MISSOURI CONSERVATION HERITAGE FOUNDATION

STREAM STEWARDSHIP TRUST FUND – GRANT PROGRAM

REQUEST FOR MITIGATION PLAN APPROVAL

The Stream Stewardship Trust Fund is available to restore, enhance, and/or protect stream systems and associated riparian habitats. Proposed projects will be prioritized and funded by the Foundation based on regional stream needs, maximum return on expended monies, level of threat to the stream system, and overall anticipated benefits to stream resources. Proposed projects should be located within the ecological drainage unit (EDU) where participating stream impacts occurred. Approval will be limited to projects that restore, enhance, or preserve Missouri's diverse stream systems.

This request form will be used by MCHF Board members assigned to the Stream Stewardship Trust Fund – Grant Program Action Team. Proposals submitted for funding consideration need to clearly explain elements of stream-based projects listed below which warrant consideration during the approval process. Spaces provided in the elements below are not to be considered limiting, and the attachment of additional pages of explanation is encouraged in order to provide full details.

The Goal of the MCHF's Stream Stewardship Trust Fund is to provide an innovative tool for the restoration, enhancement, and protection of Missouri's streams and aquatic resources.

1) Project Title - **Waters bank stabilization and riparian protection** Landowner Name **John Waters**

2) County **Christian** MDC region **Southwest**

3) Project objectives – **We are proposing this mitigation project in an effort to directly address the resource threats identified in a comprehensive characterization of the Bull Creek Priority Watershed. The objectives of this project are to mitigate the unnatural rate of stream bank erosion occurring on approximately 370 feet at the site, protect more than 300 feet of stream bank imminently vulnerable to erosion through biotechnical methods, augment and protect approximately 20.2 acres of bottomland forest to maintain a healthy riparian corridor and establish a perpetual easement to protect over 3,200 linear feet of high quality Ozark stream and associated corridor. These objectives will all address specific areas of concern discussed in the Compensation Planning Framework for the White River EDU such as minimizing sources of eroding soils, restoring, expanding and maintaining well vegetated riparian areas (especially in areas at risk of urbanization), and restoration of instream habitats that benefit sportfish, non-game fish and aquatic invertebrate populations. The East Fork of Bull Creek on US Forest Service land upstream of the project site will be used as a reference reach to help establish achievement of the defined objectives.**

4) The project submitted for consideration is in the **Bull Creek sub-basin of the White River EDU** watershed and is considered a priority by MDC for the following reasons (include how project achieves watershed objectives and describe the rationale for site selection).

This project will restore approximately 370 feet of eroding stream bank and protect 20.2 acres of riparian corridor with a perpetual easement. The planned longitudinal stone toe protection will reduce the sediment load entering Bull Creek by protecting the toe of the stream bank and pushing erosive currents away from the bank. In addition, limiting channel migration at this site will restore channel stability within this reach. The bank stabilization project will add habitat diversity by creating in-stream substrate and depth diversity. In-channel hydraulics will be restored by reducing excessive lateral movement of the stream channel. The restoration and enhancement of the riparian corridor will be an additional component to improving and stabilizing the site.

The project site is located on Bull Creek in the headwaters of the Bull Creek Priority Watershed immediately upstream of the Kipfer SSTF project site and waters from these sites flow into the Woods Fork Aquatic Conservation Opportunity Area (ACOA). The Woods Fork ACOA, which includes Camp Creek, and portions of Woods Fork and Bull Creek, was designated by MDC to target Williams' crayfish (Rank S2), three mussel species including Ouachita kidneyshell (Rank S3), Neosho mucket (S2), and purple lilliput (S2), and White River EDU fish species including southern brook lamprey (Rank S2S3). Multiple agencies have also designated aquatic priority areas within the Bull Creek watershed. The Missouri Department of Natural Resources has also designated 8 miles of Bull Creek as an Outstanding State Resource Water. Terrestrial priority areas are also within the watershed, including Busiek terrestrial COA and the Bull Creek Dolomite Glade/Oak Woodland Breaks LTA. The Bull Creek watershed has 45 recorded fish species, six recorded mussel species, and five recorded crayfish species.

Based on comprehensive background work, current threats in the Bull Creek watershed include inadequate riparian corridor and stream bank erosion in headwater reaches and bottom pasturelands, extensive residential development that can lead to the well known effects of urban runoff and nutrient introduction from residential yards, a high gravel bed load resulting from past and current land management activities, and numerous aquatic organism passage barriers. The purposed project is located in the headwaters of Bull Creek and would address stream bank erosion and sediment issues that have been identified as serious threats to watershed health. In addition, the establishment of a perpetual easement along approximately 3,000 feet of Bull Creek will help protect this high priority watershed from the impacts that can result from encroaching suburban development.

5) Site protection instrument (circle):

Acquisition **Perpetual easement** Special management agreement

6) Describe the details of the site protection instrument (ownership, legal arrangements, how the instrument assures the long-term protection of the proposed mitigation site): **The landowner specified on the deed will be verified in addition to verification of any rights granted on the property. The perpetual easement will be written into the deed of the property to stay in trees and vegetation even in the instance of land transferring hands. If any management activities are conducted in the protected area, a professionally trained forester, engineer, fisheries biologist and/or hydrologist will need to approve those alterations.**

7) Baseline information
   a. Describe the ecological characteristics of the proposed project site:
   The main project site is located on a 4th order stretch of Bull Creek approximately 1.5 miles downstream of the confluence with the West Fork of Bull Creek. The proposed bank stabilization project is located on the right descending bank. The reach of Bull Creek on the Waters property has some established riparian corridor, but much of the area within the proposed easement will need additional riparian plantings. The stream bank has eroded over 115 feet since 1995, with approximately 50% of that erosion occurring since 2008. In its current condition, the site of bank erosion is approximately 370 feet in length with bank heights averaging eight feet. The average channel width is approximately 110 feet, channel depth is approximately 8 feet and the substrate is predominately unconsolidated coarse gravel. The left descending bank is stable with a maturing riparian corridor.
   b. Historic and existing plant communities, hydrology and soils of the proposed project site:
   Historic plant community consisted of bottomland hardwood forest. The existing plant community in the riparian areas is bottomland hardwood forest with areas of inadequate riparian buffer consisting of mixed grass pasture/hay land. Soils in the project site are within the Cedargap- Razort Complex with 0-2 percent slope and is frequently flooded.

   c. Project application must include maps identifying the proposed project boundary with lat/long boundaries in decimal degrees and a GIS shape file with metadata of the delineated boundary. **See attached**

   d. Describe existing hydro-system connectivity between the stream project site and any wetlands or other waters including tributaries connecting to receiving waters:
   At the main project site, Bull Creek is a 4th order stream. One 1st order unnamed tributary and one 2nd order unnamed tributary enter Bull Creek within 1.25 miles upstream of the project site. A 1st order tributary unnamed tributary enters Bull Creek approximately 0.25 miles downstream of the project site. The National Wetlands Inventory map illustrates riverine wetland within the site. The Corps of Engineers has not made a determination regarding the extent of jurisdictional wetlands within the site. However, if jurisdictional wetlands do exist, the project should not result in a loss of wetlands or wetland function.

8) Determination of credits as determined by the Missouri Mitigation Method (attach credit calculation worksheet or other detailed information to demonstrate the specific approach for credit calculation for this project) – see separate attachment:
   a. Number of stream channel credits 629
   b. Number of riparian credits 4779
   c. Stream type (circle): Ephemeral Intermittent **Perennial**

9) Mitigation work plan
   a. Specifications of the project (geographic boundaries, construction methods, timing, sequence): **The rock stabilization project will employ 370 feet of longitudinal stone toe protection keyed into the existing bank with six tiebacks and a rock vein at the downstream end. For the size and amount of rock, please see the attached engineering design. Willow and sycamore poles will be used as a biotechnical component within the rock project area. Additionally, willow and sycamore stakes will be used to help stabilize 300 ft of stream bank that is susceptible to erosion downstream of the rock project (Site 2 on components map). The riparian corridor will be established through the installation of bare-root seedlings. The proposed planting method will be hand planting or the use of a mechanical tree planter. The plantings will be done once rock placement is completed and will include species recommended by a local MDC Private Lands Conservationist (see attached). Plantings will be maintained throughout the monitoring period.**

   b. Methods for establishing desired plant community (species composition and type, control of undesirable species, size of plants used, control of wildlife damage): **An MDC approved tree and shrub planting plan will be given to the landowner for guidance in restoring and enhancing the riparian corridor.**

   c. Grading plan and elevations of constructed features (describe or attach engineering design plans): **See design in Appendix 1**

   d. Describe or attach drawings showing existing stream channel cross sections, proposed alterations to the stream channel and/or banks, a description of in-stream structures including materials used for improvements, dimensions and elevations, and riparian plantings: **See design in Appendix 1 and maps**

10) Maintenance plan:
   a. Description and schedule of maintenance following initial construction: **Depending on initial construction time of year, trees will be planted in the spring following construction. A tree planting plan will be used for guidance and the maintenance guidelines will be followed for a successful riparian corridor establishment. Planting sites will be prepared by using an approved herbicide in the fall and also in the spring to kill fescue and other vegetation. In the spring, a pre-emergent herbicide will be applied to help control unwanted vegetation through the summer. In accordance with Missouri state law, the riparian corridor restoration area shall be kept free of weeds listed as noxious (see attached). In addition to state-listed noxious weeds, callery pear (*Pyrus calleryana*) and Japanese hops (*Humulus japonicus*) shall also be eradicated within the site.**

b. Mowing frequency and timing: **Mowing of weeds between rows of newly planted trees will be beneficial in aiding in tree survival and growth. This will be done as needed until the newly planted trees are taller than any potential weed growth.**

c. Herbicide applications (chemical used, method, timing, frequency): **The fall before the trees are to be planted spray the entire planting area to obtain bare soil. Any type of herbicide with an active ingredient that contains glyphosate can be applied (ex. Roundup, Roundup Ultra, ClearOut, Eraser, Buccaneer, Gly-4(plus)) in the fall and also in the spring to kill fescue and other vegetation. In the spring before tree seedlings break dormancy a pre-emergent herbicide will be used to help control unwanted vegetation through the summer. Stomp, Prowl, Goal, Oust, Squadron or Princep 4L are several types of pre-emergent herbicides that can be used. To control annual and perennial grasses (fescue, foxtail, and Johnson grass) during the growing season use Poast, Fusilade, or Select herbicides.**

d. Irrigation plan (include source of water): **Irrigation is not recommended.**

e. Passive water control and instream structure description and required maintenance (type and frequency): **The rock stabilization structures will employ approximately 370 feet of longitudinal stone to protection keyed into the existing bank with six tiebacks. The project will also include one rock vein at the downstream end of the longitudinal stone toe protection. The total amount of rock used for the project will be approximately 1100 tons (Appendix 1). Upon completion, the project should not require maintenance except in the case of catastrophic failure. See adaptive management section for instream structure failures.**

11) Performance standards

a. Description of the performance standards used (include metrics for determining project success):

Riparian: **Monitoring will take place for five years to ensure survivorship of 300 stems/acre after the second growing season including natural recruitment of native desirable species. Monitoring, for purposes of the easement, will continue in perpetuity. No more than 20 percent of the woody vegetation within the restored corridor may be naturally-recruited species, unless otherwise approved by the Corps. The site will be free of noxious weeds and other invasive species as described in Section 10(a) above.**

Stream Channel: **Georeferenced aerial photography will be used to monitor lateral bank movement. Periodic site inspections will be made to ensure that the structures are working as designed and remain in place. After several high flow events, we would expect to see the thalweg of the stream shift away from the eroding bank and the bank begin to stabilize as erosive forces are diverted and riparian growth becomes established.**

Reference stream(s) used (if any): **The East Fork of Bull Creek located on US Forest Service land upstream of the project site**

b. Describe how the performance standards relate to the objectives of the mitigation site (include description of the desired resource type, expected functions or services being measured, or any other applicable metrics): **One primary objective of the mitigation site is to reduce bank erosion and lateral channel migration within a 500+ LF reach of the site. The performance standards directly measure whether this objective has been accomplished. If the performance standards are met, we expect to accomplish secondary objectives, which are beyond the scope of the monitoring to measure. For example, by inhibiting lateral bank movement, the project will reduce sediment loads into the stream, and improve the quality and diversity of aquatic habitat. A second objective of the mitigation site is to reestablish and preserve forested riparian corridor. The use of minimum tree survivorship within the specified acreages directly measures this objective. As with the in-stream objectives, if the performance standards are met, we expect to accomplish secondary objectives, which are also beyond the scope of the monitoring to measure. The establishment and preservation of forested riparian corridor will contribute to water quality by filtering herbicides, pesticides, nutrients, and other contaminants associated with agricultural runoff. The forested corridor will also contribute to the improvement of habitat, both within the stream and the corridor. The forested corridor will provide shading for the stream, lowering water temperatures. Additionally, the corridor will provide a source of organic detritus and large woody debris, which provide food and habitat for benthic macroinvertebrates and other aquatic organisms. Terrestrial and avian species, including passerines, will benefit from increased habitat availability, including forage and nesting. The restored area will also provide increased habitat contiguity with other riparian and upland habitat areas near the site.**

12) Describe the method and frequency of project monitoring to determine when performance standards are being met (project site must be monitored for an appropriate period not less than 5 years after initial construction/planting), who will be conducting the monitoring, and the frequency monitoring reports will be submitted: **Monitoring will take place annually for a minimum of five years to ensure that performance standards and Corps criteria for minimum planted tree survivorship are met. Due to the number of trees proposed for planting within the site, total stem inventory is not practicable. Therefore, monitoring of trees will be performed using a random sample. Sampling methodology will incorporate the use of either fixed random transects or plots, as determined appropriate by the MCHF/MDC to estimate percent survival. The monitoring reports will document general trends in the health and vigor of the planted forested riparian corridor; such as subjective evaluation of growth, signs of disease, or species-specific mortality. If naturally-recruited tree species are required to meet minimum survivorship requirements, the reports will document the relative percentages of planted vs. naturally-recruited species, as well as species composition. Any occurrences of noxious and/or invasive species will be documented, with recommendations on control and management. Monitoring will include**

reconnaissance within the preserved riparian corridor, to determine whether the preserved corridor has been affected by clearing, dumping, or other prohibited disturbances. MCHF/MDC staff will photo document changes in stream channel morphology and will also photo document rock stabilization structures and riparian corridor restoration/enhancement. Annual site visits will include visual inspection of the longitudinal peak stone and weir, to determine if they are working as designed and remain in place; and document evidence of bank stability, such as establishment of bank vegetation. Lateral channel migration will be measured using georeferenced aerial photography and on-sight measurements along the project site and newly restored/enhanced riparian corridor every year for five years. If instances of bank instability or continued erosion are observed, the monitoring report will provide recommendations on repair or modification to meet performance standards. If, after five years of annual monitoring, the Corps determines that the performance standards have been met; no further monitoring will be required. If the performance standards have not been met and/or a reasonable assurance of long-term success can't be demonstrated; then the Corps may, at its discretion, require additional monitoring and/or corrective measures. After the Corps releases the site from annual monitoring, the site will be visited periodically to observe whether the site continues to function as designed; and determine whether the site is in compliance with the provisions of the conservation easement. Monitoring for purposes of the easement will continue in perpetuity.

13) Long-term management plan:
    a. Describe how the project site will be managed after performance standards have been met: **The project site will be protected by a perpetual easement and monitored routinely. Continuing evaluations and coordination will take place with the USACOE. If any adverse effects occur they will be addressed on a case-by-case basis with Best Management Practices (BMPs) that have been approved throughout Missouri for use on stream, livestock, and riparian corridors.**
    b. Annual cost estimate for management: **$ 60-100 per acre**
    c. Funding mechanisms will be used to finance long term management (including responsible party: **If required SSTF funds will be used to make sure the newly established riparian corridor is successfully established and maintained.**
    d. Long term management responsibilities transferred to (include description of their long-term management plan and a written stewardship commitment that includes a financing plan): **The landowner will assume responsibility for long-term management of the project. Through MDC technical assistance, the landowner will follow those guidelines to ensure a successful project. A perpetual easement will ensure that the project will stay protected into perpetuity.**

14) Adaptive management plan (due to inability to construct project in accordance with approved plans, monitoring revealing that the project is not meeting performance standards, remedial measures resulting in project modifications, design changes, revisions to maintenance requirements, revised monitoring, etc):
    a. Description of strategy to address unforeseen changes in the project: **If rock stabilization fails, SSTF will reevaluate and reconstruct rock work to specifications for a successful design. If riparian corridor does not meet requirements set forth by the NRCS, then the landowner will be required to re-plant. If riparian corridor fails due to an act of God then SSTF funds will be used to assist with a new planting.**

b. Party (ies) responsible for implementing adaptive management: **If failure in the project is due to an act of God then the agencies will assist with adaptive management. If failure is due to landowner negligence then the landowner will be responsible for adaptive management.**

c. **Inability or unwillingness of the landowner to implement remedial measures and bring the riparian corridor into compliance will result in a reduction of available credit for the mitigation project. The amount of reduction will take into account the percentage of the riparian corridor area that does not meet minimum performance requirements; and the extent to which this area falls below the performance standards. The Corps has the final authority to determine the available credits for the project.**

15) Financial Assurances:

The MCHF has previously demonstrated its ability to fund good stream projects and is committed to the installation, monitoring, and long-term management of its compensatory mitigation projects. Since an important basis for project selection is a project's fit into MDC's statewide stream management plan, a commitment of the biological, engineering, and legal resources of MDC also accompanies each project. In addition to MDC's support, the MCHF has incorporated financial assurances into its cost-per-credit and will retain financial assurances not to exceed 10% of each project's estimated completion cost to establish a continuous contingency fund balance of $250,000.00.

16) Total cost of the project is estimated at $ 119,725.00. SSTF Resources are requested in the amount of $ 119,725.00

17) Partner funds in the amount of NA are being contributed by: (if applicable):_____

18) Total stream length of the project **approximately 3200 linear feet**. Total Riparian corridor acreage **approximately 20.2 acres**

19) Total cost per credit (including all costs) estimated at $ 22.14 .

20) If the project is leveraged with contributions from others, SSTF Resources are requested to fund which practices/products/costs activities? NA

21) Schedule for project completion and/or installation: **Rock stabilization to begin fall/winter 2019; Riparian Corridor Restoration/Enhancement fall 2019/spring 2020**

Note: Proposal must include appropriate on-site photographs, county maps locating the proposed project, related topographic, soils, or other maps, drawings and materials necessary to describe planned activities. In order to reproduce color photographs and maps, a complete electronic file is requested with project proposals.

MDC Region: **Southwest** Date: **8/1/2018**

Name of project leader, and Division: **Dave Woods, Fisheries**

Lead Unit Chief Approval: Sherry Fischer

Sign: Sherry Fischer Date 8-27-18

Lead Division Administrator Approval: Date:

MDC Director Approval: approval by email Date:

Please return to the Executive Director of the Missouri Conservation Heritage Foundation.

MCHF Approval: **Date:** August 27, 2018

Figure 1. Location of project site in the White River EDU.

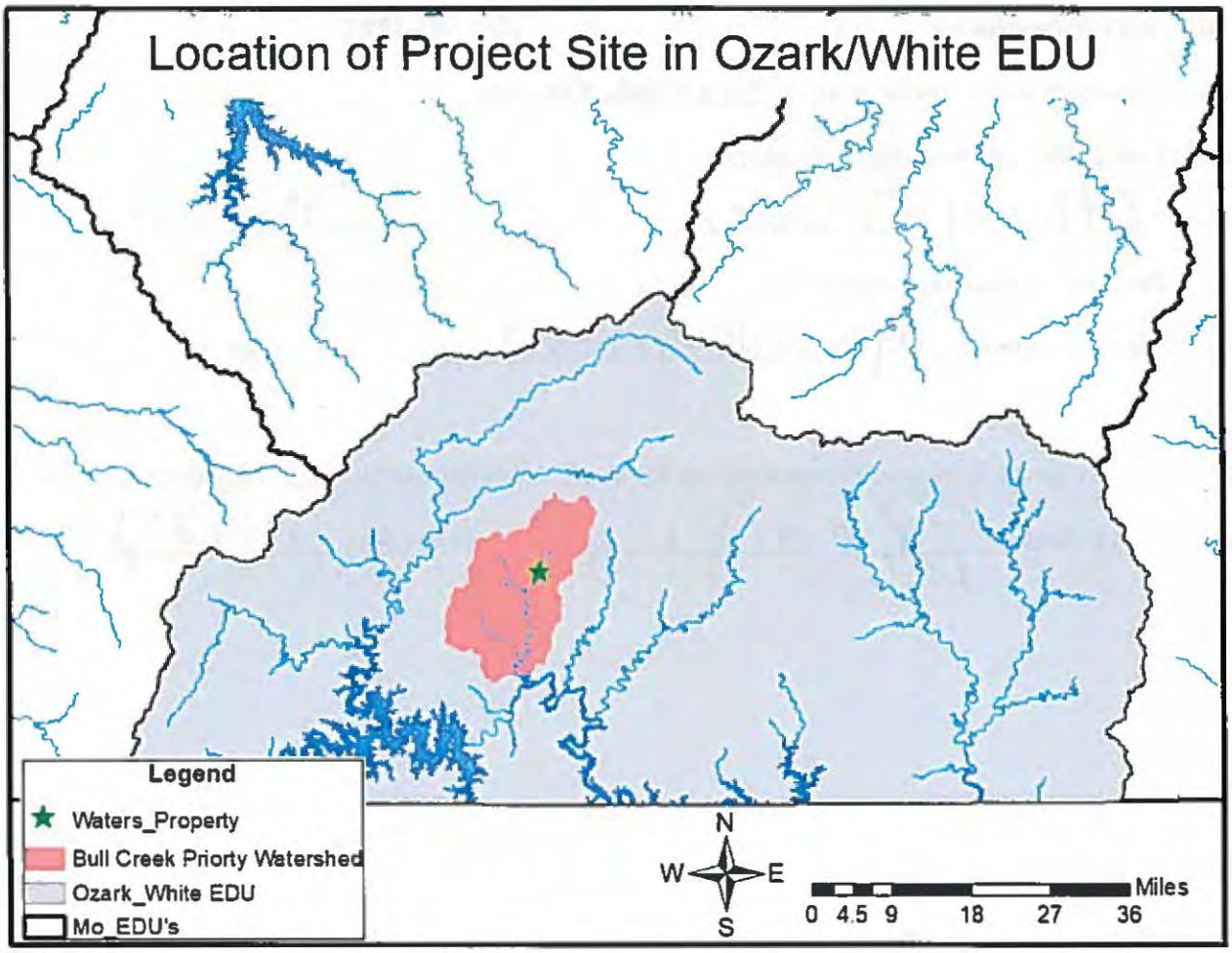


Figure 2. Location of Waters Property in southwest Missouri.

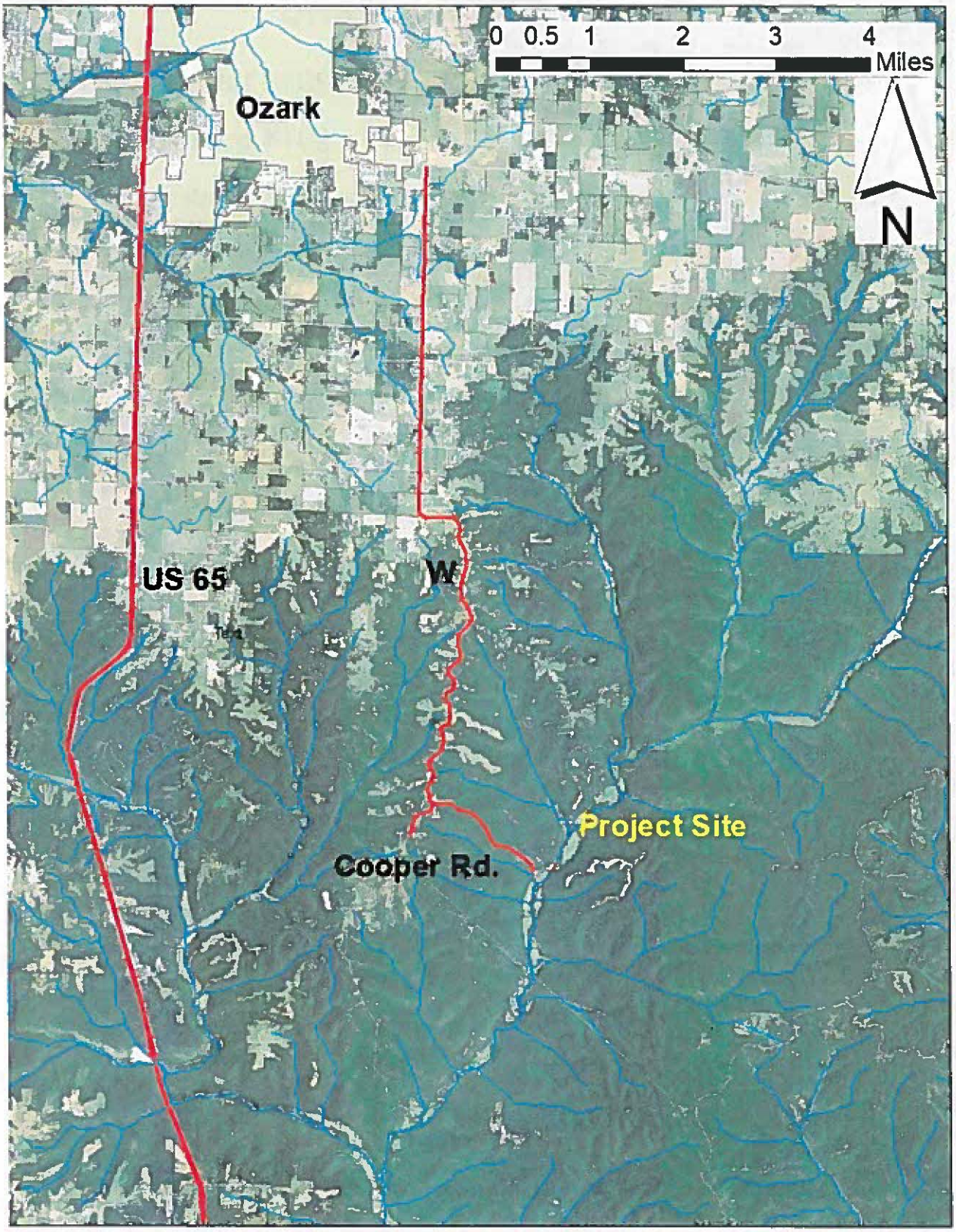


Figure 3. Progression of stream bank erosion since 1995.

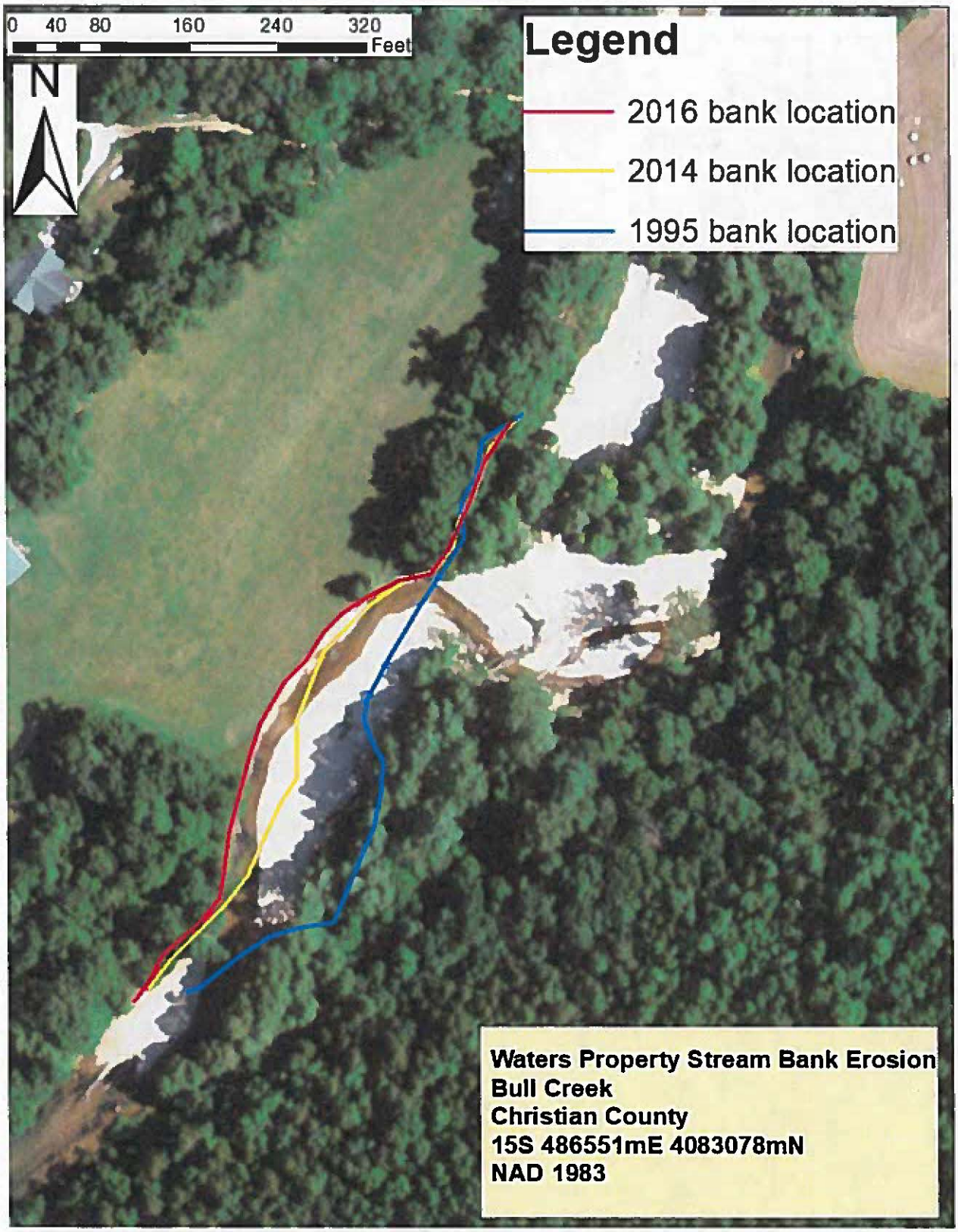


Figure 4. Proposed project components and easement boundaries for Waters project. Easement will protect approximately 13 acres of riparian corridor.

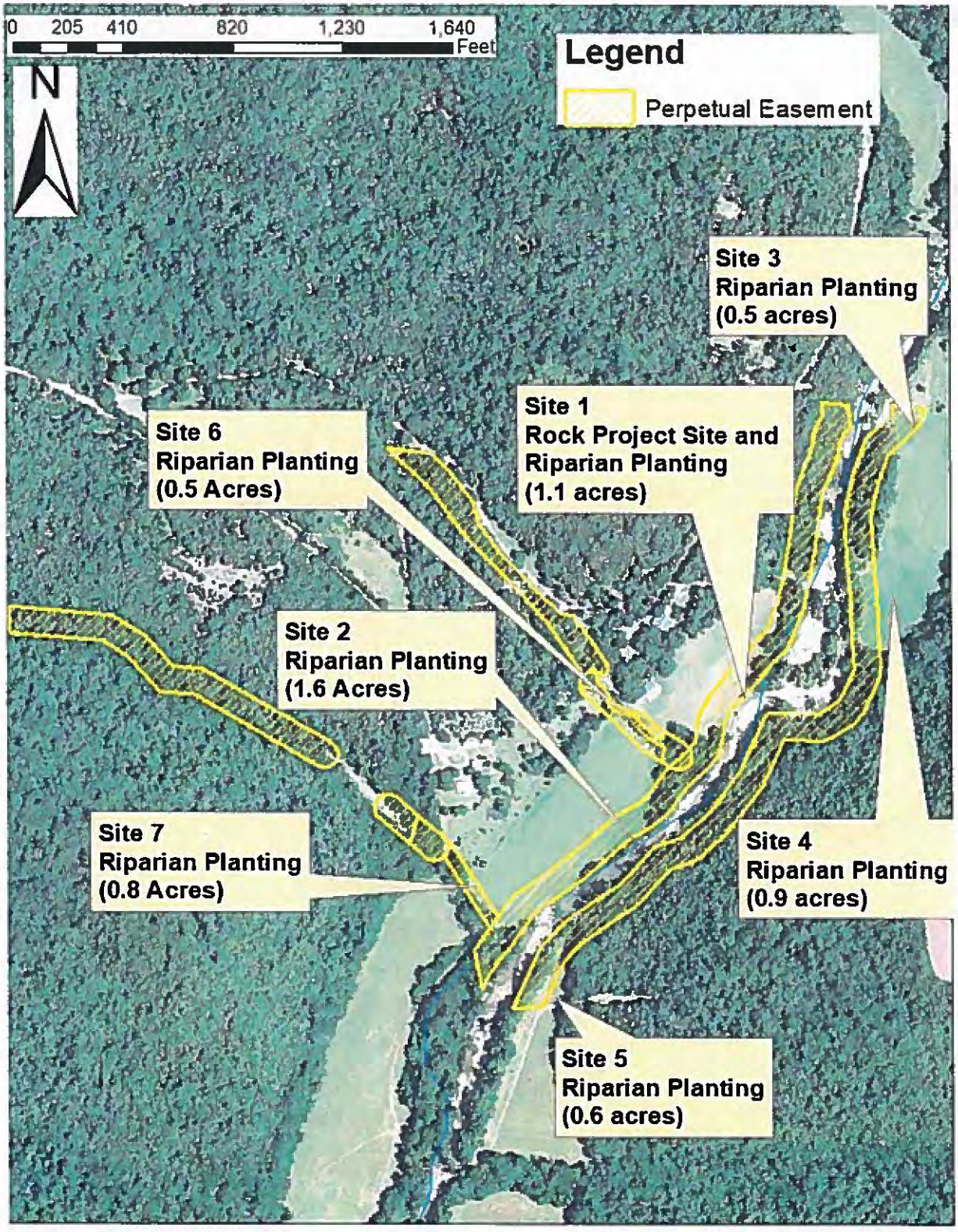


Figure 5. Heritage database records of species of conservation concern and section of Outstanding State Resource Water in the Bull Creek watershed.

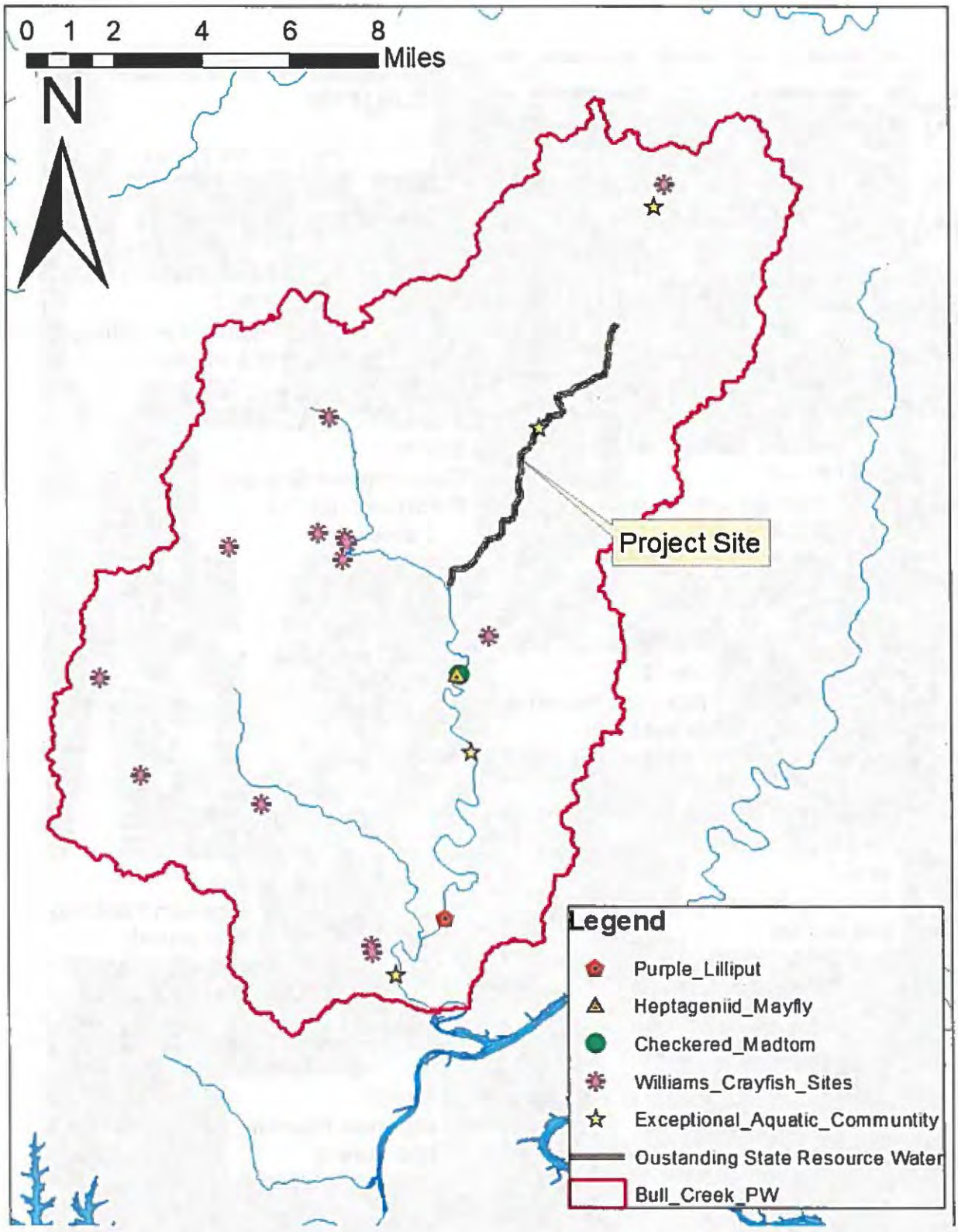


Figure 6. Photographs of bank erosion at the proposed project site on Waters property.

Appendix 1. Conceptual design for bank stabilization project.

Waters Passive Restoration – July 2018 Conceptual Design

Problem:

Impinging flow is eroding a weak bank-toe resulting in accelerated lateral and longitudinal meander movement. Substantial bank loss will continue based on the upstream bend configuration and no riparian corridor along the eroding reach.

Solution:

Install the following passive restoration measures as highlighted in the figure:

1. Longitudinal Stone Toe Protection (750-tons) with Tie-backs (300-tons) to convey flow through a mild bend. (150-cy of onsite gravel to fill area between toe rock, tie-backs and bank)
2. Rock Vane (60-tons) to control exit conveyance

In total, an estimated 1100-tons of rock would be required to provide a passive restoration system.

Waters 1013

IN-STREAM WORKSHEET

Stream Type	Ephemeral 0.15	Intermittent 0.2	Perennial Stream 0.4		
Priority Waters	Tertiary 0.05		Secondary 0.2	Primary 0.4	
Net Benefit	Stream Relocation to Accommodate Authorized Project 0.5		Moderate 1.2	Good 2.4	Excellent 3.5
Site Protection	Corps approved site protection without third party grantee 0.1		Corps approved site protection recorded with third party grantee, or transfer of title to a conservancy 0.4		
Credit Schedule	Schedule 1 0.3		Schedule 2 0.1	Schedule 3 0	

site 1

Factors	Net Benefit 1	Net Benefit 2	Net Benefit 3	Net Benefit 4	Net Benefit 5	Net Benefit 6
Stream Type	0.4					
Priority Waters	0.2					
Net Benefit	.70					
Site Protection	0.4					
Credit Schedule	0					
Sum Factors (M)=	1.7					
Stream Length Benefited (do not count each bank separately or count same channel reach twice) (LF)=	370					
Credits (C) = M X LF	629					
Total Instream Credits Generated C X LK Factor* =						

Total Instream Credits Generated from all Columns = 629

* Location and Kind (LK) Factor only applies to permittee-responsible mitigation projects (see page 18 of document).

Waters 1013

RIPARIAN BUFFER WORKSHEET

Stream Type	Ephemeral 0.15	Intermittent 0.2	Perennial 0.4
Priority Waters	Tertiary 0.05	Secondary 0.2	Primary 0.4
Net Benefit (for each side of stream)	Riparian Restoration/Establishment, Enhancement, and Preservation Factors (select values from Table 1) (also see Minimum Buffer Width (MBW) page 15)		
Supplemental Buffer Credit	Condition: Buffer established, enhanced or preserved on both streambanks To calculate:(Net Benefit Stream Side A + Net Benefit Stream Side B) / 2		
Site Protection	Corps approved site protection without third party grantee 0.05	Corps approved site protection recorded with third party grantee, or transfer of title to a conservancy 0.2	
Credit Schedule	Schedule 1 0.15	Schedule 2 0.05	Schedule 3 0
Temporal Lag (Years)	Over 20 -0.3 / 10 to 20 -0.2	5 to 10 -0.1	0 to 5 0

Factors		Net Benefit 1 (Site 2)	Net Benefit 2 (Site 3)	Net Benefit 3 (Site 4)	Net Benefit 4 (Site 5)	Net Benefit 5 (Site 6)	Net Benefit 6 (Site 7)
Stream Type		0.4	0.4	0.4	0.4	0.4	0.4
Priority Waters		0.2	0.2	0.2	0.2	0.2	0.2
Net Benefit	Stream Side A	.70	.70	.70	.70	.50	.50
	Stream Side B						.50
Supplemental Buffer Credit (Buffer on both sides)							.50
Site Protection		0.2	0.2	0.2	0.2	0.2	0.2
Credit Schedule	Stream Side A	0	0	0	0	0	0
	Stream Side B						0
Temporal Lag		0	0	0	0	0	0
Sum Factors (M)=		1.5	1.5	1.5	1.5	1.5	2.3
Linear Feet of Stream Buffered (LF)= (do not count each bank separately or count same channel segment twice)		720	220	400	400	480	630
Credits (C) =M X LF		1080	330	600	600	720	1449
Total Credits Generated C X LK Factor * =							

Total Riparian Credits Generated from all Columns = 4779

* Location and Kind (LK) Factor only applies to permittee-responsible mitigation projects (see page 18 of document) .

RIPARIAN FOREST BUFFER PLAN

for

John Waters
Stream Stewardship Trust Fund Project

on

6.0 Acres
Township 25N, Range 20W
Section(s) 5

in

Christian County

Prepared by

Andy Humble, Private Land Conservationist
Missouri Department of Conservation
1786 S. 16th Ave., Suite 103
Ozark, MO 65721
(417) 581-2719 ext. 121

August 14, 2018

PLANTING PLAN

This plan is for the establishment of a riparian forest buffer consisting of 2.7 acres along Bull Creek. The purpose of this plan is to filter sediment and other pollutants from adjoining areas, reduce bank erosion, provide downstream flood protection, and enhance wildlife habitat by establishing a mixture of woody species. This document will recommend procedures for preparing the site, selecting tree species, and method of tree planting. The attached map identifies the areas to be planted:

Planting #1- 1.1 ac
Planting #2- 1.6 ac
Planting #3- 0.5 ac
Planting #4- 0.9. ac
Planting #5- 0.6 ac
Planting #6- 0.5 ac
Planting #7- 0.4 ac
Planting #8- 0.4 ac

The landowner agrees to follow the requirements in order to receive partial reimbursement for the practices described in this management plan. These include:

1) Completion of the practice on a minimum of 6.0 acres, planting an average of 363 stems/acre for a total of 2200 trees/shrubs.
2) Maintain the area in trees for the lifespan of the easement.
3) Ensure a minimum survival rate of 302 trees/acre. Replanting will be necessary if survival is not adequate.
4) The area enrolled in the program must be protected from destructive fire and grazing.
5) Noxious weeds such as Canada thistle, Musk thistle, Scotch thistle, Field bindweed, Multiflora rose, Purple loosestrife, Common teasel, Cutleaf teasel, Kudzu, and Marijuana must be controlled on the 6.0 acres.

SOILS

The planned area to be planted is encompassed by two soil map units. The map units are listed below and more information on each soil can be found in the soil reports enclosed in your packet.

74683 Cedargap-Razort complex, 0 to 2 percent slopes, frequently flooded

SITE PREPARATION

Most sites require some type of site prep prior to establishing tree seedlings. These methods usually involve the use of herbicides to eliminate the competition of vegetation such as grasses and unwanted shrub species. Mechanical site prep is also used by means of mowing or disking.

- The areas that have been identified to be planted on the property are currently in a mixed grass that is predominantly fescue. You will need to make a broadcast application of a glyphosate product in the fall in advance of spring planting for each planting area.

- You should apply 2 application of a glyphosate product. One application should be in the fall before spring planting. The second application should be made after green up in early to mid-March to kill any fescue or other undesirable in the planting area. There are many glyphosate products on the market some common ones are, Roundup, Gly-4, Killzall, and Buccaneer. **Directions on the label should be followed as to proper mixing and procedure for application.**

TREE PLANTING

There are two options for planting the trees. You can hand plant each area using dibble bars that are available for loan at the MDC office in Ozark or Springfield. You can also machine plant the trees. If you choose to machine plant you will need to contact Cindy Garner at the Southwest Regional Office to reserve the planter, her number is **417-895-6880.** If you plan to machine plant I would reserve the planter at least a month in advance of when you would like to plant. Trees should be planted in the spring between mid-March and the end of April. It is important that you get your seedlings planted as quickly as possible after they arrive. You can choose to pick up the seedlings at the nursery or have them delivered. This will limit the amount of time that they are exposed to the elements prior to planting. If you are unable to plant your seedlings for some time, you will need to follow the storage instructions that come with them. I have also included some information on proper planting and seedling storage for you to familiarize yourself with. Seedlings should be planted on 10' x 12' spacing (12 ft. between rows and 10 ft. between trees in each row) to maintain an average of 363 trees/acre. This stocking rate will help insure that your final tree count (end of the 2nd growing season) is above the required minimum by allowing for some anticipated seedling mortality. Proper planting and handling of seedlings will influence the survival rate. Correct spacing should allow enough room between rows for your tractor to mow during the growing season which is discussed later in the plan.

Below is a list of species and the number of each I recommend planting. You are required to plant at least two different species, but I recommend you increase the number of species to create a more diverse setting. You will need at least 1000 trees. Species should be planted so that they are intermixed within rows to promote a diverse and natural setting. **Any species substitutions made to the following list will need to be approved in advance.**

Recommended Species:	# to order
American Sycamore	600
Black Walnut	500
Bur Oak	500
Nine bark	250
Redbud	350

You may order your trees from the Missouri Department of Conservation (MDC) nursery or another nursery of your choice. I have included an MDC order form in your packet. The nursery sometimes runs out of commonly desired seedlings so order as soon as possible. Be sure to specify on the order form when you want the seedlings delivered so that they arrive when you are ready to plant. You will want to coordinate this with you're the reservation of the MDC machine planter. MDC sells trees in bundles of 25 at a cost of about $8. You can elect to pick up your seedlings yourself at the MDC nursery which is

located near Licking or have them shipped to you. If requested, they will reserve and hold the trees until you pick them up.

POST PLANTING MANAGEMENT

- Weeds will need to be controlled around the trees for the first two growing seasons or until the trees become well established and out compete the weed pressure. Mulch, mechanical, and chemical treatments are all viable options to be considered for weed control. Application of herbicide is the easiest and most effective way to accomplish this, **but will need to be done prior to the buds breaking dormancy**. Apply a tank mix of 1 quart/acre of glyphosate such as Roundup plus 1oz/acre of Oust (or another approved pre-emergent) according to the label specifications in spring when competing vegetation turns green but prior to the seedlings leafing out (usually applied in March). Spray coverage can be applied in 3-4 ft strips or across the entire area. I recommend protecting the trees from overspray so there is no chance of herbicide damage if the application occurs in April or a later date. There are other herbicides available that can be sprayed over the tops of the trees at later dates without injury to the trees, but you will need to contact PLC or MDC forester.

- It is common on some floodplains for Johnson grass to be released once the fescue is eradicated. If this occurs, the grass will need to be treated promptly to reduce competition. There are herbicides available to control this if it becomes a problem. Early treatment is most successful at controlling Johnson grass. Be sure to report any signs of Johnson grass to your PLC.

- Mowing between rows should be done a couple of times during the growing season, starting around June. It is imperative that the vegetation is controlled between rows to prevent habitat from forming that will harbor rabbits and mice that may feed on the young seedlings. This will also help maintain the planting and make locating the trees easier. Any indications of pests or diseases posing a threat to the trees will need to be addressed promptly. Contact your local PLC if identified.

- Status reviews will be conducted at various times to assure the trees are being maintained and weeds are controlled. Stocking rates will be determined at the end of the growing season. If the review determines the survival rate is below 302 trees/acre, replanting will be necessary.

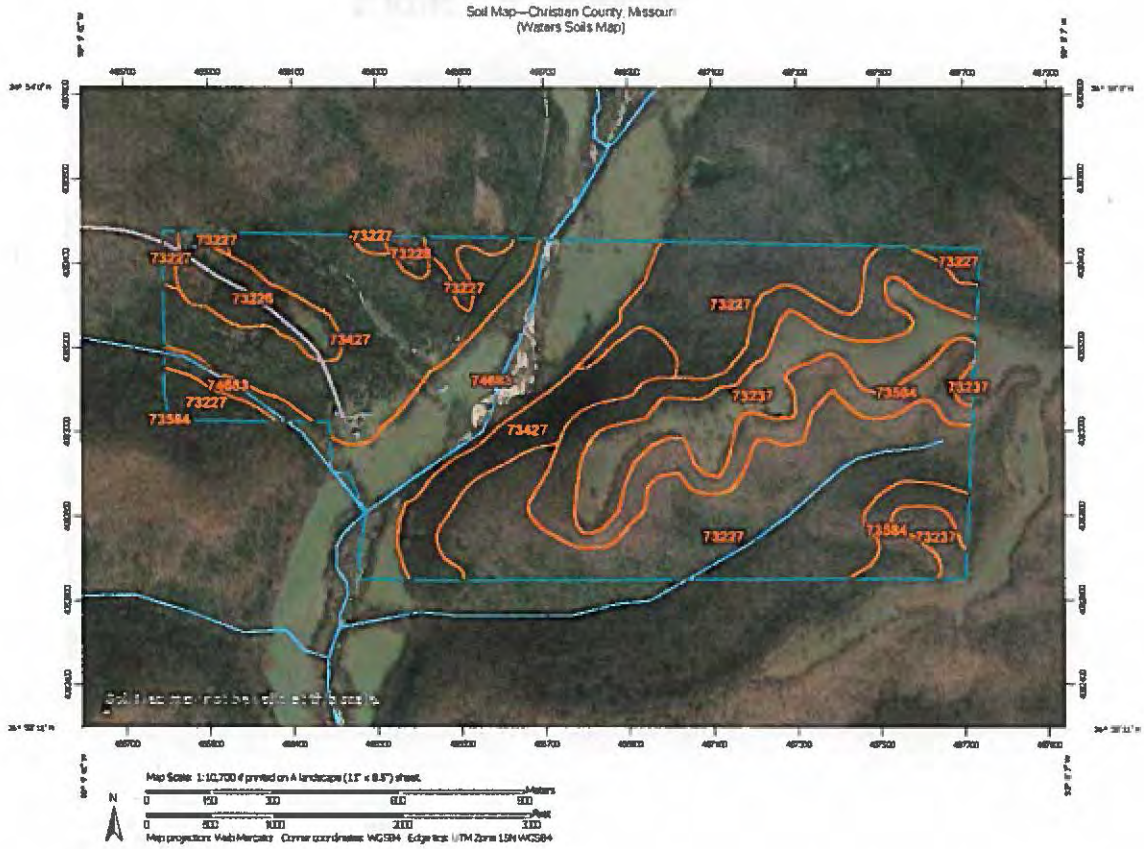
Attachments:

1. Timeline
2. Proper storage and planting
3. Soils Report

Attachments

Timeline of Actions

Date	Type of Action
Year 1	
August	Mow the area to be planted
Sept.-Oct.	Spray the area
November	Order seedlings
mid-March	Spray with glyphosate for site prep.
Mid-March to April	Plant seedlings
June-September	Mow between rows as needed to control grasses
October	Check seedling survival
November	Order additional seedlings (if necessary)
Year 2	
Feb.-March	Replant seedlings (if necessary)
March	Spray for weed control within planted rows
June-September	Mow between rows as needed to control grasses


Soil Map—Christian County, Missouri
(Waters Soils Map)
73227
73227
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73584
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73584
73237
73227
73584
73237
Map Scale: 1:10,700 if printed on A landscape (11" x 8.5") sheet.
N
0 150 300 600 900 Meters
0 500 1000 2000 3000 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

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 1:24,000.

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: Christian County, Missouri
Survey Area Data: Version 24, Sep 15, 2017

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

Date(s) aerial images were photographed: Sep 15, 2010—Nov 22, 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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
73226	Ocie-Gatewood complex, 3 to 15 percent slopes, stony	14.6	4.2%
73227	Ocie-Gatewood complex, 15 to 35 percent slopes, very stony	111.3	32.3%
73237	Clarksville very gravelly silt loam, 3 to 15 percent slopes	36.7	10.6%
73427	Gasconade-Gatewood-Rock outcrop complex, 15 to 50 percent slopes	74.9	21.7%
73584	Clarksville very gravelly silt loam, 35 to 60 percent slopes	55.0	15.9%
74683	Cedargap-Razort complex, 0 to 2 percent slopes, frequently flooded	52.4	15.2%
Totals for Area of Interest		344.9	100.0%

Map Unit Description (Brief, Generated)

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 in this report, along with the maps, provide information on the composition of map units and properties of their components.

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.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

Christian County, Missouri

Map Unit: 73226—Ocie-Gatewood complex, 3 to 15 percent slopes, stony

Component: Ocie (50%)

The Ocie component makes up 50 percent of the map unit. Slopes are 3 to 15 percent. This component is on hillslopes, hills. The parent material consists of slope alluvium over residuum weathered from dolomite over dolomite. Depth to a root restrictive layer, strongly contrasting textural stratification, is 15 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F116AY015MO Quercus Stellata-quercus Marilandica/schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Gatewood (40%)

The Gatewood component makes up 40 percent of the map unit. Slopes are 3 to 15 percent. This component is on hillslopes, hills. The parent material consists of slope alluvium over residuum weathered from dolomite over dolomite. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F116AY015MO Quercus Stellata-quercus Marilandica/ schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria

Map Unit: 73227—Ocie-Gatewood complex, 15 to 35 percent slopes, very stony

Component: Ocie (45%)

The Ocie component makes up 45 percent of the map unit. Slopes are 15 to 35 percent. This component is on hills, hillslopes. The parent material consists of slope alluvium over residuum weathered from dolomite over dolomite. Depth to a root restrictive layer, strongly contrasting textural stratification, is 15 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F116AY048MO Quercus Alba-quercus Rubra/cercis Canadensis, Quercus Stellata-quercus Marilandica/ schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria

Component: Gatewood (35%)

The Gatewood component makes up 35 percent of the map unit. Slopes are 15 to 35 percent. This component is on hillslopes, hills. The parent material consists of slope alluvium over residuum weathered from dolomite over dolomite. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F116AY016MO Quercus Alba-quercus Rubra/cercis Canadensis, Quercus Stellata-quercus Marilandica/schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: 73237—Clarksville very gravelly silt loam, 3 to 15 percent slopes

Component: Clarksville (85%)

The Clarksville component makes up 85 percent of the map unit. Slopes are 3 to 15 percent. This component is on hillslopes, hills. The parent material consists of slope alluvium over residuum weathered from dolomite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the F116AY012MO Pinus Echinata-quercus Stellata/schizachyrium Scoparium, Quercus Stellata-quercus Marilandica/schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: 73427—Gasconade-Gatewood-Rock outcrop complex, 15 to 50 percent slopes

Component: Gasconade (60%)

The Gasconade component makes up 60 percent of the map unit. Slopes are 15 to 50 percent. This component is on hillslopes, hills. The parent material consists of residuum weathered from dolomite over dolomite. Depth to a root restrictive layer, bedrock, lithic, is 13 to 21 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the R116AY052MO Limestone/ dolomite Exposed Backslope Glade/woodland Complex, Limestone/dolomite Protected Backslope Glade/woodland Complex ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Gatewood (20%)

The Gatewood component makes up 20 percent of the map unit. Slopes are 15 to 50 percent. This component is on hillslopes, hills. The parent material consists of slope alluvium over residuum weathered from dolomite over dolomite. Depth to a root restrictive layer, bedrock, lithic, is 28 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 26 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F116AY016MO Quercus Alba-quercus Rubra/cercis Canadensis, Quercus Stellata-quercus Marilandica/schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Rock outcrop (15%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map Unit: 73584—Clarksville very gravelly silt loam, 35 to 60 percent slopes

Component: Clarksville (85%)

The Clarksville component makes up 85 percent of the map unit. Slopes are 35 to 60 percent. This component is on hills, hillslopes. The parent material consists of slope alluvium over residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 50 percent. This component is in the F116AY058MO Pinus Echinata-quercus Alba/vaccinium Arboreum/schizachyrium Scoparium, Pinus Echinata-quercus Stellata/schizachyrium Scoparium, Quercus Alba-quercus Stellata/schizachyrium Scoparium, Quercus Stellata-quercus Marilandica/schizachyrium Scoparium ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: 74683—Cedargap-Razort complex, 0 to 2 percent slopes, frequently flooded

Component: Cedargap (45%)

The Cedargap component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on river valleys, flood plains. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Razort (30%)

The Razort component makes up 30 percent of the map unit. Slopes are 1 to 3 percent. This component is on stream terraces, river valleys. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the F116AY034MO Acer Saccharum-quercus Rubra/asimina Triloba ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Farewell (2%)

Generated brief soil descriptions are created for major components. The Farewell soil is a minor component.

Data Source Information

Soil Survey Area: Christian County, Missouri
Survey Area Data: Version 24, Sep 16, 2017

University of Missouri Extension

G5008, Reviewed October 1993

How to Plant Forest Trees

John P. Slusher
School of Natural Resources

Terry Robison
Missouri Department of Conservation

When seedlings arrive, keep the seedling roots protected and moist. Begin planting as soon as possible.

To store for two weeks or less

- Put the bales in a cool, shaded place.
- Separate the bales (to avoid overheating and molding).
- Pour cold water into the open end of the bales often enough to keep seedling roots moist.
- Do not store trees in water because roots may be damaged.
- Protect from severe freezing.

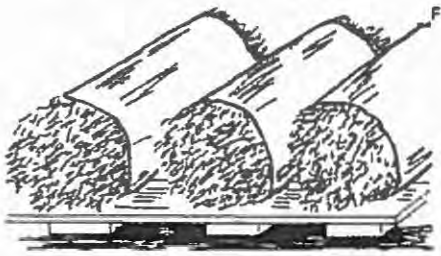


Figure 1

To store for more than two weeks

- Either hold bales in cold storage at 35 to 37 degrees Fahrenheit, or
- Put trees in a heeling-in trench.
- Dig trench in a shaded, protected place. Adjust depth to fit the roots (Figure 2). Avoid areas with high rodent populations.
- Cut bundle strings and spread trees.
- Pour water on roots as trench is being refilled with soil.
- Water as often as necessary thereafter to keep soil moist, but avoid overwatering.
- A mulch placed on soil close to trees will help hold moisture.
- Once the trees have begun growing, it is best not to remove them from the heeling-in bed until the following spring.

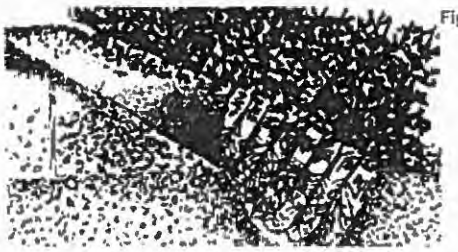


Figure 2

Note
Never leave open bales of seedlings exposed to the sun and wind. During planting operations, take out a few bundles of trees at a time. Cover the others and keep them cool and moist until they are needed. Be careful to avoid damaging the terminal buds.

Planting

By hand

- Always carry seedlings in a bucket half-full of water or wet moss. Don't allow seedling roots to become dry. Do not store the trees with their roots in water.
- On unprepared areas scalp or skin off the sod and weeds from a spot 18 inches in diameter where each tree is to be planted.
- Center or side-hole methods of hand planting are shown in Figure 3.
- Slit method of planting with a grubbing hoe is shown in Figure 4.
- Slit method of planting with a tree planting bar is shown in Figure 5.

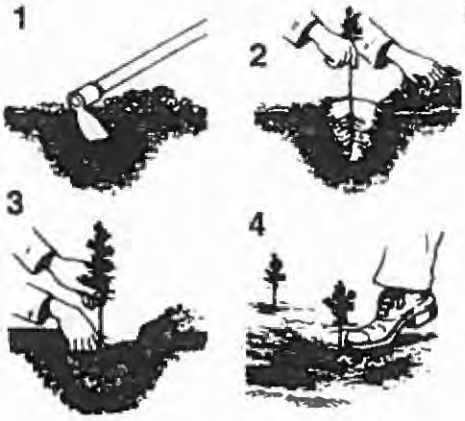


Figure 3

1. Dig hole to fit root system.
2. Set at same depth trees grew in nursery
3. Fill hole half full of soil and tamp well
4. Finish filling hole and tamp with feet.

Figure 4

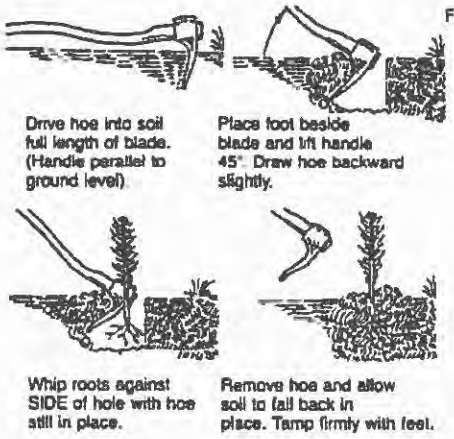
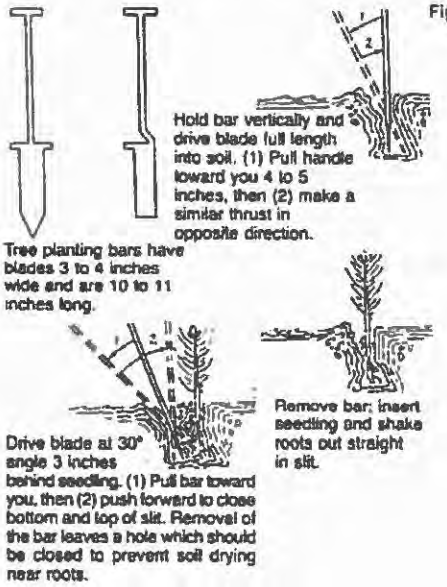


Figure 5



By machine

- Use a three- or four-person crew. One person follows the machine to straighten and pack poorly planted trees. Another keeps seedlings protected, separated, and ready to load into planting machine trays.

- **Trees in planting trays should be kept covered at all times with wet burlap or wet moss. This is important**
  If roots are exposed to the sun and wind, the trees may be dead before they are planted.
- **Run the machine deep enough to allow the roots to hang down straight in planting slit**
  Typical depth is 8 to 10 inches. If soil is too rocky or hard to permit machine planting, plant by hand.
- **Set seedlings at same depth or just slightly deeper than they grew in the nursery seed bed**

Care of plantations

Livestock damage trees of all ages, so keep livestock out of your plantations.

Protect trees from fire. Plow or disk a fire break if necessary, and maintain it during the fire season.

Prevent rank growth of weeds and grass on good soils by cultivating, using proper chemicals, disking, mowing, or hoeing as often as necessary for the first two or three years. On poor soils, a light growth of vegetation such as broomsedge or ragweed provides some protection and may be beneficial.

Inspect plantations regularly for evidence of attacks by insects or disease.

Fertilization usually is not necessary for evergreens unless serious nutrient deficiencies exist. Hardwood (deciduous) trees sometimes benefit from fertilization. Fertility needs should be determined by soil test or foliar analysis.

To avoid damaging seedling roots, do not apply fertilizers directly in the planting holes.

For further assistance in tree planting, contact your local MU Extension center or the Department of Conservation farm forester.

Related MU Extension publications

- G5009, Mechanical Tree Planters
  http://extension.missouri.edu/p/G5009

Order publications online at http://extension.missouri.edu/explore/shop/ or call toll-free 800-292-0969.

UNIVERSITY OF MISSOURI Extension

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