Maumelle River, Pulaski County, Arkansas Section 206 Aquatic Ecosystem Restoration Feasibility Study

Appendix C-1: Environmental Resources

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US Army Corps of Engineers®
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1 Table of Contents

NATURAL RESOURCES APPENDIX

1 Introduction

The Natural Resources appendix was developed to provide technical and policy support information utilized in the development of the feasibility report. This appendix provides information that documents historic conditions, future without project conditions, and known planning constraints and opportunities, to develop plans that would meaningfully restore modern historic ecosystem conditions to the streams and related riparian habitats of the study area. This appendix describes the estimation of environmental benefits and the plan formulation of the Maumelle River ecosystem study area.

The Maumelle River is a fourth order stream with a drainage area of 55 square miles (mi2) at the upstream end of the study area. The U.S. Forest Service, Ouachita National Forest owns and manages most of the upper one-third of the watershed. The remainder of the watershed is mostly forest with some pasture and agriculture existing in the wider floodplain areas. Most of the forest areas, apart from those that are managed by the non-federal sponsor (Central Arkansas Water [CAW]) and the Forest Service, are commercially owned and managed for timber production.

The Maumelle River Aquatic Ecosystem Restoration Feasibility Study (hereafter Maumelle River Study) is located in the lower part of the Lake Maumelle watershed, approximately three miles west of the lake, and 15 miles west of Little Rock, Arkansas (Figure 1-1). Central Arkansas Water (CAW) owns all property in the study, Lake Maumelle, and the riparian corridor connecting the two areas. Lake Maumelle supplies 65 percent of CAW's water demand, which is providing water to approximately 500,000 customers in central Arkansas. The remaining water demand is provided by Lake Winona, also owned by CAW.

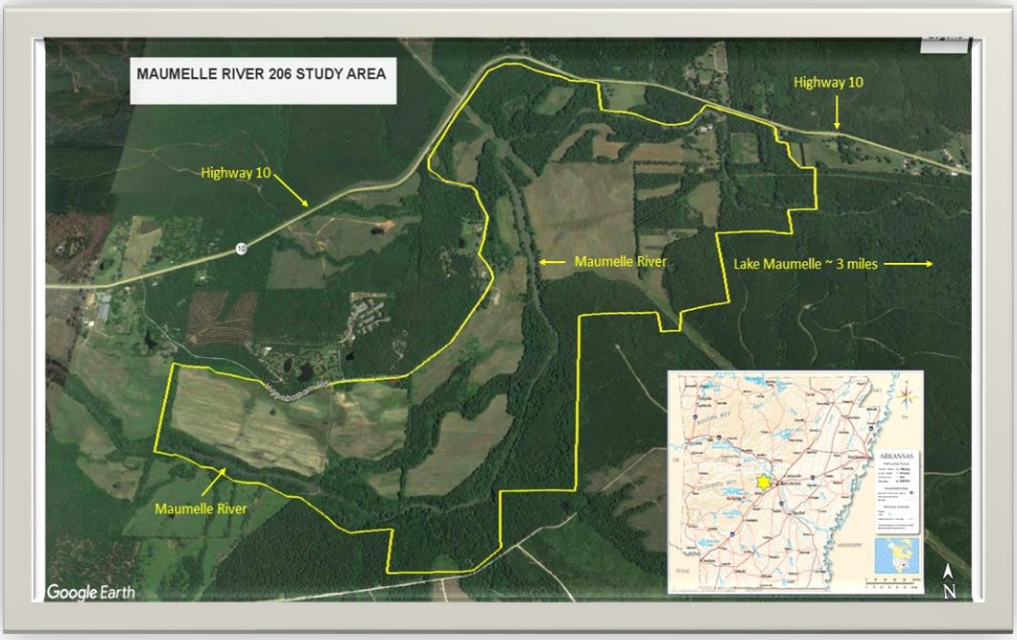

Figure 1-1. Maumelle River Study Area

The Maumelle River study area is situated in the Fourche Mountains Level IV subdivision of the Ouachita Mountains Level III Ecoregion (Figure 1-2). The Fourche Mountains Ecoregion is characterized by primarily north and south-facing slopes. Differences in temperature and moisture on these slopes influence the plant communities present. Overall, oak-hickory-pine forest is the dominant natural vegetation on these slopes and in narrow valleys. Many of the broader valleys on private land have been converted to pasture or other agriculture practices.

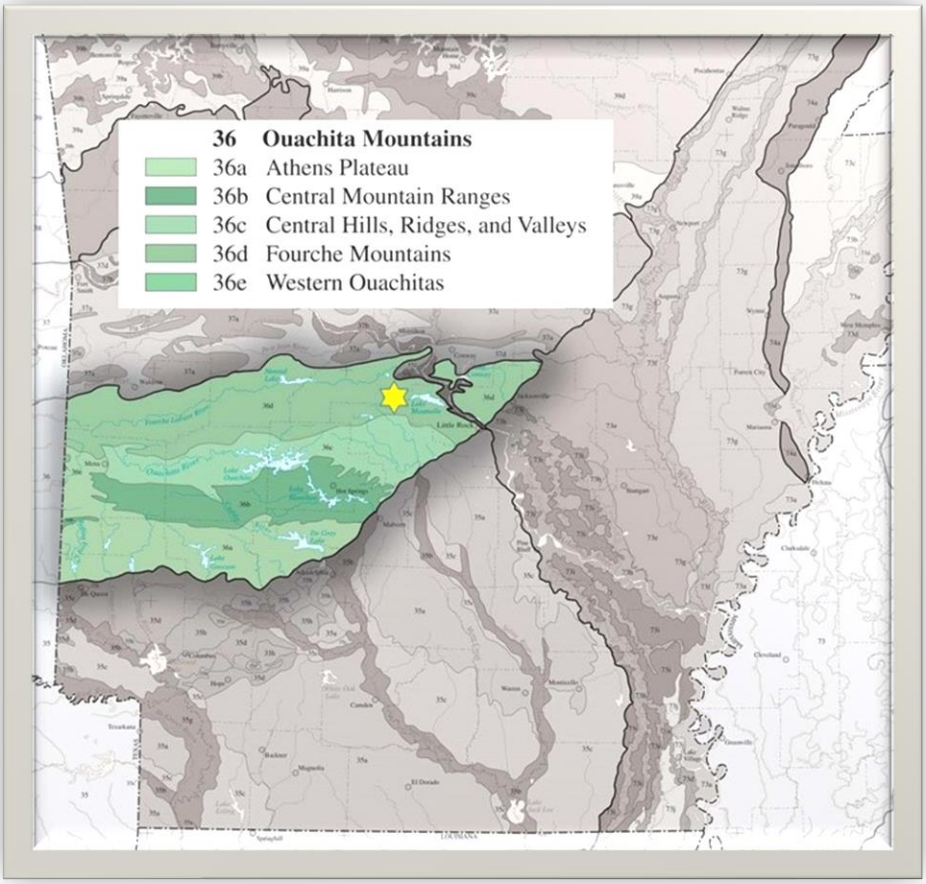

Figure 1-2. Ouachita/Fourche Mountains Ecoregion

Within the study area, the channel is composed of a gravel/cobble substrate in most locations with a few boulders and occasional exposed bedrock. The river has a variable sinuosity as it traverses the study area, with a relatively low sinuosity of 1.1 in the upper two-thirds portion of the river (upstream end of study area to RC2) and moderate sinuosity of 1.4 in the lower third of the river (below RC2 to the downstream end of study area). The average sinuosity is 1.3. The water surface slope is approximately 0.0024 ft/ft and the main channel width, estimated based on aerial photography, ranges from 100 to 200 feet with an average width of 160 feet (CAW 2013).

Partially and fully formed plans mentioned and described will only include those that were compared during the Cost Effectiveness and Incremental Cost Analysis (CEICA). This appendix is limited to the discussion of the modeling and habitat benefits associated with the final array of alternatives. Other measures and partially formed plans that were considered during early plan formulation will be described in the Integrated Feasibility Report (IFR)/Environmental Assessment

(EA). Appendix B – CEICA will discuss in detail the comparison of the plan's benefits and costs and the Tentatively Selected Plan (TSP).

2 Resource Significance

In compliance with the Council of Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations (40 CFR 1500.1(b), 1501.7(a)(2) and (3), and 1502.2(b)), guidance for USACE ecosystem restoration projects require the identification of significant resources and attributes that are likely to be affected by one or more of the plans (U.S. Water Resources Council, 1983). "Significant" is defined as "likely to have a material bearing on the decision-making process" (Apogee Research, Inc., 1996). Resource significance is determined by the importance and non-monetary value of the resource based on institutional, public, and technical recognition in the study area. The criteria are defined as:

- Institutional Recognition: The importance of the resource or attribute is acknowledged in the laws, adopted plans, and other policy statements of public agencies or private groups.
- Public Recognition: The resource or attribute is considered important by some segment of the general public.
- Technical Recognition: The importance of the resource or attribute is based on scientific or technical knowledge or judgment of critical resource characteristics.

2.1 Institutional Recognition

Significance based on institutional recognition means that the importance of the environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies or private groups. The institutional recognition of resource significance for the Maumelle Road study area is demonstrated by the following laws, policies, treaties, plans, and cooperative agreements established for the conservation and protection of these environmental resources.

2.1.1 Endangered Species Act

The Endangered Species Act of 1973 (ESA), as amended, "provides a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, and to provide a program for the conservation of these species." The Department of the Interior, acting through the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service is responsible for the protection of federally threatened and endangered species in the U.S. The ESA prohibits the take of listed animals and the interstate or international trade in listed plants and animals without a permit. The USFWS also maintains a list of Candidate species where there is information that warrants proposing them for listing under ESA, but listing is precluded due to higher priority species. The Federally listed species that have the possibility of occurring in the study area are listed in Table 2-1 and in Attachment A. It is anticipated that the ecosystem restoration proposed, such as riparian and riverine habitat restoration within the study area would benefit these species and may possibly provide suitable core habitat for some over time.

Table 2-1. Federally Listed Threatened and Endangered Species with the Potential to Occur in the Study Area (USFWS 2021)

Name	Scientific Name	Federal Listing	Habitat Present
Mammals			
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	Yes
Birds			
Eastern Black Rail	*Laterallus jamaicensis spp. Jamaicensis*	Threatened	Marginal
Piping Plover	*Charadrius melodus*	Threatened	Marginal
Red Knot	*Calidris canutus rufa*	Threatened	Marginal
Flowering Plants			
Running Buffalo Clover	*Trifolium stoloniferum*	Endangered	Yes

Source: USFWS IPaC website.

2.1.2 Bald and Golden Eagle Protection Act of 1940

The Bald and Golden Eagle Protection Act is a United States federal statute that protects two species of eagle. The bald eagle was chosen as a national emblem of the United States by the Continental Congress of 1782 and was given legal protection by the Bald Eagle Protection Act of 1940. This act was expanded to include the golden eagle in 1962. Since the original Act, the Bald and Golden Eagle Protection Act has been amended several times. It currently prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles.

The bald eagle is associated with aquatic habitats (coastal areas, river, lakes, and reservoirs) with forested shorelines or cliffs in North America. Throughout their range, they select large, super-canopy roost trees that are open and accessible, usually conifers. They winter primarily in coastal estuaries and river systems.

The Maumelle River and nearby Arkansas River are well used by resident and migrating bald eagles each year. The rural landscape surrounding the Maumelle River watershed, coupled with nearby Lake Maumelle, make the area ideal for these majestic birds. As testimony to the habitat suitability, a nesting pair of bald eagles have been documented in the study area in recent years.

2.1.3 Arkansas Species of Conservation Concern

The Arkansas Natural Heritage Commission is the repository for information on the location and status of species of conservation concern in Arkansas. A query of the Arkansas Heritage Program biodiversity database revealed three species of global, national, and state concern that are known to occur within the study area. Several other species are known to occur in the Maumelle River drainage but have yet to be documented in the study area (Table 2-2).

Table 2-2. Species of Conservation Concern in the Maumelle River watershed

Common Name	Scientific Name	Global and State Listing	Utilizes Aquatic/Riparian Habitats	Habitat within Maumelle River Study Area
[1]Ouachita Bluestar	*Amsonia hubrichtii*	G3S3	Yes	Yes
[1]Sticky hedge-hyssop	*Gratiola brevifolia*	G4S3	Yes	Yes
[1,2]Leafy Barbara's-buttons	*Marshallia caespitosa var. signata*	G4T4S1	Yes	Yes
[3]Three-way Sedge	*Dulichium arundinaceum var. arundinaceum*	G5TNRS2S3	Yes	Yes
[3]Perfoliate Bellwort	*Uvularia perfoliate*	G5S2	Yes	Yes
[3]Ouachita Blazing-star	*Liatris compata*	G3S3	Yes	Yes
[3]Willdenow's Sedge	*Carex willdenowii*	G?S?	Yes	Yes
[3]Wolf's Spikerush	*Eleocharis wolfii*	G3G5S3	Yes	Yes

[1]Species of Conservation Concern known to occur within the Maumelle River Ecosystem Study Area.

[2]Specimens collected in the Maumelle River watershed are currently being studied for consideration as a new species.

[3]Species known to occur in the Maumelle River drainage and occupy riparian and/or riverine habitats.

2.1.4 Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act of 1934 (FWCA), as amended, recognizes the contribution of wildlife resources to the nation. The 1958 amendments added provisions to recognize the vital contribution of wildlife resources to the Nation and to require equal consideration and coordination of wildlife conservation with other water resources development programs.

The USFWS and Arkansas Game and Fish Commission (AGFC) have committed to dedicate time and resources in developing a set of measures toward the ultimate identification of a preferred plan that meets USACE, USFWS, AGFC, and the sponsor's objectives for restoration of aquatic habitat. The measures identified in the Tentatively Selected Plan (TSP), will be considered by these agencies to have significant environmental outputs for fish and wildlife resources. The habitats that would be restored with implementation of the TSP would meet the intent and provisions of the FWCA by recognizing the vital contribution of wildlife resources to the Maumelle River, Arkansas, and the Nation. Institutional significance is demonstrated by the extreme interest, commitment, and recognition given to this study by the USFWS, AGFC, and other outside resource agencies. The FWCA recognizes that incremental losses to natural rivers and their habitats have become cumulatively important to nationally recognized resources and that mitigation of those losses is within the national interest. Similarly, the restoration of the habitats within the Maumelle River study area are shown to be incrementally nationally significant due to the decline of natural riverine and riparian habitat for migratory birds and aquatic species. The FWCA and USFWS concurrence is located in Attachment A.

2.1.5 Migratory Bird Treaty Act

The U.S. has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds. These migratory bird conventions impose substantive obligations on the U.S. for the conservation of migratory birds and their habitats, and through the Migratory Bird Treaty Act (MBTA), the U.S. has implemented these migratory bird conventions with respect to the U.S. The MBTA prohibits taking, possessing, importing/exporting, selling, and transporting of any listed migratory bird, its parts, nest, or eggs.

The Maumelle River lies immediately adjacent to the Arkansas River, which is positioned on a natural migratory route for hundreds of thousands of birds each year. Despite its degraded conditions and ecological losses, the high quality opportunity of the ecosystem is evident as the area currently remains a hotspot for birding opportunities. Staff and volunteers with Arkansas Audubon make frequent visits to the study area to observe and record the variety of bird species present. A list of species known to occur in the study area is included in Attachment A below. Water Resources Development Act of 1986.

The restored ecosystem functions that would be provided by the eventual recommended plan for the Maumelle River study can be considered significant by the USACE because the restoration of these functions meet with the spirit of the Water Resources Development Act (WRDA) of 1986.

2.1.6 Water Resources Development Act of 1990

Section 307(a) of WRDA of 1990 established an interim goal of no overall net loss of wetlands in the U.S. and set a long-term goal to increase the quality wetlands, as defined by acreage and function. The Maumelle River ecosystem restoration would restore the ecological and hydraulic function to the Maumelle River and adjacent Freshwater Forested Wetlands, thereby increasing the quality of this resource.

2.1.7 Executive Order 13112

Executive Order (EO) 13112 called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. It also created the National Invasive Species Council (NISC) to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the Federal response to invasive species. EO 13112 recognizes the significant contribution native species make to the well-being of the Nation's natural environment and directs Federal agencies to take preventive and responsive action to the threat of non-native species invasion and to provide restoration of native species and habitat conditions in ecosystems that have been invaded. Linked to the aquatic ecosystem degradation is the loss of native riverine and riparian vegetation species, which in addition to being vital to the aquatic environment, supports native residential and migratory game and nongame wildlife species within the Maumelle River study area. The TSP addresses non-native invasive species by implementing goals and objectives that will assist in the management and removal of these species.

2.1.8 Executive Order 13751

This order amends EO 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the NISC and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action.

2.1.9 Executive Order 13186

EO 13186 directs Federal agencies to promote the conservation of migratory bird populations, including restoring and enhancing habitat (USFWS 2019). Migratory Non-game Birds of Management Concern is a list maintained by the USFWS. The list helps fulfill a primary goal of the USFWS to conserve avian diversity in North America. Additionally, the USFWS' Migratory Bird Plan is a draft strategic plan to strengthen and guide the agency's Migratory Bird Program. The proposed ecosystem restoration would contribute directly to the USFWS Migratory Bird Program goals to protect, conserve, and restore migratory bird habitats to ensure long-term sustainability of all migratory bird populations. Range-wide protection, restoration and improvement of terrestrial and aquatic habitats and landscapes are crucial to maintain and conserve migratory birds.

Because the Maumelle River study area supports species of concern and their habitats which are addressed in numerous avian joint ventures, conservation organizations, and interagency and international cooperative plans, their institutional significance is recognized from both a regional, national, and international perspective. Restoration or improvement of the degraded habitat within the study area would support the goals of each of these plans and cooperative initiatives as the degraded habitat within the study area would increase the quality of breeding, foraging, wintering, and migration habitats for numerous bird species.

2.1.10 National Audubon Society Migratory Bird Initiative

The National Audubon Society (NAS) is recognized throughout the Americas as the largest organization committed to the protection and recovery of birds. Each year, NAS produces a Priority Birds Report that lists those birds of conservation concern (BCC) that would benefit the most from conservation work. The 2021 Audubon Priority Birds Report includes BCC that occur throughout the western hemisphere (Michel, et.al. 2021). The following BBC-listed birds are known to occur in the Maumelle River study area.

- Summer Tanager (*Piranga rubra*)
- Northern Bobwhite Quail (*Colinus virginianus*)
- Prairie Warbler (*Dendroica discolor*)
- Prothonotary Warbler (*Protonotaria citrea*)
- Canada Warbler (*Cardellina canadensis*)
- Hooded Warbler (*Wilsonia citrina*)
- Yellow Warbler (*Dendroica petechia*)
- Wood Thrush (*Hylocichla mustelina*)
- Brown-headed Nuthatch (*Sitta pusilla*)
- Semipalmated Sandpiper (*Calidris pusilla*)

2.1.11 Department of Defense Partners in Flight

The Department of Defense (DoD) Partners in Flight (PIF) program consists of a cooperative network of natural resources personnel from military installations across the U.S. DoD PIF works collaboratively with other avian conservation initiatives to conserve migratory and resident bird species and their habitat on DoD lands. In addition, DoD PIF works beyond installation boundaries to facilitate cooperative partnerships, determine the current status of bird populations, and prevent the listing of additional birds as threatened or endangered. There are eight species on the DoD PIF list that are known, or likely to, occur in the Maumelle River study area.

- Northern Bobwhite (*Colinus virginianus*)

- Bald Eagle
- Chuck-will's-widow (*Antrostomus carolinensis*)
- Eastern Whip-poor-will (*Antrostomus vociferous*)
- Red-headed Woodpecker (*Melanerpes erythrocephalus*)
- Loggerhead Shrike (*Lanius ludovicianus*)
- Kentucky Warbler
- Prairie Warbler

2.1.12 Partners in Flight

PIF is a cooperative partnership between federal, state, and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, academia, and private individuals.

Agency partners include the following:

- Federal Agencies:
    - U.S. Geological Survey (USGS),
    - National Park Service (NPS),
    - Bureau of Land Management (BLM),
    - USFWS,
    - DoD,
    - U.S. Forest Service (USFS),
    - U.S. Environmental Protection Agency (EPA),
    - U.S. Department of Agriculture Natural Resources Conservation Service (NRCS),
    - USACE,
    - U.S. Department of State
- State Wildlife Resource Agencies; and
    - AGFC
- Private Interest Groups/Private Agencies.
    - Audubon Society

The goals of PIF are to create a coordinated network of conservation partners to secure sufficient commitment and resources to implement and support scientifically-based landbird conservation plans at multiple scales. In an effort to prioritize conservation needs, PIF assessed the conservation vulnerability for landbird species and assigned a score to each species based on biological criteria such as population size, breeding distribution, non-breeding distribution, threats to breeding habitats, threats to non-breeding areas, and population trends (K.V. Rosenberg et al., 2016). There are seven species on the PIF Watch List (D-Reverse Decline [Yellow List]) that are known, or likely to, occur in the Maumelle River study area.

- Eastern Whip-poor-will[D]
- Red-headed Woodpecker[D]
- Wood Thrush[D]

- Prothonotary Warbler[D]
- Kentucky Warbler[D]
- Prairie Warbler[D]
- Canada Warbler[D]

2.1.13 North American Waterfowl Management Plan

Established in 1986, the North American Waterfowl Management Plan (NAWMP) is an international plan to reverse the downward trend in waterfowl populations (NAWMP, 2018). The goal of the plan is to protect, restore, and improve wetland habitat and increase waterfowl population numbers. An update to the plan in 1998 was signed by the United States, Canada, and Mexico and lists wetland, aquatic systems, grassland, forest, and riparian areas as habitats critical to waterfowl. The NAWMP was updated again in 2004 and 2018, and the NAWMP Science Support Team (NSST) prioritized conservation needs for waterfowl species based on socioeconomic importance of the species, the species population trend, and the vulnerability of the population to decline. The TSP for the ecosystem restoration of Maumelle River will directly affect the management of North American waterfowl species. The measures included in the plan would attract waterfowl and benefit those species by increasing the quality of forage found during their migration and by providing nest and brood-rearing habitat.

Three species listed in the NAWMP that are known to occur in the Three Rivers study area are:

- Canada Goose (*Branta canadensis*)
- Wood Duck (*Aix sponsa*)
- Hooded Merganser

2.1.14 North American Bird Conservation Initiative

The North American Bird Conservation Initiative (NABCI) is a tri-national declaration of intent between the U.S., Canada, and Mexico to strengthen cooperation on the conservation of North American birds throughout their ranges and habitats. The U.S. NABCI Committee is a coalition of government agencies, private organizations, and bird initiatives in the United States comprised of representatives from the following entities:

- USFWS
- NRCS
- BLM
- DoD
- NPS
- USGS
- USFS
- Farm Service Agency
- Wildlife Management Institute
- Association of Fish and Wildlife Agencies
- National Flyway Council
- PIF
- Association of Joint Venture Management Boards

- National Audubon Society
- The Nature Conservancy
- American Bird Conservancy
- Ducks Unlimited
- Waterbird Conservation for the Americas
- U.S. Shorebird Conservation Plan
- NAWMP
- Migratory Shorebird and Upland Game Bird Working Group
- Resident Game Bird Working Group

The NABCI divided North America into 67 ecologically distinct Bird Conservation Regions (BCRs) based on similar bird communities, habitats, and resource management issues. The Maumelle River study area is located West Gulf Coastal Plain/Ouachita BCR.

2.1.15 West Gulf Coastal Plain/Ouachita BCR

Pines dominate this area, largely shortleaf pine in the north, including the Ouachita Mountains, and longleaf pine in the south. This westernmost part of the eastern United States forest also includes hardwood-dominated bottomlands along the Arkansas River and other drainages. Red-cockaded Woodpecker is the highest priority bird in pine habitat, which is also inhabited by Bachman's Sparrow and Brown-headed Nuthatch. Conversion of the native pine forests to industrial loblolly plantations provides some bird habitat but is less useful for the highest priority species. The river and stream bottoms provide habitat used by Swainson's Warbler and large numbers of nesting herons and egrets. Bottomland hardwoods and associated wetlands support substantial wintering populations of a number of waterfowl species—principally Mallards, and breeding and wintering Wood Ducks—and are a primary migration corridor for significant numbers of other dabbling ducks. The primary threats to bottomland hardwood wetlands in the region are from reservoirs and timber harvest and subsequent conversion to pine plantation, pasture, or other land uses.

2.1.16 USFWS Birds of Conservation Concern

The 1988 amendment to (Public Law 100-653, Title VIII) to the Fish and Wildlife Conservation Act directs the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." In response to this mandate, the USFWS compiled a list of Birds of Conservation Concern (BCC) on three scales: the BCRs, USFWS Regions, and a National scale. The USFWS utilized the conservation assessment scores in the PIF North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan to identify abundance, population trends, distribution, threats, and the importance of an area to a species to identify Birds of Conservation Concern for each BCR. The goal of the BCC is to identify the highest conservation priorities within the populations of migratory and non-migratory bird species. Seven species of birds listed as USFWS Birds of Conservation Concern are known to, or may, occur within the Maumelle River study area. This project will directly benefit BCC species through the implementation of native bottomland hardwood and riparian plantings. By planting native species, the study area's biodiversity will be improved which will effectively improve foraging and nesting sites for birds. The USFWS Birds of Conservation Concern are listed below and in Appendix C-2 Environmental Compliance.

- Bald Eagle
- Red-headed Woodpecker
- Scissor-tailed Flycatcher (*Tyrannus forficatus*)
- Loggerhead Shrike
- Summer Tanager
- Orchard Oriole (*Icterus spurius*)
- American Kestrel (*Falco sparverius paulus*)

2.2 Institutional Recognition

Significance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Public recognition is evidenced by people engaged in activities that reflect an interest in or concern for a particular resource.

Efforts by a consortium of conservation groups are evidence of the institutional recognition of the Maumelle River. The USFWS, AGFC, Arkansas Department of Environmental Quality (ADEQ) and CAW developed a partnership recently to remove a low water crossing on the eastern edge of the study area. By removing this crossing, stream connectivity was restored from RC2 downstream to Lake Maumelle, providing several additional river miles of fish passage. The removal of RC 1 & 2 would eliminate remaining artificial blockages from the study area to Lake Maumelle.

2.3 Technical Recognition

Significance based on technical recognition requires identification of critical resource characteristics such as scarcity, representativeness, status and trends, connectivity, limiting habitat, and biodiversity. Therefore, technical recognition of resources varies across geographic areas and spatial scale.

a) Scarcity – Only 3% of Earth's water is fresh with only 1% actually available for use. Water systems are becoming increasingly stressed and polluted.

b) Representativeness – The study area for Maumelle River has several non-native invasive species. By improving aquatic and riparian habitat within the project area, USACE and the NFS would be able to mimic the form and function of the historic ecosystem within the Maumelle River study area.

c) Status and Trends – Over the last 100 years, approximately 95-percent of riparian habitat has been converted by river channelization, water impoundments, agricultural practices, and urbanization (Krueper, 1993). As a result, freshwater animal species are disappearing five times faster than terrestrial animals due, partially, to the widespread physical alteration of rivers (Ricciardi and Rasmussen 1999). Of 860,000 river miles within the United States, approximately 24 percent have been impacted by channelization, impoundment, or navigation. The USFWS estimates 70 percent of the riparian habitats nationwide have been lost or altered, and 50 percent of all listed threatened or endangered species depend on rivers and streams for their continued existence.

   The Maumelle River isn't exempt from these impacts. The low water crossings in the stream channel, coupled with floodplain isolation and loss of riparian forest, has resulted in significant impacts to the structure and function of the natural ecosystem that once

existed in the study area. These impacts are expected to continue unless proactive restoration measures are taken.

d) Connectivity – A high percentage of all Neotropical migrant species require woodlands of various densities and structure. Potential restoration measures would increase riverine habitat (riparian and aquatic) required by many bird species living in or migrating through central Arkansas, including many of the bird species of concern noted in the previous tables.

   Potential management actions include the reestablishment of riparian forest and aquatic habitats in strategic locations throughout the study area. The removal of two low water crossings proposed in the TSP would provide significant benefit to the movement of aquatic species throughout the study area and would play a role in the aquatic species ability to move into newly restored upstream habitats. Because of the low water crossings, fish do not have the ability to freely travel up or down the river.

e) Biodiversity –Because soils in riparian habitats adjacent to intermittent and ephemeral streams have higher moisture content, they support more abundant vegetation than adjacent uplands. This vegetation provides breeding, nesting, and foraging habitat, cover, and wildlife travel corridors that are not available in adjacent upland habitats. Parameters influencing migrant passerine bird use in riparian habitats include habitat preferences of the bird, niche diversity and plant species composition, location and accessibility of habitat, and quality of adjacent habitat. The restoration of Tributary A and reforestation of the existing sod farm would provide significant benefits to many Neotropical migratory birds, as well as native riparian-dependent wildlife.

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4 List of Preparers

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ATTACHMENT A – Birds

Maumelle River Aquatic Ecosystem Restoration Study

Audubon Bird Observation List

Common Name	Scientific Name	
Acadian Flycatcher	*Empidonax*	*virescens*
American Crow	*Corvus*	*brachyrhynchos*
American Golden-Plover	*Pluvialis*	*dominica*
American Redstart	*Setophaga*	*ruticilla*
American Robin	*Turdus*	*migratorius*
American Woodcock	*Scolopax*	*minor*
Bald Eagle	*Haliaeetus*	*leucocephalus*
Baltimore Oriole	*Icterus*	*galbula*
Barn Swallow	*Hirundo*	*rustica*
Barred Owl	*Strix*	*varia*
Belted Kingfisher	*Megaceryle*	*alcyon*
Black Vulture	*Coragyps*	*atratus*
Black-and-white Warbler	*Mniotilta*	*varia*
Blackburnian Warbler	*Setophaga*	*fusca*
Black-throated Green Warbler	*Setophaga*	*virens*
Blue Grosbeak	*Passerina*	*caerulea*
Blue Jay	*Cyanocitta*	*cristata*
Blue-gray Gnatcatcher	*Polioptila*	*caerulea*
Blue-winged Teal	*Anas*	*discors*
Blue-winged Warbler	*Vermivora*	*cyanoptera*
Broad-winged Hawk	*Buteo*	*platypterus*
Brown Creeper	*Certhia*	*americana*
Brown Thrasher	*Toxostoma*	*rufum*
Brown-headed Cowbird	*Molothrus*	*ater*
Brown-headed Nuthatch	*Sitta*	*pusilla*
Bufflehead	*Bucephala*	*albeola*
Buteo sp.	*Buteo*	
Canada Goose	*Branta*	*canadensis*
Carolina Chickadee	*Poecile*	*carolinensis*
Carolina Wren	*Thryothorus*	*ludovicianus*
Cattle Egret	*Bubulcus*	*ibis*

Common Name	*Scientific Name*	
Cattle Egret	*Bubulcus*	*ibis*
Cedar Waxwing	*Bombycilla*	*cedrorum*
Chimney Swift	*Chaetura*	*pelagica*
Chipping Sparrow	*Spizella*	*passerina*
Cliff Swallow	*Petrochelidon*	*pyrrhonota*
Common Goldeneye	*Bucephala*	*clangula*
Common Grackle	*Quiscalus*	*quiscula*
Common Yellowthroat	*Geothlypis*	*trichas*
Cooper's Hawk	*Accipiter*	*cooperii*
Dark-eyed Junco (Slate-colored)	*Junco*	*hyemalis*
Downy Woodpecker	*Picoides*	*pubescens*
Eastern Bluebird	*Polioptila*	*caerulea*
Eastern Kingbird	*Tyrannus*	*tyrannus*
Eastern Meadowlark	*Sturnella*	*magna*
Eastern Phoebe	*Sayornis*	*phoebe*
Eastern Screech-Owl	*Megascops*	*asio*
Eastern Towhee	*Pipilo*	*erythrophthalmus*
Eastern Wild Turkey	*Meleagris*	*gallopavo*
Eastern Wood-Pewee	*Sayornis*	*phoebe*
European Starling	*Sturnus*	*vulgaris*
Field Sparrow	*Spizella*	*pusilla*
Fish Crow	*Corvus*	*ossifragus*
Fox Sparrow (Red)	*Passerella*	*iliaca*
Golden-crowned Kinglet	*Regulus*	*satrapa*
Gray Catbird	*Dumetella*	*carolinensis*
Great Blue Heron	*Ardea*	*herodias*
Great Crested Flycatcher	*Myiarchus*	*crinitus*
Great Egret	*Ardea*	*alba*
Greater White-fronted Goose	*Anser*	*albifrons*
Green Heron	*Butorides*	*virescens*
Hairy Woodpecker	*Picoides*	*villosus*
Hermit Thrush	*Catharus*	*guttatus*

Common Name	Scientific Name	
Hooded Merganser	*Lophodytes*	*cucullatus*
Hooded Warbler	*Wilsonia*	*citrina*
Horned Grebe	*Podiceps*	*auritus*
House Finch	*Carpodacus*	*mexicanus*
House Wren	*Troglodytes*	*aedon*
Indigo Bunting	*Passerina*	*cyanea*
Kentucky Warbler	*Geothlypis*	*formosa*
Killdeer	*Charadrius*	*vociferus*
Lark Sparrow	*Chondestes*	*grammacus*
Least Flycatcher	*Empidonax*	*minimus*
Lincoln's Sparrow	*Melospiza*	*lincolnii*
Little Blue Heron	*Egretta*	*caerulea*
Louisiana Waterthrush	*Parkesia*	*motacilla*
Magnolia Warbler	*Setophaga*	*magnolia*
Mallard	*Anas*	*platyrhynchos*
Mississippi Kite	*Ictinia*	*mississippiensis*
Mourning Dove	*Zenaida*	*macroura*
Muscovy Duck (Domestic type)	*Cairina*	*moschata*
Nashville Warbler	*Oreothlypis*	*ruficapilla*
Northern Bobwhite	*Colinus*	*virginianus*
Northern Cardinal	*Cardinalis*	*cardinalis*
Northern Flicker (Yellow-shafted)	*Colaptes*	*auratus*
Northern Mockingbird	*Mimus*	*polyglottos*
Northern Parula	*Parula*	*americana*
Northern Rough-winged Swallow	*Stelgidopteryx*	*serripennis*
Northern Waterthrush	*Parkesia*	*noveboracensis*
Orchard Oriole	*Icterus*	*spurius*
Osprey	*Pandion*	*haliaetus*
Painted Bunting	*Passerina*	*ciris*
Pileated Woodpecker	*Dryocopus*	*pileatus*
Pine Siskin	*Spinus*	*pinus*

Common Name	Scientific Name	
Pine Warbler	*Setophaga*	*pinus*
Prairie Warbler	*Setophaga*	*discolor*
Prothonotary Warbler	*Protonotaria*	*citrea*
Purple Finch	*Haemorhous*	*purpureus*
Purple Martin	*Progne*	*subis*
Red-bellied Woodpecker	*Melanerpes*	*carolinus*
Red-eyed Vireo	*Vireo*	*olivaceus*
Red-headed Woodpecker	*Melanerpes*	*erythrocephalus*
Red-shouldered Hawk	*Buteo*	*lineatus*
Red-tailed Hawk	*Buteo*	*jamaicensis*
Red-winged Blackbird	*Agelaius*	*phoeniceus*
Rose-breasted Grosbeak	*Pheucticus*	*ludovicianus*
Ruby-crowned Kinglet	*Regulus*	*calendula*
Ruby-throated Hummingbird	*Archilochus*	*colubris*
Scissor-tailed Flycatcher	*Tyrannus*	*forficatus*
Sedge Wren	*Cistothorus*	*platensis*
Semipalmated Sandpiper	*Calidris*	*pusilla*
Sharp-shinned Hawk	*Accipiter*	*striatus*
Snow Goose	*Chen*	*caerulescens*
Song Sparrow	*Melospiza*	*melodia*
Spotted Sandpiper	*Actitis*	*macularius*
Summer Tanager	*Piranga*	*rubra*
Swamp Sparrow	*Melospiza*	*georgiana*
Tennessee Warbler	*Oreothlypis*	*peregrina*
Tufted Titmouse	*Baeolophus*	*bicolor*
Turkey Vulture	*Cathartes*	*aura*
Warbling Vireo	*Vireo*	*gilvus*
White-breasted Nuthatch	*Sitta*	*carolinensis*
White-crowned Sparrow	*Zonotrichia*	*leucophrys*
White-eyed Vireo	*Vireo*	*griseus*
White-throated Sparrow	*Zonotrichia*	*albicollis*
Wilson's Warbler	*Cardellina*	*pusilla*
Winter Wren	*Troglodytes*	*hiemalis*

Common Name	Scientific Name	
Wood Duck	*Aix*	*sponsa*
Wood Thrush	*Hylocichla*	*mustelina*
Yellow-bellied Sapsucker	*Coccyzus*	*americanus*
Yellow-billed Cuckoo	*Coccyzus*	*americanus*
Yellow-breasted Chat	*Icteria*	*virens*
Yellow-rumped Warbler (Myrtle)	*Setophaga*	*coronata*
Yellow-throated Vireo	*Vireo*	*flavifrons*
Yellow-throated Warbler	*Setophaga*	*dominica*

Denotes Arkansas Species of Conservation Concern

ATTACHMENT B – Fish

Maumelle River Aquatic Ecosystem Restoration Study – Fish

Family	Common Name	Scientific Name
Aphredoderidae		
	Pirate Perch	*Aphredoderus sayanus*
Atherinidae		

	Brook Silverside	*Labidesthes sicculus*
Catostomidae		
	Creek Chubsucker	*Erimyzon oblongus*
	Western Creek Chubsucker	*Erimyzon claviformis*
Centrarchidae		
	Black crappie	*Pomoxis nigromaculatus*
	Bluegill	*Lepomis macrochirus*
	Green Sunfish	*Lepomis cyanellus*
	Largemouth Bass	*Micropterus salmoides*
	Longear Sunfish	*Lepomis megalotis*
	Orangespotted Sunfish	*Lepomis humilis*
	Spotted Bass	*Micropterus punctulatus*
	Warmouth	*Lepomis gulosus*
Cyprinidae		
	Bigeye Shiner	*Notropis boops*
	Bluntnose Minnow	*Pimephales notatus*
	Central Stoneroller	*Campostoma anomalum*
	Pugnose Minnow	*Opsopoeodus emiliae*
	Wedgespot Shiner	*Notropis greenei*
	Redfin Shiner	*Lythrurus umbratilis*
Cyprinodontidae		
	Blackspotted Topminnow	*Fundulus olivaceus*
	Blackstripe Topminnow	*Fundulus notatus*
	Northern Studfish	*Fundulus catenatus*
Family	**Common Name**	***Scientific Name***
Esocidade		
	Grass Pickerel	*Esox americanus*
Ictaluridae		
	Slender Madtom	*Noturus exilis*
	Yellow Bullhead	*Ameiurus natalis*

Percidae		
	blackside darter	*Percina maculata*
	Cypress Darter	*Etheostoma proeliare*
	Fantail Darter	*Etheostoma flabellare*
	Greenside Darter	*Etheostoma blennioides*
	Johnnie Darter	*Etheostoma nigrum*
	Logperch	*Percina caprodes*
	Orangethroat Darter	*Etheostoma spectabile*
	Redfin Darter	*Etheostoma whipplei*
	Redspot Darter	*Etheostoma artesiae*
	Speckled Darter	*Etheostoma stigmaeum*
Ecoregion Key Species		fishes which are normally the dominant species within the important groups such as fish families or trophic feeding levels.
Ecoregion Indicator Species		Species of fish which may or may not be dominant within a species group and may not be limited to one area of the state, but which, because of their presence, are readily associated with a specific type of ecosystem.
Considered vulnerable in Arkansas		https://en.wikipedi.org/wiki/Johnny_darter

ATTACHMENT C – Soils Report

United States Department of Agriculture

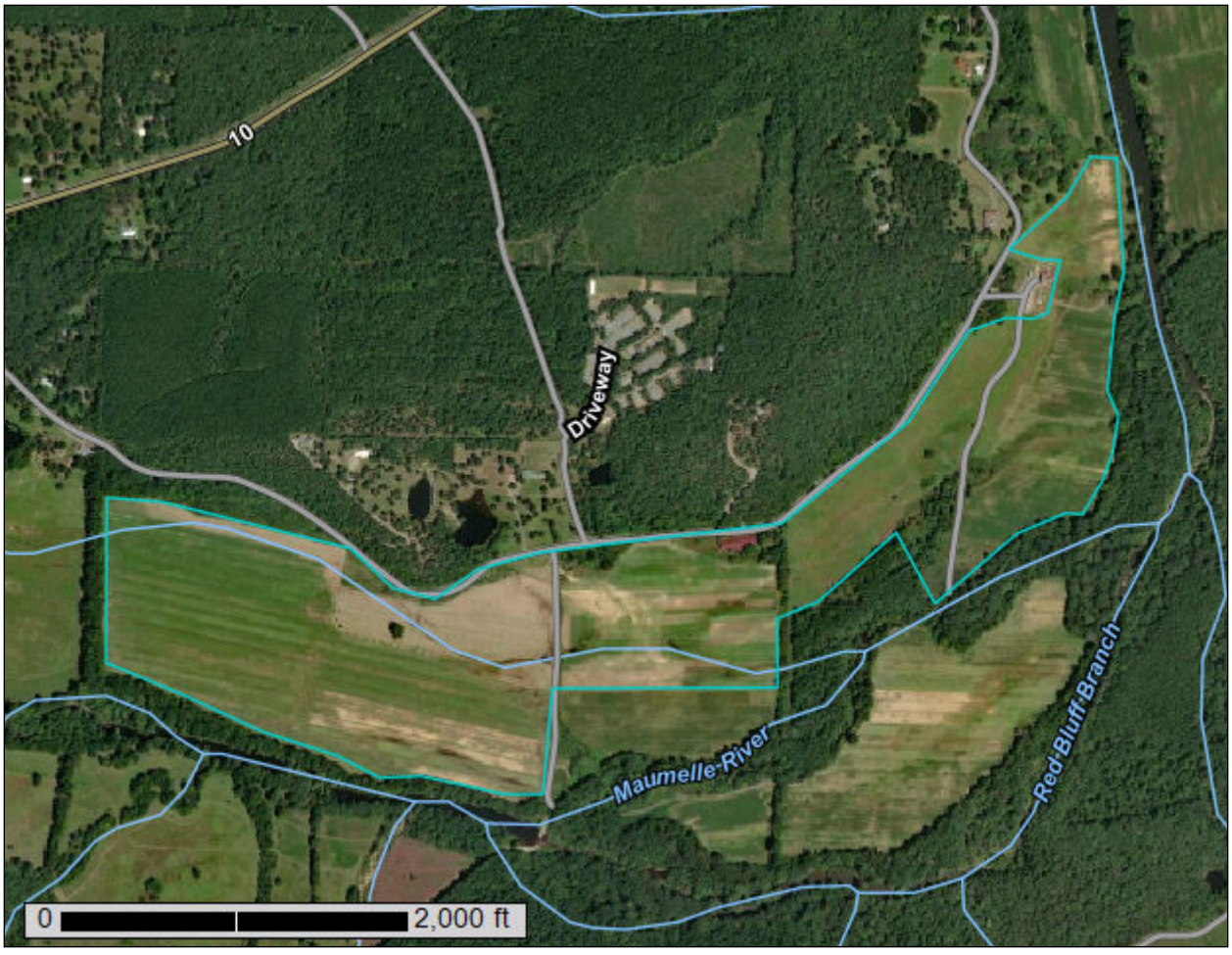
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Pulaski County, Arkansas

Maumelle River - Sod Farm Reforestation



August 11, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

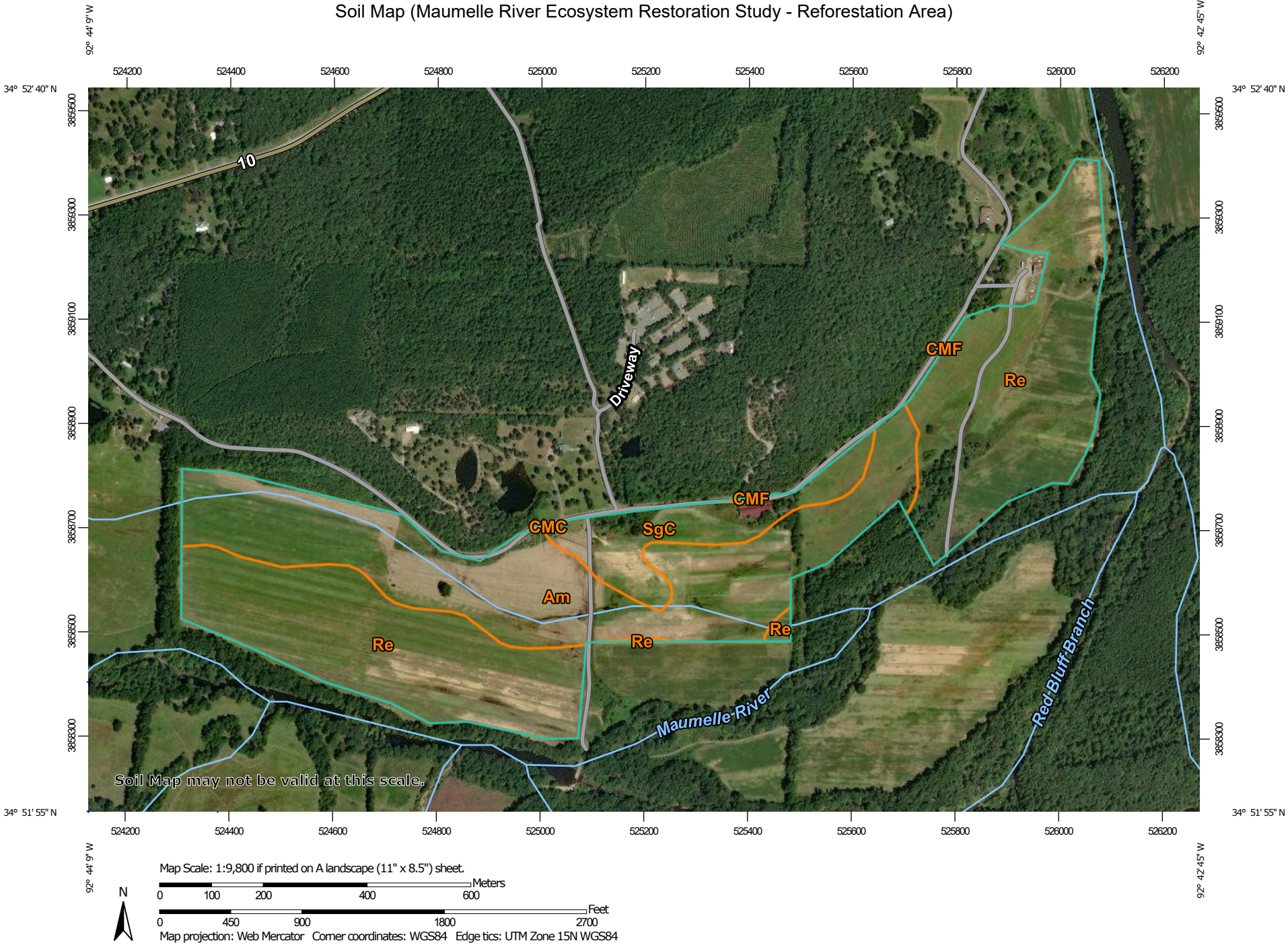
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Maumelle River Ecosystem Restoration Study - Reforestation Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Pulaski County, Arkansas
Survey Area Data: Version 17, Jun 9, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2015—Nov 23, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Maumelle River Ecosystem Restoration Study - Reforestation Area)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Am	Amy silt loam, 0 to 1 percent slopes	53.6	37.3%
CMC	Carnasaw-Mountainburg association, undulating	0.0	0.0%
CMF	Carnasaw-Mountainburg association, steep	0.1	0.1%
Re	Rexor silt loam, frequently flooded	76.7	53.3%
SgC	Sallisaw gravelly silt loam, 3 to 8 percent slopes	13.4	9.3%
Totals for Area of Interest		**143.8**	**100.0%**

Map Unit Descriptions (Maumelle River Ecosystem Restoration Study - Reforestation Area)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the

scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Pulaski County, Arkansas

Am—Amy silt loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2v5x6
Elevation: 50 to 250 feet
Mean annual precipitation: 38 to 61 inches
Mean annual air temperature: 48 to 73 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Amy and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amy

Setting

Landform: Stream terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pleistocene era silty alluvium

Typical profile

A - 0 to 3 inches: silt loam
Eg - 3 to 24 inches: silt loam
Btg1 - 24 to 40 inches: silty clay loam
Btg2 - 40 to 56 inches: silt loam
Cg - 56 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F133BY017TX - Loamy Bottomland
Hydric soil rating: Yes

Minor Components

Pheba

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (three-dimensional): Rise
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F133BY012TX - Wet Terrace
Hydric soil rating: No

Aquults

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: Yes

CMC—Carnasaw-Mountainburg association, undulating

Map Unit Setting

National map unit symbol: m04j
Elevation: 500 to 2,800 feet
Mean annual precipitation: 43 to 58 inches
Mean annual air temperature: 50 to 72 degrees F
Frost-free period: 200 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Carnasaw and similar soils: 65 percent
Mountainburg and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carnasaw

Setting

Landform: Mountains
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey residuum weathered from shale

Typical profile

A - 0 to 2 inches: gravelly silt loam
E - 2 to 6 inches: gravelly silt loam
Bt1 - 6 to 38 inches: silty clay
Bt2 - 38 to 49 inches: silty clay loam
Cr - 49 to 52 inches: bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F119XY006AR - Clayey-Loamy Upland
Hydric soil rating: No

Description of Mountainburg

Setting

Landform: Mountains
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Stony, loamy residuum weathered from sandstone

Typical profile

A - 0 to 1 inches: stony fine sandy loam
E - 1 to 6 inches: stony sandy loam
Bt - 6 to 15 inches: very gravelly fine sandy loam
R - 15 to 20 inches: bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Leadvale

Percent of map unit: 10 percent
Hydric soil rating: No

CMF—Carnasaw-Mountainburg association, steep

Map Unit Setting

National map unit symbol: m04k
Elevation: 500 to 2,800 feet
Mean annual precipitation: 43 to 58 inches
Mean annual air temperature: 50 to 72 degrees F
Frost-free period: 200 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Carnasaw and similar soils: 65 percent
Mountainburg and similar soils: 20 percent
Rock outcrop: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carnasaw

Setting

Landform: Mountains
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale

Typical profile

A - 0 to 2 inches: gravelly silt loam
E - 2 to 6 inches: gravelly silt loam
Bt1 - 6 to 38 inches: silty clay
Bt2 - 38 to 49 inches: silty clay loam
Cr - 49 to 52 inches: bedrock

Properties and qualities

Slope: 12 to 40 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Mountainburg

Setting

Landform: Mountains
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Stony, loamy residuum weathered from sandstone

Typical profile

A - 0 to 1 inches: stony fine sandy loam
E - 1 to 6 inches: stony sandy loam
Bt - 6 to 15 inches: very gravelly fine sandy loam
R - 15 to 20 inches: bedrock

Properties and qualities

Slope: 12 to 40 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Re—Rexor silt loam, frequently flooded

Map Unit Setting

National map unit symbol: m05c
Elevation: 500 to 1,500 feet
Mean annual precipitation: 43 to 58 inches
Mean annual air temperature: 50 to 72 degrees F
Frost-free period: 200 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rexor and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rexor

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Ap - 0 to 8 inches: silt loam
BE - 8 to 19 inches: silt loam
Bt1 - 19 to 50 inches: silt loam
Bt2 - 50 to 66 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 36 to 60 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: F119XY013AR - Loamy Floodplain
Hydric soil rating: No

Minor Components

Aquents

Percent of map unit: 10 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: Yes

Amy

Percent of map unit: 10 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

SgC—Sallisaw gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: m05n
Elevation: 280 to 590 feet
Mean annual precipitation: 43 to 58 inches
Mean annual air temperature: 50 to 72 degrees F
Frost-free period: 200 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sallisaw and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sallisaw

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy and gravelly alluvium

Typical profile

Ap - 0 to 7 inches: gravelly silt loam
Bt - 7 to 27 inches: silt loam
2BCt - 27 to 72 inches: very gravelly silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

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