Appendix E

BUILD Grant Road Improvements and Relocations

1. INTRODUCTION

The East Locust Creek Reservoir (ELCR, Project) would include roadway improvements and new roads to facilitate construction access, allow for east to west transportation, and provide access to recreational benefits provided by the reservoir. This appendix is intended to focus on the roadway projects, provide additional roadway details, and support the SEIS document. Please refer to the SEIS for non-roadway impacts and for impacts related to dam construction and inundation of the normal pool.

Because the roadway projects are components of the larger proposed Project, and would not be constructed “but for” the proposed Project, the purpose and need for the roadway projects are the same as the proposed Project: water supply, water-based recreation, and flood damage reduction. The proposed Project purpose and need are described in the Supplemental Environmental Impact Statement (SEIS) East Locust Creek Watershed Revised Plan section 1.5.

The roadway projects would be partially funded by a Better Utilizing Investments to Leverage Development (BUILD) grant which was awarded in November 2019. The BUILD grant, with funds totaling $13,459,009, would be overseen by the Federal Highway Administration (FHWA, cooperating agency) and administered by the Missouri Department of Transportation (MoDOT). Additional funding sources for the roadway projects include the North Central Missouri Regional Water Commission (NCMRWC, Project sponsor), NRCS (lead federal agency), USDA RD (cooperating agency), and state of Missouri funds. Information provided in this appendix is inclusive of all roadway projects, regardless of funding source. Figure 1 shows the proposed roadway projects and references the plan sets that describe the improvements. Descriptions of each of the six plan sets are provided in Section 2, below. The six plan sets are included in Attachment A.

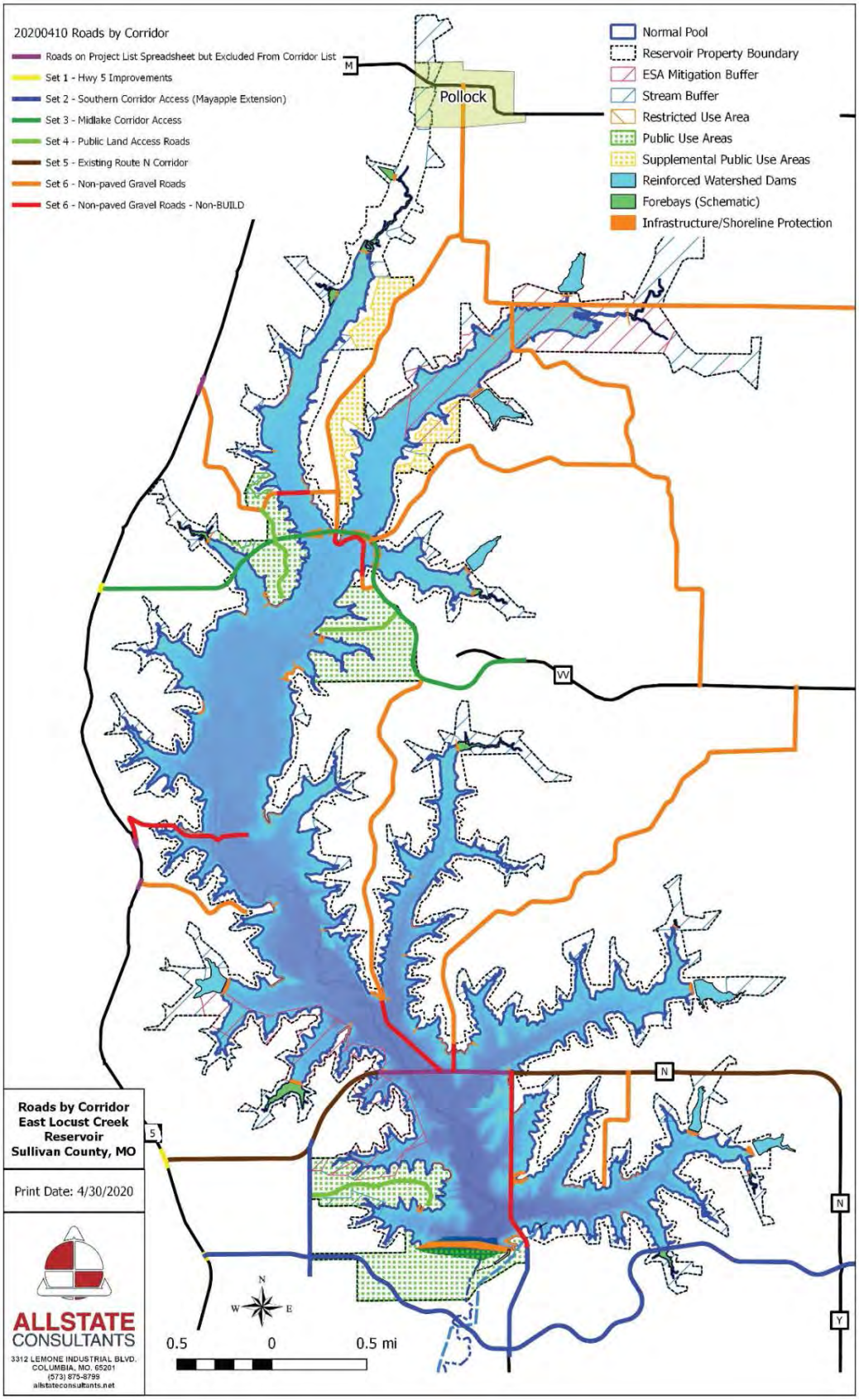

Figure 1. East Locust Creek Roads by Corridor.

2. ROADWAY IMPROVEMENT DESCRIPTIONS

Roadway Plan Set 1 - Highway 5 Intersection Improvements (Total Length 1.3 miles)

Roadway plan set 1 includes improvements to four intersections along State Highway 5. The proposed improvements total 1.3 miles in length. Intersection improvements at these four locations, detailed below, include the construction of new intersections, addition of new left turn lanes, and other minor intersection improvements. Roadway improvements included in plan set 1 include the following:

- Intersection of Highway 5 and Mid Lake Road
- Intersection of Highway 5 and Route N
- Intersection of Highway 5 and Mayapple Road
- Intersection of Highway 5 and Highway 6

Roadway Plan Set 2 - Southern Corridor Access (Total Length 5.4 miles)

Roadway plan set 2 includes 5.4 miles of improvements that will provide southern corridor access around the reservoir. There are three roadway projects associated with plat set 2, each of which is described in the bulleted list below. There is one crossing of East Locust Creek associated with plan set 2. Proposed roadway improvements include:

- Mayapple Road Improvements (3 segments)
    - *Mayapple Road to England Drive*: Widening and improvements to existing gravel road
    - *Mayapple Road from England Drive to Finch Drive*: Widening and improvements to existing gravel road
    - *Mayapple Road from Finch Drive to Highway Y:* Construction of new roadway
- England Drive Improvements
    - Reconstruction of existing gravel road and replacement with pavement
- Finch Drive Improvements
    - Construction of a dead end that serves the ELCR/NCRWC raw water intake and spillway structures (currently a gravel road)

Plan Set 3 - Mid-Lake Corridor Access (Total Length 2.9 miles)

Roadway plan set 3 includes 2.9 miles of improvements which are designed to provide east-west access across the middle of the proposed reservoir, creating a connection between Highway 5 and Route VV. There is one roadway project associated with plan set 3, which will cross the two main tributaries to ELCR and two smaller tributaries. The roadway will tie into two planned public use areas. Plan set 3 contains the following roadway project:

- Mid-Lake Road
    - Construction of a new roadway (with exception of a small amount of existing gravel road tie-ins) to connect Highway 5 to Route VV.

Plan Set 4 - Public Access Roads (Total Length 1.9 miles)

Roadway plan set 4 includes 1.9 miles of improvements that will provide access to four public use areas owned by the NCRWC. Plan set 4 includes the following four roadway projects:

- Marina Road
  - Construction of a new roadway to provide access to proposed marina
- Knob Hill Connector
  - Construction of a new roadway and improvements to a small section of gravel road to connect Knob Hill Road to the proposed mid-lake road
- East Public Access Road
  - Construction of a new roadway to provide access to the northeastern portion of the reservoir
- West Public Access Road
  - Construction of a new road to provide access to the north portion of the reservoir from the Knob Hill Road connector southward

Plan Set 5 - Route N Improvements (Total Length 4.1 miles)

Roadway plan set 5 includes 4.1 miles of maintenance along existing route N, as well as two terminations where Route N will be inundated by ELCR. The two projects associated with plan set 5 include:

- Intersection of Route N & England Drive
  - Construction of a new intersection
- Route N (East, West, Mid)
  - Construction of cul-de-sacs/trailhead areas at termini on the east and west sides of ELCR where existing roadway will be inundated.

Plan Set 6 - Non-Paved Gravel Roads (Total Length 11.9 miles)

Roadway plan set 6 includes maintenance to 11.9 miles of existing gravel roads. The 11 existing gravel roads associated with plan set 6 are low-volume, basic access roads used for agriculture. Proposed improvements include minor grading work and new gravel. The following roadways are included in plan set 6:

- Eagle Drive
- Finch Drive
- Forum Drive
- Friend Drive
- Front Drive
- Knob Hill Road
- Kentucky Road
- Log Road
- Lyric Road
- May Ridge Road
- Mulberry Road

3. ENVIRONMENTAL RESOURCE EVALUATIONS

3.1. CULTURAL RESOURCES: SECTION 106

The East Locust Creek Reservoir cultural resource survey for the proposed road improvements recorded 35 properties with at least one building over 40 years old (constructed prior to 1981). These buildings are within 200 feet of the proposed road center line and may be affected by indirect impacts. MoDOT and SHPO are determining if any of these buildings are eligible for the NRHP. Also, within the viewshed, there are four cemeteries: Mt. Zion, Hamilton-Gridstaff, Campbell, and Pollack. A previously unknown family plot, the Bingham family plot, was identified just south of Route N. The Bingham family plot is within the proposed construction corridor but will not be impacted by the proposed road improvements. In addition to the Bingham family plot, the survey resulted in the identification of six other previously unknown archaeological sites: two Precontact camp sites, three farmsteads, and the Fairview School.

3.2. PUBLIC LANDS: SECTION 4(F) AND 6(F)

Google Earth imagery, the U.S. Geological Survey (USGS) Protected Areas Database, and the Missouri State Parks list of Land and Water Conservation Fund (LWCF) Grants were used to identify Section 4(f) and Section 6(f) resources in and around proposed roadway projects. According to these resources, there is one public lands resource is located in the vicinity of the roadway projects. Sears Conservation Area, a Section 4(f) resource, is located along the southern boundary of the of the proposed construction of Mayapple Road and is managed by the Missouri Department of Conservation (MDC). However, the roadway improvements will not require new right of way or easements from and will not restrict access to this resource. The proposed construction of Mayapple Road will be built on property owned by the NCMRWC and no impacts to this Section 4(f) resource will occur as a result of the roadway improvements. In addition to Sears Conservation Area, there are five additional public lands resources located more than four miles from the project area. These resources include: Union Ridge Conservation Area (Forest Grove Park (City of Milan; 4.5-miles southwest), Dark Hollow Natural Area (MDC; 7.4-miles east), Morris Prairie Conservation Area (MDC; 7.5-miles northeast), Mineral Hills Conservation Area (MDC; 7.6-miles northeast), and Union Ridge Conservation Area (MDC; 10.1-miles east). None of these resources will be impacted by the project.

Based on this information, the roadway projects will not result in a use to any Section 4(f) properties and no conversion of any Section 6(f) lands.

3.3. WETLANDS AND STREAMS: SECTION 404 AND 401

A wetland delineation and stream assessment were completed along all roadways shown in in Figure 1 between June and September 2020. The wetland delineation was conducted per methodology outlined by the *Corps of Engineers Wetland Delineation Manual (1987)* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region, Version 2.0 (2010).* Wetland delineations were performed for all sites that were composed of hydric vegetation, hydric soils, and wetland hydrology.

Stream assessments were conducted to collect data to aid the USACE in making a preliminary jurisdictional determination of the stream reach. The assessments were conducted and were consistent with the Missouri Stream Mitigation Method (MSMM) for compensatory mitigation as necessary. Guidance for the stream assessments is contained in the *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* (2007) and the *State of Missouri Stream Mitigation Method*, last revised April 2013.

The area delineated for wetlands and streams in the field is larger than the roadway impacts to allow for adjustments in road alignment should they occur. The wetlands and stream identified below may be impacted by the road improvements.

The wetland delineation identified seven palustrine emergent (PEM) wetlands, one palustrine scrub-shrub (PSS) wetland, and two palustrine open water features in the footprint of proposed roadway projects (Figure 2). Based on the new Navigable Waters Protection Rule (NWPR) published in the Federal Register on June 22, 2020, four PEM wetlands (totaling 0.30 acre), one PSS wetland (0.05 acre), and one PUB feature (totaling 0.21 acre) are considered jurisdictional features because they abut or are adjacent to an intermittent or perennial stream which ultimately flows to the Missouri River. The Missouri River is designated as a Traditional Navigable Water (TNW). All other wetlands and open water features delineated within the Project area are likely non-jurisdictional, as they are either isolated features or are adjacent to ephemeral streams. Table 1, below, summarizes the wetland features documented in the roadway footprints.

The stream assessment identified one perennial stream, one intermittent stream, and three ephemeral streams in the footprint of the proposed roadway projects. Of the delineated stream features, the perennial stream (209 linear feet) and intermittent stream (104 linear feet) are considered jurisdictional features under the NWPR because they flow to tributaries of the Missouri River. The three delineated ephemeral streams are non-jurisdictional under the NWPR. Table 2, below, summarizes the streams documented in the surveyed area.

Table 1. Wetland Delineation Summary.

Wetland ID	Data Point	Classification[1]	Jurisdictional[2]	Size (acres)
Wetland 22	w22	PSS	Y	0.05
Wetland 24	w24	PEM	Y	0.17
Wetland 25	w25	PEM	Y	0.10
Wetland 26	w26	PAB	N	0.04
Wetland 27	w27	PEM	Y	<0.01
Wetland 28	w28	PEM	N	0.01
Wetland 30	w30	PEM	N	0.02
Wetland 32	w32	PUB	Y	0.21
Wetland 33	w33	PEM	Y	0.03
Wetland 34	w34	PEM	N	0.18
			TOTAL	**0.81**
			JURISDICTIONAL ACRES	**0.56**

[1]PEM = Palustrine emergent wetland; PSS = Palustrine scrub-shrub wetland; PAB = palustrine aquatic bottom; PUB: Palustrine unconsolidated bottom
[2]Based on the new Navigable Water Protection Rule (NWPR)

Table 2. Stream Assessment Summary.

Feature ID	Data Point	Stream Type	Stream Length (linear feet)	Jurisdictional[1]
Tributary 6	t6	Perennial	209	Y
Tributary 8	t8	Intermittent	104	Y
Tributary 9	t9	Ephemeral	133	N
Tributary 11	t11	Ephemeral	260	N
Tributary 12	t12	Ephemeral	107	N
		TOTAL	**813**	
		JURISDICTIONAL LENGTH	**303**	

[1] Based on the new Navigable Water Protection Rule (NWPR)

The streams and wetlands identified in the field study have been submitted to the USACE for preliminary jurisdictional determinations and subsequent Clean Water Act Section 404 Permit for impacts to jurisdictional features. The design plans will be reviewed to determine potential impacts to jurisdictional streams and wetlands found in the field survey. Avoidance and minimization measures and mitigation will be detailed in the Section 404 permit application.

3.4. THREATENED AND ENDANGERED SPECIES

Threatened and endangered species impacts for the roads receiving funding under the BUILD grant are covered under the biological assessment submitted to the USFWS in May 2020 and currently in formal consultation. A biological opinion is anticipated in October 2020.

The biological assessment lists four potential species to occur within the project limits (including the road improvements receiving BUILD funds): Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), gray bat (*Myotis grisescens*), and Mead's milkweed (*Asclepias meadii*). These species, their habitat, and ranges are described in the biological assessment and are summarized below.

Mead's Milkweed

Mead's milkweed habitat includes mesic to moderately dry upland tallgrass prairies throughout the eastern tallgrass prairie, from Kansas through Missouri and Illinois and north to southern Iowa and northwestern Indiana. Mead's milkweed is found in virgin, tallgrass prairies that are managed for light grazing and hay production (USFWS 2003). USFWS (1988) cited personal communication with Ronald McGregor (University of Kansas) that he has only found Mead's milkweed in tallgrass prairies. Similarly, an unpublished report by S.W. Morgan at MDC in 1980 stated that Mead's milkweed in Missouri is found in unplowed bluestem prairie (USFWS 1988).

Sullivan County does not have a known current or historic Mead's milkweed population, but three extant populations are in the Missouri glaciated plains physiographic region, in which Sullivan County is located (USFWS 2012). Habitat assessments for the roadway improvements did not identify any native, undisturbed, tallgrass prairie. Because Mead's milkweed has not been identified in Sullivan County and the habitat assessment did not identify any native, undisturbed, tall grass prairie, there will be No Effect on Mead's milkweed as a result of the roadway improvements.

Gray Bat

Gray Bat inhabits caves year-round and occupies cold hibernating caves in the winter and warm caves during the summer (USFWS 2009). Wintering caves tend to be deep and vertical. During the summer months, pregnant females form maternity colonies in caves that have domed ceilings. Gray bat does not use houses or barns for habitat (USFWS 2018; MDC 2000). Maternity colonies are formed on the cave ceilings and range from a few hundred individuals to a few thousand individuals. Summer foraging habitat includes open water of rivers, streams, and lakes or reservoirs. Gray bats may travel up to 35 kilometers between maternity colonies and foraging areas; however, most foraging areas are located 1 to 4 kilometers from a maternity colony's cave (USFWS 2009).

Because Sullivan County has potential gray foraging habitat, Olsson conducted mist netting and acoustic monitoring from June 2 – July 10, 2016, to determine the presence or probable

absence of gray bats. The sampling methodology followed the Indiana Bat Draft Recovery Plan and the Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2015). The 2016 sampling did not identify gray bats, based on 81 net nights and 35 detector nights (Olsson 2017). Because no gray bats were detected during the mist netting or acoustic monitoring, there will be no effect on gray bat as a result of the roadway improvements.

Indiana Bat

The Indiana bat (MYSO) is a migratory species that migrates from summer foraging and maternity roost habitat to winter hibernating habitat. Summer roost trees for MYSO are typically large, often dead, with exfoliating bark. The tree species primarily associated with MYSOs are ash (*Fraxinus*), elm (*Ulmus*), hickory (*Carya*), maple (*Acer*), poplar (*Populus*), or oak (*Quercus*). Roost trees typically receive sunlight for part of the day and are often in open forest canopies (USFWS 2007). In Missouri, the average roost tree diameter is 22 inches. The average height of roost trees ranges from 52 to 85 feet, and the minimum height exceeded 12 feet for a primary roost (USFWS 2007).

The female MYSO uses a maternity roost tree to give birth to a single pup in June or early July. Maternity roosts can be primary or alternate, based on the number of individuals using the roost. In Missouri, primary roost trees are typically dead trees in open, interior woodlands. Shagbark hickory trees are more likely to provide alternative maternity roosts (USFWS 2007). A maternity colony may roost in 10 to 20 trees per year, but only one to three trees may be primary roost trees (USFWS 2007). MYSOs switch roost trees an average of every two to three days, which may vary based on reproductive condition and roost type (USFWS 2007). MYSOs return to maternity roosts annually. All roost trees eventually decay and become unusable by MYSOs. Having alternative maternity roosting options may provide replacements for primary maternity roost trees (USFWS 2007).

Because Sullivan County has potential MYSO habitat, mist netting and acoustic monitoring was conducted from June 2 – July 10, 2016, to determine the presence or probable absence of MYSOs. The sampling methodology followed the Indiana Bat Draft Recovery Plan and the Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2007; 2015). Results of the sampling included the capture of 10 MYSO within the Project boundary based on 81 net nights, and there was positive detection in eight of the nine regions based on 35 detector nights (Olsson 2017).

Four maternity roost trees were identified that were clustered in two groups of two maternity roost trees. A maternity roost tree was identified as having more than five bats identified during the emergence count (Olsson 2017). Callahan (1993) defined primary roost trees in Missouri as having 30 or more bats on multiple nights. However, Kurta et al. (1996) determined this number might not be applicable to small to moderate sized maternity colonies.

Maternity roost trees A and C (see Figure 2) were 0.6 mile apart from one another, and maternity roost trees E and F were 0.1 mile apart. The two groups of maternity roost trees were 4.9 miles apart at the farthest distance and 4.5 miles apart at the closest distance. Maternity roost sites C and F may be alternative maternity roost sites because of the low bat numbers (seven) recorded during the emergence counts. Additionally, they are near a maternity roost tree with emergence counts over 30 bats.

The home ranges for the Laela and Sushi colonies were determined based on a 2.5-mile buffer around the primary maternity roost trees (Figure 3). The forested areas within the 2.5-mile buffers totals 6,611 acres with 3,778 forested acres within Laela's home range and 2,925 forested acres within Sushi's home range. There are 92 forested acres of overlap between the two home ranges.

Nine alternative maternity roost trees were identified three of which were located in the normal pool. The nine alternative maternity roost trees had emergence counts of fewer than five bats.

The utilities and road relocations would cause the loss of 34 acres of forest including 27 acres within the home range of the two maternity roosts identified in the field study. Because Indiana bats were identified within the normal pool and the road improvements will cause forest loss within the home range of the Indiana bat maternity roost trees, the road improvements May Affect, and are likely to Adversely Affect Indiana bats. The road improvements are included in the biological assessment submitted to USFWS in June 2020 and NRCS has requested formal consultation with USFWS. A draft biological opinion has been received by NRCS and concludes that the proposed Project will not jeopardize the continued existence of the Indiana bat.

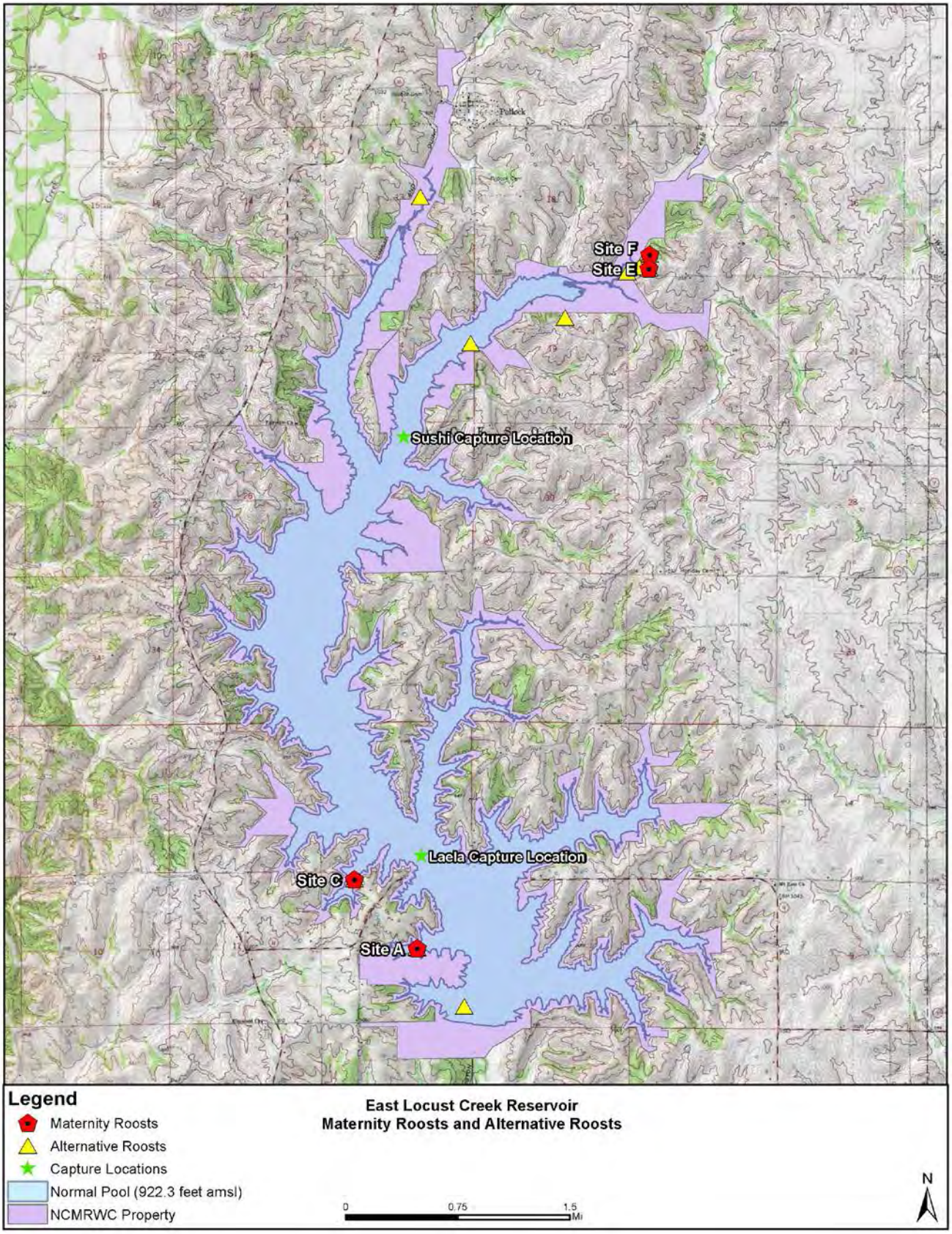

Figure 2. Maternity Roost Trees Identified for the East Locust Creek Project.

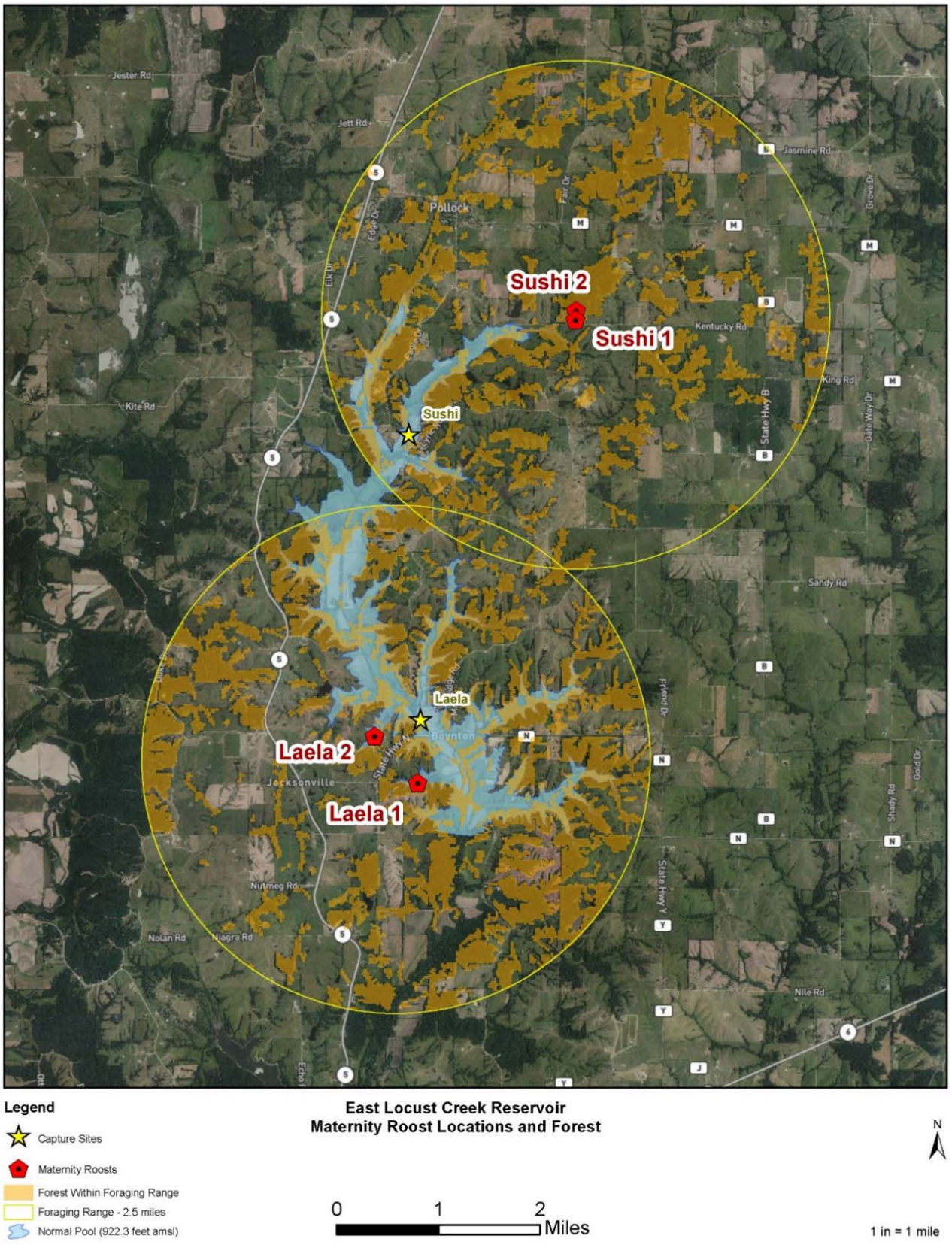

Figure 3. Laela and Sushi Colony's Home Range.

Northern Long-Eared Bat

Northern long-eared bat (MYSE) was listed as a threatened species under the Endangered Species Act on April 2, 2015, and a final 4(d) rule was published on January 14, 2016. The primary threat to the northern long-eared bat is white-nose syndrome, which is a fungal disease that causes bats to leave their hibernacula during winter. The final 4(d) rule accounted white-nose syndrome as the primary cause of northern long-eared bat decline, and not necessarily habitat loss. The 4(d) rule allows for tree clearing if it is does not take place within 0.25 mile of a known hibernaculum or within 150 feet of a known maternity roost tree during the pup season (June 1 through July 31; USFWS 2016).

As with Indiana bats, Sullivan County has potential northern long-eared bat habitat; therefore, mist netting and acoustic monitoring were conducted from June 2 – July 10, 2016, to determine the presence or probable absence of northern long-eared bats. The sampling methodology followed the Indiana Bat Draft Recovery Plan and the Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2015). Results of the sampling included the capture of six northern long-eared bats within the Project boundary based on 81 net nights and had positive acoustic detection in seven of the nine regions based on 35 detector nights.

Assuming a 3-mile home range from the lactating female capture sites, a northern long-eared bat maternity roost may be located in the Project area. There are known northern long-eared bat maternity roost trees in Adair, Putnam, and Schuyler counties. The roadway improvements include the loss of 34 acres including 25 acres within the 3-mile home range. This Project May Affect the northern long-eared bat; however, there are no effects beyond those previously disclosed in the Service's programmatic biological opinion for the final 4(d) rule dated January 5, 2016. Any taking that may occur incidental to this project is not prohibited under the final 4(d) rule (50 CFR §17.40[o]).

3.5. FARMLAND

The Project is located outside of a designated urbanized area as indicated on the 2010 U.S. Census Bureau Urban Area Reference Map and requires new right of way and easements. Therefore, the project is subject to the Farmland Protection Policy Act. A Farmland Conversion Impact Rating Form AD-1006 will be submitted to the NRCS for a determination of impacts to prime, unique, or farmland of statewide importance once the exact disturbance footprints are determined.

3.6. FLOODPLAIN

According to the attached FEMA floodplain maps portions of the proposed roadway projects are in the 100-year floodplain. In these areas, the floodplain is under the jurisdiction of Sullivan

County. According to FEMA's Community Status Book of NFIP memberships, Sullivan County is not a current member of the NFIP. Because Sullivan County is not a current member of the NFIP, the county has not adopted floodplain permitting ordinances.

3.7. FEMA/SEMA BUYOUT PROPERTIES

The Project proponent is not aware of any FEMA/SEMA buyout properties in the vicinity of the proposed roadway projects. The roadway projects will not result in development on any FEMA/SEMA buyout properties.

3.8. SOCIOECONOMIC

The road improvements do not include commercial or residential displacements but will require new right of way and temporary easements that are subject to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.

Mayapple Road, England Road, and Eagle Road may require short-term roadway closures. However, these are gravel roads with low average daily traffic (ADT) that have multiple access points in and out of the area. Possible access points for these roads include: Route VV, Route N, Lyric Road, and Hwy 5. The short-term detours for these routes would utilize the local gravel roads in the area of project construction. Right of way negotiations are still ongoing at this time, but any changes or supplements that would occur will be located at the roadway intersections on Hwy 5 (Mayapple Road, Mid Lake Road, and State Route N).

Long-term detours will use MoDOT Routes 6, RA, VV, and N. These routes will be signed and used to detour to Eagle Road, May Ridge Road, Finch Road, Kentucky Road, Lyric Road, Mayapple Road, and England Road. Once the construction of Mayapple Road has been completed, occasional detours will be needed but generally the roads will remain open to local traffic. At this time, the final traffic control plan has not been developed. The duration of each road closure and lengths of each detour will be based on construction progress, weather, final plans, and bid documents.

A joint public meeting will be held by NRCS and USACE for review of the Clean Water Act Section 404 permit and supplemental environmental impact statement. Socioeconomic impacts are anticipated to be temporary and limited to traffic disruptions, construction noise, and fugitive dust and emissions in the area of project construction.

3.9. HAZARDOUS WASTE

According to the DNR E-START map (Figure 4), there are hazardous substance investigation and cleanup sites located along the proposed roadway improvements. All 24 sites are listed as “Complete” and no further cleanup action is required. Based on this information, there are no hazardous waste concerns related to the proposed roadway projects, as all potentially hazardous sites have been previously evaluated and addressed in accordance with state and federal regulations.

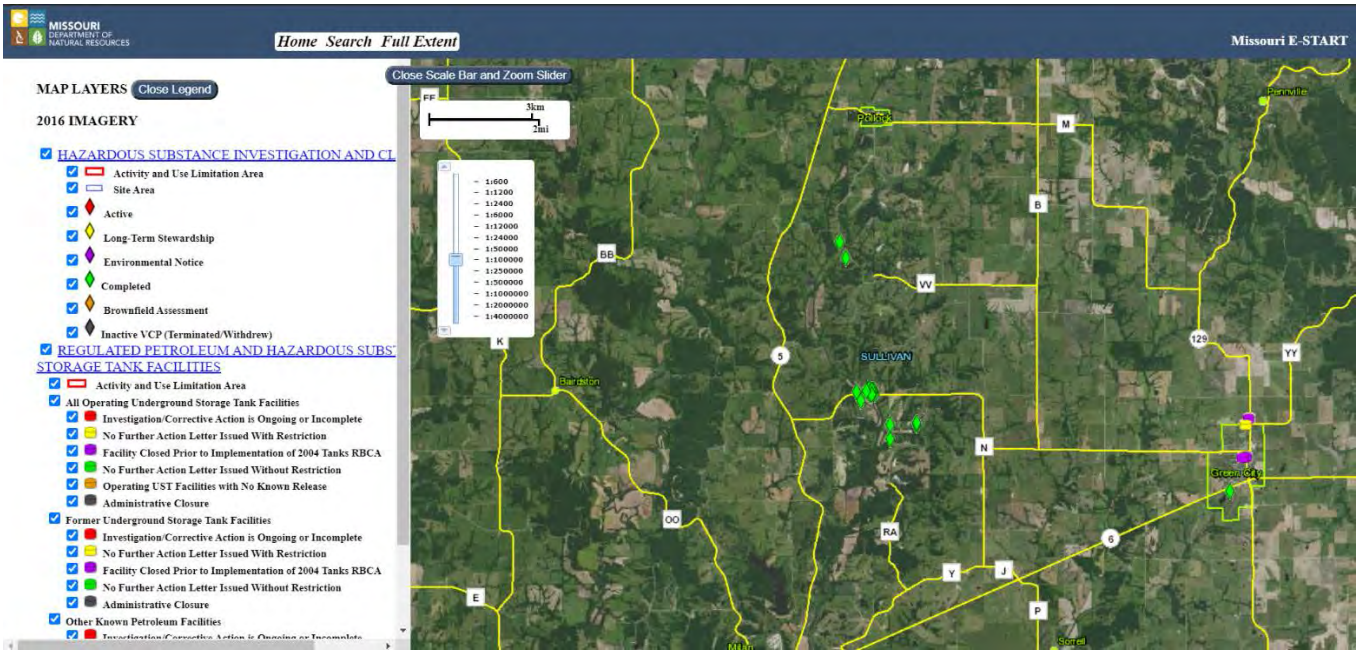

Figure 4. MDNR ESTART Map

3.10. NOISE

Based on the Federal Highway Administration (FHWA) Noise Standard in 23 Code of Federal Regulations (CFR) Part 772, the roadway improvements would classify as a Type I project because of the construction of a highway at a new location. This occurs where Route N is relocated south of the proposed dam location. Because the proposed roadway improvements are classified as a Type I activity, a noise study will be required.

3.11. REFERENCES

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Appendix F

Emergency Wetland Reserve Program Replacement

Appendix G

Shoreline Protection Plan

Appendix H

Source Water Protection Plan

SOURCE WATER PROTECTION PLAN

HEADWATERS OF EAST LOCUST CREEK WATERSHED

Prepared for the North Central Missouri
Regional Water Commission

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Table of Contents

I. INTRODUCTION / SUMMARY OVERVIEW

A. INTRODUCTION / PURPOSE STATEMENT

EXECUTIVE SUMMARY

The 49-square mile Headwaters of East Locust Creek HUC12 Watershed (HELC) lies at the upper end of East Locust Creek in Sullivan and Putnam Counties of Missouri. Within the HELC are the current and future sources of raw water for the North Central Missouri Regional Water Commission (the Commission).

The Commission was established in 2001 as part of Missouri Department of Natural Resources' (MDNR) effort to encourage consolidation of water supply resources across north central Missouri, and to phase out small, under-resourced, and inadequate water supply systems. They were given the additional charge of constructing a new water supply, the East Locust Creek Reservoir (ELCR). The Commission currently serves Sullivan and Linn Counties, which have limited groundwater resources, and is forced to rely on surface water supplies that are presently inadequate during drought conditions. In addition to providing wholesale water to three buyers, the Commission was also charged with developing a plan to provide a consistent and reliable water resource for the 10 county region. A plan was developed to construct a large surface water reservoir in Sullivan County that would consistently supply the county and surrounding region with high-quality water. The future ELCR, will be located approximately five miles north of the town of Milan, the county seat of Sullivan County (Figure 1). This Source Water Protection Plan (SWPP) is unique because both the existing Elmwood Lake and future ELCR raw water sources are in the HELC. We believe this is Missouri's first SWPP that will address water quality protection prior to construction of a reservoir.

This SWPP is also the first step toward future source water protection planning efforts. It follows the Guidelines for Developing a Source Water Protection Plan (MDNR 2014) and Minimum Design Standards for Missouri Community Water Systems (MDNR 2013). It will not only provide guidance for protecting water quality but should also help reduce treatment costs. The steering committee consisted of seven community members, most of whom live within the boundaries of the source water protection area and have an interest in local water supply, as well as resource professionals.

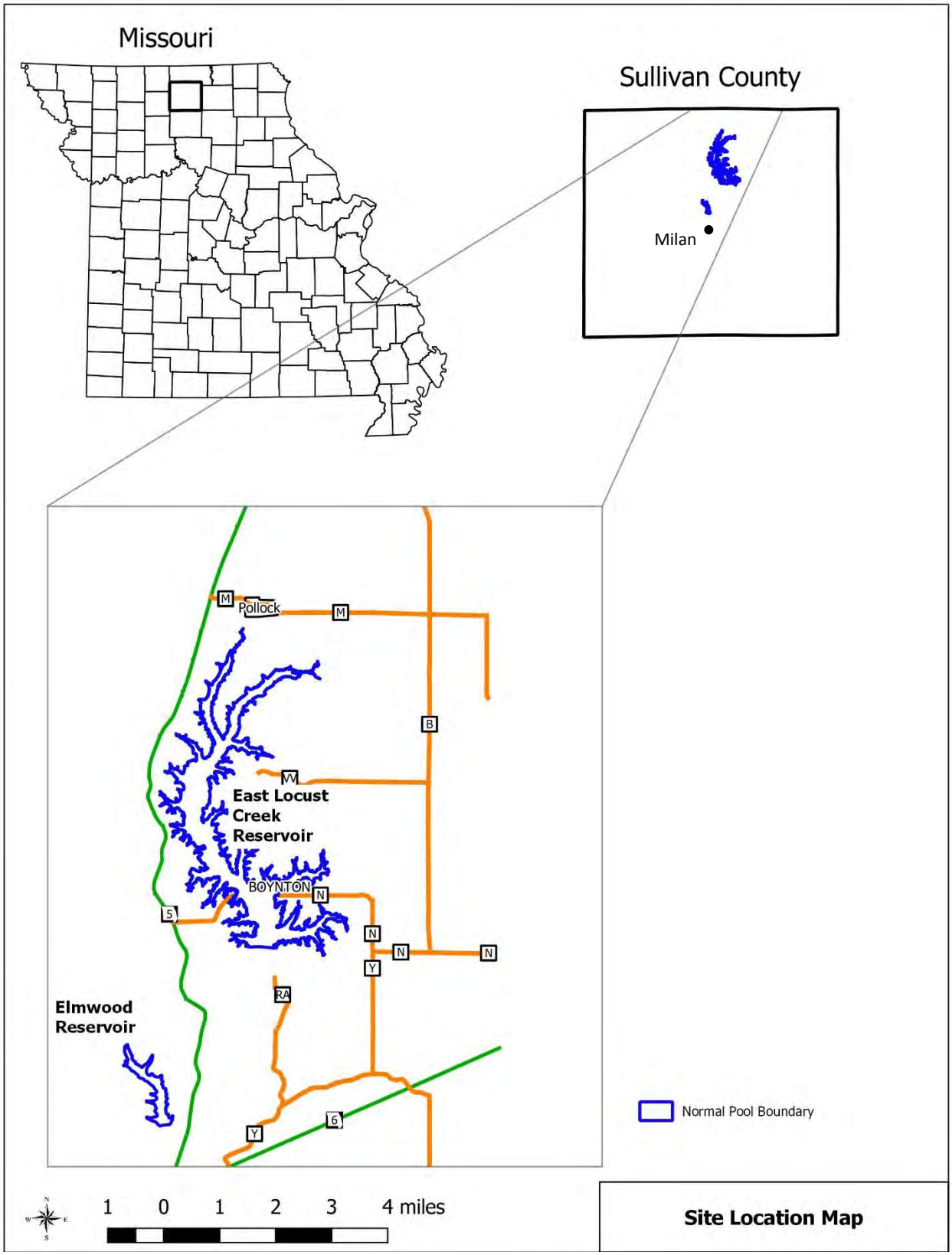

Figure 1. Project area (Published by Allstate Consultants LLC, 2018)

SOURCE WATER PROTECTION STEERING COMMITTEE

The Steering Committee was made up of citizens, most of whom live within the source water protection area, and are known to have an interest in the local water supply.

Cully Cowgill
Locust Creek Watershed Board Treasurer
Milan, MO

Phyllis Blondefield
Resident
Pollock, MO

Andy Herington
Mayor of Milan
Milan, MO

John Watt
Farmer
Green City, MO

Robert Jaques
Farmer
Milan, MO

Donnie Campbell
Farmer
Unionville, MO

Jim Hoselton
Locust Creek Watershed Board/President
Sullivan County SWCD
Humphreys, MO

Affiliate Members

Affiliate members are resource professionals who agreed to assist with the source water protection planning process.

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573-429-1383
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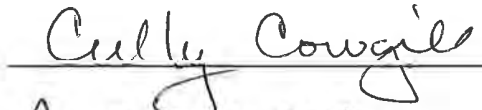
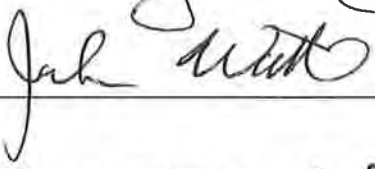
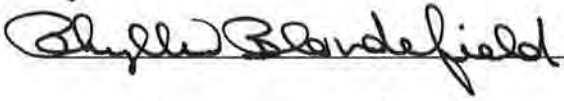
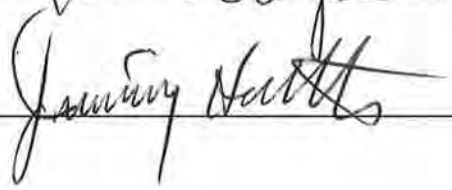
Approval of Source Water Protection Plan for Headwaters of East Locust Creek

Source Water Protection Working Group

Name	Signature
Cully Cowgill	
John Watt	
Phyllis Blondefield	
Robert Jaques	
Andy Herington	
Donnie Campbell	
Jim Hoselton	

PRIMARY CONTACT FOR PLANNING

Brad Scott
NCMRWC General Manager
201 North Market St.
Milan, MO 63556
660-265-4448

PURPOSE STATEMENT OF PLAN

Purpose

With the understanding that clean water is a limited resource, the purpose of this plan is to protect existing sources, which include Elmwood Reservoir and the headwaters of the proposed East Locust Creek Reservoir, in order to protect public health and keep water treatment costs to a minimum.

Goals & Objectives

This plan was developed by discussions, data collection, research, and a consensus of both the Commission and the Source Water Protection Steering Committee. Affiliate members of the steering committee reviewed and provided expertise related to their various disciplines. The primary goal of this effort was to develop a preliminary source water protection plan for the Commission to protect and improve drinking water sources of the Headwaters of East Locust Creek HUC12 prior to, during, and after construction of ELCR.

Objectives of this plan are as follows:

a. To provide a platform for local stakeholders to guide the Commission toward water quality protection practices that will likely be embraced and utilized by the local property owners.

b. To function as an initial step in documenting, educating and communicating the importance of water quality to the general public, especially to the landowners and residents living in the watersheds of Elmwood Reservoir and the Headwaters of East Locust Creek.

c. To describe the water quality and quantity conditions in the existing watershed.

d. To serve as a foundation for future source water protection efforts that will be incorporated into a comprehensive Water Quality Assurance Plan.

e. To develop and document local priorities for water quality protection targets and practices so that the community can obtain funding for implementation to improve water quality in East Locust Creek, Elmwood Lake, and the future ELCR.

f. To assist with contingency planning to address water quality and water quantity emergencies.

g. To develop a coalition of partners to assist with the Commission source water planning efforts.

h. To fulfill the water quality protection requirements of Section 3.1.2 of the Minimum Design Standards for Community Water Systems (MDNR 2013).

i. To ensure that the East Locust Creek and Elmwood Reservoirs remain in compliance with the proposed nutrient criteria in the State Water Quality Standards. In the event the criteria are exceeded, this document will provide a framework for addressing the issue.

This plan will be dynamic and should evolve over time to best serve the Commission and its customers.

B. PUBLIC WATER SYSTEM SUMMARY OVERVIEW

GENERAL/CONTACT INFORMATION

a. North Central Missouri Regional Water Commission (the Commission)

b. Public Water Supply System (PWSS) #2021537

c. Date of Inception
2001

d. Ownership Code
L = local government

e. Primary Contact
Bradley M. Scott, General Manager
North Central Missouri Regional Water Commission
201 North Market St.
Milan, MO 63556
660-265-4448

f. Public Water System Mailing Address
The Commission, PWS #2021537 (Mailing)
201 North Market St.
Milan, MO 63556

Physical Address
Water Treatment Plant (Physical)
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Milan, Missouri 63556

g. Designated Operator
Christopher (Mike) Ward
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Milan, MO 63556
660-265-3807
Operator Certification Level: A

h. Primary Contact for this plan
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i. Responsible Party Contact Information
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j. General Assistance Contacts

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PUBLIC WATER SYSTEM GENERAL SERVICE CHARACTERISTICS

a. Sullivan and Linn Counties are the principal counties served by the Commission.

b. The principal communities served are Milan, Green City, and Sullivan County PWSD #1. These communities and water district serve the following municipalities, including Green Castle, Humphreys, Newtown, Browning, and Pollock, as well as Smithfield Foods, Inc. (See Appendix B, p. B-4)

c. 7,539 population served

d. 3,115 service connections

e. The average consumption per day is 0.600 million gallons of potable water and another 1.0 million gallons of raw water per day to Smithfield Foods, Inc.

f. 2.8 million gallon per day treatment and supply capacity

g. 1.4 million gallons per day finished water storage

- 360,000 gallons in Clearwell
- 300,000 in Old City Elevated Tank
- 750,000 in Big Tower

h. Type of Source Water

- Groundwater 0%
- Surface Water – 100%
- GWUDISW – 0%
- Purchase groundwater - 0%
- Purchased Surface – 0%
- Purchased GWUDISW – 0%

i. Raw Water Intake Device Inventory

Elmwood Lake Intake – active
Facility ID No. IN 20216

East Reservoir Intake (South Lake) – active
Facility ID No. IN 20217

Locust Creek Intake – active
Facility ID No. IN 30117

East Fork Locust Creek Intake – active
Emergency only

Golf Course Lake (North)– active
Emergency only

j. Legal Ordinances

The Lake Authority **(**RSMo, Sections 67.500 to 67.4520**)** is a Political Subdivision created by statute specifically for the East Locust Creek Reservoir Project (the "Reservoir"). The purpose is to promote the general welfare of the local communities and provide a safe drinking water supply through the construction, operation, and maintenance of the Reservoir. Specifically, the Lake Authority has the power to acquire, own, construct, lease, and maintain recreational or water quality projects. In addition, it has zoning and planning powers exactly like any municipality within the State of Missouri. The jurisdiction of the Lake Authority extends to the watershed of the ELCR. It does not include the watershed of Elmwood Lake. For more information regarding the Lake Authority and accompanying legislation, see Appendix A.

II. SOURCE WATER PROTECTION PLAN ELEMENTS

A. WATER QUALITY AND QUANTITY DESCRIPTION

The United States is divided into watersheds that are identified by a Hydrologic Unit Code (HUC) used by conservation planners to identify drainage areas throughout the country. The code numbers get larger as the watershed gets smaller. The Headwaters of the East Locust Creek HUC12 (#102801030601, Figure 2) is located entirely within the Lower Grand HUC8 watershed (#10280103). The Locust Creek watershed, which includes the main stem of Locust Creek and both the East and West Forks of Locust Creek, has been identified by agencies such as the Missouri Department of Conservation (MDC), MDNR, and Natural Resources Conservation Service (NRCS) as a priority watershed.

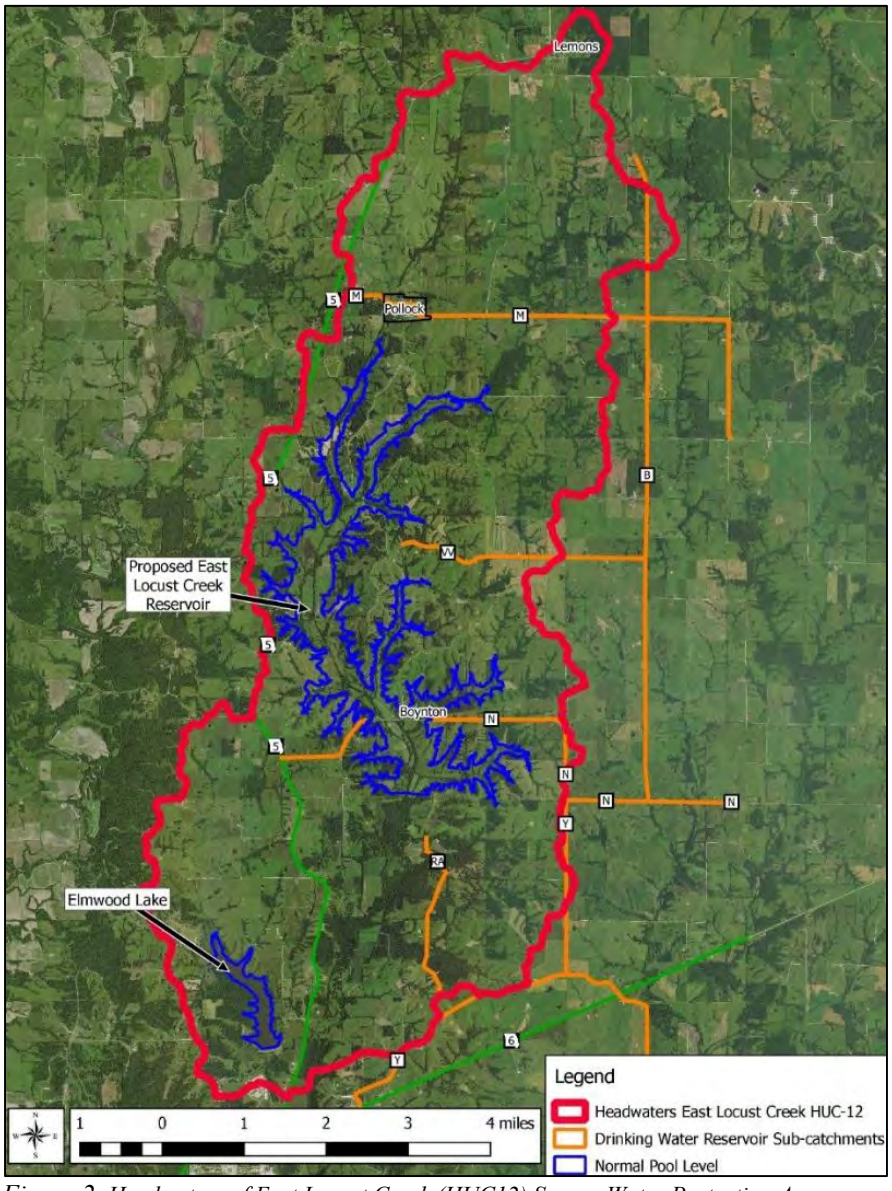

Figure 2. Headwaters of East Locust Creek (HUC12) Source Water Protection Area (Published by Allstate Consultants LLC, 2018)

According to Todd et al. (1994), the Locust Creek basin is located in the Dissected Till Plains physiographic region of Missouri. This mix of hills and plains is composed of glacial deposits on Pennsylvanian sedimentary rock. The till is predominately clay with some rock and gravel and is highly variable in depth but generally less than 200 feet. Top soils of the basin consist of loess and drift 4-8 feet deep with transitional slopes containing both prairie- and forest-derived soils. Historically, prairie grasses were the native vegetation of the region and helped develop deep, organic-rich soils favorable for agricultural row crops in the bottoms, haying, and grazing on the steeper slopes. Predominant soils in the basin are grouped by parent material, slope and soil texture into soil associations (USDA 1982). Soils in the bottoms along Locust Creek and East Locust Creek are typically a Kennebre-Nodaway-Colb-Zook association. Headwater regions and uplands have a variety of soil associations with Weller-Keswick-Lindley-Mandeville and Pershing-Armstrong-Gora being dominant. These soil associations can generally be described as silty-clay loam and highly erodible. They are in part responsible for the turbid nature of streams in the basin.

There is very little groundwater available in Northwest and North Central Missouri. The Northwest Missouri Groundwater Province, which includes Sullivan County, only contains 2.2% of Missouri's groundwater (MDNR 2018). The province has geologic characteristics similar to those in the northeastern part of the state. However, in northwest Missouri there are no high-yield, potable bedrock aquifers available, and the glacial drift in the western portion of the province is typically more water productive than to the east. Water from wells in the glacial till and the underlying consolidated bedrock in Sullivan County is mineralized and of marginal quality for domestic use (NRCS 1995). Surface water from streams and impoundments is less mineralized and of better quality for domestic use. Low flow conditions during the summer make streams unreliable as a sole water supply. Impoundments are the primary source of water for municipal uses (NRCS 1995). The East Fork of Locust Creek is on the impaired waters list for elevated levels of *E. coli* bacteria and low dissolved oxygen levels. Locust Creek in Sullivan and Putnam Counties is also listed for elevated *E. coli* levels.

WATER SYSTEM DETAILS

The North Central Missouri Regional Water Commission (The Commission) was established in 2001 as part of MDNR's effort to encourage consolidation of water supply resources across north central Missouri in anticipation of the continuing trend for small water supply systems to close due to the high cost of more protective water supply standards. The Commission serves Sullivan and Linn counties, which have limited groundwater resources. It is forced to rely entirely on surface water supplies that are presently inadequate during drought conditions. In addition to providing wholesale water to three communities and one water district in Sullivan County, the Commission was also charged with developing a plan to provide a consistent water resource for the 10-county area, including Sullivan, Schuyler, Putnam, Mercer, Grundy, Adair, Macon, Linn, Livingston and Chariton Counties. A plan was developed to construct a large surface water reservoir in Sullivan County that would consistently supply the county and surrounding region with high-quality water. The future ELCR will be located approximately five miles north of the town of Milan, the county seat of Sullivan County. The Commission's facilities all lie within Sullivan County, Missouri (Figure 1).

Currently, the Commission provides wholesale drinking water to three buyers, Milan, Green City, and Sullivan County PWSD #1. These buyers provide water to seven communities. The Commission also provides raw water to the Smithfield Farmland Corporation, a major employer in Milan, MO. It serves a population of approximately 7,539 residents and has approximately 3,115 service connections (HDR 2016). The Commission has water rights to Elmwood Lake, approximately 222 acres, and the Old East Reservoir (South Lake), approximately 38 acres. The Old East Reservoir is also known as Golf Course Lake and Lake 41. Elmwood Lake drains 6.4 square miles, and the Old East Reservoir drains approximately one square mile (MDNR 2000).

The Commission currently has three raw water sources that are routinely used and one emergency raw water intake. When Elmwood Lake levels get low, water is pumped from Locust Creek to Elmwood Lake. Under emergency situations, the Commission purchases a limited supply of finished water from Trenton, MO, approximately 25 miles west of Milan. For more details regarding the Commission's system, see Appendix B. During severe drought conditions, water is pumped from the East Fork Locust Creek and the North Golf Course Lake into the Old East Reservoir. The water treatment facility has the capacity to produce up to 2.4 million gallons of potable water per day (Jones et al. 2016). It currently produces approximately 600,000 gallons of potable water per day and another one million gallons of raw water per day to the Smithfield Farmland Corporation (Jones et al. 2016). Other infrastructure includes nine miles of 10-inch line serving Green City and Green Castle, and 18 miles of 8-inch line serving western Sullivan County. Upon completion, ELCR (approximately 2,352 acres) will allow the Commission to serve a 10-county area. Both Elmwood Lake and the site of the future ELCR lie north of the town of Milan in Sullivan County, Missouri (Figure 1). The proposed reservoir and water treatment plant will have a maximum capacity of 6.5 million gallons per day (Jones et al. 2016).

The Commission uses a conventional surface water two-stage coagulation, sedimentation, filtration, and disinfection process. Currently, the source water supplies available to the Commission are inadequate to meet potential demands, especially during a drought. The proposed East Locust Creek Reservoir is in the planning, cleanup and preparation phase, having completed all required land acquisition. It should not only provide adequate water supplies but economic development opportunities associated with recreation. This plan will include the drainage areas of Elmwood Lake and the future ELCR.

The MDNR Source Water Assessment Report (Appendix C) includes threats to these raw water supplies including the Locust Creek intake. Threats in the upper Locust Creek watershed will not be addressed by this plan. Detailed volume information on Elmwood Lake and Old East Reservoir is located in Appendix

D. The water treatment plant staff are currently producing high-quality water. Contaminant levels are well below the thresholds for concern (MDNR 2017).

In 2011, the state legislature approved special "Lake Authority" legislation (RSMo, Sections 67.500 to 67.4520) which gives the Commission authority to institute land use restrictions in the watershed of ELCR as needed to protect water quality (Appendix A). This was a way to minimize land purchases for a lake buffer by the Commission while having the ability to protect this valuable community asset. It is the hope of the Commission that very few Lake Authority regulations will be necessary. This plan focuses on a collaborative and voluntary approach to source water protection and does not assume that any land use restrictions will be implemented unless specific threats to water quality are identified and collaborative efforts to resolve them are exhausted.

B. SOURCE WATER PROTECTION AREA DELINEATIONS

The protection area includes the entire Headwaters of East Locust Creek HUC12 (Figure 2). This watershed is approximately 31,585 acres and includes a small amount of land below the dam of the proposed ELCR. The Steering Committee decided to include the entire hydrologic unit to remain consistent with the MDNR Source Water Protection Plan Grant, awarded to the Commission on November 9, 2016, rather than seek an amendment. The watersheds of Elmwood Lake and ELCR will be the priority for management recommendations. Elmwood Lake is approximately 222 surface acres and drains 6.4 square miles (Edwards et al. 2010), which results in a watershed ratio of 19:1 (Figure 2). The lake has approximately five miles of shoreline. The ELCR will be approximately 2,328 acres of surface area that drains approximately 36.6 square miles, resulting in a watershed ratio of approximately 9:1 (Figure 2). The reservoir will have approximately 82 miles of shoreline.

The Commission has an intake on Locust Creek (Appendix B). The MDNR Source Water Assessment Report (Appendix C) includes threats to the Locust Creek intake. Since this plan will focus on the Headwaters of East Locust Creek HUC12, potential contaminant sources above the Locust Creek intake are not addressed.

DETAILED CHARACTERISTICS

The watershed is characterized by steep upland topography. Sloping soils in these areas are subject to severe erosion (NRCS 1995). For detailed geologic description, see Section A. Water Quality and Quantity Description above. Pasture and hay are the predominant land uses, followed by deciduous forest (Figure 3). Land use in the ELCR watershed (Table 1) is representative of the entire source water protection area. The predominant land uses are pasture/hay (52.5%) and deciduous forest (24.8%). Only 2% of the watershed is cropland. The towns of Pollock, Boynton, and Lemons lie within the watershed of ELCR. The town of Boynton will be inundated by the reservoir. Demolition and cleanup efforts are nearly complete.

Area (Ac)	Percent (100%)*	Land Use
2,483	11.8%	Open Water
735	3.5%	Developed, Open Space
95	0.5%	Developed, Low Intensity
4	0.02%	Barren Land (Rock/Sand/Clay)
5,255	24.8%	Deciduous Forest
8	0.04%	Evergreen Forest
197	0.93%	Mixed Forest
341	1.62%	Shrub/Scrub
473	2.24%	Grassland/Herbaceous
11,068	52.5%	Pasture/Hay
426	2.02%	Cultivated Crops
8	0.04%	Woody Wetlands
3	0.01%	Emergent Herbaceous Wetlands

Table 1. East Locust Creek Reservoir Watershed Land Use
**Land use percentages add up to more than 100% due to rounding.*

The following wastewater treatment facilities operate within the Headwaters of East Locust Creek HUC12. None of these facilities discharge in the watersheds of Elmwood Lake or the ELCR.

- City of Milan Wastewater Treatment Facility
  Permit No. MO-0048151

- Auburn Hills Commonwealth Association Wastewater Treatment Facility
  Permit No. MO-0119318
  **The Auburn Hills WWTF will be closed and tied into the Milan WTF by December 1, 2018.*

- Farmland Foods, Inc. (Now Smithfield Foods, Inc.)
  Permit No. MO-0115487

C. CONTAMINANT INVENTORIES & VULNERABILITY ASSESSMENTS

The quality of the water in reservoirs and streams is impacted by management decisions on land above the water source (the watershed). A survey of reservoirs throughout the United States found non-point source pollution, excessive nutrients, and sedimentation to be the top threats to reservoirs in the Midwestern United States (Miranda 2017). The MDNR provides preliminary online Source Water Assessment Reports for drinking water supplies.

The contaminant data for these reports was compiled in 2003 and has not been regularly updated. The Source Water Protection Steering Committee also used local knowledge and expert opinion of the affiliate members to identify potential threats to water quality. The MDNR Source Water Assessment Report for the Commission (Appendix C) contained no listings of potential contaminant sources in the watershed of Elmwood Lake or the Old East Reservoir. There were five above-ground fuel storage tanks and one cemetery listed in the watershed of the Locust Creek intake. The report did not include the watershed of the ELCR.

Potential Contaminants

Recognizing that most potential contaminants for these watersheds would be subtle and non-point source, Allstate Consultants LLC, the Commission's engineering firm, and the Steering Committee investigated potential non-point source pollutants in the ELCR watershed (Figure 3). The following threats were identified:

- Nutrient loading: Small amounts of nitrogen and phosphorus can result in nuisance levels of aquatic plants, including algae, which can cause taste and odor issues. In certain instances, they can be toxic. Potential sources of nutrients throughout the watershed include agricultural runoff and inadequate sewer systems associated with farmsteads and the communities of Pollock and Lemons. Due to its size and distance from the reservoir, Lemons does not appear to be a significant threat for contamination. Some residences in Pollock have been identified as a potential threat to water quality in ELCR because the community has no centralized sewer system and a branch of East Locust Creek runs through town approximately one half mile upstream of the reservoir. Many homes in Pollock and the surrounding region simply have a straight pipe to a ditch. The eight unit USDA Multi-Family Housing Development run by the Pollock Housing Corporation has a small lagoon. A desk review of aerial photos indicates there may be a couple additional lagoons, but their condition is unknown. The watershed contains at least two small feedlots.

  As development begins around the ELCR, lawn fertilizer can become a significant source of nitrogen and phosphorus. USGS personnel have conducted extensive water quality sampling throughout the Lower Grand HUC8 watershed. They have found that 97% of the total nitrogen and phosphorus load for streams in the area occurred from February through June (Wilkison and Armstong 2015). This coincided with the time of year when the majority of stream flow occurs (Krempa and Flickinger 2017). "This likely indicates that increased nitrogen and phosphorus loads are more strongly related to streamflow than to a particular period of the year, indicating runoff, within-bank nutrients that are suspended during higher streamflows, or both are a substantial source of nutrients regardless of timing"(Krempa and Flickinger 2017). Best management practices that focus on streambank stabilization and controlling runoff during late winter and early spring will be important (Wilkison and Armstrong 2015).

The Missouri Department of Natural Resources has proposed new nutrient criteria that will be applicable to both reservoirs. The criteria specifies screening thresholds for nitrogen, phosphorous, and chlorophyll. Under these proposed criteria, the reservoirs will be classified as impaired and placed on the 303(d) list if the geometric mean of samples taken between May and September in a calendar year exceeds the Chlorophyll-a Response Impairment Threshold Value (30 ug/L more than once in three years' time. Alternatively, a reservoir will be listed as impaired if it exceeds a screening threshold value for Chlorophyll-a (18 ug/L), Total Nitrogen (843 ug/L) or Total Phosphorous (49 ug/L) in the same year that certain assessment endpoints are identified.

MDNR will derive the schedule for monitoring based on their understanding of which bodies of water are likely to be impaired; but, for the purposes of this document, it should be assumed that monitoring will occur annually.

- Sedimentation: Excessive sediment can result in the reduction of reservoir storage, increased water treatment costs, and nuisance algae levels due to nutrients associated with soil particles. It can also reduce property values and inhibit fish production. Much of the watershed is in permanent vegetative cover. Initial investigations by HDR, Inc. (2013) suggest that much of the watershed has low to moderate potential for sediment loading (Figure 4). However, some of the steeper areas have a moderate to high potential to contribute sediment to ELCR. The watershed of Elmwood Reservoir has a relatively high percentage of land with the potential to erode sediment at moderate and high rates.

  Gullies and streambank erosion are significant sources of sediment throughout North Missouri; however, this analysis did not examine it. In addition to gullies and streambank erosion, road ditches can be significant sources of sediment in a watershed as well. Conservation groups, such as the Nature Conservancy, are beginning to recognize the impacts of gravel roads on water bodies and are collaborating with local communities to address these issues. (PennState 2018, The Nature Conservancy 2017).

  Shoreline erosion can be a significant source of sediment from within the reservoir basin. This issue is being addressed during the planning and design stages. Careful consideration is being given to minimal timber clearing, recreational boating, strategically placed riprap, and off-shore breakwaters (See Figure 5).

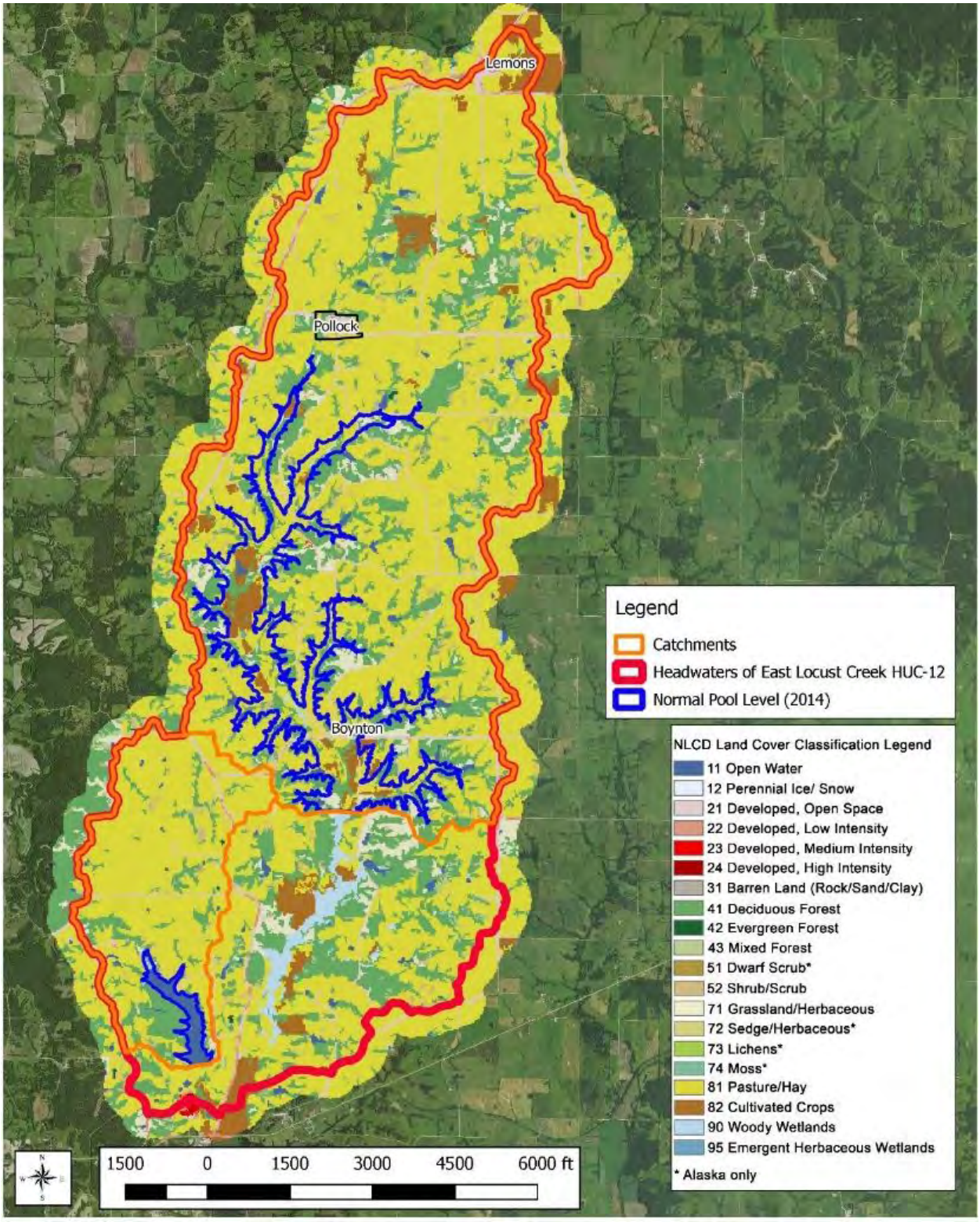

Figure 3. Potential non-point source pollutants in the Headwaters of East Locust Creek HUC 12

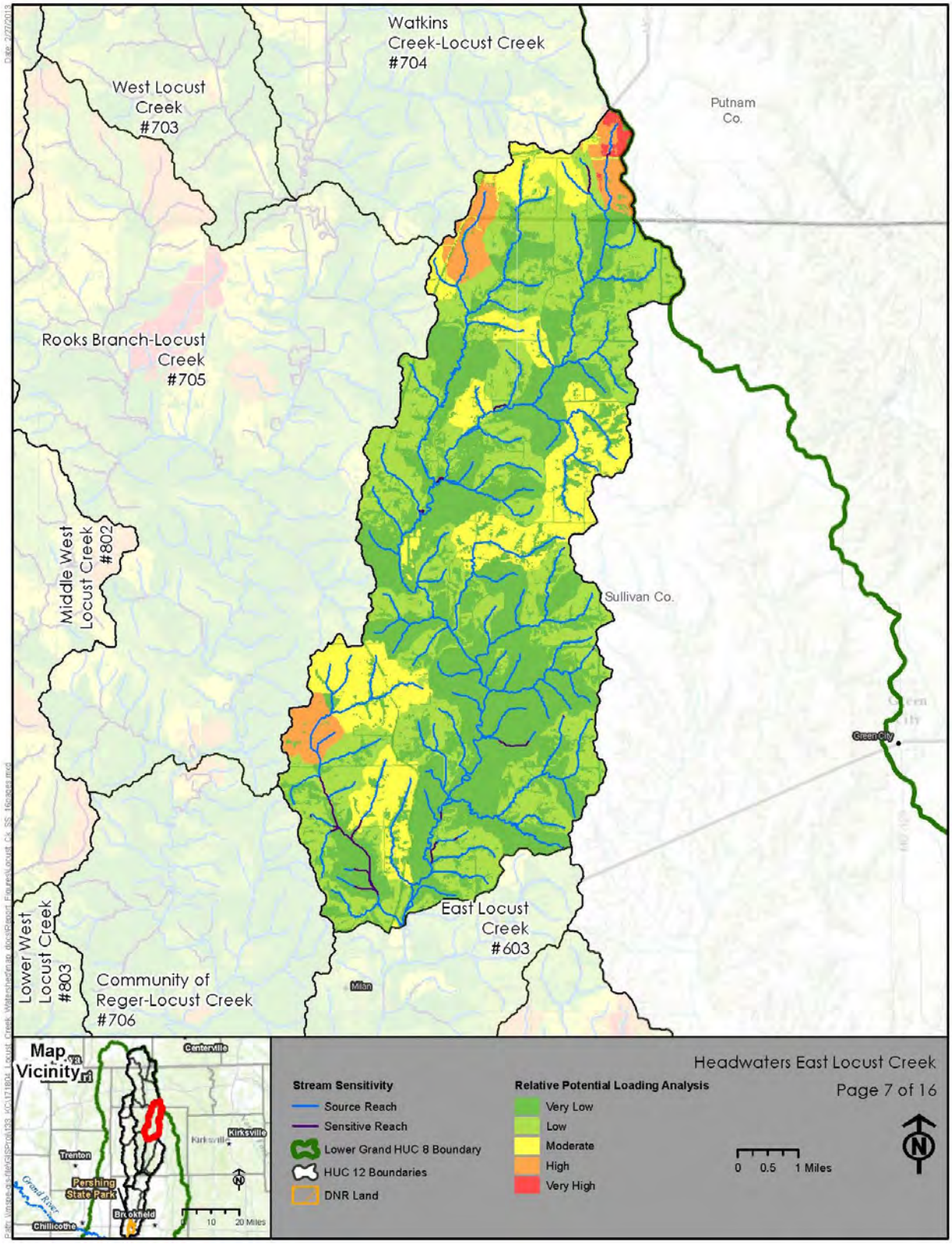

Figure 4. Sediment loading potential for the Headwaters of East Locust Creek HUC12 (HDR, 2013)

- *Escherichia coli (E coli*): High bacteria levels indicate the presence of animal (including human) excrement in a water body. High concentrations can be a health hazard. This can result in lost recreational opportunities and reduced property values. East Locust Creek is listed on the MDNR Impaired Waters List (http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm) for high levels of *E coli*. DNR sampling suggests a cumulative effect from point (waste water treatment facilities) and non-point (agricultural runoff) contributing to elevated *E. coli* levels in East Locust Creek throughout the watershed (MDNR 2007).

- Municipal waste: Household hazardous waste, like asbestos, trash, and hazardous household chemicals, are of particular concern from Boynton, Pollock and Lemons. In addition, there is an abandoned salvage yard in Pollock. An intensive cleanup effort is progressing in the town of Boynton which will be inundated by ELCR.

- Fuel storage tanks: Abandoned storage tanks are common throughout rural Missouri and are a hidden source of petroleum and other contaminants. There are currently over 30,000 underground storage tanks throughout Missouri (Bob Broze, University of Missouri, personal communication). The MDNR Source Water Assessment Report included five above ground storage tanks as potential contaminant sources above the intake located on Locust Creek.

- Cemeteries: Cemeteries have been found to be sources of leachate, arsenic, and lawn and garden maintenance chemicals. One small cemetery is located near the intake along Locust Creek. According to the Steering Committee, there are 5-8 cemeteries within the watershed of ELCR. Cemeteries are probably not a major threat to water quality in the basin; however, the category was identified in the source water contaminant report for the Commission (Appendix C).

- Railroad bed and bridges: The rail bed and associated bridges were tested for hazardous materials, including arsenic. Test results indicated they were not a threat to water quality (TetraTech 2017).

- Dissolved Oxygen: The East Fork of Locust Creek is also on the MDNR impaired waters list for low levels of dissolved oxygen (http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm). It is not anticipated that this will be a significant issue for ELCR.

As reservoir development progresses, the watershed will experience more residential and commercial development. Since this plan focuses on current contaminants, it will need to be revisited to address future source water threats, such as small scale fertilizer and pesticide uses, storm water runoff, and fuel tanks associated with marinas.

VULNERABILITY ASSESSMENT OF RAW WATER SOURCE(S)

Source water protection planning for surface water is more complex than for ground water sources (Bob Broze, University of Missouri, personal communication). Surface water supplies are unique and are often a rural community's most valuable and vulnerable resource. Surface waters are especially vulnerable due to their position on the landscape, few if any buffers from contaminants, and the desire to capitalize on ancillary benefits, such as recreation and economic development. Normally, communities would restrict access to valuable and vulnerable resources. Surface waters, however, draw people to them for recreation and development. The high expectations for surface water bodies make their management and protection especially complicated.

Climate information collected since 1895 indicates that the region is in a 30-year wet cycle and is getting wetter, especially in the winter (Guinan 2018). This is common throughout the Midwest where rainfall events are more extreme, and the landscape is shedding water faster (Tomer and Schilling 2009). Increasing rainfall during the winter months is especially troubling to water managers. The vegetation is dormant, making soils and nutrient sources, such as manure, especially vulnerable to being transported to water supplies. Sediment and nutrients are the two biggest threats to surface waters in this watershed.

This wet cycle has camouflaged a growing problem of increased water use combined with aging water supply infrastructure. Ironically, drought remains a significant threat to rural communities in the region. Local water supplies were unable to meet local needs during the recent droughts of 2000, 2012, and 2018. Climate data gathered from ancient wood from local streams indicates that there have been approximately 13 multi-decadal droughts in the last 1000 years (Stambaugh et al. 2011). Although the recent wet cycle has made some people complacent, history tells us that the region is still vulnerable to extended droughts.

The MDNR Source Water Susceptibility Report for the Commission (Appendix C) indicates that viruses or microbiological contaminants are consistently detected. It lists the Commission's source waters as highly susceptible to these types of contaminants. MDNR reports indicate that *E coli* levels exceed water quality standards for recreational use below Highway N. Initial reservoir cleanup efforts, including the town of Boynton, should help address the bacteria levels. Fortunately, the highest levels are below the future ELCR and outside of the Elmwood Lake watershed (MDNR 2006 and 2007). The Smithfield processing facility was identified as a significant source of nutrients such as nitrogen and phosphorus in the Elmwood Creek watershed (MDNR 2007). This source lies below the dam of Elmwood Lake and should not be a cause for concern.

Preconstruction water quality monitoring has begun in the ELCR watershed. The information will be used to model potential contaminant issues. For more information regarding procedures for improving the vulnerability assessment, please see the Protection Area Management Plan below.

III. PROTECTION AREA MANAGEMENT PLAN

This management plan will focus on outreach and education efforts combined with advocating for adequate funding for cost share to implement Best Management Practices (BMPs) identified by the Steering Committee and the community. BMPs to protect source water can include land use controls, regulations and permits, structural/engineered measures, emergency response planning, and public education (MDNR 2014). The BMPs below will be the foundation for source water planning and protection efforts in the near future. Source water protection efforts will be a "work in progress" as ELCR is constructed and land use changes in response to its development. Allstate Consultants will be working with the Commission to accomplish the milestones listed below. The Sullivan County Soil and Water Conservation District (SWCD) has committed to making the watershed of ELCR a priority area for their efforts, see Appendix E. Pre- and post-construction water quality monitoring will be used to evaluate the effectiveness of our source water protection efforts.

The Sullivan County SWCD and NRCS staffs are considered credible by local producers and community leaders. The Commission will work with NRCS to engage stakeholders and deploy relevant efforts to protect water quality.

PRIOR TO ELCR CONSTRUCTION

Goal: Work proactively with the producers and the community to address water quality threats in the Headwaters of East Locust Creek HUC12. Action items include the following:

- Inventory stream channels above elevation 922.3' to identify areas of excessive erosion that could contribute sediment or nutrients to ELCR.
- Work with producers, the Sullivan County SWCD, NRCS, Sullivan County Cattlemen's Association, Sullivan County Farm Bureau and others to identify BMPs that address February through June runoff events.
- Work with NRCS personnel to identify locations for dry structures and forebays to intercept sediment prior to its entering the ELCR.
- Clean up domestic waste throughout the Commission's property and the ELCR watershed.
- Model nutrient and sediment loading in the ELCR watershed to help with source water protection decision making.
- Inform the community of potential contamination from fuel storage tanks and work with local leaders to locate and properly dispose of abandoned tanks.
- Work with local agricultural producers to develop comprehensive nutrient management plans for pastures throughout the watershed.
- Move forward with the Pollock Sewer Line project and establish a sewer district.
- Partner with community leaders and the MDNR to ensure that residents of the watershed have adequate working septic systems or become tied in to the Pollock sewer system.

- Collaborate with the Sullivan County SWCD and NRCS staff to ensure funding opportunities for cost-share practices, such as fencing, establishing managed grazing systems, and buffer strips.

- Advocate with the Sullivan County Soil and Water Conservation District (SWCD) and NRCS staff to ensure funding is available for cost share practices, such as permanent vegetation establishment, sediment retention structures, dry structures, grade stabilization structures, and buffer strips.

- Inventory the network of roads and ditches to identify potential erosion and seek opportunities to better manage roadside ditches.

DURING ELCR CONSTRUCTION

Goal: Manage existing trees and install in-basin structures to minimize shoreline erosion. Action items include the following:

- Maintain a buffer of standing trees around most of the shoreline to reduce wave energy and associated shoreline erosion.

- Construct off-shore breakwaters and shoreline rip-rap in strategic locations to reduce wave energy and associated shoreline erosion. (See Figure 5.)

AFTER ELCR CONSTRUCTION

Goal: Initiate organizational structures and educational campaigns that protect the water quality and maximize benefits for the next 100 years. Action items include the following:

- Implement the Lake Authority to provide oversight for protecting water quality, see Appendix A.

- Educate homeowners about the importance of proper fertilization rates for lawns and the implications of excessive nutrient runoff for water quality.

- Inform stakeholders, such as homeowners, farmers, Missouri Department of Transportation, and other pesticide applicators, about the importance of proper pesticide application and the potential for runoff into the water supply.

- Create an extensive education campaign for community members to address concerns related to household hazardous waste. Specifically, the program will target the proper disposal substances, such as unused pharmaceuticals, pesticides, insecticides, and other potential contaminants that may be used for landscaping or lawn care. In addition, programming will include information regarding illegal discharging or dumping of automotive fluids and electronic devices or other equipment (refrigerators, washers, dryers, etc.).

- Pursue additional funding for community cleanup days in Pollock and Lemons.

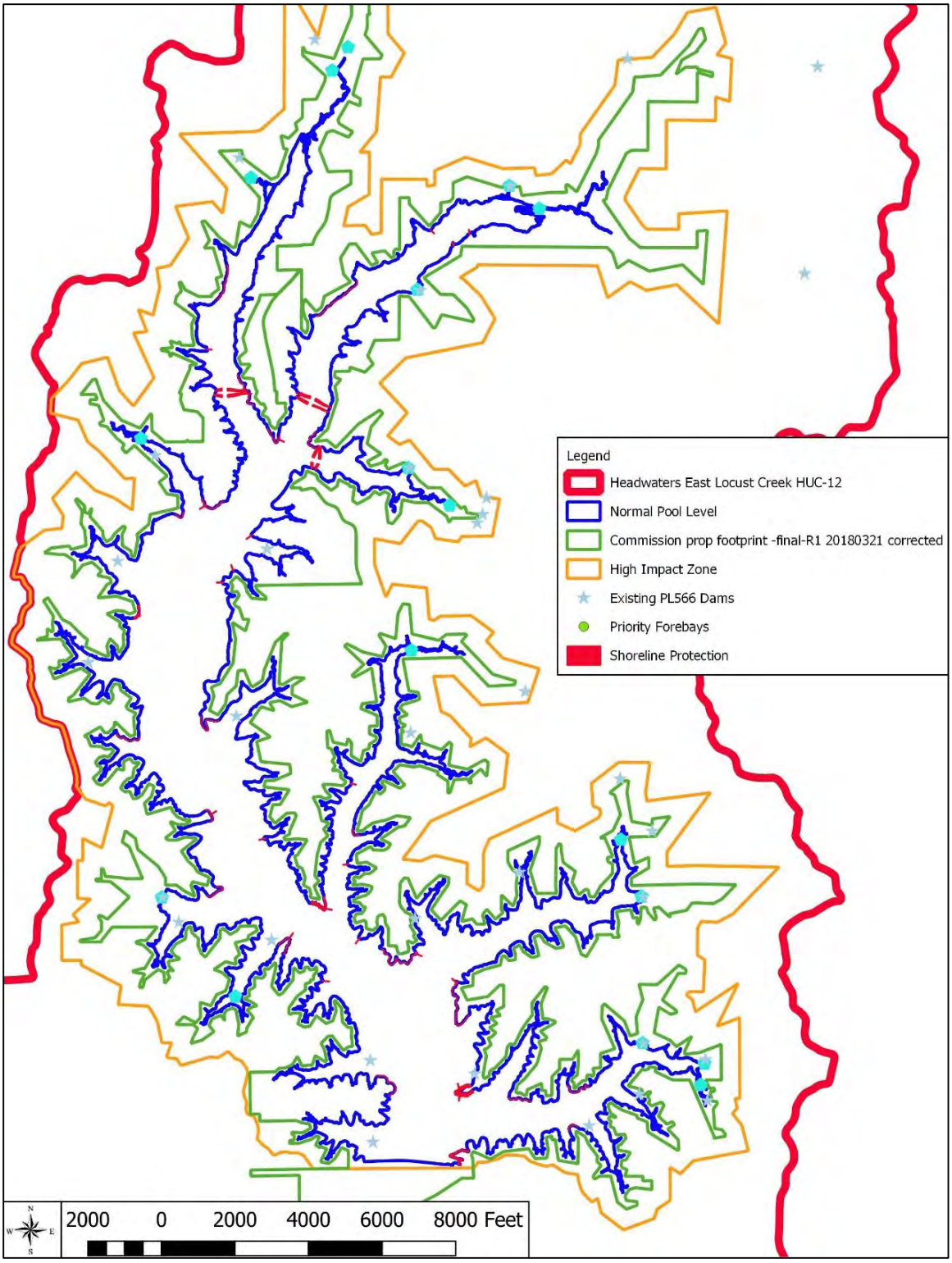

Figure 5. Preliminary Shoreline Protection & Lake Authority Emphasis Areas

The ELCR Project Team is currently working with agencies around the Midwest with experience in reservoir construction and proactive shoreline protection. Practices such as shoreline armoring, strategically placed jetties, and breakwaters will be part of the design. Figure 5 highlights potential locations for special shoreline protection efforts.

CONTINGENCY PLAN FOR WATER EMERGENCIES

Currently, the Commission has a basic emergency operations plan (Appendix F). The Steering Committee was concerned that changing this plan would encroach on the authority of the Commission. The committee suggests the following changes be considered:

- Consider developing a formal Water Shortage Response Plan that includes water use classifications and triggers for discontinuing those water uses during severe drought conditions. Drought is a significant threat to this water system. Planning prior to a drought will help minimize the number of decisions that need to be made under stressful and emotional conditions.
- Work with local emergency management staff to develop an Emergency Response Plan to be in compliance with the Federal Bioterrorism Act. This act requires all community public water systems that serve over 3,300 people develop an emergency response plan. Currently, the Commission is not in compliance with this requirement but will be developed as part of the Reservoir permitting process. For more information see http://dnr.mo.gov/env/wpp/dwsecurity/index.html .

MILESTONES & TARGET DATES FOR 2017-2019

- Met with the Commission to present them the Source Water Protection Plan for their approval at their September 2018 meeting. COMPLETE
- Update all contact information in the current emergency operations plan. COMPLETE
- Upload the Source Water Protection Plan to the Commission's website by July 1, 2017. COMPLETE
- Collaborate with the University of Missouri Extension personnel to update Sullivan County residents on ELCR progress and introduce the importance of Source Water Protection at the Sullivan County Fair, July 5-9, 2017. COMPLETE
- Organize cleanup days in Pollock and Lemons in September 2017. Work with University of Missouri Extension personnel to provide educational materials regarding the importance of proper disposal of household hazardous waste at both events. COMPLETE
- Organize cleanup day for Pollock in November 2018.
- Complete the demolition and cleanup of Boynton by October 2019. Only 2 buildings left.
- Complete a windshield tour of the East Locust Creek HUC12 to look for evidence of channel incision at road crossings and road ditches in February 2019.
- Update NRCS personnel on the details of the final plan and seek opportunities to collaborate by December 31, 2018.
- Meet with the Sullivan County SWCD at their November meeting to discuss the Source Water Protection Plan and ask them to consider these efforts for their 2019 needs assessment.
- Continue ongoing efforts to fund tying Pollock into the Milan Waste Water Treatment Facility and establishing a sewer district.
- Complete testing of the railroad bed and bridges by October 1, 2017. COMPLETE
- Work with the Commission to ensure compliance with contingency planning requirements, including the Federal Bioterrorism Act by January 1, 2020.
- Complete nutrient and sediment modelling to estimate potential load reductions for the East Locust Creek HUC12 by October 1, 2019.
- Compile all comments related to the water quality into a Water Quality Assurance Plan for ELCR by January 1, 2020.

WATERSHED MODELING

The Quality Assurance Project Plan (QAPP) for The Headwaters of East Locust Creek HUC12 is to serve as a supplemental resource to the Source Water Protection Plan (SWPP) developed for the North Central Missouri Regional Water Commission (NCMRWC). The QAPP will create a water quality modeling environment to analyze the current and proposed water supplies. Details regarding the QAPP are located in Appendix G.

Given the critical nature of the current water supply and the large investment required to construct ELCR, it is crucial that the project team be proactive in protecting the integrity of these sources. Accordingly, a SWPP was written and the QAPP is being developed as a first step towards developing a water quality modeling environment that can be used to provide information for implementation of the SWPP.

IV. SUMMARY & CONCLUSIONS

The Commission is currently providing high-quality drinking water to its customers. However, it is simply not able to produce enough water because of supply, especially during drought conditions. Drought is the significant threat to the water supply in Sullivan County and the surrounding region. The Commission is working hard with State, Federal, and local stakeholders to construct the East Locust Creek Reservoir to address their deficiency. This effort has been underway for decades. To protect this long-term effort, the Commission has worked with community leaders to think deeply about protecting water quality for future generations.

The Lake Authority legislation is an innovative approach that protects water quality in the future ELCR, while maximizing the amount of land in private ownership. The Commission will work closely with the community to find solutions that are locally appropriate and minimize the need for regulations.

The Commission's Emergency Operations Plan is currently adequate; however, during the permitting process for ELCR, an Emergency Response Plan will be developed as part of the comprehensive water quality assurance efforts.

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APPENDICES

Appendix A. Lake Authority Background & Legislation

EAST LOCUST CREEK WATER PROTECTION & SEWER DISTRICT

The primary mission of the North Central Missouri Regional Water Commission (the Commission) is to provide high-quality water to its customers, both treated and raw. The Commission has the added mission to construct the East Locust Creek Reservoir (ELCR). The latter mission requires that the Commission devise and deploy certain mechanisms that will ensure that point and nonpoint source contaminants are addressed. In order to secure a drinking water permit from the Missouri Department of Natural Resources (MDNR), it will be necessary to deploy both structural Best Management Practices and governance oversight to ensure and sustain practices that will provide the assurance of clean water flowing into ELCR. As a part of the ELCR plan and, ultimately, in pursuit of a drinking water permit from the MDNR, a Source Water Protection Plan (SWPP) will be developed and adopted. The SWPP will be a guidance document for the reduction of contaminants.

While the Commission can deploy structural Best Management Practices (BMPs) including forebays, forest and forage management, shoreline protection, wave reduction, and buffer strips, it will require the Lake Authority/future Sewer District to provide the governance and oversight necessary to protect water quality. See map on page A-3 for boundaries of the Lake Authority and sewer district.

LAKE AUTHORITY

The Commission advocated for the Lake Authority legislation that was signed into law on August 28, 2011. This legislation enabled the Commission to reduce the footprint of its property from 5,800 acres to approximately 4,550 acres by removing the need for a 300-foot buffer. In essence, in exchange for buffer acreage, the Lake Authority can exercise control over development and potential contaminating activities in the East Locust Creek Watershed from the top of the watershed to the dam. This area is a subset of the overall Headwaters of East Locust Creek (HELC) Watershed. The Lake Authority will also have oversight over the operations of the ELCR, some of which could negatively impact water quality, including recreational boating, development, docks, marina operations, and wave reduction measures.

The Commission determined their acquisition requirements, generally, based upon two criteria: 1) top of dam elevation required by the Natural Resources Conservation Service and 2) 100 feet from principal pool as recommended by MDNR. The property line was drawn to the distance from principal pool of the greater of the two criteria. In most instances, the property line exceeds 100 feet from principal pool. This is property the Lake Authority will have direct control over as it is Commission-owned property.

The Lake Authority members will be appointed by the Commission and will generally have oversight over the operations of the ELCR, but its primary mission is maintaining high-quality raw water.

HIGH IMPACT ZONE

Within the Lake Authority Area, there is a section designated as the High Impact Zone. This is a subset of the Lake Authority Area and is of particular and critical interest for the control of any activities that could contaminate or degrade the water quality of the ELCR. It is generally defined as being a line of demarcation setback 500 feet from the East Locust Creek property line, with certain exceptions, that include large tracts owned by the Commission. This area is generally owned by private individuals and will be the area prone to development. It is imperative the Lake Authority have oversight of development and activities in the High Impact Zone.

BEYOND THE HIGH IMPACT ZONE WITHIN THE LAKE AUTHORITY AREA

The remainder of the area is also of particular interest and activities will be monitored and evaluated. The Lake Authority will collaborate with communities and partners to ensure potential water quality concerns are addressed.

POLLOCK SEWER LINE – Lake Authority

Near the Headwaters of ELCR is the Village of Pollock. Pollock does not have a centralized sewer system or adequate standards and threatens the ELCR water quality. The conceptual plan will provide sewer service to Pollock residents and then provide service to residents and future residents within or adjacent to the Lake Authority Area. The sewage will be transported to and then treated by the City of Milan. The Lake Authority will strongly encourage hook-ups from Pollock south to the dam.

POLLOCK SEWER LINE – Sewer District

Beyond the dam, it will be necessary to create and maintain a sewer district to maintain water quality beyond the watershed of ELCR.

EAST LOCUST CREEK WATERSHED PROTECTION & SEWER DISTRICT

It is necessary to create the East Locust Creek Watershed Protection and Sewer District (the District). Within the environs of the ELCR, authority will be wielded by the Lake Authority and the District. Below the dam, only The District will have authority. It will be imperative that The District and the Lake Authority cooperate and collaborate with free-flowing communications and, advisedly, shared administration.

East Locust Creek Watershed Protection & Sewer District
"The District"

Initial District Members:
North Central Missouri Regional Water Commission (NCMRWC)
East Locust Creek Reservoir Authority (ELCRA)
City of Milan
Village of Pollock
Sullivan County Commission

PROJECT – East Locust Creek Reservoir (ELCR)

District Member 1	District Member 2	District Member 3	District Member 4	District Member 5
NCMRWC Statute ( )	ELCR Authority (ELCRA) Statute ( )	City of Milan 4th Class City ( )	Village of Pollock	Sullivan County Commission
Final ELCR Jurisdiction	Develop and Enforce PWS Protection Rules and Regulations for ELCR Watershed / Lakeshore and all Development	Provide Contract WW Treatment Services to District	Adopt all ELCRA Ordinances and Comply with all Enforcement	Adopt all ELCRA Ordinances
Water Sales / Treatment Distribution / Oversight of all WTP / ELCR Operations	Develop Subdivision Zoning Regulations in ELCR Watershed	Provide WW Collection / Operations & Maintenance Services to District	(USDA, CDBG, EDA Applicant)	Subordinate all Enforcement
Water Supply / Quality Protection / Administration	Develop Habitat and Lakeshore Preservation / Replacement Regulations	Provide Billing, Monetary and Administration Services to District		
Permit Clearance & Issuance of all Final Permits	Develop BMP's and Water Protection Regulations	Provide Planning, Zoning, Subdivision Regulations, & Building Inspection Services to District to include Plat Review, Planning, and Building Permitting, Buffer Management	Subordinate all Enforcement	Adopt all Sewer District Regulations
Water Treatment Owner Operation	Develop Dock Permitting / Inspection Regulations			
Marketing for Water Sales	Develop Recreation Controls for Water Supply Protection Regulations			
	Mitigation Compliance Reporting / Habitat Operations	Support ELCWPSD as Continuing Authority	Support ELCWPSD as Continuing Authority	Support ELCWPSD as Continuing Authority

Drinking Water Supply Protection
and
MDNR Public Water Supply Permit Compliance

N

SCALE: 1" = 2500'
0 1250 2500 5000

	ELCDWR DRINKING RESERVOIR WATERSHED
	FORCE MAIN ALIGNMENT
	ALTERNATE FORCE MAIN ALIGNMENT
	LOWER EAST LOCUST CREEK WATERSHED

LEMONS
COUNTY LINE
COUNTY LINE
HIGHWAY 5
ROUTE B
VILLAGE OF POLLOCK
ROUTE M
KENTUCKY RD.
ROUTE VV
ROUTE N
ROUTE N
ROUTE B
ROUTE N
ROUTE Y
HIGHWAY 6
ROUTE Y
HIGHWAY RA
ROUTE OO
HIGHWAY 5
HIGHWAY 6
CITY OF MILAN
FM
FM
AUBURN HILLS
CITY OF MILAN WWTP FACILITIES

CONCEPTUAL SEWER DISTRICT SCHEMATIC

SULLIVAN COUNTY, MISSOURI

DATE
04-11-2018

JOB NUMBER
10144.01

SCALE
1"=2,500'

ALLSTATE CONSULTANTS
3312 LEMONE INDUSTRIAL BLVD.
COLUMBIA, MO 65201
(573) 875-8799
allstateconsultants.net

I:\2010\10144.01 East Locust\dwg\Utilities\10144_Prop Forcemain.dwg, Sewer District Exhibit (1), 9/24/2018 10:21:33 AM

Missouri Revised Statutes

Chapter 67
Political Subdivisions, Miscellaneous Powers
Section *67.4500*

August 28, 2011

Definitions.

67.4500. As used in sections 67.4500 to 67.4520, the following terms shall mean:

(1) "Authority", any county drinking water supply lake authority created by sections 67.4500 to 67.4520;

(2) "Conservation storage level", the target elevation established for a drinking water supply lake at the time of design and construction of such lake;

(3) "Costs", the sum total of all reasonable or necessary expenses incidental to the acquisition, construction, expansion, repair, alteration, and improvement of the project, including without limitation the following: the expense of studies and surveys; the cost of all lands, properties, rights, easements, and franchises acquired; land title and mortgage guaranty policies; architectural and engineering services; legal, organizational marketing, or other special services; provisions for working capital; reserves for principal and interest; and all other necessary and incidental expenses, including interest during construction on bonds issued to finance the project and for a period subsequent to the estimated date of completion of the project;

(4) "Project", recreation and tourist facilities and services, including, but not limited to, lakes, parks, recreation centers, restaurants, hunting and fishing reserves, historic sites and attractions, and any other facilities that the authority may desire to undertake, including the related infrastructure buildings and the usual and convenient facilities appertaining to any undertakings, and any extensions or improvements of any facilities, and the acquisition of any property necessary therefor, all as may be related to the development of a water supply source, recreational and tourist accommodations, and facilities;

(5) "Water commission", a water commission owning a reservoir formed pursuant to sections 393.700 to 393.770;

(6) "Watershed", the area that contributes or may contribute to the surface water of any lake as determined by the authority.

(L. 2011 H.B. 89)

Effective 7-11-11

CROSS REFERENCE:

Nonseverability clause, 640.099

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Missouri Revised Statutes

Chapter 67
Political Subdivisions, Miscellaneous Powers
Section *67.4505*

August 28, 2011

Authority created, powers, purpose--income and property exempt from taxation--immunity from liability.

67.4505. 1. There is hereby created within any county of the third classification with a township form of government and with more than seven thousand two hundred but fewer than seven thousand three hundred inhabitants a county drinking water supply lake authority, which shall be a body corporate and politic and a political subdivision of this state.

2. The authority may exercise the powers provided to it under section 67.4520 over the reservoir area encompassing any drinking water supply lake of one thousand five hundred acres or more, as measured at its conservation storage level, and within the lake's watershed.

3. It shall be the purpose of each authority to promote the general welfare and a safe drinking water supply through the construction, operation, and maintenance of a drinking water supply lake.

4. The income of the authority and all property at any time owned by the authority shall be exempt from all taxation or any assessments whatsoever to the state or of any political subdivision, municipality, or other governmental agency thereof.

5. No county in which an authority is organized shall be held liable in connection with the construction, operation, or maintenance of any project or program undertaken pursuant to sections 67.4500 to 67.4520, including any actions taken by the authority in connection with such project or program.

(L. 2011 H.B. 89)

Effective 7-11-11

CROSS REFERENCE:

Nonseverability clause, 640.099

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Missouri Revised Statutes

Chapter 67
Political Subdivisions, Miscellaneous Powers
Section *67.4510*

August 28, 2011

Members, appointment.

67.4510. A county drinking water supply lake authority shall consist of at least six but not more than thirty members, appointed as follows:

(1) Members of the water commission shall appoint all members to the authority, one-third of the initial members for a six-year term, one-third for a four-year term, and the remaining one-third for a two-year term, until a successor is appointed; provided that, if there is an odd number of members, the last person appointed shall serve a two-year term. Upon the expiration of each term, a successor shall be appointed for a six-year term;

(2) No person shall be appointed to serve on the authority unless he or she is a registered voter in the state for more than five years, a resident in the county where the water commission is located for more than five years, and over the age of twenty-five years. If any member moves outside such county, the seat shall be deemed vacant and a new member shall be appointed by the county commission to complete the unexpired term.

(L. 2011 H.B. 89)

Effective 7-11-11

CROSS REFERENCE:

Nonseverability clause, 640.099

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Missouri Revised Statutes

Chapter 67
Political Subdivisions, Miscellaneous Powers
Section *67.4515*

August 28, 2011

Initial meeting, when--officers, executive director--surety bond requirements--conflict of interest.

67.4515. 1. The water commission shall by resolution establish a date and time for the initial meeting of the authority.

2. At the initial meeting, and annually thereafter, the authority shall elect one of its members as chairman and one as vice chairman, and appoint a secretary and a treasurer who may be a member of the authority. If not a member of the authority, the secretary or treasurer shall receive compensation that shall be fixed from time to time by action of the authority. The authority may appoint an executive director who shall not be a member of the authority and who shall serve at its pleasure. If an executive director is appointed, he or she shall receive such compensation as shall be fixed from time to time by action of the authority. The authority may designate the secretary to act in lieu of the executive director. The secretary shall keep a record of the proceedings of the authority and shall be the custodian of all books, documents, and papers filed with the authority, the minute books or journal thereof, and its official seal. The secretary may cause copies to be made of all minutes and other records and documents of the authority and may give certificates under the official seal of the authority to the effect that the copies are true and correct copies, and all persons dealing with the authority may rely on such certificates. The authority, by resolution duly adopted, shall fix the powers and duties of its executive director as it may from time to time deem proper and necessary.

3. Each member of the authority shall execute a surety bond in the penal sum of fifty thousand dollars or, in lieu thereof, the chairman of the authority shall execute a blanket bond covering each member and the employees or other officers of the authority, each surety bond to be conditioned upon the faithful performance of the duties of the office or offices covered, to be executed by a surety company authorized to transact business in the state as surety, and to be approved by the attorney general and filed in the office of the secretary of state. The cost of each such bond shall be paid by the authority.

4. No authority member shall participate in any deliberations or decisions concerning issues where the authority member has a direct financial interest in contracts, property, supplies, services, facilities, or equipment purchased, sold, or leased by the authority. Authority members shall additionally be subject to the limitations regarding the conduct of public officials as provided in chapter 105.

(L. 2011 H.B. 89)

Effective 7-11-11

CROSS REFERENCE:

Nonseverability clause, 640.099

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Missouri Revised Statutes

Chapter 67
Political Subdivisions, Miscellaneous Powers
Section *67.4520*

August 28, 2011

Powers of authority--transfer of property to authority, when--zoning and planning powers.

67.4520. 1. The authority may:

(1) Acquire, own, construct, lease, and maintain recreational or water quality projects;

(2) Acquire, own, lease, sell, or otherwise dispose of interests in and to real property and improvements situated thereon and in personal property necessary to fulfill the purposes of the authority;

(3) Contract and be contracted with, and to sue and be sued;

(4) Accept gifts, grants, loans, or contributions from the federal government, the state of Missouri, political subdivisions, municipalities, foundations, other public or private agencies, individuals, partnerships, or corporations;

(5) Employ such managerial, engineering, legal, technical, clerical, accounting, advertising, stenographic, and other assistance as it may deem advisable. The authority may also contract with independent contractors for any of the foregoing assistance;

(6) Disburse funds for its lawful activities and fix salaries and wages of its employees;

(7) Fix rates, fees, and charges for the use of any projects and property owned, leased, operated, or managed by the authority;

(8) Adopt, alter, or repeal its own bylaws, rules, and regulations governing the manner in which its business may be transacted; however, said bylaws, rules, and regulations shall not exceed the powers granted to the authority by sections 67.4500 to 67.4520;

(9) Either jointly with a similar body, or separately, recommend to the proper departments of the government of the United States, or any state or subdivision thereof, or to any other body, the carrying out of any public improvement;

(10) Provide for membership in any official, industrial, commercial, or trade association, or any other organization concerned with such purposes, for receptions of officials or others as may contribute to the advancement of the authority and development therein, and for such other public relations activities as will promote the same, and such activities shall be considered a public purpose;

(11) Cooperate with municipalities and other political subdivisions as provided in chapter 70;

(12) Enter into any agreement with any other state, agency, authority, commission, municipality, person, corporation, or the United States, to effect any of the provisions contained in sections 67.4500 to 67.4520;

(13) Sell and supply water and construct, own, and operate infrastructure projects in areas within its jurisdiction,

including but not limited to roads, bridges, water and sewer systems, and other infrastructure improvements;

(14) Issue revenue bonds in the same manner as provided under section 67.789; and

(15) Adopt tax increment financing within its boundaries in the same manner as provided under section 67.790.

2. The state or any political subdivision or municipal corporation thereof may in its discretion, with or without consideration, transfer or cause to be transferred to the authority or may place in its possession or control, by deed, lease, or other contract or agreement, either for a limited period or in fee, any property wherever situated.

3. The state or any political subdivision may appropriate, allocate, and expend such funds of the state or political subdivision for the benefit of the authority as are reasonable and necessary to carry out the provisions of sections 67.4500 to 67.4520.

4. The authority shall have the authority to exercise all zoning and planning powers that are granted to cities, towns, and villages under chapter 89, except that the authority shall not exercise such powers inside the corporate limits of any city, town, or village which has adopted a city plan under the laws of this state before August 28, 2011.

(L. 2011 H.B. 89)

Effective 7-11-11

CROSS REFERENCE:

Nonseverability clause, 640.099

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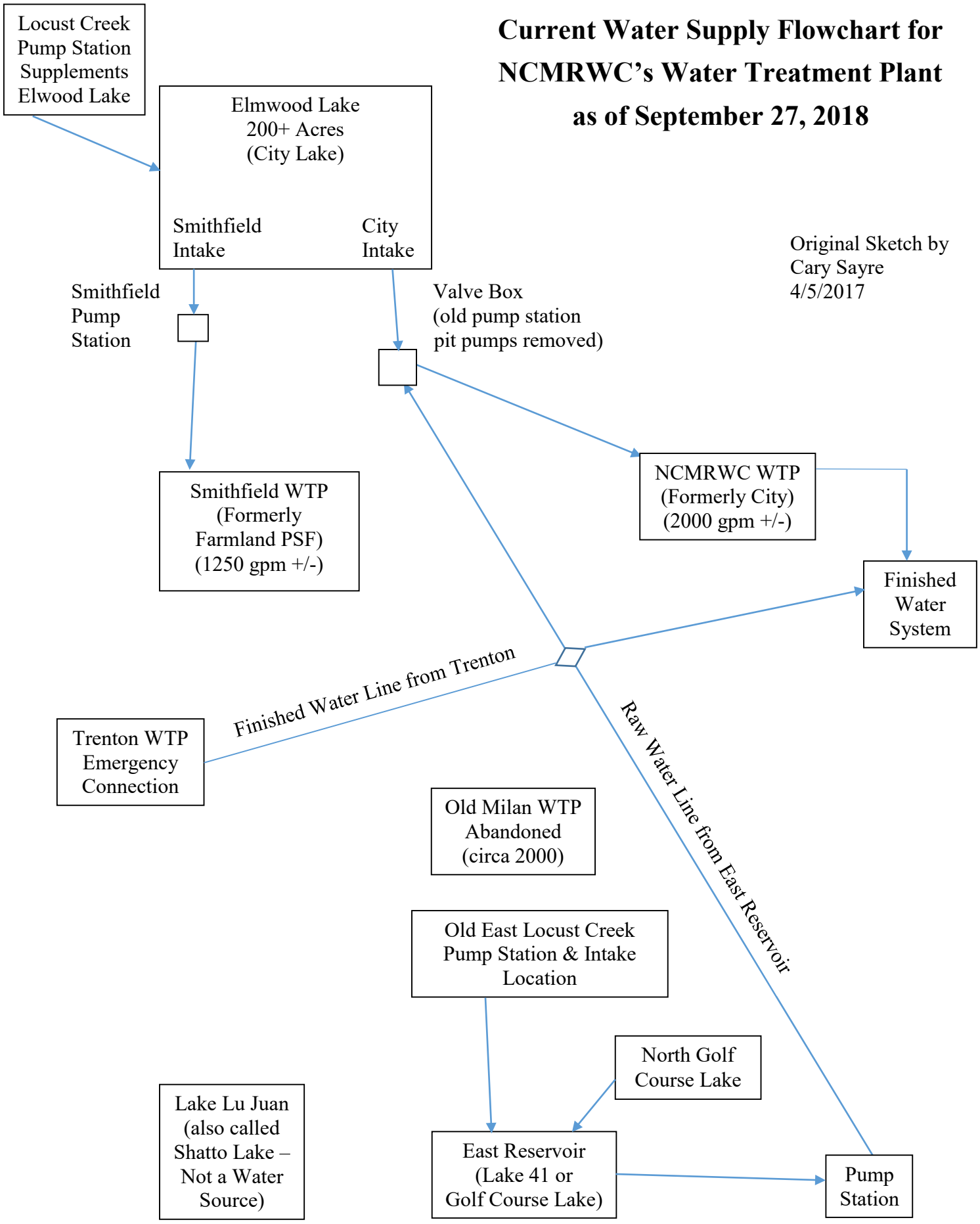
Appendix B. Water System Details

Current Water Supply Flowchart for NCMRWC's Water Treatment Plant as of September 27, 2018



Sullivan County

Sullivan County is located within the north central portion of the Study Area in Missouri (see Figure 1-53). There are seven public water systems within Sullivan County: Sullivan Co. PWSD 1, North Central MO Regional Water Commission (NCMRWC), and the Cities of Green City, Green Castle, Humphreys, Milan, and Newtown. There is one private non-transient non-community (NTNC) water system within Sullivan County operated by Smithfield Farmland Corporation. Of the seven public water systems, only one is a surface water supplier (NCMRWC). The remaining six purchase finished surface water from within Sullivan County either directly from NCMRWC or via a consecutive connection. NCMRWC does have an emergency connection with the City of Trenton in Grundy County.

Figure 1-54 illustrates the supplier and customers in Sullivan County. Table 1-19 presents the general water system information for each system within Sullivan including the total number of connections, total population served, average daily flow, design capacity (or contracted capacity), total emergency capacity, water source, and source capacity. According to the MDNR DWW, the eight public water systems within Sullivan serve a total population of 8,739.

Of the seven public water systems, only one is a surface water supplier (NCMRWC). The remaining six purchase finished surface water from within Sullivan County either directly from NCMRWC or via a consecutive connection. NCMRWC does have an emergency connection with the City of Trenton in Grundy County.

Current Groundwater Suppliers

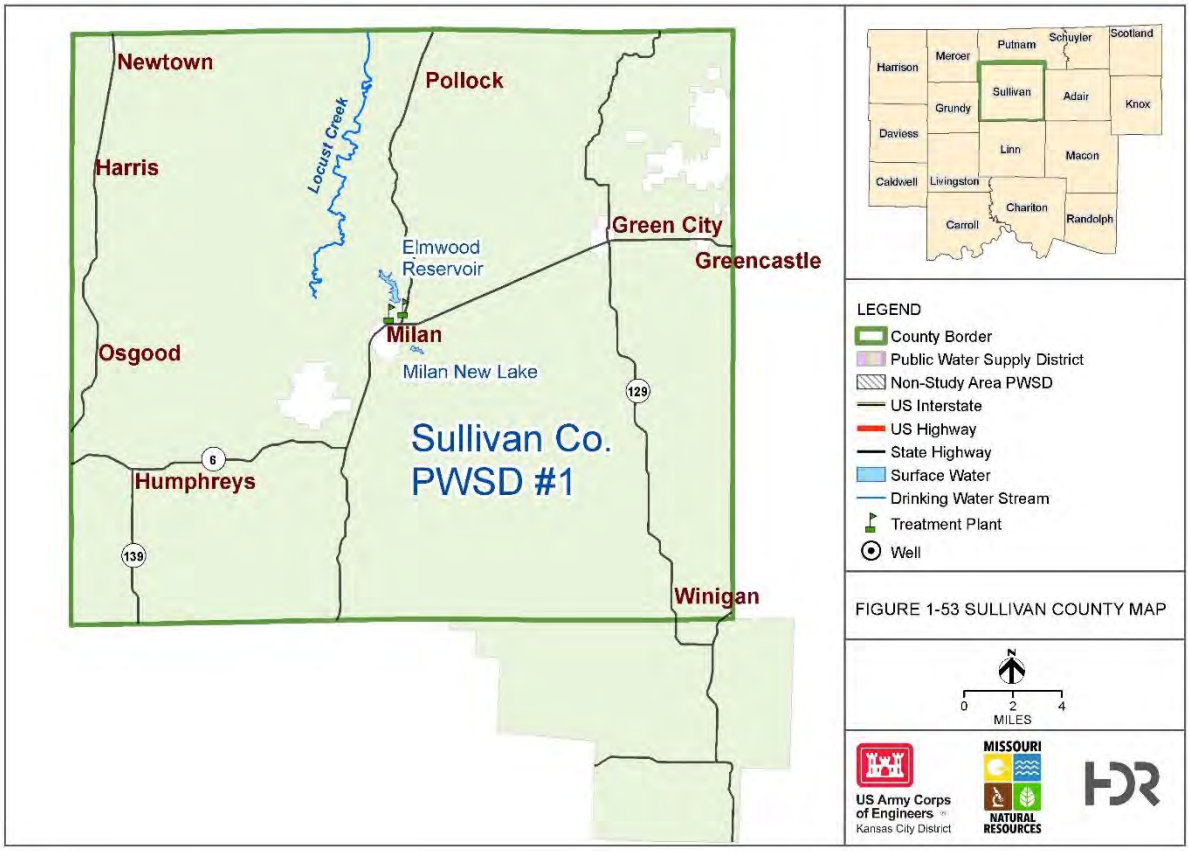
Sullivan County does not have any groundwater sources or systems that purchase groundwater.

Current Surface Water Suppliers

In Sullivan County, the NCMRWC utilizes Elmwood Lake, Golf Course Lake, and Locust Creek for surface water supply. NCMRWC also has an emergency connection with Trenton Municipal Utilities.

The NCMRWC cannot meet current demand without pumping supplemental flow from Locust Creek into the Elmwood Reservoir. Smithfield Farmland Corp also draws from the Elmwood Reservoir to provide water to a poultry-processing plant and water for the Premium Standard Farms meat processing plant. The combined use from NCMRWC and Smithfield result in a total water demand of 1.65 MGD. According to the 2011 WSS, the optimum yield of the Elmwood and Golf Course Lakes is 0.937 MGD. Figure 1-55 depicts the total annual demand versus the optimum yield for the Elmwood and Golf Course Lakes and the optimum yield achieved by pumping Locust Creek. According to the 2015 NCMRWC Water System Source Improvement report, the Elmwood Lake demands stressed Locust Creek and Old City Lake to record low levels in spring 2013.

As part of this 2016 Study, the optimum yield determined in the 2011 WSS has been overlain with the more recent annual demands compiled as part of the Missouri's Major Water Users Database. However, the demands projected were not analyzed using RESOP, it is merely an aide to the reader to better understand the availability of the source.


Newtown
Pollock
Harris
Locust Creek
Elmwood
Reservoir
Green City
Greencastle
Milan
Milan New Lake
Osgood
Sullivan Co.
PWSD #1
Humphreys
Winigan
6
139
129
Putnam
Schuyler
Scotland
Harrison
Mercer
Sullivan
Adair
Knox
Grundy
Daviess
Linn
Macon
Caldwell
Livingston
Chariton
Carroll
Randolph
LEGEND
County Border
Public Water Supply District
Non-Study Area PWSD
US Interstate
US Highway
State Highway
Surface Water
Drinking Water Stream
Treatment Plant
Well
FIGURE 1-53 SULLIVAN COUNTY MAP
N
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4
MILES
US Army Corps
of Engineers
Kansas City District
MISSOURI
NATURAL
RESOURCES

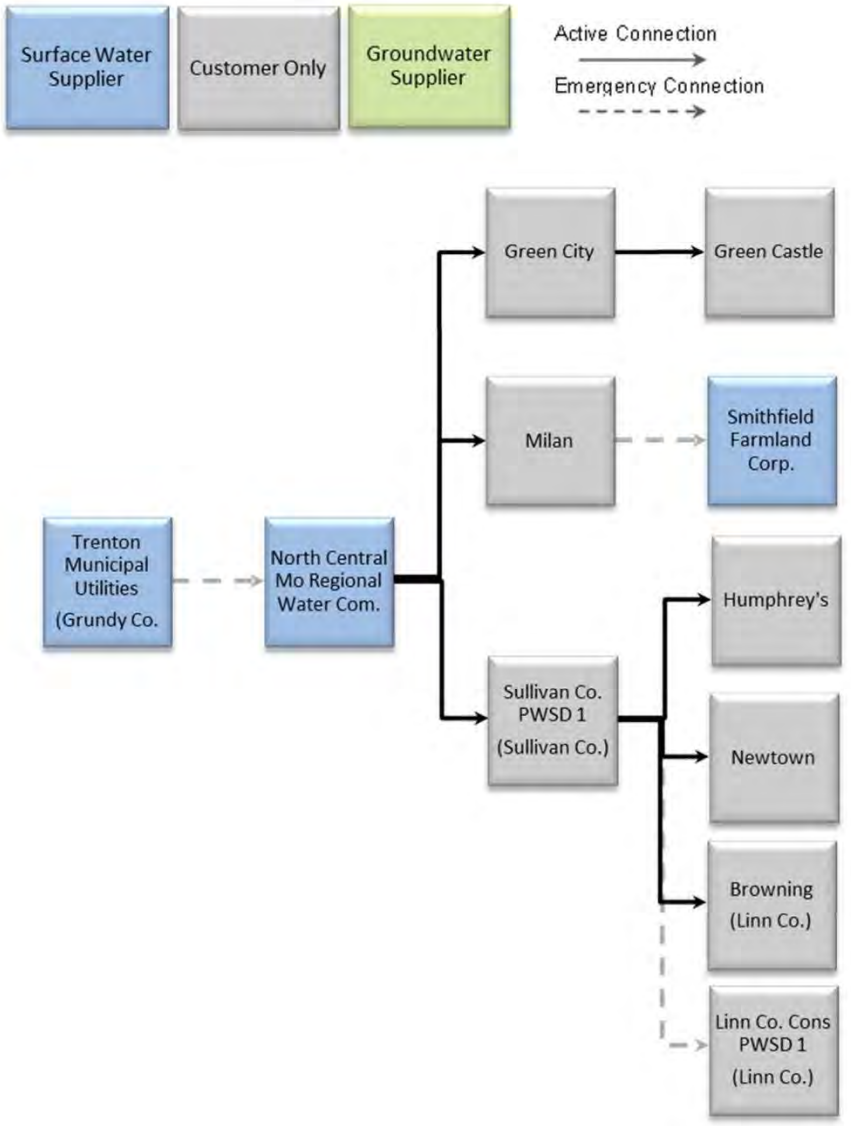


Figure 1-54 Sullivan County Water Suppliers and Customers

Table 1-19 Sullivan County – Water System Information

System/ID #	Connections [1]	Population[1]	ADF (MGD)[1]	Design Capacity/Contract (MGD)[1]	Total Emergency Capacity (MGD)[2]	Source[1],[3],[4]	Source Name [3]	Source Capacity (MGD)[3],[4]
GREEN CASTLE MO2010328	100	275	0.03	NR	0.03	SW Purchase		Purchase
GREEN CITY MO2010329	326	671	0.06	0.43	0.23	SW Purchase		Purchase
HUMPHREYS MO2010389	43	98	0.01	NR	0.01	SW Purchase		Purchase
MILAN MO2010523	809	1,960	0.16	0.20	0.78	SW Purchase		Purchase
NEWTOWN MO2010574	87	183	0.02	NR	0.02	SW Purchase		Purchase
NORTH CENTRAL MO REGIONAL WATER COM MO2021537	3	25	0.65	2.80	1.20	2 Lakes, 1 Creek	Elmwood Lake Golf Course Lake Locust Creek	1.09
SMITHFIELD FARMLAND CORP MO2181076	9	1,200 (NTNC)	0.32	0.40	NR	1 Lake	Elmwood Lake	NR
SULLIVAN CO PWSD 1 MO2024594	1,738	4,327	0.74	0.70	0.09	SW Purchase		Purchase
Totals	**3,115**	**7,539**	**1.99**	**4.53**	**2.35**			

NR = Not Reported NTNC = Non-Transient Non-Community
[1]MDNR Drinking Water Watch
[2]NCMRWC 2015 Preliminary Engineering Report and Feasibility Analyses for Water System Source Improvements
[3]MDNR 2011 RESOP Analysis
[4]MDNR 2007 Groundwater System Evaluation

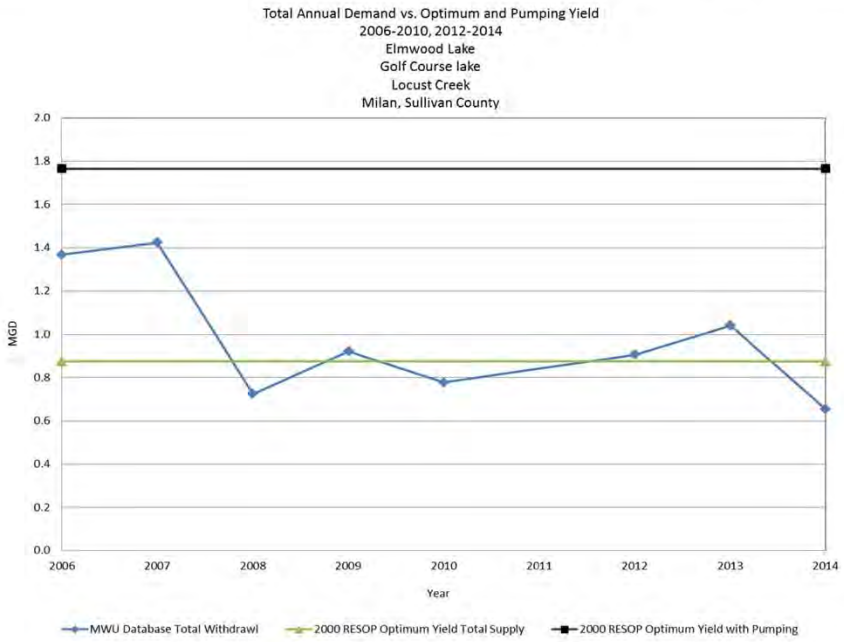
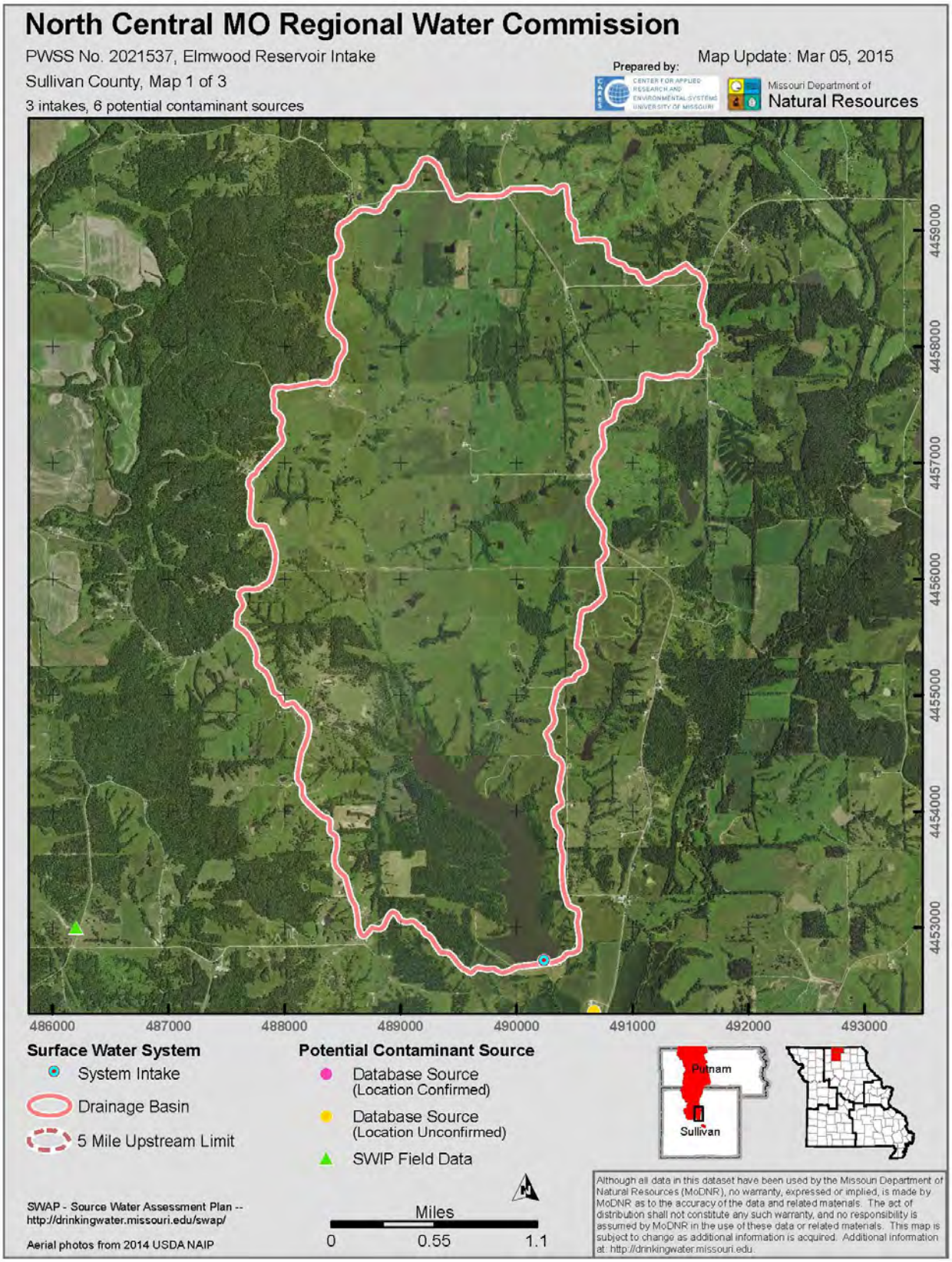


Figure 1-55 Demand Compared to 2000 Calculated Optimum Yield from Elmwood Lake, Golf Course Lake, and Locust Creek

Note: The demands projected above were not analyzed using RESOP. It is merely an aide to better understand the availability of the source.

Appendix C. MDNR Source Water Assessment Report, March 2016


North Central MO Regional Water Commission
PWSS No. 2021537, Elmwood Reservoir Intake
Sullivan County, Map 1 of 3
3 intakes, 6 potential contaminant sources
Prepared by:
Map Update: Mar 05, 2015
Missouri Department of Natural Resources
4459000
4458000
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4454000
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493000
Surface Water System
System Intake
Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source (Location Confirmed)
Database Source (Location Unconfirmed)
SWIP Field Data
Putnam
Sullivan
SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
Aerial photos from 2014 USDA NAIP
Miles
0
0.55
1.1
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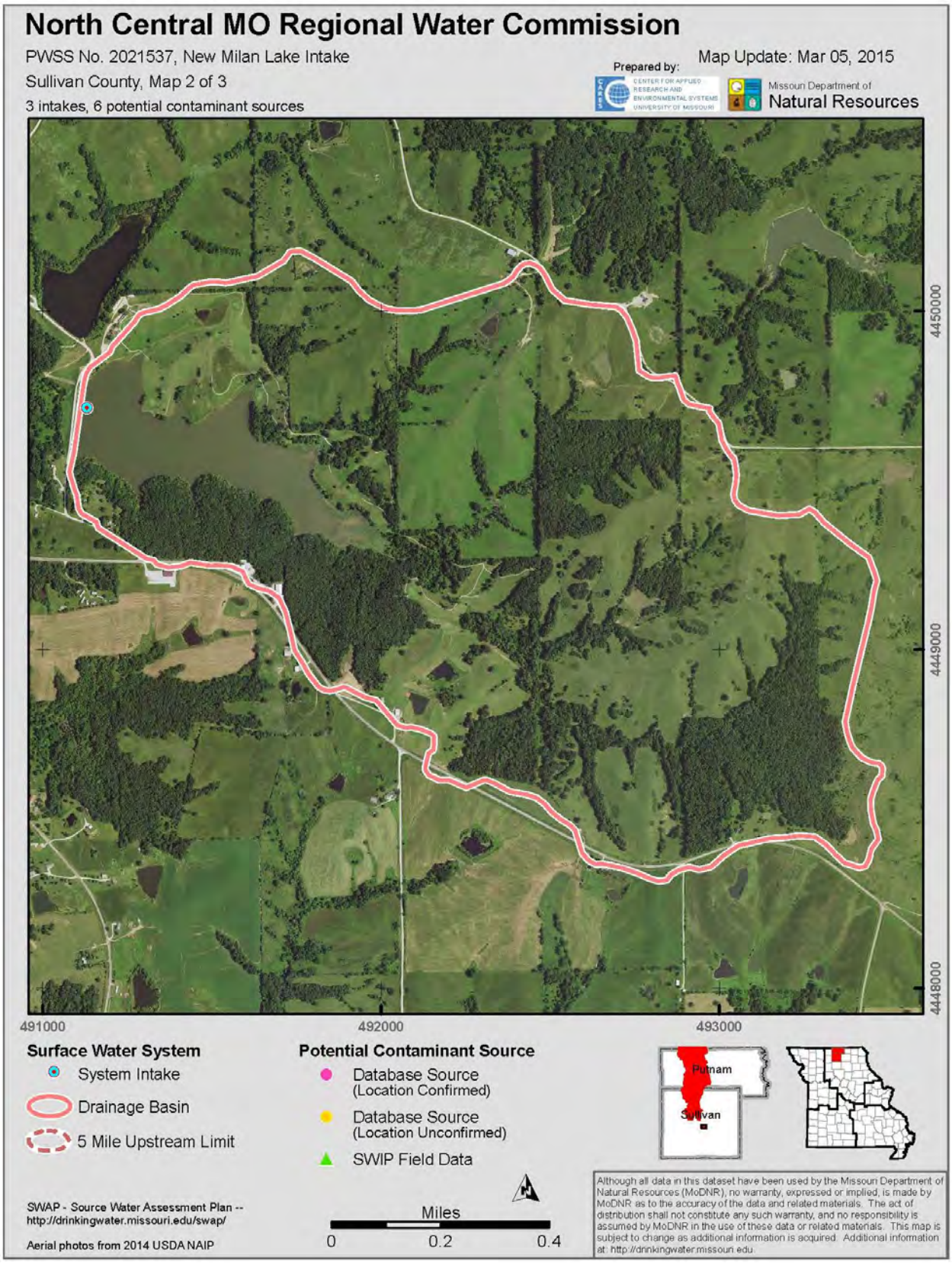
North Central MO Regional Water Commission
PWSS No. 2021537, New Milan Lake Intake
Sullivan County, Map 2 of 3
3 intakes, 6 potential contaminant sources
Prepared by:
Map Update: Mar 05, 2015
Missouri Department of
Natural Resources
4450000
4449000
4448000
491000
492000
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Surface Water System
System Intake
Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source
(Location Confirmed)
Database Source
(Location Unconfirmed)
SWIP Field Data
Putnam
Sullivan
Miles
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0.4
SWAP - Source Water Assessment Plan --
http://drinkingwater.missouri.edu/swap/
Aerial photos from 2014 USDA NAIP
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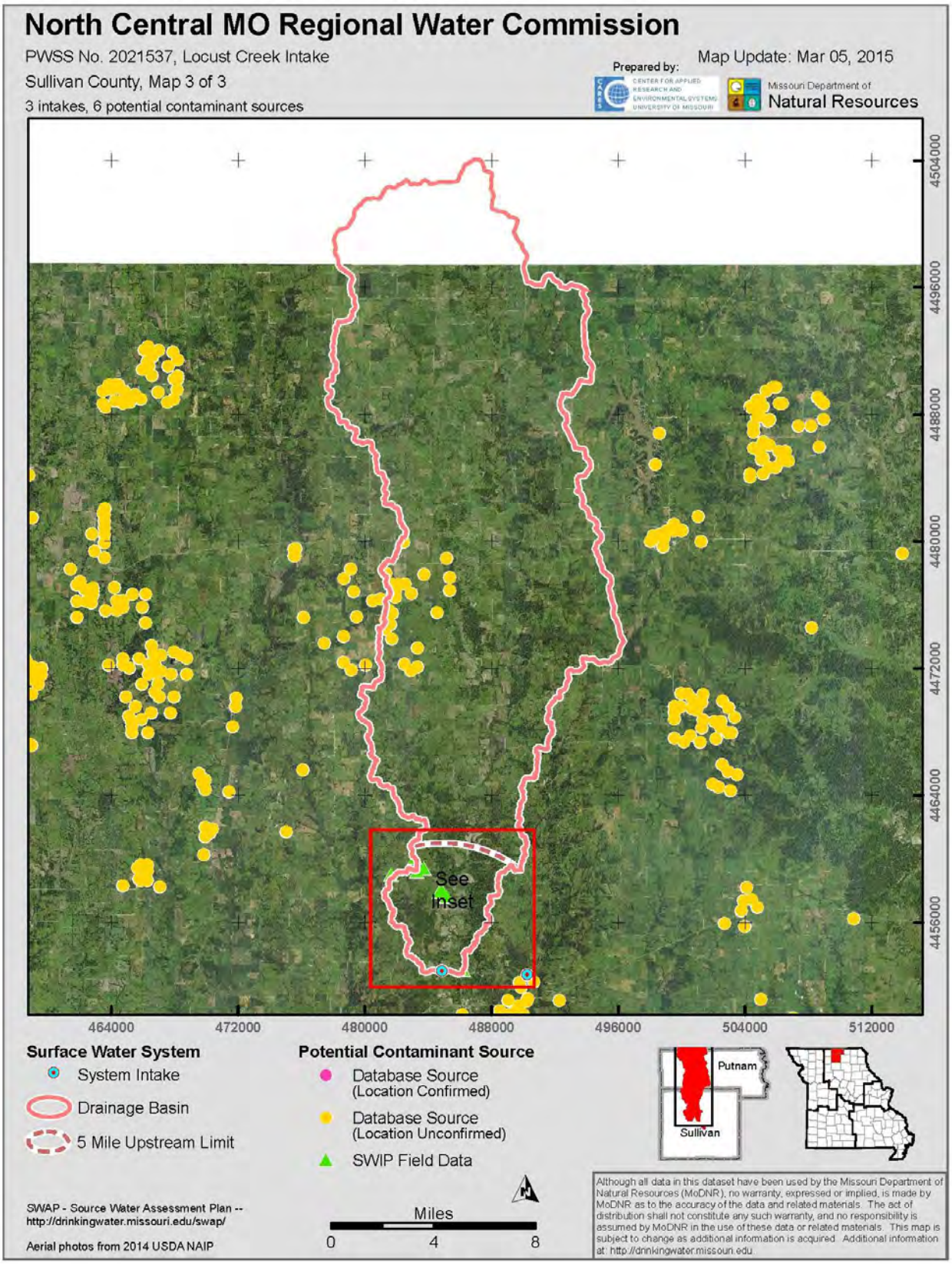
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3
3 intakes, 6 potential contaminant sources
Prepared by:
Map Update: Mar 05, 2015
Missouri Department of Natural Resources
4504000
4496000
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Surface Water System
System Intake
Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source (Location Confirmed)
Database Source (Location Unconfirmed)
SWIP Field Data
Putnam
Sullivan
Miles
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SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
Aerial photos from 2014 USDA NAIP
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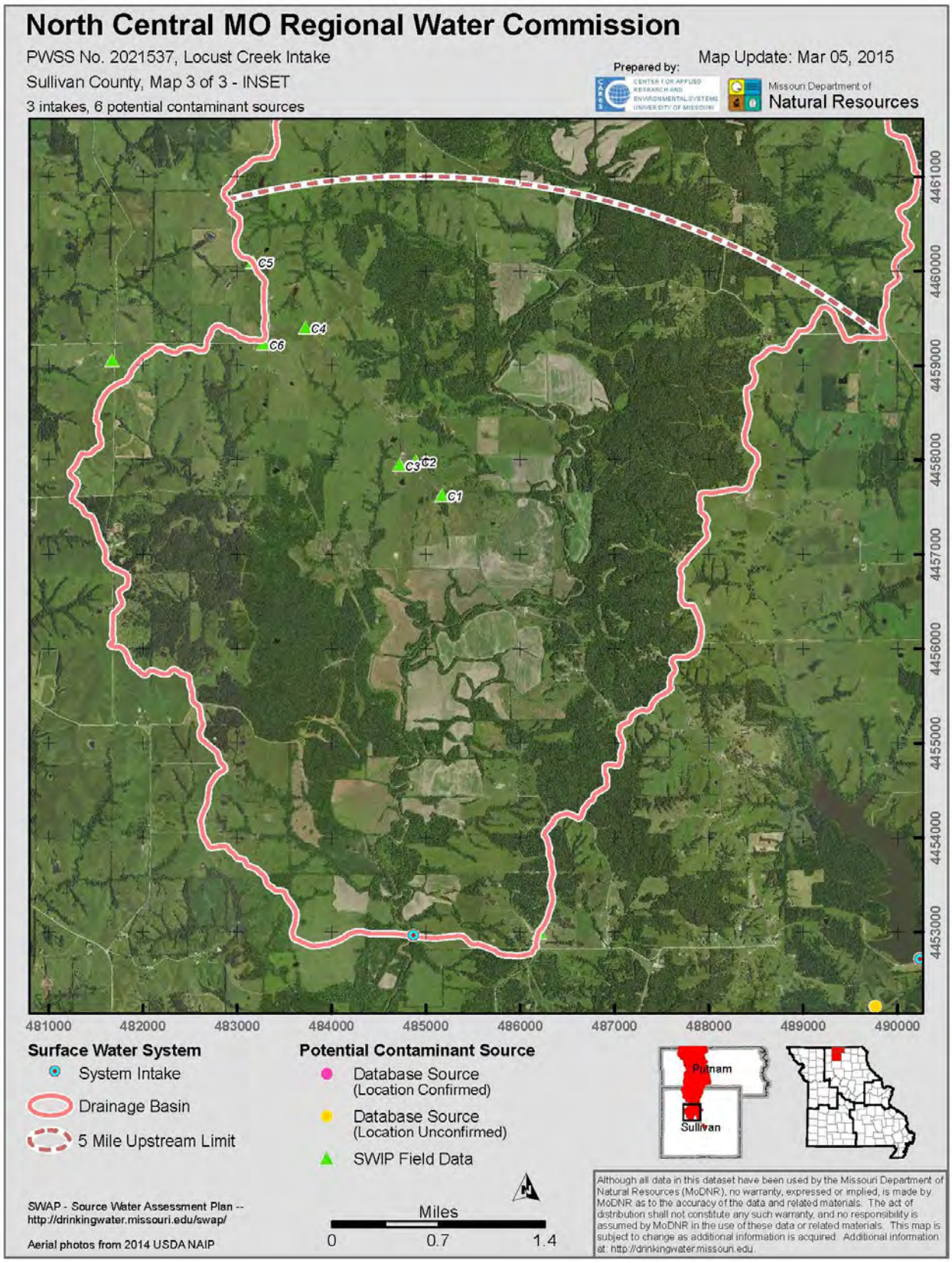
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3 - INSET
3 intakes, 6 potential contaminant sources
Prepared by:
Map Update: Mar 05, 2015
Missouri Department of Natural Resources
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Surface Water System
System Intake
Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source (Location Confirmed)
Database Source (Location Unconfirmed)
SWIP Field Data
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Miles
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SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
Aerial photos from 2014 USDA NAIP
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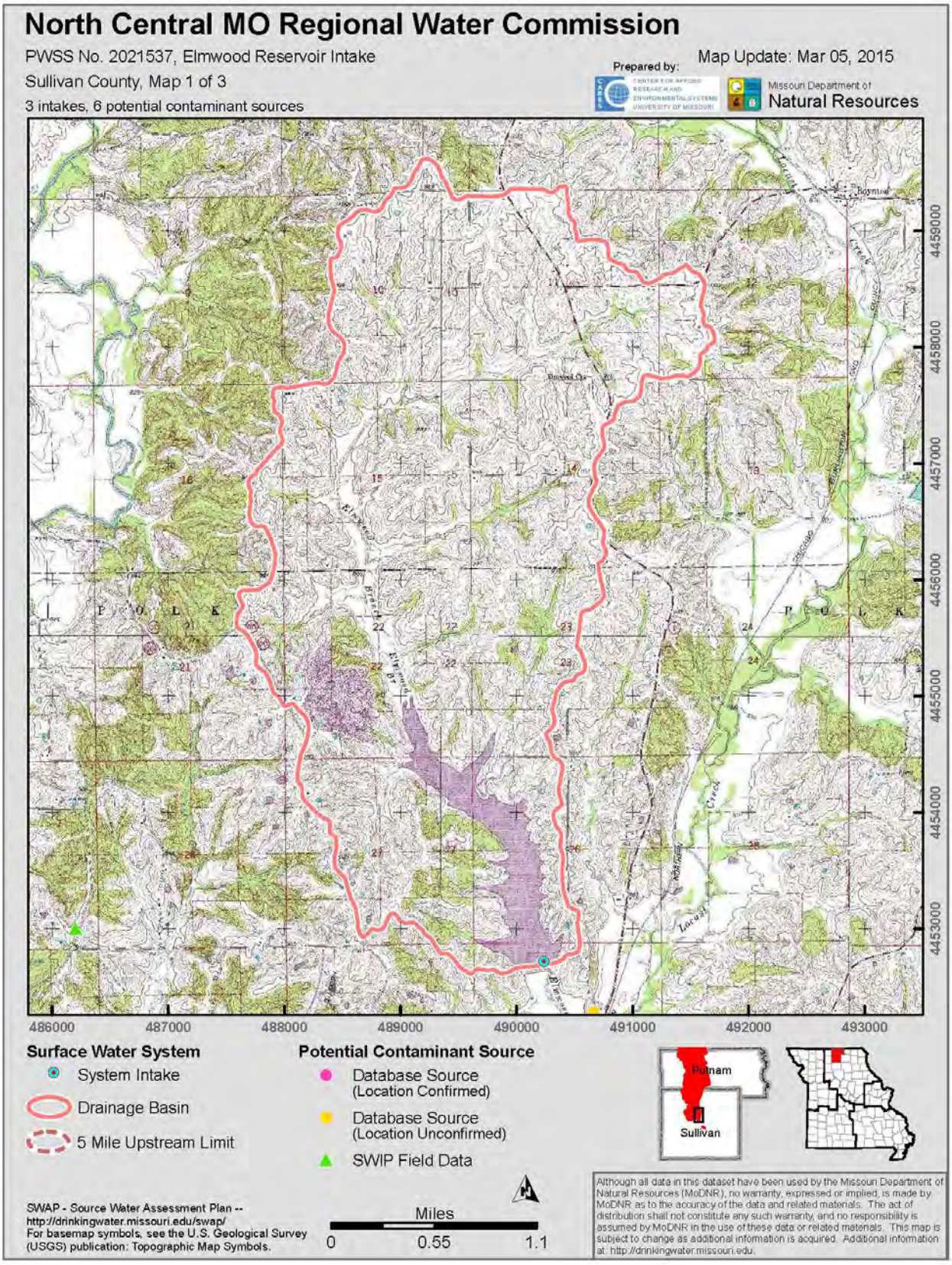
North Central MO Regional Water Commission
PWSS No. 2021537, Elmwood Reservoir Intake
Sullivan County, Map 1 of 3
3 intakes, 6 potential contaminant sources
Map Update: Mar 05, 2015
Prepared by:
Missouri Department of Natural Resources
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Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source (Location Confirmed)
Database Source (Location Unconfirmed)
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SWAP - Source Water Assessment Plan --
http://drinkingwater.missouri.edu/swap/
For basemap symbols, see the U.S. Geological Survey (USGS) publication: Topographic Map Symbols.
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North Central MO Regional Water Commission

PWSS No. 2021537, New Milan Lake Intake

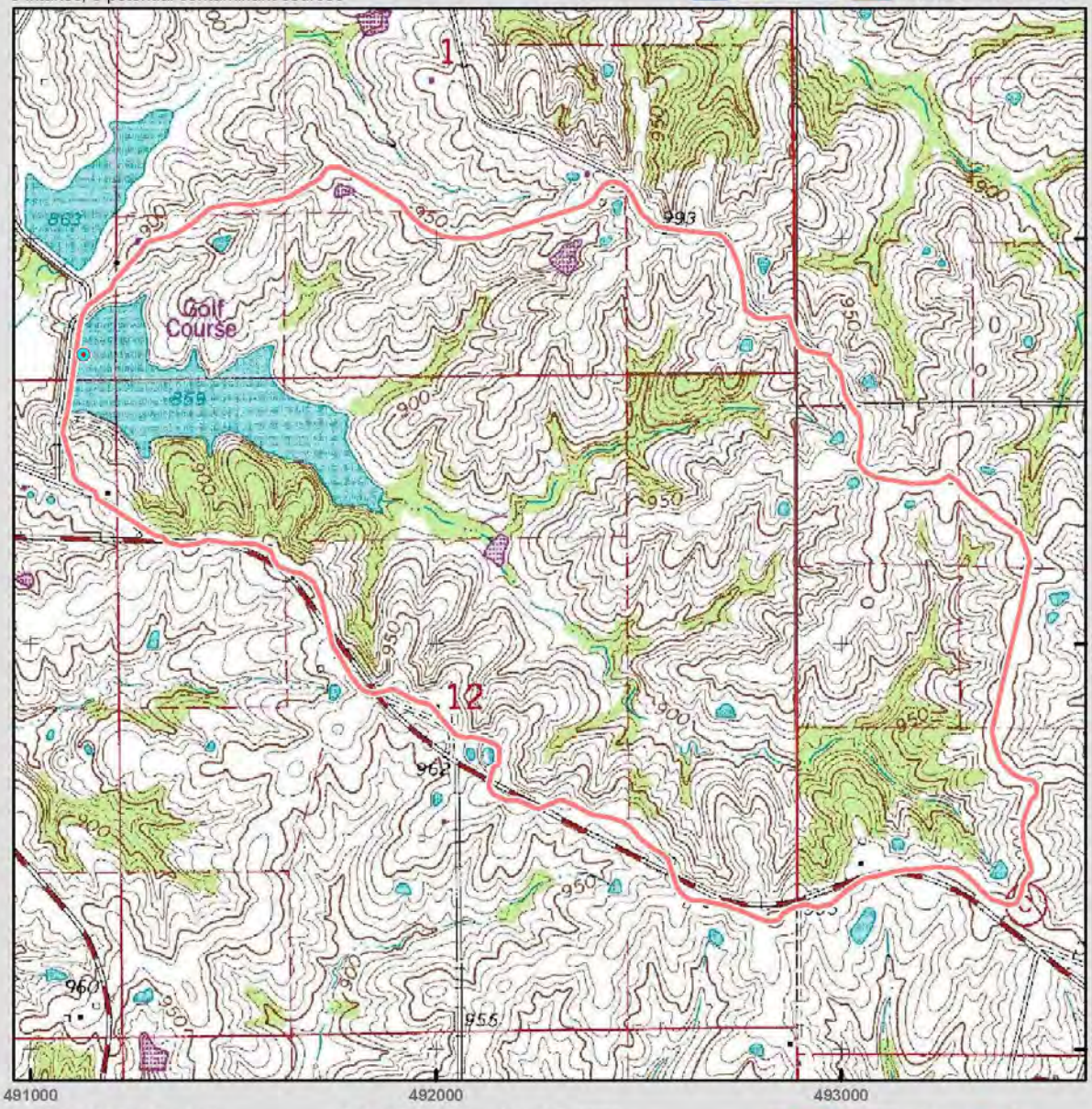
Sullivan County, Map 2 of 3

3 intakes, 6 potential contaminant sources

Map Update: Mar 05, 2015

Prepared by:

Missouri Department of Natural Resources



Surface Water System

- System Intake
- Drainage Basin
- 5 Mile Upstream Limit

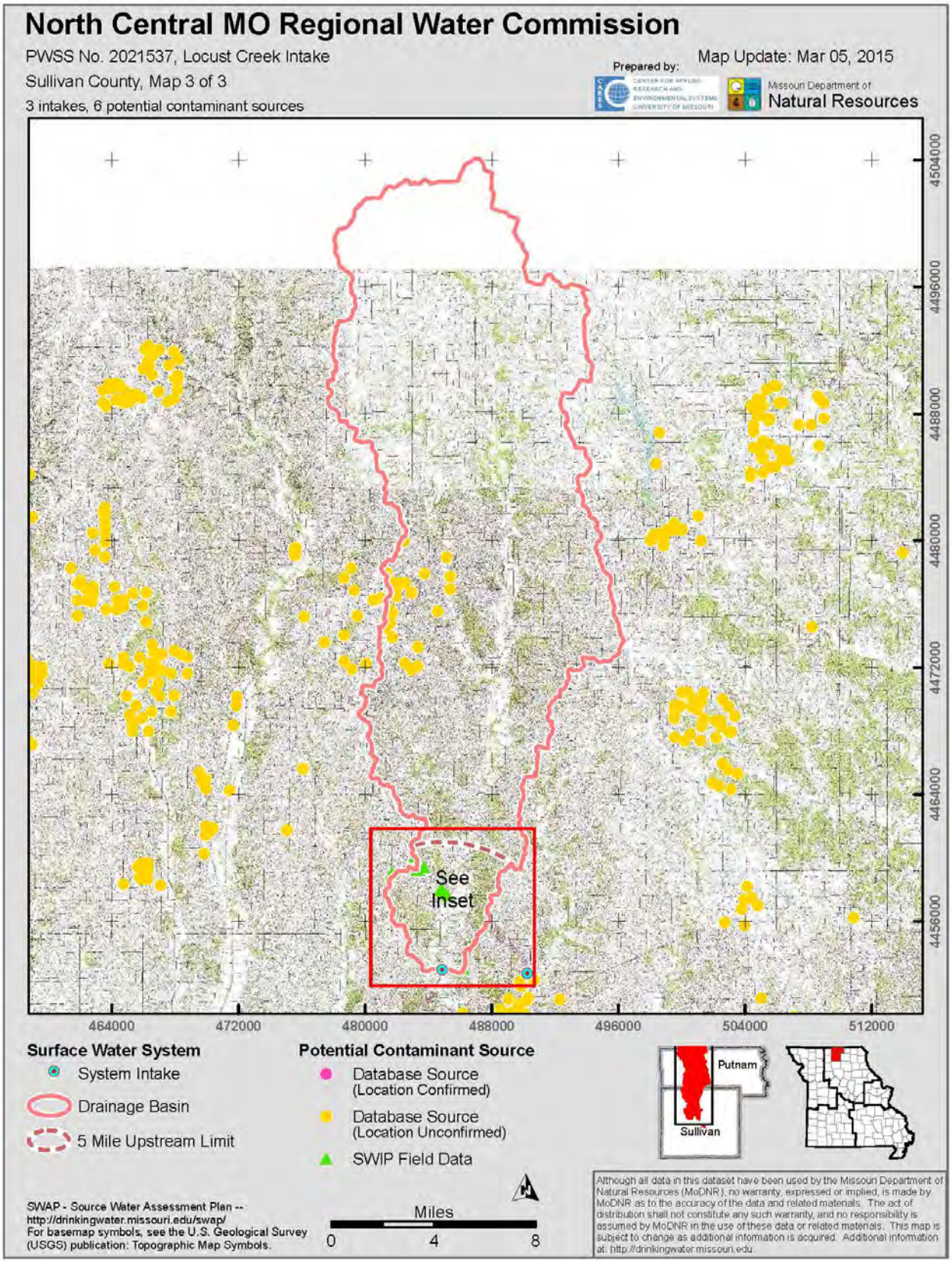
Potential Contaminant Source

- Database Source (Location Confirmed)
- Database Source (Location Unconfirmed)
- SWIP Field Data

Miles

0 0.2 0.4

SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
For basemap symbols, see the U.S. Geological Survey (USGS) publication: Topographic Map Symbols.


North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3
3 intakes, 6 potential contaminant sources
Prepared by:
Map Update: Mar 05, 2015
Missouri Department of Natural Resources
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Surface Water System
System Intake
Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source (Location Confirmed)
Database Source (Location Unconfirmed)
SWIP Field Data
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Miles
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SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
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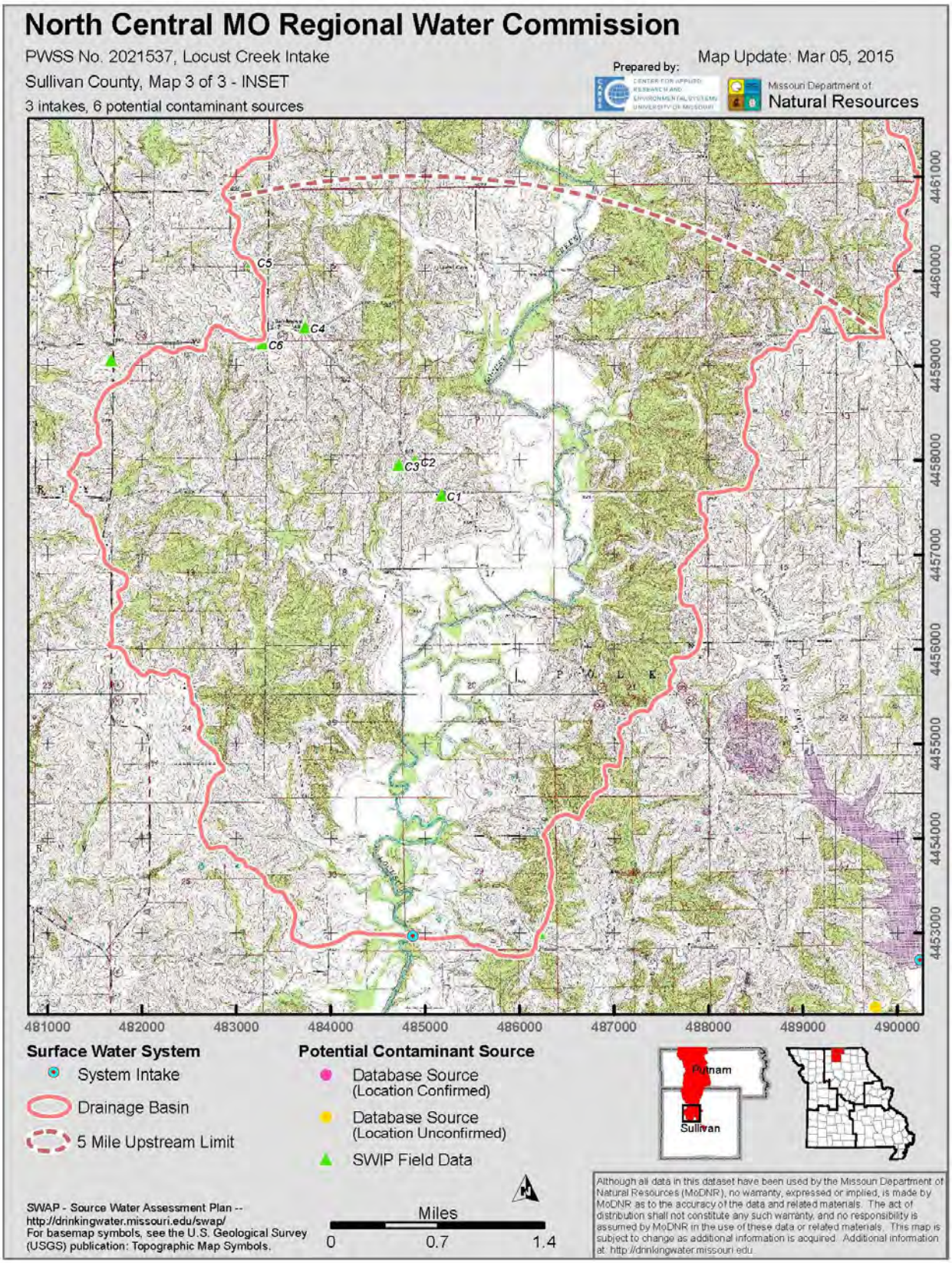
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3 - INSET
3 intakes, 6 potential contaminant sources
Map Update: Mar 05, 2015
Prepared by:
Missouri Department of Natural Resources
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Surface Water System
System Intake
Drainage Basin
5 Mile Upstream Limit
Potential Contaminant Source
Database Source (Location Confirmed)
Database Source (Location Unconfirmed)
SWIP Field Data
Putnam
Sullivan
SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
For basemap symbols, see the U.S. Geological Survey (USGS) publication: Topographic Map Symbols.
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1.4
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North Central MO Regional Water Commission

PWSS No. 2021537

Sullivan County

3 intakes

Prepared by:

Sheet Update: Mar 05, 2015

Intake ID	20216	20217	30117
Extended PWS #	2021537203	2021537202	2021537201
Local Intake Name	Elmwood Reservoir Intake	New Milan Lake Intake	Locust Creek Intake
Intake Type	Impoundment Intake	Impoundment Intake	River Intake
Contributing Acres	4,122.26	664.84	139,285.02
Latitude	-93.11477	-93.10421	-93.1778785665
Longitude	40.22486	40.19778	40.2270358509
Location Method	DRG/Map	DOQQ	GPS
Method Accuracy (ft)	200	33	82
USGS 7.5 Quadrangle	Milan East	Milan East	Milan West
County	Sullivan	Sullivan	Sullivan
MoDNR Region	Northeast	Northeast	Northeast

North Central MO Regional Water Commission

PWSS No. 2021537

Northeast County

6 potential contaminant sources

Prepared by:

CENTER FOR APPLIED RESEARCH AND ENVIRONMENTAL SYSTEMS UNIVERSITY OF MISSOURI

Missouri Department of Natural Resources

Sheet Update: Mar 05, 2015

Map C.No.	CARES ID	Site Name	Type	Location Code	Accuracy Code	Method Code	Database Code
C1	386133		Tank (above-ground fuel)	TK	33 ft	I2	CARES
C2	386134		Tank (above-ground fuel)	TK	33 ft	I2	CARES
C3	386135		Tank (above-ground fuel)	TK	33 ft	I2	CARES
C4	386136	Bairdstone Cemetery	Cemetery	CF	33 ft	I2	CARES
C5	386137		Tank (above-ground fuel)	TK	33 ft	I2	CARES
C6	386138		Tank (above-ground fuel)	TK	33 ft	I2	CARES

Method Codes

Code	Address Matching (Geocoding)
A2	Block/Group
A3	Street Centerline
A4	Nearest Street Intersection
A5	Primary Street Name
A6	Digitization
AO	Other Address Matching
Z1	ZIP Code Centroid
	Census - 1990
C1	Block Centroid
C2	Block/Group Centroid
C3	Tract Centroid

Code	Global Positioning System
G1	Static Mode
G2	Kinematic Mode
G3	Differential Post Processing
G4	Precise Positioning Service
G5	Signal Averaging
G6	Real Time Differential Processing
	Interpolation
I1	Topo Map
I2	Aerial Photography (DOQQ)
I3	Satellite Imagery

Code	Other
P1	Land Survey
S2	Quarter Description
UN	Unknown

Location Codes

BL	Building
CF	Center of Facility
IN	Intersection
LS	Lagoon or Pond
MG	Main Access Point (Gate)
MA	Main Office
OT	Other
PL	Pile
RD	Road
TK	Tank, Standpipe, or Tower
WL	Well
UN	Unknown

Accuracy Codes

Code	Metric
m	Meters
km	Kilometers
	English
ft	Feet
yd	Yards
mi	Miles
UN	Unknown
NF	Site not found at database position
NV	Site position not verified

North Central MO Regional Water Commission

PWSS No. 2021537

Contaminant Summary Sheet

6 potential contaminant sources

Prepared by: CENTER FOR APPLIED RESEARCH AND ENVIRONMENTAL SYSTEMS, UNIVERSITY OF MISSOURI

Missouri Department of Natural Resources

Sheet Update: Mar 05, 2015

6 Potential Contaminant Sources in the Listed Databases:

	AFS (EPA AIRS Facility Sites)		Perchlo (MoDNR Perchlorate Sites in Missouri)
	APCP (MoDNR Air Pollution Control Program Sites)		Pest Ap (MDA Licensed Pesticide Applicators)
	APF (MoDNR Active Permitted Landfills & Transfer Stations)		RCRIS (EPA Resource Conservation and Recovery Information System)
	CERCLIS (EPA CERCLIS)		Silos (USGS Minuteman II Missile Silos)
	Chemcov (VA Selected Chemical Sites)		SMARS (MoDNR Superfund Management and Registry System)
	Dealcov (MDA Pesticide Dealer Locations)		Tanks (MoDNR Petroleum Tank Database)
	Dioxin (MoDNR Confirmed Dioxin List)		Tier 2 (MERC Tier II Reports)
	Grain B (USDA Former Grain Bin Sites)		Tire D (MoDNR Resolved and Unresolved Waste Tire Dumps)
	HW Gen (MoDNR Hazardous Waste Generators)		TRI (EPA Toxic Release Inventory)
	HW Tran (MoDNR Hazardous Waste Transporters)		VCP (MoDNR Voluntary Cleanup Program Sites)
	LUST (MoDNR Leaking Underground Storage Tanks)		WQIS (MoDNR Water Quality Information System)
	MoDOT (MoDOT Highway Maintenance Facilities)		
	PADS (EPA PCB Activity Data Base System)	6	SWIP Field Inventory (see below)

6 Potential Contaminant Sources in the SWIP Field Inventory:

0	Airport or abandoned airfield	0	Machine or metalworking shop
0	Animal feedlot	0	Manufacturing (general)
0	Apartments and condominiums	0	Material stockpile (industrial)
0	Asphalt plant	0	Medical institution
0	Auto repair shop	0	Metal production facility
0	Automotive dealership	0	Mining operation
0	Barber and beauty shop	0	Other
0	Boat yard and marina	0	Paint store
0	CAFO	0	Park land
0	Campground	0	Parking lot
0	Car wash	0	Petroleum production or storage
0	Cement Plant	0	Pharmacies
1	Cemetery	0	Photography shop or processing lab
0	Communication equipment mfg	0	Pit toilet
0	Country club	0	Plastic material and synthetic mfg
0	Dry cleaner	0	Print shop
0	Dumping and/or burning site	0	Railroad yard
0	Electric equipment mfg or storage	0	Recycling/reduction facility
0	Electric substation	0	Research lab
0	Farm machinery storage	0	Restaurant
0	Feed/Fertilizer/Co-op	0	Sawdust pile
0	Fire station	0	School
0	Funeral service and crematory	0	Sports and hobby shop
0	Furniture manufacturer	0	Swimming pool
0	Furniture repair or finishing shop	0	Tailing pond
0	Garden and/or nursery	5	Tank (above-ground fuel)
0	Garden, nursery, and/or florist	0	Tank (other)
0	Gasoline service station	0	Tank (pesticide)
0	Golf courses	0	Tank (underground fuel)
0	Government office	0	Trucking terminal
0	Grain bin	0	Veterinary service
0	Hardware and lumber store	0	Wastewater treatment facility
0	Hazardous waste (Federal facility)	0	Well (abandoned)
0	Highway maintenance facility	0	Well (domestic)
0	Jewelry or metal plating shop	0	Well (irrigation)
0	Junk yard or salvage yard	0	Well (livestock)
0	Lagoon (commercial)	0	Well (monitoring)
0	Lagoon (industrial)	0	Well (public water supply)
0	Lagoon (municipal)	0	Well (unknown)
0	Lagoon (residential)		
0	Landfill (municipal)		
0	Laundromat		
0	Livestock auction		

North Central MO Regional Water Commission

PWSS No. 2021537

Susceptibility Determination Sheet

3 intakes

Prepared by: CENTER FOR APPLIED RESEARCH AND ENVIRONMENTAL SYSTEMS UNIVERSITY OF MISSOURI

Missouri Department of Natural Resources

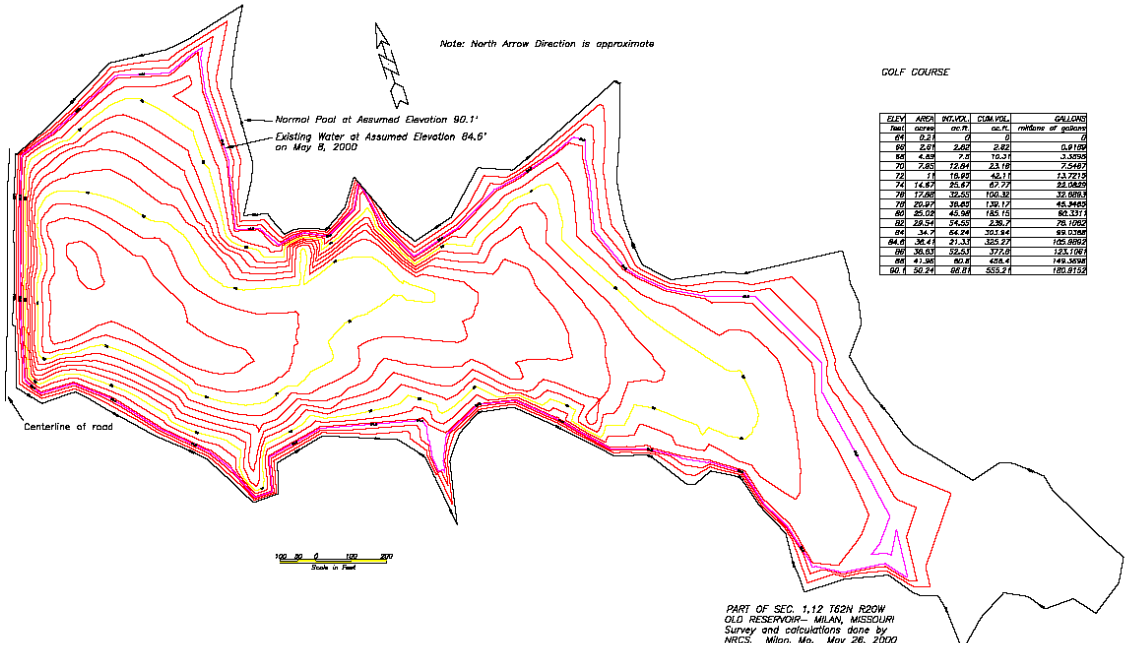
Sheet Update: Mar 05, 2015

The Missouri Department of Natural Resources (MoDNR) has assembled this information to assess the susceptibility of drinking water sources to contamination. There are many unforseen and unpredictable factors that may cause a source to be contaminated. MoDNR routinely monitors all public supplies to ensure public health is protected. Public water systems and local communities are encouraged to take all measures possible to reduce the susceptibility of their drinking water source to chemical contamination. For more information, call 1-800-361-4827.	Not Susceptible	Moderately Susceptible	Highly Susceptible	Incomplete Data
A system is highly susceptible based on detection histories if:				
Volatile Organic Chemicals (VOCs) have been consistently detected the source water,				X
Synthetic Organic Chemicals (SOCs) have been consistently detected the source water,				X
Inorganic Chemicals (IOCs) have been detected in a well above naturally occurring levels,				X
Nitrates have been consistently detected at or above one-half the MCL, or				X
Viruses or microbiological contaminants are consistently detected in the source water.			X (1)	
A system is moderately susceptible to contaminants if:				
Any contaminants listed in Appendix F-a are found in the source water area,		X (2)		
Land use in the source water area is a likely non-point source of contamination,				X
The water body receives recharge from a contaminated groundwater source, or				X
There is a high density of transportation corridors in the source water area.				X
A system is highly susceptible to contamination if:				
Any contaminant sites identified in the source water area are known to have released contaminants into the environment and may reach the water body, or				X
A large portion of the land use in the source water area is a likely non-point source of contamination, or				X
The source water is affected by contaminated groundwater.				X

(1) This system uses a water source that shows signs of contamination. The Department of Natural Resources will monitor the degree of contamination. The water system should treat the water accordingly to remove contamination before it enters the distribution system. The water system and watershed protection team should also make an effort to eliminate contaminants entering the source water.

(2) An intake (or intakes) serving this system has been determined to be susceptible due to the presence of potential contaminant sources. The water system and the watershed protection team should take extra care to ensure that all potential contaminants in the source water area are handled properly to avoid contamination of the drinking water supply. Periodic monitoring will be required to track contamination of the source water. If possible, contaminant sources should be removed from the source water area.

Appendix D. Bathymetric & Volume Information for Elmwood Lake and Old East Reservoir in Sullivan County



ELEV	AREA	INT.VOL.	CUM.VOL.	GALLONS
feet	acres	ac.ft.	ac.ft.	millions of gallons
64	0.21	0	0	0
66	2.61	2.82	2.82	0.9188
68	4.88	7.5	10.31	3.36155
70	7.65	12.84	23.16	7.5447
72	11	18.65	41.81	13.7215
74	14.67	25.67	67.77	22.0825
76	17.86	32.53	100.32	32.6816
78	20.97	38.83	139.17	45.3465
80	25.02	45.98	185.15	60.3371
82	29.54	54.56	239.7	78.1056
84	34.7	64.24	303.94	99.0388
84.6	36.41	21.33	325.27	105.9893
86	36.63	73.04	377.8	123.1061
88	41.96	80.8	458.4	149.3698
90.1	50.24	98.81	555.21	180.9153

Figure 22.4.b Bathymetric map and area/volume table of Golf Course Reservoir, Milan, Missouri. **ri**

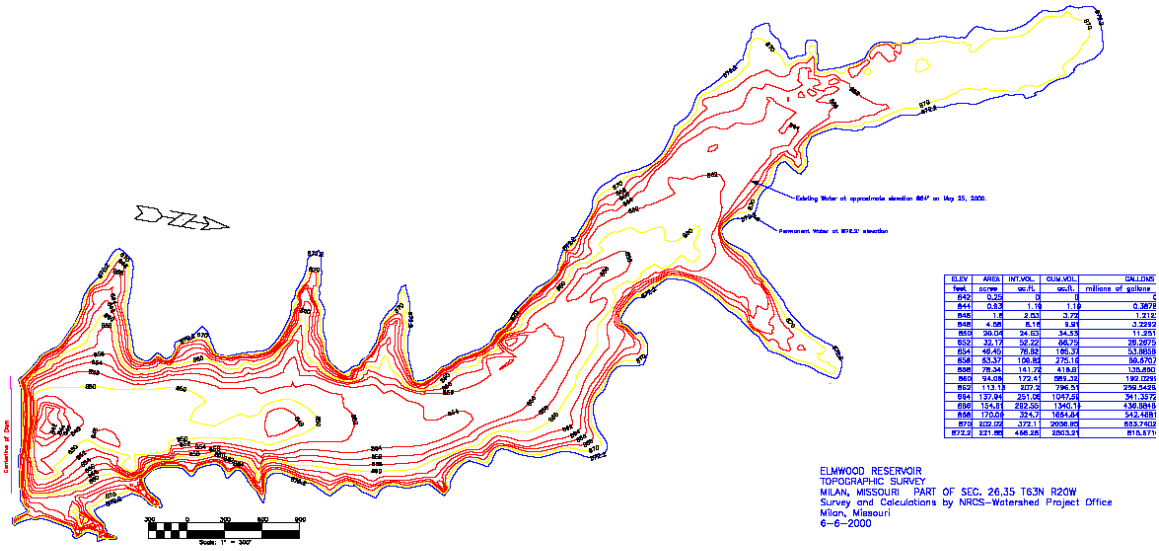


Figure 22.4.a Bathymetric map and area/volume table of Elmwood Reservoir, Milan, Missouri.

Appendix E. Sullivan County Soil & Water Conservation District Letter of Support

Sullivan County Soil and Water Conservation District
23487 Eclipse Drive
Milan, Mo. 63556
660-265-3440 Ext. 3

August 23, 2017

Mr. Brad Scott, General Manager
North Central Missouri Regional Water Commission
201 N. Market Street
Milan, MO 63556

Dear Mr. Scott:

The Sullivan County Soil and Water Conservation District Board strongly supports the completion of the East Locust Creek Reservoir Project. Currently, Sullivan County does not have a reliable source of drinking water. This project will address a critical need for both Sullivan County citizens and agricultural producers. At our August 4th meeting, the Board agreed to assist with your source water protection efforts by making the watershed of the lake a priority for District funds.

We look forward to collaborating on this critically important project.

Jimmy Hoselton
Chairman
Sullivan County Soil and Water Conservation District

Appendix F. The Commission’s Emergency Operations Plan

MIKE WARD – OPERATION MANAGER – A- #940	660-292-0744
LAWRENCE ALLEN – CHIEF OPERATOR – A – 12136	660-946-4328 660-973-62…
J.C MACALISTER – D – 9143	660-265-3774 660-988-5559
ELLEN HODGE – OFFICE MANAGER	660-265-4448 660-342-2547
BRAD SCOTT – MANAGER	816-590-0264
AUTHORITY CONTACTS	
MODNR – NORTHEAST	660-385-8000
EPA REGION 7	913-551-7030
EMERGENCY RESPONSE	573-634-2436
MODNR CENTRAL OFACE	573-751-5331 OR 573-751-4674
FBI	816-512-8200
STATE EMERGENCY MANAGEMENT	573-751-9100
STATE LAB	573-751-7929
SULLIVAN CO. LEPC	911
RURAL ELECTRIC COOP	660-265-4404

SUPPLY REPAIR CONTACTS	
REGER ELECTRIC – MILAN	660-445-2130
THN ELECTRIC	660-665-4598
SIDENER	816-377-0044 800-528-2887
HACH (CHEMICAL)	800-227-4224
BRENNTAG MID-SOUTH INC. (CHEMICAL)	800-821-7400
AQUAPURE (CHEMICAL)	216-709-0092
DAN STEVENS (TRACHOE SERVICES)	660-635-1631
SYSTEMS	913-422-9260
G.S. ROBBINS	314-302-0090
HENKE APPLICATIONS	660-748-5859
HAYNES EQUIPMENT	913-782-4962
U.S. FILTER-WATRELINE PARTS	314-442-4450

RESPONSE TO FACILITY FAILURE

IF THE NCMRWC WATER PLANT FAILS FOR WHATEVER REASON THERE IS CONTINGENCY PLAN TO PROVIDE WATER TO THE NCMRWC MEMBERS AND THEIR CUSTOMERS.

1. 8” FINISHED WATER MAIN FROM TRENTON, MO, WILL SUPPLY 400,000 GPD TO SULLIVAN RURAL AT ENTRY POINT AND WILL SUPPLY WATER TO REMAINING NCMRWC MEMBERS UNDER POSSIBLE RESTRICTIONS ON WATER USE.
2. 8” FINISHED WATER MAIN FROM FARMLAND FOODS WHICH WILL PROVIDE A MINIMUM OF 200,000 GPD TO THE MILAN AND GREEN CITY GREEN CASTLE AREA.
3. FINISHED WATER MAY TRANSPORTED FROM WATER SALESMAN AT WATER PLANT VIA MILAN RURAL FIRE TRUCKS. MILAN RURAL HAS 31,200 GALLON TANKS AND 21,000 GALLON TANKS. TRUCKS SHOULD BE DISINFECTED WITH TWO GALLONS OF BLEACH PER 2,000 GALLONS OF WATER FOR SIX HOURS AND THEN DRAINED AND FLUSHED AND REFILLED.

CHEMICAL HAZARD OR FIRE
THE MILAN RURAL FIRE DEPT. IS THE FIRST RESPONDER TO EITHER A CHEMICAL HAZARD OR FIRE.

THE NCMRWC HAS TWO REFERENCE MANUALS FOR EMERGENCY RESPONSE

1. MODNR
2. SULLIVAN COUNTY LEPC

BOTH MANUALS MAY BE USED FOR REFERENCE DEPENDING ON SITUATION.

COOPERATIVE ACTIONS
THE NCMRWC WILL BE IN DIRECT COOPERATION WITH THEIR REGULATORY AUTHORITY, THE MISSOURI DEPARTMENT OF NATURAL RESOURCES FOR DIRECTION AND GUIDENCE SO THAT ANY EMERGENCY MAY BE RESOLVED IN A TIMELY MANNER.

ELECTRICAL FAILURE
THE NCMRWC CONTACT FOR ELECTRIC OUTAGE IS THE RUAL ELECTRIC COOPERATIVE AND THEY SHALL ACT AS REPAIR AND REPLACE FOR ANY PRIMARY POWER OUTAGE PROBLEMS.

SNOW REMOVAL
IN CASE OF A BLIZZARD, THE NCMRWC MAY CONTRACT THE CITY OF MILAN ROAD DISTRICT FOR HEAVY SNOW REMOVAL.

List of Engineers

Larkin and Associates
9233 Ward Parkway Suite 300
Kansas City, Mo. 64114

Rhodes Engineering
401 West Helm
Brookfield, Mo. 64628

ET Archer
3234 E. 11th Suite 2305
Kansas City, Mo. 64106

Mark Young, PE (MBE)
Bucher Willis & Ratliff Corporation
7920 Ward Parkway
Kansas City, Mo. 64114-2021

Cary Sayre, PE
Allstate Consultants
119 S. Main Street
Marceline, Mo. 64658

EPM Inc. (MBE)
13A SW 3rd St.
Lee's Summit, Mo. 64063

Dubois Consultants Inc. (MBE)
5737 Swope Parkway
Kansas City, Mo. 64130

Akin Gordon & Cowger Engineers Inc. (WBE)
P.O. Box 754
Liberty, Mo. 64068

Shafer Kline & Warren Inc.
921 Jackson St.
Chillicothe, Mo. 64601

Crowley, Wade, Milstead, Inc.
3200 South M-291
Independence, Mo. 64057

Snyder & Associates
802 Francis
St. Joseph, Mo. 64501

Benton & Associates, Inc.
713 N. High St.
Kirksville, Mo. 63501
adorrell@bentonassociates.com

Great River Engineering, Inc.
P.O. Box 29
Bowling Green, Mo. 63334

Bartlett & West Inc.
1719 Southridge Dr., Suite I00
Jefferson City, Mo. 65109
phone: 573-634-3181

Olsson Associates
1251 NW Briarcliff Parkway
Kansas City, Mo. 64116
phone: 816-361-1177
fax: 816-361-1888
www.oaconsulting.com

Arcturis (WBE)
1910 Pine Street
St. Lows, Mo. 63103
ARCTURIS.COM

Trabue, Hansen & Hinshaw Inc.
1901 Pennsylvania Drive
Columbia, Mo. 65202
phone: 573-814-1568
twooten@thhinc.com

Poeping, Stone, Bach, and Ass.
Attn: Michael Purol, PE
80 Broadway, Suite 224
U.S. Federal Building
P.O. Box 190
Hannibal, Mo. 63401
phone: 573-406-0541
fax: 573-406-0390
michaelp@psba.com

Gredell Engineering Resources
1505 East High Street
Jefferson City, Mo. 65101
phone: 573-659-9078
fax: 573-659-9079

Appendix G: Quality Assurance Project Plan

Quality Assurance Project Plan

for

Headwaters of East Locust Creek

Prepared for

The North Central Missouri Regional Water Commission

201 North Market Street

Milan, MO 63556

Prepared by

Allstate Consultants

3312 LeMone Industrial Blvd.

Columbia, MO 65201

Approval Signatures (required prior to project start):

_____		Date: _____
Project Manager	Print Name	
_____		Date: _____
QA Officer	Print Name	
_____		Date: _____
Project Official	Print Name	
_____		Date: _____
Project Official	Print Name	

Table of Contents

Provide a table of contents for the document, including sections, figures, tables, references, and appendices. Apply a document control format on each page following the Title and Approval Sheet when required by the Project Manager and QA Manager.

1.0 PROJECT MANAGEMENT

1.1 Distribution List

Project Manager
Bradley M. Scott
NCMRWC General Manager
201 North Market St.
Milan, MO 63556
(660) 265-4448

Engineer
John Holmes, PE, CFM, LEED-AP
Allstate Consultants LLC
3312 LeMone Industrial Blvd.
Columbia, MO 65201
(573) 875-8799

1.2 Project/Task Organization

The Quality Assurance Project Plan (QAPP) for The Headwaters of East Locust Creek HUC 12 is to serve as a supplemental resource to the Source Water Protection Plan developed for the North Central Missouri Regional Water Commission (NCMRWC). The QAPP will create a water quality modeling environment to analyze the current and proposed water supplies. The NCMRWC has directed Allstate Consultants LLC to develop the QAPP and the associated model of the HUC 12. Specifically, John Holmes (P.E., C.F.M., LEED-AP) and Brent Elliott will develop the watershed model and Bradley Scott (NCMRWC General Manager) will act as the Quality Assurance (QA) Manager. The project team will continue to grow as the development of the model progresses.

1.3 Problem Definition/Background

The Headwaters of East Locust Creek HUC 12 is home to the existing Elmwood Reservoir and the proposed East Locust Creek Reservoir (ELCR), both of which have the primary purpose of providing public drinking water. Elmwood Reservoir is the current primary source of water for the North Central Missouri Regional Water Commission (NCMRWC) which has been tasked with developing ELCR and leading in regionalization of water supply in the 10-county region surrounding Sullivan County, Missouri, the home of both reservoirs. NCMRWC currently supplies water for Sullivan County and a small part of Linn County to the south but does not have adequate water sources to be able to produce water during a drought similar to the drought of the 1950s (design drought). Elmwood Reservoir is supplemented with pumping from additional sources, but this pumping would not be sufficient to prevent running out of water in

the design drought.

The ELCR is being designed to allow the 10-county region to have adequate water during the design drought. Construction of ELCR is anticipated to cost nearly $100 million and commence in 2019 or 2020. Reservoir construction will take 2 years and filling could take an additional 2 to 5 years. Consequently, Elmwood Reservoir will likely remain the primary drinking water source for NCMRWC until at least 2023 and possibly until 2026.

Given the critical nature of the current water supply and the large investment required to construct ELCR, it is crucial that the project team be proactive in protecting the integrity of these sources. Accordingly, a Source Water Protection Plan (SWPP) was envisioned and this QAPP is being written to guide development of a water quality modeling environment to provide information for implementation of the SWPP. The goal of this QAPP is to assist the project team in developing a modeling environment that will efficiently provide useful information in the short and long term. The modeling environment will need to address at least three phases.

- Elmwood Reservoir and its auxiliary sources, current conditions
- ELCR watershed and reservoir bed, pre-construction
- ELCR watershed management and reservoir operations, post construction

A significant driver in the need for a modeling environment is new nutrient criteria proposed by the Missouri Department of Natural Resources (MDNR) and under review by EPA. If accepted by EPA, the criteria will be applicable to both reservoirs. The criteria specifies screening thresholds for nitrogen, phosphorous, and chlorophyll. Under these proposed criteria, the reservoirs will be classified as impaired and placed on the 303(d) list in one of two ways.

A. The geometric mean of samples taken between May and September in a calendar year exceeds the Chlorophyll-a Response Impairment Threshold Value (30 ug/L) more than once in three years' time.

B. The geometric mean of samples taken between May and September in a calendar year exceeds screening threshold value for Chlorophyll-a (18 ug/L), Total Nitrogen (843 ug/L) or Total Phosphorous (49 ug/L) in the same year that one of five response assessment endpoints are identified in the reservoir. The five response assessment endpoints are:
    1. Occurrence of eutrophication-related mortality or morbidity events for fish and other aquatic organisms,
    2. Epilimnetic excursions from dissolved oxygen or pH criteria,
    3. Cyanobacteria counts in excess of 100,000 cells/mL,
    4. Observed shifts in aquatic diversity attributed to eutrophication, and,
    5. Excessive levels of mineral turbidity that consistently limit algal productivity during the period of May 1 – September 30.

MDNR will derive the schedule for monitoring based on their understanding of which bodies of water are likely to be impaired; but, for the purposes of this document, it should be assumed that MDNR monitoring will occur annually.

Selection of a modeling environment involves weighing the costs and benefits of a range of model capabilities and finding a model that fits the budget while providing as many of the desired capabilities as possible. The capabilities needed depend on the modeling project goals. Some of the questions that could be partially answered by the model are listed below.

- Current Conditions
    - How much additional nutrient loading could Elmwood Reservoir handle if it becomes necessary to supplement water supply from higher concentration sources?
    - How long will the current water sources adequately supply water if a drought continues?
    - If the proposed new state nutrient criteria are implemented, will Elmwood Reservoir be listed? What avoidance alternatives are available?
- ELCR watershed and reservoir bed pre-construction
    - Will the proposed clearing be sufficient to avoid excessive nutrient loading at startup?
    - What will be the post-project concentration of any constituents that exist in the reservoir bed prior to inundation?
    - What will be the best elevation to locate the ecological flows intake to ensure optimal water conditions for downstream?
    - Which constituent issues are of most concern?
    - What sources contribute the most pollutants?
    - How proactive do we need to be about nutrients, sediment, etc.?
    - Will the model be flexible enough to provide additional answers as new questions arise?
- ELCR watershed management, including reservoir operations and buffer management
    - Under what set of climatic conditions do we need to pay special attention to nutrient loading problems?
    - Can the model predict algal blooms and guide reaction?
    - Can the model be adjusted to help in rapid evaluation of developing issues?
    - Policy decisions
        - What will be the constituent impacts of agricultural use changes in the watershed?
        - What will be the constituent impacts of future development?
        - What watershed BMP policies would be most cost effective?

- What agricultural practice policies would be most cost effective?
- What activities should the project team incentivize in watershed?
- What is the value of increasing buffer widths?
- How will climate change impact the reservoirs?
- How will potential regulatory changes affect the reservoirs?

- Can impairment listing be avoided at a reasonable cost?
- If ELCR is considered for addition to the impaired waters list, can we provide information to refute the listing?
- Financials
  - Can we document the need for funding for source water protection?
  - What are the cost benefit tradeoffs of proposed projects?
  - What will be the added treatment cost due to a proposed change?
  - Would a BMP cost be recouped in reduced water treatment cost?
  - Compare policy decisions to water treatment costs?

The following capabilities are being considered in this evaluation.

Capabilities	Variables	Options
Model watershed loading rates of various constituents[a].	On what spatial scale?	The source water protection plan is intended to cover the HUC 12, so a spatial scale that supports a HUC 12 level analysis would be optimal.
	On what temporal scale?	No need for a sub-daily time step has been identified. An annual time step would be too coarse to address many of the project purposes. A daily time step would be optimal, but a monthly time step may be adequate for most purposes.

Capabilities	Variables	Options
	How broad an array of constituents?	Core constituents that are certainly needed from the watershed model are: ● Total Nitrogen ● Nitrate/Nitrite ● NH3 ● Total Phosphorous ● Sediment ● BOD ● Runoff Volumes However, all other things being equal, whichever model has the broadest range of capabilities is best for addressing future concerns.
	What BMP/Practices should it simulate?	The watersheds are currently heavily agricultural in nature so the ability to model agricultural practices is highly valuable. The watershed will likely experience some retail and residential development due to construction of ELCR so the ability to model limited "urban" BMPs is also of value.
Model the fate and interactions of these constituents in the reservoirs	Built into watershed model, linked to watershed model, or completely independent?	Given the need to model the watershed at a relatively small scale and a relatively small time step plus the need to utilize a two dimensional reservoir model for East Locust Creek, it is most likely that a linked model is the best option. However, a single model that met all these criteria would be optimal.
	On what spatial scale?	Given the certainty that ELCR will be a stratified reservoir and that we wish to use the ELCR model for a variety of purposes, it would be appropriate to use a two-dimensional model with the second dimension being used to model the stratification. Alternatively, it may be possible to get by with a one-dimensional model for Elmwood Reservoir because it is not expected to need as wide an array of modeling capabilities.

Capabilities	Variables	Options
	On what temporal scale?	Because a major concern will be predicting and reacting to algal blooms, a daily model is probably required for ELCR. The Elmwood Reservoir model may be adequate on a monthly temporal scale. An annual model would not be sufficient for either.
	How broad an array of constituents?	The reservoir models will need to evaluate the same core constituents as the watershed model, plus chlorophyll. However, all other things being equal, whichever model has the broadest range of capabilities is best for addressing future concerns.
a. For the purposes of this document, "constituents" is intended as a general term representing the range of pollutants, contaminants, conditions, parameters, etc., including but not limited to nutrients, algae, oxygen, oxygen demand, sediment, temperature, etc.		

As of this writing, the watershed model selection has been narrowed down to one of the following three choices.

- BASINS
- HSPF
- SWAT

All three of these choices provide the capabilities described in the table above and all three have interface options that allow for fairly rapid collection and processing of basic model data. We are leaning towards SWAT because it has the best options for modeling agricultural practices but are not yet committed to that choice.

It is our plan to use the WASP model for the reservoir water quality modeling because it can be linked to multiple watershed models and because it has all of the capabilities described above.

1.4 Project/Task Description and Schedule

The project is envisioned as a phased and practical approach to develop a robust model over the long term. In the interim, confidence in model results for various project sub-areas and constituents will gradually grow at varying rates. For example, the Elmwood Reservoir portion of the model will have data for calibration readily available early in the project and will represent an active drinking water system necessitating a high level of confidence before model results are used to make operational decisions. The ELCR portion, on the other hand, will need to produce hypotheses to help make design decisions before full scale calibration is even possible. In the short term it is hoped that the model, while possibly still uncalibrated, will be capable of providing useful but tentative direction to the project team in making decisions regarding the preparation of the reservoir bed. As time passes, it may become possible to calibrate watershed inputs prior to the filling of ELCR and improve confidence to some degree, even before the

receiving water response can be calibrated. By the time the reservoir is filled and starting to provide drinking water, it is hoped that the model will be ready to be calibrated and the project team will have developed insights into where the critical calibration points are.

Time Frame	Item	Assigned To
Ongoing	Nutrient sampling of existing drinking water sources	John Holmes, Christina Judas
Ongoing	Design of ELCR	Project Team
Fall 2018	Watershed and receiving water model selection	John Holmes, Brent Elliot
Fall 2018	Uncalibrated watershed model development	John Holmes, Brent Elliot
Fall 2018	Elmwood Reservoir water quality model development and calibration	John Holmes, Brent Elliot
Winter 2018	Apply Elmwood Reservoir model to management of Elmwood Reservoir	John Holmes, Brent Elliot
Winter 2018	"Calibration" of entire watershed model based on Elmwood Reservoir results	John Holmes, Brent Elliot
Spring 2019	ELCR water quality model - uncalibrated	John Holmes, Brent Elliot
Spring 2019	Apply uncalibrated ELCR water quality model predictions to final design of ELCR	John Holmes, Brent Elliot
Spring 2019	Develop plan for early verification and adaptation of ELCR design assumptions that are based on the model	John Holmes, Brent Elliot
Spring 2019	Water quality sampling of major watershed inputs into proposed ELCR	Greg Pitchford, Heather Krempa
Summer 2019	Verification of watershed model calibration for ELCR major inputs	John Holmes, Brent Elliot
Fall 2019	Design of ELCR complete	Project Team
Spring 2020	Adjust sampling plan based on 2019 results and continue water quality sampling of major watershed inputs into proposed ELCR	Greg Pitchford, Heather Krempa, John Holmes, Brent Elliot
Spring 2020-Fall 2021	Construction of ELCR	Project Team
Fall 2021-Fall 2026	Reservoir filling	Rainfall
2025-2026	Calibrate ELCR water quality model	TBD

1.5 Quality Objectives and Criteria for Model Inputs/Outputs

As described above, model output quality expectations will vary by location and constituent and through time as more calibration data becomes available. As the model is applied to a specific purpose, it will be necessary to write a Model Application Report (MAR) describing the purpose and criteria to be applied.

Examples of acceptance criteria and the types of data issues addressed are described below.

Data reasonableness: Data from various sources, including data collected prior to initiation of this plan will occur when necessary to provide needed input to the models and in some cases, calibration data. The reasonableness of these data will need to be evaluated and documented. For example, was the data set collected prior to major changes in the watershed?

Data completeness: Data that comes with quality control documentation will be weighted more heavily than other data, all other things being equal. The source of all data used in the models should be documented and the completeness of the set should be evaluated prior to its use. Additional sampling data collected will need to provide the information necessary to determine whether the reservoirs are meeting the proposed nutrient criteria and to meet the appropriate quality standards for that purpose.

Data representativeness: Data representativeness should also be addressed in the model documentation, such as specifying time and location for sample collection and comparability in sampling and sample analysis methods for input data. Other methods for assessing data representativeness relative to current conditions (e.g., photograph verification, visual assessment, considering data from bathymetric and ground truth land use surveys) can be detailed as needed.

Acceptability of model calibration and testing inputs and outputs: We are defining model calibration in this setting as how well the model is able to reproduce observed flow rates and concentrations of nutrient, dissolved oxygen, and chlorophyll-a (e.g., trends and peak values), as measured from field surveys.

Generally speaking, the long term goal will be that at least 90% of the input nutrient concentration measurements at a given sampling station should be within two standard errors of the mean measurement at that station.

Other goodness-of-fit evaluations may also be considered when determining model evaluation associated with these criteria. For example, data may need to be transformed (e.g., logarithmic) to better achieve these criteria and other model assumptions, or further investigations into specific data values may be necessary.

While it is preferable to develop quality criteria that tend to be quantitative in nature, certain stages of the model application process may benefit from assessments that are more general and qualitative. For example, when evaluating the outcome of model calibration, qualitative

assessments may be done by evaluating how well the outputs of the fitted model are able to match the overall trend in prediction over time or over the entire watershed area. This evaluation could be documented in a MAR by using graphs. An evaluation of how well these model outputs reflect peaks and valleys in the predicted water quality values at specified time points or at certain points in the watershed can also be compared to what has been observed and collected in surveys.

1.6 Documents and Records

Documentation will be important for defending the model predictions used for all purposes ranging from design decisions to providing supporting information for addressing impairments. The type of information that will be part of the record should be itemized so that modelers are aware before the project begins of the records that should be kept. Examples of appropriate documentation include: calibration and sensitivity analyses results, records of written rationale for selection of models or modules, record of code verification (e.g., hand-calculated checks, comparison to other models), sources of existing data used, and any adjustments to model parameter values that result from model calibration. All records, including modeler's notebooks and electronic files, should be maintained by the project manager in a central project archive.

2.0 DATA GENERATION AND ACQUISITION

2.1 Calibration

Water quality data on such measures as chlorophyll-*a*, phosphorus, nitrate, and dissolved oxygen that were collected from earlier surveys, in addition to flow measurements obtained from the United States Geological Survey gage on East Locust Creek (06901205), will be supplemented by additional sampling and used in calibrating the model depending on the particular application.

The calibration will judge the extent to which the model is able to predict current and future water quality measures that agree with what was actually observed in the surveys. For instance, the extent to which the model accurately captures observed trends in the water quality data at the various sampling points in the reservoirs, after taking into account the underlying variability in these monitored data, will be determined and appropriately documented. The performance criteria upon which the calibration will be deemed acceptable will be noted in a MAR developed for each individual application of the model.

Within the model calibration exercise, model rate coefficients will be adjusted as necessary to meet the calibration criteria and to reflect current scientific knowledge and various process rates that fall within a reasonable range of values found in the scientific literature. A list of internal variables used to calibrate the model outputs should be included in the MAR, along with any adjustments made to the model. The rationale for any needed model adjustments based on the results of the calibration process will be documented in the MAR.

2.2 Data Acquisition Requirements (Non-Direct Measurements)

As indicated previously, different types of data already existing in various databases may be used for model calibration and as input to the model. The MAR will include a section discussing the different sources of these data, the intended uses of these data on the project, the specific criteria for accepting an existing data source for use on the project, and any limitations that the use of these data may have on this project.

The primary types of existing data to be used in the modeling effort are any existing nutrient point source loads. Non-point source loads for the watershed will be predicted based on the latest NLCD land use classifications. Data from any permitted point sources in the watershed are taken from whatever discharge monitoring reports exist in the state's point source database. When average flow conditions are assumed, non-point source loadings are calculated as a sum (across the different types of land uses) of land use areas multiplied by their respective land use loading coefficients. Land use loading coefficients will be based on best available data and may be modified within reasonable ranges for calibration. Non-point sources represent such contributors as atmospheric deposition, as well as loads from septic tanks, urban development, agriculture, and forest land.

Where the modeling effort will consider different scenarios that represent either baseline or future conditions and low versus average flow characteristics, these scenarios will simulate seasonality effects as appropriate. Therefore, different sets of existing data (i.e., point source loads and non-point source loads) will be needed as model inputs for each scenario. These data sources should be listed in the MAR for each scenario, along with any limitations that these data may have in terms of predicting the scenarios.

Where water quality and physical field data were collected by others in earlier surveys according to documented field and laboratory protocols and at documented monitoring stations it may be used for model inputs and calibration. In order to ensure this data is appropriate for use in this model, survey records will be checked to assure conformance with procedures established for their initial collection and to assure that the resulting data meet the project requirements Data should be reviewed to be sure that their values fall within previously-observed and reasonable ranges (e.g., base flow nutrients and groundwater). Any limitations on the existing data that may impact a model's predictive ability for this project should be discussed in the MAR. For example, water quality surveys for which data were used in model calibration were collected over 15 years ago, and therefore, any changes to the waterway and its environment since then needs to be taken into consideration.

3.0 ASSESSMENT AND OVERSIGHT

3.1 Assessment and Response Actions

Different types of assessments and model performance evaluations may be performed as appropriate in any given model application. The assessments and evaluations should be documented in the MAR.

Examples include:
• Testing the Model - The ability of the selected model and modules to correctly represent modeled conditions will be assessed focusing on project purposes. A sensitivity analysis will be performed to determine the effect of flow rates, focusing on non-point flows and corresponding loads. The goal of this analysis is to test the sensitivity of the model during high flows to assure its responses are reasonable. If needed, further verification will be done by comparing model prediction results with survey data for base conditions.

• Performing Multiple Runs of the Model to Simulate Drought Impacts - To assess the extent to which drought impacts the model outputs and, ultimately, to incorporate impacts into a drought response plan, the model will be fitted under different scenarios for nutrient loading and stream and reservoir flow conditions. Some assessment is necessary to verify that the different scenarios that are selected represent the critical conditions for which the drought may impact the ability to meet water quality standards.

• Evaluating Existing Data - Modeling staff will evaluate data to be used in calibration and as model input according to criteria discussed in the MAR and will follow-up with the various data sources on any concerns that may arise.

Appendix H. Definitions & Acronyms

DEFINITIONS (selected terms)

Aquifer – A formation or series of formations that are sufficiently permeable to conduct groundwater and to provide economically significant quantities of water to wells or springs.

Community Water System - A system for the provision to the public of piped water for human consumption, if the system has at least fifteen (15) service connections or regularly serves an average of at least twenty-five (25) individuals on a year-round basis.

Contaminant - Any physical, chemical, biological, or radiological substances in water including, but not limited to, those substances for which maximum contaminant levels (MCLs) are established by the Missouri Department of Natural Resources.

Groundwater – Water derived from one or more aquifers through wells or springs.

Groundwater Under the Direct Influence of Surface Water (GWUDISW) - Any water beneath the surface of the ground with significant and relatively rapid shifts in water characteristics, such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the Missouri Department of Natural Resources. The determination of direct influence may be used on site-specific measurements of water quality or documentation of well construction characteristics, or both, and geology with field evaluation. The presence of macroorganisms, algae, or large-diameter pathogens in raw well water will also constitute as groundwater under the direct influence of surface water.

Hydrologic Unit Code (HUC) - is a sequence of numbers or letters that identify a hydrological feature like a river, river reach, lake, or area like a drainage basin (also called watershed) or catchment.

Maximum Contaminant Level - The maximum permissible level, as established in 10 Code of State Regulations 60-4, of a contaminant in any water that is delivered to any user of a public water system.

Maximum Contaminant Level Goal - A level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur and which allows an adequate margin of safety. These levels are not enforceable by the State of Missouri or the United States Environmental Protection Agency.

Missouri Safe Drinking Water Law - The Revised Statutes of Missouri, sections 640.100 through 640.140.

Noncommunity Water System - A public water system that is not a community water system. There are two types of noncommunity public water systems (transient and non-transient). A transient noncommunity public water system will have at least fifteen (15) service connections or regularly serve an average of twenty-five (25) or more persons for at least sixty (60) days of the year. A nontransient noncommunity public water system will serve at least twenty-five (25) persons (e.g., the same persons) for over six (6) months of a year.

Potential Contaminant Source – Specific point or non-point sources from which contamination of drinking water may originate.

Public Water System – A system for the provision to the public of piped water for human consumption, if the system has at least fifteen (15) service connections or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days out of the year. A public water system is either a 'community' or 'noncommunity' water system.

Risk Ranking – A prioritized ranking of known and potential contaminants to water supply sources based on the assessed relative threat that each potential or known contaminant possesses with respect to the water source.

Secondary Contaminant Levels - Those contaminant levels established by the Missouri Department of Natural Resources for contaminants that may affect the taste, odor, color, staining and scale-forming tendencies of water.

Service Connection - Any water line or pipe connected to a water distribution main or pipe for the purpose of conveying water to a point of use.

Sole Source Aquifer – A drinking water supply in an area with few or no alternative sources to the ground water resource, and where if contamination occurred, using an alternative source would be extremely expensive. If such an aquifer supplies a public water system on which at least 50% of the population depends, it may be designated as a sole source aquifer.

Source Water Protection Area – The area around a raw water source that is significant with respect to recharge of the water source reservoir (e.g., aquifers, rivers, or lakes). For groundwater wells, this area represents the regions that are immediately adjacent to the wellhead and extend a discreet distance away from the wellhead (e.g., the recharge area for the well). For surface water supply sources, this area represents the watershed or drainage basin that feeds directly into the source reservoir or stream. Every water supply intake device will have unique parameters that affect the size of the source water protection area. The Missouri Department of Natural Resources developed preliminary source water protection areas for all public water system raw water intake devices through the Vulnerability Assessment project. Additional modeling or monitoring is the most effective method for improving the accuracy of delineated source water protection areas.

Surface Water – All water which is open to the atmosphere and subject to surface runoff. This includes all tributary streams and drainage basins, natural lakes, and artificial reservoirs above the point of the water supply intake.

Susceptibility Determination – The level of risk of a drinking water source to contamination from known or potential contaminants (regulated or unregulated). During the Vulnerability Assessment project, preliminary susceptibility determinations were performed for all public water supply sources in the state by the Missouri Department of Natural Resources.

Treated Water - Water which is handled or processed in any manner to change the physical, chemical, biological, or radiological content and includes water exposed to the atmosphere by aeration.

Underground Injection Control Program – A program to prevent injection activities from endangering underground sources of drinking water.

Vulnerability Assessment (source water) – An analysis of the susceptibility of a drinking water source to contamination from synthetic organic chemicals. The Missouri Department of Natural Resources has performed preliminary vulnerability assessments for all public water systems in Missouri.

Watershed – A land region draining into a single river or other body of water. A group of watersheds that drain into a major water body is often referred to as a drainage basin.

Watershed Approach - A watershed approach is a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both groundwater and surface water flow characteristics.

Water Supply Source - All sources of water including wells, infiltration galleries, springs, reservoirs, lakes, streams, or rivers from which water is derived for public water systems, including the structures, conduits, pumps, and appurtenances used to withdraw water from the source or to store or transport water to the water treatment facility or water distribution system.

Wellhead Protection Area – The surface and subsurface area surrounding a well or well field, supplying a public water system, through which contaminants are reasonably likely to travel to contaminate a source.

ACRONYMS

AFO - Animal Feeding Operation

AgNPS - Agricultural Non-Point Source (pollutant)

APCP - Air Pollution Control Program (Division of Environmental Quality, MDNR)

ASDWA - Association of State Drinking Water Administrators

AST - Above ground Storage Tank

AWWA - American Water Works Association

BMP - Best Management Practice

CAFO - Concentrated Animal Feeding Operation

CCR - Consumer Confidence Report

CFR - Code of Federal Regulations

CRP - Conservation Reserve Program

CSR - Code of State Regulations

DEQ - Division of Environmental Quality (MDNR)

DGLS - Division of Geology and Land Survey (Division of Environmental Quality, MDNR)

DHSS - Missouri Department of Health and Senior Services

EER - Emergency Environmental Response (Field Services Division, Environmental Services Program, MDNR)

EOP - Emergency Operations Plan

ERP - Emergency Response Plan

ESP - Environmental Services Program (Field Services Division, MDNR)

FSD - Field Services Division (Missouri Department of Natural Resources)

GIS - Geographic Information System

GW - Groundwater

GWUDISW - Groundwater Under the Direct Influence of Surface Water

HUC - Hydrologic Unit Code

HWP - Hazardous Waste Program (Division of Environmental Quality, MDNR)

ID - Identification

KCRO - Kansas City Regional Office (MDNR)

LRP - Land Reclamation Program (Division of Environmental Quality, MDNR)

LUST - Leaking Underground Storage Tank

MCL - Maximum Contaminant Level

MCLG - Maximum Contaminant Level Goal

MDA - Missouri Department of Agriculture

MDC - Missouri Department of Conservation

MGD - Million Gallons per Day

MRWA - Missouri Rural Water Association

MoCREP - Missouri Conservation Reserve Enhancement Program

MoDNR - Missouri Department of Natural Resources

MTBE - Methyl Tertiary Butyl Ether

NERO - Northeast Regional Office (MDNR)

NRCS - Natural Resources Conservation Service

NPL - National Priorities List

NPS - Non-Point Source (pollution)

NRWA - National Rural Water Association

PCB - Polychlorinated Biphenyl

PDWB - Public Drinking Water Branch (formerly PDWP; Division of Environmental Quality, Water Protection Program, MDNR)

PDWP - Public Drinking Water Program (reorganized as PDWB in 2004)

PWS - Public Water System

SDWA - Safe Drinking Water Act

SDWIS - Safe Drinking Water Inventory System

SALT - Special Area Land Treatment

SERO - Southeast Regional Office (MDNR)

SLRO - St. Louis Regional Office (MDNR)

SOC - Synthetic Organic Chemicals

SRF - State Revolving Fund

SW - Surface Water

SWAP - Source Water Assessment Plan (Missouri State source water protection plan)

SWCP - Soil and Water Conservation Program (Division of Environmental Quality, MDNR)

SWIP - Source Water Inventory Project

SWMP - Solid Waste Management Program (Division of Environmental Quality, MDNR)

SWP - Source Water Protection

SWPA - Source Water Protection Area

SWPP - Source Water Protection Plan

SWRO - Southwest Regional Office (MDNR)

TOT - Time-of-Travel

UMEX - University of Missouri Extension

USDA - United States Department of Agriculture

USEPA - United States Environmental Protection Agency

USGS - United States Geological Survey

UST - Underground Storage Tank

VA - Vulnerability Assessment

VOC - Volatile Organic Chemicals

WBID - Water Body Identification Code

WHP - Wellhead Protection

WHPA - Wellhead Protection Area

WHPP - Wellhead Protection Program (Missouri State wellhead protection plan)

WPCB - Water Pollution Control Branch (Division of Environmental Quality, Water Protection Program, MDNR)

WPP - Water Protection Program (Division of Environmental Quality, MDNR)

WQCC - Water Quality Coordinating Committee

WRC - Water Resources Center (Office of the Director, MDNR)