops	245.72	12.11%	40.70	7.53%	4.89	0.18%	18.31	3.23%	0.00	0.00%
Woody Wetlands	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%

Subwatershed Land Use Classification	Camprground		Kinkaid Lake - NW		Johnson Creek		Sharp Rock		Spring Creek	
	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU	Acreage	% of SMU
Open Water	25.58	1.23%	330.20	19.24%	9.79	0.36%	14.25	1.49%	13.79	0.81%
Developed, Open Space	62.29	2.99%	40.75	2.37%	89.19	3.27%	21.37	2.24%	79.62	4.70%
Developed, Low Intensity	44.27	2.12%	16.48	0.96%	34.03	1.25%	24.04	2.52%	108.98	6.43%
Developed, Medium Intensity	0.00	0.00%	1.56	0.09%	0.00	0.00%	0.00	0.00%	5.34	0.31%
Developed, High Intensity	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Barren Land	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.22	0.01%
Deciduous Forest	848.46	40.67%	1,033.78	60.24%	2,069.76	75.88%	417.79	43.81%	774.20	45.67%
Evergreen Forest	6.01	0.29%	16.92	0.99%	36.48	1.34%	18.47	1.94%	3.11	0.18%
Mixed Forest	144.60	6.93%	178.57	10.40%	169.48	6.21%	0.00	0.00%	37.81	2.23%
Shrub/Scrub	1.33	0.06%	0.00	0.00%	2.22	0.08%	0.00	0.00%	0.22	0.01%
Grassland/Herbaceous	2.00	0.10%	16.03	0.93%	4.45	0.16%	0.89	0.09%	4.00	0.24%
Pasture/Hay	416.67	19.97%	81.27	4.74%	270.01	9.90%	369.26	38.73%	422.80	24.94%
Cultivated Crops	534.80	25.64%	0.67	0.04%	42.26	1.55%	87.47	9.17%	245.09	14.46%
Woody Wetlands	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%

APPENDIX C- MRLC Classifications

Class\ Value	Classification Description
Water	
11	**Open Water** - areas of open water, generally with less than 25% cover of vegetation or soil.
12	**Perennial Ice/Snow** - areas characterized by a perennial cover of ice and/or snow, generally greater than 25% of total cover.
Developed	
21	**Developed, Open Space** - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
22	**Developed, Low Intensity** - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
23	**Developed, Medium Intensity** - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
24	**Developed High Intensity** -highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.
Barren	
31	**Barren Land (Rock/Sand/Clay)** - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Forest	
41	**Deciduous Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
42	**Evergreen Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
43	**Mixed Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
Shrubland	
51	**Dwarf Scrub** - Alaska only areas dominated by shrubs less than 20 centimeters tall with shrub canopy typically greater than 20% of total vegetation. This type is often co-associated with grasses, sedges, herbs, and non-vascular vegetation.
52	**Shrub/Scrub** - areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
Herbaceous	
71	**Grassland/Herbaceous** - areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
72	**Sedge/Herbaceous** - Alaska only areas dominated by sedges and forbs, generally greater than 80% of total vegetation. This type can occur with significant other grasses or other grass like plants, and includes sedge tundra, and sedge tussock tundra.
73	**Lichens** - Alaska only areas dominated by fruticose or foliose lichens generally greater than 80% of total vegetation.
74	**Moss** - Alaska only areas dominated by mosses, generally greater than 80% of total vegetation.
Planted/Cultivated	
81	**Pasture/Hay** - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
82	**Cultivated Crops** - areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
Wetlands	
90	**Woody Wetlands** - areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
95	**Emergent Herbaceous Wetlands** - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

APPENDIX D- Assessment Forms

KINKAID CREEK WATERSHED STREAM INVENTORY

DATE: _____STREAM NAME: _____REACH ID: _____

MAP ID: _____SMU ID: _____ASSESSMENT UNIT ID:_____

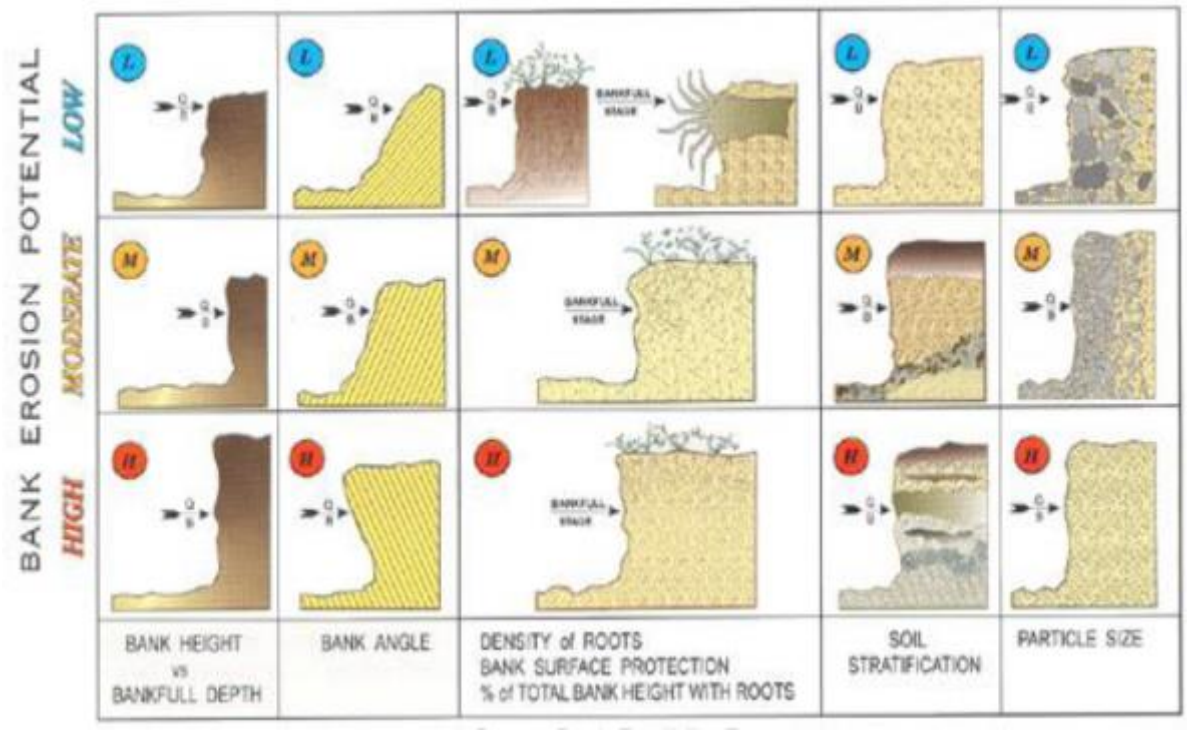
PHOTOS: _____ APPROXIMATE LENGTH: _____ FIELD ASSESSOR: _____

DEGREE OF STREAMBED EROSION

NONE	LOW	MODERATE	HIGH
Stable: less than 5% of banks affected	Moderately Stable: 5-33% banks have areas of erosion	Moderatley Unstable: 33-66% of banks have areas of erosion	Unstable: 66-100% of banks have high levels of erosion

DEGREE OF STREAMBANK EROSION

NONE	LOW	MODERATE	HIGH
Stable: less than 5% of banks affected	Moderately Stable: 5-33% banks have areas of erosion	Moderatley Unstable: 33-66% of banks have areas of erosion	Unstable: 66-100% of banks have high levels of erosion



MEAN BANK HEIGHT AND CHANNEL WIDTH (in feet, facing downstream)

LEFT BANK HEIGHT	MEAN CHANNEL WIDTH	RIGHT BANK HEIGHT

CONDITION OF RIPARIAN AREA

Land Cover (%): Scrub/Shrub: _____ Lawn: _____ Wetlands: _____ Crops: _____
Wooded: _____ Pasture: _____ Impervious: _____ Prairie: _____

ENVIRONMENTAL CONDITION OF RIPARIAN AREA: Good: ___Fair:____ Poor: ____
COMMENT**:**_____
_____

DEGREE OF CHANNELIZATION

NONE: _____LOW: _____ MODERATE: _____ HIGH: _____

DEBRIS BLOCKAGES (Instream/ Overbank)

LOW: _____ MODERATE: _____ HIGH: _____
COMMENT: _____

KINKAID CREEK WATERSHED LAKE INVENTORY

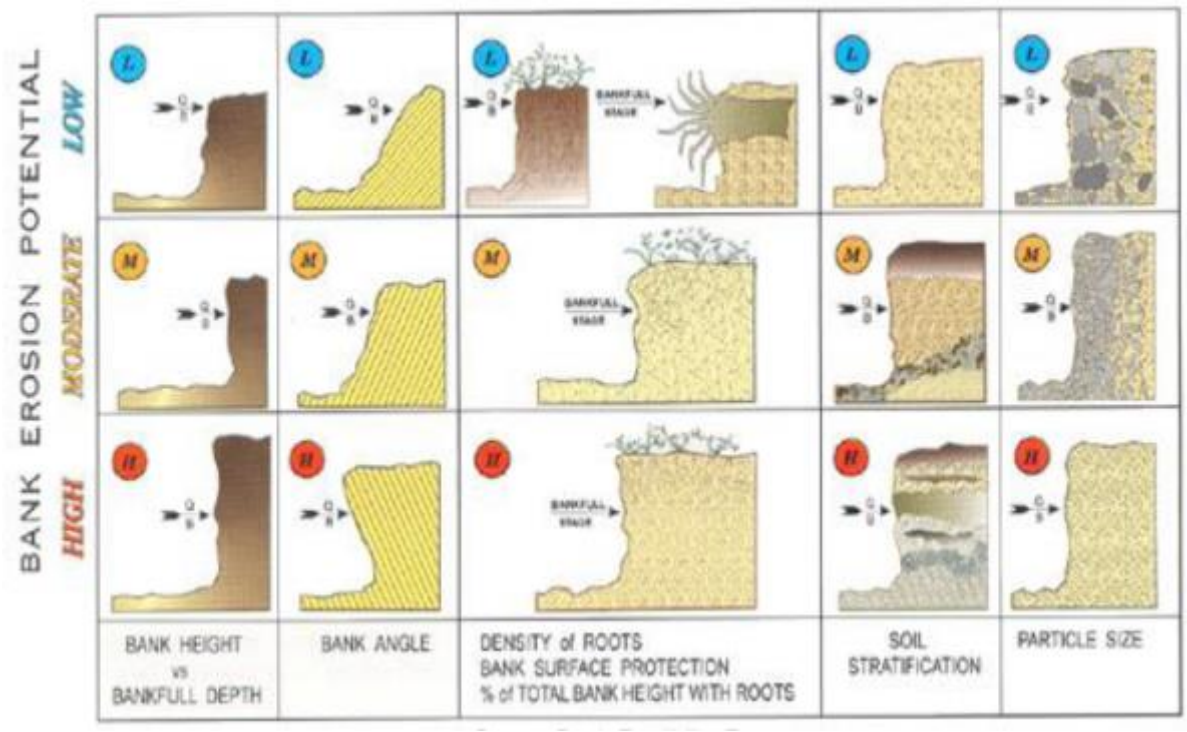
DATE: _____LAKE NAME: _____SHORE ID: _____

MAP ID: _____SMU ID: _____ASSESSMENT UNIT ID:_____

PHOTOS: _____ APPROXIMATE LENGTH: _____ FIELD ASSESSOR: _____

DEGREE OF SHORELINE EROSION

NONE	LOW	MODERATE	HIGH
Stable: less than 5% of banks affected	Moderately Stable: 5-33% banks have areas of erosion	Moderatley Unstable: 33-66% of banks have areas of erosion	Unstable: 66-100% of banks have high levels of erosion



MEAN BANK HEIGHT: _____

CONDITION OF RIPARIAN AREA

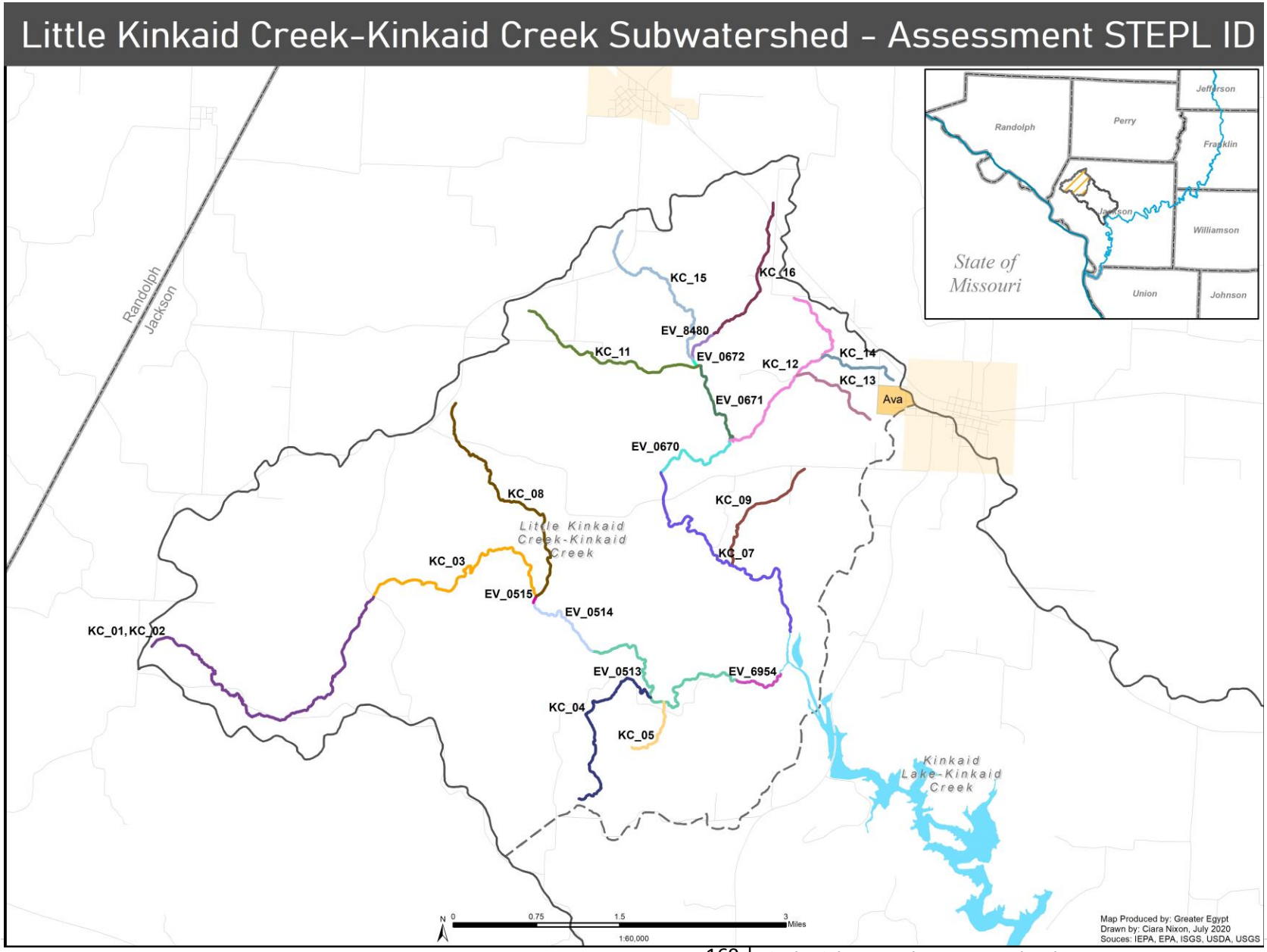
Land Cover (%): Scrub/Shrub: _____ Lawn: _____ Wetlands: _____ Crops: _____
Wooded: _____ Pasture: _____ Impervious: _____ Prairie: _____

ENVIRONMENTAL CONDITION OF RIPARIAN AREA: Good: ___Fair:____ Poor: ____
COMMENT**:**_____
_____

DEBRIS BLOCKAGES (Overbank)
LOW: _____ MODERATE: _____ HIGH: _____

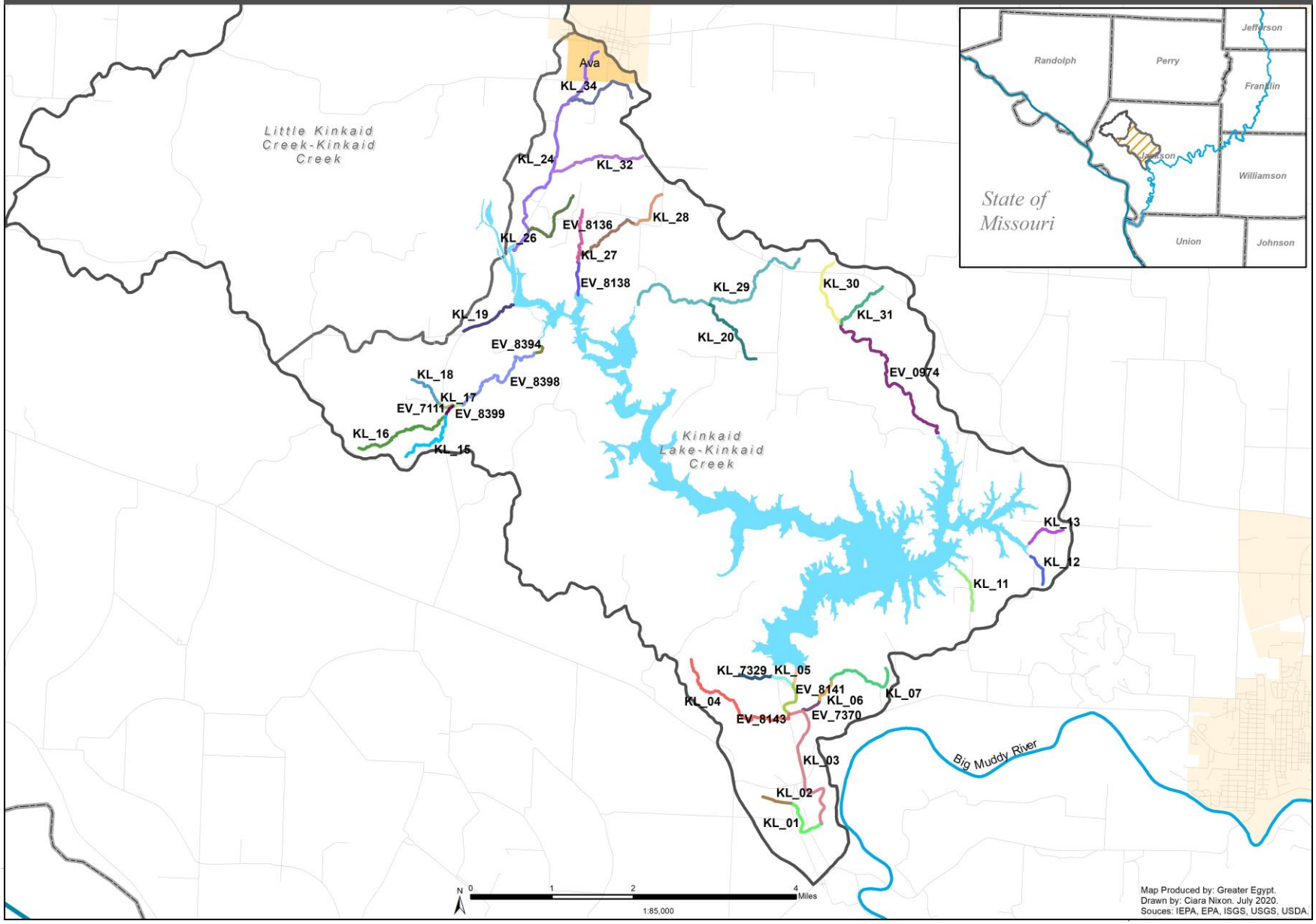
COMMENT: _____

APPENDIX E- Assessed Stream Reach Information



Little Kinkaid Creek - Kinkaid Creek Subwatershed - Assessed Stream REACH Information					
Reach Code	**Stream Name**	**Subwatershed Management Unit**	**STEPL ID**	**IEPA ID**	**Stream Length (ft)**
7140106000513	Kinkaid Creek	Middle Kinkaid Creek	EV_0513	IL_NB	12,116.40
7140106006954	Kinkaid Creek	Middle Kinkaid Creek	EV_6954	IL_NB	2,652.22
7140106007038		Middle Kinkaid Creek	KC_04		10,362.30
7140106007002		Middle Kinkaid Creek	KC_05		3,442.09
7140106000514	Kinkaid Creek	Upper Kinkaid Creek	EV_0514	IL_NB	4,390.05
7140106000515	Kinkaid Creek	Upper Kinkaid Creek	EV_0515	IL_NB	353.12
7140106000516	Kinkaid Creek	Upper Kinkaid Creek	KC_03	IL_NB	12,562.40
7140106000517	Kinkaid Creek	Upper Kinkaid Creek	KC_01, KC_02	IL_NB	18,163.30
7140106000956		Upper Kinkaid Creek	KC_08		12,941.30
7140106006874		Lower Little Kinkaid Creek	KC_09		6,687.14
7140106000669	Little Kinkaid Creek	Lower Little Kinkaid Creek	KC_07	IL_NBA	14,260.40
7140106008480	Little Kinkaid Creek	Lower Little Kinkaid Creek	EV_8480	IL_NBA	1,829.03
7140106000672	Little Kinkaid Creek	Upper Little Kinkaid Creek	EV_0672	IL_NBA	412.40
7140106000670	Little Kinkaid Creek	Upper Little Kinkaid Creek	EV_0670	IL_NBA	4,961.92
7140106000671	Little Kinkaid Creek	Upper Little Kinkaid Creek	EV_0671	IL_NBA	4,707.20
7140106000965		Upper Little Kinkaid Creek	KC_12		11,069.40
7140106006792		Upper Little Kinkaid Creek	KC_13		4,727.79
7140106006765		Upper Little Kinkaid Creek	KC_14		4,209.53
7140106008479		Upper Little Kinkaid Creek	KC_16		7,705.65
7140106000967		Upper Little Kinkaid Creek	KC_11		9,946.69
7140106000966		Upper Little Kinkaid Creek	KC_15		9,779.98

Kinkaid Lake-Kinkaid Creek Subwatershed - STEPL ID



Kinkaid Lake - Kinkaid Creek Subwatershed - Assessed Stream REACH Information					
Reach Code	Stream Name	Subwatershed Management Unit	STEPL ID	IEPA ID	Stream Length (ft)
7140106007472	Lower Kinkaid Creek	Lower Kinkaid Creek	KL_02		2,042.36
7140106007329	Lower Kinkaid Creek	Lower Kinkaid Creek	KL_7329		2,401.10
7140106007336	Lower Kinkaid Creek	Lower Kinkaid Creek	KL_05		1,493.28
7140106008141		Lower Kinkaid Creek	EV_8141	IL_NB-01	1,020.96
7140106008161	Lower Kinkaid Creek	Lower Kinkaid Creek	KL_01		3,642.18
7140106000509	Lower Kinkaid Creek	Lower Kinkaid Creek	KL_03	IL_NB-01	10,159.00
7140106008143		Lower Kinkaid Creek	EV_8143	IL_NB-01	2,648.76
7140106000977	Lower Kinkaid Creek	Lower Kinkaid Creek	KL_04		9,778.32
7140106007370		Heiple	EV_7370		1,530.48
7140106007359	Heiple	Heiple	KL_06		1,774.89
7140106007322	Heiple	Heiple	KL_07		5,512.67
7140106007249	Kinkaid Lake-Central Body	Kinkaid Lake-Central Body	KL_11		3,047.33
7140106007182	Kinkaid Lake-East	Kinkaid Lake-East	KL_13		2,789.55
7140106007222	Kinkaid Lake-East	Kinkaid Lake-East	KL_12		2,213.11
7140106000974		Lone Oak	EV_0974		12,628.70
7140106000975	Lone Oak	Lone Oak	KL_30		5,023.07
7140106006998	Lone Oak	Lone Oak	KL_31		4,345.16
7140106000971	Campground	Campground	KL_29		15,464.80
7140106007036	Campground	Campground	KL_20		5,584.61
7140106007035	Kinkaid Lake-Northwest	Kinkaid Lake-Northwest	KL_19		3,887.84
7140106008400	Johnson Creek	Johnson Creek	KL_17		1,287.56
7140106008399		Johnson Creek	EV_8399		703.09
7140106008398		Johnson Creek	EV_8398		7,998.83
7140106008397	Johnson Creek	Johnson Creek	KL_18		2,587.43
7140106007111		Johnson Creek	EV_7111		832.40
7140106008394		Johnson Creek	EV_8394		690.93
7140106007152	Johnson Creek	Johnson Creek	KL_16		7,511.92

Kinkaid Lake - Kinkaid Creek Subwatershed - Assessed Stream REACH Information					
Reach Code	**Stream Name**	**Subwatershed Management Unit**	**STEPL ID**	**IEPA ID**	**Stream Length (ft)**
7140106007158	Johnson Creek	Johnson Creek	KL_15		5,121.01
7140106008136		Sharp Rock	EV_8136		5,321.83
7140106008138		Sharp Rock	EV_8138		2,383.46
7140106006961	Sharp Rock	Sharp Rock	KL_27		3,750.68
7140106008135	Sharp Rock	Sharp Rock	KL_28		2,991.10
7140106000969	Spring Creek	Spring Creek	KL_24		16,127.20
7140106006935	Spring Creek	Spring Creek	KL_26		5,111.26
7140106006885	Spring Creek	Spring Creek	KL_32		6,630.22
7140106006833	Spring Creek	Spring Creek	KL_34		5,629.55