SOURCE WATER PROTECTION PLAN

Headwaters of East Locust Creek

Prepared for the North Central Missouri Regional Water Commission

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Contents

Approval of Source Water Protection Plan for Headwaters of East Locust Creek

Source Water Protection Working Group

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Robert Jaques	Robert Jaques
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PRIMARY CONTACT FOR PLANNING

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EXECUTIVE SUMMARY

The 49 square mile Headwaters of East Locust Creek HUC-12 (HELC) Watershed sits 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 (NCMRWC).

The North Central Missouri Regional Water Commission (NCMRWC) was established in 2001 as part of MDNR's effort to encourage consolidation of water supply resources across north central Missouri, and to phase out small, under-resourced, and inadequate water supply systems. The NCMRWC currently serves Sullivan and Linn counties which are characterized by limited groundwater resources. It is forced to rely on surface water supplies that are presently inadequate during drought conditions. Aside from providing wholesale water to three water districts in Sullivan County, the NCMRWC was also charged with developing a plan to provide a consistent and reliable water resource for the area. A plan was developed to construct a large surface water reservoir in Sullivan County that would supply the county and surrounding region consistently with high quality water. The future reservoir, called the East Locust Creek Reservoir (ELCR), will be located approximately five miles north of the town of Milan, the county seat of Sullivan County. This source water protection plan is unique because both the existing (Elmwood Lake) and future (ELCR) raw water sources are in the HELC. We believe that this is Missouri's first source water protection plan that will begin to address water quality protection prior to construction of a reservoir.

This plan is also the first step towards future source water protection planning efforts. This plan follows the guidelines for a state approved source water protection plan (MDNR 2014). It will not only provide guidance for protecting water quality, but should help reduce treatment costs. The working group consisted of seven members of the community and additional resource professionals.

INTRODUCTION

Goals and Objectives

Clean water is a limited resource. Protection of existing sources is the most prudent way to protect public health and keep water treatment costs to a minimum. This plan will be developed by discussions, data collection and a consensus of both the NCMRWC and the Source Water Protection Working Group listed below. Affiliate members of the working group reviewed and provided expertise related to their various disciplines. The goal of this effort is to develop a preliminary source water protection plan for the NCMRWC to protect and improve water quality in Elmwood Reservoir and the headwaters of East Locust Creek.

Specific objectives of this plan are:

a. To give local stakeholders the opportunity to guide us towards water quality protection practices that are likely to 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 existing watershed, water quality and quantity conditions.

d. To serve as a foundation for future source water protection efforts including a 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 that will 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 assist in developing a coalition of partners to assist with source water planning efforts of the NCMRWC.

This plan will be a "living document" that changes over time to best serve the NCMRWC and its customers.

System and Source Overview

The North Central Missouri Regional Water Commission (NCMRWC) 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 NCMRWC serves Sullivan and Linn counties which are characterized by limited groundwater resources. It is forced to rely entirely on surface water supplies that are presently inadequate during drought conditions. Aside from providing wholesale water to three water districts in Sullivan County, the NCMRWC was also charged with developing a plan to provide a consistent water resource for the area. A plan was developed to construct a large surface water reservoir in Sullivan County that would supply the county and surrounding region consistently with high quality water. The future reservoir, called the East Locust Creek Reservoir (ELCR), will be located approximately five miles north of the town of Milan, the county seat of Sullivan County. The NCMRWC facilities all lie within Sullivan County, Missouri (Figure 1).

Currently, the NCMRWC provides wholesale drinking water to three buyers, Milan, Green City, and Sullivan County PWSD #1. These buyers provide water to seven communities and 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 Milan Lake (approximately 38 acres). The

Old Milan Lake is also known as the Golf Course or Lake 41. Elmwood Lake drains 6.4 square miles, and the Old Milan Lake drains approximately 1 square mile (MDNR 2000). When lake levels get low, water is pumped from Locust Creek to Elmwood Lake. Under emergency situations, the Commission purchases water from Trenton, MO approximately 25 miles west of Milan. (See Appendix A for more details regarding the NCMRWC system.) 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 lake and water treatment plant will have a maximum capacity of 6.5 million gallons per day (Jones et al. 2016). Land acquisition efforts for the lake are nearly complete.

The NCMRWC uses a conventional surface water two stage coagulation, sedimentation, filtration, and disinfection process. Currently, the source water supplies available to the NCMRWC are inadequate to meet potential demands, especially during a drought. The proposed East Locust Creek Reservoir (ELCR) is in the planning and land acquisition phase. 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. In 2011, the state legislature approved a special "Lake Authority" legislation which gives NCMRWC authority to institute land use restrictions in the watershed of ELCR as needed to protect lake water quality. 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 until such time as specific threats to water quality are identified and collaborative efforts to resolve them are exhausted. For more detailed information regarding the NCMRWC operations, see Appendix A or contact the NCMRWC directly at:

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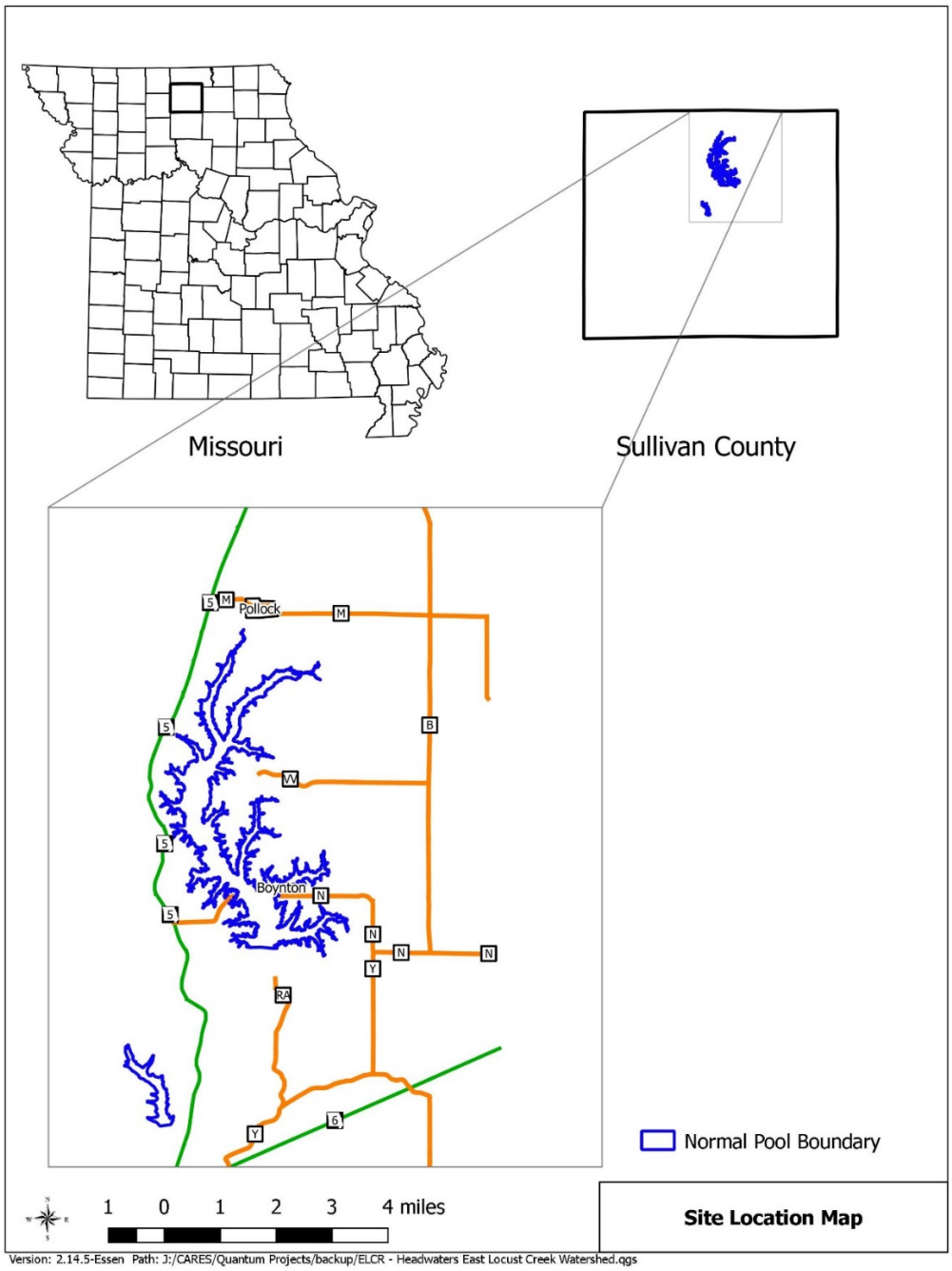

Figure 1. Project area location.

Watershed Overview

The United States is divided into watersheds that are identified by a hydrologic unit code (HUC). The code numbers are based upon a hierarchy that gets more detailed as you go down the system. This numbering system is used by conservation planners to identify drainage areas throughout the country. The Headwaters of the East Locust Creek HUC12 (#102801030601) lies 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, Missouri Department of Natural Resources, and Natural Resources Conservation Service as a priority watershed.

According to Todd et al. (1994), the Locust Creek basin lies in the Dissected Till Plains physiographic region of Missouri. This is a mix of hills and plains 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. 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, in part responsible for the turbid nature of streams in the basin.

The Northwest Missouri groundwater 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.

SOURCE WATER PROTECTION WORKING GROUP

The working group was made up of citizens, known to have an interest in the local water supply. Most live within the source water protection area. The members and their contact information are listed below.

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Affiliate Members

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

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SOURCE WATER PROTECTION AREA

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 working group decided to include the entire hydrologic unit to remain consistent with the grant proposal, rather than seeking an amendment. The watersheds of Elmwood and ELCR will be the priority for management recommendations. The watershed is characterized by steep upland topography. Sloping soils in these areas are subject to severe erosion (NRCS 1995). Pasture and hay are the predominant land use 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 lake, demolition and cleanup efforts are currently underway. (Land use percentages add up to more than 100% due to rounding.)

The NCMRWC does have an intake on Locust Creek (Appendix A). The MDNR Source Water Assessment Report (Appendix B) also includes that watershed. This plan will focus on the Headwaters of East Locust Creek HUC12. Potential contaminant sources above the Locust Creek intake are highlighted.

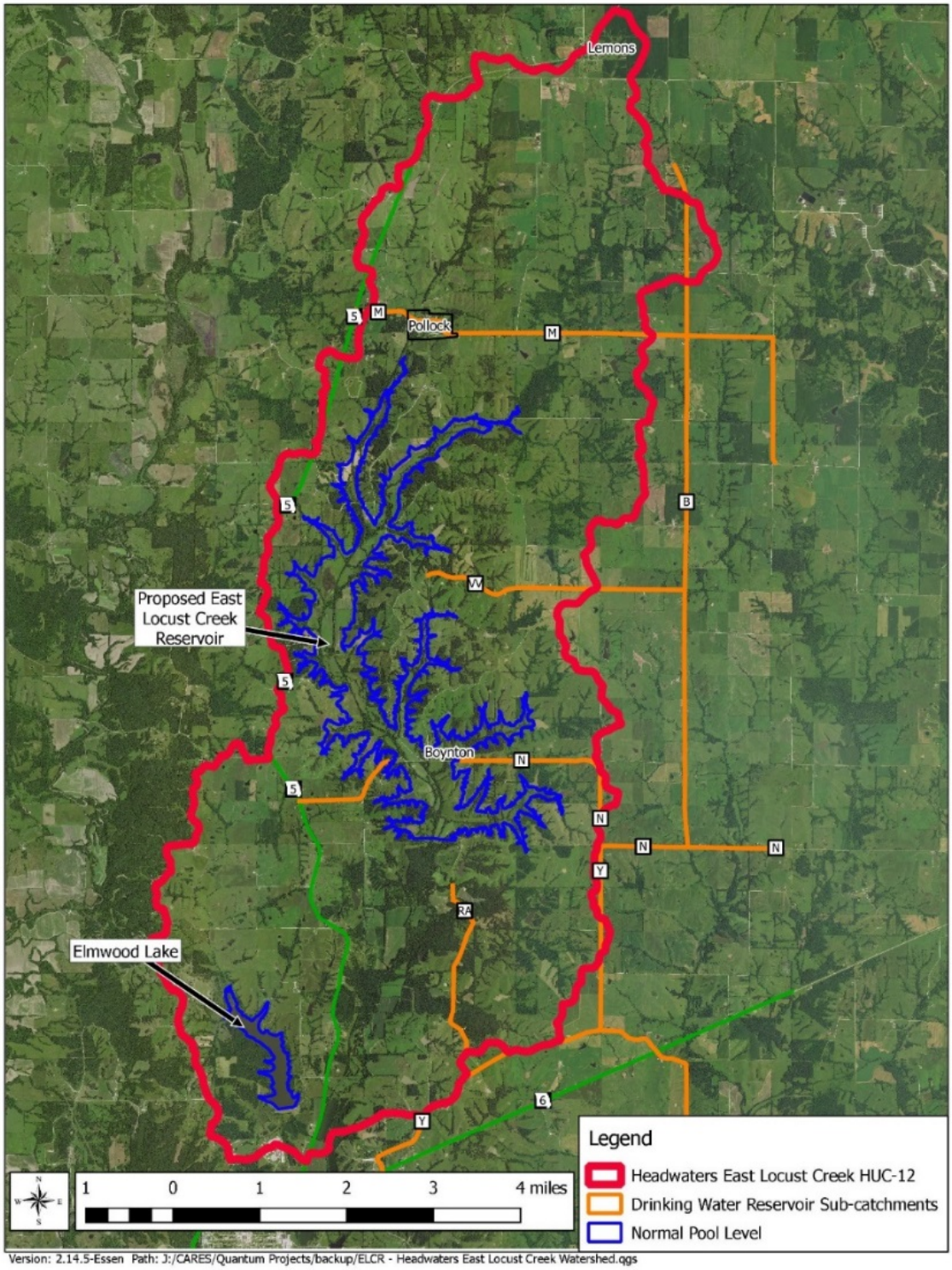

Figure 2. Source water protection area for the North Central Missouri Regional Water Commission.

Elmwood Reservoir

Elmwood Lake is approximately 222 surface acres and drains 6.4 square miles (Edwards et al. 2010). This results in a watershed ratio of 19:1 (Figure 2). The lake has approximately five miles of shoreline.

East Locust Creek Reservoir

ELCR will be approximately 2,352 acres of surface area that drains approximately 36.6 square miles. This results in a watershed ratio of approximately 10:1 (Figure 2). The lake will have approximately 82 miles of shoreline.

Table 1. East Locust Creek Reservoir Watershed Land Use

Area (Ac)	Percent	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)
5,244	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
	=====	
	100.00%	

KNOWN AND POTENTIAL CONTAMINANTS

The quality of the water in reservoirs and streams is determined 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 Missouri Department of Natural Resources (MDNR) provides preliminary online Source Water Assessment Reports for drinking water supplies. The contaminant data for these reports was compiled in 2003 and is not regularly updated. The report for the NCMRWC (Appendix B) contained no listings of potential contaminant sources in the watershed of Elmwood Lake or the Old Milan 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 investigated potential non-point source pollutants in the ELCR watershed (Figure 3).

- Nutrient loading: Small amounts of Nitrogen and Phosphorus can result in nuisance levels of aquatic plants. Algae 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 lake, Lemons does not appear to be a significant threat. Some residences in the Village of 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 lake. 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 does have a small lagoon and aerial reconnaissance indicates that 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.

- Sedimentation: Excessive sediment can result in 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 suggest that much of the watershed has low or moderate potential for sediment loading (Figure 4). However, some of the steeper areas do have a moderate to high potential to contribute sediment to ELCR. The watershed of Elmwood Reservoir had a relatively high percentage of land with the potential to erode sediment at moderate and high rates. This analysis did not look at channel incision. Gullies and streambank erosion are significant sources of sediment throughout north Missouri. Shoreline erosion also has the potential to significantly impact both lakes. Road ditches can be significant sources of

sediment in a watershed. 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. See: https://www.dirtandgravel.psu.edu/ and http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/arkansas/explore/reducing-sediment-from-unpaved-roads.xml .

- *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 associated with communities of Boynton, Pollock, and Lemons: Waste such as asbestos, trash, hazardous household chemicals, etc. are associated with rural communities. There is an abandoned salvage yard in Pollock. An intensive cleanup effort is currently underway in the town of Boynton which will be inundated by ELCR.

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

- Cemeteries: Cemeteries have been found to be sources of leachate, arsenic, and lawn and garden maintenance chemicals. One small cemetery has been identified above but downstream of the intake along Locust Creek (Appendix B). According the working group, 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 NCMRWC (Appendix B).

- Railroad bed and bridges: Elevated levels of arsenic were detected in the abandoned railroad bed that runs through the proposed ELCR. Preliminary sampling does not anticipate arsenic levels to exceed water quality standards, however more intensive sampling will be conducted to validate that assumption. The wooden bridges are also being sampled to determine if they pose a threat to future water quality.

- 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 lake development progresses, the watershed will experience more residential and commercial development. This plan will need to be revisited to address source water issues such as small scale fertilizer and pesticide uses, storm water runoff, and fuel tanks associated with marinas. This plan focuses on current contaminants.

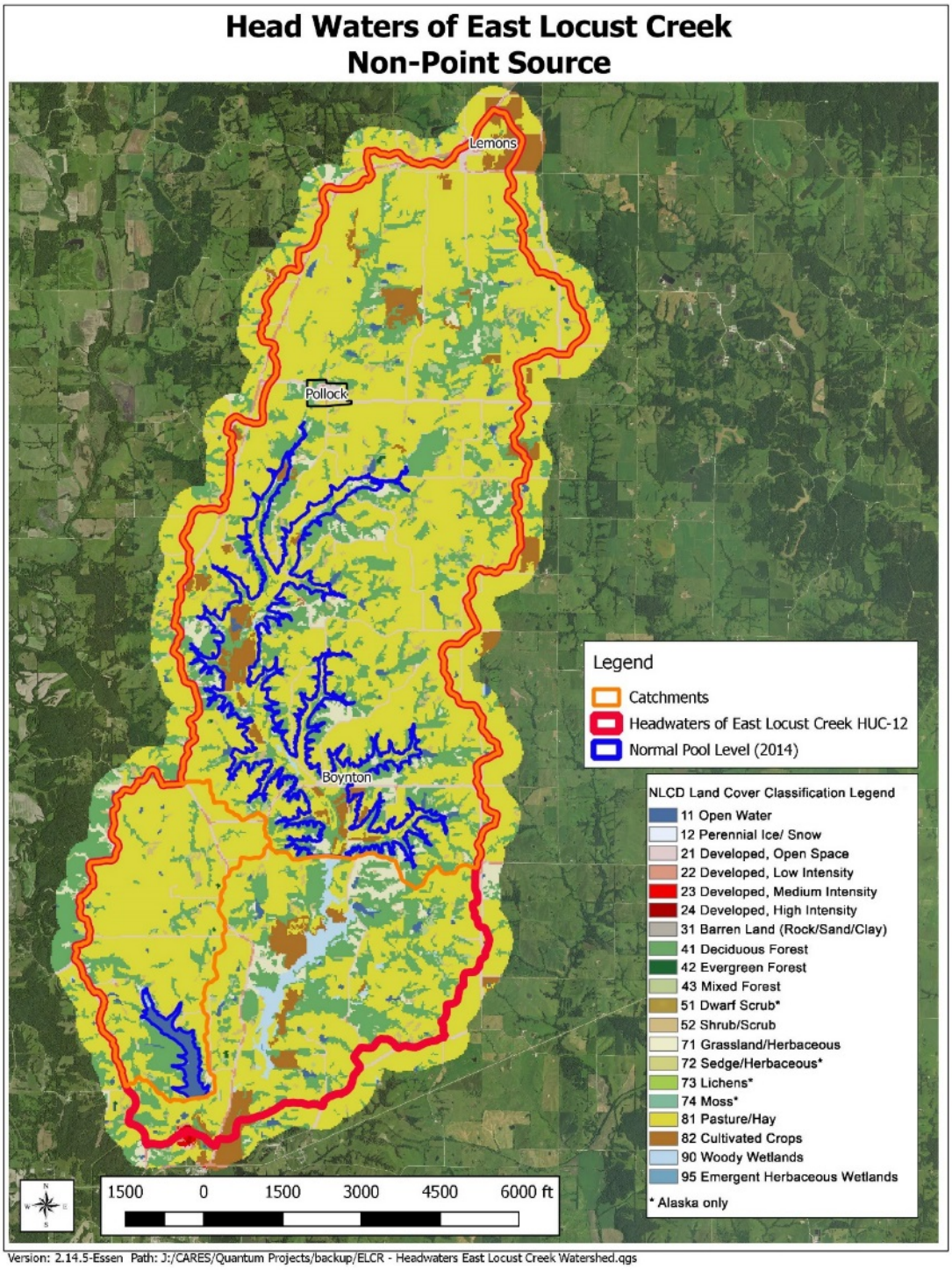

Figure 3. Potential non-point source pollutants in the Headwaters of East Locust Creek HUC12.

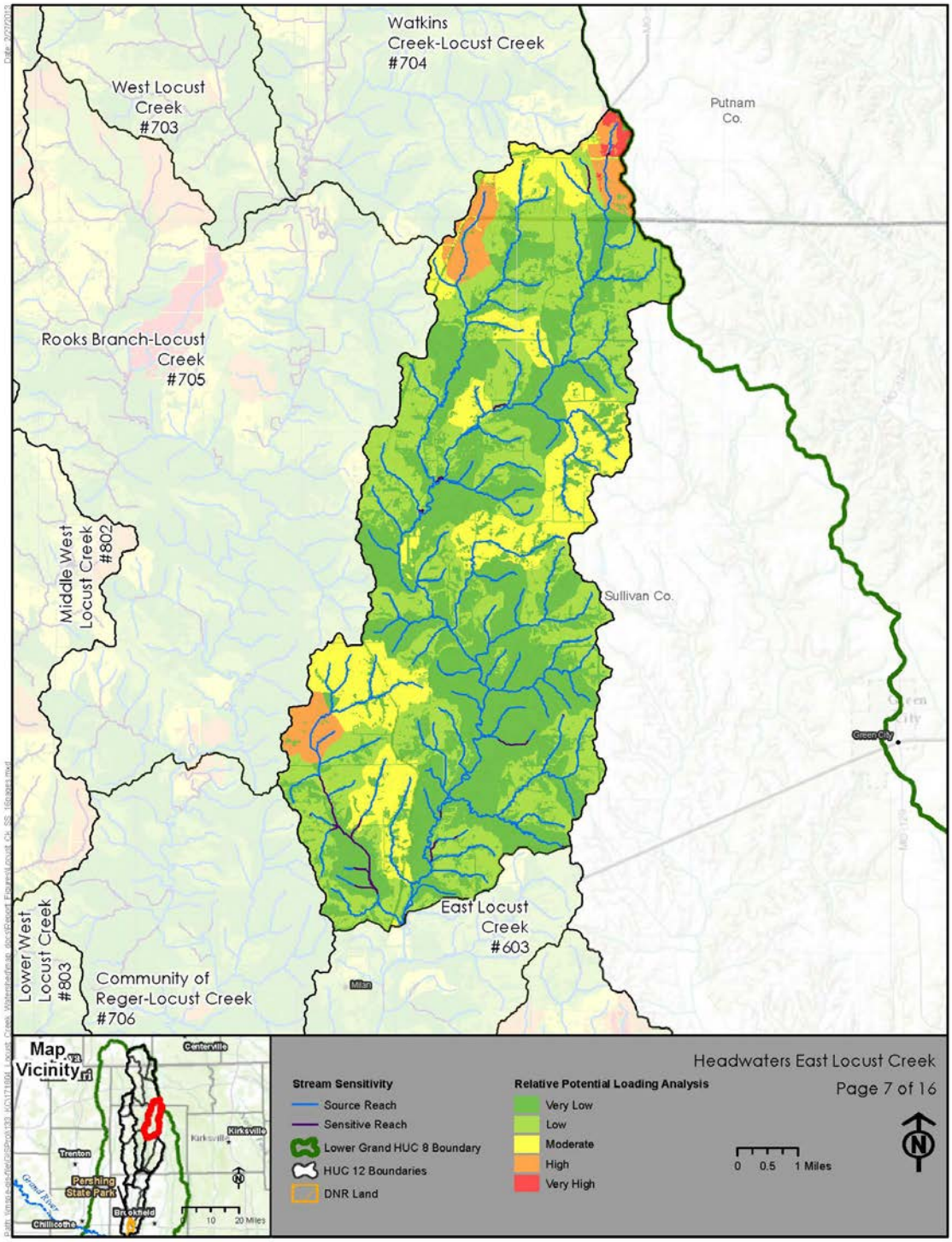

Figure 4. Sediment loading potential for the Headwaters of East Locust Creek HUC12.

SUSCEPTIBILITY OF SOURCE WATERS TO CONTAMINATION AND EMERGENCIES

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. Water is probably the most valuable resource a rural community has. 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 since 1895 indicates that the region is in a 30 year wet cycle and is continuing to get wetter, especially in the winter (Guinan 2016). This is common throughout the Midwest where rainfall events are getting more extreme and the landscape is shedding water faster than it used to (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 and 2012. 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). The recent wet cycle has made many people complacent, but history tells us that the region is still vulnerable to extended droughts.

The MDNR Source Water Susceptibility Report for the NCMRWC (Appendix B) indicates that viruses or microbiological contaminants are consistently detected. It lists NCMRWC source waters as highly susceptible to these types of contaminants. MDNR reports indicate that *E coli* levels exceeds water quality standards for recreational use below Highway N. 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 Reservoir and should not be a cause for concern in the lake. The susceptibility report considers source waters moderately susceptible to above ground fuel storage tanks and cemeteries. Fuel storage tanks are certainly a potential contaminant source that will become more common as development begins around ELCR. Cemeteries are probably not a major threat in the watershed due to their small size and minimal fertilization practices.

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 (BMP's) identified by the

working group and the rest of the community. BMP's to protect source water can include land use controls, regulations and permits, structural/engineered measures, emergency response planning, and public education (MDNR 2014). The best management practices 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 progresses and land use changes in response to its development. Allstate Consultants will be working with the NCMRWC to accomplish the milestones listed below.

Storm Water Runoff

Educate the community about the proper use and disposal of household chemicals, pharmaceuticals, pesticides, herbicides, fertilizers, or other potential contaminants that may be used for landscaping or lawn care.

Inform the public of the hazards of illegal discharging or dumping of automotive fluids, discarded electronic devices, or other equipment (refrigerators, washers, dryers, etc.).

Seek funding for community clean up days in Pollock and Lemons.

Above Ground and Under Ground Storage Tanks

Inform the community of the potential for contamination from above ground and underground storage tanks. Work with local community leaders to determine if abandoned tanks exist and work to properly remove these tanks.

Large- and Small-Scale Fertilizer Applications

Work with local agricultural producers to develop comprehensive nutrient management plans for pastures throughout the watershed.

Inform homeowners of the importance of proper fertilization rates on their lawns and the implications of excessive nutrient runoff to water quality.

Large- and Small-Scale Pesticide Applications

Inform stakeholders such as homeowners, farmers, Highway Department and County employees about the importance of proper application of pesticides and the potential for runoff into the water supply.

On-site Septic Systems

Work with community leaders and the MDNR to ensure that residents of the watershed have adequate working septic systems.

Continue to work toward tying the community of Pollock into the Milan sewer system.

Animal Waste

Work with the Sullivan County Soil and Water Conservation District and NRCS staff to ensure that funding is available for cost-share practices such as fencing, establishing managed grazing systems, and buffer strips.

Sedimentation

Sheet, Rill and Gully Erosion

Work with the Sullivan County Soil and Water Conservation District (SWCD) and NRCS staff to ensure that 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.

Shoreline Erosion

The ELCR planning 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.

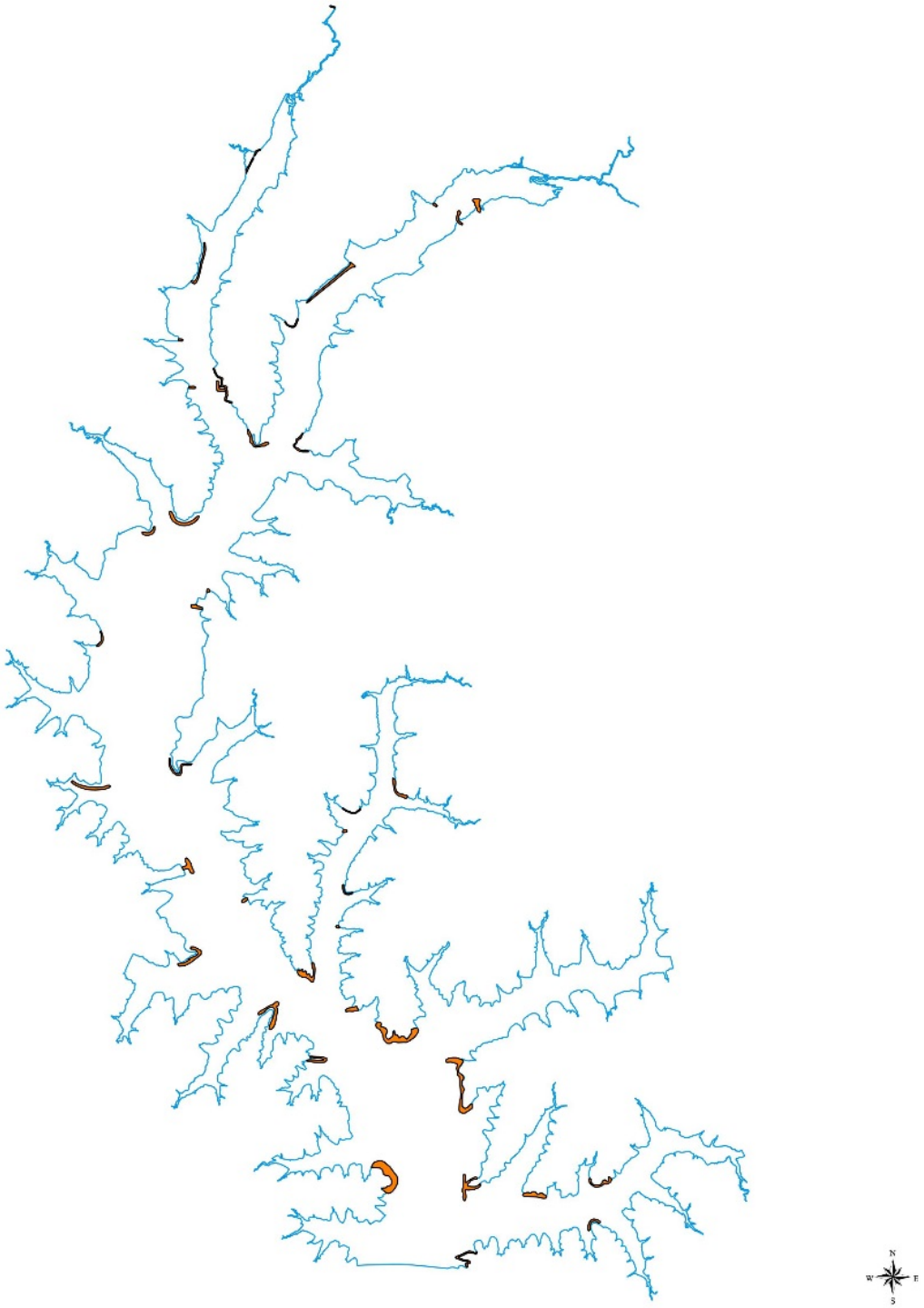

Figure 5. Preliminary Shoreline Protection Areas for ELCR. (Highlighted areas will need special protection.)

CONTINGENCY PLAN FOR WATER EMERGENCIES

Currently, the NCMRWC has a basic emergency operations plan (Appendix C). The working group was concerned that changing this plan would encroach on the authority of the NCMRWC. The group 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.
- Update all contact information in the current emergency operations plan.
- 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 to develop an emergency response plan. Currently, the NCMRWC is not in compliance with this requirement. For more information see: http://dnr.mo.gov/env/wpp/dwsecurity/index.html .

MILESTONES AND TARGET DATES FOR 2017-2018

- Meet with the NCMRWC to present them the Source Water Protection Plan for their approval at their July 2017 meeting.
- Upload the Source Water Protection Plan to the NCMRWC website by July 1, 2017.
- Collaborate with the University of Missouri Extension personnel to update Sullivan County residents on ELCR lake progress and introduce the importance of Source Water Protection at the Sullivan County Fair, July 5-9, 2017.
- Organize clean-up 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 the demolition and clean-up of Boynton by October 2017.
- 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 2018.
- Update NRCS personnel on the details of the final plan and seek opportunities to collaborate by July 1, 2017.

- Meet with the Sullivan County SWCD at their July meeting to discuss the Source Water Protection Plan and ask them to consider these efforts for their 2018 needs assessment.
- Continue ongoing efforts to fund tying the Community of Pollock into the Milan Waste Water Treatment Facility.
- Complete testing of the railroad bed and bridges by October 1, 2017.
- Work with the NCMRWC to ensure compliance contingency planning requirements including the Federal Bioterrorism Act by January 1, 2018.
- Update the NCMRWC on source water planning progress with recommendations for continued progress at their June 2018 meeting.
- Complete nutrient and sediment modelling to estimate potential load reductions for the East Locust Creek HUC12 by October 1, 2018.
- Complete the Water Quality Assurance Plan for ELCR by January 1, 2019.

REFERENCES

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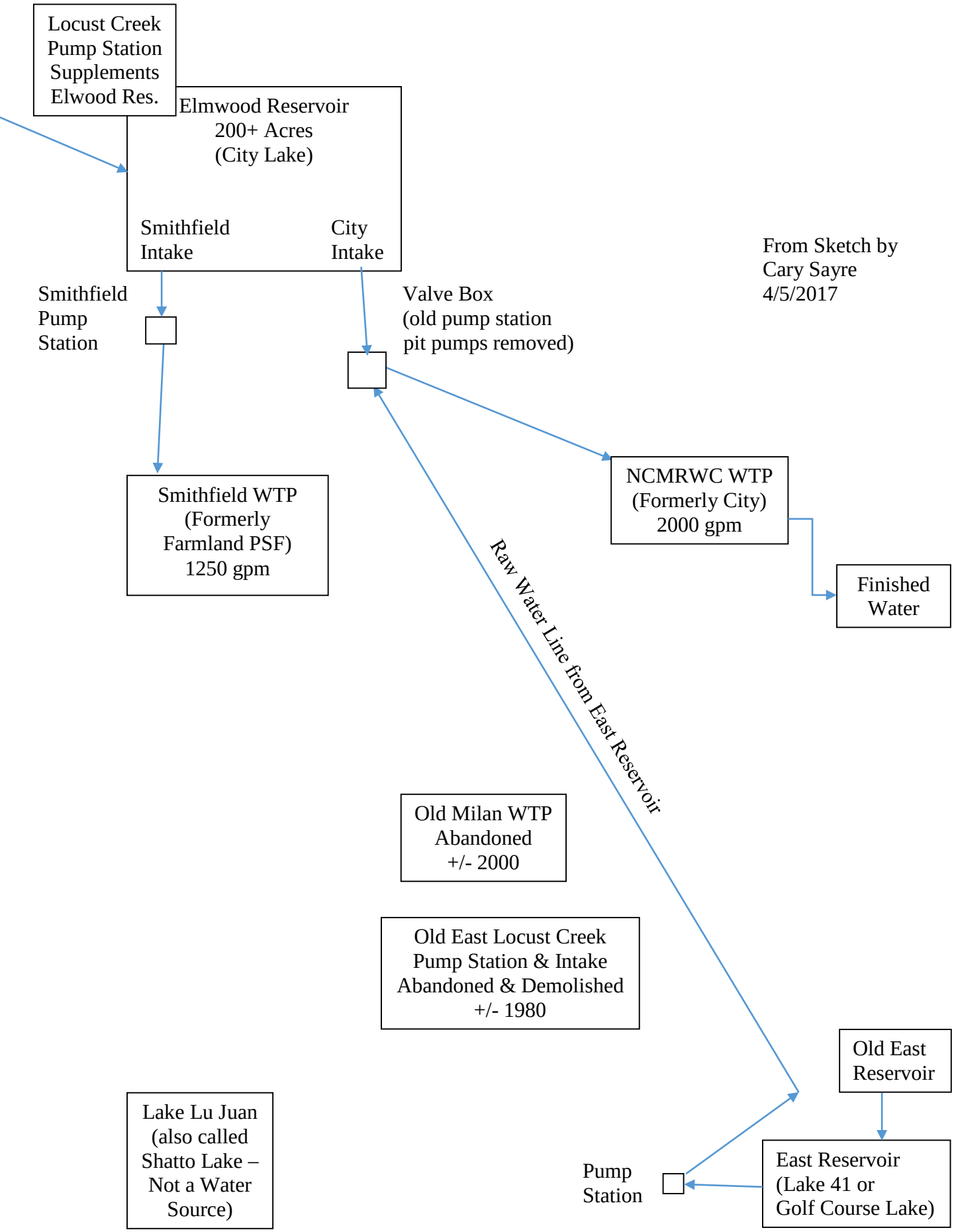
Appendix A. Details regarding the NCMRWC Water System.


Locust Creek Pump Station Supplements Elwood Res.
Elmwood Reservoir
200+ Acres
(City Lake)
Smithfield Intake
City Intake
From Sketch by Cary Sayre 4/5/2017
Smithfield Pump Station
Valve Box
(old pump station pit pumps removed)
Smithfield WTP
(Formerly Farmland PSF)
1250 gpm
NCMRWC WTP
(Formerly City)
2000 gpm
Finished Water
Raw Water Line from East Reservoir
Old Milan WTP
Abandoned
+/- 2000
Old East Locust Creek Pump Station & Intake
Abandoned & Demolished
+/- 1980
Old East Reservoir
Lake Lu Juan
(also called Shatto Lake – Not a Water Source)
Pump Station
East Reservoir
(Lake 41 or Golf Course Lake)

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

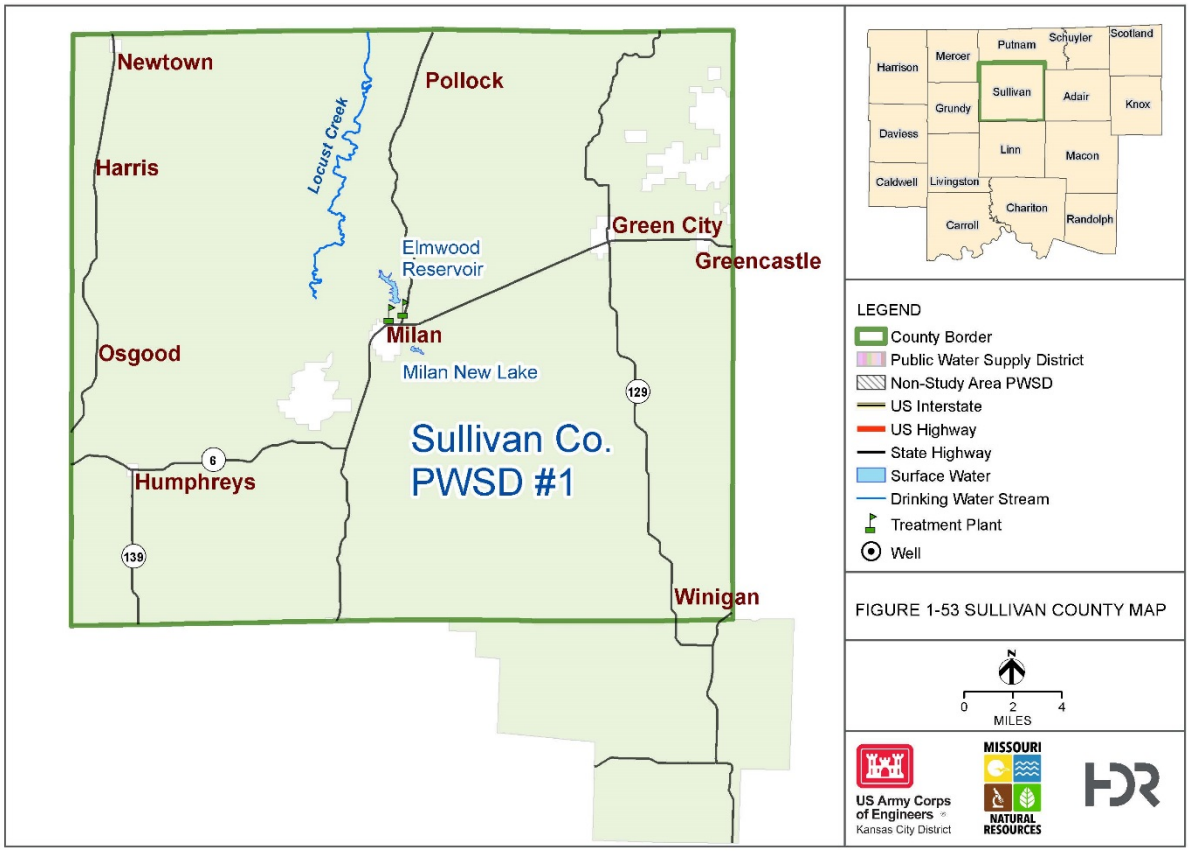
Sullivan County does not have any groundwater sources or systems that purchase groundwater.

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
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MILES
US Army Corps of Engineers
Kansas City District
MISSOURI
NATURAL RESOURCES

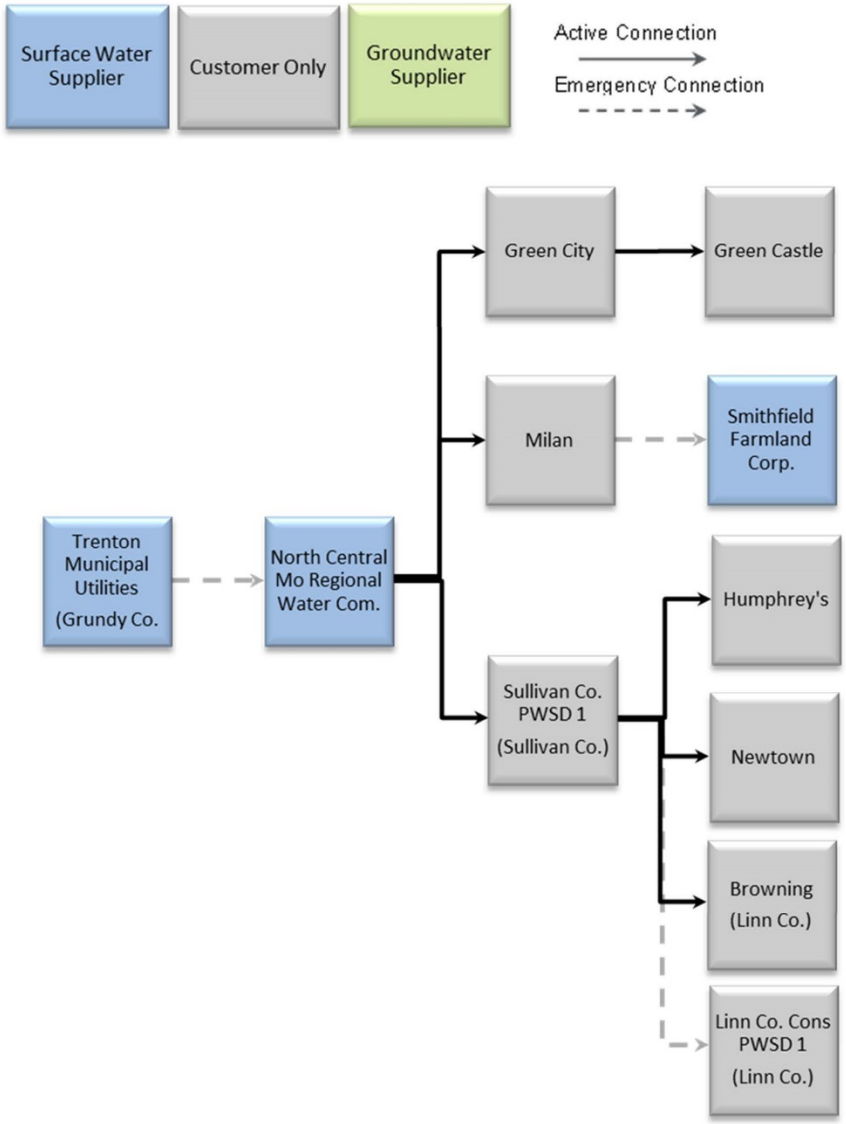


Figure 1-54 Sullivan County Water Suppliers and Customers

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)[1]	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

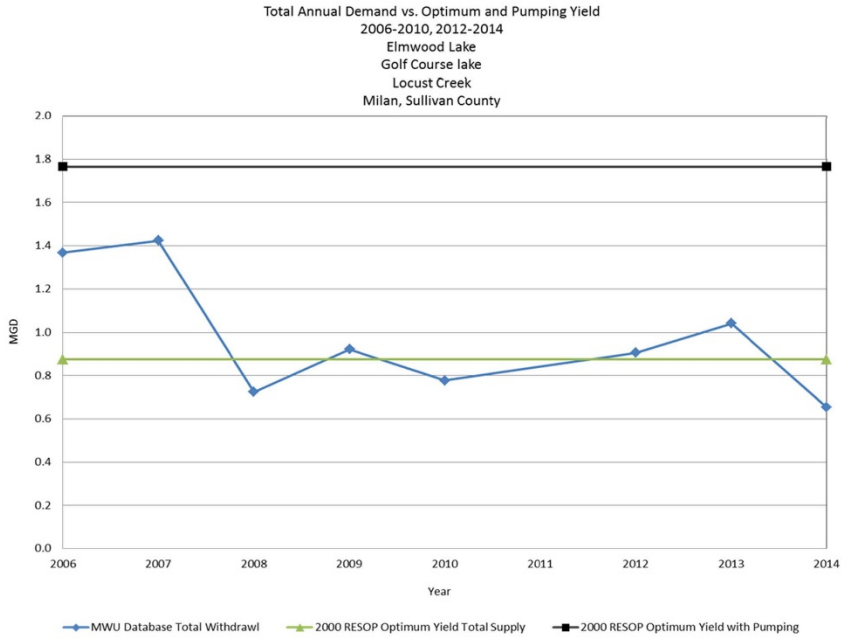
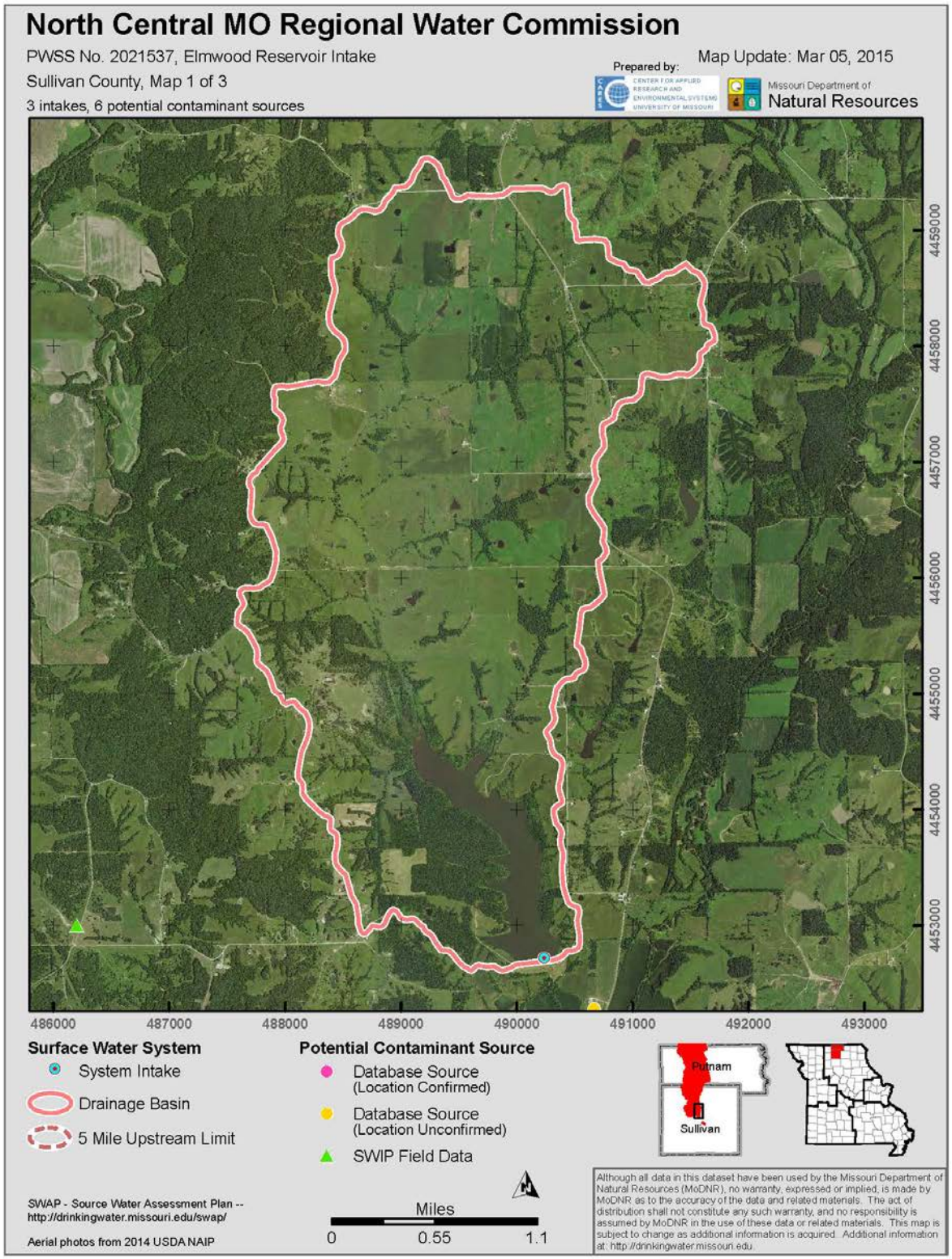


Figure 1-55 Demand Compared to 2000 Calculated Optimum Yield from Elmwood Lake, Golf Course Lake, and Locust Creek

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

Appendix B: 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
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
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SWIP Field Data
Putnam
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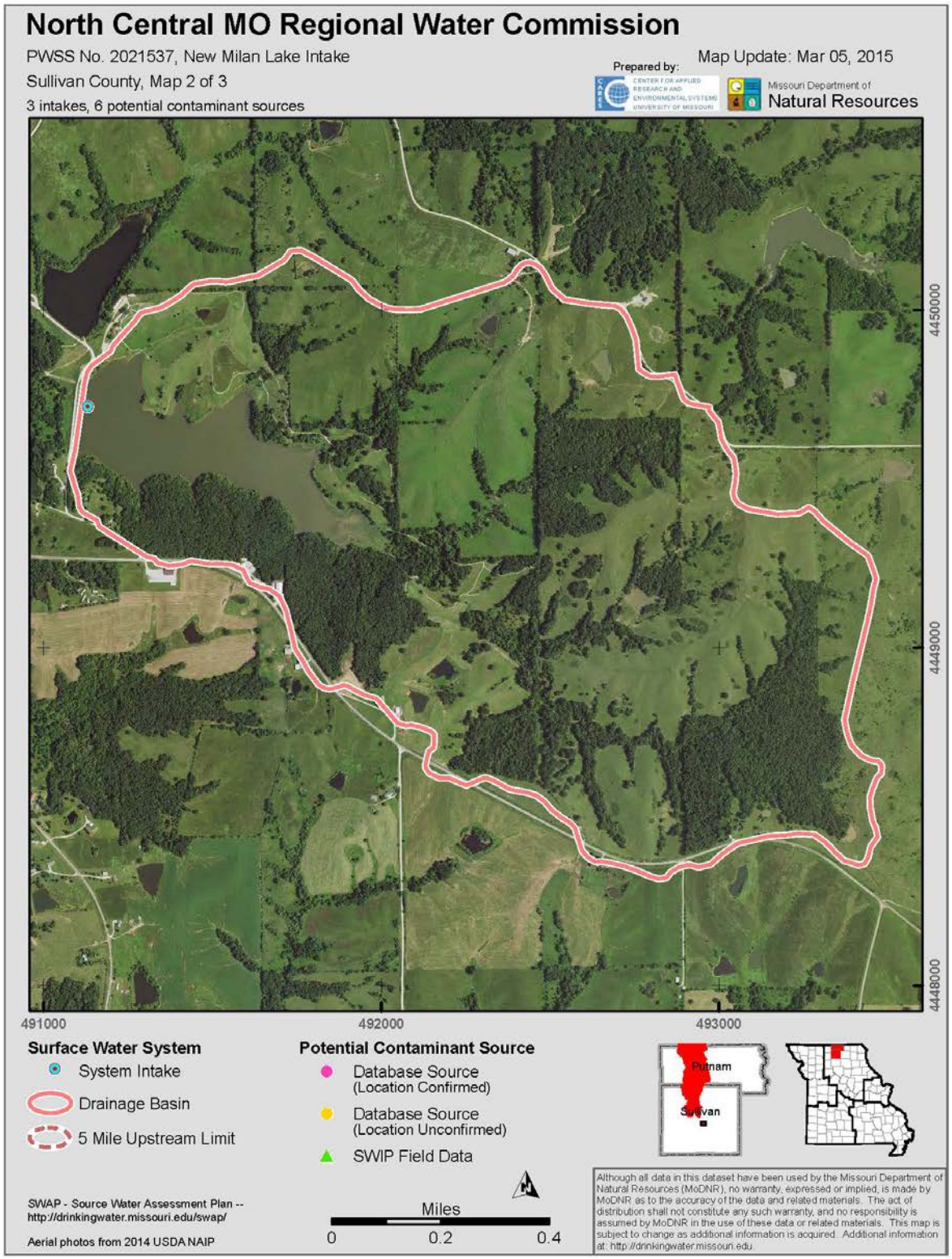
SWAP - Source Water Assessment Plan --
http://drinkingwater.missouri.edu/swap/
Aerial photos from 2014 USDA NAIP
Although all data in this dataset have been used by the Missouri Department of Natural Resources (MoDNR), no warranty, expressed or implied, is made by MoDNR as to the accuracy of the data and related materials. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by MoDNR in the use of these data or related materials. This map is subject to change as additional information is acquired. Additional information at: http://drinkingwater.missouri.edu.


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
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SWAP - Source Water Assessment Plan --
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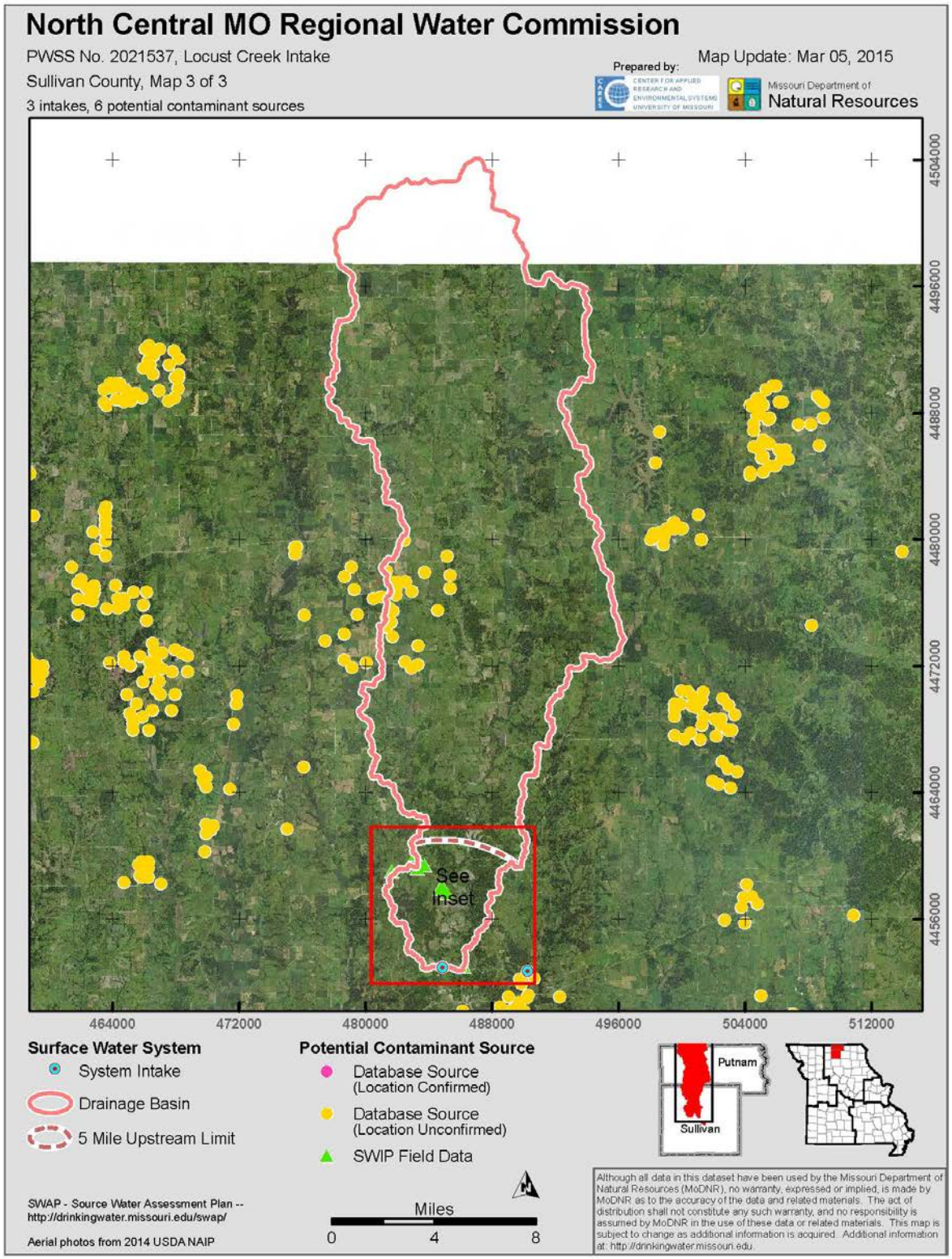
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3
3 intakes, 6 potential contaminant sources
Prepared by:
Map Update: Mar 05, 2015
Missouri Department of
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SWAP - Source Water Assessment Plan -- http://drinkingwater.missouri.edu/swap/
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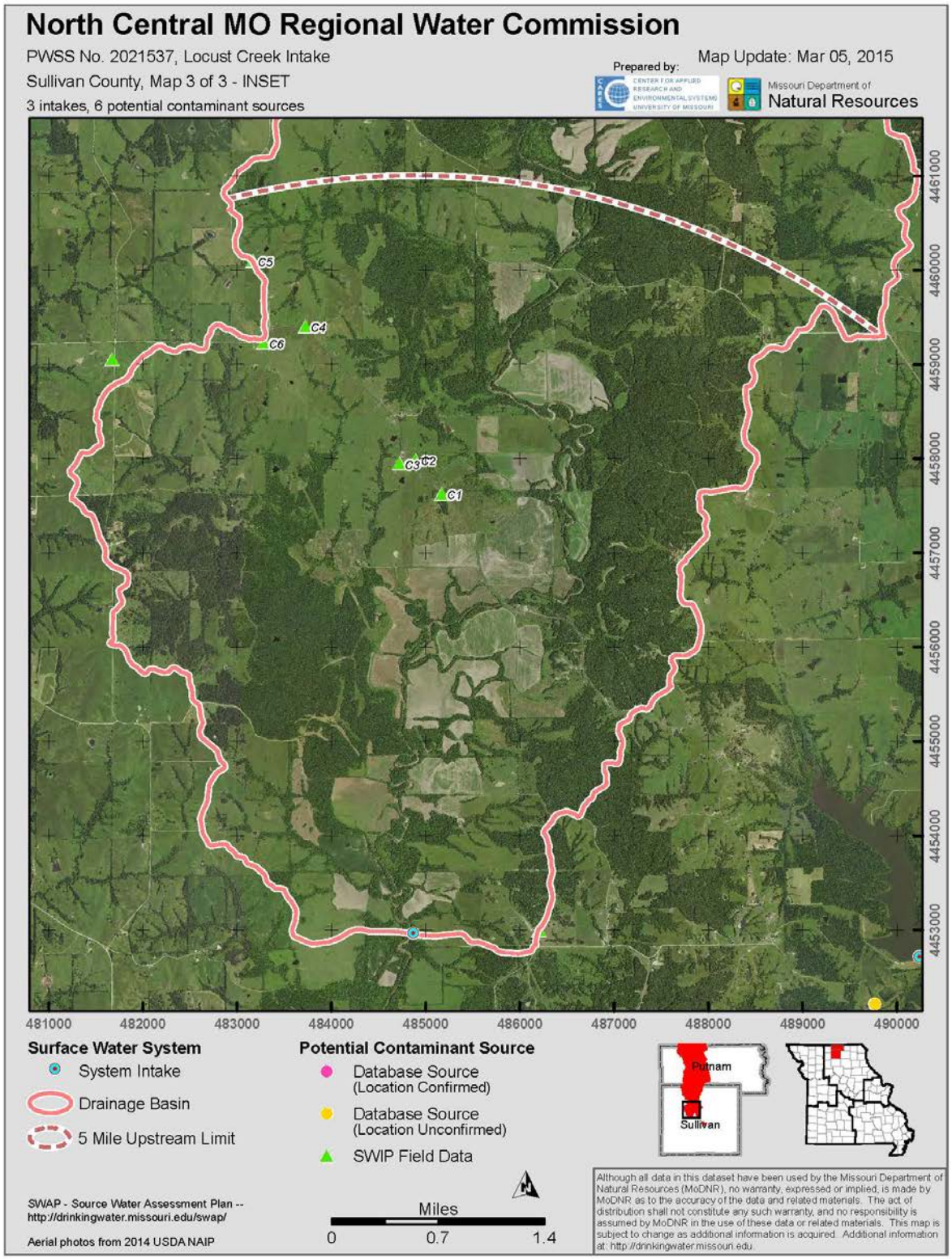
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3 - INSET
3 intakes, 6 potential contaminant sources
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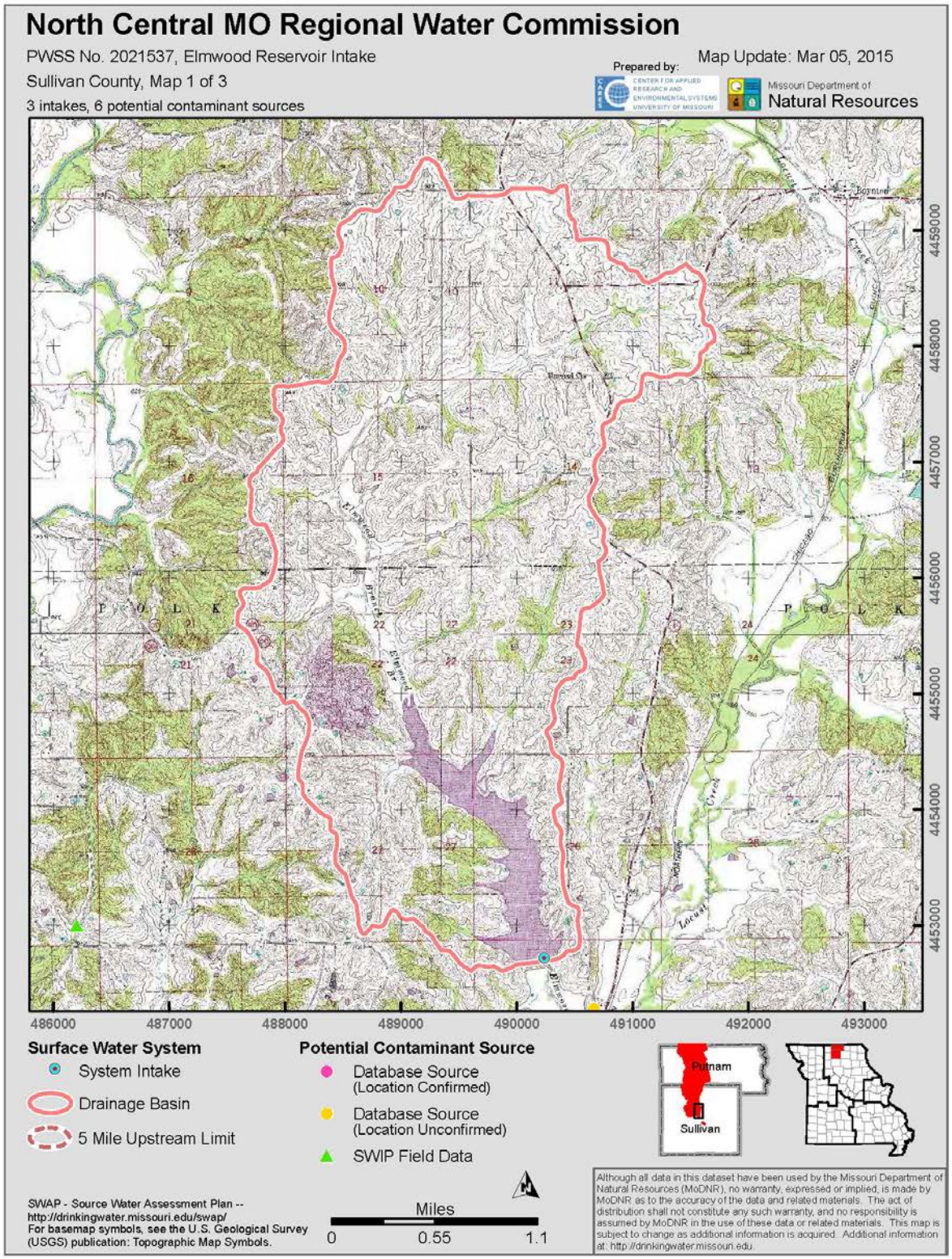
North Central MO Regional Water Commission
PWSS No. 2021537, Elmwood Reservoir Intake
Sullivan County, Map 1 of 3
3 intakes, 6 potential contaminant sources
Map Update: Mar 05, 2015
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SWAP - Source Water Assessment Plan --
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For basemap symbols, see the U.S. Geological Survey
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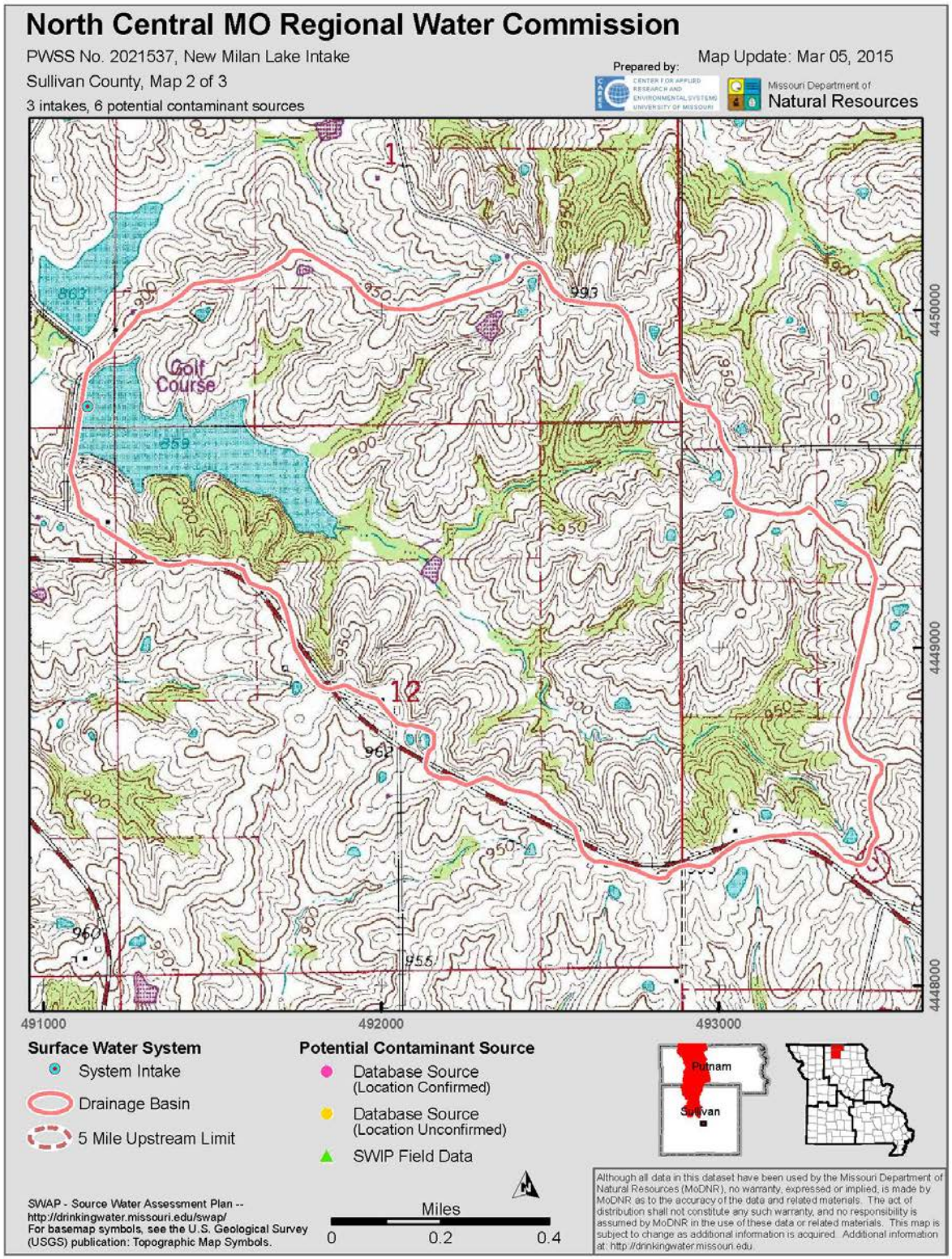
North Central MO Regional Water Commission
PWSS No. 2021537, New Milan Lake Intake
Sullivan County, Map 2 of 3
3 intakes, 6 potential contaminant sources
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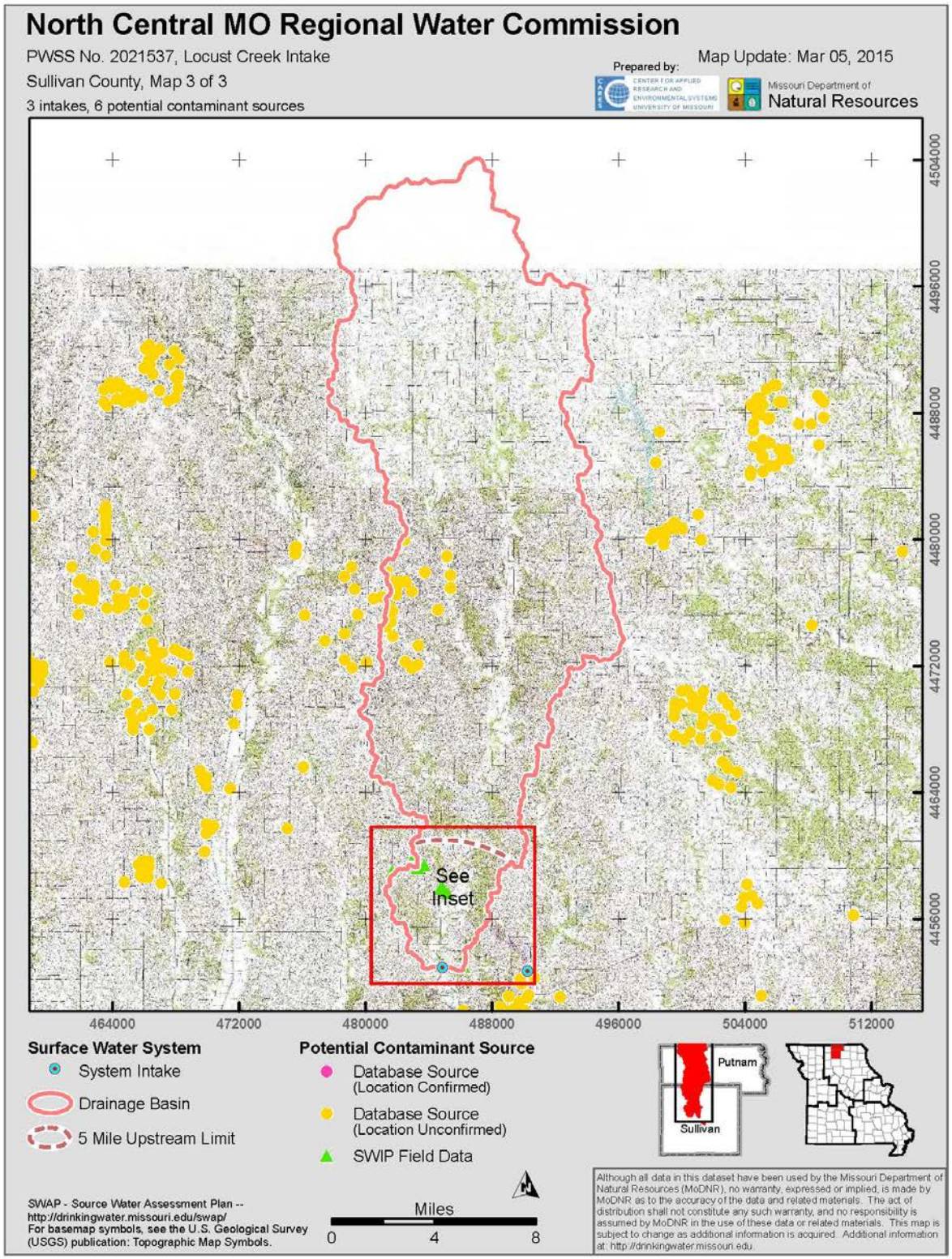
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3
3 intakes, 6 potential contaminant sources
Map Update: Mar 05, 2015
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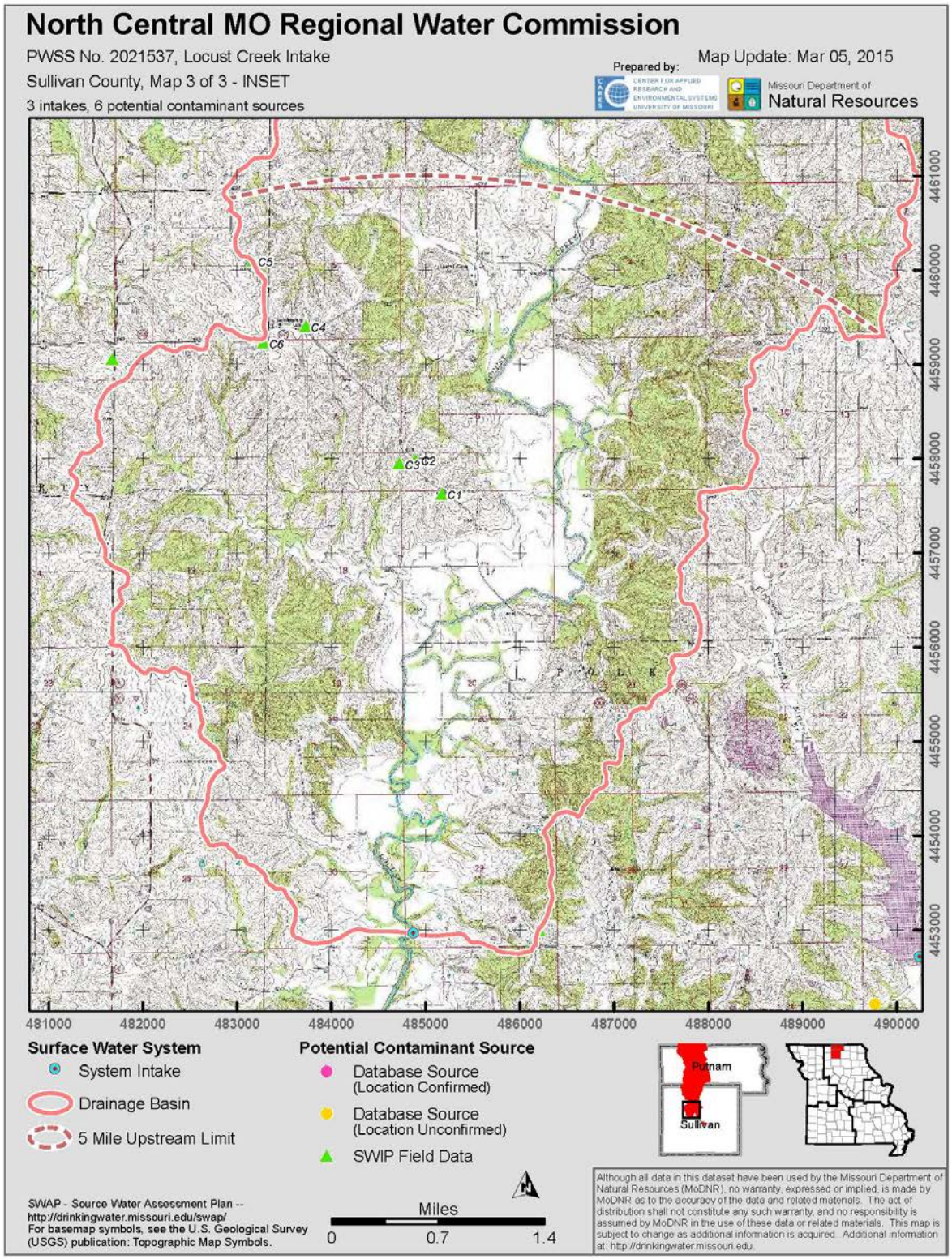
North Central MO Regional Water Commission
PWSS No. 2021537, Locust Creek Intake
Sullivan County, Map 3 of 3 - INSET
3 intakes, 6 potential contaminant sources
Map Update: Mar 05, 2015
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Missouri Department of
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North Central MO Regional Water Commission

PWSS No. 2021537

Sullivan County

3 intakes

Sheet Update: Mar 05, 2015

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

Missouri Department of Natural Resources

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

Sheet Update: Mar 05, 2015

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

Missouri Department of Natural Resources

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

Sheet Update: Mar 05, 2015

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

Missouri Department of Natural Resources

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 C: NCMRWC Emergency Operations Plan

MIKE WARD - OPERATION MANAGER - A-# 940	660-265-3859 660-292-0744
LAWRENCE ALLEN - CHIEF OPERATOR - C-12136	660-946-4328 660-292-1381
J.C MACALISTER - D-9143	660-265-3901
ELLEN HODGE - OFFICE MANAGER	660-265-4448
BRAD SCOTT - MANAGER	816-590-0264
RICK GARDNER - PRESIDENT	660-265-8671
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 MANAGMENT	573-751-9100
STATE LAB	573-751-7929
SULLIVAN CO. LEPC	911
RURAL ELECTRIC COOP	660-265-4404

SUPPLY REPAIR CONTACTS	
REGER ELECTRIC	
THN ELECTRIC	660-665-4598
SIDENER	816-377-0044
HACH CHEMICAL	800-227-4224
BRENTAG CHEMICAL	800-821-7400
AQUA PURE 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 - WATERLINE 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 SUlLLIVAN 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 SULLIVAN RURAL FIRE TRUCKS. SULLIVAN RURAL HAS 3 1200 GALLON TANKS AND 2 1000 GALLON TANKS. TRUCKS SHOULD BE DISINFECTED WITH TWO GALLONS OF BLEACH PER 1,000 GALLONS OF WATER FOR SIX HOURS AND THEN DRAINED AND FLUSHED AND REFILLED.

CHEMICAL HAZARD OR FIRE

THE SULLIVAN COUNTY 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 RURAL 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

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

Rhodes Engineering
401 West Helm
Brookfield, Mo. 64628

ET Archer
324 E. 11111 Suite 2305
Kansas City, Mo. 64106

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

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

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

Dubois Consultants Inc. (MJ3E)
5737 Swope Parkway
Kansas City, Mo. 64130

Akin Gordon & Cowger Engineers Inc. (W"BE)
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 I 00
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, P.E.
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 D: Definitions and 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 - 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.
- 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, Missouri Department of Natural Resources)
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 (Missouri Department of Natural Resources)
DGLS - Division of Geology and Land Survey (Division of Environmental Quality, Missouri Department of Natural Resources)

DHSS - Missouri Department of Health and Senior Services
EER - Emergency Environmental Response (Field Services Division, Environmental Services Program, Missouri Department of Natural Resources)
EOP - Emergency Operations Plan
ERP - Emergency Response Plan
ESP - Environmental Services Program (Field Services Division, Missouri Department of Natural Resources)
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, Missouri Department of Natural Resources)
ID - Identification
KCRO - Kansas City Regional Office (Missouri Department of Natural Resources)
LRP - Land Reclamation Program (Division of Environmental Quality, Missouri Department of Natural Resources)
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 (Missouri Department of Natural Resources)
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, Missouri Department of Natural Resources)
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 (Missouri Department of Natural Resources)
SLRO - St. Louis Regional Office (Missouri Department of Natural Resources)
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, Missouri Department of Natural Resources)
SWIP - Source Water Inventory Project
SWMP - Solid Waste Management Program (Division of Environmental Quality, Missouri Department of Natural Resources)
SWP - Source Water Protection
SWPA - Source Water Protection Area
SWPP - Source Water Protection Plan
SWRO - Southwest Regional Office (Missouri Department of Natural Resources)
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, Missouri Department of Natural Resources)
WPP - Water Protection Program (Division of Environmental Quality, Missouri Department of Natural Resources)
WQCC - Water Quality Coordinating Committee
WRC - Water Resources Center (Office of the Director, Missouri Department of Natural Resources)