

Final

Supplemental Environmental Impact Statement East Locust Creek Watershed Revised Plan



Prepared By:

United States Department of Agriculture
Natural Resources Conservation Service

In Cooperation With:

North Central Missouri Regional Water Commission
Locust Creek Watershed District
Putnam County Commission
Sullivan County Commission
Putnam County Soil and Water Conservation District
Sullivan County Soil and Water Conservation District

Cooperating Federal Agencies:

U.S. Army Corps of Engineers
U.S. Department of Agriculture Rural Development
Federal Highway Administration

December 2020

**DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
EAST LOCUST CREEK WATERSHED REVISED PLAN
SULLIVAN COUNTY, MISSOURI**

PREPARED BY:

U. S. Department of Agriculture - Natural Resources Conservation Service

IN COOPERATION WITH:

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| Sullivan County Soil and Water Conservation District | Sullivan County Commission |

Cooperating Federal Agencies: U.S. Army Corps of Engineers, U.S. Department of Agriculture
Rural Development, Federal Highway Administration

AUTHORITY:

This document was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law (PL) 83-566, as amended (16 U.S.C. 1001-1008).

ABSTRACT:

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) has prepared this draft supplemental environmental impact statement (DSEIS) for the proposed East Locust Creek Watershed Revised Plan. A final environmental impact statement (FEIS) and Record of Decision (ROD) were completed in 2006 (NRCS 2020). This DSEIS is intended to supplement and update information presented in the FEIS, including an expanded alternatives analysis that complies with the National Environmental Policy Act (NEPA) and Clean Water Act Section 404(b)(1) guidelines.

The FEIS and DSEIS identified three project purposes: to provide a public water supply source for a 10-county region of north-central Missouri; to provide water-based recreation opportunities for the same region; and to reduce flood damages along a 22.5-mile reach of East Locust Creek. Lack of a dependable, long-term water supply is a health, safety, and human welfare issue for north-central Missouri. A needs analysis determined that a project is necessary to provide a dependable, affordable water supply that meets an estimated long-term demand of 7 million gallons per day; provides approximately 61,000 user-days of water-based recreational opportunities; and reduces annual flood damages by approximately \$86,800.

This DSEIS considered a wide range of alternatives for each of the three project purposes. Alternatives were screened to determine if they met the project purposes and alternatives were evaluated for impacts to the environment. Alternatives were combined as necessary to meet all three purposes. Multipurpose alternatives considered included East Locust Creek Reservoir and four other reservoir locations, as well as the No Action alternative. Four other reservoir locations were evaluated in combination with the Floodplain Acquisition alternative to meet the three project purposes.

The Preferred Alternative, determined from the analyses in the FEIS and this DSEIS, is the East Locust Creek Reservoir. This alternative creates a 2,328-acre multipurpose reservoir that would meet the project purposes of water supply and water-based recreation in the 10-county region served by the North Central Missouri Regional Water Commission (NCRMWC) and reduces flood damages along East Locust Creek. This alternative was determined in the FEIS to be the National Economic Development alternative. The No Action and Action alternatives were included in a detailed evaluation of potential impacts to social, economic, and natural resources.

COMMENTS AND INQUIRIES:

Comments and inquiries must be received by November 23, 2020. Submit comments and inquiries to: Chris Hamilton, Assistant State Conservationist (Water Resources), Missouri NRCS State Office, 601 Business Loop 70 West, Suite 250, Columbia, Missouri 65203, telephone: 573.876.9416; email: chris.hamilton@mo.usda.gov. USDA is an equal opportunity provider, employer, and lender.

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List of Acronyms

| | |
|---------|--|
| AF | Acre-Foot; Acre-Feet |
| BGEPA | Bald and Golden Eagle Protection Act |
| BMPs | Best Management Practices |
| BVCP | Brownfields Voluntary Cleanup Program |
| CA | Conservation Area |
| CB&Q | Chicago Burlington & Quincy Railroad |
| CCWWC | Clarence Cannon Wholesale Water Commission |
| CFR | Code of Federal Regulations |
| cfs | Cubic Feet per Second |
| COA | Conservation Opportunity Area |
| CPWSD | Consolidated Public Water Supply District |
| CWA | Clean Water Act |
| DNR | Department of Natural Resources |
| DSEIS | Draft Supplemental Environmental Impact Statement |
| DTL | Default Target Level |
| EA | Environmental Assessment |
| EFH | Essential Fish Habitat |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | Environmental Protection Agency |
| ESA | Environmental Site Assessment |
| EWRP | Emergency Wetland Reserve Program |
| FEIS | Final Environmental Impact Statement |
| FEMA | Federal Emergency Management Agency |
| FPPA | Farmland Protection Policy Act |
| FWRs | Floodwater Retarding Structures |
| gpcd | Gallons per Capita Day |
| gpm | Gallons per Minute |
| HEC-HMS | Hydrologic Engineering Center's Hydrologic Modeling System |
| HEC-RAS | Hydrologic Engineering Center's River Analysis System |

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| HHW | Household Hazardous Wastes |
| HUC | Hydrologic Unit Code |
| LEDPA | Least Environmentally Damaging Practicable Alternative |
| MBTA | Migratory Bird Treaty Act |
| MDC | Missouri Department of Conservation |
| MDED | Missouri Department of Economic Development |
| MDNR | Missouri Department of Natural Resources |
| mg/L | Milligrams per Liter |
| MGD | Million Gallons per Day |
| MGS | Missouri Geological Survey |
| MMU | Macon Municipal Utilities |
| MO | Missouri |
| MoDOT | Missouri Department of Transportation |
| MPUA | Missouri Public Utility Alliance |
| MRBCA | Missouri Risk-Based Corrective Action |
| MRWA | Missouri Rural Water Association |
| MSL | Mean Sea Level |
| NASA | National Aeronautics and Space Administration |
| NCMRWC | North Central Missouri Regional Water Commission |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NLCD | National Land Cover Database |
| NOAA | National Oceanic and Atmospheric Administration |
| NOI | Notice of Intent |
| NPDES | National Pollutant Discharge Elimination System |
| NRCS | Natural Resources Conservation Service |
| NRHP | National Register of Historic Places |
| NWI | National Wetlands Inventory |
| NWPM | National Watershed Program Manual |
| O&M | Operation and Maintenance |
| PCC | Project Capital Cost |
| PEM | Palustrine Emergent |
| PER | Preliminary Engineering Report |
| PFO | Palustrine Forest |
| PL | Public Law |
| PPWV | Project Present Worth Value |
| PSS | Palustrine Scrub-shrub |
| PUB | Palustrine Unconsolidated Bottom |
| PWSD | Public Water Supply District |
| RBTL | Risk-based Threshold Levels |
| RCRA | Resource Conservation and Recovery Act |
| RD | Rural Development |
| REC | Recognized Environmental Condition |
| RESOP | Reservoir Operation Study Computer Program |
| RMA | Recreation Market Area |
| ROD | Record of Decision |
| ROW | Right-of-Way |
| RRWA | Rathbun Regional Water Association |
| RUS | Rural Utilities Service |
| SCORP | Statewide Comprehensive Outdoor Recreation Plan |
| SEIS | Supplemental Environmental Impact Statement |

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|-------|---------------------------------------|
| SWPPP | Storm Water Pollution Prevention Plan |
| USACE | U.S. Army Corps of Engineers |
| USC | U.S. Code |
| USDA | U.S. Department of Agriculture |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| WNS | White-nose Syndrome |

SUMMARY

(OFFICE OF MANAGEMENT AND BUDGET FACT SHEET)

Draft Supplemental Environmental Impact Statement (DSEIS) East Locust Creek Watershed Revised Plan Sullivan County, Missouri Missouri Sixth Congressional District

Authority: This document was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law (PL) 83-566, as amended (16 U.S. Code 1001, *et seq.*).

Sponsors: North Central Missouri Regional Water Commission (NCMRWC); Locust Creek Watershed District; Putnam County Soil and Water Conservation District; Putnam County Commission; Sullivan County Soil and Water Conservation District; Sullivan County Commission.

Lead Federal Agency: U.S. Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS)

Cooperating Federal Agencies: U.S. Army Corps of Engineers (USACE), U.S. Department of Agriculture Rural Development (RD), and Federal Highway Administration

Reason for Preparing a Supplement: This draft supplemental environmental impact statement (DSEIS) updates the 2006 final environmental impact statement (FEIS) to satisfy National Environmental Policy Act (NEPA) requirements and to comply with the USACE 404(b)(1) guidelines. The 2006 FEIS is available from the Missouri NRCS website (NRCS 2020).

Proposed Action: The proposed action would create a water supply that meets the project purposes and needs. Water supplied by the proposed action would be transferred by transmission pipelines to Milan, Missouri, which is the location of the existing NCMRWC water treatment plant. Recreational facilities would be created to support recreational opportunities generated by the proposed action, and flood damages would be reduced along the 22.5-mile reach of East Locust Creek between the toe of the dam and the confluence of Locust Creek. Connected actions include modifications and upgrades to the existing water treatment plant over the 100-year reservoir life to support a 7 million gallons per day (MGD) water supply, and water distribution pipelines from the water treatment plant to water systems within NCMRWC in the 10-county region.

Purpose and Need for Action: The sponsor and NRCS have identified three project purposes for the proposed action: water supply, water-based recreation, and flood damage reduction. The NCMRWC and the Missouri Department of Natural Resources (MDNR) have identified the need for an adequate, dependable, and high-quality water supply system for the rural areas and municipalities in a 10-county region of north-central Missouri. This region has been affected by droughts and water shortages several times in the recent past, including the drought of record in the 1950s. In addition, there is a need to reduce damages from flooding on 22.5 miles of East Locust Creek, where localized flooding occurs routinely and where major flooding has occurred in the area in 2010, 2013, and 2014. Furthermore, there is a need to meet the unmet demand for water-based recreational opportunities in the 10-county region.

Description of Proposed Action: The Proposed Action is to build a 2,328-acre multipurpose reservoir located northeast of Milan, Missouri, that would support water supply and water-based recreation for the 10-county region and reduce flood damage along a 22.5-mile reach of East

Locust Creek from the toe of the dam to Locust Creek. The reservoir would provide 7 MGD of water supply and approximately 92,000 annual user-days of recreation. The annual flood damage reduction benefits would total \$86,800. The lake size was adjusted from 2,235 acres in the 2006 FEIS to 2,328 acres in this DSEIS. The change in estimated normal pool size is because of the use of more accurate elevation data to estimate the normal pool size and elevation. The 2006 FEIS used photogrammetry measurements and the DSEIS was based on 2009 lidar measurements. The proposed action includes an earthen dam, normal pool, raw water line, existing water treatment plant with upgrades, road and utilities relocations and improvements, BUILD-funded road improvements, utility corridors, and a water intake structure. A connected action includes water transmission lines to adjoining public water systems.

Resource Information:

Latitude and Longitude: 40.270517 degrees north latitude, -93.081655 degrees west longitude

Hydrologic Unit Code 8-digit Number and Name: 10280103 – Lower Grand

Climate and Topography: The proposed project is located in a continental climate with annual precipitation of approximately 45 inches. The topography consists of undulating hills and flat riparian corridors.

Watershed Size (10-digit Hydrologic Unit Code): 1028010306 – East Locust Creek, 79,500 acres

Current Land Cover in the Hydrologic Unit Code-10 Watershed (Homer et al. 2015):

- Cropland – 6,160 acres
- Grassland – 48,300 acres
- Forestland – 13,900 acres
- Brush, woodland – 5,020 acres
- Wetland – 2,750 acres
- Open water – 1,240 acres
- Urban – 2,030 acres
- Other – 30 acres

Land Ownership (in the 10-county North Central Missouri Regional Water Commission Region):

- Private – 98 percent
- Federal, state, and local government – 2 percent

Population (in the 10-county North Central Missouri Regional Water Commission Region) and Demographics:

The population of the 10-county NCMRWC region is 107,130 (U.S. Census 2010). The population demographics are approximately 96 percent white, 1.5 percent Black or African American, 0.6 percent Asian, 0.2 percent American Indian or Alaska Native, 0.1 percent Native Hawaiian and other Pacific Islander, 0.4 percent some other race, and 1.2 percent two or more races.

Alternative Plans Considered: Alternatives were identified for each individual purpose and then screened to determine if the individual alternative met the individual purpose. Individual alternatives were then combined (if needed) with alternatives from the other purposes to create multipurpose alternatives that met all three purposes and needs. In addition to the No Action alternative and the Proposed Action alternative, the evaluation for purpose and need included 19 water supply

alternatives; 10 flood damage reduction alternatives; three water-based recreation alternatives; and five alternatives for the dual purposes of water supply and recreation. The screening process for each purpose and need is described in the following sections.

Water Supply Purpose

The water supply alternatives were developed after defining the water supply project purpose, which is:

Provide a dependable, affordable, long-term water supply to meet the water demand for the 10-county region of north-central Missouri including Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties.

An additional drinking water source in north-central Missouri is needed to meet the existing and future needs of water suppliers and water users in the region and to provide resiliency against uncertainty in future water demands and climate change.

Alternatives evaluated to meet the water supply purpose included groundwater sources, connections to existing systems, streams and rivers, existing lakes, the creation of a new reservoir, or a combination of these alternatives. A No Action alternative was also evaluated. All the alternatives were screened for their ability to meet the water supply purpose and need by using the following criteria:

- Reliably provide at least 7 MGD average daily demand during a drought equivalent to the drought of record
- Provide a feasibly attainable water supply
- Provide a water supply through the willing participation of stakeholders
- Meet current MDNR Minimum Design Standards for Missouri Community Water Systems

Flood Damage Reduction Purpose

The flood damage reduction alternatives were developed after determining the flood damage reduction project purpose, which is:

Reduce flooding damages by at least 50 percent on 22.5 miles of East Locust Creek above the confluence with Locust Creek.

Alternatives were developed to address the flood damage reduction purpose. Alternatives evaluated included Zoning, Floodplain Acquisition, Conservation Measures, Wetland Storage Areas, Conveyance, Levees and Raising Bridges, Small Detention Dams, and a combination of alternatives. These alternatives were screened by the following criteria:

- Provide at least 50 percent flood damage reduction
- Comply with existing state and federal codes and regulations
- Decrease or maintain current peak flows.

Recreation Purpose

The recreation alternatives were developed after determining the recreation project purpose, which is:

Provide water-based recreation to meet the unmet demand for the 10-county recreation management area including Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties.

Alternatives that were considered to meet recreation needs include creating new stream access, expanding existing public lakes, expanding and improving existing private lake access, and developing an alternative reservoir location. These alternatives were screened by comparing reasonable efforts necessary to implement the alternative while still meeting the purpose and need. Alternatives were screened by the following criteria:

- Allow for fishing and boating/sailing/canoeing/kayaking
- Provide a full range of water-based recreational activities
- Meet or exceed 5 percent (61,000 annual user-days) of the presently unmet annual user-day demand for adequate water-based recreational opportunities
- Be available for public use and have public access, including reasonable parking and walking lanes for access to water-based recreation

Multipurpose Alternatives Considered: Following screening of alternatives that meet the three individual project purposes (water supply, water-based recreation, and flood damage reduction), the alternatives that passed the screening criteria were combined (if necessary) to meet the three purposes for the project. The new alternatives are identified as multipurpose alternatives because they meet all of the three project purposes. The multipurpose alternatives identified and evaluated include the following:

- No Action (Carried forward)
- Proposed Action – East Locust Creek Reservoir (Carried forward)
- Little East Locust Creek Reservoir and Floodplain Acquisition (Eliminated)
- Big Locust Creek Reservoir and Floodplain Acquisition (Eliminated)
- West Fork Locust Creek Reservoir and Floodplain Acquisition (Eliminated)
- Yellow Creek Reservoir and Floodplain Acquisition (Eliminated)

Proposed Action Costs: The Proposed Action 75-year life cycle costs are detailed in Appendix A and are based on a range of assumptions that are used in the alternatives analysis. The funding sources are projected to include:

- 46 percent – USDA – NRCS
- 31 percent – USDA – RD
- 15 percent – Local
- 7 percent – State
- 1 percent – Miscellaneous

The costs breakdown is projected to include:

| | |
|---|----------------------|
| Construction: | \$40,800,000 |
| Engineering: | \$6,400,000 |
| Relocation: | \$5,300,000 |
| Real Property Rights: | \$19,500,000 |
| Operation and Maintenance (nonfederal): | \$4,000,000 |
| Mitigation: | \$7,300,000 |
| Other: | \$19,600,000 |
| TOTAL COSTS: | \$102,900,000 |

Water supply, flood damage reduction, and recreational economic benefits were estimated in accordance with the Water Resources Planning Act of 1965 (Public Law [PL] 89-80), as amended (42 U.S. Code 1962a-2 and d-1), the Watershed Protection and Flood Prevention Act (PL 83-566), as amended (16 U.S. Code 1001-1008), and NRCS policy found in the National Watershed Program Manual (NWPM) (Title 390, Parts 500-506) and the National Resource Economics Handbook, Water Resources Handbook for Economics (Title 200, Part 611). PL 89-80 requires specific methods for calculating benefits and costs that are developed by the U.S Water Resources Council and published in Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. PL 83-566 requires that agriculture and rural communities must account for at least 20 percent of the total benefits of the project. Water Resources Council and NRCS policy requires procedures be used to identify alternative project National Economic Development benefits and National Economic Development costs, using viable alternative solutions consistent with local, regional, and national objectives.

| Comparison of Benefits and Costs 2006 FEIS Discount Rate (5.125%) | | | | | | |
|--|-------------------------|---------------------------------|---------------------|--------------------|---------------------|------------------------|
| Proposed Action | Average Annual Benefits | | | | Average Annual Cost | Benefit/ Cost Ratio |
| | Water Supply Benefits | Flood Damage Reduction Benefits | Recreation Benefits | Total Benefits | | |
| East Locust Creek Reservoir (MA1) | \$3,514,800 | \$83,100 | \$2,652,900 | \$6,250,800 | \$5,721,100 | 1.09 |

| Comparison of Benefits and Costs FY 2020 Water Resources Discount Rate (2.75%) | | | | | | |
|---|-------------------------|---------------------------------|---------------------|--------------------|---------------------|------------------------|
| Proposed Action | Average Annual Benefits | | | | Average Annual Cost | Benefit/ Cost Ratio |
| | Water Supply Benefits | Flood Damage Reduction Benefits | Recreation Benefits | Total Benefits | | |
| East Locust Creek Reservoir (MA1) | \$2,114,900 | \$83,100 | \$2,652,900 | \$4,850,900 | \$3,442,400 | 1.41 |

Proposed Action Benefits: Proposed Action benefits include improved quality of life resulting from installation of an affordable, adequate, and dependable water supply system, reduced flood damages, and increased recreational opportunities.

Water Supply Benefits. The NCMRWC and MDNR have determined that an adequate and dependable water supply is not available to the citizens of north-central Missouri. If the 1950s drought of record occurred today, the water supply could not meet even current demand, much less projected future demand. This inadequacy contributes to the high cost of water as a percent of income in the area, compared to elsewhere in the state of Missouri. Providing affordable, dependable water is a human health, safety, and quality of life issue. The Proposed Action would provide a regional water supply that could reduce costs and provide a dependable water supply during the drought of record. Many water suppliers in the region have closed or face challenges meeting drinking water standards. A regional water system that provides an adequate and dependable water supply would lower costs through economies of scale, meet the current water demand during the drought of record, provide resilience to climate change, promote business

development, and allow for population growth. Though not a project purpose, the Proposed Action may support agricultural water demands.

Water-based Recreation Benefits. The Proposed Action would provide water-based recreational opportunities to help meet the unmet demand in the 10-county region. The Proposed Action will provide all types of boating opportunities, as well as fishing and wildlife recreational opportunities. It also will provide habitat for aquatic and terrestrial species associated with reservoirs. The reservoir will feature a wide range of habitats including open water, shallow mud flats, flooded timber, and lacustrine riparian areas. Warm water fish species such as largemouth bass, walleye, crappie, catfish, and bluegill could be stocked in coordination with the Missouri Department of Conservation (MDC) and would provide fishing opportunities. Avian species including bald eagles, migratory waterfowl, and shorebirds could benefit from the increased variety of aquatic habitats and would provide birding and wildlife viewing opportunities. Increased recreational opportunities can also provide economic benefits by diversifying the local economy to provide visitor services.

Flood Damage Benefits. Flood damages have been documented frequently along a 22.5-mile reach of East Locust Creek above the confluence with Locust Creek. Flooding along this reach has affected the City of Milan, agricultural operations, and infrastructure along this reach. The Proposed Action would reduce flood damages to the municipalities and landowners affected by East Locust Creek flooding, and it would reduce risks to life and property as a result.

Environmental Impacts

This DSEIS evaluates potential impacts from the Proposed Action.

Farmland

Under the Farmland Protection Policy Act (FPPA), federal agencies must identify and consider the adverse effects of federal programs on the preservation of prime or unique farmland. Whenever a federal agency's time or money is used in the direct or indirect conversion of farmland to nonagricultural uses, the agency must report the conversion to USDA on Form AD-1006. Approximately 270 acres of cropland and approximately 1,080 acres of hay and pastureland in the 2,328-acre normal pool would be inundated by the Proposed Action. This totals 1,350 acres, compared with 54,500 acres of total farmland within the East Locust Creek watershed, representing approximately 2.5 percent of the total farmland within the watershed. Approximately 50 acres of prime farmland and 440 acres of farmland of statewide importance would be converted to non-farmland use under the Proposed Action. The East Locust Creek watershed contains 1,170 acres of prime farmland and 10,000 acres of farmland of statewide importance. NRCS is responsible for reporting this conversion on FORM AD-1006.

Forest

The East Locust Creek watershed has approximately 18,900 acres of forest, brush, and woodland habitat. Forestland within the watershed is highly fragmented, consisting mainly of riparian corridors and upland drainageways, with larger blocks of forest greater than 20 acres in size scattered throughout the area. Based on aerial photograph interpretation, the Proposed Action would affect approximately 1,410 acres of forest habitat, which is 7 percent of the forest habitat within the watershed.

Wetlands

Based on the National Wetlands Inventory (NWI) data (USFWS 2020), there are 1,981 acres of wetlands including 635 acres of emergent (herbaceous) wetlands and 1,346 acres of forested wetlands in the 79,500-acre East Locust Creek (HUC-10) watershed. NWI wetlands within the proposed normal pool included 216 acres (11 percent) of wetlands – including 110 acres (17 percent) of emergent wetland and 106 acres (8 percent) of forested wetland.

Wetland delineations within the normal pool were completed in 2015 and 2016 and identified 362 acres, including 273 acres of emergent wetlands, 79 acres of forested wetlands, and 10 acres of scrub-shrub wetlands. Wetland delineations are not available for the East Locust Creek HUC-10 watershed for comparison. Wetlands that are currently or were previously farmed or that are comprised of over 50 percent reed canarygrass (*Phalaris arundinacea*) total 225 acres or 62 percent of the wetland acres in the normal pool. An additional 28 acres of unconsolidated bottom waters (ponds) were also identified. Unavoidable impacts to wetlands resulting from the Proposed Action will be mitigated in accordance with USACE compensatory mitigation requirements.

Streams

The normal pool of the reservoir associated with the construction of the Proposed Action would permanently inundate approximately seven miles of the main stem of East Locust Creek. Based on MDNR stream classification data, there are 200.1 miles of stream (typically excludes ephemeral streams) in the East Locust Creek watershed (CSR 2014). Streams and tributaries within the normal pool were delineated in 2015 and 2016. Approximately 49.1 miles of stream channel including approximately 12.6 miles of intermittent stream, 8.9 miles of perennial stream, and 27.6 miles of ephemeral stream were delineated. A preliminary jurisdictional determination has been provided for the normal pool by the USACE. Stream impacts would result from utilities relocations and road relocations and improvements. A total of 0.2 mile of temporary and permanent road and utility impacts were identified by National Hydrography Dataset (NHD) data.

A portion of East Locust Creek is considered by the State of Missouri to be impaired. East Locust Creek from Pollock to south of Milan is included on the draft of Missouri's 2018 303(d) List of Impaired Waters for low dissolved oxygen and the presence of *E. coli* bacteria.

Changes in flow regime and water temperature below the reservoir may adversely affect aquatic species that are sensitive to these characteristics. Releases from the proposed reservoir will be managed to mimic natural flow conditions to the extent possible. No threatened or endangered aquatic species have been identified for Sullivan County.

Terrestrial Vegetation

Terrestrial vegetation provides habitat for many wildlife species. The most common land cover types that would be affected by the Proposed Action are cultivated cropland, grassland, and deciduous forest. The herbaceous land cover primarily consists of introduced cool-season grass pasture with a substantially lesser acreage of native warm-season grass pasture. The deciduous forest consists of a variety of species including oaks, hickory, and cottonwood.

Wildlife

Typical wildlife for the areas affected by the normal pool includes white-tailed deer, coyote, raccoon, opossum, striped skunk, squirrels, snakes, turtles, and frogs. Forested areas, trees, and brush thickets associated with the riparian corridor may provide nesting habitat for nesting

migratory bird and eagle species. The deciduous forest may provide nesting, foraging, and cover habitat for many species of birds, raptors, bats, deer, coyote, and small mammals. Vegetation removal for construction of the Proposed Action would decrease the amount of upland habitat available in the project area. Mobile species, such as most birds and larger mammals, would be expected to move out of the project area once construction activities commence.

Threatened and Endangered Species

Mead's milkweed (*Asclepias meadii*), Indiana bat (*Myotis sodalis*), and northern long-eared bat (*Myotis septentrionalis*) are the federally listed species for Sullivan County. The plains spotted skunk (*Spilogale putorius interrupta*) is a state-listed species in Sullivan County. Mead's milkweed surveys for the area of the normal pool were conducted through field verification. The field verification did not identify any occurrence of the species. Several surveys were conducted to determine the presence of Indiana bat and northern long-eared bat within the project area. Survey methodology included acoustic monitoring, mist netting, radio tracking, emergence counts, and bat habitat assessments. These studies concluded that Indiana bats and northern long-eared bats are present within the proposed normal pool, as is Indiana bat foraging and maternity roost tree habitat.

A biological assessment (BA) related to federally listed species has been developed and has been submitted to the U. S. Fish and Wildlife Service (USFWS) and can be found on the NCMRWC website (NCMRWC 2016). Coordination and consultation with USFWS on potential impacts to the bat species have been ongoing and has resulted in a draft Biological Opinion (BO) from USFWS. According to MDC records, no recorded sightings of the plains spotted skunk have occurred within 10 miles of the Proposed Action. MDC coordination has been completed and best management practices were received. No surveys have been recommended.

Major Conclusions: The Proposed Action would address the problems of an inadequate, undependable water supply and unmet demand for recreational opportunities in the 10-county region of north-central Missouri and floodwater damages downstream of the toe of the dam. The water supply and recreational benefits will serve over 100,000 citizens in the 10-county region. Unavoidable environmental impacts have been identified related to dam construction and the inundation of 2,328 acres. Following avoidance and minimization, the adverse impacts to wetlands, streams, and forest habitat resulting from the Proposed Action will be mitigated in accordance with an approved mitigation plan. As identified in the 2006 FEIS, the Proposed Action is the National Economic Development alternative.

Areas of Controversy: No significant unresolved issues or controversies have been identified.

State and Local Project Support: MDNR has expressed support for the Proposed Action. In 2016, MDNR Director Sara Parker Pauley provided a letter of support to the NCMRWC. The letter stated that MDNR expresses, "support of the full design capacity of East Locust Creek Reservoir." Director Pauley also stated, "the Department agrees that the current design yield of 7 million gallons per day is appropriate and should be utilized as the final design capacity for the reservoir" (Appendix B). In 2017, the newly appointed MDNR Director Carol Comer, also provided a letter of support. Director Comer's letter stated, "... the Department agrees that the current design yield of 7 million gallons per day is appropriate and should be utilized as the final design capacity for the reservoir" (Appendix B).

Local citizens supported the project by passing a tax to provide funding for the local share of project costs. In 2010, the citizens of Sullivan County passed a half-cent sales tax increase to provide funding for the Proposed Action. Additionally, the following water systems, individuals, and entities provided letters of support (Appendix B) to the NCMRWC.

- City of Brookfield (Associate Member)
- City of Chillicothe (Associate Member)
- City of Kirksville (Associate Member)
- City of Lancaster (Associate Member)
- City of Marcelline (Associate Member)
- City of Milan (NCMRWC Member)
- City of Princeton (Associate Member)
- City of Trenton (Associate Member)
- Consolidated Public Water Supply District (CPWSD) Number 1 – Linn County (Associate Member)
- CPWSD Number 1 – Schuyler County (Associate Member)
- Macon Municipal Utilities (MMU; Associate Member)
- Public Water Supply District (PWSD) Number 1 – Adair County (Associate Member)
- PWSD Number 1 – Macon County (Associate Member)
- PWSD Number 1 – Mercer County (Associate Member)
- PWSD Number 1 – Putnam County (Associate Member)
- PWSD Number 2 – Chariton County (Associate Member)
- PWSD Number 3 – Linn-Livingston Counties (Associate Member)
- PWSD Number 3 – Chariton and Linn Counties (Associate Member)
- Sullivan County Farm Bureau
- Sullivan County Commission
- Caldwell County Commission
- U.S. Senator Roy Blunt
- U.S. Senator Claire McCaskill
- Under Secretary for Natural Resources and Environment, Robert Bonnie, USDA
- University of Missouri
 - Water Resources Research Center
 - Missouri Climate Center

East Locust Creek Reservoir Administrative Record

The table below is a summary of the Administrative Record of federal and state agency and jurisdictional approvals, notices, and actions to date.

| Date | Record Type | What |
|------------|----------------------|--|
| 1987 | Report Published | Original East Locust Creek Watershed Plan-Environmental Assessment. (Included 49 additional small floodwater retarding structures but no multipurpose reservoir.) |
| 1995 | Report Published | Rhodes Engineering Company Inc. – Preliminary Engineering Report for North Central Missouri Regional Water Supply. |
| 08-01-2003 | Report Published | Burns & McDonnell Water System Feasibility Study – evaluated groundwater, four streams, four existing suppliers, and five reservoir locations. Recommended East Locust Creek Reservoir. |
| 11-01-2003 | Report Published | Burns & McDonnell Water System Master Plan – conceptual design of reservoir and review of environmental impacts. |
| 05-20-2004 | Report Published | Water Use Study of North Central Missouri Regional Water Commission – Report from Department of Natural Resources (DNR), resulted in increased firm yield requirement from 4.5 to 8.5 MGD. |
| 09-22-2006 | Regulatory Decision | Environmental Protection Agency (EPA) publishes a statement in the Federal Register (Volume 71, Issue 184) stating, “EPA’s previous concerns have been resolved; therefore, EPA does not object to the proposed action.” This is regarding the original Environmental Impact Statement (EIS) and the East Locust Creek Watershed Plan. |
| 09-27-2006 | Regulatory Decision | Notice of Intent (NOI) of the Record of Decision to proceed with the installation of the East Locust Creek Watershed Revised Plan was published. This revised plan provided for a firm yield of 7.0 million gallons of raw water per day. |
| 01-01-2007 | Report Published | East Locust Creek Watershed Revised Plan and EIS completed (NRCS 2006) – Reviewed the 2003 Water System Feasibility Study, concurring with its evaluation of 22 alternatives and its further consideration of eight of the alternatives and resulting recommendation for East Locust Creek Reservoir. Then, refined the alternatives analysis with a detailed analysis of four alternatives revolving around the proposed East Locust Creek Reservoir and small floodwater retarding structures. |
| 05-19-2010 | Meeting (Permitting) | Project team met with U.S. Army Corps of Engineers (USACE) district regulatory staff including Mark Frazier and state regulatory staff. |
| 10-01-2010 | Meeting (Permitting) | Allstate consultants and Brad Scott met informally with Jim Ptacek and Ward Lenz to discuss project status. Stream impact factor was first identified as a big issue at this meeting. |
| 10-14-2010 | Meeting (Permitting) | Allstate consultants met with USACE state regulatory staff in Jefferson City, Missouri, to discuss preliminary mitigation numbers. |
| 11-18-2010 | Meeting (Permitting) | The Project team met with EPA for a general project update and discussion. |
| 11-18-2010 | Meeting (Permitting) | Project team met with USACE Kansas City district in Kansas City, Missouri. |
| 12-22-2010 | Regulatory Decision | USACE notified the reservoir team that the Missouri Stream Mitigation Method linear impact factor can be based on the stream segment length instead of on the cumulative total of all affected lengths |
| 03-21-2011 | Meeting (Permitting) | Project team, Natural Resources Conservation Service (NRCS), and USACE met with Colonel Hoffman and left a list of 10 requests. |
| 08-04-2011 | Regulatory Decision | Email from Mark Frazier that contained responses to questions. |
| 01-26-2012 | Meeting (Permitting) | Project team, DNR, and USACE met in Jefferson City, Missouri, to introduce the project to Shelly Carter. Included in the discussion was the need for separate alternatives analysis for each purpose. |
| 10-25-2013 | Regulatory Decision | East Locust Creek Reservoir Preliminary Engineering Report approval letter from DNR. |

| Date | Record Type | What |
|------------------|--------------------------------------|--|
| 03-07-2014 | Meeting (Permitting) | East Locust Creek Reservoir and Little Otter Creek Reservoir teams, NRCS, Green Hills Regional Planning Commission, and DNR met with Colonel Sexton and Mark Frazier in Trenton, Missouri. |
| 11-13-2014 | Regulatory Decision | USACE signed letter agreeing to be a cooperating agency. |
| 12-08-2014 | Regulatory Decision | NOI to start the Draft Supplemental Environmental Impact Statement (DSEIS) process published in the Federal Register. |
| 12-29-2014 | Report Draft Submitted to Regulators | NRCS submitted first draft jurisdictional determination document on a 167-acre subarea. |
| 02-04-2015 | Report Draft Submitted to Regulators | Draft purpose and need section submitted to regulatory agencies (USACE, EPA, U.S. Fish and Wildlife Service [USFWS], DNR, etc.). |
| 02-25-2015 | Comments Received | USACE commented on purpose and need. |
| 02-25-2015 | Meeting (Permitting) | East Locust Creek Reservoir permitting meeting held with regulatory agencies. |
| 03-31-2015 | Meeting (Permitting) | Jurisdictional determination guidance meeting held with USACE and EPA |
| 05-20-2015 | Meeting (Permitting) | East Locust Creek Reservoir Draft SEIS (DSEIS) meeting held with agencies (MDNR, USFWS, EPA, USACE, and NRCS) |
| 5-26 – 5-27-2015 | Meeting (Permitting) | Project team and regulatory agencies (EPA, USACE) field check one region to refine jurisdictional determination process. |
| 07-22-2015 | Report Draft Submitted to Regulators | Revised purpose and need section, screening criteria section, and list of alternatives for consideration submitted to regulatory agencies. |
| 08-06-2015 | Meeting (Permitting) | East Locust Creek Reservoir permitting meeting with regulatory agencies scheduled, but then cancelled to allow more time for review. |
| 08-14-2015 | Regulatory Decision | Letter from U.S. Department of Agriculture (USDA) waived \$341,000 payment in original NRCS contract for inundated PL-566 structures. |
| 09-10-2015 | Comments Received | Comments from USACE on DSEIS received. |
| 09-15-2015 | Regulatory Decision | Mark Frazier sent letter to Harold Deckerd regarding the coordination of reviews of DSEIS. |
| 09-22-2015 | Report Draft Submitted to Regulators | Project team submitted proposed DSEIS review plan to regulatory agencies. |
| 09-25-2015 | Meeting (Permitting) | East Locust Creek Reservoir permitting meeting held with regulatory agencies to discuss coordination. |
| 09-25-2015 | Comments Received | Received comments on the purpose and need from USACE. Comments questioned population projections. |
| 10-08-2015 | Comments Received | Received comments on the purpose and need from EPA. Comments questioned future demand projections. |
| 10-13-2015 | Comments Received | Comments received from EPA on purpose and need section of DSEIS. |
| 01-07-2016 | Report Draft Submitted to Regulators | Revised purpose and need section provided to regulatory agencies. |
| 01-26-2016 | Comments Received | Received comments on the purpose and need from USACE. Included objection to including "7 MGD" in the purpose. |
| 02-08-2016 | Regulatory Decision | Letter from Director of DNR, Sara Parker Pauley, to Brad Scott affirming the state's support of the need for 7 MGD. (Copied to Colonel Sexton.) |
| 02-26-2016 | Comments Received | Received comments on the purpose and need from EPA. EPA requested we remove a specific quantity of water supply from the purpose statement. |
| 02-29-2016 | Meeting (Regulatory) | Aaron Ball and Jim Ptacek discussion. |
| 03-24-2016 | Meeting (Permitting) | Project team and agencies hold conference call to discuss USACE and EPA comments. |

| Date | Record Type | What |
|------------|--------------------------------------|--|
| 09-16-2016 | Meeting (Permitting) | Project teams for East Locust Creek and Little Otter Creek reservoirs and various agencies met with Colonel Guttormsen. |
| 09-19-2016 | Meeting (Permitting) | Met with the U.S. Fish and Wildlife Service. |
| 12-02-2016 | Report Draft Submitted to Regulators | Revised purpose and need section provided to regulatory agencies. |
| 01-09-2017 | Comments Received | Received comments on the purpose and need from USACE. Comments revolve around declining population and potential alternatives for water supply. |
| 01-18-2017 | Comments Received | Received comments on the purpose and need from the EPA. |
| 01-23-2017 | Regulatory Decision | Preliminary Engineering Report approval extension granted by MDNR. |
| 02-08-2017 | Meeting (Permitting) | Teleconference to discuss agency comments with agencies (USACE, EPA, USFWS, NRCS, and MDNR). Project team informed to take the comments under advisement and move forward. |
| 03-10-2017 | Response to Regulatory Comments | North Central Missouri Regional Water Commission (NCMRWC) submitted responses to USACE and EPA comments to the NRCS. I have the letter on Commission letterhead, but not a confirmation of sending. |
| 06-05-2017 | Meeting (Permitting) | NRCS met with Colonel Guttormsen to discuss schedule for East Locust Creek Reservoir and Little Otter Creek projects. Agreed to consider revised schedule and submittal of East Locust Creek Reservoir DSEIS in its entirety instead of a piece at a time. |
| 07-26-2017 | Regulatory Decision | DNR Director Carol Comer sent letter of support affirming the need to design the reservoir for 7 MGD. |
| 10-06-2017 | Meeting (Permitting) | Project team met with USFWS to discuss fence clearing. |
| 10-24-2017 | Meeting (Permitting) | Project team met with USFWS and NRCS to discuss existing Indiana bat maternity roosts on Cunningham property. |
| 01-18-2018 | Comments Received | Comments received on DSEIS from NRCS. |
| 04-11-2018 | Meeting (Permitting) | Project team met with MDNR to discuss source water protection and mitigation. |
| 04-16-2018 | Regulatory Decision | USDA provided draft Letter of Conditions establishing conditions for gap funding of local share of costs. |
| 07-31-2018 | Comments Received | NRCS National Water Management Center provided comments to the project team on the East Locust Creek Reservoir DSEIS |
| 08-23-2018 | Regulatory Decision | DNR approved PER for East Locust Creek Reservoir. |
| 10-04-2018 | Report Draft Submitted to Regulators | Biological assessment submitted to USFWS. |
| 11-14-2018 | Report Draft Submitted to Regulators | DSEIS to submitted to agencies. |
| 11-26-2018 | Regulatory Decision | Letter of approval of multipurpose water resources fund plan. |
| 11-27-2018 | Regulatory Decision | USDA RD – Draft Letter of Conditions – updated |
| 11-27-2018 | Regulatory Decision | Missouri Department of Natural Resources (MDNR) approves of Source Water Protection Plan |
| 01-28-2019 | Report Draft Submitted to Regulators | DSEIS submitted to NRCS – added Rathbun letter |
| 01-31-2019 | Regulatory Decision | USFWS approved clearing for fences. |
| 02-04-2019 | Report Draft Submitted to Regulators | DSEIS submitted to agencies |
| 03-01-2019 | Comments Received | Received DSEIS comments from USACE. |

| Date | Record Type | What |
|------------|--------------------------------------|---|
| 04-16-2019 | Comments Received | Received DSEIS comments from USFWS. |
| 07-11-2019 | Comments Received | Received additional comments on the draft biological assessment from USFWS. |
| 10-11-2019 | Regulatory Decision | NCMRWC approved resolution affirming commitment to meeting USFWS obligations. |
| 10-23-2019 | Report Draft Submitted to Regulators | Biological assessment submitted to USFWS. |
| 12-04-2019 | Comments Received | USFWS commented on biological assessment. |
| 02-14-2020 | Report Draft Submitted to Regulators | Biological assessment submitted to NRCS for distribution to USFWS. |
| 02-28-2020 | Report Draft Submitted to Regulators | Biological assessment and request for formal consultation sent to USFWS. |
| 03-27-2020 | Comments Received | Received comments from USFWS on the biological assessment indicating that USFWS needed a few more things before we can enter consultation. |
| 04-07-2020 | Meeting (Permitting) | Project team met with NRCS and USFWS to discuss biological assessment and consultation. |
| 04-09-2020 | Regulatory Decision | Federal Highway Administration (FHWA) became a cooperating federal agency for the DSEIS. |
| 05-01-2020 | Report Draft Submitted to Regulators | Biological assessment submitted to NRCS for distribution and USFWS for information. |
| 05-12-2020 | Report Draft Submitted to Regulators | DSEIS from NRCS to FHWA, Missouri Department of Transportation (MoDOT), USFWS, USACE, USDA-RD, and EPA |
| 05-20-2020 | Report Draft Submitted to Regulators | Missing appendices from 2020-05-12 DSEIS sent to agencies. |
| 05-27-2020 | Comments Received | EPA comments received on DSEIS. |
| 05-28-2020 | Meeting (Permitting) | Met with NRCS and USACE to discuss DSEIS, mitigation, and construction access. |
| 6-10-2020 | Comments Received | Received USFWS comments on the biological assessment. |
| 6-11-2020 | Comments Received | Comments received from USACE. |
| 6-16-2020 | Meeting (Permitting) | Project team met with USACE to discuss DSEIS and alternatives analysis. |
| 6-16-2020 | Meeting (Permitting) | Project team met with USACE to discuss mitigation. |
| 8-07-2020 | Meeting (Permitting) | Project team met with with Colonel Hannan (USACE), NRCS, and Senator Roy Blunt's staff to provide Colonel Hannan an overview of the project and discuss permitting. |
| 8-13-2020 | Report Published | Final biological assessment sent to NRCS, USDA-RD, and USFWS. |
| 8-19-2020 | Report Draft Submitted to Regulators | DSEIS submitted to USACE. |
| 08-19-2020 | Report Draft Submitted to Regulators | Updated DSEIS submitted to USACE. |
| 08-21-2020 | Meeting (Permitting) | Project team met with NRCS and USACE to discuss permitting and construction access. |
| 08-27-2020 | Meeting (Permitting) | Project team met with NRCS and USACE Planning and Regulatory Division to discuss Garden of Eden mitigation project modelling. |
| 09-07-2020 | Meeting (Permitting) | Project team met with MDNR and NRCS to give an update on the mitigation plan and 401 certification. |

| Date | Record Type | What |
|------------|--------------------------|---|
| 10-23-2020 | Notice of Availability | Notice of availability published on the federal register. |
| 10-23-2020 | Final Biological Opinion | Final biological opinion received from USFWS. |
| 10-01-2020 | Meeting (SEIS) | Project team met with EPA to discuss their comments on the SEIS. |
| 11-02-2020 | Comments Received | Comments received from USDA RD. |
| 11-10-2020 | Public Hearing | NRCS, USACE, NCMRWC, Olsson, and Allstate held a public hearing to address questions and receiving comments on the SEIS and 404 permit application. |
| 11-12-2020 | Meeting (SEIS) | Project team met with NRCS and USDA RD to discuss their comments on the SEIS. |
| 11-30-2020 | Comments Received | Comments received from EPA. |
| 12-02-2020 | Meeting (SEIS) | Project team met with NRCS and EPA to discuss their comments on the SEIS. |

1.0 Introduction and Purpose and Need

2.0 Alternatives Analysis

3.0 Affected Environment and Predicted
Environmental Consequences

4.0 Cumulative and Growth-Inducing Effects

5.0 Comparison of Alternatives and Mitigation

6.0 Compliance and Consultation with Applicable
Laws, Policies, and Plans

7.0 Public Involvement

8.0 References

9.0 List of Preparers

10.0 Distribution List

1.0 Introduction and Purpose and Need

1.1 Introduction

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) has prepared this draft supplemental environmental impact statement (DSEIS) for the proposed East Locust Creek Reservoir (Proposed Action). This DSEIS updates information and analyses contained in the final environmental impact statement (FEIS) for the East Locust Creek Watershed Revised Plan, which was announced in the Federal Register August 11, 2006. A Record of Decision (ROD) was signed September 14, 2006. The NRCS is the lead federal agency and the U.S. Army Corps of Engineers (USACE), Federal Highway Administration (FHWA), and USDA Rural Development (RD) are cooperating federal agencies. The North Central Missouri Regional Water Commission (NCRMWC) is the local project sponsor.

The 79,500-acre East Locust Creek Watershed (Hydrologic Unit Code [HUC] 1028010306) is located in north-central Missouri approximately 30 miles west of Kirksville in Sullivan County (Figure 1.1-1) with small portions of the watershed in neighboring Putnam and Linn counties. East Locust Creek is a tributary to Locust Creek which drains to the Grand River and then to the Missouri River. Several communities are located within the watershed boundary; the largest is the City of Milan, population 1,960 (U.S. Census 2010). Milan is located in the middle of the East Locust Creek watershed. The eastern edge of the incorporated area of Milan is in the floodplain of East Locust Creek; the western part of town extends beyond the western boundary of the watershed.

The recommended plan of the 2006 FEIS identified the Proposed Action, a 2,328-acre multipurpose reservoir located on the main stem of East Locust Creek approximately 4 miles north of Milan. The 2006 FEIS described the reservoir as providing 7 million gallons per day (MGD) of rural water supply, developing water-based recreational facilities, and reducing flood damages.

The Proposed Action will require the discharge of fill material into jurisdictional waters of the U.S., necessitating a permit from the USACE under Section 404 of the Clean Water Act (CWA). The USACE requested that a supplemental environmental impact statement (SEIS) be prepared to evaluate potential alternatives to the Proposed Action in addition to the ones considered in the 2006 FEIS. It is the intent of this SEIS to help the USACE render its permit decision, thus the CWA Section 404(b)(1) alternative analysis requirements are also included as part of the alternative development in this DSEIS.

This DSEIS provides an objective and thorough assessment of reasonable alternatives that meet the project purpose and need and their potential impacts to social, economic, and natural environmental resources. As required by the Section 404(b)(1) analysis for the least environmentally damaging practicable alternative (LEDPA), the supplemental information in this document focuses on complying with the CWA, updating the list of environmental resources, and considering the public interest. The analysis will consider whether alternatives are reasonable and practicable. The Council on Environmental Quality (CEQ) defines reasonable alternatives as alternatives that substantially meet the agencies purpose and need (CEQ 2007); practicable alternatives are “available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes” (EPA 2019). The goal of the analysis

is to identify a reasonable and practicable alternative that meets the project purposes and needs as established in the 2006 FEIS while minimizing impacts to resources.

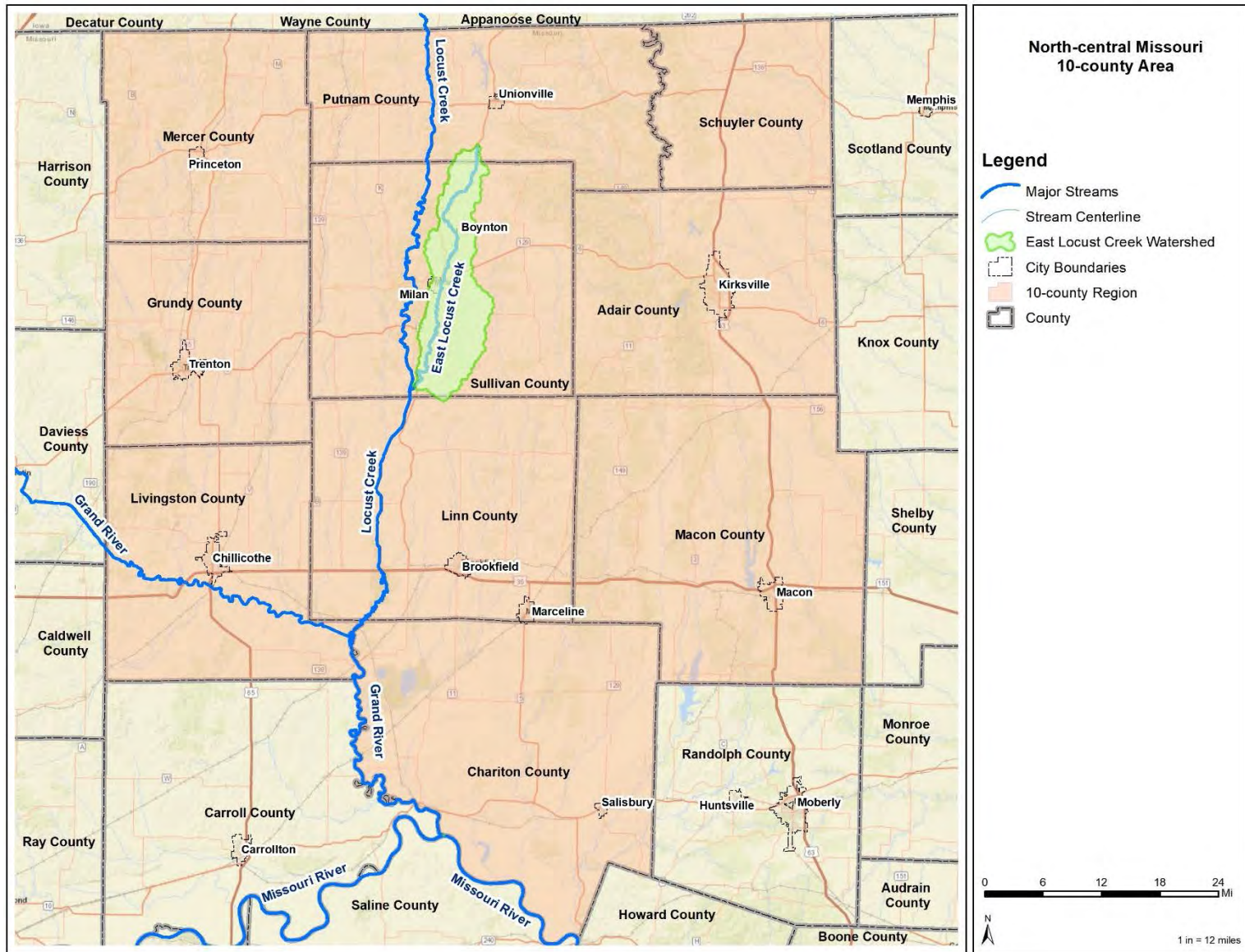


Figure 1.1-1. East Locust Creek Watershed (Hydraulic Unit Code 10), and 10-county Region.

1.2 History and Background

Early Planning

The Sullivan and Putnam counties commissions and the Sullivan and Putnam counties soil and water conservation districts initially applied for federal watershed planning assistance in the East Locust Creek Watershed in 1974. Missouri Governor Christopher Bond approved their application that same year. The U.S. Soil Conservation Service (later renamed and hereafter referred to as NRCS) collected pre-authorization planning data and analyzed the East Locust Creek Watershed as part of the larger 1982 *Northern Missouri River Tributaries Study*.

In March 1984, NRCS began planning activities for the East Locust Creek Watershed under the authority of the Watershed Protection and Flood Prevention Act of 1954, Public Law (PL) 83-566, as amended (USC 2012). NRCS completed the East Locust Creek Watershed Plan-environmental assessment (EA) in 1986. The plan recommended one large and 120 small floodwater retarding structures to reduce soil erosion and flood damages. A finding of no significant impact was published in the Federal Register July 17, 1986. Local sponsors signed the Watershed Agreement in November 1986 and assistance for installation was authorized August 1987.

Federal funding was provided under the PL 83-566 program by the NRCS to reduce flooding damages. Of the 121 small floodwater detention dams planned, 72 were constructed. The structures in East Locust Creek watershed decreased estimated annual crop and pasture flood damages from \$2,200,000 to \$822,300 in 2005 dollars (NRCS 2006). There are seven floodwater detention dams inundated by the proposed East Locust Creek Reservoir and an additional seven dams that will have the normal pool at the downstream face of the existing dams; the seven dams that will retain normal pools will be armored to make sure they remain functional as sediment basins.

Formation of Local Sponsor and 2006 East Locust Creek Revised Watershed Plan

Recognizing that the large lake proposed in the 1986 EA could help meet the regional need for a dependable water supply, in November 2000 the Locust Creek Watershed Board requested an NRCS study to revise the 1986 East Locust Creek Watershed Plan-EA and include a public water supply reservoir. Supporting the need for a dependable regional water supply, the *Missouri Drought Plan* classified the 10-county region as having “severe surface and groundwater supply drought vulnerability” (MDNR 2002).

Following authorization, NRCS began planning activities in July 2003 and completed the East Locust Creek Watershed Revised Plan March 2006. NRCS issued a notice of intent (NOI) to prepare an environmental impact statement (EIS) in September 2004 (Federal Register 2004). The East Locust Creek Watershed Revised Plan found the present water supply systems for the neighboring 10-county region inadequate and vulnerable to drought conditions. In addition, the East Locust Creek Watershed Revised Plan documented annual flood damages to crop and pastureland, fences, roads, and bridges and identified the need for additional water-based recreational opportunities in the surrounding area. The revised plan recommended the construction of a multipurpose reservoir that would provide a water supply, water-based recreation, and flood prevention. The reservoir would be located on the main stem of East Locust

Creek approximately 4 miles north of Milan, Missouri, and would provide 7 MGD of raw water to be treated for public consumption (NRCS 2006).

NRCS announced a ROD to proceed with installation of a multipurpose reservoir September 2006. November 10, 2005, the 109th Congress passed PL 109-97, H.R. 2744, Section 726, which states, "Notwithstanding any other provision of law, the Natural Resources Conservation Service shall provide financial and technical assistance through the Watershed and Flood Prevention Operations program to carry out the East Locust Creek Watershed Plan Revision in Missouri, including up to 100 percent of the engineering assistance and 75 percent cost share for construction of the site...". Subsequently, an agreement between the NRCS and NCMRWC was reached to provide federal funding for land acquisition of East Locust Creek Reservoir. All land for the proposed East Locust Creek Reservoir location has been purchased without the need for condemnation.

The NCMRWC became a local sponsor of the planning effort and in 2003, it contracted with Burns & McDonnell to complete a water system feasibility study. The study developed current and projected water use estimates and evaluated alternative water sources that would allow the NCMRWC to provide water to the area (Burns & McDonnell 2003).

The NCMRWC is a joint municipal utility commission formed in 2001 with assistance from the Missouri Department of Natural Resources (MDNR) "to provide an abundant source of low-cost, pure, quality water for the residents of North Central Missouri" (NCMRWC 2017). The water suppliers that joined to form the commission are the City of Green City, the City of Milan, Public Water Supply District No. 1 of Sullivan County, and the City of Green Castle. Member systems have administrative, operational, capital, and maintenance responsibilities that will ensure the continued health, welfare, and safety of their citizens. Small rural water systems often lack the economic means to adequately meet these responsibilities.

Community water systems may be eligible for state or federal grant assistance if they are determined to be "disadvantaged communities." A disadvantaged community is one with a population of less than 3,300 whose user rates are at or above 2 percent of the median household income (MHI), and the community's MHI is at or below 75 percent of the state average MHI (10 CSR 60-13.020(4)(C)(3)). NCMRWC member systems have been analyzed and determined to meet the threshold for disadvantaged community status.

In 2015, MDNR Water Resources Center published the East Locust Creek Reservoir Water Rate Analysis, which shows the 10-county region as having water rates \$5.26 – \$37.82 higher than the state average water rate (\$27.85 per 5,000 gallons) and MHI's between 15.0 – 26.8 percent below the state average MHI (\$49,109). The rural residential customers of the NCMRWC have lower average household incomes than other areas of the state, yet pay disproportionately more for water.

Since 2010, a half-cent retail sales tax has generated approximately \$240,000 annually. These funds have been applied to the local funding match for project-related expenses not covered by state and federal funding. The NCMRWC is dependent on federal and state financing assistance to develop a dependable water source for its citizens.

Missouri Department of Natural Resources Study and Support

MDNR completed a study in 2004 that set an acceptable range of design yield from 4.5 to 8.5 MGD (MDNR 2004). In 2013, MDNR approved the preliminary engineering report (PER) and said to “proceed toward the construction of the surface water source capable of 7 MGD average daily design flow demand.” An extension of the PER approval was received by the NCMRWC in 2017. MDNR directors have provided four letters supporting the construction of a reservoir in north-central Missouri. Three of the letters were provided by former directors Stephen Mahfood or Sara Parker Pauley (Appendix B), and the latest letter is from current Director Carol Comer (Appendix B). Additionally, Michael Wells, the MDNR deputy director for water resources, wrote a letter in 2010 to the NCMRWC that endorses the Burns & McDonnell Water System Feasibility Study, gives priority to regional water supply systems, recognizes the water supply shortages near Sullivan County, and commends the NCMRWC in developing, “a long-term sustainable water system for the region” (Appendix B).

Former Director Pauley said, “Sullivan County and the north-central Missouri region often experience the most critical water supply shortages in the state.” She also stated, “the department agrees that the current design yield of 7 million gallons per day is appropriate and should be utilized as the final design capacity for the reservoir.” Current Director Comer stated, “surface water supplies in the 10-county region of North Central Missouri are vulnerable to drought, and the use of groundwater in northern Missouri is limited, not only because of a lack of quantity, but also because of its poor quality.” Director Comer also stated, “the Department agrees that the current design yield of 7 million gallons per day is appropriate and should be utilized as the final design capacity for the reservoir” (Appendix B).

Draft Environmental Impact Statement Agency Comments

The DEIS was reviewed by multiple agencies and comments were received and addressed. September 22, 2006, the Environmental Protection Agency (EPA) published a notice in the Federal Register (EPA 2006) related to the 2006 FEIS that stated, “EPA’s previous concerns have been resolved; therefore, EPA does not object to the proposed action.” The Proposed Action has not substantially changed since the 2006 FEIS.

The U.S. Fish and Wildlife Service (USFWS) provided comments related to aquatic resources, endangered species, and specific comments related to the DEIS (USFWS, letter to Mr. Roger A. Hansen, Appendix B in NRCS 2006). The comments related to aquatic resources requested additional descriptions of the wetlands affected by the project, provided concerns about the wetlands along the reservoir fringe, requested additional information on replicating downstream flow of East Locust Creek, requested wetland and stream mitigation be described in detail, and requested an explanation on how the project sponsor will implement long-term operation and maintenance of fish and wildlife habitat. The comments related to endangered species requested NRCS consult with the USFWS’s Columbia, Missouri, Ecological Services Office. The specific comments were related to clarifying specific sentences or paragraphs (USFWS, letter to Mr. Roger A. Hansen, Appendix B in NRCS 2006).

The USACE commented on the recommended plan in the DEIS and stated, “this section should include a discussion as to how and why the Proposed Action was selected and how the project site was determined. The discussion should justify the selected alternative as the least

environmentally damaging practicable alternative that meets the overall project purpose” (USACE, letter to Roger Hansen, Appendix B in NRCS 2006).

The East Locust Creek Reservoir administrative record is summarized above and contains a list of meetings and coordination with federal agencies.

1.3 Authority

This document was prepared under authority of the Watershed Protection and Flood Prevention Act, PL 83-566, as amended (16 U.S. Code [USC] 1001-1008), and in accordance with Section 102(2)(c) of NEPA of 1969, PL 91-190, as amended (USC 1992), and the Federal Water Pollution Control Act, as amended in 1972. Responsibility for complying with NEPA rests with the NRCS. Responsibility to issue or deny a Section 404 permit under the CWA for impacts to jurisdictional waters rests with the USACE and the EPA.

The Proposed Action is funded through the Watershed Protection and Flood Prevention Act of 1954 (PL 83-566), administered by USDA-NRCS and sponsored by the NCMRWC. Additionally, the PL 83-566 authority was extended by an act of Congress to specifically allow construction of the proposed East Locust Creek Reservoir project (RW1) with special cost-share rates. November 10, 2005, the 109th Congress passed PL 109-107, H.R.2744, Section 726, which states: “Notwithstanding any other provision of law, the Natural Resources Conservation Service shall provide financial and technical assistance through the Watershed and Flood Prevention Operations program to carry out the East Locust Creek Watershed Plan Revision in Missouri, including up to 100 percent of the engineering assistance and 75 percent cost share for construction cost of site RW1 [Proposed Action]”. All references to “East Locust Creek Reservoir” in this document pertain to Site RW-1 as described in PL 109-107 and in the 2007 East Locust Creek Watershed Revised Plan & Environmental Impact Statement.

Sections 3 and 4 of PL 83-566 provide for federal assistance for multiple authorized project purposes including the following, which are the basis for the NEPA and 404(b) alternative analysis project purposes described herein.

- Flood Prevention (flood damage reduction)
- Public Recreation
- Agricultural Water Management (including agricultural water supply in rural communities)

Other PL 83-566-authorized project activities that may occur include the following:

- Watershed Protection
- Public Fish and Wildlife

1.4 Purpose of this Analysis

This DSEIS document is intended to update the 2006 FEIS and provide information to comply with the USACE 404(b)(1) guidelines (40 CFR 230). The updates focus on information that has changed since the 2006 FEIS and do not intend to duplicate information provided in the 2006 FEIS. Readers should reference the 2006 FEIS document as the primary document and use the DSEIS to supplement the 2006 FEIS. Copies of the 2006 FEIS can be found on the Missouri NRCS website (NRCS 2020).

Both the NEPA requirements and the 404(b)(1) guidelines require determining project purposes and needs and the review of a reasonable range of alternatives, with the goal of identifying a Proposed Action. To update the 2006 FEIS, this DSEIS document focuses on the project purposes and needs, on the alternatives analysis, and on a preliminary review of impacts of alternatives to social, economic, and natural environmental resources.

The CWA 404(b)(1) guidelines require the identification of the LEDPA, which primarily evaluates impacts to aquatic resources such as wetlands and streams and only secondarily considers other resources in a public interest evaluation. The alternatives analysis in this DSEIS provides information to aid the USACE in its Section 404 permit decision.

1.5 Project Purpose and Need for Action

The project purpose and need for action statements have been slightly altered from the 2014 NOI based on information gathered in interagency meetings. Regulatory agencies want to assure that the purpose and need is not so narrowly defined that it excludes legitimate alternatives. The original purposes of water supply, flood damage reduction, and recreation remain unchanged. The multiple purposes of the East Locust Creek project are the following:

- Provide a dependable, affordable long-term water supply to meet the water demand for the 10-county region of north-central Missouri, including Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties (Section 1.5.1).
- Reduce flooding damages on 22.5 miles of East Locust Creek above the confluence with Locust Creek (Section 1.5.2).
- Provide water-based recreation to meet the unmet demand for the 10-county recreation management area including Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties (Section 1.5.3).

PL 83-566 does not impose restrictions on how individuals or municipal users can use a treated public water supply.

1.5.1 Need for Dependable, Affordable Long-term Water Supply

An additional drinking water source in north-central Missouri is needed to meet the existing and future needs of water suppliers and water users in the region during drought conditions and to provide resiliency against uncertainty in future water demands and climate change. The lack of a dependable, long-term water supply poses health, safety, and human welfare issues for north-central Missouri. The NCMRWC and MDNR have identified the need for an adequate, dependable, and high-quality water supply system for the rural areas and municipalities of north-central Missouri. The area to be served by the NCMRWC includes 10 counties in north-central Missouri, which are listed above.

Many of the 10-county regions' suppliers need alternative water sources to provide a dependable, long-term water supply. Some examples are as follows:

- Green City was mandated in 2003 by the MDNR to abandon its existing water plant because it could not meet the state drinking water standards. Consequently, the city has signed on as a charter member of the NCMRWC (Burns & McDonnell 2003). Reasons for the MDNR mandate were not reported in the Burns & McDonnell report, but Appendix C (Allstate 2016) pages 4-7, describes typical reasons why plant closures may occur.

Reasons include the inability to keep up with increasingly stringent trihalomethane, disinfection, turbidity, and security.

- The City of Milan has been under voluntary or mandatory water conservation for several years and has been required to purchase water from Trenton when the current supply lake is lower than 48 inches, per an MDNR mandate (Brad Scott, personal correspondence to Jennifer Hoggatt, October 2017).
- Other water suppliers in the region experience problems that increase the cost of water while limiting water availability. A 2016 study of water supply in 17 counties in north-central Missouri (including all 10 counties that will be served by the proposed reservoir) coordinated by USACE and MDNR, reported that " every system expressed confidence in the reliability of their source; however this is not likely realistic" (HDR Inc. 2016). The report expands on that statement by describing factors leading to presumably unanticipated reductions in the capacities of existing systems in the region. In addition to unanticipated reductions in capacity, water systems also tend to underestimate their susceptibility to extended droughts as described in Appendix C (Allstate 2016). The Regional Water Source Evaluation (Allstate 2016, Appendix C) analyzed the systems in the 10-county region for their current ability to continue to produce water during the drought of record. Figure 1.5.1.2, taken from the Regional Water Source Evaluation (Allstate 2016, Appendix C), shows the systems that are expected to run out of water during the drought of record resulting in the loss of 67 percent of the region's water supply.
- From 1980 to 2015, 28 former water source suppliers in the 10-county region either closed their water treatment plants and now buy water on the wholesale market from other water sources or have been folded into other water supply systems (Allstate 2016, Appendix C). Reasons for closing their plants include the following:
 - Declining yield
 - Water high in iron
 - Silt in groundwater well
 - Diminished reservoir capacity because of siltation
 - Inadequate water treatment plant
 - Struggle with disinfection by-products
 - Difficulty maintaining a qualified water treatment plant operator

At present, the 10-county region is supplied by a total of 56 water systems. Of these water systems, only 19 water producers have their own sources: 16 water producers in the region, and three water producers outside the region. The loss of 28 water producers since 1980 (Allstate 2016, Appendix C) represents a 60 percent decrease in the number of water sources within the 10-county region. The loss of this amount of systems points to the increasing lack of long-term, dependable water supplies.

A long-term, dependable water supply will provide adequate water to the 10-county region for at least the next 100 years and will not fall short during a drought equivalent to the drought of record.

1.5.1.1 Inadequacy of Existing Water Supply

The existing water supply in the region is inadequate for a number of reasons, including the following:

- An inability to meet even the current demand during the drought of record
- A lack of capacity to meet future contingencies that require higher volumes of water
- More recently, less severe droughts that have caused hardship for the region

The following sections discuss some of the reasons for these inadequacies.

Current Water System Unplanned “Clusters”

The 10-county region’s primary water producers pump water from a groundwater or surface water source and sell water to their retail customers and other (consecutive) water systems. Consecutive water systems do not have a water source, rather they buy water from primary water producers (or even second or third systems that bought water from producers) to sell to their retail customers. The consecutive water systems are limited in the amount of water they can purchase by whether they have interconnections with other water systems and by the size of the interconnection pipes.

The 10-county region is served by 19 primary water-producing water systems. Three of those water systems—Clarence Cannon, Livingston County Public Water Supply District (PWSD) No. 4, and Rathbun – are located outside the 10-county region. The interconnections of producers and consecutive systems can be complicated, but by grouping systems using the same raw water source(s) into “clusters,” the regional availability of water can be displayed more clearly and accurately. The 19 water systems and the consecutive systems they support are grouped as clusters separated by geographical region served, and by their source of raw water, specifically groundwater producer, surface water producer, or an out-of-region producer (Figure 1.5.1.1-1).

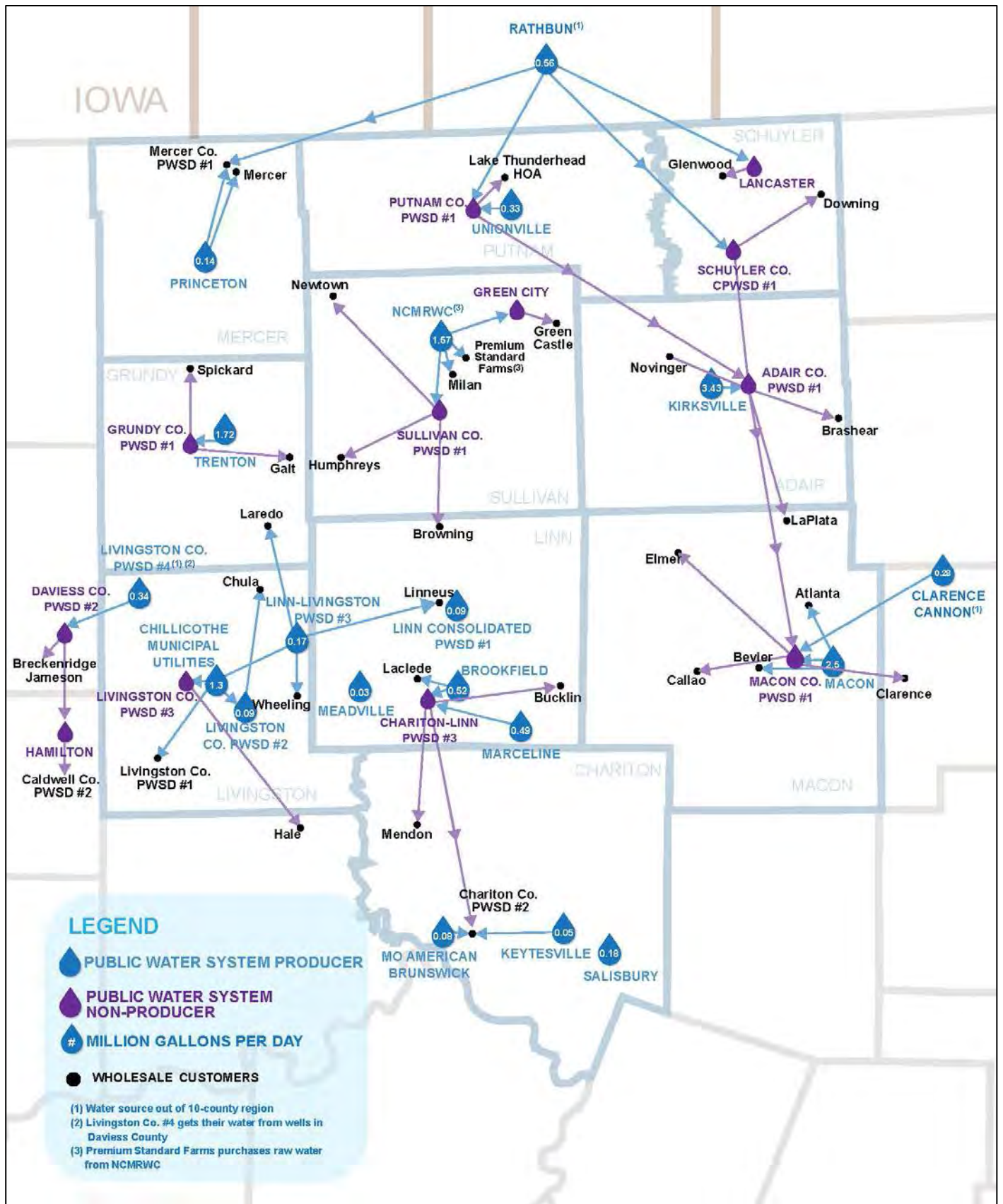


Figure 1.5.1.1-1 Nineteen Public Water Systems and the Consecutive Systems Supported.

Although Brookfield and Marceline are separate water systems, they serve an overlapping geographic region and system of interconnections, so they are grouped together in the analysis below.

As indicated above, many systems that once produced their own water now must buy water from other systems. These consecutive systems form an unplanned regional water system around a nearby water-producing system. The producing water systems serving the systems around them were not designed to serve the larger, unplanned cluster. For example, Keytesville is a primary water system that produces its own water and sells water to Chariton County PWSD No. 2. Keytesville uses 0.031 MGD, and Chariton County PWSD No. 2 uses 0.022 MGD of Keytesville's water, for the total of 0.053 MGD shown in Table 1.5.1.1-1. Chariton then purchases additional water from Missouri American Water Company in Brunswick. The consecutive water systems and water purchases are described in the Regional Water Source Evaluation (Allstate 2016, Appendix C).

Although the clusters may or may not have capacity to meet average daily needs, infrastructure, peak demands, and drought planning are often not considered in detail as consecutive water systems are added to the service area of the water producer (Allstate 2016, Appendix C). Table 1.5.1.1-1 lists all the water systems that provide water to the 10-county region and the amount of water they provide to the 10-county region. The average daily water supplied to the 10-county region includes water used by the primary water system and water directly or indirectly sold to other water systems within the 10-county region. Any water sold outside the region is not included in the 10-county region water supply. For example, Livingston County PWSD No. 4 sells 0.14 MGD outside the 10-county region that is not included in the 10-county region water supply.

Although an individual water system's water supply may be greater than the amount of water used by the individual water system, additional water is only available to the individual water system and not to other systems in the 10-county region that may need the water. Thus, the overall system capacity does not increase because an individual water system has more water than it uses. For example, Chillicothe uses 1.3 MGD and has an additional 1.34 MGD in additional capacity. The additional 1.34 MGD is not available to the other water systems because either the infrastructure is not available or the water system does not wish to sell the water.

Table 1.5.1.1-1. Primary Water Source Water Systems in the 10-county Region.

| Water System | Source | Average Daily Water Supplied to 10-county Region (MGD) |
|---|--|---|
| Brookfield and Marceline | Brookfield Lake, Yellow Creek, Marceline Lake, Old Marceline Lake, Mussel Fork Creek | 1.014 |
| Chillicothe Municipal Utilities | Groundwater wells | 1.300 |
| Clarence Cannon Wholesale Water Commission | Mark Twain Reservoir | 0.278 |
| Keytesville | Groundwater wells | 0.053 |
| Kirksville | Forest Lake, Hazel Creek Lake | 3.432 |
| Linn County CPWSD No. 1 | Groundwater wells | 0.085 |
| Livingston County PWSD No. 2 | Groundwater wells | 0.087 |
| Linn-Livingston PWSD No. 3 | Groundwater wells | 0.168 |
| Livingston County PWSD No. 4 | Groundwater wells | 0.200 |
| Macon Municipal Utilities (MMU) | Long Branch Lake | 2.500 |
| Meadville | Groundwater wells | 0.034 |
| Missouri American Water Company – Brunswick | Groundwater wells | 0.084 |
| NCMRWC | Elmwood/Golf Course Lake, Locust Creek | 1.572 |
| Princeton | Groundwater wells | 0.137 |
| Rathbun Regional Water Association (RRWA) | Rathbun Lake | 0.557 |
| Salisbury | Groundwater wells | 0.175 |
| Trenton | Thompson River | 1.718 |
| Unionville | Unionville Lake | 0.330 |
| 10-COUNTY REGION TOTAL | | 13.724 |

Source: Allstate 2016, Appendix C

High Cost of Water

The cost of water in north-central Missouri is higher, relative to income, than in other locations in the state. The higher cost is because of a number of issues including the need to move water from one system to another and the inadequacy or lack of water sources for many systems. The high cost of water relative to median household incomes is shown in Figure 1.5.1.1-2.

In a region where public water supply systems without a source of water outnumber those with a water source by nearly two to one, systems often receive water via “wheeling” (Allstate 2016, Appendix C). Wheeling is a term that describes how wholesale treated water is delivered from one system, through a second system, and on to a third system, because there is no direct pipeline connection between systems one and three. Although this water is provided to the third system at a wholesale rate, it is usually at a higher-than-basic wholesale rate because the second (middleman) system typically charges a wheeling fee to cover operation and maintenance, administrative, and debt service costs for the water provided. Because of the lack of dependable water sources in the region, the few systems with water are overextending their source’s capacity through wheeling. These sources have become unintended regional supplies that were never

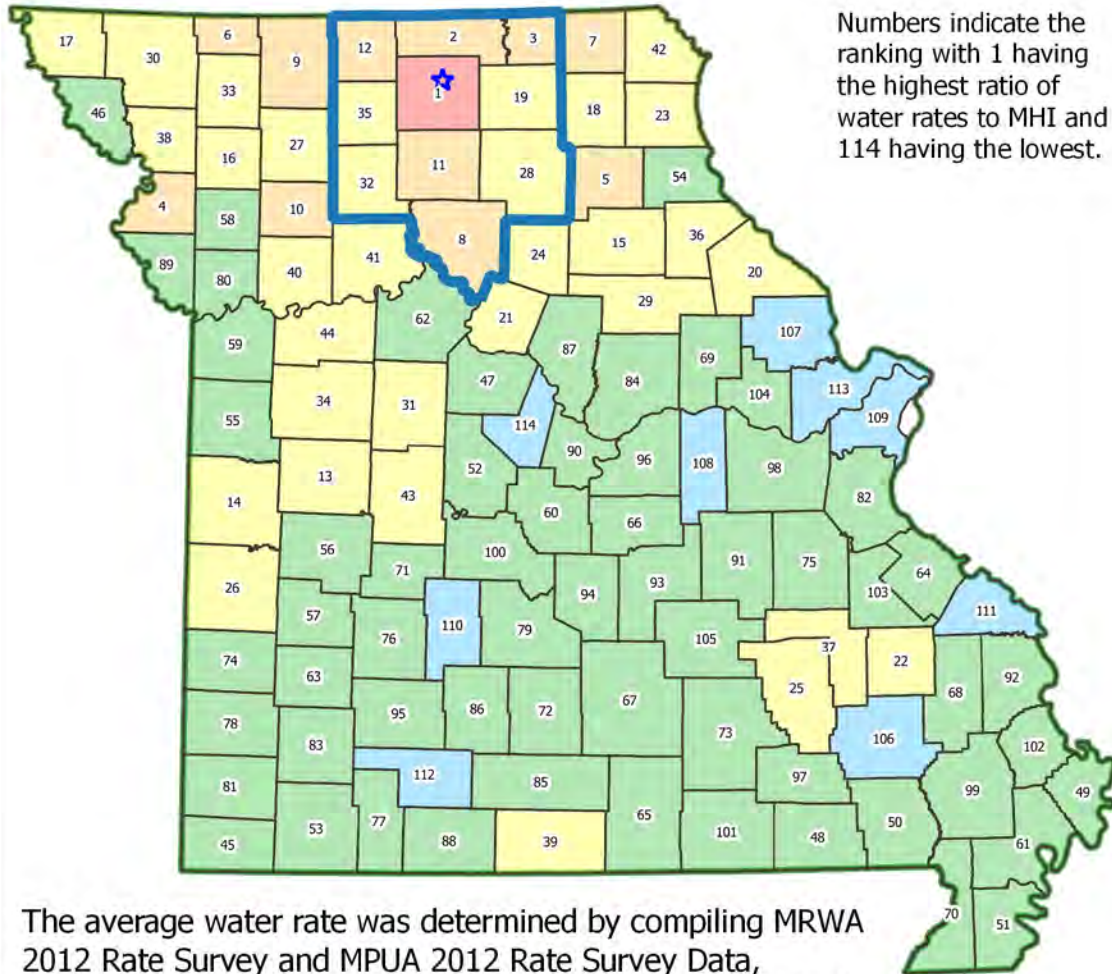
designed to fully serve additional water systems. The lack of adequate infrastructure and water sources in unintended regional systems leads to a shortage of water during a drought, a lack of emergency supplies, and higher water costs.

The higher retail water rates from nonregional systems that supply water to consecutive systems, like those in the 10-county region, are caused by the additive effects of connecting several smaller systems and the cost of wheeling. Small-volume producers have a higher per-unit cost of water. This, coupled with the costs associated with delivery through one or more systems, means that the end users ultimately pay higher water rates than those charged by systems closer to the source. In contrast to the small-volume producer, a regional, large-volume producer can provide water at a lower baseline cost than a small-volume producer. The end user for both a large-volume and a small-volume producer is still paying more than those located closer to a water source, but the baseline rates are more affordable for the large-volume producer. Research indicates that larger water systems can cut costs by anywhere from 10 to 50 percent over small water systems (Shih et al. 2006).

Higher water costs are evident in the 10-county region. The Missouri Rural Water Association's (MRWA) 2014 Water Rate Survey Results lists the cost per 5,000 gallons of water for the 10-county region as \$55.40, which equals a 39 percent premium when compared to the state average of \$39.81 (MRWA 2014). The increased costs are especially difficult for residents of the 10-county region, which has an average MHI that is 20 percent lower than the state average (U.S. Census 2010). Customers within the region spend a higher percentage of their monthly incomes on water than water customers elsewhere in the state. The data from these studies indicate that approximately 17 percent of Sullivan County residents live at or below the poverty level, and these residents are paying as much as 6 percent of their annual income for water.

Figure 1.5.1.1-2 uses the MRWA 2012 Missouri rate study and the Missouri Public Utility Alliance (MPUA) 2012 Missouri rate study to calculate the average water rate for Missouri counties.

Average Water Rate by County as a Percentage of County Median Household Income



The average water rate was determined by compiling MRWA 2012 Rate Survey and MPUA 2012 Rate Survey Data, determining the weighted average rate by county from each data source and then averaging the rate from the two sources for each county.

- ★ East Locust Creek Reservoir
- NCMRWC 10 County Service Area
- Water Rate as Percentage of County MHI (MRWA and MPUA data)
- Average Water Rate 0 to 0.5% of County MHI
- Average Water Rate 0.5 to 1.0% of County MHI
- Average Water Rate 1.0 to 1.5% of County MHI
- Average Water Rate 1.5 to 2.0% of County MHI
- Average Water Rate Greater than 2.0% of County MHI

Figure 1.5.1.1-2. Cost of Water Relative to Median Household Income in Missouri Counties (Missouri Rural Water Association [MRWA] 2014 and Missouri Public Utility Alliance [MPUA] 2012).

Inadequacy of Existing Water Systems in the 10-county Region During Drought

A 2016 water study, titled North Central Missouri Regional Water Source Evaluation, assessed the long-term dependability of the primary water systems (Allstate 2016, Appendix C). The study evaluated the ability of a surface water system to provide water during the 1950s drought of record and the dependability of groundwater wells. Key points of the study included surface water evaluation, groundwater evaluation, and out-of-region water evaluation during the drought of record (Allstate 2016, Appendix C).

A drought of record is the worst recorded drought since compilation of meteorologic and hydrologic data began. In terms of severity and duration, the devastating drought of the 1950s is considered the drought of record for Missouri. It is critical that the 10-county region water supply be dependable enough to meet the demand for water in the event of a similar drought. MDNR drinking water design standards require designing water systems for the drought of record (MDNR 2013a). However, even shorter-term droughts have put stresses on the water supply in this region, as discussed below.

Drought in Missouri

This 10-county region has long been identified as a drought critical area (MDNR 2002). The impact of the constant threat of drought was summed up by the Missouri Department of Economic Development (MDED) in a report that stated the following:

“The major infrastructure problem in non-metro Missouri is providing safe drinking water for residents. Many areas are without public water and many communities have serious water quality problems. Lower income residents often don’t have the financial resources to get decent water. Even when assistance is provided, there is often a void in knowing what strategy to follow for developing proper water source, supply and treatment on a long-range as well as short-term basis. The drought of 1988 made it clear that the non-entitlement communities of Missouri, especially in the north one-half of the state, do not presently have the capacity to supply water to residents in critical periods of stress”
(MDED 1995).

Few water supply improvements have been made in the region and no water supply lakes have been created since the MDED report was published. MDNR Deputy Director for Water Resources Michael Wells noted the following in a 2010 letter to the NCMRWC:

“While many of the communities in the region have addressed their short-term water shortage needs in recent years, studies have shown that these short-term solutions are not sustainable through extended periods of drought nor will they support long-term economic growth in the region.”

“During periods of extended drought in Missouri, the Missouri Drought Assessment Committee, which I chair, has recognized that communities in and near Sullivan County often have the most critical water supply shortages in the state.”

Recent droughts like the 2011 t – 2012 drought have caused hardship on Missouri (Office of Governor Jay Nixon 2013); however, these droughts were exceeded by the drought of record. The drought of record occurred between 1951 and 1959 (MDNR 2011a). During the 5-year period of 1953 – 1957 during the drought of record, the precipitation deficit was 60.64 inches (University of Missouri 2016). Over a 5-year period leading up to and including the 2011 – 2012 drought, a precipitation surplus of 23.32 inches was recorded (University of Missouri 2016).

The shortage of water during drought was a hardship to the agricultural industry and residents. The importance of Missouri agriculture has been documented by the Office of Governor Jay Nixon (2013): “Missouri’s farmers have long led the nation in agricultural production, nationally ranking second in the number of farms and in cattle and calves, as well as in the top 10 for poultry, horses, hogs, corn and soybeans. Farmers and farm families’ contributions to their communities have also made them economic engines by supporting youth programs, providing jobs and strengthening Missouri’s rural areas.”

The 2011 – 2012 drought caused an estimated statewide loss of \$547 million in livestock and poultry. The state emergency operation center was activated, and a federal disaster declaration was made for all Missouri counties including the 10-county region (Office of Governor Jay Nixon 2013). Emergency assistance was granted to 38 applicants across eight of the 10 counties in the region to connect agribusinesses to rural public water systems. A total of 52 counties in the state and a total of 201 approved projects statewide received cost-share connection assistance. Nineteen percent, or nearly one in five of these projects were within the 10-county region. As of November 15, 2012, 2,126 wells were drilled or deepened throughout the state through the cost-share program. Because of unfavorable underlying geology, only six deepened well projects, or 0.2 percent of the state total, were in the 10-county region (Office of Governor Jay Nixon 2013).

The lack of dependable water was evident in the short-term drought of 2012. While the drought of record’s severity and impacts on the current economy and water systems are difficult to predict, recent less severe droughts provide insight into the potential impacts. Planning for a long-term dependable water source includes providing water during drought emergencies of equal severity to the drought of record.

Dependability of Surface Water Systems During Drought

The six surface water system clusters in the 10-county region include the following:

- Brookfield and Marceline
- Kirksville
- Macon Municipal Utilities (MMU)
- NCMRWC
- Trenton Municipal Utilities
- Unionville

The MDNR's Minimum Design Standards for Missouri Public Water Systems define two methods for evaluating the dependability of a surface water source: the Reservoir Operation Study Computer Program (RESOP), and the evaluation of the lowest seven-day average flow that occurs on average once every 10 years (7Q10). These methods are used with other MDNR design criteria such as the following:

- The ability to provide sufficient water through the drought of record and maintain 120 days of additional storage for public confidence (for reservoirs)
- The ability to maintain other water volume use requirements (for reservoirs)
- The ability to maintain adequate downstream flow for instream flows (MDNR 2013a)

RESOP analysis calculates the reservoir yield capacity, which is the amount of water that can be withdrawn from a reservoir on a daily basis and endure drought of record conditions without depleting the supply. When compared to the normal demand, which is the current average daily use according to data, only those sources with a reservoir yield greater than the normal demand of their cluster were determined to provide an adequate water supply.

A 7Q10 threshold is used by MDNR to protect the integrity of streams. By definition, the flow in the stream will be lower during the drought of record, because a drought of record is much more severe than a drought that occurs on average every 10 years (i.e., 10 percent chance of occurrence in a given year). If a stream flow source is to be considered dependable, users must be able to withdraw water at a rate that will not cause the stream flow to be lower than the 7Q10 threshold. By definition, the stream will already have average flows below the 7Q10 threshold in a drought that occurs on average every 10 years, without any withdrawals.

If a surface water source was not able to provide adequate water based on the approved MDNR methods, the surface water source was considered at risk of running out of water completely during an event of equal magnitude and duration to the local drought of record. Analysis of the Regional Water Source Evaluation (Allstate 2016, Appendix C) found that five of the six surface water clusters were determined to have an inadequate water supply; they accounted for 76.3 percent (8.066 MGD) of the total demand (10.556 MGD) provided by in-region, surface water sources in 2015 (see Table 1.5.1.1-1) The inadequate clusters are the following:

- Brookfield and Marceline (1.014 MGD)
- Kirksville (3.432 MGD)
- NCMRWC (1.572 MGD)
- Unionville (0.330 MGD)
- Trenton Municipal Utilities (1.718 MGD)

RESOP and 7Q10 calculations are included in the 2016 North Central Missouri Regional Water Source Evaluation Study (Allstate 2016, Appendix C).

Dependability of Groundwater Systems

The nine groundwater systems in the 10-county region include the following:

- Chillicothe Municipal Utilities
- Keytesville
- Linn County Consolidated Public Supply Water District (CPWSD) No. 1
- Livingston County PWSD No. 2
- Linn-Livingston PWSD No. 3
- Meadville
- Missouri American Water Company – Brunswick
- Princeton
- Salisbury

The MDNR’s Minimum Design Standards for Missouri Public Water Systems do not directly stipulate drought of record or reserve capacity for groundwater wells. It does require the source capacity to meet or exceed design maximum-day demand and that all systems serving over 500 people have redundant water sources (MDNR 2013a). However, the development of redundant and replacement wells that provide sufficient yield to be considered dependable is difficult in north-central Missouri (MDNR 1997).

Analysis of groundwater from the Regional Water Source Evaluation (Allstate 2016, Appendix C) was based on regional and local geology, historical data, and engineering design criteria. Specific well analysis cannot definitively predict how long or at what rate a well will yield water or what the water quality will be. In northwest Missouri, the groundwater yield is so highly mineralized that, for practical purposes, it is not a dependable source in most locations. Miller and Vandike (1997) divided Missouri into groundwater provinces and subprovinces. They state, “Bedrock formations in the Northwestern Missouri groundwater province older than Pennsylvanian-age yield highly mineralized water. Usable quantities of groundwater are locally available from Pennsylvanian strata, but yields are typically low and the water quality is marginal” (Miller and Vandike 1997).

Historical records of the region document the difficulty of developing a well of adequate quality and yield. The available groundwater well data from MDNR lists 28 public water supply wells that have been plugged, inactivated, or modified to be observation wells in the 10-county region. Six of the nine groundwater systems have been determined to have an inadequate water supply; they account for 26.5 percent (0.563 MGD) of the total supply (2.122 MGD) provided by in-region, groundwater sources in 2015. They are as follows:

- City of Keytesville (0.053 MGD)
- City of Meadville (0.034 MGD)
- City of Princeton (0.137 MGD)
- Linn CPWSD No. 1 (0.085 MGD)
- Linn-Livingston PWSD No. 3 (0.168 MGD)
- Livingston County PWSD No. 2 (0.087 MGD)

Groundwater evaluations are included in the 2016 North Central Missouri Regional Water Source Evaluation Study (Allstate 2016, Appendix C).

Dependability of Out-of-region Water Systems

The following three systems provide water from outside the 10-county region:

- Rathbun Regional Water Association (RRWA; Rathbun Lake)
- Livingston County PWSD No. 4
- Clarence Cannon Wholesale Water Commission

In 2015, out-of-region treated water supplies accounted for 7.5 percent or 1.035 MGD of the total 13.723 MGD of water produced in the 10-county region. Of the 1.035 MGD, approximately 54 percent, or 0.557 MGD, was supplied by RRWA, of Centerville, Iowa.

The RRWA has indicated that they do “not believe that the available water supply storage allocation in Rathbun Lake will allow us to provide potable water to customers outside of our association’s current service territory” (Glenn 2019). Additionally, the dependability of RRWA is limited by an Iowa law that restricts conveyance of water across state lines. The availability of water during emergencies is restricted in a specific order as stipulated in Iowa Administrative Code 455B.266 Priority Allocation:

“...the department may suspend or restrict usage of water by category of use on a local or statewide basis in the following order:

- a. Water conveyed across state boundaries.** (emphasis added)
- b. Uses of water primarily for recreational or aesthetic purposes.
- c. Uses of water for the irrigation of hay, corn, soybeans, oats, grain sorghum or wheat.
- d. Uses of water for the irrigation of crops other than hay, corn, soybeans, oats, grain sorghum or wheat.
- e. Uses of water for manufacturing or other industrial processes.
- f. Uses of water for generation of electrical power for public consumption.
- g. Uses of water for livestock production.
- h. Uses of water for human consumption and sanitation supplied by rural water districts, municipal water systems, or other public water supplies as defined in Section 455B.171.”

When there is a shortage, water conveyed across state boundaries is the first usage that Iowa must cut. Because water could be suspended or restricted during a drought emergency, Rathbun Lake is not a dependable water source for Missourians.

Summary of Inadequacy of Existing Water Systems

Based on the evaluation of the 19 primary water systems serving the 10-county region, only six water systems have a dependable water supply that can be expected to provide enough water to meet the current water demand for the next 100 years and during the drought of record. These six water systems can provide only a total of 4.537 MGD of the 13.724 MGD water demand for the 10-county region, or approximately one-third of the volume of water needed. These systems, and their water sources are the following:

- Chillicothe Municipal Utilities (1.3 MGD) – Groundwater
- Clarence Cannon Wholesale Water Commission (0.278 MGD) – Out-of-region
- Livingston County PWSD No. 4 (0.2 MGD) – Out-of-region
- MMU (2.5 MGD) – Surface water
- Missouri American Water Company – Brunswick (0.084 MGD) – Groundwater
- Salisbury (0.175 MGD) – Groundwater

The remaining 13 water systems provide the remaining 9.186 MGD to the 10-county region and do not have a dependable water source that can be counted on to provide even the current water demand during the drought of record. These systems and their water sources are the following:

- Brookfield and Marceline (1.014 MGD) – Surface water
- Kirksville (3.432 MGD) – Surface water
- NCMRWC (1.572 MGD) – Surface water
- Unionville (0.330 MGD) – Surface water
- Trenton (1.718 MGD) – Surface water
- City of Keytesville (0.053 MGD) – Groundwater
- City of Meadville (0.034 MGD) – Groundwater
- City of Princeton (0.137 MGD) – Groundwater
- Linn CPWSD No. 1 (0.085 MGD) – Groundwater
- Linn-Livingston PWSD No. 3 (0.168 MGD) – Groundwater
- Livingston County PWSD No. 2 (0.087 MGD) – Groundwater
- RRWA (0.557 MGD) – Out-of-region

Figure 1.5.1.1-3 shows a breakdown in the 10-county region water suppliers according to adequacy.

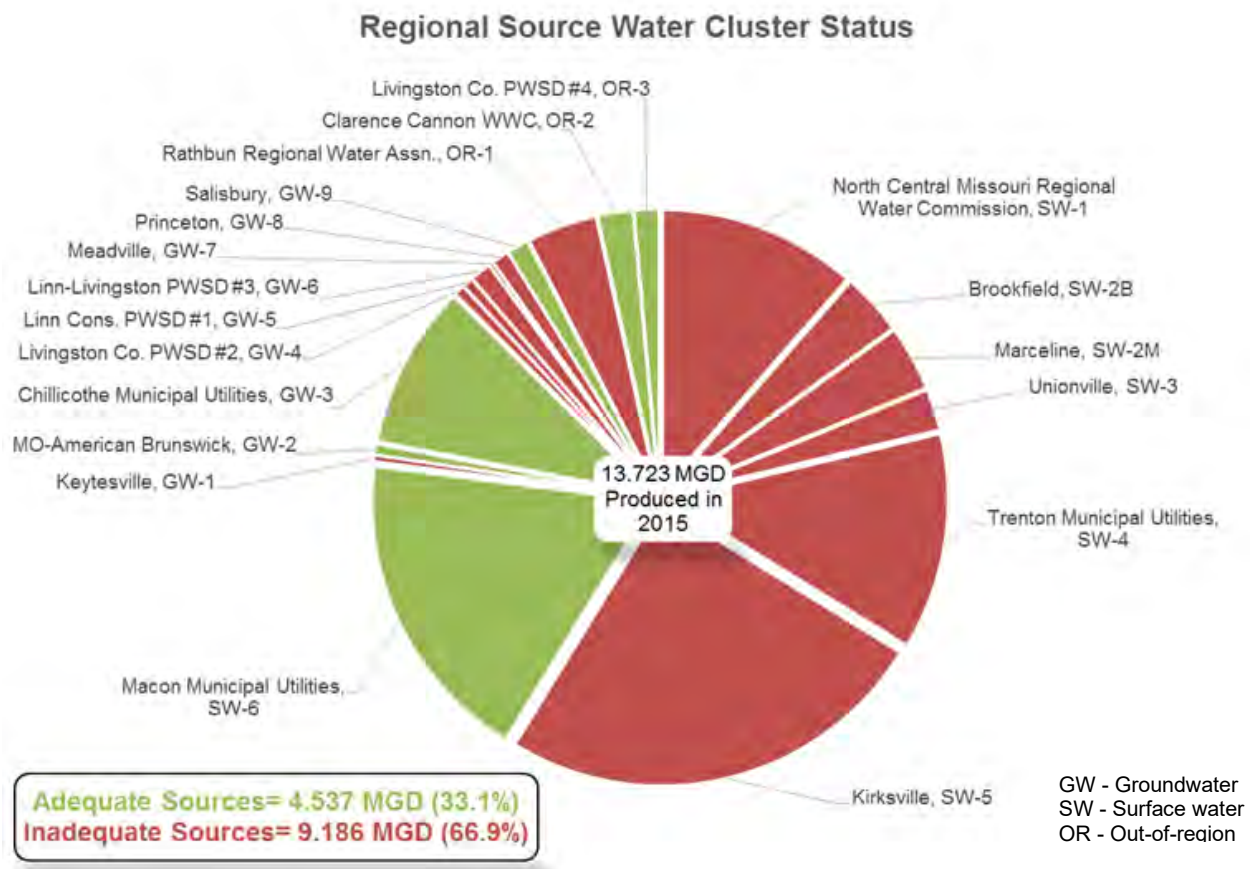


Figure 1.5.1.1-3. Adequacy of 10-county Region Water Systems.

1.5.1.2 Projected Water Supply Needs

The projected need is based on the 9.186 MGD inadequate supply demonstrated in the previous section, with additional contingencies built in to account for unforeseen demand and compliance

with MDNR drinking water design standards. The MDNR drinking water design standards account for water loss in treatment and distribution.

1.5.1.2.1 Planning Contingencies

Predicting future water demand includes accounting for potential demand increases that cannot reasonably be predicted. A 10 percent contingency or 0.92 MGD water demand increase for the inadequate water sources is added to the unfinished total projected demand to account for climate change and increased drought risk, population and water demand growth, increased agricultural demand, and increased business demand. While it is difficult to predict which contingency will occur over the next 100 years, any one of the contingencies or a combination of contingencies could require the supply of 0.92 MGD or more.

Extreme Weather Events and Increased Drought Risk

In August 2003 and 2012, the 10-county region was under a “category 3” drought as established by the MDNR. This level of drought requires water conservation practices and is one step below the emergency drought category (MDNR 2002). Future droughts in the central plains (including Missouri) are projected to be more severe with an increased risk that a drought could last for a decade or longer, according to a National Aeronautics and Space Administration (NASA) study (Cole and McCarthy 2015). The NASA study is based on the effects of climate change and carbon dioxide emissions related to the probability of future droughts. The most severe drought period in Missouri since record keeping began in the late 19th century was from 1951 to 1959 (MDNR 2011a).

In an October 30, 2000, letter to the NCMRWC from the University of Missouri-Columbia’s Missouri Climate Center, Dr. Adnan Akyuz stated, “Climatology of Missouri shows that the probability of severe summer drought in Missouri is 20 percent, or once every 5 years. Thus, Northern Missouri is more susceptible to drought than the rest of the state.” He concluded, “Because of the issues mentioned above, I endorse any action to construct a new water supply lake in Sullivan County to serve as a regional public water supply source” (A. Akyuz, personal communication, Oct. 30, 2000, Appendix B).

At the 2014 Governor’s Conference on Natural Resources, Dr. Pat Guinan of the Missouri Climate Center presented information that showed that the recent droughts of 2000, 2003, 2011, and 2012, have garnered the current level of overwhelming concern and support for more dependable water supplies, but these were all “short duration” droughts compared to the drought of record. As Mr. Guinan pointed out in his summary, “The 2012 drought resulted in numerous impacts, affecting many sectors in Missouri. However, it was a young drought when compared to other historic droughts, i.e., 1952-56” (Guinan 2014).

Paleoclimate reconstruction with subfossil oak wood collected in north-central Missouri streams showed drought duration and frequency in the U.S. Corn Belt during the period from 992 A.D. to 2004 A.D. (Stambaugh et al. 2011). This study identified three years since AD 992 that were drier than 1934, the driest year of the instrumental period. Thirteen droughts of 10 years or more in length occurred during the period. The longest drought of the period occurred during the late 12th century and lasted sixty-one years. This study documents that the 10-county region has experienced droughts with severity and duration that exceed those of modern record.

During recent short-duration droughts, it became necessary to implement emergency measures. In the 1990s, over \$500,000 was invested in two failed instream intakes along Locust Creek prior to the current intake configuration. The current intake, which is 3.1 miles from its discharge in Elmwood Lake, was built in 2002 at a cost of \$921,000 and is configured for low- and high-stream flow. Even with this creek intake, the reality of water shortages forced a 2008 project to pump treated water from Grundy County PWSD No. 1. Because of hydraulic limitations over the 35-mile pipeline, only 0.11 MGD can be supplied. This project had a final cost of nearly \$2 million. The Regional Water Source Evaluation (Allstate 2016, Appendix C) shows in the drought of record analysis that neither the Locust Creek intake nor the Grundy County PWSD No. 1 treated waterline can supply sufficient water for the current demand.

In the time since the 2006 FEIS was completed, the United States has become increasingly aware of the impacts that extreme weather events may have on agriculture, industry, and our quality of life. May 6, 2014, the White House issued a comprehensive, authoritative scientific report on the impacts of current and future climate change on every region of the country (White House 2014). The state report for Missouri says the following:

*“The Midwest’s agricultural lands, forests, Great Lakes, industrial activities, and cities are all vulnerable to climate variability and climate change. Climate change will tend to amplify existing risks climate poses to people, ecosystems, and infrastructure. Direct effects will include increased heat stress, **flooding, drought, and late spring freezes**.... Climate change may intensify other stresses on urban dwellers and vegetation, including increased atmospheric pollution, heat island effects, **a highly variable water cycle**, and frequent exposure to new pests and diseases” (Emphasis added. Source: White House 2014).*

In March 2016, the White House issued a presidential memorandum for the heads of executive departments and agencies on building national capabilities for long-term drought resilience. The purpose stated, “Our Nation must sustain and expand efforts to reduce the vulnerability of communities to the impacts of drought.” Drought planning and capacity building are policy goals listed in the memorandum, among others. (White House 2016)

A recent report (Moody’s Investors Service 2017) highlights the growing awareness of the potential impacts of extreme weather events on local governments. Moody’s Investors Service is the bond rating business of Moody’s Corporation; it provides international financial research on bonds issued by commercial and government entities. Moody’s Investors Service is considered one of the “Big Three” credit rating agencies, along with Standard & Poor’s and Fitch Group. Moody’s Investors Service issued a report November 28, 2017, titled, *Environmental Risks -- Evaluating the impact of climate change on U.S. state and local issuers* (Moody’s Investors Service 2017). The report explains how the company incorporates extreme weather events into its credit ratings for state and local bonds. The increasing frequency and magnitude of “climate shocks” such as droughts, floods, and storms can significantly impact the ability of communities to service their debt if they have not taken steps to mitigate potential impacts. Moody’s Investors Service will consider both exposure and what communities are doing to mitigate the potential impacts of climate shocks when issuing bond ratings. Communities that have not prepared for

extreme weather events are a greater credit risk and will pay higher interest rates than those that are prepared.

Extreme weather events are likely to produce more frequent and potentially more extended droughts. A project meeting the water supply needs of the 10-county region will protect the human health, safety, and welfare of communities and citizens from the increased risk of prolonged droughts, and thus, from a shortage of adequate water supply.

Conservation and Drought Mitigation

The NCMRWC and its members have exhaustively explored and implemented numerous alternative measures to supplement and augment both finished water supplies and raw surface water supplies and have also implemented water conservation measures because of a current drought and impending water shortage. Finished water supply alternatives have included interconnections with other existing rural water supply district systems; however, these interconnections cannot provide the minimum amount of water economically nor in an amount necessary to fully mitigate short-term drought conditions.

Numerous alternatives for raw water supply augmentations of Elmwood Lake have been evaluated, planned, and implemented. These alternatives include installing a raw surface water pump station in main stem Locust Creek; it has been in operation (though flows in Locust Creek necessary to operate the pump have been sporadic). In addition, temporary pumping of East Locust Creek and its tributaries delivers water into other local lakes that is then pumped to Elmwood and the NCMRWC drinking water treatment plant. None of the temporary or pilot measures attempted or implemented provide a solution to the regional water supply demands, nor are they sufficient to meet MDNR minimum capacity requirements.

A temporary, short-term water shortage mitigation measure has been proffered by Smithfield Foods Incorporated, which operates a packing plant in Milan, Missouri, very near Elmwood Lake. That proposal would deliver treated wastewater effluent into Elmwood Lake using the Locust Creek pump line. A rigorous testing protocol is proposed and is subject to approval by MDNR. Treated wastewater effluent delivery would only be allowed when a water shortage is imminent based on Elmwood Reservoir lake level. Treated wastewater effluent flows into Elmwood Creek (below the Elmwood Lake) would continue during normal lake conditions and demand.

Increased Domestic Water Demand

The population growth trend in the 10-county region does not correlate well to water demand, because other factors affect demand numbers. Water consumption data is available from 2006 to 2016 (MDNR 2016). Water demand over the 11-year period increased 6 percent, a trend opposite to the slight decline in population. The North Central Missouri Water Supply Reliability Study coordinated by USACE and MDNR comes to several conclusions regarding the impact of population change on water source dependability (HDR Inc. 2016), which are the following:

- Population declines only provide excess water capacity if water sources are well maintained and not affected by pollution or sedimentation.
- The decline in a reliable water source is a potential factor in the population decline.
- Population decline may reflect a decline in workforce, which limits the availability of registered operators for local water systems.

- Declining population may reduce funds for water systems.

The long-term population trend for the 10-county region shows a population decline starting in 1900. The population decline was steepest from 1900 to 1960 before moderating in the 1970s and 1980s. The population in the 10-county region was 107,130 according to 2010 census data, which was a decrease of 1,160 people, or 1.1 percent, from the 2000 census data (U.S. Census 2010). The current population trend shows a stabilization of the population decline.

An evaluation of births, deaths, and net migrations completed by the Missouri Office of Administration shows a projected 2030 population of 102,228 people for the 10-county region (Missouri Office of Administration 2008). This represents a decline of 2,848 people (2.8 percent) from the 2015 population. On a 10-year basis, this is a decline of 0.56 percent, which shows a decreasing rate of population decline. The decline in population of 2,848 people would account for 0.162 MGD based on the current 119 gallons per capita day (gpcd) water demand.

The long-term population decline does not necessarily indicate a decrease or increase in population projection over the next 100 years. The flattening of the decline curve over the last 25 years and in future projections to 2030 indicate the population is stabilizing and could increase in the future. Some counties, like Adair, Macon, and Sullivan have experienced a recent population increase (HDR Inc. 2016). Similarly, the increase in water consumption over the last 11 years indicates a short-term trend that may continue or may remain volatile into the future. Potential business growth and population dynamics will affect water consumption over the next 100 years. Given the uncertainties in water use and population trends, it is difficult to predict future water demand.

From a water planning perspective, a continued increase in water demand is likely. Short-term water usage shows an increase of 6 percent over the last 11 years. Accounting for the 0.92 MGD ten percent planning contingency described above, water demand increase would equate to a 0.018 MGD increase annually for 50 years. Beyond 50 years it is not possible to accurately project population or water use trends. Because an accurate water usage projection cannot be made past 50 years, it is assumed that the amount required at 100 years will be the same amount as required at 50 years. Based on the 2015 population and water consumption data, the per capita water consumption totals 119 gpcd. At this rate, a population increase of 7,731 people over 50 years (an average of 155 people per year in the 10-county region) would consume the 0.92 MGD 10 percent contingency.

Increased Agriculture Demand

Based on the latest USDA National Agriculture Statistics Service data, Missouri is ranked second in the nation in number of beef cattle; there are 170,400 head of beef cows, excluding calves, in the 10-county region (USDA 2014a). According to the *Missouri Livestock Watering Systems Handbook*, cattle watering should plan for a peak demand of 30 gallons per day for a 1,000-pound cow (NRCS 1998). This equates to 5.1 MGD within the 10-county region. MDNR calculated livestock water demand for the 10-county region at 4.9 MGD for beef cows. (MDNR 2014b).

Livestock producers can stockpile forages but running low on water creates an emergency. During the 2012 drought, public water supplies were used to help meet the needs of livestock producers. There were 201 approved projects that included connections to public water supplies

in 52 Missouri counties (Office of Governor Jay Nixon 2013). The drought of record would reasonably cause a similar or greater demand on drought-strained public water systems. The 0.92 MGD ten percent contingency would provide the 10-county region with only 18 percent of the estimated peak beef cattle water demand.

Increased Business Demand

Business expansion in the 10-county region is limited in part because of the lack of dependable water sources. Reliable groundwater supplies are not available in much of the region and have created a limiting factor for the location and establishment of rural business facilities (Burns & McDonnell 2003). Such facilities must be located near the source of raw materials, including water (Burns & McDonnell 2003).

Historically, two examples demonstrate the water demanded by businesses. The officials at the Smithfield Farmland facility in Milan have wanted to add a third shift for some years but have been restricted by a lack of water. They have approached the NCMRWC to purchase raw water from a new water supply reservoir, if and when one is constructed (MDNR 2004). The addition of a third shift would likely increase the facility's current water usage to 1.54 MGD. Smithfield Farmland has drilled test wells in the Milan area, but available yields are inadequate to supplement their water supply (Burns & McDonnell 2003). Water supply is Smithfield Farmland's primary factor in determining a future plant location (MDNR 2014b). In 2002, ConAgra closed a food processing facility in Milan. When operating, ConAgra had a daily average water demand comparable to that of Smithfield Farmland (Burns & McDonnell 2003). Development and expansion of facilities, such as Smithfield Farmland and ConAgra, are not possible without a dependable water supply.

Although these problems were documented more than a decade ago, they have not been remedied and continue to create barriers for businesses seeking to expand in or relocate to this area. Because of the proprietary nature of future business plans, information is not available regarding other businesses that may have considered this area for relocation or expansion but declined to do so for lack of water. The importance of water in a business's relocation and expansion decisions was detailed in a letter to the Green Hills Regional Planning Commission by an economic development marketing and site selection firm. The letter stated that "water is a strategic economic development asset," and that "Communities and regions with ample water and wastewater treatment capacities will have an advantage..." (J. Ady, personal communication, Dec. 16, 2015). Water source dependability is also important because companies "want to understand the source of the water (groundwater or surface), its chemical characteristics, and the community's ability to treat various levels of biochemical oxygen demands in the water" (J. Ady, personal communication, Dec. 16, 2015). Lastly, the letter states that companies are "actively looking for new locations with better long-term water supplies" (J. Ady, personal communication, Dec. 16, 2015).

More recently, Kraft-Heinz has completed a \$250 million expansion of its Kirksville facility. The new facility is operational and created an additional 448 jobs. The 450,000-square-foot facility is more than double the size of the original 188,000-square-foot facility (Kirksville Daily Express 2018). Additional water usage is expected to total 0.375 MGD for the facility expansion (Ken Dunlap with City of Kirksville, personal email, August 31, 2016).

As the economic development firm recognized in its letter to the Green Hills Regional Planning Commission, a dependable water supply could help convince businesses to relocate or expand their businesses in the 10-county region (J. Ady, personal communication, Dec. 16, 2015). A few businesses like Smithfield Farmland (0.923 MGD) or a series of smaller businesses and business expansions could require the 10 percent contingency (0.92 MGD), or even more, over the 100-year time frame.

Summary of Planning Contingencies

The four planning contingencies in this section addressed unforeseen changes in climate and increased drought risk, increased domestic water demand, increased agriculture demand, and increased business demand. As described above, any one of these planning contingencies could require the planned 10 percent or 0.92 MGD water supply contingency. The more likely scenario would include a portion of the water supply from multiple planning contingencies or all of the planning contingencies to reach the 0.92 MGD water supply. In either scenario, a planning contingency is appropriate and necessary to address additional future water needs.

1.5.1.2.2 Water Loss in Treatment and Distribution

Water demand in the 10-county region is presented as finished water demands, except for water supplied to Smithfield Farmland. Smithfield Farmland is a hog slaughter facility that buys primarily raw water from the NCMRWC. Current MDNR design standards require raw water sizing for surface water supplies to account for water loss because of treatment and distribution, or approximately 20 percent of the raw water supply (MDNR 2013a). These losses are standard in finished water distribution and account for system losses.

Accounting for water loss in treatment and distribution is summarized below.

Total Finished Water Demand

$$\begin{array}{r}
 \text{Inadequate Water Sources plus Planning Contingencies minus Smithfield Farmland} \\
 (9.186 \text{ MGD}) \quad + \quad (0.92 \text{ MGD}) \quad - \quad (0.923 \text{ MGD}) \\
 \hline
 = \text{Total Finished Demand (9.183 MGD)}
 \end{array}$$

Water Loss in Treatment and Distribution

$$\begin{array}{r}
 \text{Total Finished Demand times Twenty Percent Typical Loss} \\
 (9.183 \text{ MGD}) \quad \times \quad (0.20) \\
 \hline
 = \text{Total Estimated Water Loss in Treatment and Distribution (1.837 MGD)}
 \end{array}$$

1.5.1.3 Total North Central Missouri Regional Water Commission Raw Water Supply Need

The lack of dependability of surface, groundwater, and out-of-region water systems showed a total water supply need of 9.186 MGD as shown on Figure 1.5.1.1-3. Prudent planning methodology requires a contingency to account for possible increases in water demand that cannot be reasonably predicted. A 10 percent contingency was chosen to account for climate change or severe drought, population or water demand growth, increased agricultural demand,

or an increased business demand. Water treatment and distribution losses were calculated in Section 1.5.1.2.2.

The total calculated NCMRWC raw water supply needed was determined by adding the following water supply components:

Lack of Dependability of Existing Systems (9.186 MGD)
plus Ten Percent Planning Contingency (0.92 MGD)
plus Estimated Water Loss in Treatment and Distribution (1.837 MGD)
= Total NCMRWC Raw Water Supply Need (11.943 MGD)

Projecting future water demands over the 100-year project life is inherently uncertain because of unpredictable changes in climate, population, business development, natural disasters, and other factors. Increasing uncertainty in future water supply is evidenced by the large number of water supply systems that have ceased water supply operations in the past 35 years. Deterioration of current water source systems caused by siltation of lakes, groundwater level declines, and other factors will likely continue, with water source-challenged systems looking for a dependable, affordable water supply. Those systems that are currently susceptible to drought shortages will continue to have reduced source capacity and increasing water deficits resulting from source deterioration, cost of meeting water quality standards, and climatic uncertainties.

A new source that would eliminate shortfalls in current supplies does not necessarily provide for all contingencies such as potential growth in industry or population that must be served over the next 100 years. The total water needed for the 10-county region includes replacing or supplementing water systems that are not dependable during the drought of record, planning for contingencies, and accounting for water loss in treatment and distribution. Changes in population dispersion, population growth patterns, industry density, political environment, and other factors could affect which systems are a part of this project. Recognizing these uncertainties, and consistent with the 2006 FEIS, 7 MGD was selected as the absolute minimum amount of raw water that an alternative must be able to provide.

The project provides a regional water system that would supplement the existing water suppliers in the 10-county region. A regional water system came at the request of MDNR because it regulates drinking water in Missouri and was reaffirmed in an October 2018 letter from Governor Parsons who calls the project “a part of Missouri’s strategic regionalization strategy”. The proposed Project is not intended to replace all water suppliers. Based on the North Central Missouri Regional Water Source Evaluation (Allstate 2016), the list of water suppliers that have an unreliable water supply during the drought of record were included in the 10-county region demand. The North Central Missouri Regional Water Source Evaluation builds on the Everett Baker report (MDNR 2004) that supports the water supply need for the region. The proposed Project will take pressure off existing water systems that do not join the NCMRWC.

Letters of support (Appendix B) for a dependable water supply were obtained from 18 water supply systems including 9 of the 12 primary water supply systems that were deemed to have inadequate water systems in the 2016 North Central Missouri Regional Water Source Evaluation Study (Allstate 2016, Appendix C). Not all the letters of support indicated an immediate use of the regional water supply system, though they indicated a future use if the need arises. Currently, 13 associated members are interested in joining the NCMRWC. It is the nature of water districts

and communities to reject claims that their water supply is vulnerable. If a water supply is available, future planning will make use of the water supply. Based on the 2016 North Central Missouri Regional Water Source Evaluation Study (Allstate 2016, Appendix C), future planning for the region must have another water source to plan for the drought of record.

1.5.2 Need for Flood Damage Reduction

This project intends to provide flood damage reduction benefits along a 22.5-mile reach of East Locust Creek above the confluence with Locust Creek (Figure 1.5.2-1). This reach in Sullivan County includes the community of Milan but is primarily comprised of agricultural land. The 2006 FEIS includes flood damage estimates and flood damage reduction benefits along both East Locust Creek and Locust Creek, referred to as “on-site” and “off-site”, respectively. The current analysis determines the flood damage reduction need and updates the on-site information from the 2006 FEIS. Analysis of the Locust Creek floodplain is consistent with the 2006 FEIS and is not revised further in the current document.

The East Locust Creek 100-year floodplain includes approximately 5,041 acres in the reach downstream from the toe of the dam and extending to the confluence with Locust Creek (Figure 1.5.2-1). According to National Land Cover Database (NLCD) data, the area includes 10 acres of high-density developed (urban) land, 29 acres of medium-density developed (normally residential) land, 73 acres of low-density developed (rural agriculture and residential) land, and approximately 86 acres of developed open space, including parks, industrial ground, and infrastructure such as roads and utility rights-of-way. The remaining acreage (4,843 acres) includes agricultural cropland, pasture, deciduous forest, and wetlands.

Past Flood Events

Anecdotal evidence offers insight into the threat to life and property posed by flooding along East Locust Creek. According to Officer Terry Michaels, Milan Chief of Police, East Locust Creek almost always overtops its banks even during common, nonsevere rain events. Floods have damaged commercial properties in Milan, and the floodwater routinely overtops bridges, cutting off access between communities located east and west of East Locust Creek (T. Michaels, personal communication, Dec. 30, 2014).

A major disaster declaration was issued October 31, 2014, for eight counties in northern Missouri, including Sullivan County, for severe storm damage and flooding that occurred September 9 and 10, 2014 (FEMA 2014). Sullivan County incurred some of the greatest damages, with assessments of \$50.04 per capita (\$335,969; U.S. Census 2010) in the county to allay some of the damage costs (FEMA 2014). Similar storm and flood damage affected northern Missouri, including Sullivan County, in May and June, 2013, with severe storms and a subsequent disaster declaration, as well as a disaster declaration for storm and flood damage in August 2010 (MSEMA 2014). Figure 1.5.2-2 shows the impact of a 100-year flood event to the City of Milan.

Extreme Weather Events and Future Flood Events

In the time since the 2006 FEIS was completed, there has been an increased awareness and focus on extreme weather events. Just as water supply will be affected by predicted extremes in precipitation and the potential for more frequent or extreme droughts, so too will the risk of flooding.

Recent research indicates that Missouri may be at risk for more frequent severe storm events with the potential to increase flood damages. The 2017 Climate Science Special Report states, “Significant increases in flood frequency have been detected in about one-third of stream gauge stations examined for the central United States, with a much stronger signal of frequency change than is found for changes in flood magnitude in these gauges.” In the Central U.S., a future increase in flood frequency is more likely than an increase in flood magnitude. (U.S. Global Change Research Program 2017).

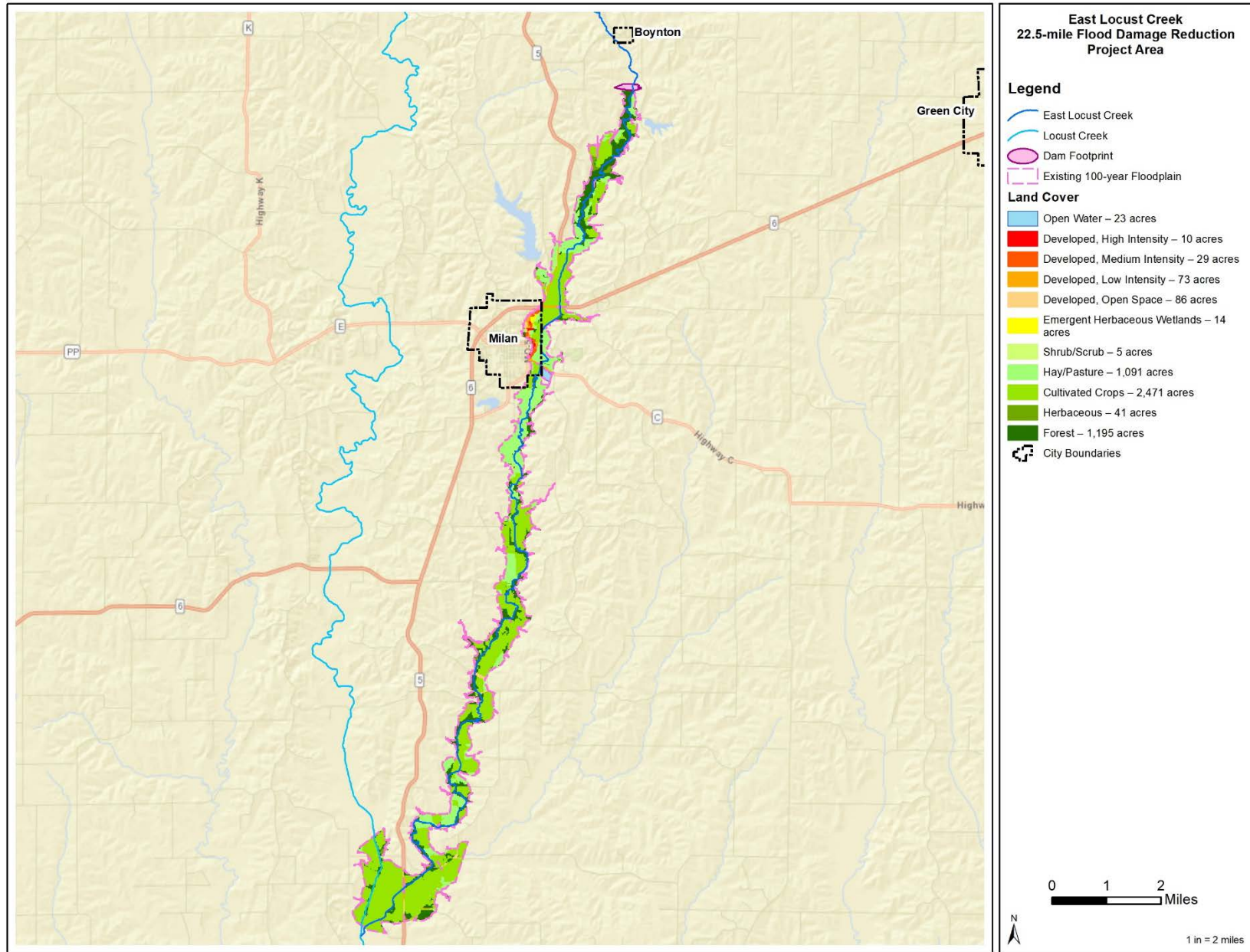


Figure 1.5.2-1. East Locust Creek 100-year Floodplain.

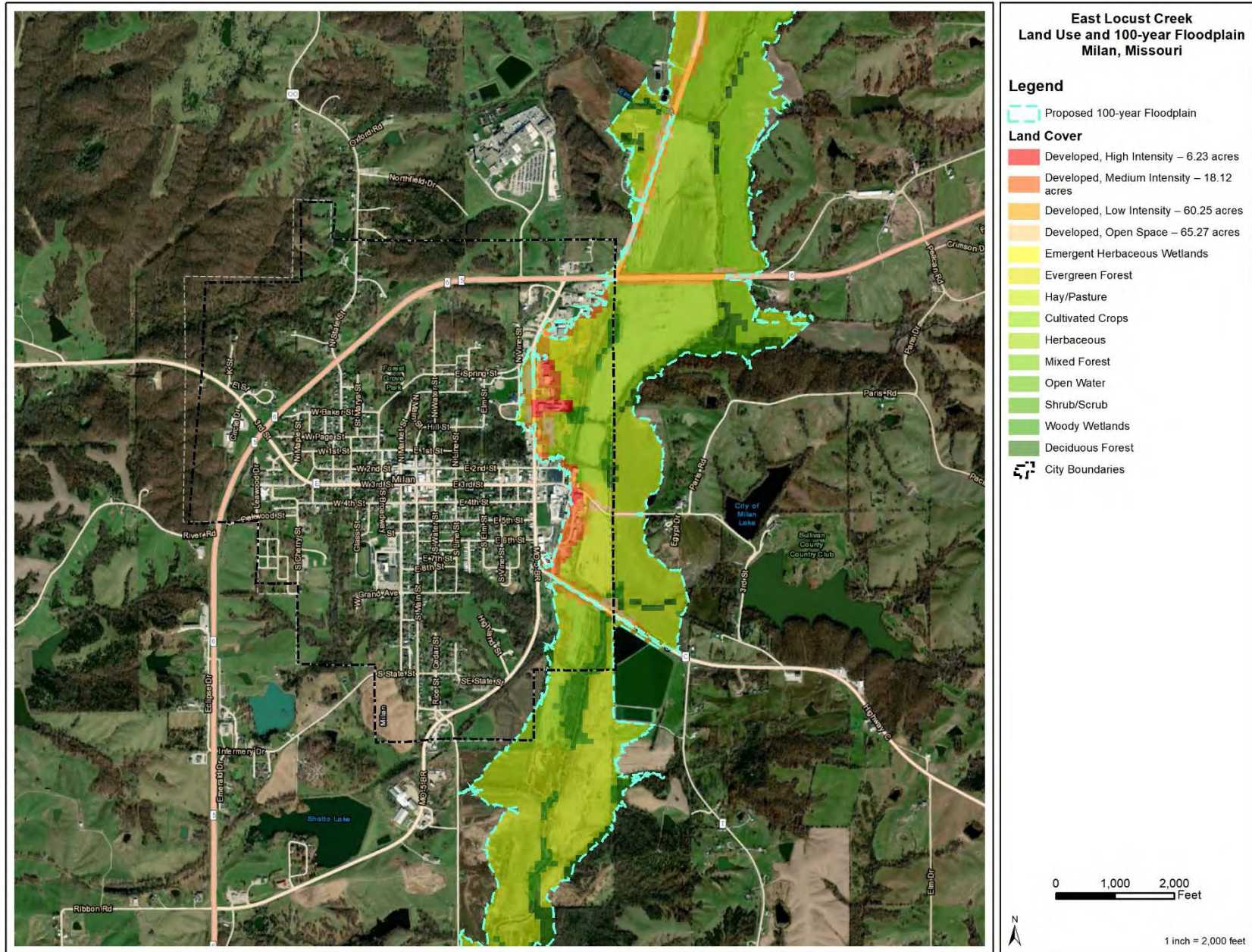


Figure 1.5.2-2. Milan 100-year Floodplain.

Floods occur primarily from March through June. The most damaging flood along East Locust Creek occurred in 1947 when 8,800 acres were flooded. This storm, estimated to be a 100-year event, dropped 7.1 inches of rain in 24 hours and caused an estimated \$799,000 of crop and pasture damage, based on 2004 current normalized prices. Other off-site agricultural damages, such as fences and debris, were estimated to be \$193,000 (NRCS 2006).

Flooding from heavy rains commonly occurs in most tributary streams in northern Missouri and may be expected once or twice in most years (Decker 2014). Flash flooding can be expected in minor streams following heavy thunderstorms, typically in the spring and early summer, but they may occur during any month. Since 2009, National Oceanic and Atmospheric Administration (NOAA) climatological data for Milan show at least two severe storms (defined as greater than 2 inches in 24 hours) per year, except for 2012, which was a period of exceptional drought. Five severe storms occurred in 2010 and three severe storms occurred in 2014, including a 6.9-inch downpour in September of that year.

The frequency of severe storms in Missouri – as predicted with modeled climate change – is expected to increase, with the potential of flash flooding also increasing because storms are likely to occur during anticipated wetter winters and springs (UCS 2009). Because more of the expected precipitation increases will fall as heavy downpours, infiltration amounts decrease and runoff volumes correspondingly increase, thereby increasing flood potential.

Annual Flood Damage Reduction

The July 1987 East Locust Creek Watershed Plan and Environmental Assessment proposed construction of 121 small floodwater retarding structures (FWRs) in the East Locust Creek Watershed. At the time that the 2006 East Locust Creek Watershed Revised Plan and Environmental Impact Statement were written, 72 small FWRs were constructed. Of these, 12 were in the Headwaters East Locust Creek HUC-12 above the proposed reservoir dam and 7 were in the Headwaters East Locust Creek HUC-12 and would be inundated either wholly or partially by the proposed reservoir dam. Twenty-two of the remaining structures were in the East Locust Creek HUC-12 floodplain below the proposed reservoir dam and 17 were in the Little East Locust Creek HUC-12, which is a tributary to East Locust Creek. The 2006 EIS proposed plan modified the earlier plan by recommending construction of the proposed East Locust Creek Reservoir in lieu of the remaining 21 unbuilt FWRs in the Headwaters East Locust Creek HUC-12 and the 6 remaining unbuilt FWRs in the East Locust Creek HUC-12. In addition, the 2006 plan proposed constructing 22 FWRs in the Little East Locust Creek HUC-12 in lieu of the 18 remaining unbuilt FWRs in the Little East Locust Creek HUC-12. Nine of the 22 FWRs were built before funding was pulled from the program. The remaining 13 are not expected to be re-funded.”

The 72 FWRs constructed under the 1987 watershed plan reduced total average annual flood damages in the East Locust Creek and Locust Creek floodplains from \$2,650,000 to \$1,230,000, in 2005 dollars. The additional 9 FWRs constructed under the 2006 revised watershed plan resulted in a 7 percent reduction in estimated annual flood damages in the East Locust Creek and Locust Creek floodplains (from \$1,230,000 to \$1,140,000).

Average annual flood damages for the current analysis were calculated using the NRCS ECON2 model. ECON2 modeling determines damages between cross-sections from several known data points. It uses several types of information, including commodity prices, crop distributions, water surface elevations where damages begin, and elevation and areas affected for specific storm-

event flows based on the modeling of stream flood flows. Flood flows were computed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) model. Flood flows estimated by the HEC-HMS model were entered into the River Analysis System (HEC-RAS) hydraulic model of East Locust Creek from the outlet of the proposed dam to the mouth at the confluence with the main stem of Locust Creek. HEC-RAS modeling estimates water surface elevations over the geographic area of interest for storm events of various frequencies.

ECON2 modeling calculates bridge damages using a damage curve for each bridge. The damage curve indicates how much damage occurs at certain water surface elevations. The ECON2 model then analyzes the flows for the different flooding frequencies to calculate the average annual damages (USDA 1990). The ECON2 model estimates that the cost of damages to infrastructure, such as roads, bridges, and utilities, is \$73,600 per year.

ECON2 modeling was also used to estimate the annual damage to agricultural land, including cropland and pastureland. ECON2 modeling used hydraulic information from HEC-RAS and hydrologic information from HEC-HMS to determine the flooded area. The time of year that the flood event occurred was factored into the economic damages that occur from the flood event (USDA 1990). ECON2 modeling calculated that the average damages to crops and pasture are \$674,000 per year.

Another way to calculate cropland flood damage is from crop insurance claims, which are tracked by the USDA Risk Management Agency and categorized by the natural disaster that caused the damage. While not all farmers have crop insurance, the 10-year average annual losses caused by flooding in Sullivan County are \$71,153 (USDA 2014b). Crop insurance policies cover 50 to 80 percent of the yield and 55 to 100 percent of the price (USDA 2014b). The loss values are based on the crop price during the year in which the loss occurred. Crop losses are difficult to quantify because of replanting, partial loss, or loss of yield. Partial loss and loss of yield are losses in profit at harvest, while replanting losses could also include a reduction in yield and duplicated fuel, labor, and equipment costs, which are difficult to quantify.

The USDA Risk Management Agency's average annual value of \$71,153 for Sullivan County (USDA 2014b) is likely below the actual agricultural loss value. However, the estimated crop and pasture losses identified from ECON2 modeling (\$674,032) could be above the actual value. Neither estimate accounts for field damages. For the purposes of this DSEIS, a number between the two was chosen; the estimated crop losses caused by annual flooding are \$100,000 for the flood damage within the 22.5-mile reach from the toe of the dam to the confluence of Locust Creek. The estimated value is in the middle of the range and accounts for additional flood damages to fields.

The total average annual flooding cost includes losses to crops and infrastructure. Based on an estimated average annual loss of \$100,000 for crops and an average annual estimated \$73,600 for infrastructure, the average annual flood damages total \$173,600 along the main stem of East Locust Creek from the toe of the dam to the confluence with Locust Creek.

1.5.3 Need for Water-based Recreation

This project is intended to provide water-based recreation for the unmet demand in the 10-county region. The recreational need has been identified as water-based for fishing, nonrestricted boating activities (includes wake boating), and swimming. The recreational purpose for the East Locust Creek project is not and has not been to provide athletic recreational facilities such as golf, tennis,

basketball, soccer, or football. Key additional benefits associated with a lake for water-based recreation are camping, hiking, bird-watching/nature study, and picnicking within the area managed for wildlife habitat, among other potential uses. These additional benefits are secondary to the primary purpose of water-based recreation.

Quantifying the Regional Need for Water-based Recreation

The need for water-based recreation was derived from supply-and-demand data. The 2006 FEIS prepared a recreation evaluation for East Locust Creek that used the 1990 Missouri Statewide Comprehensive Outdoor Recreation Plan (SCORP) to develop demand estimates, and Uhlig (1980) to develop supply estimates. The 2006 FEIS analysis used a population within 25 miles of the proposed East Locust Creek Reservoir site, which included the entire population of Sullivan County and portions of populations from nine other counties. The results of the 2006 FEIS indicated a water-based recreation demand of 213,000 annual user-days after removing secondary recreational activities such as hiking and camping, and an estimated supply of 52,700 annual user-days from seven lakes within the 25-mile radius. The result of the recreational analysis determined an unmet demand of 160,000 annual user-days. The analysis concluded that the East Locust Creek project would support the unmet demand by supplying 72,000 annual user-days.

Since 2006, the 2013 – 2017 Missouri SCORP has been published by MDNR for the Missouri State Inter-agency Council for Outdoor Recreation, with updated demand estimates (NRCS 2006). This updated information quantifies rural and urban recreational uses and looks at trends to support future needs. The 2013 – 2017 Missouri SCORP indicates that fishing and hunting are two important activities for introducing youth to the outdoors and are much more popular in Missouri than in the U.S. as a whole, particularly among rural residents (MDNR 2013d). Furthermore, the 2013 – 2017 Missouri SCORP references the USFWS' 2006 National Survey of Fishing, Hunting, and Wildlife as indicating that two-thirds of rural Missourians go fishing each year, compared to 55 percent of urban residents.

Trends documented by the 2013 – 2017 Missouri SCORP for the next five years indicate fishing as the top activity expected to grow in Missouri (MDNR 2013d). According to the 2013 – 2017 Missouri SCORP, 20 percent of fishermen who fish at least once a year indicated their fishing will increase, while only five percent indicated their fishing will decrease. The 2013 – 2017 Missouri SCORP also indicates substantial resident participation for all types of boating, including motor boating, sailing, canoeing, and kayaking. The East Locust Creek purpose is consistent with the 2013 need for water-based recreation for fishing, swimming, and boating/sailing/canoeing/kayaking, as determined by the 2013 – 2017 Missouri SCORP.

Use of the recreational site depends to an extent on the population living within a certain distance from it. A recreational market area (RMA) was developed based on the distance Missourians would travel to participate in outdoor recreation (MDNR 2013d). The 2013 – 2017 Missouri SCORP showed that 65 percent of rural Missourians would travel less than 50 miles for outdoor recreation on a weekend. For consistency with the other project purposes, the entire 10-county region is established as the RMA. The average distance from the center point of the 10-county region to its borders is approximately 47 miles. Using the 10-county region as the RMA, an estimated 65 percent of residents within the 10-county region would travel to a centrally located lake within the RMA and are included in the need analysis. The remaining 35 percent of residents are likely to travel outside the 10-county region for recreation and are not included in the need analysis. The population of the 10-county region is 107,130 people (U.S. Census 2010). Based

on an estimated 65 percent of residents who would travel 50 miles or less, the population of recreational users in the RMA totals 69,600 people.

Figures 1.5.3-1 and 1.5.3-2 show the RMA with existing lakes, stream access points, and county population based on the 2010 U.S. Census. For clarification, final recreation demand and supply numbers are rounded to four significant digits.

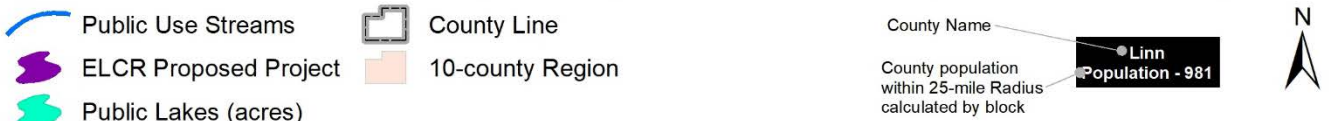
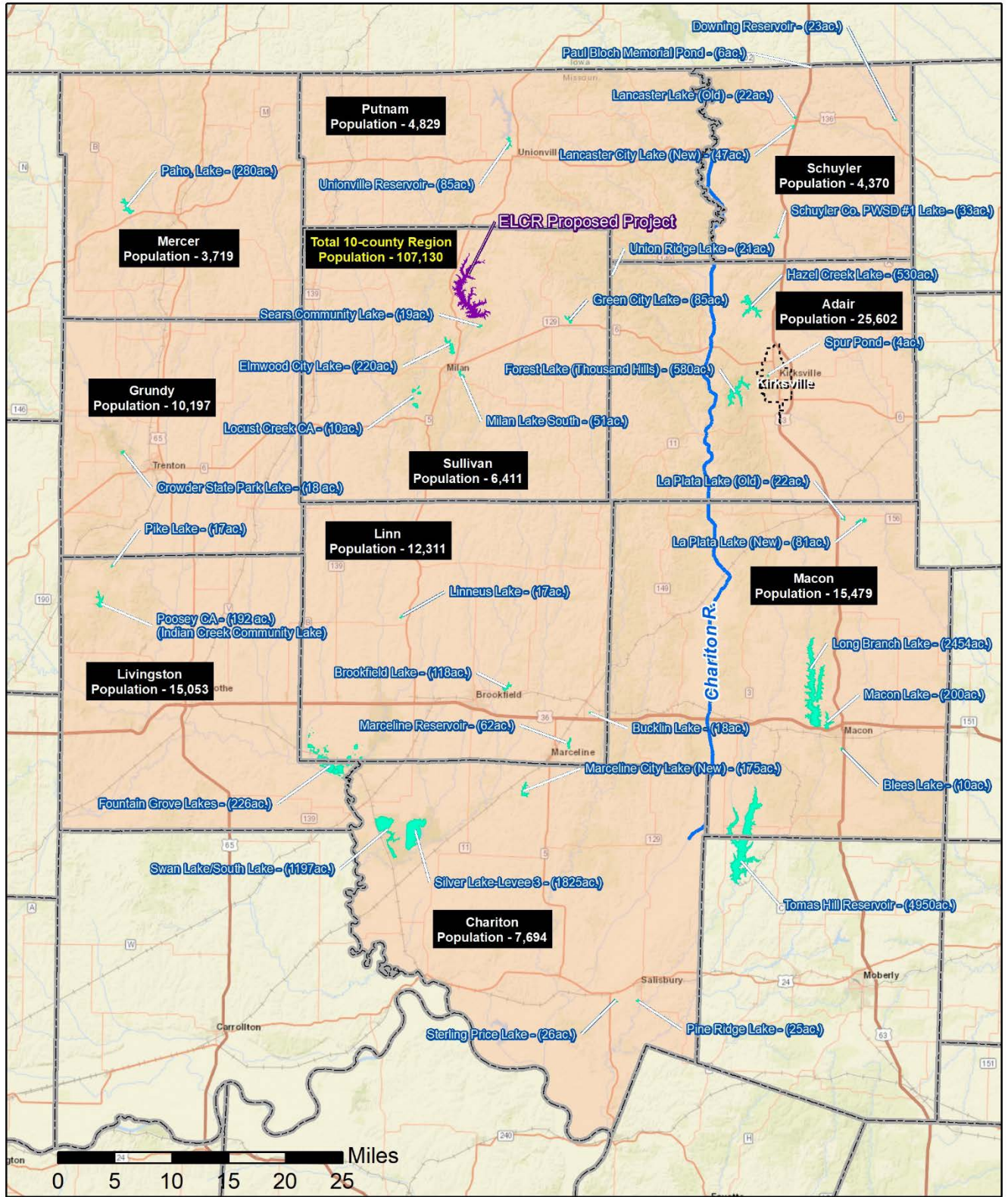


Figure 1.5.3-1. Lakes Within Recreation Market Area.

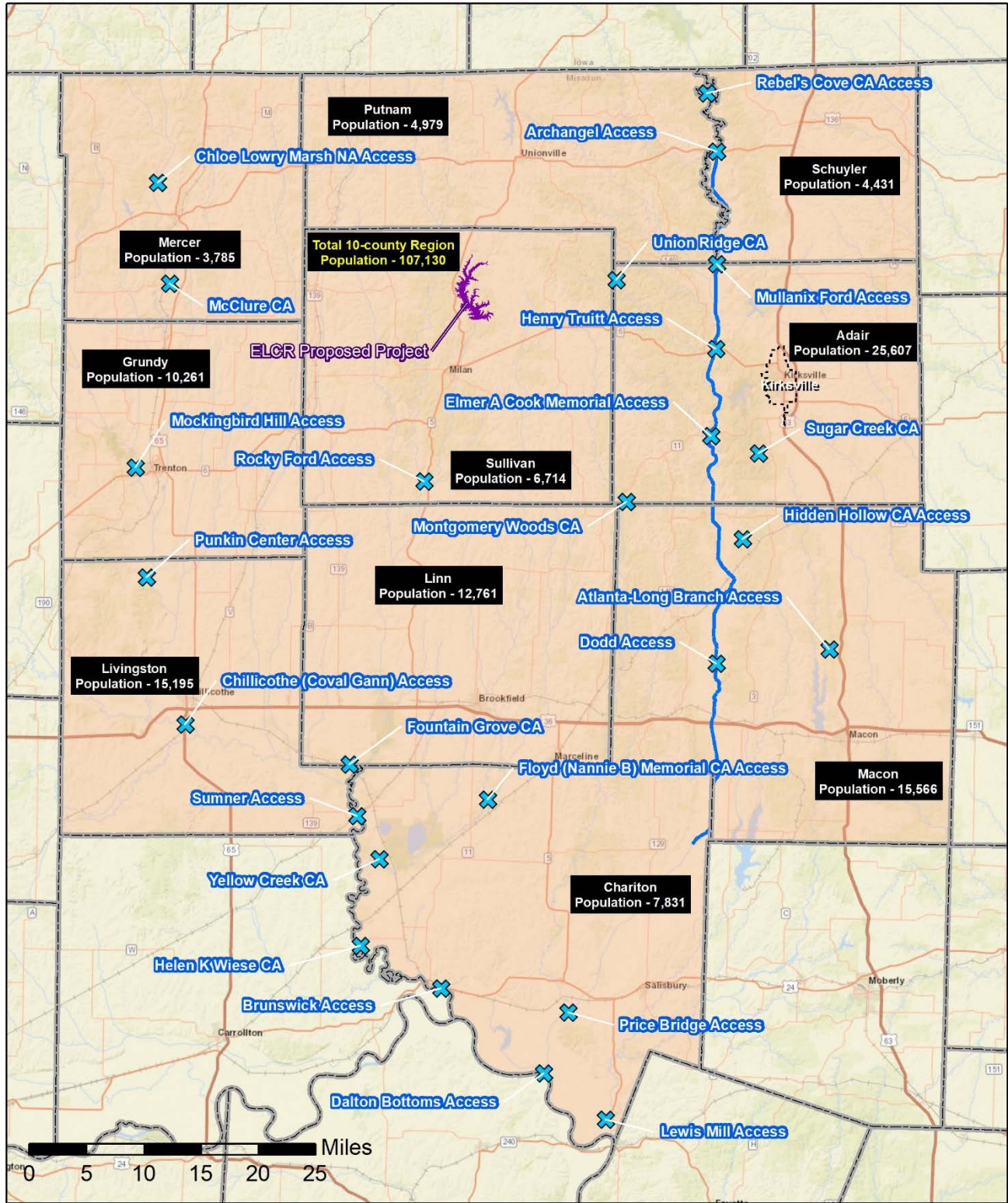


Figure 1.5.3-2. Stream Access Within Recreation Market Area.

Recreation Demand Calculations

Demand for recreation is based on how often people would use the recreation type in a year (annual user-days per person). The 2013 – 2017 Missouri SCORP includes participation data for the two categories of water-based activities – fishing and boating/sailing/canoeing/kayaking – that will be evaluated for East Locust Creek. Data from SCORP Table 9 (MDNR 2013d) was used to calculate the annual user-days per person for these two activities. Tables 1.5.3-1 and 1.5.3-2 summarize the methodology and resulting user-days for participants for each activity. Note that the total annual user-days per person is consistent with the USFWS 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, which stated the Missouri statewide average days fished per angler was 17 days (USFWS 2013).

Once user-days per person-demand was determined, the number of people who would fish or boat in the RMA was then estimated. The population within the 10-county region was modified by the percentage of people who indicated a willingness to travel to participate in outdoor recreation outside the 10-county RMA region. Sixty-five percent of the people who live in the 10-county region are willing to travel within the RMA for recreational opportunities. This assumes those willing to travel greater distances may go to facilities farther away from their residences. The calculations included a Travel Factor of 0.65 (65 percent).

Table 1.5.3-1. Calculation of Total Annual User-days for Fishing.

| How Often do People Fish | Annual Visits (Days) | Percentage (%) of People Who Report Fishing this Often | Annual User-days per Person (Annual Visits x Percentage) |
|--|----------------------|--|--|
| Once per year | 1 | 15.5 | 0.2 |
| Every 4 – 6 months | 2 | 16.4 | 0.3 |
| Every 2 – 3 months | 5 | 8.2 | 0.4 |
| Monthly | 12 | 25.5 | 3.1 |
| 2 – 3x/month | 30 | 10.0 | 3.0 |
| Weekly | 52 | 15.5 | 8.0 |
| 2 – 3x/week * | 130 | 9.1 | 11.8 |
| 4 – 5x/week * | 234 | 0 | 0 |
| Daily * | 365 | 0 | 0 |
| Subtotal Annual User-days | | | 26.8 |
| Travel Factor | | | 0.65 |
| TOTAL ANNUAL USER-DAYS PER PERSON | | | <u>17.4</u> |

* Because of seasonal restrictions, those surveyed who indicated daily or 4-5x/week were included as 2-3x/week or 130 annual visits.

Table 1.5.3-2. Calculation of Total Annual User-days for Boating/Sailing/Canoeing/Kayaking.

| How Often do People Go Boating | Annual Visits (Days) | Percentage (%) of People Who Report Boating this Often | Annual User-days per Person (Annual Visits x Percentage) |
|--|----------------------|--|--|
| Once per year | 1 | 26.8 | 0.3 |
| Every 4 – 6 months | 2 | 19.1 | 0.4 |
| Every 2 – 3 months | 5 | 7.6 | 0.4 |
| Monthly | 12 | 21.0 | 2.5 |
| 2 – 3x/month | 30 | 5.7 | 1.7 |
| Weekly | 52 | 12.0 | 6.2 |
| 2 – 3x/week * | 130 | 7.6 | 9.9 |
| 4 – 5x/week * | 234 | 0 | 0 |
| Daily * | 365 | 0 | 0 |
| Subtotal Annual User-days | | | 21.4 |
| Travel Factor | | | 0.65 |
| TOTAL ANNUAL USER-DAYS PER PERSON | | | 13.9 |

* Because of seasonal restrictions, those surveyed who indicated daily or 4-5x/week were included as 2-3x/week or 130 annual visits.

The Total Annual User-days per Person in the relevant population was calculated for each of the two recreational uses, and then multiplied by the relevant population to obtain the total annual demand, as summarized in Table 1.5.3-3.

Table 1.5.3-3. Annual User-days Demanded by the Relevant Population.

| Activity | Percent (%) of Population Participating in this Activity* | Number of People Participating | Annual User-days per Person | Demand Annual User-days |
|-----------------------------------|---|--------------------------------|-----------------------------|-------------------------|
| Fishing | 59 | 63,207 | 17.4 | 1,100,000 |
| Boating/Sailing/Canoeing/Kayaking | 52 | 55,708 | 13.9 | 774,000 |
| TOTAL DAYS | | | | 1,874,000 |

*Source: MDNR 2013a

For outdoor fishing and boating/sailing/canoeing/kayaking, a demand exists for 1,874,000 user-days of recreation from residents within the 10-county RMA.

Supply Calculations

The methodology to calculate total recreation supply for fishing and boating within the RMA is consistent with the methodology used in the 2006 FEIS. One difference is that river access points were not included in the 2006 FEIS but are included in this DSEIS. Because estimates of supply can vary, three methodologies were compared, as described below.

Uhlig (1980) Methodology

The Uhlig method, used in the 2006 FEIS, bases supply on parking availability. The RMA includes the 10-county region and contains 13,700 acres of public lakes and 64 miles of stream access. Adequate parking is an essential component of supply. To determine supply, the 2006 FEIS used availability of parking; it estimated the number of parking spaces by multiplying the total waterbody

acreage by 0.1. For the DSEIS, existing parking spaces were estimated by using aerial imagery to measure the area of the parking lot at each waterbody. Parking spaces were then estimated from the average space needed for a car and truck with trailer. The areas required for a single car or truck with trailer parking space were calculated based on reviewing USACE lakes with distinguishable parking stalls and measuring the square footage required for a car parking space (355 square feet) or a truck with trailer space (587 square feet). Parking spaces created by a turn-in or circle drive were estimated based on a vehicle requiring 30 feet to park and were included as additional parking spaces. The average of these two numbers (471 square feet) was used to estimate the number of parking spaces at existing lakes and river accesses (Table 1.5.3-4). A total of 1,869 available vehicle spaces is estimated for the 10-county region.

Table 1.5.3-4. Lake and River Access Parking Spaces.

| Missouri Department of Conservation and Public Lake and River Access | Stream Access (miles) | Lake or Pond Size (acres) | Parking Lot Area (square feet) | Additional Parking Spots | Total Parking Spots |
|--|-----------------------|---------------------------|--------------------------------|--------------------------|---------------------|
| Archangel Access | 0.20 | 0 | 7,252 | 0 | 15 |
| Brookfield City Lake | 0.00 | 118 | 19,709 | 22 | 64 |
| Brunswick Access | 0.10 | 0 | 18,400 | 0 | 39 |
| Bucklin Lake | 0.00 | 18 | 0 | 5 | 5 |
| Chillicothe (Coval Gann) | 0.20 | 0 | 3,927 | 0 | 8 |
| Dalton Bottoms Access | 0.25 | 0 | 30,520 | 0 | 65 |
| Dodd Access | 0.25 | 0 | 6,226 | 0 | 13 |
| Downing Reservoir | 0.00 | 23 | 1,411 | 2 | 5 |
| Elmer A. Cook Memorial | 0.10 | 0 | 3,222 | 0 | 5 |
| Floyd (Nannie B) Mem CA* | 0.25 | 0 | 0 | 1 | 1 |
| Forest Lake (Thousand Hills) | 0.00 | 580 | 121,354 | 0 | 258 |
| Fountain Grove CA | 0.00 | 226 | 0 | 0 | 22 |
| Fountain Grove CA | 12.00 | 0 | 6,297 | 0 | 13 |
| Green City Lake | 0.00 | 85 | 2,830 | 0 | 6 |
| Hazel Creek Lake | 0.00 | 530 | 14,131 | 2 | 32 |
| Henry Truitt Access | 0.13 | 0 | 7,751 | 0 | 16 |
| La Plata City Lake | 0.00 | 81 | 3,982 | 0 | 8 |
| Lake Paho CA | 0.00 | 280 | 11,961 | 86 | 111 |
| Lancaster | 0.00 | 6 | 0 | 2 | 2 |
| Lancaster City Lake | 0.00 | 47 | 5,906 | 0 | 13 |
| LaPlata Lake (Old) | 0.00 | 22 | 0 | 5 | 5 |
| Lewis Mill Access | 0.20 | 0 | 7,069 | 0 | 15 |
| Linneus Lake | 0.00 | 17 | 0 | 3 | 3 |
| Locust Creek CA | 0.00 | 10 | 3,616 | 2 | 10 |
| Long Branch Lake | 0.00 | 2,454 | 52,562 | 305 | 417 |
| Macon (Blees Lake) | 0.00 | 10 | 3,221 | 0 | 7 |
| Macon City Lake | 0.00 | 200 | 7,743 | 17 | 33 |
| Marceline Reservoir (old Marceline City) | 0.00 | 62 | 17,059 | 0 | 36 |
| Marceline City Lake | 0.00 | 175 | 4,554 | 0 | 10 |
| McClure CA | 1.00 | 0 | 2,439 | 0 | 5 |
| Milan (Elmwood Lake) | 0.00 | 220 | 5,395 | 4 | 15 |
| Milan Lake South | 0.00 | 51 | 2,250 | 5 | 10 |
| Mockingbird Hill Access | 0.30 | 0 | 6,331 | 0 | 13 |
| Mullanix Ford Access | 0.17 | 0 | 6,282 | 0 | 13 |
| Poosey CA (Indian Creek) | 0.00 | 255 | 56,877 | 2 | 123 |

| Missouri Department of Conservation and Public Lake and River Access | Stream Access (miles) | Lake or Pond Size (acres) | Parking Lot Area (square feet) | Additional Parking Spots | Total Parking Spots |
|--|-----------------------|---------------------------|--------------------------------|--------------------------|---------------------|
| Price Bridge Access | 0.70 | 0 | 0 | 2 | 2 |
| Punkin Center Access | 0.30 | 0 | 1,303 | 0 | 3 |
| Rebel's Cover CA | 5.00 | 0 | 20,267 | 0 | 43 |
| Rocky Ford Access | 0.14 | 0 | 3,588 | 0 | 8 |
| Salisbury (Pine Ridge Lake) | 0.00 | 25 | 12,317 | 0 | 30 |
| Schuyler County PWSD No.1 | 0.00 | 33 | 0 | 2 | 2 |
| Sears CL** | 0.00 | 19 | 6,800 | 0 | 14 |
| Silver Lake | 0.00 | 1,825 | 719 | 6 | 8 |
| Spur Pond | 0.00 | 4 | 4,053 | 0 | 9 |
| Sterling Price CL | 0.00 | 26 | 0 | 7 | 7 |
| Sumner Access | 0.10 | 0 | 14,796 | 0 | 31 |
| Swan Lake | 0.00 | 1,197 | 3,197 | 0 | 7 |
| Thomas Hill Reservoir CA | 0.00 | 4,950 | 95,693 | 0 | 253 |
| Union Ridge | 0.00 | 21 | 9,223 | 0 | 20 |
| Unionville (Lake Mahoney) | 0.00 | 85 | 5,439 | 2 | 14 |
| Yellow Creek CA | 4.00 | 0 | 1,120 | 0 | 2 |
| TOTAL | 25.4 | 13,655 | 618,792 | 482 | 1,869 |

Source: MDC 2017a

Note: Lakes are indicated by the grey rows and streams are indicated by the white rows.

* CA = Conservation Area; **CL = Conservation Lake

The supply calculations do not account for the quality of the public lake or stream access or the life expectancy of the public lake or stream access. Many of the lakes are already over 50 years old and may not be functioning over the desired 100-year life expectancy of the project. Older lakes have increased potential for fish kills and sedimentation, and high nutrient inputs can increase eutrophication and affect the quality of the fishery and potentially impact the safety of human water contact. For the purposes of this DSEIS, to be conservative, a high-level analysis was completed that assumes the existing recreational lakes and stream accesses are available long-term.

The 2006 FEIS used the methodology of Uhlig (1980) to determine the number of user-days supplied by these lakes for all recreational types each year. For this DSEIS, the calculations are as follows:

- 1,869 spaces * 4 people per car * 2 times per day (Uhlig 1980) = 14,952 people per day
- 14,952 people per day / 0.0231 (Sunday-use factor; Uhlig 1980) = 647,273 annual user-days of recreation supplied

Based on the Uhlig 1980 methodology, the existing lakes and stream accesses in the 10-county region provide 647,000 annual recreation user-days for lake and stream access. This totals 107,000 stream user-days for stream access (310 parking spaces) and 540,000 lake user-days for lake access (1,559 parking spaces). The lake access equates to 39.5 user-days per acre of lake.

U.S. Army Corps of Engineers Recreation Use Data

The annual recreation use of USACE lakes in northern Missouri was evaluated as an alternative method of calculating the annual recreation user-days supplied by lakes in the 10-county region.

The USACE has recreation use data on three USACE lakes in northern Missouri: Smithville Lake, Long Branch Lake, and Mark Twain Lake (USACE 2013a).

The USACE data duplicates similar recreational uses that could occur during a single use. For example, the water skiers would also be counted as boaters. To account for the duplicate uses, a correction factor was subtracted to make the total uses consistent with the total person trips. As shown in Table 1.5.3-5, the USACE lakes provide approximately 73 annual recreation user-days per acre.

Table 1.5.3-5. Average Annual Recreation Use – U.S. Army Corps of Engineers Lakes.

| Skiers, Boaters, and Fishermen Person-Trips | | | |
|--|--------------|------------|----------------|
| USACE Lake | Person Trips | Lake Acres | Trips per Acre |
| Long Branch | 162,389 | 2,430 | 66.8 |
| Mark Twain | 1,085,361 | 18,600 | 58.4 |
| Smithville | 672,786 | 7,190 | 93.6 |
| Average | n/a | n/a | 72.9 |
| Calculation of Supply of Lake User-days | | | |
| Lake Acres in the 10-county Region | | | 13,655 |
| USACE Average Trips per Acre | | | 72.92 |
| Total Annual User-days | | | 996,000 |

Source: USACE 2013a

Based on 13,655 lake acres in the 10-county region, this would total 996,000 annual lake user-days. Because the lake acres do not account for stream access, 107,000 annual stream user-days from stream access are added to the USACE recreation use data. This totals 1,103,045 annual recreation user-days of water-based recreation for the 10-county region using USACE data.

Missouri Department of Conservation Recreation Use Data

The annual recreation use of Missouri Department of Conservation (MDC) lakes in the 10-county region also was evaluated as an alternative method of calculating the annual recreation user-days supplied by lakes in the 10-county region (MDC 2016). The MDC recreation use data is available for 18 lakes in the 10-county region; other lakes in the 10-county region did not have MDC data available. The lakes include municipal lakes, USFWS lakes, and USACE lakes. One of the lakes, the USFWS Swan Lake, was removed because the lake uses do not include boating or fishing, as indicated by the low number of recreational uses.

The MDC report based the recreational uses (angler days) on surveys of fishing permit holders. The fishing permit holder numbers do not include people 65 years and older, or ages 3 to 15 years, because these groups are not required to have permits. In order to include these groups, the data in the MDC report was “corrected” based on the percentage of people who fish in Missouri and the population in the 65 years and older category and the 3 years to 15 years category. Tables 1.5.3-6 and 1.5.3-7 show the recreation use calculations.

Table 1.5.3-6. Missouri Department of Conservation Data Correction.

| Correction Factor Calculations | |
|---|-------------|
| Missouri Population (2010) ¹ | 5,988,927 |
| Number of People holding Missouri Fishing Permits ² | 747,436 |
| Missouri Population 65 years and older or 3 to 15 years of age ¹ | 1,867,880 |
| Estimated number of People age 65 and older or 3 to 15 years of age that fish | 233,117 |
| Correction Factor (percent of population that do not need permits) | 0.31 |
| % of Missouri population that fishes | 16.4 |

¹ Source: U.S. Census 2010

² Source: MDC 2016

Table 1.5.3-7. Missouri Department of Conservation Data Annual Lake Use.

| Lake Name | Lake Acres | Lake Uses (User-days per Acre) | Recreation Uses Correction Factor (User-days per Acre) | Average Annual (User-days per Acre) |
|---|-------------------|---------------------------------------|---|--|
| Brookfield City Lake | 118 | 807 | 1,059 | 9 |
| Forest Lake (Thousand Hills) | 580 | 23,293 | 30,558 | 53 |
| Fountain Grove CA | 226 | 32,598 | 42,765 | 189 |
| Green City Lake | 85 | 4,741 | 6,220 | 73 |
| Hazel Creek Lake | 530 | 4,005 | 5,254 | 10 |
| La Plata City Lake | 81 | 8,056 | 10,569 | 130 |
| Lake Paho CA | 280 | 10,624 | 13,938 | 50 |
| Lancaster City Lake | 47 | 1,030 | 1,351 | 29 |
| Locust Creek CA | 10 | 3,062 | 4,017 | 408 |
| Long Branch Lake | 2,454 | 42,397 | 55,620 | 23 |
| Macon City Lake | 200 | 3,121 | 4,094 | 20 |
| Marceline City Lake | 175 | 22,551 | 29,584 | 169 |
| Milan (Elmwood Lake) | 220 | 206 | 270 | 1 |
| Poosey CA (Indian Creek Community Lake) | 255 | 12,803 | 16,796 | 66 |
| Sterling Price CL | 26 | 2,316 | 3,038 | 117 |
| Thomas Hill Reservoir CA | 4,950 | 118,227 | 155,101 | 31 |
| Union Ridge | 21 | 4,309 | 5,653 | 269 |
| TOTALS | 10,258 | 294,146 | 385,887 | 38 |

Source: MDC 2016

Based on the 13,700 lake acres in the 10-county region, the MDC method would total 519,000 annual lake user-days. Because the lake acres do not account for stream access, the 107,000 annual stream user-days from stream access are added to the MDC recreation use data. This totals a supply of 626,000 annual user-days of water-based recreation for the 10-county region.

Comparison of Methodologies

The Uhlig 1980 methodology is the only methodology that accounts for peak use days. Use of actual or survey data that provides average annual recreation use does not account for peak days but assumes peak use if factored in on an annual basis. The USACE lake data is based on lakes that are all larger than the Proposed Action and in the case of Mark Twain Lake, substantially larger. The quality of amenities may also differ between USACE lakes and other lakes in the 10-county region.

The same number of annual user-days for stream access were included for all three methodologies and were based on Uhlig 1980. Comparison of the lake analysis shows a supply range of 519,000 (38 user-days per acre) to 996,000 annual lake user-days (72 user-days per lake acre) with an average of 685,000 annual lake user-days. Because the Uhlig 1980 methodology is the only methodology of the three that accounts for peak use days, the 540,000 annual lake user-days (39.5 user-days per lake acre) is used for calculating the lake supply. This value is consistent with and within the range of other methodologies for calculating recreation use in the 10-county region. The 540,000 annual lake user-days is added to the 107,000 annual stream user-days to result in a supply total of 647,000 annual recreation user-days.

Data Limitations

Determining recreation supply by parking spaces does not determine who will use the parking spaces. Waterbodies within the RMA have numerous uses in addition to water-based recreation. For example, Thousand Hills Lake has many nonwater-based recreational uses that include camping (primitive and cabins), hiking, dining, picnicking, and wildlife viewing. These additional uses would reduce the total supply of parking spaces for water-based recreational uses.

In addition, many of the lakes in the 10-county region have boating restrictions that do not allow boat wakes, require 10 horsepower or less motors, or only allow electric motors. MDC policy states that lakes smaller than 70 acres can only support electric motors. Of the remaining lakes in the 10-county region, only Long Branch, Thomas Hill, and Thousand Hills lakes do not have motor restrictions or allow up to 90 horsepower motors. Other lakes larger than 70 acres have restrictions that include electric only or no-wake boating (MDC 2017a). Lakes with motorized restrictions are not able to provide the full range of boating opportunities as described in the Missouri SCORP and result in additional limitations on the supply calculated using the method of Uhlig 1980.

Recreational fishing in the 10-county area is tied to older lakes, many of which were built prior to 1970. Several of these lakes are experiencing water quality issues and declining sportfish populations. A person's desire to fish is determined not only by the lake size or proximity, but also, at least in part, by the quality of fisheries available. The Uhlig methodology (1980) does not account for the quality of a fishery in determining the recreational opportunities it can provide.

The data limitations result in a calculation of annual recreation user-days that overestimate the supply in the 10-county region. Because the annual recreation user-days calculated by Uhlig cannot be split into specific uses, the overestimation was not adjusted.

Unmet Demand Results

The recreation supplied by waterbodies in the 10-county region includes activities other than water-based recreation (boating and fishing), and the demand does not account for lake-based swimming. With the data limitations, the Unmet Demand for boating and fishing is determined by subtracting supply from demand as follows:

$$\begin{array}{r} \text{Demand (1,874,000 annual recreation user-days)} \\ - \text{Supply (647,000 annual recreation user-days)} \\ \hline = \text{Unmet Demand (1,227,000 annual recreation user-days)} \end{array}$$

The unmet demand for the 10-county region, as calculated based on public surveys from the 2013 – 2017 Missouri SCORP, and water-based recreational opportunities as determined by Uhlig (1980), is 1,227,000 annual user-days.

Demand calculations were consistent between the current methodology and 2006 FEIS. The source of data for the demand calculations changed from the 1990 Missouri SCORP to the 2013 – 2017 Missouri SCORP.