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 **Woods Fork Road Low Water Crossing Replacement Project**

   Landowner Name **Christian County Commission**

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

3) Project objectives – We are proposing this mitigation project because we believe it will fulfill the following objectives: 1) Remove the existing low water crossing and replace with a newly designed, bottomless low water crossing to facilitate fish passage and allow for improved sediment transport increasing stream stability. 2) Use the newly designed crossing as a demonstration project for neighboring county road services working on streams within Bull Creek Priority Watershed and other priority watersheds in the region.
   These objectives will all address specific areas of concern discussed in the Compensation Planning Framework for the White River EDU including aquatic resource problems, water quality problems, and aquatic resource conditions. In addition, Woods Fork and Camp Branch stream reaches within Busiek State Forest and Wildlife Area will be used as a reference reach to help establish achievement of the defined objectives.

4) The project submitted for consideration is in MDC Priority Watershed, Bull Creek 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). Approximately four miles downstream of this crossing is the Woods Fork Aquatic Conservation Opportunity Area (ACOA), which includes Camp Creek, and portions of Woods Fork and Bull Creek. This ACOA was designated by MDC to target aquatic species such as Williams' Crayfish (Rank S2), three mussel species including Ouachita Kidneyshell (Rank S3), Neosho Mucket (S2), and Purple Lilliput (S2), and White River Ecological Drainage Unit (EDU) fish species including the Southern Brook Lamprey (Rank S2S3). Removing this AOP barrier will reconnect aquatic habitat and improve sediment transport within the headwaters of Woods Fork. Fish community and macroinvertebrate sampling conducted within Woods Fork in 2017 found low scores for fish Index of Biotic Integrity (IBI) and macroinvertebrate Stream Condition Index (SCI). Aquatic organism passage barriers and poor sediment transport are variables likely contributing to those impaired stream conditions.

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): This project will be completed under a 30-year term cooperative agreement between Christian County, the Missouri Conservation Heritage Foundation, and the Missouri Department of Conservation.

7) Baseline information

   a. Describe the ecological characteristics of the proposed project site: The project site is located on Woods Fork approximately 7 miles upstream from its confluence with Bull Creek. Woods Fork is a 4th order stream at the project site draining a 9.4 square mile (6034 acre) watershed. Woods Fork is a sub-watershed within the Bull Creek watershed. Bull Creek is a MDC Priority Watershed. Landuse within the entire Bull Creek watershed is 67% forest, 24% grassland, 5% deciduous woody/herbaceous, 2% impervious surface, 1% barren land, <1% cropland, and <1% urban.

   b. Historic and existing plant communities, hydrology and soils of the proposed project site: See Appendix A. White EDU, Appendix B. AES, and Appendix C. LTA.

   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 Figures 1, 2, and 3.

   d. Describe existing hydro-system connectivity between the stream project site and any wetlands or other waters including tributaries connecting to receiving waters: The project site is located on Woods Fork approximately 7 miles upstream from its confluence with Bull Creek. Above this AOP barrier there are approximately 0.8 miles of 4th order stream, 2 miles of 3rd order streams, 2.7 miles of 2nd order streams, and 15.6 miles of 1st order streams. Removing this barrier will connect at least 10 miles of aquatic habitat.

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):
   a. Number of stream channel credits 6423.3
   b. Number of riparian credits N/A
   c. Stream type (circle): Ephemeral (Intermittent) Perennial

9) Mitigation work plan
   a. Specifications of the project (geographic boundaries, construction methods, timing, sequence): The current low water crossing is a concrete structure with no openings for sediment or water, it is effectively a low-head dam. The upstream side of the crossing has completely aggraded with sediment with a scour pool on the downstream side. Several attempts to stabilize the downstream banks and fill the scour pool have been attempted. Those attempts include the placement of rock fill of various sizes and grouted concrete on the rock fill or directly on the eroding streambanks and streambed. Aquatic organism passage barriers exist at low to moderate flows when the structure creates perch and jump barriers. Only during high flows, when the entire structure is over-topped, is fish passage possible and during those high flows, velocity and exhaustion barriers likely exist. See Figures 4, 5, 6, and 7. The boundaries of the project will be confined to the foot-print of the existing low water crossing. The project will entail demolition of the existing low water crossing by chipping/breaking up the structure, then loading and hauling the debris off-site. Once removed, the new low water crossing (bottomless design) will be constructed on the same foot-print and tie into the existing road approaches. See Figure 8.
   b. Methods for establishing desired plant community (species composition and type, control of undesirable species, size of plants used, control of wildlife damage):This project does not include establishing any plant communities. Any areas disturbed during construction will be planted to pre-existing cover.
   c. Grading plan and elevations of constructed features (describe or attach engineering design plans): The elevation of the new low water bridge will not be significantly higher than the existing low water crossing. Since the existing road approaches will be used, the grade of the new structure will closely match that of the existing structure. However, the new structure will be a clear-span type of structure without a floor and will utilize the natural stream bed to facilitate AOP and natural sediment transport.
   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: No alterations to the existing stream channel and/or banks are planned for this project. A low water crossing (bottomless design) will be constructed in place of the existing concrete structure. Some rip-rap will be placed around the bridge abutments to protect from scour. The new low water bridge will have a total span opening of approximately 50 feet and have an elevation similar to the existing low water crossing.

10) Maintenance plan:
   a. Description and schedule of maintenance following initial construction: : 1) remove gravel and flood debris from the deck of the crossing as needed; 2) remove snags and obstructions from the stream channel, in the immediate vicinity of the crossing, if flow under the crossing is obstructed; 3) examine the crossing immediately following high

flow events for scour or undercutting that may impact the structural integrity of the crossing; and 4) provide maintenance as needed to the crossing and roadway approaches.

b. Mowing frequency and timing: Not applicable
c. Herbicide applications (chemical used, method, timing, frequency): Not applicable
d. Irrigation plan (include source of water): Not applicable
e. Passive water control and instream structure description and required maintenance (type and frequency): See Cooperative Agreement Document between the County, MDC, and MCHF for information.

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

    Riparian: Not applicable

    Stream Channel: The three main standards that will be met by this project are: 1) the existing crossing that has been identified as a barrier to AOP and sediment transport will be removed; 2) the newly designed low water crossing will not have a floor and use the natural stream bed; and 3) the length of the clear-span opening of the low water bridge will be greater than 75% of the bank-full channel width.

    Reference stream(s) used (if any): These performance standards have been successfully documented in facilitating AOP and sediment transport in Ozark watersheds. Woods Fork and Camp Branch stream reaches within Busiek State Forest and Wildlife Area will be used as a reference reach to help establish achievement of the defined objectives.

    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): Removing the existing low water crossing with a bottomless structure will not only facilitate fish passage, but will also improve sediment transport thereby restoring a critical component of the natural stream process and enhancing stream habitat stability within this reach.

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: Photo documentation of the crossing will occur after the first two bankfull events or annually for two years to ensure that the stream crossing is allowing for sediment transport and is being appropriately maintained by the county.
13) Long-term management plan:
    a. Describe how the project site will be managed after performance standards have been met: Through the 30-year term cooperative agreement the county has agreed to provide standard maintenance as outlined above. Additionally, the county has agreed to incorporate fish passage and sediment transport considerations into subsequent design and construction whenever the crossing must be repaired or replaced.
    b. Annual cost estimate for management: Responsibility of Christian County.
    c. Funding mechanisms will be used to finance long-term management (including responsible party): Christian County road and bridge department will manage and

perform maintenance as needed. Funding will be provided through the county's annual budget for road/bridge maintenance.

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): Long-term management responsibilities are transferred to Christian County Commission. A long-term management plan and stewardship commitment are included in the above referenced cooperative agreement.

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 there is an inability to construct the project in accordance with approved plans, no further action will be taken and the existing structure will be left in place. If the structure fails due to an act of God, the County has agreed to replace the structure with a new structure that facilitates fish passage and sediment transport. Design changes will only occur after consultation and approval by MDC, USACE, and County.

b. Party (ies) responsible for implementing adaptive management: If failure in the project is due to an act of God, the agencies will assist with adaptive management implementation. If project failure is due to County negligence, the County will be responsible for implementing adaptive management plans and remedial measures with oversight from agencies.

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 $193,538.00. SSTF Resources are requested in the amount of $160,582.50.

17) Partner funds in the amount of $32,955.55 (in-kind) are being contributed by: (if applicable): Christian County

18) Total stream length of the project 1586ft Total Riparian corridor acreage N/A

A more intensive method for calculating liner feet of upstream impacts was used to determine credits at this crossing. This surrogate method was used because the existing stream crossing is acting as a dam that has trapped sediment to the elevation of the deck of the crossing. To calculate liner feet of stream impact at this crossing, a long profile survey was conducted along the stream bed. Streambed elevation was surveyed and mapped downstream of the crossing and that streambed gradient was used to extrapolate a percent slope and draw an estimated streambed profile upstream of the crossing until the long profile survey streambed elevation matched the

estimated streambed elevation. See Figures 9 and 10 for the long profile. Downstream impacts were calculated using the typical method of two times the length of the scour hole.

19) Total cost per credit (including all costs) estimated at $ 25.00 .

20) If the project is leveraged with contributions from others, SSTF Resources are requested to fund which practices/products/costs activities? Demolition, hauling, and disposal of existing low water crossing; Project engineering/design; and construction costs. Post construction stabilization and planting as needed.

21) Schedule for project completion and/or installation: Planning, engineering, environmental review and permit acquisition upon Corps and IRT approval. Demolition, removal of existing crossing and construction of new crossing preferred for fall of 2021.

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 Region

Assistant Deputy Director Resource Management Approval: approval by email

Date: 6/10/21

Name of project leader, and Division: Shane Bush, Regional Resource Management

SSTF Liaison Approval: Sherry Fraker Date: 5/24/21

MDC Director Approval: approval by email Date: 5/27/21

MCHF Approval: [signature] **Date:** 5/25/2021

Woods Fork Crossing, Christian County

Stream Type		0.2
Priority Waters		0.05
Net Benefit		3.5
Site Protection		0
Credit Schedule		0.3
Sum Factors (M)=		4.05
Stream Length Benefited (LF)	1436ft US + 2x75ft DS = 1586ft	
Credits (C)=MxLF	4.05x1586=6423.3	
Dollars Available (C)x$25=		**$160,582.50**

Figure 1. Woods Fork Rd. over Woods Fork. GPS Coordinates Lat: 36.903263, Lon: -93.23474.

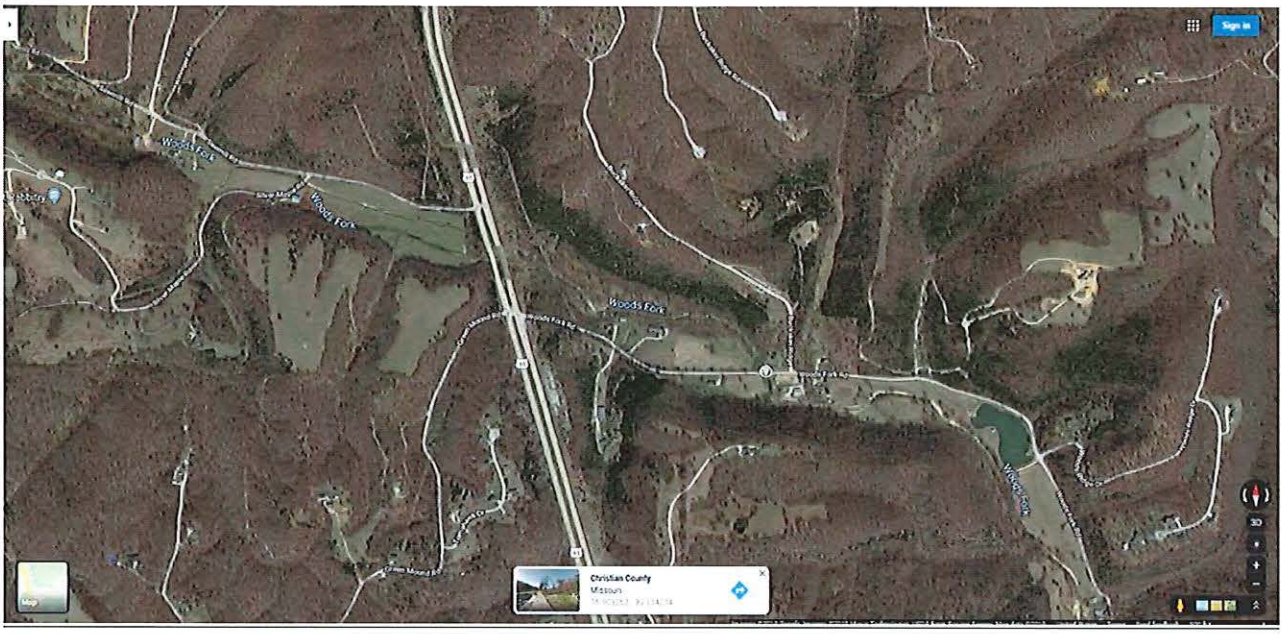


Figure 2. Location of Woods Fork Crossing Watershed within MDC's Bull Creek Priority Watershed, Christian County, Missouri

Figure 3. AOP Barriers in the Woods Fork Watershed

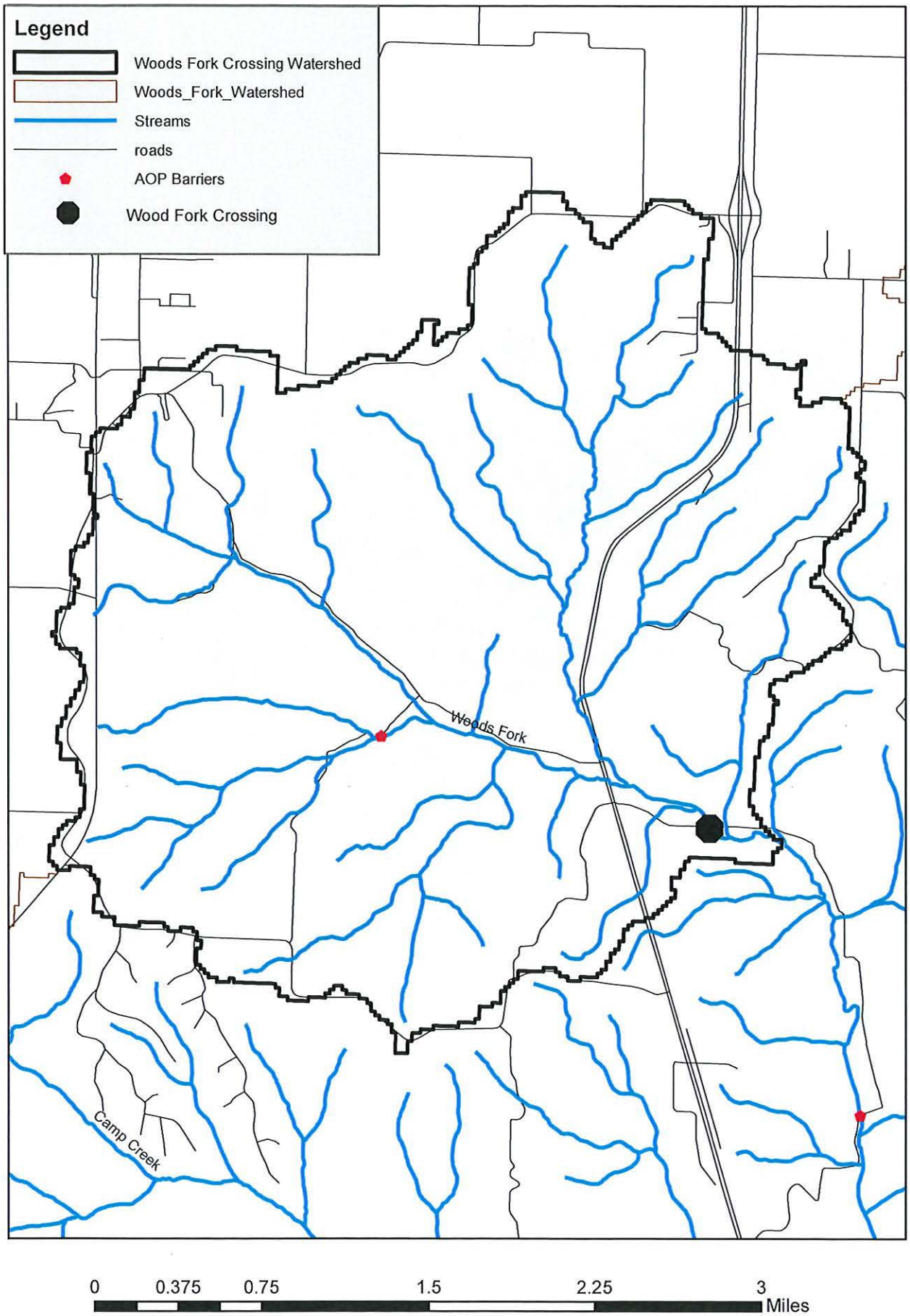


Figure 4. Standing on the crossing looking downstream

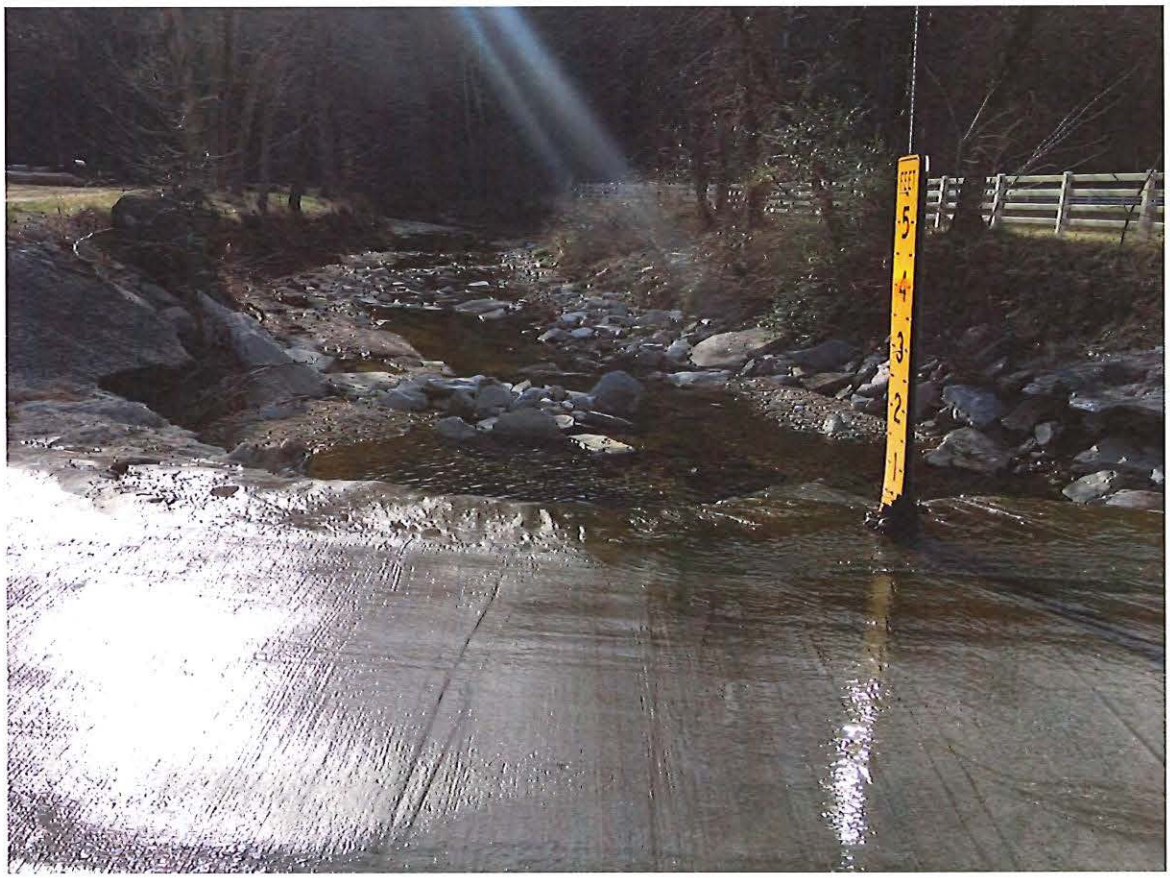
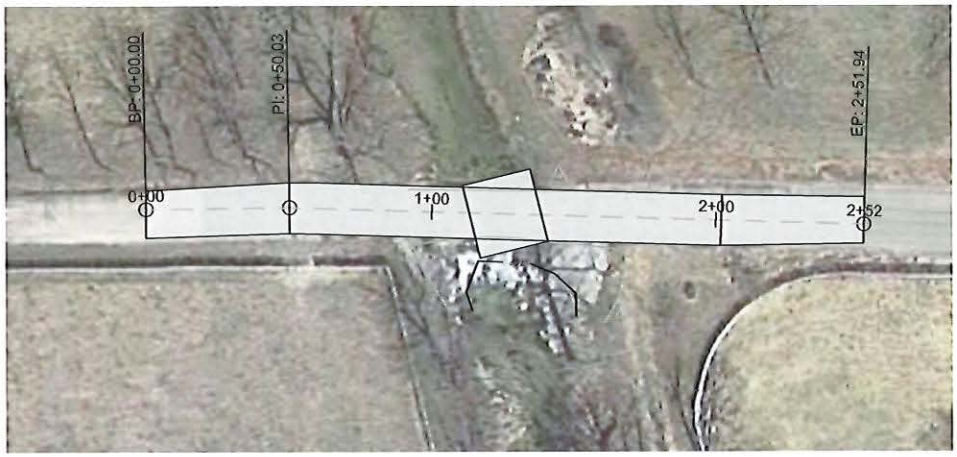


Figure 5. Standing downstream looking upstream

Figure 6. Standing on the crossing looking upstream

Figure 7. Standing upstream looking downstream

Figure 8. Sample Design



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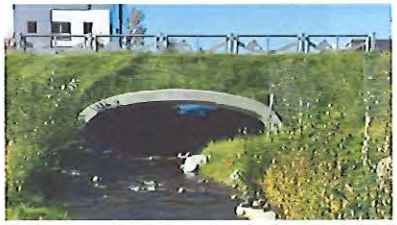
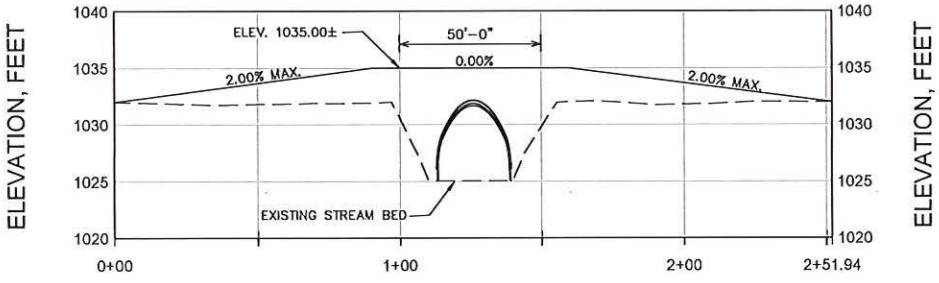
SCALE: 1"=50'



EXAMPLE OF STRUCTURAL PLATE BOX CULVERT

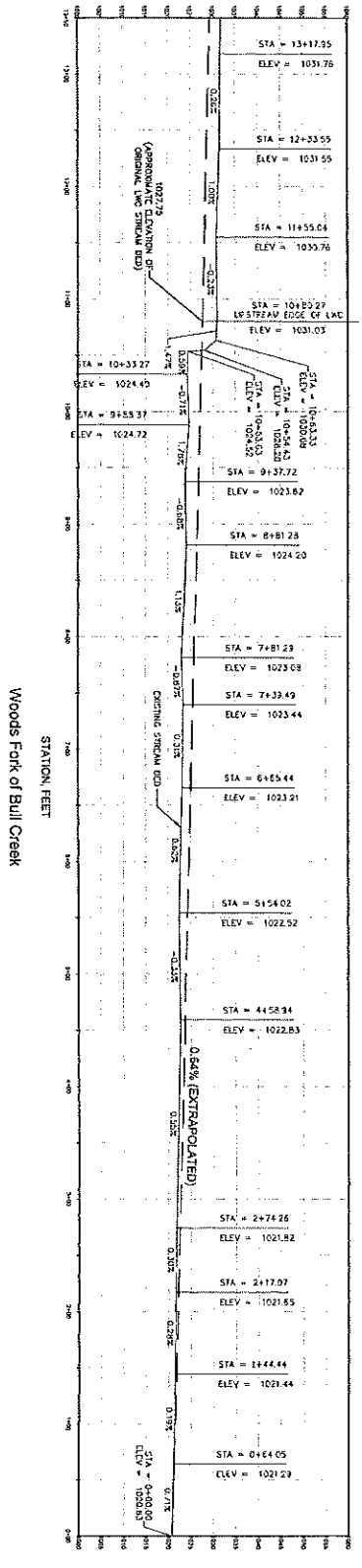


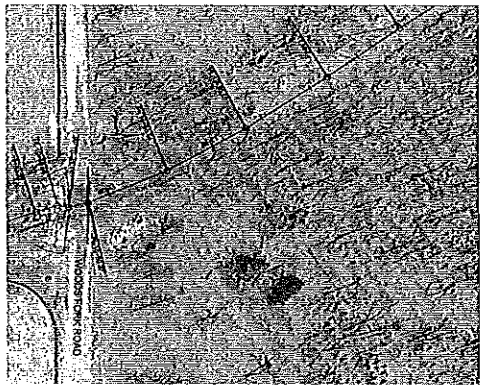
JOB # 3817.03

WOODS FORK CROSSING
STRUCTURAL PLATE BOX
CULVERT

GRE
GREAT RIVER
ENGINEERING
2826 S. INGRAM MILL, SPRINGFIELD, MO 65804
PHONE: (417) 886-7171 FAX: (417) 886-7591
www.greatriv.com
Missouri State Certificate of Authority Numbers
Engineering: 2000156555 Land Surveying: 2001011476 Landscape Architecture: 2007010479

Figure 9





01 OF 02

WOODS FORK CROSSING - WOODS FORK ROAD
CHRISTIAN COUNTY, MISSOURI

STREAM PROFILE AND GRADE EXTRAPOLATION

CHECKED BY: XXXX
DRAWN BY: XXXX
JOB NUMBER: 3817.03
FILE NAME: XXXX

GRE GREAT RIVER ENGINEERING

No.	Revision/Issue	Date
1		
2		
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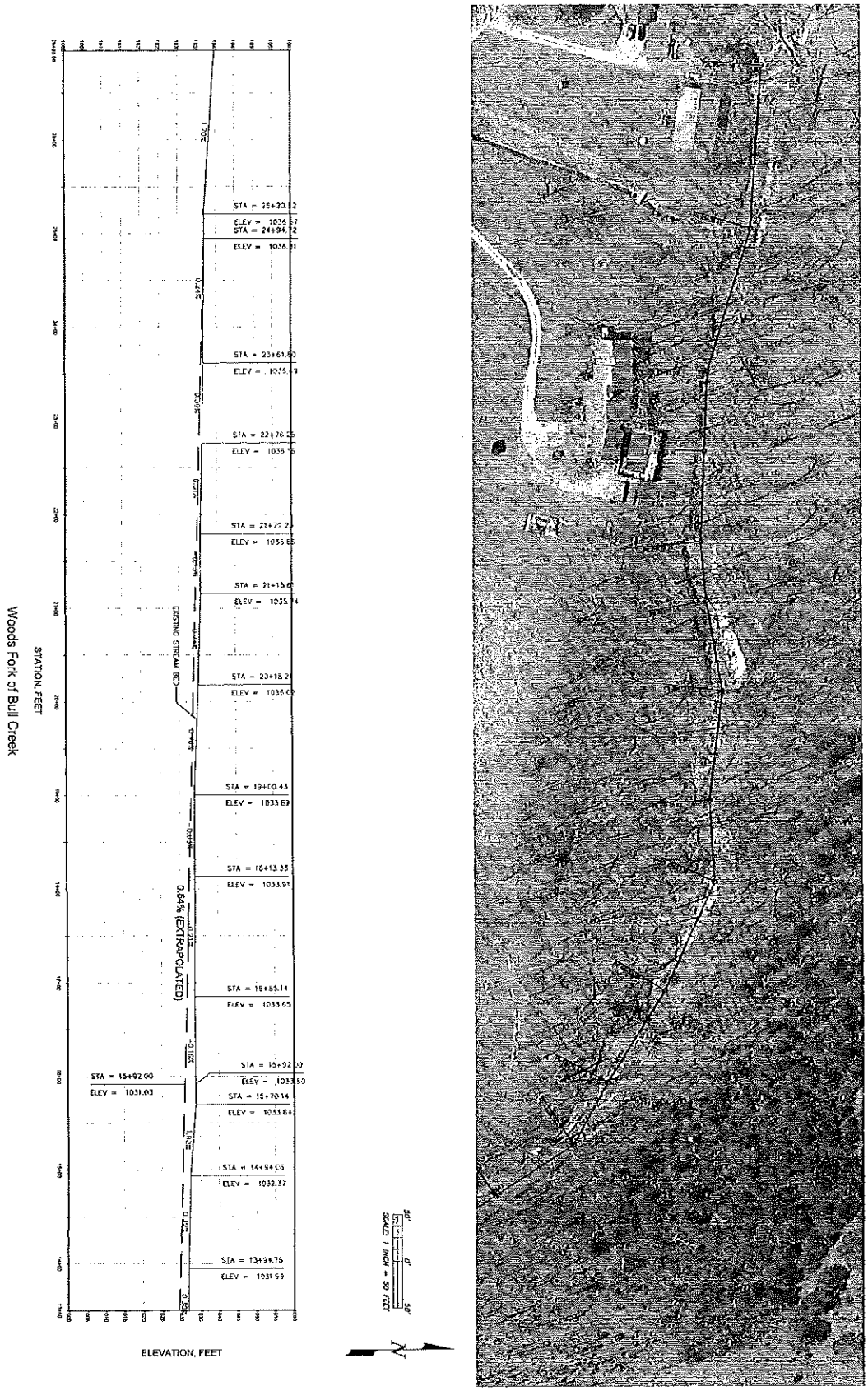
Figure 10



02 OF 02	WOODS FORK CROSSING - WOODS FORK ROAD CHRISTIAN COUNTY, MISSOURI	CHECKED BY: XXX	GRE GREAT RIVER engineering		No.	Revision/Issue	Date
	STREAM PROFILE AND GRADE EXTRAPOLATION	DRAWN BY: XXX					
		JOB NUMBER: 3617.03					
		FILE NAME: XXXXX					

Appendix A.

DESCRIPTION OF THE WHITE EDU

The White EDU lies in southern Missouri and northern Arkansas and encompasses that portion of the White River watershed within the Ozark Highlands as described by Bailey (1995). Overall there are 20,880 Km of primary stream channel within this EDU, of which 5,283 Km are classified as perennial in the National Hydrography Dataset. Of this total 12,351 Km (59%) falls within Missouri. In addition to the White River, for which this EDU is named, the other major streams within this EDU include the James and North Fork of the White River.

The landscape of this EDU largely falls within the White River Hills Ecological Subsection. However, it also includes portions of the Central Plateau and Springfield Plain subsections. A distinctive feature of this EDU is the extremely high density of springs and the relatively high gradient of the streams across all size classes. The average gradient across all stream size classes is 18.2 m/km. Average gradients (m/km) by size class are: headwater 24.1, creek, 5.4, small river 1.5, and large river 0.6. For sake of brevity and ease of comparative understanding it is best to describe the geographic variation in landscape and stream conditions according the major ecological subsections. However, it should be noted that a total of five different Aquatic Ecological System Types were delineated within the White EDU in order to account for the more detailed, but equally important, differences in watershed and stream conditions that exist within this EDU.

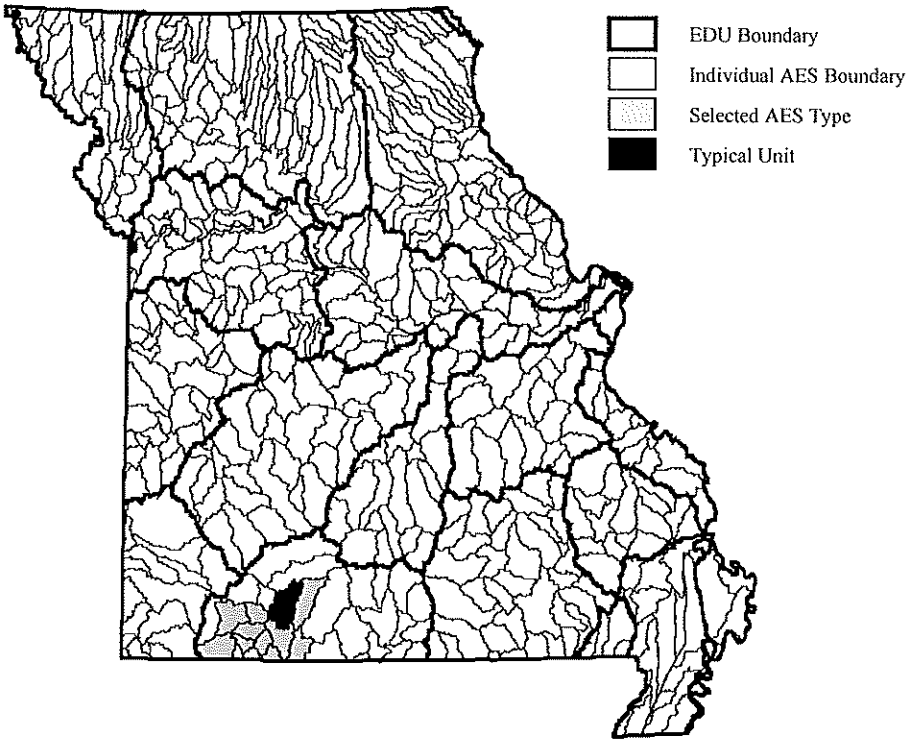
The upper portions of the James River and Finley Creek watersheds fall within the Springfield Plain subsection. Some of the highest elevations in the state occur here, however, local relief is generally only 100-200 feet. This area is mainly underlain by very cherty MS limestones, but the deepest valleys cut through the Devonian limestones into the Ordovician Jefferson City-Cotter formations. The high percentage of limestone results in high groundwater contributions to streams within this area, and springs and cave are quite abundant. Some of the highest densities of sinkholes and losing streams can be found here. The relatively deep soils were formed in weathered cherty limestone and often capped thin mantle of loess as the surface material. Surface textures consist of cherty and silty loams with moderate to slow infiltration rates. Streams are generally Ozark in character and occupy narrow valleys separated by relatively broad ridges compared with other portions of the EDU. Streams are clear, with high base flows, and low suspended sediment loads, however these streams have a higher percentage of fine substrates than streams draining the White River Hill subsection and have higher suspended loads during periods of elevated discharge. Substrates mainly chert gravel and cobble, with well-defined riffles, gravel bars and bluff pools are quite prevalent. Extensive stretches of bedrock channels also exist. The steep slopes combined with the moderate to slow infiltration rates of the soils results in the streams having a flashy hydrograph with flooding common during and after intense rainfall events, which bypass the karst drainage system. Historically this portion of the EDU was covered in oak savanna and woodland. Cherty ridgetops generally supported isolated oak-pine woodlands. Glades and small prairie openings were also a common feature. Today the region is largely timbered with second-growth mixed-oak forests. The density of the woodlands has increased in the absence of fire. Most bottomlands and ridgetops have been cleared for pasture. Most glades are now severely overgrown with eastern red cedar. Some of the principle management concerns include lead and Zinc mine drainage, low pH and high SO4 concentrations, CAFO's, fragmentation of riparian forest, fragmentation from Table Rock Lake, road construction, urban development from Springfield, MO, and leaking septic tanks.

The White River Hills subsection is mainly underlain by the thick cherty, shaley dolomites of the Ordovician Jefferson City-Cotter formations. Local relief is generally quite high, ranging from 300 to 800 feet. The soils are very rocky/stony and consist of cherty and silty loams with slow to moderate infiltration rates. Streams very Ozark in character and occupy very narrow valleys separated by very narrow ridges compared with other portions of the EDU. Streams are clear, with amazingly high gradients and base flows, and very low suspended sediment loads. Substrates mainly chert gravel, cobble, with well-defined riffles, gravel bars, sand bars and bluff pools are quite prevalent. Extensive stretches of boulder laiden and also bedrock channels exist. Springs are numerous, and streams have high groundwater contributions, but many of the smallest stream channels are ephemeral due to losses to the underlying karst drainage.

The steep slopes combined with the moderate to slow infiltration rates of the soils results in the streams having a flashy hydrograph with flooding common during and after intense rainfall events. Historically this area contained one of the most distinct mosaics of terrestrial communities in the state. The region is particularly noted for its abundance of "bald knobs" (i.e., dolomite glades). These glades graded into open Oak/Savanna and woodland. Low slopes and bottoms were forested in oak and mixed deciduous hardwoods. Cane thickets were also common in the bottoms. Cherty ridgetops generally supported isolated oak-pine woodlands. Small prairie openings were also a common feature. Today most of the dolomite glades and open woodlands have grown up in eastern red cedar and other invasive woody species. Glades are often overgrazed. The density and character of the woodlands have increased in the absence of fire. Most bottomlands have been cleared for pasture and Cane thickets are rare. Some of the principle management concerns include lead and zinc mine drainage, upland and riparian cattle grazing, excessive nutrient loads from nonpoint sources, fragmentation of riparian forest, fragmentation and inundation of critical habitats from Bull Shoals Reservoir and Table Rock Lake, road construction, gravel mining, urban development from Branson, MO, and leaking septic tanks.

There are 89 fish, 48 mussel and 9 crayfish species that either inhabit, or at one time inhabited, the White EDU. According to the Missouri Natural Heritage database there are 21 globally listed (rare, threatened, or endangered) species and 29 state listed species. The fish assemblage is characterized by regionally and locally endemic, intolerant, species and could generally be classified according to the dominant families as a Minnow/Sucker/Sunfish/Darter assemblage. Distinctive fish species include the Duskystripe shiner, Ozark cavefish, and the yoke darter. Common and distinctive mussel species include the Arkansas Brokenray, Curtis Pearlymussel, Fatmucket, giant floater, Neosho mucket, and Pondmussel. The crayfish assemblage is the most distinct in the state, with several locally endemic species including the Bristly Cave, Longpincered, Meek's, Ozark, Ringed, and William's crayfish. The most commonly encountered crayfish species include the Ozark, ringed, and Spothanded. Of the 146 fish, mussel, and crayfish species present within the EDU, 88 were identified as target species (50 fish, 30 mussels, and 8 crayfish).

Appendix B.
AES-Type 26 (Bull Creek)



Geographic location:

Restricted to the Ozark Aquatic Subregion.

Ozark/ White EDU

Description:

This AES-Type is completely contained within the Ozark/White EDU. Local relief ranges from 50 to nearly 500 feet. This AES-Type consists of cherty, shaley dolomites of the Ordovician Jefferson City Cotter Formation with karst features and numerous chert fragments. The land surface is thoroughly dissected by drainage networks. Soils were formed from weathered Mississippian and Ordovician limestone and dolomite. Surface soil textures are typically cherty, silty loam, or stony and exhibit slow to moderate infiltration rates. Streams have relatively narrow floodplains and very steep gradients while carrying bedloads of sand and gravel which accumulate into bars. Flows are highest in the late winter and early spring. Flash floods occur after periods of intense rainfall. There are a large number of springs that contribute a significant portion of water to stream base flows throughout much of the year. Headwater streams are often dry, as a result of karst, and lose much of their water to the ground. According the Missouri Department of Conservation's White River Watershed Inventory and Assessment plan, Bull Creek's substrate consists of gravel, cobble, pebble, boulder, and bedrock in relatively equal proportions. The combined headwater and creek mean stream gradient is very high at 22.0 meters per kilometer and is the highest of any AES-Type in Missouri. Historical vegetation consisted largely of glade and woodland complexes.

Typical unit: 475 – Bull Creek

Appendix C.

OZ4c Bull Creek Dolomite Glade/Oak Woodland Breaks Land Type Association

Location and Boundaries:

The LTA consists of rugged hills along Bull Creek. Northern and western boundaries are the crest of the pronounced Burlington Escarpment that marks the edge of the Springfield Plain. The northeastern boundary is the watershed divide with upper Swan Creek. Southeastern and southern boundaries are based on the change to a dissected plain of lower relief.

General Description:

High Mississippian limestone ridges give way abruptly to steep slopes cut into the Jefferson City-Cotter dolomite with frequent rock ledges. Glade/woodland complexes formerly were common on these slopes with thin soils, but most are dense cedar thickets today. Cleared pasture occupies the rounded uplands on the western side and most alluvial plains. The balance of lands is in dense second-growth oak timber. The LTA includes substantial USDA Forest Service lands and the Busiek Conservation Area.