National Park Service
U.S. Department of the Interior

Buffalo National River
Harrison, Arkansas

Cave Mountain Road Rehabilitation Environmental Assessment

January 2022

Executive Summary

Buffalo National River (BNR or the Park) has prepared an EA to evaluate a county- and state-lead effort to reconstruct and pave the 1.8-mile section of Cave Mountain Road (Newton County Road 9560) that crosses Park property. The project is a collaborative effort between Buffalo National River (BNR), Newton County, the Arkansas Department of Transportation, and the Buffalo River Conservation Committee designed to reduce environmental impacts of the current road and improve access.

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide a decision-making framework as follows: 1) Assess a reasonable range of alternatives to meet the purpose of the proposed action; 2) Evaluate potential issues and impacts to the natural and cultural resources of the Park; and 3) Identify required mitigation measures designed to lessen the degree or extent of any potential adverse environmental impacts.

This EA evaluates two alternatives: Alternative A: no action; and Alternative B: road rehabilitation and improvement (Preferred Action). Under Alternative A, the road would continue to be graded and repaired by the county and existing culverts maintained. Under Alternative B, the county would rehabilitate and improve the road using NPS best management practices. Actions would include paving with asphalt, widening the driving surface to 24 feet as feasible, removing trees from portions of the right-of-way, replacement of old culverts, and installation of additional culverts. The alternatives are described in detail in Chapter 2.

The actions summarized in this plan help fulfill planning priorities to improve human health and safety, and the actions also protect and improve the water quality of the BNR. The Park's planning portfolio consists of individual plans, studies, and inventories, which together guide Park decision-making. The planning portfolio enables the use of targeted planning documents (such as this one) to meet a broad range of Park planning needs and fulfill legal and policy requirements. This planning portfolio is promptly updated with the development of additional planning documents.

This EA identifies the categories of resources, or *Impact Topics*, found within the project area that are most likely to be affected by the actions described within the alternatives. These topics have undergone a detailed analysis by agency staff to determine the most likely effects on the resources and the required mitigations to avoid resource damage. The Impact Topics are identified in section 1.5 of this document, and in **Table *1***. The preferred action would not result in significant impacts to any resources within BNR.

Public Comment

This EA will be available for public comment for 30 days, from February 7, 2022 to March 9, 2022, through the NPS Planning, Environment and Public Comment (PEPC) website which provides access to current plans and related documents and is located here: National Park Service - PEPC - Buffalo National River (nps.gov) or mail comments by March 9, 2022 to:

Mark Foust, Superintendent
Buffalo National River
402 N Walnut St.
Harrison, AR 72601

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment––including your personal identifying information––may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

On the cover: Cave Mountain Road at Buffalo National River, Kingston, Arkansas.
Photograph by NPS.

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1.0 Introduction

Buffalo National River (BNR or the Park) – the country's first national river – is protected as a free-flowing watercourse that spans 132 wild and scenic miles across the park's linear boundaries. Unique and rare within the Ozark Plateau, the Buffalo River is undammed from its headwaters in the Boston Mountains to its confluence with the White River 153 miles downstream. Flowing in an easterly direction, the park's towering bluffs, waterfalls, canyons, caves, and historic sites provide an exceptional setting for discovery, solitude, and diverse recreational opportunities.

Several exceptional qualities highlight the park's establishment as a unit of the national park service in 1972 (Public Law 92-237). A U.S. House of Representatives Committee Report (1972) described the justification for the establishment of Buffalo National River as "… not one single quality, but the combination of its size, its completeness, its wild qualities, and its associated natural, scenic, and historical resources that make the Buffalo worthy of national recognition." At a high level, BNR conserves and interprets a contiguous area containing unique scenic and scientific features – and so much more.

Recognized for its distinctive ecology at local, national, and global levels, BNR is home to Ozark Highland endemic species and many federally threatened and endangered species. The Park showcases the importance of how public lands can help protect rare species and their habitats.

BNR is also known for its dense array of karst features including hundreds of caves and thousands of sinkholes, sinking streams, springs, and other natural features. In the driest parts of the year, portions of the river may run underground for long distances. Outstanding examples of faulting, landslides, and ore mineralization are evident across the Park's topography, and ample fossil deposits have formed in ancient layers through its long geologic history.

The Park's 95,730 acres are divided into three management districts – the upper, middle, and lower districts. Park headquarters are in Harrison (Boone County), Arkansas, just north of the upper and middle districts. Park visitation has averaged more than 1.4 million visitors per year (2011to 2021). In addition to water-based activities with multiple launch points along the river, the Park offers more than 100 miles of hiking trails and designated trails for horseback riding. Designated wilderness represents over one-third of the Park's total acreage. Because there are few roads which parallel the river and few accessible overlooks, river and trail trips are among the best ways to experience the Park.

There are an estimated 2000 miles of roads within the Buffalo River watershed, many in existence prior to the establishment of the Park in 1972. Roads have been built into steep hillsides, across hydrologic drainage areas, and within the riparian buffers of the river and its tributaries. Cave Mountain Road similarly was established prior to the establishment of the Park. Though no formal Park trails exist in the 1.8-mile Cave Mountain Road project area, most road traffic consists of local residents and visitors to U.S. Forest Service property (Whitaker Point/Hawksbill Crag). The Whitaker Point area within the Ozark National Forest receives high visitation and is a source of numerous emergency assistance calls for county, state, and federal agencies.

Complementing the Park's outstanding natural qualities, BNR embraces the story of Ozarks settlement and history from the first inhabitants as early as 12,000 years ago to today's rural community. The Park has eight Native American tribal partners and was established in large part to protect one of the nation's remaining unspoiled landscapes.

1.1 Scope of the Project

This project seeks to improve water quality and human health and safety by rehabilitating and paving Cave Mountain Road. This Environmental Assessment evaluates a no action alternative and an action alternative that rehabilitates and resurfaces the existing road.

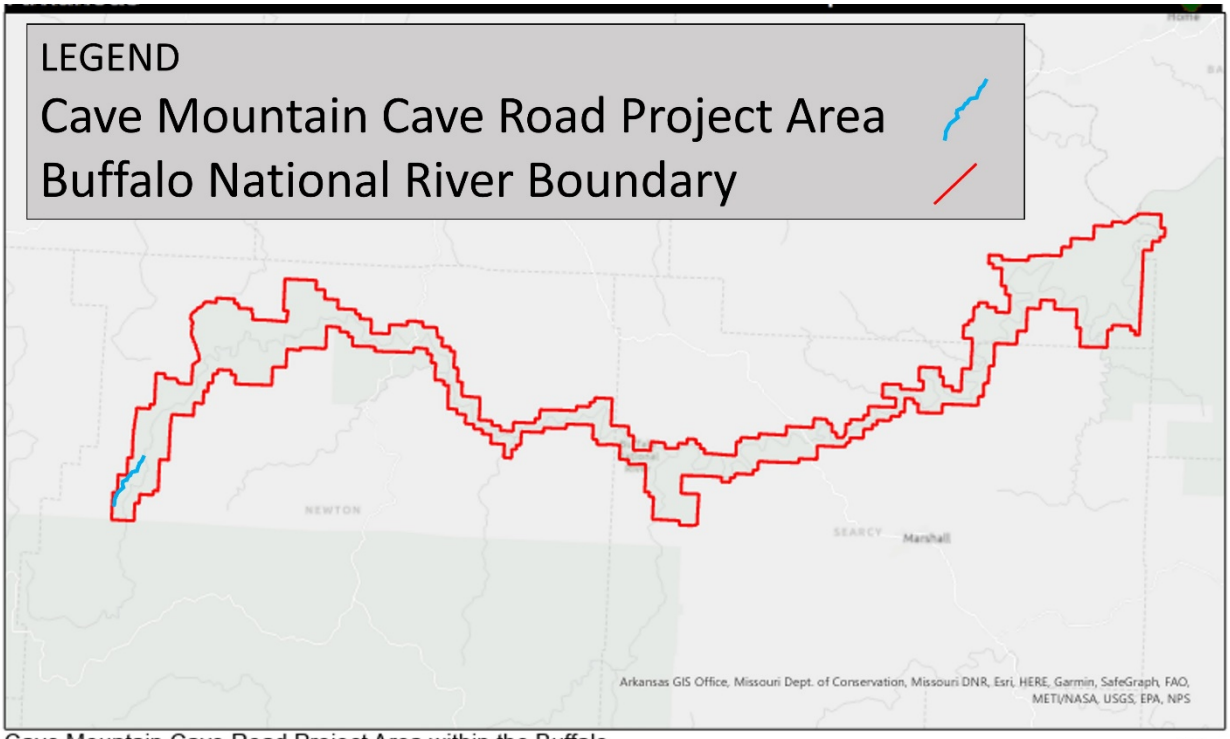
This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that: (1) analyzes a reasonable range of alternatives to meet the objectives of the proposal, (2) evaluates potential issues and impacts on resources and values, and (3) identifies mitigation measures to lessen the degree or extent of these impacts.

1.2 Purpose and Need for Action

Cave Mountain Road serves as the primary access route from Arkansas Highway 21 to Whitaker Point. Whitaker Point, also known as Hawksbill Crag, is a popular scenic vista accessible by hiking trail on adjacent United States Forest Service (USFS) lands. The Whitaker Point trail and vista attracts thousands of visitors annually and is a source of numerous emergency assistance calls for county, State, and federal agencies. High traffic volumes have led to poor road conditions, high usage, and impacts to water quality from runoff. The current road is gravel with insufficient drainage and does not meet the Arkansas Department of Transportation's standards for roads. The purpose of and the need for the project is to improve conditions to provide adequate drainage, pave the 1.8-mile section the road on NPS land, and increase safety by expanding road width and adding guard rails in certain areas.

1.3 Project Objectives

Objectives are specific statements providing a basis for comparing the alternatives in achieving the desired outcomes of the action (NPS 2015). All alternatives carried forward for detailed analysis must meet all objectives in no small degree and must resolve the purpose of and need for action. The planning team identified the following objectives: improve human health and safety, and water quality.



Cave Mountain Cave Road Project Area within the Buffalo National River
PEPC 97186
Township 15 North, Range 23 West, Sections 15, 21, 22, 28
USGS Quad Map – Boxley
Newton County, AR

0 5 10 20 Kilometers

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Suika Rivett
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Figure 1: Map of Buffalo National River and Project Area.

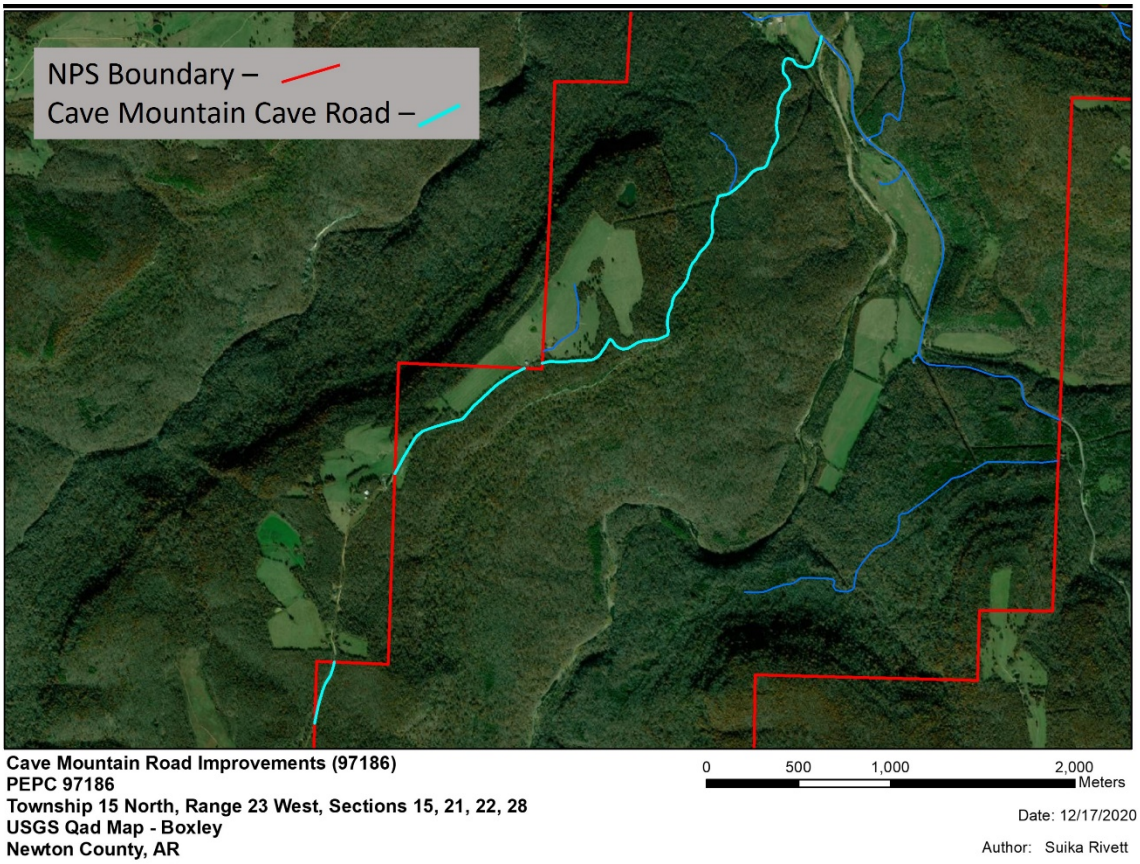

Figure 2: Map of Cave Mountain Road.

1.4 Relationship to Existing Plans and Programs

By incorporating information developed in past inventories, planning efforts, and ongoing research, implementation of the Cave Mountain Road project will assist in achieving Park objectives outlined in the following documents:

Final Master Plan (FMP)

The Final Master Plan (1977) lists the primary resource management goal as preserving the free-flowing river, natural river scene, and water quality, provide recreation for visitors where the impact on the environment is minimized, provide protection to rare and endangered flora and fauna, and cultural resources are protected, restored, and maintained in good condition and are managed within their broader ecosystem and cultural contexts. Unpaved roads are a significant sediment source to the Buffalo River. Reducing sediment discharge from the Cave Mountain Road is consistent with maintaining water quality. The Master Plan did not include an associated compliance document.

Foundation Document

This document identifies the significant resources and values of the Park that were important enough to merit national Park unit designation. Significance statements describe the distinctive nature of the Park and inform management decisions, focusing efforts on preserving and protecting the most important resources and values of the Park unit.

Boxley Area Comprehensive Access Plan (Boxley CAP)
The Boxley CAP establishes priorities for resource, facility asset, and visitor use management in the Boxley Valley area of Buffalo National River as changes in use patterns and increasing visitation in one of the most popular areas of the Park are observed. This plan includes strategies and site improvements to protect Park resources and the quality of the visitor experience.

Water Resources Management Plan
The Water Resources Management Plan (2004) summarized the water resources and related issues. This plan identified gaps in information on water resources and issues to provide a basis for future project development. Reducing sediment discharge from the Cave Mountain Road is consistent with maintaining water quality.

Buffalo River Watershed –Based Management Plan (2018) Prepared for the Arkansas *Natural Resources Commission*
This plan addresses the entire Buffalo River watershed. It provides a framework for landowners, communities, and organizations to voluntarily undertake water quality projects in the watershed. It includes discussion of current and historical water quality and quantity data from the watershed, as well as recent research within the watershed. Land use, water quality, and geological information was compiled and analyzed to identify tributary subwatersheds on which to focus initial management practices and activities.

Buffalo National River Road Inventory and Assessment (2003)
The Road Inventory and Assessment identified problem areas and suggested solutions to minimize resource impacts related to roads in order to reduce maintenance and improve public access. The document includes an inventory and assessment of roads currently being maintained inside the Park boundary. It also describes impacts caused by road drainage systems and documents specific problem locations. The proposed improvements to Cave Mountain Road are consistent with this assessment.

1.5 Impact Topics

Topics related to geologic resources, human health and safety, paleontological resources, species of concern (bats), and water resources are analyzed in detail in this EA. These topics were retained for detailed analysis either because (a) they are central to the proposal or of critical importance, (b) analyzing them will inform the decision-making process, and/or (c) because the environmental impacts associated with the issue are a point of contention.

Issues related to cultural and historic resources, wilderness, vegetation, natural sounds, socioeconomics, wildlife, air quality, visitor use and experience, and floodplains have been dismissed from detailed analysis because they are not central to the proposal, do not assist with making a reasoned choice between alternatives, or are not a point of contention.

Table 1 below summarizes which topics were retained or dismissed and includes the rationale for dismissal.

Table 1. Impact Topics Retained or Dismissed

Impact Topic	Retain	Dismiss	Rationale for Dismissal
Air Quality and Smoke Management		X	The project will have no impacts on air quality either during construction or as a result of the project. Best management practices will be used during construction to minimize dust and smoke. Tree removal to widen the road will result in small slash piles that may be burned adjacent to the project area. Burning is not anticipated to extend beyond a day or two. Smoke management is not a necessary consideration for this project.
Cultural and Historic Resources		X	Based on the results the archeological survey conducted in December 2020, it was determined that this impact topic could be dismissed. The project area contains three cultural resource sites; however, none that are recommended eligible for the National Register of Historic Places. The project will avoid disturbance at all three sites and BNR staff will monitor work near the sites. There would be no effects across the alternatives and further analysis of the topic would not influence the selection of the preferred alternative.
Geologic Resources (including bluff lines, cave and karst features, karst processes, soils, landslides and slope stability)	X		
Human Health and Safety	X		
Paleontological Resources	X		
Socioeconomics		X	Based on an evaluation of preliminary impacts tied to socioeconomics, it was determined that this impact topic could be dismissed. There would be no noticeable socioeconomic effects across the alternatives and further analysis of the topic would not influence the selection of the preferred alternative.
Natural Sounds		X	There will be a temporary increase in ambient noise with intermittent surges in sounds as a result of construction activities. This topic was retained for analysis for its potential to impact special status species and geology.
Species of Concern (Bats)	X		
Vegetation	X		
Visitor Use and Experience		X	The visitor experience at BNR and more specifically the area around Cave Mountain Cave Road is unique within the region. Cave Mountain Cave Road is within Boxley Valley and is located near Ponca, Arkansas. The Park is a popular draw for local, regional, and international visitors seeking outdoor opportunities such as hiking, canoeing, fishing, camping, backpacking, photography, and wildlife viewing. Visitor use and experience along the 1.8 miles of road in the project area are limited to canoeing and photography as there are no formal Park trails, Cave Mountain Cave is closed to visitors, and there are limited vantage points for sight-seeing. The project area is primarily used as a travel corridor for visitors to the Ozark National Forest. A temporary closure will be implemented during construction activities. Alternative routes are available.
Water Resources	X		
Wildlife		X	The NPS determined that the implementation of best management practices during construction as outlined in this plan would result in negligible effects to wildlife and would be limited in duration. Species other than bats and freshwater mussels are not likely to be adversely affected by actions included in either of the alternatives. Bats are discussed under Species of Concern (Bats) and freshwater mussels are discussed in the Water Resources section.
Wilderness Character		X	While the wilderness boundary is within 100 feet of the existing roadway for approximately one mile in the project area, activities related to the project will only occur within twenty-five feet on either side of the centerline of the existing road. The wilderness boundary will be a minimum of 70 feet from the project area. The alternatives proposed would not adversely affect wilderness qualities.

2.0 Alternatives

This EA analyzes a no-action alternative and one action alternative. This chapter describes the alternatives in detail, while impacts associated with the actions proposed under each alternative are outlined in Chapter 3: Affected Environment and Environmental Consequences.

2.1 Elements Common to all Alternatives:

Cave Mountain Road would continue to be maintained annually by the county.

2.2 Alternatives Considered but Dismissed from Detailed Analysis

Close and or relocate the existing road. As the existing road maintenance results in soil erosion and sediment transport to Buffalo River, the concept of closing and relocating the road to an alternate location was considered. This alternative was dismissed because the alternative addresses issues beyond the scope of this NEPA review, would greatly impact other Park resources, and would not address the purpose and need.

2.3 Alternative A: No Action

The "no action" alternative is presented to provide a benchmark for evaluation of the action alternative. Under this alternative, the county would continue to grade and maintain the road in its existing footprint, no change to drainage patterns or culvert placement would occur.

2.4 Alternative B: Road Rehabilitation and Improvement (Preferred Alternative)

This alternative would implement a county and state funded road improvement project on NPS land intended to reduce siltation and potential impacts to water quality within the BNR watershed as well as improve human health and safety. The project will include widening the 1.8-mile county road, where feasible due to topography, to 24 feet of pavement with 50 feet right-of-way. Road width is currently between 15 and 22 feet wide. The project will consist of tree removal, replacement of 13 existing culverts, the addition of 13 new culverts (total of 26 culverts), road widening, ditching, adding 0.5 miles of guardrails in certain locations, and potentially removing rock features within the proposed road corridor. The road will be resurfaced with a base layer of compacted clay, crushed stone and gravel, and then hardened asphalt.

The following Best Management Practices (BMPs) would be adhered to during all phases of construction:

- Erosion control measures, such as silt fencing, will be utilized throughout construction operations.
- Strategically-placed large rocks will be used in lieu of guardrails in areas that may affect Cave Mountain Cave's structural integrity.
- Newton County and NPS will adhere to Appendix B of the Arkansas State Highway and Transportation Department (AR-DOT) 2016 Erosion and Sediment Control Design and Construction Manual to minimize adverse impacts to geologic features. https://www.ardot.gov/wp-content/uploads/2021/02/Erosion-and-Sediment-Control-Manual-12-6-16-Current.pdf.

These stipulations to minimize adverse impacts shall be followed:

1. Construction operations will cease 30 minutes prior to astronomical dusk.
2. Trees will only be removed from November 15th to March 15th.

3. Blasting, guard rail installation, and other substantial ground vibrating actions will not occur within 1/2 mile of Cave Mountain Cave.

4. Culvert discharge will not be allowed to enter discrete recharge points such as karst openings.

5. To avoid disturbance of hibernating bats within Cave Mountain Cave, blasting, guard rail installation, and other disturbance-causing activities will be completed between March 16th and November 14th.

6. The road will not be moved any closer to the entrance of Cave Mountain Cave.

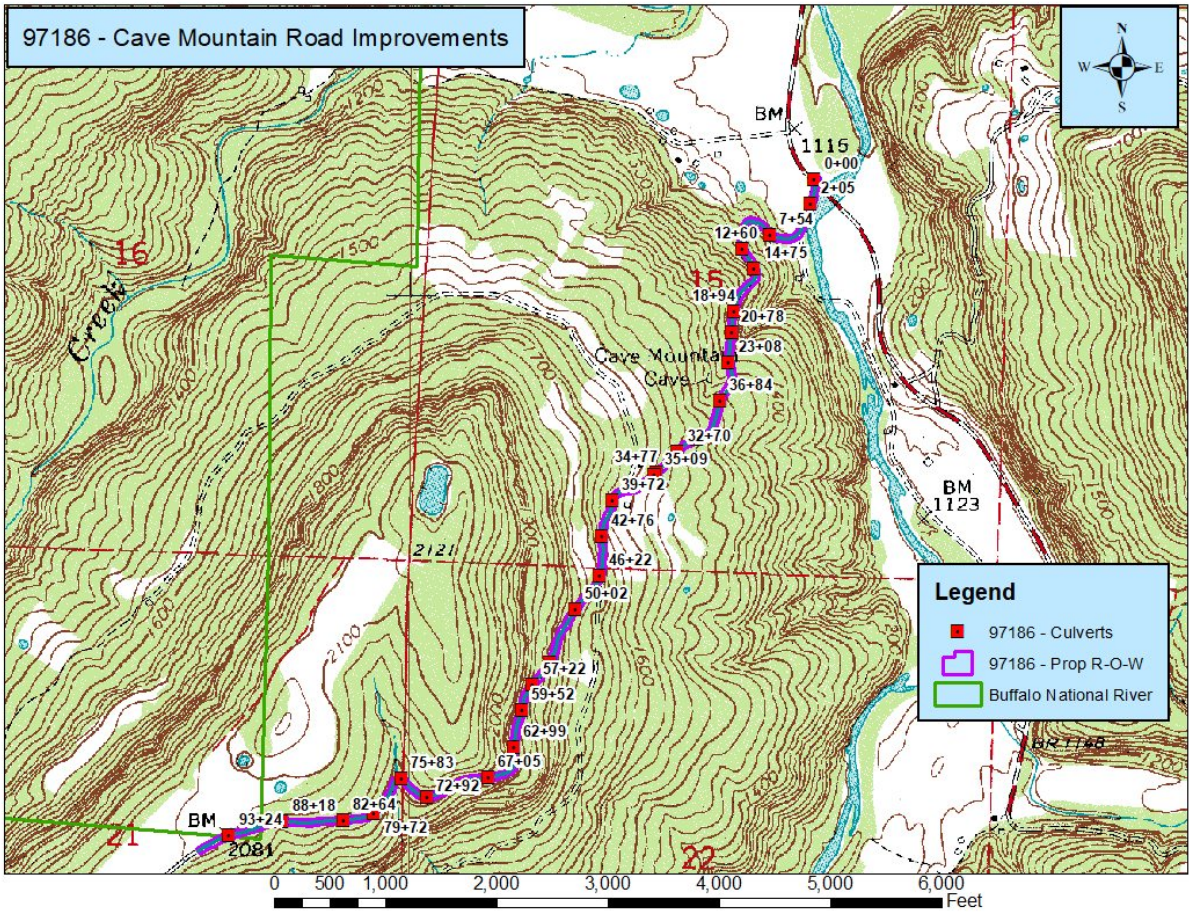

Figure 3. Proposed location of Culverts in Alternative B- Road Rehabilitation and Improvement.

3.0 Affected Environment and Environmental Consequences

This chapter describes the affected environment and documents the existing conditions of the Park. These descriptions serve as a baseline for understanding the resources potentially impacted as a result of implementing an alternative. This chapter analyzes the environmental consequences or "impacts" of the no-action alternative and action alternative for each resource. The resource topics presented in this section correspond to the environmental issues and concerns identified during internal scoping.

In accordance with the Council on Environmental Quality (CEQ) regulations, the environmental consequences analysis includes the direct, indirect, and cumulative impacts (40 CFR 1502.16) of each alternative. The intensity of the impacts are assessed in the context of the Park's purpose and significance and any resource-specific context that may be applicable (40 CFR 1508.27). The methods used to assess impacts vary depending on the resource considered, but generally are based on a review of pertinent literature and Park studies, the information provided by on-site experts and other agencies, professional judgment, and Park staff knowledge and insight.

3.2 Trends and Reasonably Foreseeable Planned Actions

In assessing potential impacts of each alternative, the following trends and reasonably foreseeable actions have also been considered:

- **Buffalo National River has experienced a Park-wide increase in visitation to include boaters, hikers, and equestrian use.**
    - Several projects to address visitation increase to the project area and the surrounding Boxley Valley were analyzed in the Boxley Valley Comprehensive Area Plan and EA. The impacts of proposed and reasonably foreseeable planned actions outlined in that plan and EA would result in beneficial effects to visitors in the project area.

- **Continued Regional Population Growth**
    - The human population in Northwest Arkansas, centered upon Springdale, Arkansas, has increased over the past 40 years. According to the 2010 census, the population in Washington and Benton counties was 424,404, or 14.6% of the total population of Arkansas. In contrast, in the 1970 census of the same area, the population was 127,846, which accounted for only 6.6% of the statewide population. The mean household income in these two counties has increased by 124% in the same time period. These population and income increases have dramatically increased the number of visitors to the upstream sections of the Park. This is in large part an issue of proximity as Boxley Valley is only one hour from Fayetteville, Arkansas. This visitation growth is expected to continue for the near future.

- **Proposed United States Forest Service (USFS) improvements to Whitaker Point.**
    - Within five miles of proposed road improvements to the Cave Mountain Road (Newton County Road 9560) crossing NPS lands, the USFS has proposed the following: improve approximately 0.2 miles of existing road, develop a parking area, approximately two acres in size, west of the current parking area to hold 30-100 vehicles, install a vault toilet at the new parking area, construct 0.2 miles of hiking trail from the new parking area and through a newly acquired recreational easement to link up with the existing trail, relocate approximately 0.3 miles of trail within

wilderness, and decommission 0.4 miles of old trail.

- **Climate Related Patterns**
  - As the impacts of climate change become more apparent, soil conditions may change. Higher intensity and more frequent rainfall may lead to more erosion on susceptible soils within the Ozarks. These trends are recognized by ARDOT and considered in design recommendations. The additional culverts and strategic placement in the project design account for potential increased rainfall intensity and frequency.

3.3 Geologic Resources (including bluff lines, cave and karst features, karst processes, soils, landslides and slope stability)

3.3.1 Affected Environment

Geologic resources include natural bluff lines, cave and karst features, karst processes, soils, landslides and slope stability. The bedrock at BNR consists entirely of sedimentary rock units laid down between the Ordovician and Pennsylvanian periods of the Paleozoic. The bedrock in the immediate area of the project includes the Mississippian age Boone formation, Batesville sandstone, Fayetteville shale, and Pitkin limestone; and the Pennsylvanian age Hale formation, Bloyd formation, and Atoka formation. The description of the geology comes primarily from the geologic map of the Boxley Quadrangle (Hudson & Turner, 2007). A detailed description of these formations can be found in Appendix A.

Cave Mountain Cave is the most important karst feature near the project area and is in the Boone formation, with passages extending under Cave Mountain Road. The cave is a very important hibernaculum for two endangered species, the Indiana bat (*Myotis sodalis*), and the Gray bat (*M. grisescens*), and one threatened species the Northern Long-eared bat (*Myotis septentrionalis*). The cave is also a summer roost for a substantial number of Gray bats.

The middle Bloyd sandstone forms the prominent bluff or rimrock at the upper edge of steep valleys and hillsides. The unit is iconic in the area, resulting in many of the scenic and recreational features of the Buffalo River valley, including Hawksbill Crag, numerous waterfalls, Sam's Throne, and Horseshoe Canyon Ranch rock-climbing area. Material sloughed off this bluff forms prominent talus slopes in the project area. Float (pieces of rock which have migrated downhill from their source) forms deep sequences in the project area, effectively burying every unit, down to the Pitkin Limestone. Below the Pitkin, the lower slopes of the Fayetteville shale reduce the downhill movement of the float, but the float is still apparent all the way to the valley floor.

<u>Soils</u>

The road passes through eight soil mapping units. These are represented on the map (Figure 6) as Mapping Unit Symbol numbers, and correlate to the Newton County Soil Survey (USDA-SCS, 1988).

- <u>3 is Arkana-Moko complex, 20 to 40 percent slopes</u>. These soils range from moderately deep to shallow, very cherty, and well drained. This mapping unit is on steep hillsides that are uneven and convex. This soil is rated to have rapid surface runoff, a severe erosion hazard, and high shrink-swell potential. The soil is classified as having severe limitations for local roads and streets because of low strength, slope, depth to rock, and

shrink-swell.

- 15 is Enders-Leesburg stony loams, 8 to 20 percent slopes. This complex consists of soils that are deep, strongly sloping to moderately steep, and well drained. This soil complex has a rapid surface runoff rating, a very severe erosion hazard rating, a moderate landslide hazard rating, and a high shrink-swell potential rating.
- 31 is the Nella gravelly loam, 3 to 12 percent slopes. This soil is deep, gently to strongly sloping, and well drained. This soil is rated as having medium to rapid surface runoff and very severe erosion hazard.
- 33 is Nella stony loam, 8 to 20 percent slopes. This soil is deep, strongly sloping to moderately steep, and well drained. The Nella stony loam is rated as having rapid surface runoff, a very severe erosion hazard, and low shrink-swell potential.
- 38 is the Nella-Steprock-Mountainburg very stony loams, 20 to 40 percent slopes. This complex consists of soils that are steep, very stony, well drained, and low shrink-swell potential. These soils have rapid runoff and a very severe erosion hazard.
- 39 is the Nella-Steprock-Mountainburg very stony loams, 40 to 60 percent slopes. This complex consists of soils that are very steep, very stony, well drained, and low shrink-swell potential. Runoff is rated as very rapid. Erosion hazard is very severe.
- 43 is Noark very cherty silt loam, 8 to 20 percent slopes. The Noark is deep, strongly sloping, and well drained on convex hillsides. The surface runoff is rated as rapid, the erosion hazard is rated as very severe, and the shrink-swell potential is rated as low. The soil is classified as having moderate limitations for local roads and streets because of slope.
- 48 is Razort Loam, occasionally flooded. This soil is deep, level to nearly level, and well drained. Floods occur less often than once every 2 years under normal weather conditions. Flooding is for brief periods during the winter and early spring. The soil has a surface runoff rating of slow to medium, an erosion hazard rating of slight, and shrink-swell potential rated as low. The soil is rated as having severe limitations for local roads and streets because of flooding.

Runoff- The proposed road widening contains 0.31 additional acres of soils rated as having slow-medium surface runoff, 0.44 acres rated as having medium-rapid surface runoff, 1.34 acres rated as having rapid surface runoff, and 0.37 acres rated as having very rapid surface runoff.

Erosion Hazard -The proposed road widening contains 0.31 additional acres of soils rated as having a slight erosion hazard, 0.97 acres of soils rated as having a severe erosion hazard, and 4.59 acres rated as having a very severe erosion hazard.

The combination of steep slopes, relatively deep unconsolidated sediments, an uphill bias for road widening, steeper cut banks, the majority of soils rated as having a rapid or very rapid surface runoff and severe to very severe erosion hazards make soil erosion and its consequences an important topic and reflects the need for installed BMPs.

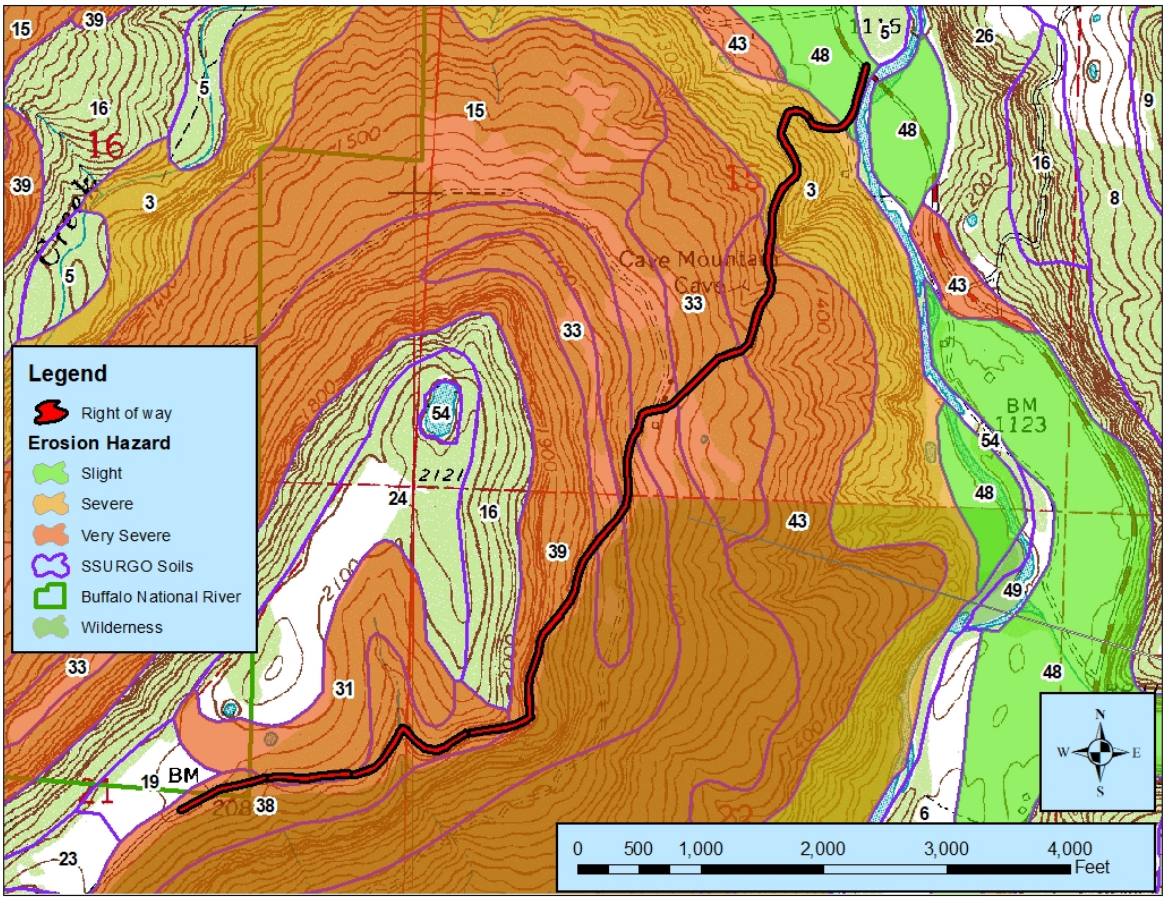

Figure 4: Soil Erosion Hazard for soils likely to be disturbed by construction activities.

3.3.2 Environmental Consequences

3.3.2.1 Alternative A: No Action

The no action alternative would continue the current management strategy for Cave Mountain Road, including general maintenance of the roadway as needed, grading and repairing the roadbed, especially after storm events. The trend of increased outdoor recreation is expected to continue, including an increase in traffic usage of this and surrounding roadways. Impacts to geology and soils under the no action alternative would be ongoing, substantial, and would necessitate more intense maintenance to protect resources.

Geology: The placement of the existing culverts was not sensitive to karst openings and other geologic features. The limited number of culverts and distance between culverts does little to manage erosion. Continuation of management under the no action alternative would result in downcutting of ditches, undercutting of ledge rock, and potential for increased slope instability.

Soils: Erosion trends would continue with few culverts to divert runoff during heavy rainfall. Currently, there are no BMPs in place to reduce sediment reaching the mainstem of the Buffalo River.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.3.2.2 Alternative B: Road Rehabilitation and Improvement

Geology: Geohazards such as landslides have been occurring at a higher frequency in the Ozark region. Construction actions such as blasting, vibration from equipment, pile driving, etc. have the potential to disturb geologic resources, however, these disturbances would be temporary, occurring only during construction, and would have minor adverse impacts to geologic resources. There would be long-term beneficial impacts to geology as new culverts would reduce the erosional forces on the bedrock layers reducing downcutting and ledge undercutting while maintaining slope stability.

Soils: During construction soils would be disturbed as a result of road widening and vegetation removal, leading to the potential for minor erosion. These impacts are expected to be short in duration and will be minimized by proper engineering controls and appropriate BMPs. After construction, seeding of areas will occur to help stabilize soils and reduce rill erosion from occurring within the disturbed site. Overall, the project would have long-term beneficial impacts to soils as a result of less erosion events from improved infrastructure.

The county will apply BMPs outlined in Appendix B of the Arkansas State Highway and Transportation Department (AR-DOT)2016 Erosion and Sediment Control Design and Construction Manual to minimize the impact to geologic features and soil. https://www.ardot.gov/wp-content/uploads/2021/02/Erosion-and-Sediment-Control-Manual-12-6-16-Current.pdf

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.4 Human Health and Safety

3.4.1 Affected Environment

Cave Mountain Road (Newton County Road 9560) passes through BNR lands from where it leaves AR Hwy 21 in Boxley Valley to the top of Cave Mountain. The road is steep, winding, and narrow, passing through mature mixed hardwood forest adjacent to steep rocky slopes and bluff lines. The road receives traffic primarily from rural residents and visitors to BNR and USFS lands. Some commercial traffic may use the road at certain times, generally rural delivery trucks or logging equipment. Approximately 1.8 miles of the road that would be affected by the rehabilitation and resurfacing project falls within NPS boundaries.

Traffic to the Whitaker Point trailhead (Hawksbill Crag) is expected to increase as a result of increased recreation. Due to the complex topography and high bluff lines, search and rescue operations are frequent at the Whitaker Point overlook and surrounding area. Responders to search and rescue incidents travel on the Cave Mountain Cave Road often.

Currently, the gravel road develops wash-boarding that leads to driving instability such

as loss of traction and vehicle slides off the road. Runoff, lack of shoulders, and proximity of mature trees and rock outcrops can contribute to hazardous driving conditions, especially during inclement weather.

3.4.2 Environmental Consequences

3.4.2.1 Alternative A: No Action

Gravel road surface, lack of shoulders, inadequate cross-drainage and large adjacent drop-offs would continue to be hazardous for motorists. The lower section of the road would continue to degrade quickly after maintenance resulting in high amplitude washboards that could potentially cause vehicle control issues. Ice on the roadway due to inadequate drainage could result in vehicles sliding off the road where they could encounter trees or steep ravines. Under the no action alternative, the high potential for accidents, and high search and rescue response times would remain the same or increase over both the short- and long-term.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.4.2.2 Alternative B - Road Rehabilitation and Improvement

Under this alternative, Cave Mountain Road would be resurfaced with asphalt improving traction especially during inclement weather. The addition of shoulders and vehicle barriers in strategic areas, as well as drainage improvements would improve safety in the long-term. There is the potential for temporary delays or road closure during construction. Detours for search and rescue missions would be required. Response time via alternate routes would take more time in the short-term. Once the project is complete, response time via Cave Mountain Road is expected to be much faster.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.5 Paleontological Resources

3.5.1 Affected Environment

The proposed Cave Mountain Road construction project area contains fossiliferous strata ranging in age from early through late Mississippian (Late Paleozoic). The paleontological resources documented in the few exposed blocks or down-dropped bedrock represent common marine invertebrate fossils including corals, brachiopods, crinoids, and invertebrate trace fossils. The geologic formations potentially encountered along the road corridor are largely buried by younger surficial deposits and talus accumulations derived from eroded rock units exposed upslope and above the road on Cave Mountain. The surficial deposits and talus limited the ability to examine the bedrock and fully assess the paleontological resources during the pre-

construction paleontological resource assessment. The talus accumulations and large boulders along the slopes adjacent to Cave Mountain Road indicate the area is both a long-term and active rockfall area.

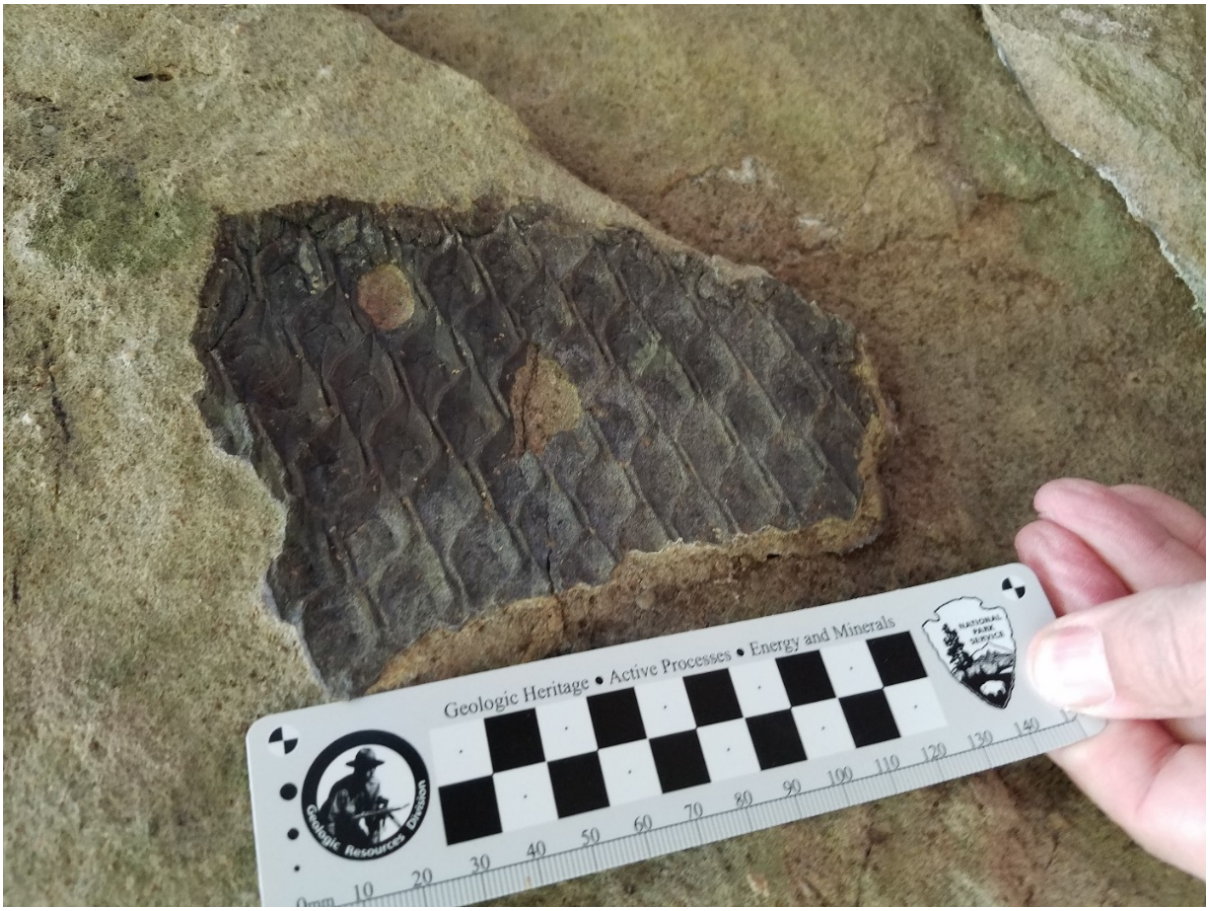

Figure 5. Early Pennsylvanian lycopsid, a primitive vascular tree, preserved in the Bloyd Formation on Cave Mountain within Buffalo National River. (NPS Photo)

Figure 6. Late Mississippian crinoid from a block of the Pitkin Limestone along the Cave Mountain Road.

3.5.2 Environmental Consequences

3.5.2.1 Alternative A- No Action

The no action alternative would continue the current management strategy for Cave Mountain Road, including general maintenance of the roadway as needed, grading and repairing the roadbed, especially after storm events. Continuation of management under the no action alternative would result in downcutting of ditches, undercutting of ledge rock, and potential for increased slope instability, all of which could expose

paleontological resources, destroy the resources, or relocate them away from their origin, resulting in loss of scientific integrity.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.5.2.2 Alternative B- Road Rehabilitation and Improvement

This alternative would have minimal impacts to paleontological in the project area. A minimal number of common marine invertebrate fossils such corals, brachiopods, crinoids, and invertebrate trace fossils may be displaced or damaged. With the removal of the overlying surficial deposits and talus, the underlying bedrock may be exposed and enable greater access to any potential fossils in these units. Monitoring for paleontological resources in the bedrock exposed during construction activities will help to identify and remove specimens for educational and display purposes.

Stabilization of the slope above the road and erosion control through implementation of the BMPs outlined in Appendix B of the Arkansas State Highway and Transportation Department (AR-DOT) 2016 Erosion and Sediment Control Design and Construction Manual will safeguard fossiliferous geologic units overlying Cave Mountain Road. https://www.ardot.gov/wp-content/uploads/2021/02/Erosion-and-Sediment-Control-Manual-12-6-16-Current.pdf.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.6 Species of Concern (Bats)

3.6.1 Affected Environment

The road passes within 200 feet of the entrance to Cave Mountain Cave, a priority 1 Gray bat (*Myotis grisescens*) hibernaculum. The gray bat is listed as endangered (USFWS, 1976). Cave Mountain Cave contains the largest hibernating population of the endangered (USFWS, 1967) Indiana bat (*M. sodalis*) in Arkansas. Cave Mountain Cave contains threatened (USFWS, 2015) Northern Long-eared bats (*M. septentrionalis*), and Tri-color bats (*Perimyotis subflavus*). In addition to the cave, the road runs adjacent to a stretch of the Middle Bloyd Sandstone. This sandstone forms the rimrock that holds up the top of the highlands in this part of the Boston Mountains physiographic province. It often contains crevices, pockets, and talus which have the potential to provide roosting habitat for the Ozark Big-ear bat (Endangered), Northern long-eared bat, and Small Footed bat (Arkansas listed species). The road runs adjacent to or over this unit for approximately 1,825 feet. (USFWS, 1976) (USFWS, 1967) (USFWS, 2015)

Gray Bat

The Gray Bat is federally listed as Endangered and is considered critically imperiled in Arkansas. The population of hibernating gray bats in Cave Mountain Cave has reached approximately 600,000 individuals. The summer population is highly variable as it is used as a transient bachelor roost.

The gray bat emerges from caves at dusk and flies to foraging areas over water. They particularly

prefer foraging over slab bottom streams and adjacent riparian areas where there are plenty of aquatic organisms hatching. Lactating females may maintain specific feeding territories, which are up to 20 km from the roost. The bat will use the riparian areas as flyways from the roost to the major foraging site, picking up mayflies and other aquatic insects as they travel (BCI, 2001 and NatureServe Explorer, 2019). Sixteen caves and one mine at BNR are known to provide roosting habitat for the Gray bat.

Indiana Bat
The Indiana bat is federally listed as Endangered and is considered critically imperiled in Arkansas. The Indiana bat population in Cave Mountain Cave has varied but counts indicate approximately 4,000 individuals may hibernate there. Cave Mountain Cave is extremely important for the long-term survival of the Indiana bat.

The Indiana bat emerges from its roost after sundown. They forage in or beneath the forest canopy, often along streams. They also forage along wooded fencerows, in clearings with early successional vegetation, and in upland forest. Their diet consists primarily of moths, caddis flies, beetles, flies and homopteran insects. Summer roosts of the Indiana bat are beneath the bark of elms, cottonwoods, birch, green ash, oaks, shagbark hickory trees, and snags of five-inches diameter or greater. Their roosts are often found in open lowland habitat but can also be found in upland forest areas. This species tends not to fly very far from its summer roost to forage. They generally will not travel much more than 1km for foraging, except for post-lactating females, which may forage 2.6 km from their roost (BCI, 2001 and NatureServe Explorer, 2019). Ten caves at BNR contain hibernating colonies of Indiana bats.

Northern Long-Eared Bat
The northern long-eared bat is listed as Threatened under the Endangered Species Act. Populations at BNR have been greatly reduced since 2015 because of White Nose Syndrome (WNS). Northern Long-Eared bats in a hibernaculum at BNR since 2016. Winter cave surveys conducted by Arkansas Game and Fish Commission (AGFC) had documented as many as 100 individuals of this species using Cave Mountain Cave. The Northern long-eared bat is a forest and woodland bat that utilizes caves and mines for hibernation and trees, snags, and old buildings for maternity sites. The bat appears to forage primarily in upland forest and woodland. They are considered opportunistic feeders, relying upon aerial capture and gleaning to acquire a wide variety of insect prey.

Tri-Color Bat
The tri-color bat is considered globally and nationally imperiled. This species has suffered ninety-percent population loss since WNS was discovered in North America (Cheng, et al., 2021). The tri-color bat was once ubiquitous in caves at BNR, now it is much less common to find. Female tri-color bats utilize foliage for summer roosting. They are found primarily in clusters of dead leaves, but also in live foliage and squirrel nests. Oaks are the preferred roost trees. They roost in trees and foliage well below the forest canopy (Veilleux, Whitaker, Jr. , & Veilleux, 2003)

3.6.2 Environmental Consequences

3.6.2.1 Alternative A- No Action

Under this alternative current road management and maintenance activities would remain the same and no infrastructure improvements would occur. Current bat population trends would continue. BNR and Newton County would continue to work together to follow USFWS established restrictions pertaining to road maintenance

actions.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.6.2.2 Alternative B- Road Rehabilitation and Improvement

Construction activities could create disturbance through noise, vibrations, and equipment. Alterations to the habitat from construction are expected to be temporary, negligible, and would have no measurable impacts to the population as a whole within BNR. BMPs such as timing restrictions will be implemented to reduce potential adverse impacts. Impacts would be mitigated by planning construction activities outside sensitive roosting times for listed bat species. Protecting known, occupied maternity roost trees would be required by Park managers under this alternative and all efforts to avoid disturbing roost and other sensitive habitat would be taken to minimize impacts to threatened or endangered bat species. Proposed activities would have a short-term effect on listed bats, who depend on Cave Mountain cave as a primary hibernaculum.

Northern long-eared bats known to inhabit the area would be subject to a special rule under Section 4(d) of the Endangered Species Act (ESA). Specifically, the final 4(d) rule allows the U.S. Fish and Wildlife Service to protect habitat affected by white-nose syndrome during the bat's most sensitive life stages, while minimizing regulatory requirements for land managers and landowners within the species' range (USFWS 2016). Considerations include avoiding management activities near bat hibernacula (such as caves and mines) during winter months and other vulnerable life stages (such as spring staging and fall swarming) to provide focused protection against the spread of white-nose syndrome.

Buffalo National River prepared a biological assessment and consulted with the USFWS regarding the impacts to bats as a result of implementing alternative B- Road Rehabilitation and Improvement. The USFWS concurred with BNR's determination of 'Not Likely to Adversely Affect' the Gray Bat, Indiana Bat, Northern Long-Eared Bat, or the Ozark Big-eared Bat within the project area.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.7 Vegetation

3.7.1 Affected Environment

Plant communities located in the Ozarks physiographic region are rich and diverse due in part to primarily sandy and silty loam soils that are highly permeable. The area's ridges, bluffs, hillsides, and valleys provide a variety of habitats that contribute to the Park's 1,500 vascular plant species. The eight vegetation map codes for the project area are shown in Figure 7 and described from the bottom of Cave Mountain Cave Road to the top on NPS lands.

- Map Code CVD refers to Cultural Developed Area.
- Map Code FRH refers to Riparian Hardwood Forest.
- Map Code HMX refers to Ruderal Herbaceous Field.

- Map Code FDX refers to Ruderal Hardwood Forest.
- Map Code SMX refers to Ruderal Shrubland.
- Map Code FBH refers to Ozark Rich Beech – Mixed hardwood Forest.
- Map Code FDO refers to Mixed Oak – (Hardwood) Dry Forest.
- Map Code FOM refers to White Oak – Red oak – Sugar Maple Mesic Forest.

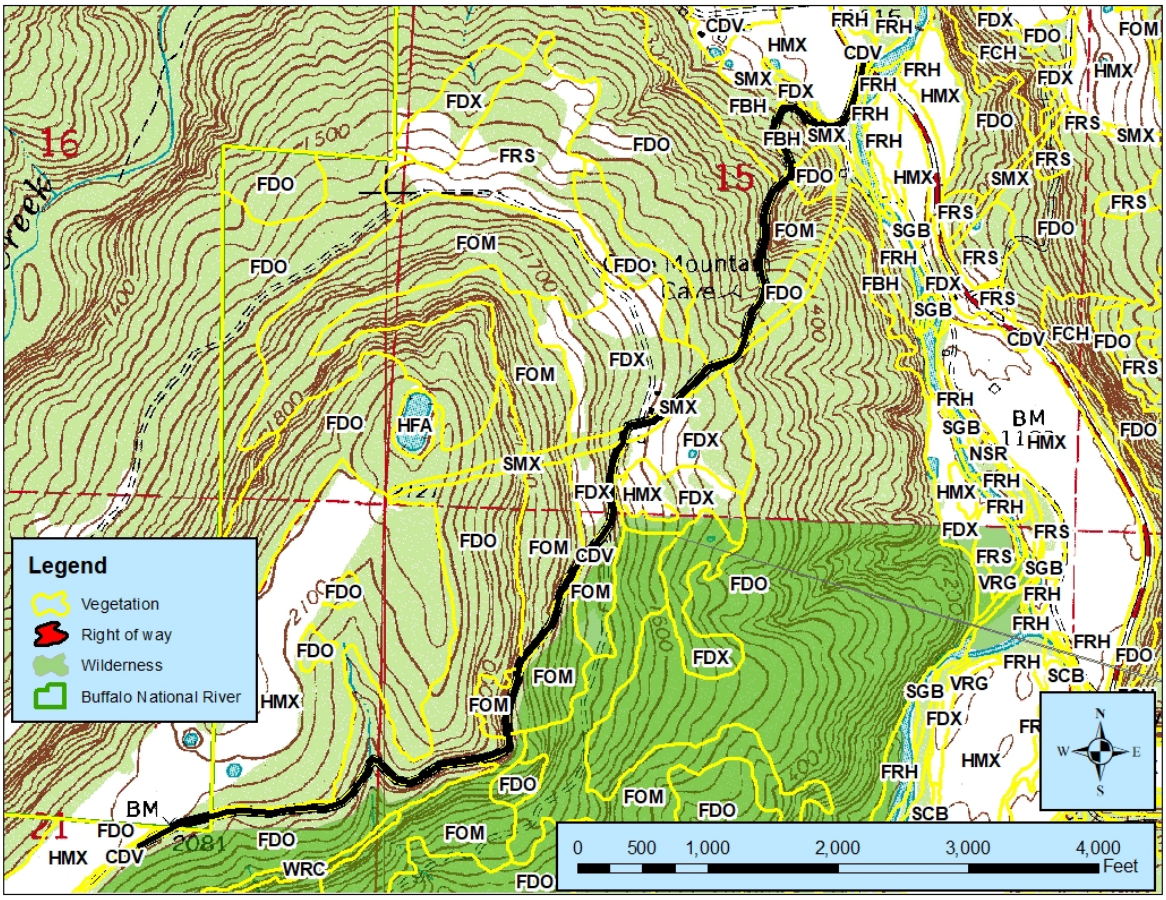

Figure 7: Vegetation Map Codes

3.7.2 Environmental Consequences

3.7.2.1 Alternative A - No Action

Under this alternative current road management and maintenance activities would remain the same and no infrastructure improvements would occur. Known vegetative communities would continue to be impacted by traffic and maintenance actions. No substantial changes would occur to alter the vegetative communities in the project area as a result of the No-Action alternative.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.7.2.2 Alternative B - Road Rehabilitation and Improvement

Construction impacts would occur at separate times of the year. Tree removal and associated ground disturbance will occur between November 15 and March 15; however, work will only take a few days once started. The remainder of the road construction actions to include grading, culvert replacement, guard rail installation, and paving will take place during the summer months and last approximately three months. These actions will adversely impact less than 5 acres of vegetation which would be permanently removed. Five acres of vegetation constitutes less than 0.005% of total vegetation within BNR.

Construction activities have the potential to allow invasive species to move in and proliferate. Best management practices during construction such as retaining vegetation or reestablishing it by means of seeding and mulching, sodding, or erosion matting will reduce the likelihood of invasive species taking hold. Additionally, disturbed and de--vegetated areas will be reseeded with appropriate native species.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.8 Water Resources

3.8.1 Affected Environment

Established as America's first National River, BNR flows freely for 153 miles through remarkable bluffs of the Ozark Mountains—135 of those miles are within the national river (the first 18 miles run through the Upper Buffalo Wilderness in the Ozark National Forest). The project area is in the upper section of the river. Cave Mountain Road begins by paralleling the Buffalo River near its turnoff on Hwy 21 with the river's edge approximately 35 feet from the road's centerline. Near the top of the mountain this distance expands to around 2,700 feet. The area between the road and the river is heavily vegetated (see section 3.6). Several unnamed intermittent streams drain into the river in the project area.

Given its proximity to the river, erosion processes along the road can contribute substantial amounts of sediment to the river channel. The Buffalo River is listed as an Extraordinary Resource Water, the highest water quality designation given by the Arkansas Department of Environmental Quality, therefore the impact of this sediment to the aquatic environment is a concern. Currently, water quality in the Buffalo River is good, however, increases in turbidity have been documented at the closest water quality monitoring station (2021 report in process).

In addition to nearby land uses that impact water quality, the presence of dirt and gravel roads and other earth disturbing activities also impact the quality of water. Eroded soils in water become suspended solids and eventually settle to the bottom of the water course as sediment. Suspended solids and excessive sedimentation can have adverse impacts to water quality and aquatic fauna if not controlled. Freshwater mussels have been found to be sensitive to increases in total suspended solids (TSS) in the water column (Landis, et al. 2013). Mussels filter to feed and complete their life cycle. Increased sediment in the water column erodes their gills and requires them to flush

them more frequently to increase efficiency, having a negative impact on their health and reproductive success. Roadbed sediments will enter the Buffalo mainstream disrupting natural fluvial processes and have the potential to impact freshwater mussels downstream.

Riparian areas serve important roles in protecting water quality within the Buffalo River watershed. Riparian buffers help decrease erosion as they reduce the speed of overland and river flows which help sediments settle along riverbanks. The nutrients trapped within the sediments promote growth of forest and buffer vegetation. They also provide an energy source to streams in the form of dissolved carbon and organic debris particulates, which is a critical food source for the base of the food chain, including benthic invertebrates that feed on the detritus (2004 water resource management plan).

3.8.2 Environmental Consequences

3.8.2.1 Alternative A- No Action

Under this alternative current road management and maintenance activities would remain the same and no infrastructure improvements would occur. Current erosional processes (i.e. sedimentation) will continue or worsen as the roadbed continues to incise into the mountain by maintenance activities. Additionally, the inadequate number of culverts, especially along the steep grades, will continue to damage the roadbed requiring frequent grading, which in turn will increase sedimentation concerns. Overall, the no-action alternative would continue to have a long-term adverse impact to water quality.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

3.8.2.2 Alternative B- Road Rehabilitation and Improvement

Activities which could cause adverse impacts to water quality during this alternative would include vegetation removal, road widening/benching, culvert placement, and hardening of the road surface. Precipitation events during these activities would cause short-term, temporary adverse impacts to water quality; however, these impacts could be lessened with the implementation of stormwater BMPs (see section 3.2) when precipitation is expected to occur within the work area.

There are an estimated 2,000 miles of roads within the Buffalo River watershed, many in existence prior to the establishment of BNR in 1972. Roads have been built into steep hillsides, across hydrologic drainage areas, and within the riparian buffers of the river and its tributaries. The lack of drainage structures needed to disperse flows along roadways allows large volumes of runoff to collect in ditches. The channeling of water increases the erosional potential leading to greater sediment loads being transported to receiving waterways. The proximity of the road to the mainstem of the Buffalo River increases the concerns of allowing the current maintenance to continue.

Overall, this alternative would have long-term beneficial impacts on water quality by doubling the number of culverts which will restore a more natural stream function in the vicinity of BNR. Additionally, paving the road will reduce the introduction of gravel and

sediment to the river system and remove the need to disturb the road surface via grading after precipitation events.

The above analysis incorporates the trends discussed in Section 3.2, additionally, this alternative would not result in an increase in adverse impacts as a result of reasonably foreseeable future actions.

4.0 Consultation and Coordination

4.1 Lead and Cooperating Agencies

An internal review of the Cave Mountain Road Environmental Assessment is being conducted by the National Park Service staff at Buffalo National River and by staff at the Midwest Regional Office located in Omaha, Nebraska.

4.2 Federal Agencies

U.S. Fish and Wildlife Service

4.3 State Agencies

Arkansas Game and Parks Commission
Arkansas State Historic Preservation Office

4.4 Tribal Partners

The Absentee Shawnee Tribe of Oklahoma
The Caddo Nation of Oklahoma
The Cherokee Nation
The Eastern Shawnee Tribe of Oklahoma
The Osage Nation
The Quapaw Tribe of Oklahoma
The Shawnee Tribe
The United Keetoowah Band of Cherokee Indians in Oklahoma

4.5 Local Agencies

Newton County

4.6 Other Environmental and Regulatory Requirements

Endangered Species Act: Section 7 consultation with U.S. Fish and Wildlife Service Executive

Orders 11988 and 11990: Floodplain management

National Historic Preservation Act (Section 106): Provide for review by the Advisory Council on Historic Preservation

A Notice of Availability of the Cave Mountain Road Environmental Assessment will be published in the local newspaper, allowing 30 days for public comment.

5.0 List of Preparers and Contributors

The persons responsible for the review of the proposed action, the supporting information and analyses, and the preparation of this EA are listed below:

US DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

Buffalo National River
402 N Walnut St.
Harrison, AR 72601

- Mark Foust, Superintendent
- Melissa Trenchik, Chief of Resources Stewardship, Science, Interpretation and Education
- Charles Bitting, Natural Resource Manager
- Shawn Hodges, Ecologist

National Park Service, Regions 3, 4, and 5
601 Riverfront Drive
Omaha, NE 68102

- Christine Gabriel, Regional Environmental Coordinator
- Amber Rhodes, Environmental Protection Specialist

References

NPS. (2006). *Management Policies 2006*. Retrieved from https://www.nps.gov/policy/MP_2006.pdf

Appendix A -Detailed Description of Geologic Formations in the Project Area

The Boone formation is divided into two units (members), the St. Joe member (Mbs) (Lower Mississippian, Osagean to Kinderhookian) and the main body of the Boone (Mb) (Upper to Lower Mississippian, Meramecian to Osagean). The Boone formation is a common host to caves and sinkholes. The total thickness in the area is 380 to 405 feet.

The St. Joe member is a thin-bedded, bioclastic limestone with abundant 3- to 6- mm wide crinoid fragments in a fine matrix. The St. Joe member is often red to pink on fresh surfaces. The lower portion may have thin wavy shale partings between layers of limestone. The base of the unit is a 0.5- to 1-ft-thick bed of tan sandstone containing phosphate pebbles. The St. Joe member is from thirty to fifty feet thick in the Boxley 7.5' quadrangle.

The main body of the Boone is a medium- to thick-bedded, chert-bearing bioclastic limestone. The limestone is light to medium gray on fresh surfaces and usually coarsely crystalline with interspersed crinoid fragments. The upper one-third of the unit contains dense fine-grained beds of limestone. The chert content varies vertically and laterally within the Boone and may exceed 50 percent. The chert is light to medium gray on fresh surfaces and forms lenticular to anastomosing lenses. The chert rich horizons are poorly exposed where they develop abundant float of white weathered chert on hillsides.

The Batesville sandstone (Mbv) (Upper Mississippian, Chesterian) is a fine grained, light to medium brown, calcite cemented sandstone with interbedded limestone. The top of the Batesville develops a topographic flat and is commonly host to sinkholes which formed by collapse into underlying cavities in the Boone. Thickness in the area is from 5 to 30 feet.

The Fayetteville shale (Mf) (Upper Mississippian, Chesterian) is a black shale with interbeds of tan, calcite cemented sandstone as thick as 12 feet. The formation is primarily a black, fissile shale that is poorly exposed on the low slopes developed on it. The lower portions of the shale may contain septarian concretions up to two feet in diameter. The Fayetteville shale is susceptible to landslides, its thickness varies from 140 to 220 feet.

The Pitkin limestone (Mp) (Upper Mississippian, Chesterian) is medium to dark gray and fetid. The limestone varies from fine grained in the lower portion to coarse grained and locally oolitic near the top. The beds may contain abundant crinoids, brachiopods, corals, and the bryozoan Archimedes sp. The Pitkin, with a total thickness of up to 130 feet, forms prominent ledges and cliffs. The Pitkin is host to caves and karst features such as springs.

The Hale Formation (Lower Pennsylvanian, Morrowan) is divided into two members, the Cane Hill and Prairie Grove. The unit is an interbedded sequence of sandstone, siltstone, shale, and thin limestone, ranging from 100 to 180 feet thick.

The lower member is the Cane Hill (Phc) which is a sequence of interbedded shale, siltstone, and sandstone. The formation forms gentle to moderately steep slopes. The Cane Hill is 80 to 160 feet thick and very susceptible to landslides.

The Prairie Grove (Phg) is the upper member. It is a reddish-brown to brown , fine to medium grained calcite cemented sandstone. Beds are planar and crossbedded. The Prairie Grove may contain interbeds of coarse bioclastic limestone. The weathered surface of the

sandstone forms rounded surfaces with elliptical cavities up to 1 foot in length. The thickness of the unit is 20 to 60 feet.

The Bloyd Formation (Lower Pennsylvanian, Morrowan) is divided into upper and lower parts, with a total thickness of up to 380 feet.

The lower Bloyd (Pbl) is primarily shale and siltstone interbedded with limestone and thin beds of sandstone. This portion of the unit forms moderate to steep slopes and is poorly exposed. It ranges from 40 to 100 feet in thickness.

The upper Bloyd (Pbu) is primarily sandstone with interbedded siltstone and shale. The upper portions of the upper Bloyd forms topographic flats and ledges. The upper sandstone beds are commonly bioturbated, including horizontal burrows as long as 3 inches. The base of the unit is colloquially known as the middle Bloyd or Parthenon sandstone. The middle Bloyd sandstone forms the prominent cliffs in the area. The middle Bloyd sandstone is a fluvial sand up to 80 feet thick. It contains tabular and trough-crossbed sets, white quartz pebbles, and casts of plant fossils, most notably lepidodrendon.

The middle Bloyd sandstone is a very competent unit, but over time house-size and smaller boulders have slid or tumbled from this unit, creating a sizeable talus slope and resulting in many large blocks of sandstone sitting a substantial distance downhill from the current edge of the unit. These mass wasting events continue today.

The Atoka Formation (Pa) (Middle Pennsylvanian, Atokan) does not outcrop in the project footprint. The Atoka consists of alternating shale, siltstone, and sandstone on the highest elevations of the Boxley quadrangle. Thickness is as much as 400 feet.

The valley floor contains younger terraces and active channel alluvial deposits (Qty) in this location.

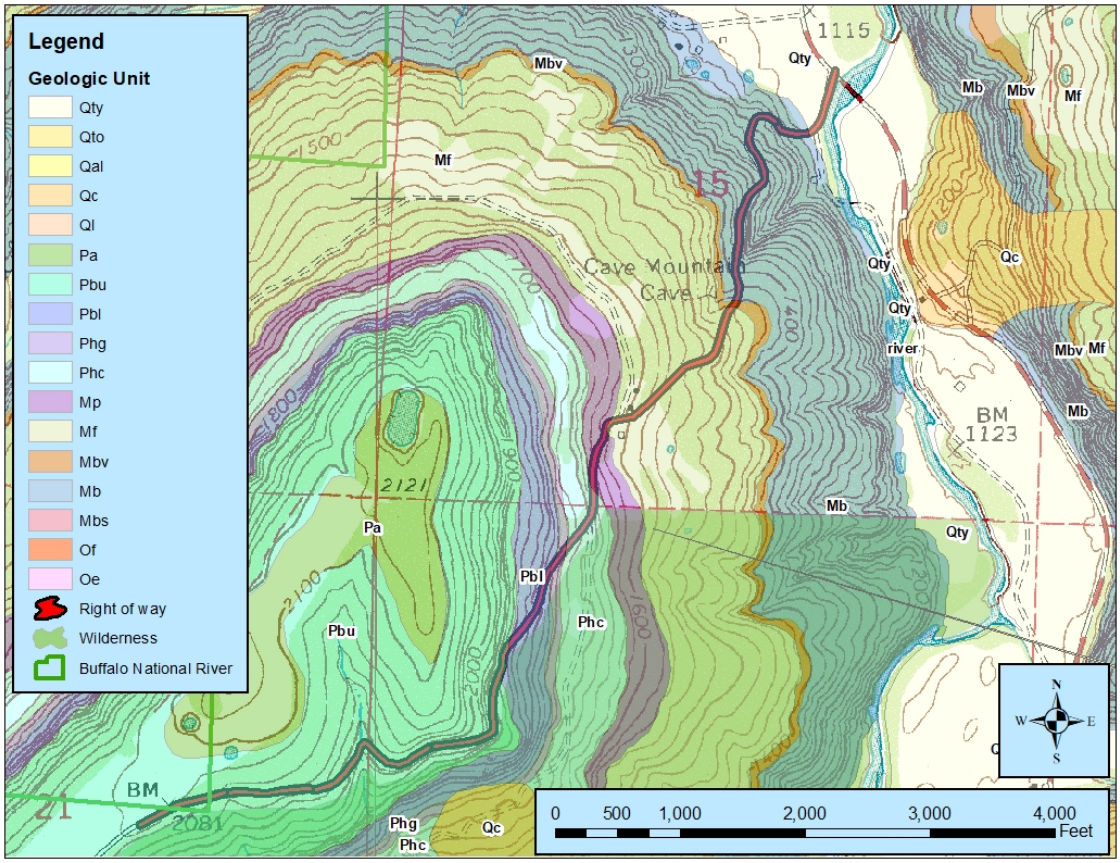

Figure 8: Geologic Map of project area

Appendix B -USFWS Consultation Letter

IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 S. Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

July 30, 2021

Reference: I1394

Melissa Trenchik
Buffalo National River
402 N Walnut St.
Harrison, AR 72601

Dear Ms. Trenchik:

The U.S. Fish and Wildlife Service (Service) has received your letter dated June 28, 2021 and reviewed your revised biological assessment received via email on July 29, 2021, concerning the Cave Mountain Road Improvement project. Our comments are submitted in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended 16 U.S.C. 1531 et seq.).

The Service concurs with your "may affect, not likely to adversely affect" determination for the Gray Bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), Northern Long-eared Bat (*Myotis septentrionalis*), and Ozark Big-eared Bat (*Corynorhinus townsendii*) based on the conservation measures provided in the biological assessment. Buffalo National River has met consultation requirements by informing the Service of their "no effect" determination for Missouri Bladderpod (*Physaria filiformis*), Red Knot (*Calidris canutus rufa*), Rabbitsfoot (*Quadrula cylindrica cylindrica*), Piping Plover (*Charadrius melodus*), Whooping Crane (*Grus americana*) and Black Rail (*Laterallus jamaicensis*).

We appreciate your interest in the conservation of endangered species. If you have any questions, please contact the Arkansas Ecological Services Staff at (501) 513-4483.

Sincerely,

CHRISTOPHER DAVIDSON

Digitally signed by CHRISTOPHER DAVIDSON
Date: 2021.07.30 11:10:42 -05'00'

For Melvin Tobin
Field Supervisor