Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment Programmatic and Site Specific Draft Environmental Impact Statement

National Park Service
U.S. Department of Interior

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August 2018

Estimated Lead Agency Total Costs Associated with Developing and Producing this EIS is $410K

UNITED STATES DEPARTMENT OF THE INTERIOR – NATIONAL PARK SERVICE
DRAFT CONTAMINATED MINE DRAINAGE MITIGATION AND TREATMENT PROGRAMMATIC AND SITE SPECIFIC DRAFT ENVIRONMENTAL IMPACT STATEMENT

Big South Fork National River and Recreation Area

Lead Agency: National Park Service (NPS), U.S. Department of the Interior

This *Contaminated Mine Drainage Mitigation and Treatment Programmatic and Site Specific Daft Environmental Impact Statement* (EIS) describes four alternatives (including a no-action alternative) for the mitigation and treatment of contaminated mine drainage (CMD) within Big South Fork National River and Recreation Area (Big South Fork NRRA, or "the park"). The park encompasses approximately 125,310 acres on the Cumberland Plateau in an area that was subject to extensive coal mining and timber harvesting from the 1800's to the late 1960's; the environmental impacts from the coal mining activities persist in the form of CMD. The purpose of this EIS is to develop a programmatic approach and guidance for the Big South Fork NRRA to improve water quality through the remediation of CMD sites in a manner that protects resources, visitor use/ experience, and the human health and safety in Big South Fork NRRA. This EIS will provide Big South Fork NRRA a broad framework to remediate CMD locations throughout the Big South Fork NRRA, along with providing a framework for treatment at specific CMD sites identified in previous investigations.

As described below, access to remediate potential CMD sites is the element that varies the most among the alternatives, and subsequently has the largest effect on the variation of impacts between the alternatives. Under Alternative 1 (no action), current conditions and management strategies for treating CMD sites would remain unchanged, and no action would be planned to remediate CMD; the National Park Service (NPS) would have to initiate remediation on a case-by-case basis. Under Alternative 2, the park would have no restrictions to the development and maintenance of access to remediate 25 potential CMD sites. Alternative 3 would limit access to existing routes identified in the current General Management Plan (GMP), with the ability to widen routes, use and improve historic access routes, and construct up to 0.1 mile of new access road to sites, except hiking and mountain biking trails, unless the trail is co-located on a historic road, though historic tramways would be excluded from use. Approximately 13 CMD sites could be accessed for remediation under Alternative 3. Alternative 4 would limit access to existing roads and larger access routes identified in the current GMP, such as horse trails and multiple use trails, and new access roads to sites that are less than 0.1 mile in length, but would not use historic access routes, such as former roads or tramways. Approximately 10 CMD sites could be accessed for remediation under Alternative 4. This EIS analyzes impacts of these alternatives in detail for topography and soils, water resources, biological resources, cultural resources, visitor use and experience, and soundscapes and the acoustic environment.

This draft EIS is available for public and agency review and comment from August 3 to September 17, 2018. The draft EIS will be available start August 3 through the NPS Planning, Environment, and Public Comment (PEPC) website at https://parkplanning.nps.gov/. Limited copies may also be available upon request by contacting the park Superintendent. Public meetings will be held August 28, 29, and 30, 2018.

The final EIS will provide responses to substantive public comments, incorporate those comments and suggested revisions as necessary, and provide copies of relevant comment correspondences. Once the document is released and a Notice of Availability (NOA) is published by the Environmental Protection Agency, a 30-day no-action period will follow. Following that, the alternative or actions constituting the approved plan will be documented in a Record of Decision (ROD) that will be signed by the Regional Director of the NPS Southeast Region.

For further information, visit http://parkplanning.nps.gov/biso or contact:
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National Park Service
U.S. Department of the Interior

Big South Fork National River and Recreation Area
Kentucky and Tennessee

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EXECUTIVE SUMMARY

PURPOSE AND NEED

Big South Fork National River and Recreation Area (Big South Fork NRRA, or "the park") encompasses approximately 125,310 acres on the Cumberland Plateau in Tennessee and Kentucky, approximately 70 highway miles northwest of Knoxville, Tennessee. This region, including the park, was subject to extensive coal mining and timber harvesting from the 1800's to the late 1960's resulting in a variety of environmental impacts. Since the establishment of the park, much of the forested area has recovered, but the impacts from the coal mining activities persist in the form of contaminated mine discharge (CMD).

It is the intent of the Big South Fork NRRA, a unit of the National Park Service (NPS), to improve the water quality in the Big South Fork of the Cumberland River (Big South Fork River) and tributaries by mitigating contamination produced at abandoned coal mining sites and associated mining waste and spoils. Many surface waters that are located within the Big South Fork NRRA are presently impacted by contaminated water from mine discharges and from reactive mine spoils that were discarded from up-slope underground coal mines. These CMD sites impact water quality by lowering pH and raising acidity, often increasing the concentration of metals and other contaminants in the water and sediment. Decreased water quality can adversely impact aquatic habitats and ecosystems in the Big South Fork River and its tributaries.

PURPOSE OF THE PLAN

The purpose of this Contaminated Mine Drainage Mitigation and Treatment Programmatic and Site Specific Draft Environmental Impact Statement (EIS) is to develop a programmatic approach and guidance for the Big South Fork NRRA to improve water quality through the remediation of CMD sites in a manner that protects resources, visitor use/ experience, and the human health and safety in Big South Fork NRRA. This EIS will provide Big South Fork NRRA a broad framework to remediate CMD locations throughout the Big South Fork NRRA. In addition to providing a framework for treatment at other sites within the park, eight specific CMD sites will be analyzed in greater detail in the EIS. These eight sites were identified in previous investigations as being high priority sites to be considered for treatment.

NEED FOR ACTION

Water quality and the health of aquatic habitats in the Big South Fork River and its tributaries have been adversely impacted by contaminated water discharging from CMD sites. The EIS is needed to identify appropriate CMD remedial technologies and to provide an efficient strategy for park managers to limit or prevent CMD and ultimately improve water quality in the Big South Fork River and tributary streams. Mitigation and treatment of CMD would improve aquatic systems and resources and likely improve wildlife habitat, natural ecosystems, and visitor experience at the Big South fork NRRA.

OBJECTIVES

The alternatives selected for detailed analysis in this EIS must resolve the purpose and need for action. The following objectives for performing remediation at CMD locations were developed by the interdisciplinary team (IDT), and are grounded in the enabling legislation, purpose, significance, and mission goals of the Big South Fork NRRA:

General

- Improve water quality of surface waters of the Big South Fork NRRA and tributaries that have been impacted by CMD; and
- Identify and protect park resources from adverse effects of CMD remedial activities.

Vegetation/Unique Vegetation Communities

- Protect vegetation deemed by NPS as species or communities of concern from adverse effects (including from invasive or non-native vegetation) of CMD remedial activities; and
- Restore natural vegetation communities.

Visitor Experience, Conflicts, & Safety

- Prevent, minimize, or mitigate conflicts between remedial activities and visitor use;
- Protect human health and safety from CMD and associated historic mining safety issues and adverse effects of remedial activities; and
- Protect railroad tracks and right-of-way (ROW) owned by the Big South Fork Scenic Railway (owned and operated by the McCreary County Heritage Foundation).

Water Resources

- Improve water quality of surface waters (including aquatic habitat and ecosystems) in the Big South Fork NRRA through the remediation of CMD while protecting water resources from adverse effects of the remedial actions themselves.

Wildlife and Aquatic Species

- Protect all wildlife and aquatic species, including threatened and endangered species and critical habitats, from adverse effects of CMD remedial activities

Cultural Resources

- Protect cultural resources, including cultural resources that are eligible for inclusion in or listed on the National Register of Historic Places (Section 106 compliance) from adverse effects of CMD remedial activities.

ALTERNATIVES DEVELOPMENT

The National Environmental Policy Act (NEPA) requires that federal agencies consider the proposed action and a range of reasonable project alternatives. The proposed action is for Big South Fork NRRA to treat CMD through the most efficient remedial approach to improve water quality. The range of project alternatives must include a “No Action” alternative, as required by NEPA regulations; under the No Action, or No Remediation alternative, no action would be

planned for the remedial treatment of CMD in Big South Fork NRRA. The NPS would have to initiate remediation on a case by case basis.

The IDT developed three action (project) alternatives, taking into consideration feedback from the public and other federal agencies during the planning process. These action alternatives meet the Purpose and Need of the project to a large degree and the objectives developed for the project. Because these action alternatives would be technically and economically feasible, they are considered to be “reasonable” alternatives.

SUMMARY OF THE ALTERNATIVES

These alternatives were developed to meet the stated purpose and need and provide a reasonable range of options for the mitigation and treatment of CMD sites. As described below, access to remediate potential CMD sites is the element that varies the most among the alternatives, and subsequently has the largest effect on the variation of impacts between the alternatives. Allowable access under an alternative represents the upper bound for access that could be implemented, and that is acceptable under any alternative to utilize less than the maximum amount of access.

Alternative 1: No Remediation

Under the No Remediation alternative, current conditions and management strategies for treating CMD sites would remain unchanged. The park may periodically monitor these sites. If the No Remediation alternative is selected, CMD sites would continue to produce contaminated water and poor water quality would persist in many of the tributary streams, surface waters, and the Big South Fork River within the park. Under the No Remediation alternative, no action would be planned; NPS would have to initiate remediation on a case by case basis.

Alternative 2: Full Access (Proposed Action)

Under Alternative 2, the park would have full access to remediate potential CMD sites. As access would not be limited, most programmatic CMD sites (approximately 17 based on current information on the locations of CMD sites within Big South Fork NRRA), could be accessed for remediation. Additionally, all 8 specific CMD sites could be remediated. NPS would clearly articulate the programmatic management framework to remediate CMD sites located within Big South Fork NRRA and to ensure long-term protection of the park resources and values. NPS would ensure that park resources are protected during the construction of new access, maintained access, upgrades of existing access, and the CMD remedial approach and its necessary operations and maintenance (O&M) activities.

Alternative 3: Moderate Access (Preferred Alternative)

Under Alternative 3, NPS could use existing routes identified in the current General Management Plan (GMP) with the ability to widen routes for CMD construction and long-term maintenance, use and improve historic access routes, and construct up to 0.1 mile of new access road to sites, with the exception of hiking and mountain biking trails, which could not be utilized for access unless the trail is co-located on historic logging road, or mining road, excluding historic tramways. As access would be somewhat limited (where there are no limitations to access under Alternative 2), not all treatable CMD sites could be accessed for

remediation under Alternative 3. An estimate of up to 8 programmatic CMD sites could be remediated under the programmatic implementation of Alternative 3 for the purposes of evaluation in this EIS. Additionally, only 5 of the specific CMD sites could be remediated. NPS would actively implement CMD technology using all suitable CMD technologies and O&M as required.

Alternative 4: Minimal Access

Under Alternative 4, the NPS could use existing roads and larger access routes identified in the current GMP, such as horse trails and multiple use trails, and construct new access roads to sites that are less than 0.1 mile in length, but could not use historic access routes, such as former logging roads or tramways, or smaller access routes, such as hiking or mountain biking trails. Access improvement standards would be consistent with those described for Alternative 3. As access would be very limited, much more so than under Alternatives 2 or 3, most CMD sites could not be accessed for remediation. An estimate of up to 6 CMD sites could be remediated under the programmatic implementation of Alternative 4 for the purposes of evaluation in this EIS. Additionally, only 4 of the specific sites could be remediated. Under Alternative 4, the NPS would actively treat CMD using suitable remedial technologies that have a low, infrequent, and/or minor O&M, and would have a preference for passive remedial approaches.

ENVIRONMENTAL CONSEQUENCES

Under all three action alternatives, the type of impacts from the mitigation and treatment of CMD are similar because the remedial approaches utilized to address CMD may be the same, although some alternatives have a preference for passive over active remediation. Impacts associated with remediation would be the clearing, grading, stream crossings, etc., necessary for access to remedial sites and the implementation of a remedial option, which could result in vegetation loss, erosion, sedimentation, etc. As described previously, the key difference between the alternatives and the potential level of impacts and improvements is not the type of impacts, it is site accessibility, which would determine the number of sites that could be remediated, and subsequently the miles of access, total footprint (acres of impact), stream crossings, etc., that could be potentially impacted under an alternative.

Under Alternative 1, the No Remediation alternative, no mitigation or treatment would be planned, CMD sites would continue to produce contaminated water, and poor water quality would persist in many of the tributary streams, surface water and rivers found within the park.

Under Alternative 2, access would not be limited and most treatable CMD sites, approximately 25 in total, could be remediated, including the treatment of approximately 11,600 gallons per minute (gpm) of CMD. The implementation of remedial approaches for CMD under Alternative 2 would have the largest potential for measurable improvements to CMD among the alternatives, but would also have the largest potential impacts to the natural and cultural environment associated with construction, operation, and maintenance of a remedial approach. Implementation of Alternative 2 could include access improvements of up to approximately 25 sites, including 7.2 mi of access to the 8 selected sites, and up to approximately 145 acres

requiring preparation for remediation, including approximately 44 stream crossings, and potential site work in streams; however, as mentioned previously this alternative would have the highest potential to significantly reduce the adverse impacts of CMD in local streams and to improve to the water quality of the Big South Fork River.

Alternative 3 would have similar effects to Alternative 2, but moderate access would limit potential remediation, up to approximately 13 sites and treatment of approximately 5,700 gpm of CMD. Implementation of the alternative would include access improvements of up to approximately 13 sites total, including 5.2 mi of access to the 5 selected sites, and approximately 22 stream crossings and potential site work in streams. However, this alternative would have potential to significantly reduce the adverse impacts of CMD in local streams and to improve the water quality of the Big South Fork River; though the potential would be lower than Alternative 2 due to inaccessible sites.

Under Alternative 4, with the most restrictive means of access, remediation would include access improvements of up to approximately 10 sites total and treatment of approximately 4,600 gpm of CMD. Remediation would include up to 4.6 mi of access to the 4 selected sites, and approximately 14 stream crossings. As a result, Alternative 4 would have the lowest environmental impacts associated with construction, operation, and maintenance, but would also have the lowest potential for improvements to CMD impacts in the park.

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APPENDICES

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

This “Purpose of and Need for Action” chapter describes the reasons that the National Park Service (NPS) is taking action at this time. It is the intent of the Big South Fork National River and Recreation Area (Big South Fork NRRA, or “the park”), a unit of the National Park System, to improve the water quality in the Big South Fork of the Cumberland River (Big South Fork River) and tributaries by mitigating contamination produced at abandoned coal mining sites and associated mining waste and spoils. Many surface waters that are located within the Big South Fork NRRA are presently impacted by contaminated water from mine discharges and reactive mine spoils that were discarded from up-slope underground coal mines. These contaminated mine drainage (CMD) sites impact water quality by lowering pH and raising acidity, often increasing the concentration of metals and other contaminants in the water and sediment. Decreased water quality and contaminated sediment can adversely impact aquatic habitats and ecosystems in the Big South Fork River and its tributaries.

The treatment of CMD sites may include an active treatment system, a passive treatment system, source control techniques, or any combination of the three. The use of a CMD technology will require access to the CMD site, the installation and operation of the CMD technology, and the operations and maintenance (O&M) necessary to keep the treatment system functioning effectively.

This Contaminated Mine Drainage Mitigation and Treatment Programmatic and Site Specific Draft Environmental Impact Statement (EIS) will provide Big South Fork NRRA a broad framework to remediate CMD locations throughout the Big South Fork NRRA. In addition to providing a framework for treatment of sites within the park, eight specific CMD sites will be analyzed in greater detail in the EIS. These eight sites were identified in previous investigations as being high priority sites to be considered for treatment.

The EIS serves to define the proposed actions associated with this project, explore possible alternatives, and identify the affected environment and environmental consequences associated with the proposed action in accordance with the National Environmental Policy Act of 1969 (NEPA), 42 United States Code (USC) 4321.

The EIS provides a framework or plan for taking a range of actions for the eight specific sites and is intended to meet programmatic NEPA compliance requirements for the impacts associated with the footprints of the remedial actions for the specific sites. Additional investigation, engineering, design, and planning will be done prior to implementation. However, as the EIS will serve as compliance for the eight specific sites, once this additional work is completed for a specific site, the site would be considered “shovel ready”.

In contrast, this EIS provides a base plan for programmatic sites intended to expedite future NEPA compliance. Site-specific analyses and compliance would be tiered off of this EIS before

remediation could be implemented at one of the programmatic sites. Remedial actions would be reviewed using the EIS framework which would include ensuring that the additional appropriate environmental NEPA compliance requirements are met before taking any action; the NPS would obtain required permits and comply with NEPA and other applicable laws on a case by case basis as funding becomes available to treat CMD at individual sites.

PURPOSE OF AND NEED FOR ACTION

The purpose of an action is a broad statement of goals and objectives that the NPS intends to accomplish by taking action. Under NPS Director's Order 12, "need" is defined as existing conditions that need to be changed; problems that need to be remedied, decisions that need to be made, or policies or mandates that need to be implemented. Need is why action is being taken at this time. The following purpose and need statements were developed by the NPS for this EIS with input from the public and federal agencies.

Purpose of the Plan

The purpose of the plan is to develop a programmatic approach and guidance for the Big South Fork NRRA to improve water quality through the remediation of CMD sites in a manner that protects resources, visitor use / experience, and the human health and safety in Big South Fork NRRA. In addition to the development of a programmatic approach and guidance for the treatment of CMD in the park, this EIS is also intended to present an approach for the treatment of each of the eight specific CMD sites, identified based on previous data and initial analysis of potential impacts to park resources.

Need for Action

Water quality and the health of aquatic habitats in the Big South Fork River and its tributaries have been adversely impacted by contaminated water discharging from CMD sites. The EIS is needed to identify appropriate CMD remedial technologies and to provide an efficient strategy for park managers to limit or prevent CMD and ultimately improve water quality in tributaries of the Big South Fork NRRA impacted by CMD and areas impacted by CMD that flow directly into the river. Mitigation and treatment of CMD would likely improve wildlife habitat, natural ecosystems, and visitor experience at the Big South Fork NRRA.

OBJECTIVES

Objectives are those items that must be achieved to a large degree for the action to be considered a success. All alternatives selected for detailed analysis must meet all objectives to a large degree, as well as resolve purpose and need for action. Objectives for performing remediation at CMD locations must be grounded in the enabling legislation, purpose, significance, and mission goals of the Big South Fork NRRA and must be compatible with the direction and guidance provided by the 2005 General Management Plan (GMP) (NPS 2005).

The following objectives related to the remediation of CMD sites in the Big South Fork NRRA were developed by the interdisciplinary team (IDT) familiar with the issues and park resources:

General

- Improve water quality in tributaries of the Big South Fork NRRA impacted by CMD and areas impacted by CMD that flow directly into the river; and
- Identify and protect park resources from adverse effects of CMD remedial activities.

Vegetation/Unique Vegetation Communities

- Protect species of management concern from adverse effects (including protection from invasive or non-native vegetation) of CMD remedial activities; and
- Restore natural vegetation communities.

Visitor Experience, Conflicts, & Safety

- Prevent, minimize, or mitigate conflicts between remedial activities and visitor use;
- Protect human health and safety from CMD and associated historic mining safety issues and adverse effects of remedial activities; and
- Protect railroad tracks and right-of-way (ROW) owned by the Big South Fork Scenic Railway (owned by the McCreary County Heritage Foundation).

Water Resources

- Improve water quality of surface waters (including aquatic habitat and ecosystems) in tributaries of the Big South Fork NRRA impacted by CMD, and areas impacted by CMD that flow directly into the river, through the remediation of CMD while protecting water resources from adverse effects of the remedial actions themselves.

Wildlife and Aquatic Species

- Protect all wildlife and aquatic species, including threatened and endangered species and critical habitats, from adverse effects of CMD remedial activities.

Cultural Resources

- Protect cultural resources, including cultural resources that are eligible for inclusion in or listed on the National Register of Historic Places (NRHP) from adverse effects of CMD remedial activities (Section 106 compliance).

PROJECT SITE LOCATION

The Big South Fork NRRA is approximately 50 miles northwest of Knoxville, Tennessee and comprises 125,310 acres, with approximately 94,000 acres in Scott, Fentress, Morgan, and Pickett counties, Tennessee and approximately 31,000 acres in McCreary County, Kentucky (Figure 1-1 [figures are included as Appendix A]). Counties that contain and surround the park consist of scattered, low-density rural development with no major urban areas. The Big South Fork NRRA is contained within the Cumberland Plateau physiographic province, which is the southern portion of the Appalachian Plateau structural province, and is comprised of rugged terrain and best known for its gorge covering approximately half of the park's acreage. The gorge area is defined in the park's enabling legislation as "lands and waters of the Big South Fork, Clear Fork, and New River which lie between the gorge or valley rim on either side and those portions of the main tributaries and streams in the watersheds of the Big South Fork, Clear Fork, and New River that lie within the gorge or valley rim or either side, except that no

lands or waters north of Kentucky Highway Numbered 92 shall be included" (Public Law 93-251 § 108). The remaining acreage in the park is defined as the "adjacent area." The landscape contains diverse plant and animal communities that are found in aquatic environments, floodplains, upland forests, and sandstone glades. When the Big South Fork NRRA was created, the land had suffered from long-term intensive land use including coal mining, timber harvesting, oil and gas operations, and a large network of unmaintained roads.

The Big South Fork NRRA includes relatively flat areas of the plateau as well as the gorge, created by the Big South Fork River and its tributaries. The main gorge is characterized by many sheer bluffs at the gorge rim and steep talus slopes. As a result, there is little natural floodplain development along the Big South Fork River, while valleys within the gorge contain huge boulders calved from the cliffs above. Tributaries are generally characterized by steep densely-vegetated V-shaped gorges. Elevations range from approximately 740 feet (ft) above mean sea level (AMSL) along the Big South Fork River to approximately 1,250 ft AMSL on knolls at the edge of the river gorge.

The eight specific CMD locations selected for remediation in this EIS are located along the Big South Fork River approximately five miles north of the Kentucky/Tennessee border in McCreary County, Kentucky (Figure 1-2). These CMD sites vary in size and together total approximately 55 acres of total disturbance, including the access that would be required to remediate the sites. The CMD sites currently discharge into tributaries of the Big South Fork NRRA or flow directly into the river through mine discharges or through spoil piles. These CMD locations are discussed in more detail below.

The locations of all potential programmatic sites are not currently known, as additional sites may be discovered in the future; however, some potential site locations are known and have been mapped as a part of previous acid mine drainage mapping within the park (Figure 1-3). These sites were determined from an NPS database, which includes potential CMD occurrences from previous documentation, surveys, and the Abandoned Mineral Lands (AML) Comprehensive Inventory and Assessment (NPS 2014a). The potential CMD occurrences utilized for the programmatic sites depicted in Figure 1-3 were selected because they were denoted as "action required", "high risk", or "effluent [discharge]" within the database. Potential CMD occurrences were grouped together into a programmatic site if the occurrences could have shared access, and were in the immediate vicinity of one another (e.g., 3 adjacent adits).

BACKGROUND

Extensive coal mining and timber harvesting occurred from the 1800s to the late 1960s and has had substantial environmental impacts to the region, including within the area that is now designated as the Big South Fork NRRA. The Stearns Coal and Lumber Company, which was the largest coal mining company that operated within what is now the Big South Fork NRRA, established a large-scale underground coal mining operation that at its height of operation employed approximately 1,300 coal miners. The Stearns Coal and Lumber Company was founded by J.S. Stearns in the early 1900s.

The Stearns coal seams were the most prolifically mined coal seams within the Big South Fork area, located in the lower part of the Beattville Shale Member. The Stearns coal is actually three coal seams that are discontinuous and sometimes merge into one to two beds. From the upper seams to the lower, the seams are referred to as the Stearns 2 Seam, the 1 ½ Seam, and the 1 Seam. These seams are separated vertically by 20 to 60 ft and 10 to 15 ft, respectively. Generally, the seams display a regional dip to the southeast at approximately 1%, but as with all coal seams, local variations exist. The majority of these seams are located in the Kentucky portion of the Big South Fork NRRA, north of Laurel Branch Crossing, on both the east and west sides of the Big South Fork River.

Mining of the Stearns coal seams initially started in the early 1900's, and reportedly began at Barthell within the Stearns 2 seam, and later began at Worley Mine #3 in the Stearns 1 seam. Worley miners later created another entrance (Mine #4) to allow for better load-out of Mine #3. After advancing the workings to a point where the two mines should have intersected, it was realized that the two mines were in different coal seams. This middle seam became known as the Stearns 1½ seam, and the upper and lower seams kept their original designation as 1 and 2. Miners from the 1 seam mined from Mine #4 at a slight angle upward until they intersected the existing workings in the 1½ seam in Mine #3. This connection may allow the designers of the remediation system to use innovative methods to treat the discharge at Worley.

Coal mining by the Stearns Coal and Lumber Company peaked around 1929, but by 1963 the company began to close their active mines due to the economic decline in the coal market (NPS 1997). Evidence of these past coal mining activities within the park include abandoned coal mines and the waste produced from coal mining activities. The waste materials generated from coal mines were generally deposited in rock dumps near the mines. These coal mine spoil piles occur throughout the park and contribute to the formation of CMD.

Water emanating from coal mines or flowing through spoil piles can become acidified and can mobilize and transport contaminants. Sulfuric acid and ferric hydroxide enter streams at Big South Fork NRRA as water drains from or erodes through the coal mining areas. Other common contaminants arising from acid mine runoff include aluminum, cadmium, cobalt, copper, iron, magnesium, manganese, and zinc. Consequently, some streams in Big South Fork NRRA are severely impacted habitats with limited ability to support aquatic life (Emmott *et al.* 2005) from Natural Resource Condition Assessment [NRCA]). O'Bara *et al*. (1982 from NRCA) outlined several water quality parameter thresholds indicative of acid mine drainage (Table 1-1 [tables are included as Appendix B]). These water quality parameters have been exceeded at CMD sites within Big South Fork NRRA.

Since 1974, some remedial efforts have been made to minimize the effect of mine spoils on surface waters. Mine reclamation efforts have primarily focused on several abandoned coal mines including the mine sites of Blue Heron, Worley, and Alum Ford in the Kentucky portion of Big South Fork NRRA. These efforts were largely funded by the U.S. Department of the Interior (DOI)-Office of Surface Mining (OSM), while the recently completed efforts at Blue Heron were funded by the U.S. Army Corps of Engineers (USACE). Additional reclamation activities have been completed within the Big South Fork River watershed, but outside of the Big South Fork

NRRA, by Tennessee Department of Environment and Conservation (TDEC) the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), and Kentucky Division of Abandoned Mine Lands (work along Lower Rock Creek).

PREVIOUS STUDIES

During the 1990s, NPS conducted field investigations to better understand and prioritize the degree of contaminated water flowing from CMD sites into Big South Fork NRRA surface waters (a bibliography of previous studies and the number of sites investigated is included as Table 1-2). These studies consisted of water sampling at CMD sites to establish a baseline to determine water quality by using pH, dissolved oxygen, temperature, and metal concentrations. Water quality was then used to characterize CMD sites for remedial activities. These studies identified approximately 17 CMD locations situated on both the eastern and western sides of the Big South Fork River.

In 2003, a draft Environmental Assessment (EA) was prepared that analyzed eight CMD locations (the Laurel Branch sites were combined as one site) from a Gannett Fleming, Inc. Phase III evaluation (Gannett Fleming, Inc. 1998). The draft EA included an analysis of two action alternatives for remediation and recommended various passive treatment and source control technologies. Based on the potential impacts to park resources, the draft EA was not completed, and the NPS decided to develop this EIS to address remedial activities at CMD sites.

In addition to the programmatic elements of this EIS, eight specific CMD sites are included for consideration for treatment (Figure 1-2). Photographic depictions of some of these sites are included in Appendix C. These sites were selected based on initial data collected to document CMD and potential impacts to park resources, and are described in detail in Chapter 2. Recent in-situ qualitative data collected by NPS Water Resources Division staff with a water quality meter on May 17 and 18, 2016, revealed that current parameters are within previously recorded ranges, indicating that the sites are not self-remediating. The CMD sites, as shown in Figure 1-2, include (from north to south):

- Worley Mine #86
- Worley Mine #88
- Slavey Hollow
- Nancy Grave
- Devils Creek
- Laurel Branch Confluence
- Laurel Branch Stream Spoils
- Blair Creek

During the scoping process, a 9th site, the Blue Heron Spoils site, was also considered for inclusion in the EIS. That site was assessed by the USACE under a separate NEPA EA. The Blue Heron Spoils remediation was a separate project from this EIS. It was the result of an Incidental Take Statement and associated Biological Opinion (BO) that was issued by the U.S. Fish and Wildlife Service (USFWS) related to Wolf Creek Dam and Lake Cumberland operations (USFWS 2014), resulting in the subsequent development of conservation measures by USACE, NPS and USFWS that would improve habitat conditions within much of the historical reach of the Big South Fork River for the duskytail darter (*Etheostoma percnurum*), now

classified as the tuxedo darter (*Etheostoma lemniscatum*) (see Appendix C for photo). As a result, Blue Heron Spoils was removed from consideration in this EIS as a specific site; however, it is included under cumulative impact considerations. In addition, there are additional sites between Blue Heron Spoils and Laurel Branch Confluence that were not incorporated into the USACE remediation of Blue Heron Spoils. Consideration of these sites were addressed under the programmatic aspects of this EIS.

ENABLING LEGISLATION AND ACCESS

The Big South Fork NRRA must comply with laws and regulations pertaining to activities that are allowed or prohibited within its boundaries. The Big South NRRA was created on March 7, 1974, through the passage of the Water Resources Development Act. This act established 125,000 acres for the park. The Water Resources Development Act reads, in part:

…*conserving and interpreting an area containing unique cultural, historic, geologic, fish and wildlife, archaeologic, scenic and recreational values, preserving as a natural, free-flowing stream the Big South Fork of the Cumberland River, major portions of its Clear Fork and New River stems, and portions of their various tributaries for the benefit and enjoyment of present and future generations, the preservation of the natural integrity of the scenic gorges and valleys, and the development of the area's potential for healthful outdoor recreation.*

Section 108 (e) of the Water Resources Development Act establishes management objectives and land use restrictions within the Big South Fork NRRA. Restrictions within the gorge are defined within Section 108 (e) (2) (A) and cover the extraction of, or prospecting for mineral, petroleum products, and gas, the cutting of timber, the construction of structures, motorized transportation, and the existing routes for access to cemeteries.

Also, the Enabling Legislation addresses access within the Big South Fork NRRA gorge area specifically, stating that "No motorized transportation shall be allowed in the gorge area except on designated access routes, [and] existing routes for administration of the National Area…" Primary and secondary access road improvements are specifically defined in the legislation, with "All other existing roads in the gorge area shall be maintained for non-motorized traffic only…"

Access to the CMD sites must consider these requirements. However, the enabling legislation provides the park with access to the gorge for the "administration of the National Area", referred to as administrative access. As the proposed actions of this EIS represent an administrative project, the park is permitted to use administrative access to access the gorge. Administrative access may use "existing access routes", or access through the "construction of necessary access roads…in the furtherance of [administrative jurisdiction]. for the conservation and management of wildlife and natural resources."

The GMP established resource zones to characterize the resources and values identified in the enabling legislation. Impacts associated with proposed recreational activities, types and levels of development were evaluated across resource zones. An approved network of roads and trails for public access and recreation was established along with construction and maintenance

standards for all roads and trails. Administrative access for environmental remediation should evaluate resource benefits resulting from the proposed action along with recreational and other environmental impacts.

ISSUES AND IMPACT TOPICS

Issues were identified by the NPS through internal, public, and agency scoping. Consideration of environmental resources (natural, cultural, or social) that are influenced by, or related to, the proposed action leads to the identification of issues and impact topics. Issues and impacts are usually caused by no action or problems that might be associated with one of the alternatives considered, but can include questions, concerns, or other relationships, including those that may provide benefits.

The following impact topics are directly related to the remedy and treatment of CMD and have been identified for detailed analysis in this EIS.

Water Resources

The NPS is required to maintain or improve the quality of surface water and groundwater located within park boundaries (NPS 2004). The remediation of CMD sites would have a positive impact on the water quality of surface water by reducing the amount of contamination released into tributaries of the Big South Fork NRRA and areas impacted by CMD that flow directly into the river. The section of the Big South Fork River located between River Mile (RM) 54.8 and RM 44.3 is designated as an Outstanding State Resource Water (OSRW) and Outstanding National Resource Water (ONRW), which includes a portion of the selected CMD sites (the selected CMD sites are from approximately RM 42 at the Worley Mine sites to approximately RM 47 at the Blair Creek site). In addition, the Big South Fork River is designated as a Kentucky Wild River from the Tennessee / Kentucky border at approximately RM 55.2 to the Devil's Jump area at approximately RM 45.5.

Water quality of the Big South Fork River and associated tributaries could be affected from increased sedimentation during the construction or upgrade of access and from the movement or removal of soil and spoils during the construction at CMD locations. Sedimentation containing contaminants from CMD sites could directly affect sediment and water quality of receiving waters. Best practices will be implemented by the park to minimize sedimentation flow into the Big South Fork River.

Floodplains and Wetlands

Directors Order 77-1 (Wetland Protection) and 77-2 (Floodplain Management) provides guidance on wetland protection and floodplain management (NPS 2003, 2012b). In addition, Executive Order (EO) 11990 (Protection of Wetlands) requires NPS and other federal agencies to evaluate the likely impacts of their actions on wetlands. Some alternatives may necessitate work in the floodplain, including the placement of constructed wetland cells in floodplain environments. The placement of constructed wetland cells in floodplains could alter the land use on floodplains and affect floodplain plant and animal communities. Wetlands may be present at CMD locations and could be affected depending on the CMD technology installed at

individual CMD sites. Best practices, including avoidance, minimization, and mitigation, will be implemented by the park to reduce impacts to floodplains and wetlands.

Vegetation, Wildlife, and Aquatic Species, Federally Listed Threatened and Endangered Species, Species of Special Concern

The Big South Fork NRRA is required to protect federally listed species and critical habitats located within the boundaries of the park. There are 21 federally listed terrestrial and aquatic species found in the park, including 11 mussel species and 3 fish species. In addition, the Big South Fork NRRA contains 85 known state-listed threatened and endangered plant species. The various construction activities associated with accessing and treating CMD, as well as the no-action alternative, could affect these resources. The park will consult with the USFWS prior to any remediation activities at individual CMD locations.

Non-native species have spread to portions of the Big South Fork NRRA and have affected the health of some plant species or plant communities. There are numerous non-native species in the Big South Fork NRRA with plants comprising 70 per cent of all non-native species. The use of mechanized equipment could spread non-native plant species growing at the sites and introduce non-native species to CMD locations, especially during the construction phase at CMD sites.

Cultural Resources and Cultural Landscapes/Cultural Spaces

The Big South Fork NRRA has a long history of human activity that includes both prehistoric and historic populations. Archeological remains from the coal mining period continue to be important places on the landscape to the descendants of coal miners that worked the coal fields during the late 19th to 20th centuries. The Worley Mine #86 and #88 locations are examples of sensitive cultural resources that connect past coal mining activities to present communities. The Worley Branch Mine #86 and #88 is situated adjacent to a former mining housing complex, foundations associated with coal extraction activities, and former tramways, which can be found throughout the park associated with other mines. Tramways can also be associated with other mining related cultural resources, such as former scales. The construction of CMD technologies could affect cultural resources and cultural landscapes.

The GMP defines certain cultural spaces as having aesthetic value and must be protected by the park. Cultural spaces are areas that the NPS considers to have cultural importance and include former farmsteads, bridges, former mining communities, and railroad grades. Cultural landscapes and spaces are to be preserved with no unacceptable damage to these resources.

Topography and Soils

The Big South Fork NRRA contains unique topographic or geologic features that include arches, rock shelters, and chimneys. These features could be affected by access roads and remediation activities associated with some alternatives. Use of mechanized equipment could cause soil compaction and rutting of soils. Soil erosion could increase from the increased use of access roads and during the construction of CMD technologies.

Visitor Use and Experience

The presence of new access roads and/or new CMD technology could affect visitors to Big South Fork NRRA. Park visitors access and experience the park through roads that allow access to park facilities, the network of trails, and through recreational activities on the Big South Fork. Proposed remedial actions may require certain trails or portions of trails to be temporarily closed during the construction and maintenance of remedial technology. Also, park enabling legislation is very specific on prohibitions on the opening of new roads, so the opening of any new or historic access routes to CMD sites should be done using the least intrusive methods and should not be open for public use. New access routes and/or the construction of retention ponds and constructed wetland cells could be perceived by the public as impacting the natural setting/feel of the park. The use of motorized equipment for remediation work and possible O&M would be minimized on routes not specified in the legislation for motorized transportation as it relates to the requirement to protect the gorge. While access routes may be subject to frequent use during construction and infrequent use during periodic maintenance, the access routes would not be authorized for recreational trail use, unless access is on foot. The use of all-terrain vehicles (ATVs) in the park unit is an ongoing issue subject to management and enforcement actions. Noise levels may become temporarily elevated during the construction of CMD technologies. The park will use Best Management Practices (BMPs) to minimize increased noise levels during the construction phase at CMD sites.

TOPICS DISMISSED FROM FURTHER CONSIDERATION

Land Use

Land use includes natural conditions or human-modified conditions and activities occurring at a particular site. Human-modified land use categories include residential, commercial, industrial, transportation, communications and utilities, agricultural, institutional, recreational, and other developed use areas. Management plans and zoning regulations determine the type and extent of land use allowable in specific areas and are often intended to protect specially designated or environmentally sensitive areas. Because the impacts to land use from current or future CMD projects would be minimal, and there would be very little difference between impacts from the different alternatives, NPS has dismissed land use as an impact topic.

Environmental Justice

EO 12898 (59 Federal Register [FR] 7629; 1994) requires that Federal agencies address impacts to minority and low-income populations during a federal action. Based on the lack of low-income or minority populations near CMD locations and the beneficial effects to water quality from remedial activities, no adverse impacts to low-income or minority populations are anticipated, and there would be minimal differences between impacts from the different alternatives. Therefore, environmental justice was eliminated as an impact topic for this EIS. Additionally, EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, was intended to prioritize the identification and assessment of environmental health risks and safety risks that may affect children. With the exception of Big South Fork NRRA visitors, no children are present in the project area; no day-care facilities, schools, or other facilities with typically higher numbers of children occur in close proximity to the project area. At this time, there are no statistics available estimating the numbers of children that visit the Big South Fork

NRRA, including the project area, and there would be minimal differences between impacts from the different alternatives. Therefore, protection of children was eliminated as an impact topic for this EIS.

Air

Federal air regulations are provided in the Clean Air Act of 1970, which established national policy for preserving, protecting and enhancing air quality. Congress also mandates the federal land manager to "protect air-quality related values" including visibility, flora, fauna, surface water, ecosystems, and historic resources. It further directs the land manager to "assume an aggressive role in protecting the air quality values of land areas under his jurisdiction... In cases of doubt the land manager should err on the side of protecting the quality-related values for future generations."

The Big South Fork NRRA is designated a Class II air quality area under the Clean Air Act. Air quality in Class II areas is protected by allowing only limited increases over baseline concentrations of pollution for sulfur dioxide, nitrogen dioxide, and particulate matter, provided that National Ambient Air Quality Standards, established by the U.S. Environmental Protection Agency (USEPA) are not exceeded.

The proposed project would be accomplished through the use of traditional motorized construction equipment. Emissions created by the construction equipment could have minimal air quality impacts at localized areas within the Big South Fork NRRA. Construction activities related to CMD remediation and the development of access would require motorized vehicle and equipment use and could generate short term air quality impacts. These impacts would largely be confined to the CMD areas as remediation systems are implemented and vehicular traffic accesses the sites for construction. Because the impacts to air quality from the alternatives would be minimal, and there would be minimal differences between impacts from the different alternatives, NPS has dismissed air quality as an impact topic.

Additionally, in 2014, the Council on Environmental Quality (CEQ) provided guidance that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated greenhouse gas emissions, and the implications of climate change for the environmental effects of a proposed action. NPS has considered the contribution of this plan's actions to greenhouse gases emissions. The impact of this plan on greenhouse gas contribution and associated climate change has been deemed minimal, and that aspect of climate change is being dismissed.

Prime and Unique Farmlands

Prime Farmlands are monitored by the NRCS to ensure preservation of agricultural lands that are of statewide or local importance. The Farmland Protection Policy Act was passed in order to minimize the amount of land irreversibly converted from farmland due to federal actions. Prime farmland, as defined by the USDA NRCS, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. Soils designated as prime farmland are capable of

producing high yields of various crops when managed using modem farming methods. Designation of such lands is based on soil type present. Big South Fork NRRA contains seven soil associations that have been identified as prime farmland soils. They are: Allegheny-Grigsby, Lily Loam, Lonewood Clarkrange, Sequoia Silt Loam, Sequoia-Wernock, Sewanee Loam, and Wernock Silt Loam (NPS 2012a). There are no prime farmland soils within the eight specific CMD site areas described in this EIS, but prime farmland soils could be present at potential programmatic sites, as the extent of the potential sites is unknown at this point. However, as the impacts to prime farmland soils from current or future CMD projects would be minimal, and there would be very little difference between impacts from the different alternatives, NPS has dismissed prime farmland soils as an impact topic.

Tribal Indian Trust Resources

Tribal Indian Trust Resources (EO 13175) requires early consultation if a proposal is to have substantial direct effect on Tribal Indian Trust Resources. The proposed project area does not contain Tribal Indian Trust Resources, and as a result the proposed action would not affect these resources.

Socioeconomics Resources

Socioeconomic resources include land area and demographics, local economy, housing, shops and services, recreational facilities, and public and occupational health and safety resources. However, only local economy, shops and services, and recreational facilities would be impacted by the various alternatives, and these impacts would likely be negligible and short-term.

The Big South Fork NRRA contains five developed campgrounds (including two horse campgrounds: Station Camp Horse Camp and Bear Creek Horse Camp), one lodge (Charit Creek Lodge), a horse stable, two visitor centers, 11 vehicular river accesses, and numerous recreational opportunities. In addition, the Big South Fork Scenic Railway (owned by the McCreary County Heritage Foundation) is an NPS concessionaire. The Scenic Railway operates out of Stearns, Kentucky and offers trips along the historic tracks of the Kentucky and Tennessee (K & T) Railway, from Stearns through the Big South Fork NRRA to the Blue Heron historic mining community and north along the Big South Fork to Worley.

Recreational facilities and shops and services would be impacted under the action alternatives, as trail use would be temporarily limited during construction and O&M, but times of high visitor use would be accommodated by scheduling work during periods of lower visitation when possible (restricting work on weekends/holidays or during peak visitation months). Further, NPS would provide visitor notifications, reroutes, and detours along other access routes when possible. These impacts are expected to be temporary and likely negligible among the alternatives.

The local economy would also be impacted under the action alternatives. The influx of workers during construction and O&M phases is expected to be a positive impact on the local economy. However, due to the limited number of workers in comparison to an annual average of approximately 600,000 visitors, the impact is expected to be minimal or negligible, and temporary. The Big South Fork Scenic Railway ROW would be utilized to access potential

remedial sites (i.e., Worley #86 and Worley #88), and could be affected by the construction and O&M of remedial systems. However, due to coordination between NPS and the railway, no adverse impacts to the operation and revenue of the railway are expected, despite the proximity of the tracks to potential remedial sites.

The alternatives would likely have minimal or negligible impacts, and these changes would be similar among the alternatives, and would be short-term. As a result, socioeconomics were dismissed from further consideration, though aspects of recreational facilities impacts are addressed under Visitor Use and Experience.

Transportation

Transportation was dismissed from further consideration because the impacts associated with transportation are largely covered under more comprehensive impact topics (e.g. noise and detours/closures), while other impacts, such as traffic congestion, are expected to be negligible or minor, and would be temporary.

Transportation of materials (e.g. gravel, limestone, etc.) and equipment, along with commuting construction workers, could potentially increase local traffic congestion. However, given the size and scale of the potential CMD sites (e.g., the limited number of workers, equipment, and trucks per site), that remediation of all available CMD sites under an alternative likely would not be conducted concurrently, and that sites are distributed throughout the park on both sides of the river, these impacts are expected to be negligible or minor. For example, based on typical remediation projects, likely CMD site access (e.g., a Class 6 one lane road), and peak construction operations, a site could contribute an estimated 4 to 6 trucks per hour to local traffic. Though the counties that contain and surround the park are rural, truck transportation on local roads and highways is common, given local and regional resource extraction (e.g., oil and gas, logging, etc.), commercial and industrial operations, and transient traffic. For example, traffic on the portion of Highway 27 in McCreary County is comprised of approximately 15% trucks annual average daily traffic (AADT), and exceeds 1,000 trucks AADT (KYTC 2018).

The alternatives would likely have minimal or negligible impacts given the degree of existing local and regional truck traffic and the limited additional traffic that would be associated with remediation activities; further these changes would be similar among the alternatives due to the distribution of potential sites, and would be short-term. As a result, transportation was dismissed from further consideration, though aspects of traffic noise are addressed under Soundscapes and the Acoustic Environment, and detours and closures are addressed under Visitor Use and Experience.

Waste Disposal

The transportation and disposal of wastes would follow applicable federal and state laws for any materials removed during construction, remediation, and O&M. Wastes would be taken offsite for recycling or for disposal in a commercial landfill or other approved disposal site, as appropriate.

In regulatory terms, a hazardous waste is defined by the Resource Conservation and Recovery Act (RCRA) where the waste is specifically listed as a known hazardous waste or meets the

characteristics of a hazardous waste. Overburden and mining waste rock (i.e., spoils) are generally regarded as solid waste, not hazardous waste, as they were excluded from regulation under RCRA Subtitle C in 1980 when reused onsite. When transporting offsite, wastes from construction, remediation, and O&M would be recycled whenever possible, or would be subject to hazardous waste screening, as appropriate, to confirm that the wastes are non-hazardous prior to disposal. The production of hazardous waste is not anticipated; however, if required, hazardous waste transportation and disposal would follow all applicable federal and state laws for hazardous materials as defined by RCRA.

The transport and disposal of waste would not be expected to have adverse impacts, given that the processes would follow applicable federal and state laws. Additionally, the risk of solid waste releases would be expected to be very low, and potential releases would likely have negligible or minor impacts and would be short-term (for example, release of waste spoil material during a traffic accident would be mitigated with subsequent removal of released rock and soil during the accident cleanup). As a result of the low likelihood of hazardous waste generation and the expected degree of potential impacts from the transportation and disposal of all waste types, waste disposal was dismissed from further consideration.

PLANNING DOCUMENTS

Management of the Big South Fork NRRA is driven by the U.S. Congress' intent for the area, as well as NPS regulations, to conduct management planning in order to ensure that development or non-development of the Big South Fork NRRA is conducted in a well-suited, environmentally-sound, orderly manner. Under requirements mandated by Congress and subsequently the NPS, the Big South Fork NRRA has been operating under a GMP and associated management documents.

Big South Fork National River and Recreation Area Resource Management Plan (1996)

The Resource Management Plan for the Big South Fork NRRA identifies the present status of natural and cultural resources of the park (NPS 1996) and provides an overview of the resource management programs and needs.

Big South Fork National River and Recreation Area Water Resources Management Plan (1997)

The Water Resources Management Plan addresses water quality and quantity issues, and their monitoring and management. The purpose of the plan is to assist the Big South Fork NRRA managers in making decisions and establishing priorities for the protection, use, conservation, and management of the waters and water-related resources of the park unit. The plan evaluates the existing conditions of water resources, identifies water-related resources issues, and guides future management decisions (NPS 1997).

The Water Resources Management Plan addresses water quality by listing the following goals:

- Maintain, and where needed, restore a high-level water quality to support natural ecosystem functioning and healthful water based recreation

- Maintain and enhance a water resources inventory and monitoring program that accurately reflects the condition of water resources, detects changes and impacts, and provides a useful basis for Big South Fork NRRA management decisions. Attributes that represent the condition of water resources include habitat, biological, physical, and chemical parameters
- Develop and maintain a regular data management and analysis program, including development of a Geographic Information System (GIS) database
- Ensure that development and operations do not adversely affect water resources and water-dependent environments
- Preserve the Big South Fork River, major portions of the Clear Fork and New River, and portions of their various tributaries, as natural free flowing streams
- Restore and maintain natural aquatic, wetland, and riparian environments in which natural, physical, chemical, and biological processes function with minimal interference

Big South Fork National River and Recreation Area Final General Management Plan/Environmental Impact Statement (2005)

NPS uses general management planning to establish the resource conditions and visitor experiences that should be achieved and maintained by a specific unit of the National Park System over time. The GMP for the Big South NRRA provides a clearly-defined direction for resource protection and visitor use at Big South Fork NRRA for a period of 15-20 years. The plan established a management zone system representing area-specific applications of management objectives, a resource management strategy that addresses the complexity of issues both inside and outside the boundaries of the park unit, enhanced and expanded visitor-oriented programs to provide opportunities to experience the values of the park unit, and boundary expansion. Overall, the development level and types of facilities proposed over the planning horizon of 15 to 20 years would remain essentially the same. Specific to CMD, the GMP includes that “Special projects, including management of oil and gas activities, reclamation of contaminated mine drainage, native species management, cultural landscape identification and management, and increased monitoring, would be continued or initiated” (NPS 2005).

The GMP defines the road and trail classification and standards for roads and trails located within the park. The GMP also defines the different types of roads and trails and the types of use that can be conducted on each access type. The GMP discusses the recreational use of the park’s road and trail system. While the GMP does not specifically address roads and trails for CMD treatment, some alternatives may require the improvement of roads and trails or the construction of temporary access roads. The use of existing roads and trails is discussed in more detail in Chapter 2.

NPS Management Policies 2006

The NPS Management Policies (2006a) provide the overall function, set the framework, and provide direction for management decisions within the NPS. Management policies cover park system planning, land protection, natural resource management, cultural resource management, interpretation and education, use of parks, park facilities, and commercial visitor services. The policies guide NPS staff to manage NPS units consistently and professionally.

Adherence to NPS policy is mandatory, unless specifically waived or modified by the Secretary of the Interior, or Director of the NPS.

Section 4.6.3 of NPS Management Policies discusses water quality issues. This policy recognizes that the pollution of surface water and groundwater by point and non-point sources can impair natural resources and diminish the utility of park waters for visitor use and enjoyment. It is the policy of the NPS to prevent the pollution of park waters. This policy states that the NPS shall:

- Work with the appropriate governmental bodies to obtain the highest possible standards available under the CWA for the protection of park waters;
- Take all necessary actions to maintain or restore the quality of surface waters and groundwater within the park.

Big South Fork National River and Recreation Area Non-Federal Oil and Gas Management Plan/Environmental Impact Statement (2012a)

The Non-Federal Oil and Gas Management Plan and its associated EIS for the Big South NRRA provides a programmatic plan guiding oil and gas activities in the park and introduces Special Management Areas (SMAs) and distance setbacks from SMAs, which are relevant to potential remediation activities that may occur under alternatives presented in this EIS.

CHAPTER 2: ALTERNATIVES

INTRODUCTION

This chapter describes the actions that could be considered for future treatment at CMD sites in Big South Fork NRRA. The NEPA requires that federal agencies consider the proposed action and a range of reasonable project alternatives, and analyze impacts these alternatives could have to the environment. The proposed action is for Big South Fork NRRA to treat CMD through the most efficient remedial approach available. The range of project alternatives must include a "No Action" alternative, as required by NEPA regulations at 40 Code of Federal Regulations (CFR) Section 1502.14. Under the No Action, or No Remediation alternative, no action would be planned for the remedial treatment of CMD in Big South Fork NRRA. The proposed action, together with the alternatives to the proposed action and the no-action alternative, are collectively referred to as the "alternatives" within this EIS.

A discussion of the background on CMD technology is included to understand the project alternatives, including the types of remedial approaches and level of effort needed to operate and maintain the different technologies. The No-Action alternative and action alternatives selected for detailed analysis are briefly described. The remainder of Chapter 2 provides a detailed description of the methods and alternatives considered, analysis of the eight selected CMD sites, alternatives that were considered but eliminated from detailed analysis, and identification of the initial proposed action, the agency's preferred alternative, and the environmentally preferred alternative.

TYPES OF CMD REMEDIAL APPROACHES

There are three primary remedial approaches that have been developed to treat CMD: active treatment, passive treatment, and source control. These approaches were developed to raise the pH in the water and to decrease the concentration of metals in the water. Active and passive treatment systems can include constructed wetland cells, the addition of chemicals to the water, or methods to raise the pH of the water which aids the precipitation of the potentially harmful contaminants out of the water column (Table 2-1 and 2-2). Source control separates the elements (air, water, and metal and non-metal constituents) that produce CMD, usually by diversion, capping, segregation, and removal (Costello 2003). Additional detail on the types of CMD remedial approaches is provided in Appendix D.

The type of remedial approaches that are considered by NPS are influenced by the physical and chemical properties present (i.e., water quality), the local topography and required access to implement an approach, and the costs associated with an approach. Chemical properties of CMD that influence the selection of the remedial approach include alkalinity, acidity and pH, and the volume and flow rate of the affected water. Additional constraints influencing the suitability of a treatment method include potential environmental impacts that would result from constructing access and the remedial approach.

ALTERNATIVES DEVELOPMENT PROCESS

The project alternatives were developed in consideration of public comments and consultation with state and federal agencies to meet the Purpose and Need of the project to a large degree and the objectives developed for the project. During the alternative development process, park documents were reviewed that included previous water quality reports, the park GMP, and other relevant documents. A field visit was conducted by the IDT to a few selected CMD sites to observe the current conditions. The action alternatives evaluated in this EIS were crafted based on the environmental impacts and their ability to meet the Purpose and Need of the project. The proposed action, or "the initial NPS proposal to address a purpose and need," is Alternative 2 (Full Access). Additional options for the proposed action based on access limitations that might also meet the project Purpose and Need were identified by the IDT and are expressed as Alternative 3 (Moderate Access) and Alternative 4 (Minimal Access). Because these action alternatives would be technically and economically feasible, they are considered to be "reasonable" alternatives.

Overview of Project Elements

The IDT identified the different elements of a CMD project that would most heavily influence the improvement to resources. The intent was to include within each action alternative those elements that could result in environmental impact during the life of the remedial action. These different elements were used as a starting point to develop and analyze each alternative. The primary elements of any CMD remedial project at BISO are access to the site, the CMD remedial approach selected, and the operations and maintenance associated with the remediation.

Access

The Big South Fork NRRA established guidelines for the management of existing access infrastructure in the GMP. The GMP designates park access as trails or roads. All three action alternatives would need some level of access to implement the remedial approach at CMD sites. For the purpose of this document, access is defined as the path by which necessary equipment can travel from a paved public road through the park to the CMD site. Throughout the park there is an extensive system of historic and currently maintained roads and trails which could be utilized as access to a CMD site.

Depending on the equipment requirements of the selected remedial approach, the O&M requirements, the CMD site, and the condition of the road and trail system, it could be necessary to clear, widen, construct and/or repair the selected access pathway. Most of the potential CMD sites are remote, and though there may be historic access to a site or adjacent to a site, most of the historic access (e.g. former tram ways and extraction roads) has had decades to become reclaimed and revegetated. In addition, even in areas with existing adjacent access that is currently maintained, access would likely need to be extended from a road or trail into the site to provide actually entry for remediation, due to the terrain in Big South Fork NRRA.

Access routes not included in the current road and trail system that would be needed for future O&M activities would be maintained at a minimal standard to keep the road intact, reduce

erosion, and prevent growth of trees that could inhibit future access. Some routes would only be used temporarily during construction of CMD treatment systems, would not have ongoing O&M, and would be allowed to revegetate. Routes not identified in the GMP would not be designated for vehicular, horse, or recreational access. Such use designations are important for visitor experience as it allows park visitors to plan their recreational experience: hiking, biking, or horse riding.

CMD Remedial Approach

The prevention, remediation, and/or control of CMD may be accomplished through active treatment systems, passive treatment systems, or source controls. The individual CMD remedial approaches would vary in their effectiveness at treating CMD, their footprint, and their O&M requirements.

Operations and Maintenance

All three action alternatives would need some level of O&M and would vary depending on the type of remedial approach used at individual CMD sites. The site-specific frequency and magnitude of the O&M would vary depending on the CMD remedial approach used and the characteristics of the CMD site. Low O&M would include allowing for partial reclamation of access routes that were used to install the remedial option, while high O&M refers to those access routes that would require the route be maintained to support frequent O&M at the CMD location.

ELEMENTS COMMON TO ALL ALTERNATIVES

The following sections provide descriptions of elements, which are portions of the issues and impact topics discussed in Chapter 1, that are common among the action alternatives, including requirements and mitigation measures. As a result, they are generally not discussed in this EIS beyond this section; the portions of the issues and impact topics that differ between alternatives, are subsequently progressed throughout this EIS.

Preliminary Investigations to Support the Selection of Remedial Action

Regardless of alternative, preliminary investigations would likely be needed to quantify the physical and chemical characteristics of CMD. Prior to the commencement of remedial activities at a CMD site, data would be collected, as necessary, to determine the appropriated final remedial design and subsequent action. This could include a general feasibility study/cost analysis (using tools such as the OSM's AMDTreat software) to determine if water quality improvements are able to be implemented and are cost-effective. The NPS could construct temporary access routes to selected sampling sites if necessary. Once the sampling is completed, the temporary access routes would be allowed to revegetate and return to natural pre-disturbance conditions, where appropriate. The re-establishment of native vegetative communities would be accomplished by seeding with native plants and using straw to mulch and stabilize soils, or in the case of small treatment areas, allowing native vegetation to reclaim the area naturally. Only park-approved native plant species and/or native seed mixtures would be used, while seeding would meet the NPS standard of an 80% survival rate for two years.

The NPS would also employ a plan to minimize the introduction of exotic plants into these disturbed areas.

If necessary, prior to preliminary sampling, surveys for threatened and endangered species (including fish, mussels, and bats, as appropriate) and cultural resources would be conducted. If the construction and use of temporary access could impact a federally listed species or its critical habitat, the NPS must comply with Section 7 (a) (2) of the Endangered Species Act (ESA), which requires federal agencies to ensure their actions do not jeopardize the continued existence of federally listed species or adversely modify any critical habitat. If cultural resources are present and could be affected by activities associated with the construction of temporary access routes, coordination between the NPS and the Tennessee or Kentucky State Historic Preservation Offices (SHPO) would be required to determine the appropriate actions and mitigation measures to minimize, to the extent possible, any adverse impacts to those resources, and to ensure Section 106 compliance.

Special Management Areas

SMAs were defined in the Non-Federal Oil and Gas Management Plan / EIS for the Big South Fork NRRA and the Obed Wild and Scenic River (WSR) (NPS 2012a). SMAs were developed to protect park resources by permitting oil and gas operations under specific operating stipulations. The park developed the operating stipulations that may affect resources such as geology, cultural resources, visitor experience, state and federally listed species, viewsheds, state natural areas, and state listed plant communities organized by SMAs. The park has designated five SMAs for Big South Fork NRRA. Under all action alternatives, these areas would be avoided to the extent possible while implementing the CMD remedial approach, or mitigation would be implemented to protect identified values. The specific SMAs are described briefly below, and additional information on SMAs is provided in Chapter 3.

- Sensitive Geomorphic Feature SMA – This SMA includes sensitive geomorphic features and includes rock shelters, arches, chimneys, natural bridges, waterfalls, and windows.
- Cliff Edge SMA – Cliff edges are defined in the GMP for the park unit as the exposed, rocky, sparsely vegetated, sandstone outcrops along the rim of the gorge. They can be found along the main gorge of Big South Fork NRRA and up the valleys of many tributaries.
- Visitor Experience/Administrative Area SMA – This SMA includes those areas identified in the park GMP as First Order Development and Visitor Use Zones.
- Trails SMA – This SMA includes all designated trails identified in the GMP. Visitor experiences and values occurring in visitor use areas, including along trails of the park unit, should be protected from all potential impacts, including CMD remediation.
- Cultural Landscapes and Cemeteries SMA – This SMA includes 61 known cemeteries in the park unit and 7 cultural landscapes.

Cultural Resources

The Big South Fork NRRA has a long history of human occupation extending from 12,000 years Before Present (BP) to the present. Prior to remedial activities at a CMD site under any action alternative, field surveys, as necessary, would be conducted in consultation with the appropriate

SHPOs to determine if cultural resources that are eligible for listing in the NRHP are present; in addition, if resources are discovered during surveys, eligibility would be considered.

Plant Communities

Prior to remedial activities at each CMD site under any action alternative, field surveys, as necessary, would be conducted or coordinated by NPS to determine if threatened and endangered plant communities are present in areas of disturbance associated with the CMD remedial approach.

Wildlife

Prior to the construction of remedial approaches, the NPS would consult with the USFWS to determine if field surveys are needed to identify threatened and endangered species or bats and bat habitat at CMD sites for any of the action alternatives. If field surveys are necessary, the NPS would conduct or coordinate identification surveys to determine if such species are present at CMD sites.

Aquatic Habitat

During the construction and O&M phases, the NPS would use protective measures to control and limit soil erosion that could result from construction activities and increased vehicle traffic to protect nearby streams under any of the action alternatives. Any remedial treatment would also be designed to limit the potential of sediment transport from CMD areas to streams.

Geology

The NPS would follow the guidelines to protect sensitive geomorphic features and cliff edges as stipulated for the protection of SMAs under any of the action alternatives. Additionally, the NPS would engineer any CMD remedial approach to maintain slope stability.

Wetlands

Prior to the implementation of an action alternative, the NPS would conduct field surveys to identify if wetlands are present at individual CMD sites. No detailed wetland delineations have been conducted for CMD remedial sites. The NPS would avoid wetlands wherever possible or conduct USACE compensatory mitigation when avoidance is not feasible. The proposed remedial activities for the selected sites meet the exemption criteria for the Wetland Statement of Findings (WSOF) requirements under DO-77-1 Section 4.2.2(9). It is likely that programmatic sites will also meet the exemption criteria, but a WSOF evaluation would be completed for programmatic sites on a case-by-case basis once more detail is known.

Floodplains

The NPS would avoid the construction of structures on floodplains whenever feasible under an action alternative; however, some CMD sites are located within the designated floodplain and would require remediation activities to occur within the floodplain. The proposed remedial activities for the selected sites are excepted from Floodplain Statement of Findings (FSOF) under Procedural Manual 77-2 (which implements EO 11988) based on the proposed activities. It is likely that programmatic sites will also be excepted, but a FSOF evaluation would be completed for programmatic sites on a case-by-case basis once more detail is known.

Visitor Experience

The NPS would minimize the closure of access during the construction phase and O&M phase through the timing of construction and O&M activities under any of the action alternatives.

Park Management and Operations

Park management and operations refer to the adequacy of staffing levels and the quality and effectiveness of park infrastructure in protecting and preserving vital resources and providing for an effective visitor experience, which would be common to all alternatives. Park infrastructure facilities include roads that provide access to and within the park (for administrative, visitor, and emergency use), housing for staff required to work and live in the park, visitor orientation facilities (visitor centers, developed and interpreted sites, and other interpretive features), visitor amenities (including lodging and food service), administrative buildings (park staff offices and workspace), management-support facilities (garages, shops, storage buildings and yards used to house and store equipment, tools, and materials), and utilities (phones, sewer, water, and electricity) (NPS 2012a).

Currently, Big South Fork NRRA has approximately 55 full-time employees and the number of seasonal employees varies from year to year based on available funds. It is expected that CMD remediation would require an increased workload for some staff for coordination, review of plans, oversight of construction and compliance, site inspections, and operation and maintenance activities/coordination. These requirements would be greatest during construction activities and would be short-term (a few weeks to a few months). O&M is expected to require infrequent staff involvement on a short-term basis (few days to weeks), but could increase as the number of treated CMD sites increases.

Staffing and O&M for CMD Remediation

Implementation of programmatic or selected site remediation would likely include additional studies, research, planning, surveys, and other tasks prior to construction, and sampling, O&M, monitoring, and other similar activities following implementation of any of the action alternatives. These activities would necessitate the allocation of NPS staff (or contractors), along with additional resources. As a result, the development of a remedial approach for each location would consider the NPS staff allocation and long-term O&M cost implications in order to secure the appropriate staff and funding prior to commencing remediation for a site.

SELECTED CMD SITES FOR ANALYSIS IN THE EIS

While the EIS is programmatic and provides a management framework for the NPS to install and maintain remedial treatment systems throughout Big South Fork NRRA, eight specific CMD sites were selected for analysis as part of the EIS (Figure 1-2). Data from water quality studies that were conducted by AMEC (in 1997) and by Gannett Fleming, Inc. (in 1998) for the NPS, were used to analyze each CMD site within the three action alternatives. While these data provide a historic context to construct preliminary conceptual designs, additional investigations would be needed at the eight CMD sites to finalize and refine the proposed remedial treatment systems. These eight CMD sites would be analyzed under each alternative. The NPS would conduct remedial actions at individual CMD sites after site-specific analysis and compliance with

the NEPA and other applicable state and federal laws. Prior to any remedial activity, the NPS would obtain required permits and comply with NEPA and other applicable laws on a case by case basis as funding becomes available to treat CMD at individual sites.

Worley Mine #86 Site

The Worley Mine #86 site is located on the eastern side of the Big South Fork River (Figure 1-2). A wet seal was placed at Worley #86 in an attempt to minimize the formation of CMD. The wet seal consists of a wall constructed across the mine opening that allows for water to flow out of the opening but prevents air from entering the mine. The CMD produced at Worley #86 is entering Worley Branch from a single entry, discharging from the wet seal, approximately 760 ft upstream of the Big South Fork Scenic Railway.

Worley Mine #88 Site

The Worley Mine #88 site is located on the eastern side of the Big South Fork River approximately 1/3 mile south of the Worley Branch/Big South Fork River confluence (Figure 1-2). The mine entry is located on the north side of an unnamed tributary to the Big South Fork River south of Worley Branch. The site consists of a single gated entry discharging through a weir. A second entry is located directly under an ephemeral waterfall directly adjacent to the southern side of the gated entry; the second entry appears to be sealed, with a 6-inch polyvinyl chloride (PVC) pipe protruding (known as a critter pipe). The area around the gated entry is small (less than 0.25 acre) and there is no tramway road leading to the site at the seam elevation. The Worley Mine #88 discharge flows from the adit into a ditch directly to the Big South Fork River. This area lies immediately adjacent to the Big South Fork Scenic Railway.

Slavey Hollow Site

The Slavey Hollow site is located on the western side of the Big South Fork River in the northern portion of the park (Figure 1-2). The mine entry associated with the discharge point is located approximately 1,000 ft upstream of the confluence of Slavey Hollow and the Big South Fork River, on the south side of the stream, and consists of at least two sealed portals. A second entry is located on the northern side of the stream, but appears to be sealed with a 6-inch PVC critter pipe protruding, and is not discharging CMD. The southern mine entry is currently discharging through a sealed entry via an 18-inch corrugated plastic pipe, and through a naturally-occurring seep. The side slopes of the stream channel and overall drainage are extremely steep and contain many bluffs with vertical slopes.

Nancy Grave Site

The Nancy Grave site is located on the western side of the Big South Fork River approximately 3,000 feet upstream of the confluence of Big South Fork River and Roaring Paunch (2,000 feet from the Kentucky Trail) in the central portion of the proposed remediation sites (Figure 1-2). Approximately 200 ft upstream of the Nancy Grave drainage confluence with the Big South Fork River, mine spoils extend from the creek banks upslope 70-80 ft to the coal seam level, as indicated by the former mining tramway. The stream flows subsurface above the tramway, where large amounts of spoil were placed in the drainage. A ravine, which conveys this water once it re-emerges, has developed below the tramway and subsequently merges with the natural, pre-mining stream channel approximately 200 ft downstream. The stream emerges at

the base of a spoil pile as a seep near this location. Nancy Grave drainage is also being impacted on the south side of the creek by CMD emanating from a 1,000 square foot seepage zone lateral to an existing powerline ROW. The seepage appears to flow directly to both the Big South Fork River and Nancy Grave drainage.

Devils Creek Site

The Devils Creek site is located on the western side of the Big South Fork River just north of the trestle located at Blue Heron (Figure 1-2). CMD enters Devils Creek from diffuse discharge points along the steep spoil-covered side slopes on the northern side of the creek (AMEC 2003). The mine entries contributing to these diffuse discharge points have been sealed and the actual elevation of the entries is approximately 840 ft, approximately 40-50 vertical ft below the mine tramway. The diffuse discharge points are located in an approximately 1-acre area below the tramway.

Laurel Branch Confluence Site

The Laurel Branch Confluence site is located approximately 800 ft downstream (to the north) of the confluence of Laurel Branch and the Big South Fork River. This site consists of approximately 1-2 acres of partially re-vegetated spoils. The spoils extend steeply up from the eastern bank of the Big South Fork River at near-vertical slopes. These slopes have been cut away by erosion during river high flow events. The base of the spoil piles contains partially pyrolized spoil below loose material. The top of the spoils are slightly higher than the alluvial terraces along the river, which are visible near the southern limits of the site. From the crest, the spoils extend at a slight grade into the hillside, which is covered with spoil but is well vegetated. CMD seeps flowing directly into the Big South Fork River occur at the base of these spoil piles.

Laurel Branch Spoils Site

The Laurel Branch Spoils site is located on Laurel Branch on the eastern side of Big South Fork River, in the southern portion of the Kentucky section of Big South Fork NRRA. The Lee Hollow Loop horse trail traverses the Laurel Branch Spoils site and crosses Laurel Branch at a sandstone crossing.

Historic mining operations in this drainage basin left spoil piles alongside slopes and within the Laurel Branch stream channel. As a result, approximately 100 ft of Laurel Branch is impacted by partially pyrolized spoil piles. In addition, the area upstream of the spoil piles is filled with permeable alluvial deposits, which allows groundwater to flow unimpeded into the contaminated spoil areas, where it accumulates contaminants and continues into Laurel Branch.

Water quality of Laurel Branch deteriorates as it flows through the mine spoils. Below the spoils, the stream exhibits depressed pH, increased acidity, and increased metal concentrations during low flows, while upstream water quality parameters reflect the absence of CMD impacts (Gannett Fleming, Inc. 1998).

Blair Creek Site

The Blair Creek site is located on the eastern side of the Big South Fork River (Figure 1-2). There are two adits present on the south side of Blair Creek that are gated and are not discharging CMD. However, CMD enters the stream for approximately 1,500 ft along both sides

of Blair Creek. Seeps below the adits on the toe slope of tailings, just above the Blair Creek stream elevation, may be connected with old mine works along with another adit located on the north side of the stream that has been closed with a "wet seal". The mine maps indicate that a mine pool is located approximately 20 to 50 feet from the seepage locations. A mine pool is a portion of mine workings that has been flooded. Pools can be fed by streams, groundwater, or precipitation, and can hydraulically connected to discharge points, which can subsequently result in a continual CMD.

DESCRIPTION OF THE ALTERNATIVES

A comparison of the alternatives by project element is included as Table 2-5. The following approaches are the recommended remedial options based on current technologies and site conditions, particularly for the selected remedial sites. Impacts in subsequent sections are footprint-based to accommodate for advances in technology that would have the same (or smaller) footprint than the currently recommended approach, but would more efficiently and appropriately treat CMD.

Alternative 1: No Remediation

Programmatic Sites

Under the No Remediation alternative, current conditions and management strategies for treating CMD sites would remain unchanged. The park may periodically monitor these sites. If the No Remediation alternative is selected, CMD sites would continue to produce contaminated water, and poor water quality would persist in many of the tributary streams, surface water and rivers found within the park. Under the No Remediation alternative, no action would be planned for the remedial treatment of CMD in Big South Fork NRRA. The NPS would have to initiate remediation on a case by case basis.

Selected Remedial Sites

Similar to the programmatic discussion above, under the No Remediation alternative, current conditions and management strategies for treating CMD at each of the eight CMD sites would remain unchanged. The park may continue to monitor these sites. If the No Remediation alternative is selected, CMD sites would continue to produce contaminated water and poor water quality would persist in many of the tributary streams, surface waters, and rivers found within Big South Fork NRRA.

Alternative 2: Full Access (Proposed action)

Programmatic Sites

Under Alternative 2, NPS would develop the programmatic management framework to remediate CMD sites located within Big South Fork NRRA to ensure long-term protection of the park resources and values. NPS would ensure that park resources are protected during the construction of new access, maintained access, upgrades of existing access, and the CMD remedial approach and its necessary O&M. As access would not be limited, most treatable CMD sites could be accessed for remediation (Table 2-3). An estimate of up to 17 CMD sites could be remediated under the programmatic implementation of Alternative 2 for the purposes

of evaluation in this EIS (Figure 1-3). Additionally, all 8 specific sites described in Chapter 1 could also be remediated. Details for the specific sites are given after the programmatic discussion.

Access

Under Alternative 2, the NPS would have no restrictions to the development and maintenance of access (Table 2-4). NPS could use existing routes identified in the current GMP with the ability to widen routes for CMD construction and long-term maintenance, redevelop and/or improve historic routes to the sites for construction and maintenance, or build new roads as necessary for construction and maintenance. Access to the CMD site could range from the use of the existing system of roads and trails with no vegetation clearing to the creation of new access roads.

The development of access is not restricted to the existing access width or capacity; however, whenever possible, roads would not exceed those standards of the Class 6 (non-public) administrative road. The GMP defines these standards as a width of 8-12 ft, 12-16 ft cleared ROW and a 12-ft cleared height. Following the completion of the proposed remediation measures and depending upon future monitoring and O&M requirements, the proposed access routes would be restored to the existing width according to the appropriate NPS trail standards; however, gravel and rock placed for surface improvements may be left within the trail surface and/or removed and hauled to a designated area approved by the NPS. Side banks would be replanted using the NPS approved planting list of native plants. Revegetation would be accomplished by seeding and using straw to mulch and stabilize soils, or in the case of small treatment areas, allowing native vegetation to reclaim the area naturally; seeding would meet the NPS standard of an 80% survival rate for two years. During construction, temporary erosion control measures would be installed on these access roads and trails according to BMPs, such as silt fences and water breaks, sedimentation basins, filter fences, sediment berms, interceptor ditches, straw bales, rip-rap, or other sediment control structures. BMPs are discussed in further detail in Appendix F.

The use of temporary access would be preferred, but if needed, new access could be constructed to a particular CMD site. Under this alternative, there would be no restrictions to the type or level of upgrades or improvements to existing access.

- NPS could construct new permanent access routes with no restrictions to grade, length, ROW width, or height clearance. Permanent access routes, not associated with the established GMP trail system, would not be for public use but would be maintained, as required, by the NPS.
- NPS could construct new, temporary access routes with no restrictions to grade, length, ROW width, or height clearance. After work is completed, temporary access roads would be gated off from further vehicular, horse, and recreational access, and natural revegetation of the temporary access route would be allowed to occur or reclaimed with native vegetation as needed based on future access requirements.
- NPS could improve/upgrade existing access with no restrictions to grade, length, ROW width, and height clearance. Natural revegetation of the temporary access

route would be allowed to occur or reclaimed with native vegetation as needed based on future access requirements. Upgrades or improvements could include the filling of low areas, washouts and large ruts. Temporary access could be placed to bypass areas where upgrades or improvements are not sufficient to make a portion of existing access useable.

Though all levels of access development are approved for this alternative, it does not imply they would be utilized; the park would minimize impacts at all stages of the alternative to the extent practicable.

CMD Remedial Option
Under Alternative 2, the NPS could consider the CMD technology that balances the desired water quality improvement with impacts to the environment related to the construction and O&M of CMD remedial approach. The selection of the CMD technology would be made on a case by case basis, considering the balance between impacts to resources and the improvement of water quality. All suitable CMD technologies could be considered by NPS.

Operations and Maintenance
Under Alternative 2, the NPS could consider CMD technology with no restrictions to the frequency and timing of O&M. Access could be maintained to support the most appropriate equipment for the selected O&M to achieve the maximum improvement in water quality.

Selected Remedial Sites
Worley Mine #86
Under Alternative 2, access to the Worley Mine #86 would be accomplished along 0.55 mile (mi) of the existing Worley Road (Figure 2-1). Worley Road is an existing gravel road that is maintained by the county and NPS, and currently supports vehicular traffic.

Under Alternative 2, the remedial treatment system would consist of the following:

- NPS would collect CMD from the mine adit prior to oxidation via a wet seal and direct it to a 1,500 ton capacity ALD that would be approximately 150 ft long.
- The stream flow of Worley Branch upstream of the CMD would be diverted through a culvert to bypass the remediation area and prevent contamination.
- NPS would direct CMD from the ALD into an approximately 0.33 acre settling pond (Wetland Cell 2), followed by a 0.33 acre constructed aerobic wetland, Wetland Cell 1. These two aerobic cells would be constructed within the Worley Branch drainage basin. This constructed wetland treatment system would stretch approximately 600 ft from the ALD to just above the existing Big South Fork Scenic Railway. Treated discharge from the wetland cells would be piped beneath the railroad bed to the Big South Fork River.

Under Alternative 2, O&M would consist of dredging the wetland cells every 10 to 30 years, refilling, and revegetating. This material would be disposed of at an approved off-site location. Native vegetation and grading in the 2 to 3 years following construction may be required. In addition, it would be necessary to replace or maintain the limestone in the ALD every 15 to 20

years. There would also be periodic CMD and system effluent sampling to gauge remedial effectiveness, and small maintenance activities to ensure the system is working correctly.

Worley Mine #88

Under Alternative 2 access to the Worley Mine #88 site could be accomplished along the existing Worley Road and the existing corridor of the Big South Fork Scenic Railway (Figure 2-2). Vehicles and equipment would travel 0.62 mi down Worley Road, cross the railroad tracks, then travel 0.36 mi along a temporary road south to the mine between the tracks and the river (western side of the railroad tracks), then re-cross the tracks at Worley Mine #88 with 0.06 mi of new access to the site. The limited space between the hillslope cut and the railroad tracks does not permit access on the eastern side of the tracks.

The temporary road along the railroad would not exceed those standards of the Class 6 (non-public) administrative roads: a width of 8-12 ft, 12-16 ft of cleared ROW, and a 12-ft cleared height. Side banks would be replanted using the NPS recommended planting list of native plants. During construction, temporary erosion control measures would be installed according to NPS BMPs. Following the completion of the proposed remediation measures, the road would be gated off and would not be maintained, though gravel and rock placed for surface improvements may be left and/or removed. The road may be reopened for a short time period (less than a month) to perform O&M as required, but would follow the same standards as the road that was constructed during the installation of the remedial approach.

The treatment system for the Worley Mine #88 has not been determined and would require additional data prior to selecting a remedial approach. For subsequent sections, a generalized and expanded conservative footprint is utilized to accommodate various remedial options. However, a remedial system could consist of one of the following examples:

- NPS could seal the mine entry at the Worley Mine #88 and pump the CMD using a piping system up to Worley Mine #86 for treatment.
- The mine entry at the Worley Mine #88 site may be physically and hydrologically connected to Worley Mine #86. As discussed in Chapter 1, miners from the 1 seam mined from upward until they intersected the existing workings in the 1½ seam. This connection may allow the designers of the remediation system to use innovative methods to treat the discharge at Worley. Though further geological study would be required, the hydrologic connection may make it possible to apply the mine seal and divert the CMD via backflow to Worley Mine #86 for treatment.
- NPS could also install ALDs or dosers, or use a combination of approaches to develop a remedial system to treat the CMD at the Worley Mine #86 point of discharge.
- The construction of anaerobic passive treatment might also be used, but requires large wetland cells. Because the wetlands can issue noxious odors and would be located near the railroad tracks, and as space is limited due to the railroad tracks, wetland treatment may not be a viable option due to sufficient space and visitor experience.

The O&M requirements are unknown at this time, as the remedial approach for Worley #88 has not been determined. Regardless of the approach that is selected, there would be cost and

staff availability implications tied to O&M, such as periodic monitoring of the remedial structures or system, dredging wetlands, replacing limestone in ALDs or dosers, testing pumping equipment, or checking to see that mine seals have not caused CMD to be discharged at another location.

Slavey Hollow Site

Under Alternative 2, access to the Slavey Hollow site would be accomplished through the construction of a temporary access road that would originate along Wilson Ridge Road. The access route would continue east 0.48 mi along a former logging road, crossing 1 small stream, and then south along 0.66 mi of former tram rail bed, crossing 3 additional small streams. From the old tram rail bed, approximately 0.09 mi of new access to the mine entry and location of the wetland cells would be required, which may overlap with a historic extraction road (Figure 2-3).

The access road would follow the standards of a Class 6 (non-public use) administrative road. During construction, temporary erosion control measures would be installed on access roads and trails per NPS BMPs, and side banks would be replanted using the NPS recommended planting list of native plants. After the remedial treatment system is installed, the temporary access road would be gated off and would not be maintained by the NPS; however, gravel and rock placed for surface improvements may be left within the trail surface or removed to a designated area. Natural revegetation of the temporary access route would be allowed to occur. The temporary access could be reopened for a short time period (less than a month) to perform O&M as required. Temporary access roads that are opened to perform O&M would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

Under Alternative 2, the recommended CMD remedial treatment system for the Slavey Hollow site would consist of the following:

- The interception of the discharge from the existing wet-sealed mine entry. From the existing 18-inch wet seal pipe, the CMD would be collected and routed through a high-density polyethylene (HDPE) pipe approximately 1,000 feet along the south side of the drainage to a proposed remedial treatment system consisting of constructed wetland cells. Installation techniques would allow for the installation of the pipe without the need of additional access roads along the south side of the drainage.
- Construction of a remedial treatment system within the Big South Fork River floodplain consisting of two aerobic wetland cells. The first wetland would consist of a 0.5 acre settling pond (Wetland Cell 1) while the second wetland cell would consist of a 0.25 acre polishing unit (Wetland Cell 2). Discharge from the polishing unit would discharge directly into the Big South Fork River.

Under Alternative 2, O&M of the passive treatment system would require dredging the constructed wetland cells every 10 to 30 years, then refilling and revegetating the cells. This dredge material would be disposed off-site. In addition, there would be periodic CMD and system effluent sampling to gauge remedial effectiveness and small maintenance activities to ensure the system is working correctly.

Nancy Grave Site
Under Alternative 2, access to the Nancy Grave site would originate along Wilson Ridge Road and travel southwest along 0.13 mi of former logging road to Segment C of the Kentucky Trail, then continue 0.48 mi southeast along the trail, which is predominantly historic road, to the site (Figure 2-4). Access to the site would require crossing Nancy Grave drainage. Construction of the access road would follow the standards of a Class 6 (non-public) administrative road. During construction, temporary erosion control measures would be installed on access roads and trails per NPS BMPs, and side banks would be replanted using the NPS recommended planting list of native plants.

After the remedial treatment system is installed, the proposed access route would be restored to the existing width according to NPS trail standards and to accommodate future O&M activity; however, gravel and rock placed for surface improvements may be left within the trail surface or may be removed to a designated area. The access could be reopened for a short time period (less than a month) to perform O&M as required, but would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

The CMD remedial approach for the Nancy Grave site would consist of the following:

- The construction of an ALD trench at the toe of the powerline spoils to intercept the subsurface flows from this CMD site to a proposed approximately two-acre aerobic wetland treatment cell system on the Big South Fork River floodplain on the north side of Nancy Grave drainage (Figure 2-4). Site topography is such that the best location for the wetland cell is on the opposite side of the Nancy Grave drainage from the seeps. The ALD discharge would be directed by piping below Nancy Grave drainage to provide treatment for only the power line seeps and not the flow in Nancy Grave drainage. Treated water from the wetland cell would flow directly into the Big South Fork River.
- The construction of an HDPE-lined stream channel to divert and contain the stream channel flows before they reach the spoils below the tramway. The lined channel would extend through the spoils and route uncontaminated flows to the Big South Fork River.

Under Alternative 2, O&M of the passive treatment system would require dredging the constructed wetland cells every 10 to 30 years, refilling, and revegetating. This dredge material would be disposed off-site. In addition, there would be periodic CMD and system effluent sampling to gauge remedial effectiveness, and small maintenance activities to ensure the system is working correctly.

Devils Creek Site
Under Alternative 2, access to the Devils site would have the same initial route as the Nancy Grave access. Access would originate along Wilson Ridge Road and travel southwest along 0.13 mi of former logging road to Segment C of the Kentucky Trail, then continue 0.48 mi southeast along the trail, which is predominantly historic road, to the Nancy Grave site, then continue along the Kentucky Trail another 0.35 mi to the Devils Creek site (Figure 2-4). Access to the site would require crossing Nancy Grave drainage. Construction of the access road would follow the standards of a Class 6 (non-public) administrative road. During construction, temporary erosion control measures would be installed on access roads and trails per NPS

BMPs, and side banks would be replanted using the NPS recommended planting list of native plants.

After the remedial treatment system is installed, the proposed access route would be restored to the existing width according to NPS trail standards and to accommodate future O&M activity; however, gravel and rock placed for surface improvements may be left within the trail surface or may be removed to a designated area. The access would be reopened for a short time period (less than a month) to perform O&M as required, but would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

Under Alternative 2, the CMD remedial approach for the Devils Creek site would consist of the following:

- Engineering to intercept the CMD from the discharge points and from spoil piles, directing the water into an ALD that flows into an aerobic treatment system.
- Construction of an aerobic treatment system that would consist of a settling pond approximately 0.75 acres in size (Cell 1) and a polishing pond approximately 0.75 acres in size (Cell 2) [see Table 2-2 for pond descriptions]. These cells would be constructed on an upper terrace of Big South Fork River on the north side of Devils Creek. Once the potential contaminants are reduced in the constructed wetland cells, the treated water would then be discharged into Devils Creek, approximately 100 ft upstream of the confluence with Big South Fork River.

Under Alternative 2, O&M of the passive treatment system would require dredging the constructed wetland cells every 10 to 30 years, refilling, and revegetating. This dredge material would be disposed of off-site. In addition, it would be necessary to replace or maintain the limestone in the ALD every 15 to 20 years. There would also be periodic CMD and system effluent sampling periodically to gauge remedial effectiveness and small maintenance activities to ensure the system is working correctly and to maintain access.

Laurel Branch Confluence Site

Under Alternative 2, access to the Laurel Branch Confluence site would be accomplished west along 0.41 mi of the existing Laurel Branch Road, then northwest along 1.45 mi of the Lee Hollow Loop Horse Trail, and then north along 0.09 mi of the Blue Heron Loop Hiking Trail (Figure 2-5). The Lee Hollow Loop Horse Trail is a historic road and has been converted into a horse trail. Access to the site would require crossing 3 small streams and Laurel Branch at an existing sandstone crossing on the horse trail, then using the Blue Heron Loop hiking trail downslope to the site. To avoid the use of the hiking trail, the horse trail is preferred and is technically within 500 ft of the site; however, the horse trail is further upslope, and new access from the horse trail to the site would exceed 500 ft to accommodate the steep grade of the terrain. Construction of the access would follow the standards of a Class 6 (non-public) administrative road. During construction, temporary erosion control measures would be installed on access roads and trails per NPS BMPs, and side banks would be replanted using the NPS recommended planting list of native plants.

After the remedial treatment system is installed, the sections of the proposed access route would be restored to their existing trail widths according to NPS trail standards and maintained according to trail standards; however, gravel and rock placed for surface improvements may be left within the trail surface or may be removed to a designated area. The access would be reopened for a short time period (less than a month) to perform O&M as required, but would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

Under Alternative 2, the recommended remedial treatment system for the Laurel Branch Confluence is the separation of surface water from the spoils pile. The CMD remedial approach for the Laurel Branch Confluence site would consist of the following:

- NPS would regrade approximately 2 acres of the spoil material adjacent to the Big South Fork River. Following the regrading of the main spoil pile immediately adjacent to the Big South Fork River, spoil material from the steep upslope section would be pushed downhill to the main spoil area where it would be compacted in small lifts. The upslope spoils would be lowered until the capacity of the lower area was met. A bench would be created at the top of the new fill approximately 30-40 ft below a natural bluff extending from the edge of the spoil into natural ground.
- NPS would incorporate lime into each lift during regrading to help neutralize the potentially acid-forming spoils and add alkalinity to any water contacting spoils.
- NPS would construct an HDPE-lined interceptor channel at the eastern edge of the bench along steeply sloped hillside to convey surface runoff away from the mine spoils. The lined interceptor channel would convey water directly to the Big South Fork River. This interceptor channel would help prevent surface runoff from entering the pyrolized spoil adjacent to Big South Fork River.
- NPS would cover the disturbed areas with soil and allow native vegetation to revegetate the area and install riprap along the face of the regraded spoils to the appropriate storm level.
- NPS would install piezometers in the regraded spoils to monitor ground water quantity. The information from the monitoring would be used to determine future actions to the site.

Under Alternative 2, O&M at the Laurel Branch Confluence site would require periodic monitoring on an annual or biannual basis. In addition, the site area may require remedial revegetation and grading in the 2 to 3 years after construction.

Laurel Branch Spoils Site
Under Alternative 2, access to the Laurel Branch Confluence site would be accomplished west along 0.41 mi of the existing Laurel Branch Road, and then northwest along 1.25 mi of the Lee Hollow Loop Horse Trail, and then approximately 0.09 mi of new access from the trail to the site (Figure 2-5). Access to the site would require crossing 3 small streams. Construction of the access would follow the standards of a Class 6 (non-public) administrative road. During construction, temporary erosion control measures would be installed on access roads and trails

per NPS BMPs, and side banks would be replanted using the NPS recommended planting list of native plants.

After the remedial treatment system is installed, the sections of the proposed access route would be restored to their existing trail widths according to NPS trail standards and maintained according to trail standards; however, gravel and rock placed for surface improvements may be left within the trail surface or may be removed to a designated area. The access could be reopened for a short time period (less than a month) to perform O&M as required, but would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

Under Alternative 2, the recommended remedial treatment system for the Laurel Branch Spoils site is the separation of surface water from the spoils pile. The CMD remedial approach for the Laurel Branch Spoils site would consist of the following:

- NPS would install 10 ft by 20 ft box culverts (100-year 6-hr storm design) at the existing stream grade to convey surface water through the mine spoils, preventing contact. The fill above the culverts would consist of excavated spoils to keep them out of contact with the stream channel. The culverts would extend approximately 120 ft along the stream channel presently impacted by mine spoils. The culverts would segregate the uncontaminated stream from the partially pyrolized spoils.
- NPS would install a HDPE liner at the contact of the permeable alluvial deposits and the pyrolized spoils to prevent recharge of the spoils and seepage into the stream upstream of the culvert. Limestone would be potentially placed in the channel to provide roughness and stability, and to also provide alkalinity.
- NPS would construct a trench at the upstream end of the spoil pile and backfill it with impermeable materials to form a cut-off trench. The trench would be excavated to bedrock along the interface between the alluvium and pyrolized spoils.

Under Alternative 2, O&M at the Laurel Branch Spoils site would require periodic monitoring on an annual or biannual basis. In addition, the site area may require remedial revegetation and grading in the 2 to 3 years after construction.

Blair Creek Site
Under Alternative 2, the recommended access to the Blair Creek site would be accomplished from Bear Creek Horse Camp northwest along the Bear Creek Loop Horse Trail and then north along the Lee Hollow Loop Horse Trail for approximately 1.72 mi (Figure 2-6). During construction, temporary erosion control measures would be installed on access roads and trails per NPS BMPs, and side banks would be replanted using the NPS recommended planting list of native plants.

After the remedial treatment system is installed, the sections of the proposed access route would be restored to their existing trail widths according to NPS trail standards and maintained according to trail standards. After the remedial treatment system is installed, any temporary access road would be gated off and would not be maintained by the NPS; however, gravel and rock placed for surface improvements may be left within the trail surface or may be removed to

a designated area. The access would be reopened for a short time period (less than a month) to perform O&M as required, but would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

Under Alternative 2, the recommended treatment system for the Blair Creek site would consist of the following:

- NPS could install piezometers into the mine pool that would allow NPS to collect water samples from the mine pool or to monitor the elevation of the mine pool.
- NPS would excavate into the underground mine at its lower level of the stream in an attempt to de-water the diffuse discharge points from the mine pool above the level of the stream, and subsequently convey the mine discharge via a pipe adjacent to the stream channel to treatment cells.
- NPS would construct a two to three tier wetland cell system on a bench situated on the north side of Blair Creek. CMD would be directed approximately 1,500 ft via a pipe from the excavation into the underground mine to the wetland cells, consisting of a settling pond and polishing unit. An ALD would potentially be installed at the end of the pipe to add alkalinity to the CMD prior to entering the constructed wetland cells. Discharge from the wetland cells would enter directly into the Big South Fork River.
- Additional potential remedial options may be considered for the lower portions of the Blair Creek site, including but not limited to the installation of dosers or ALDs to add limestone to the system to increase the pH. Additional investigations would be conducted prior to the implementation of a remedial approach to determine the appropriate treatment system for the site and access.

Under Alternative 2, O&M would consist of dredging the wetland cells every 10 to 30 years, refilling, and revegetating. This material would be disposed off-site. Native vegetation and grading in the 2 to 3 years following construction may be required. In addition, there would be periodic CMD and system effluent sampling periodically to gauge remedial effectiveness, and small maintenance activities to ensure the system is working correctly. Based on the 8 selected CMD sites, and estimated remediation costs ranging from $380,000 to $800,000 per site, remediation of the selected sites under Alternative 2 is estimated to cost $3,200,000.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Sites

Under Alternative 3, the NPS would actively implement CMD technology using all suitable CMD technologies and O&M as required. NPS could use existing routes identified in the current GMP with the ability to widen routes for CMD construction and long-term maintenance, use and improve historic access routes, and construct up to 0.1 mile of new access road to sites, with the exception of hiking and mountain biking trails, which could not be utilized for access unless the trail is co-located on historic logging road or mining road. In addition, former tramways would not be utilized for access under Alternative 3. As access would be somewhat limited (where there are no limitations to access under Alternative 2), not all treatable CMD sites could be accessed for remediation under Alternative 3 (Table 2-3). An estimate of up to 8 CMD sites could be remediated under the programmatic implementation of Alternative 3 for the purposes

of evaluation in this EIS. Additionally, only 5 of the specific sites described in Chapter 1 would also be remediated, along with portions of the remaining site. Details for the specific sites are given after the programmatic discussion.

Access

This alternative provides the use of existing historic routes that already impacted the environment during construction and allows for new construction to a site, but new construction would be limited to 0.1 mile (Table 2-4). Under Alternative 3, access would be the use of existing access (trails or roads) where possible, with NPS making minor improvements or upgrades to provide an even surface for trucks and mechanized equipment. However, under Alternative 3, hiking and mountain biking trails would not be utilized for access (unless the trail is co-located on historic logging road, tramway, or mining road). Minor improvements to existing access could include the filling of mud holes, the filling of small washouts and large ruts. Following the completion of the proposed remediation measures, the proposed access route would be restored to the existing width according to NPS trail standards and to accommodate future O&M activity; however, gravel and rock placed for surface improvements may be left within the trail surface and/or removed to a designated area. Side banks would be replanted using the NPS recommended planting list of native plants. During construction, temporary erosion control measures would be installed on access roads and trails per NPS BMPs.

In addition to the elimination of mountain biking and hiking trails for access, access would be limited to 0.1 miles of new, temporary roads and trails for use during the construction phase of each remedial project. This differentiates Alternative 3 from Alternative 2, which would have no limitations on the length of new access that could be constructed, and could use mountain biking and hiking trails for access. The standards applied to these temporary roads would not exceed those standards of the Class 6 (non-public) administrative roads. The GMP defines these standards as a width of 8-12 ft, 12-16 ft cleared ROW and a 12-ft cleared height. Temporary roads would be gated off and would not be maintained after the construction of the remedial approach is completed by the NPS. Temporary roads may be reopened for a short time period (less than a month) to perform O&M as required. Temporary access roads that are opened to perform O&M would follow the same standards as temporary roads that were constructed during the installation of the remedial approach.

CMD Remedial Option

For Alternative 3, CMD technologies that have minor/infrequent, frequent, or more intensive O&M could be considered for treatment, as in Alternative 2. See Tables 2-1 and 2-2 in the Types of CMD Remedial Approaches section earlier in this chapter for additional detail.

Operations and Maintenance

O&M would be required on new access routes at a minimum level. O&M for existing roads and trails would be done by the NPS as part of routine operations per the designated road and trail standards. Occasional increased O&M would be required if equipment is needed to work at a CMD site. The temporary access would be reopened for a short time period (less than a month) to perform O&M as required. Temporary access roads that are reopened to perform O&M would follow the same standards as temporary roads that were constructed during the

installation of the remedial approach. As mentioned above, the levels of access development that are approved for this alternative does not imply that the levels that would be utilized at every CMD site; the park would minimize impacts to the extent practicable. This alternative would limit CMD treatment to sites that could be accessed from existing roads, historic routes, and from new access that would be less than 0.1 miles in length.

Selected Remedial Sites

Under Alternative 3's moderate access, the Worley Mine #88, Slavey Hollow, and Devils Creek sites would not be accessible; remediation of these areas would not occur.

Worley Mine #86

Under Alternative 3, access, remedial approach considered, and O&M would be consistent with Alternative 2.

Nancy Grave

Under Alternative 3, access, remedial approach considered, and O&M would be consistent with Alternative 2.

Laurel Branch Confluence Site

Under Alternative 3, access, remedial approach considered, and O&M would be consistent with Alternative 2.

Laurel Branch Spoils Site

Under Alternative 3, access, remedial approach considered, and O&M would be consistent with Alternative 2.

Blair Creek Site

Under Alternative 3, access, remedial approach considered, and O&M would be consistent with Alternative 2.

Based on the 5 selected CMD sites, and estimated remediation costs ranging from $380,000 to $800,000 per site, remediation of the selected sites under Alternative 3 is estimated to cost $2,100,000.

Alternative 4: Minimal Access

Programmatic Sites

Under Alternative 4, the NPS would actively treat CMD using suitable remedial technologies that have a low, infrequent, and/ or minor O&M, and would have a preference for passive remedial approaches. Under Alternative 4, the NPS could use existing roads and larger access routes identified in the current GMP, such as horse trails and multiple use trails, and construct new access roads to sites that are less than 0.1 mile in length, but could not use historic access routes, such as former logging roads or tramways, or smaller access routes, such as hiking or mountain biking trails. Access improvement standards would be consistent with those described for Alternative 3. As access would be more limited than under Alternatives 2 or 3, most CMD sites could not be accessed for remediation (Table 2-3). An estimate of up to 6 CMD sites could be remediated under the programmatic implementation of Alternative 4 for the

purposes of evaluation in this EIS. Additionally, only 4 of the specific sites described in Chapter 1 could be remediated, along with portions of a third site. Details for the specific sites are given after the programmatic discussion.

Access
Under Alternative 4, the development of access would include the same 0.1 mile of new access limitation as Alternative 3, but would further restrict access by excluding smaller access routes, such as hiking and mountain biking trails (Table 2-4). This differentiates Alternative 4 from Alternative 3, which would use the smaller access routes. Temporary access roads that are reopened to perform O&M would follow the same standards as temporary roads that were constructed during the installation of the remedial approach. By restricting access, Alternative 4 would ultimately limit the number of sites eligible for treatment.

CMD Remedial Option
Under Alternative 4, CMD technologies that could be considered. However, passive remediation would be the preferred approach for backcountry sites, whereas the preferred approach for frontcountry sites that are accessible by a main road would use all available technologies that have minor to no O&M requirements. In combination with the access restrictions, the lower number of treated CMD sites, and the potentially lowered effectiveness of the available treatment systems with little to no O&M requirements.

Operations and Maintenance
Under Alternative 4, CMD technologies that have minor or no O&M would be considered for individual CMD sites. Existing access would be used to perform O&M including the reopening of previously constructed temporary roads for a several week period to complete O&M activities. O&M for existing roads and trails would be done by the NPS as part of routine operations per the designated road and trail standards.

Selected Remedial Sites
Under Alternative 4's minimal access, the Worley #88, Slavey Hollow, Nancy Grave, and Devils Creek sites would not be accessible; remediation of these sites would not occur.

Worley Mine #86
Under Alternative 4, access, remedial approach considered, and O&M would be similar to Alternative 3.

Laurel Branch Confluence
Under Alternative 4, access, remedial approach considered, and O&M would be similar to Alternative 3.

Laurel Branch Spoils
Under Alternative 4, access, remedial approach considered, and O&M would be similar to Alternative 3.

Blair Creek Site

Under Alternative 4, access would be consistent with Alternative 3, while remedial approach considered and O&M would be similar to Alternative 3, but with a greater emphasis on passive remediation and limited O&M.

Based on the 4 selected CMD sites, and estimated remediation costs ranging from $380,000 to $800,000 per site, remediation of the selected sites under Alternative 4 is estimated to cost $1,200,000.

ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

In developing alternatives for this EIS, several alternatives or elements of alternatives were initially considered by the IDT as a result of internal and external scoping. Several of these were eliminated from further detailed evaluation as standalone alternatives, but were incorporated as elements common to all alternatives as described previously in this chapter. Others did not meet the stated objectives of the plan to a large degree, could not be implemented for technical or logistical reasons, did not meet park mandates, or were outside the scope of the planning effort. The alternative and the reasons for dismissal are described below.

Use of Existing Access with No Improvements

During the development of the alternatives for the EIS, the IDT considered an alternative in which remedial approach implementation would only utilize existing access, with no upgrades or improvements allowed to the access. Under this alternative, the NPS would not be able to construct temporary access to CMD sites. A review of the existing access was conducted by the team to determine if there was sufficient existing access that could be utilized for the installation of CMD remedial approaches. The study consisted of reviewing GIS map layers showing existing access in relation to known CMD sites. Additionally, information was compiled from the park on the status of existing access and the need for upgrades and improvements to the existing access. This alternative was dismissed because without upgrades or improvements, access would be limited to one CMD site, Worley #86, and was not thought to be sufficient to meet the purpose and need.

Environmentally Preferred Alternative

The NPS is required to identify the environmentally preferred alternative in its Record of Decision (ROD) documents, and may identify the environmentally preferred alternative in an EIS. Guidance from the CEQ states that the environmentally preferred alternative means it is "the alternative that causes the least damage to the biological and physical environment: it is also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (CEQ 1981). The environmentally preferred alternative would be Alternative 3. It minimizes impacts from construction, access, and O&M costs, while still providing water quality benefits from CMD remediation.

NATIONAL PARK SERVICE PREFERRED ALTERNATIVE

To identify the preferred alternative, NPS evaluated each alternative on its ability to meet the plan objectives, considering potential impacts on the environment and on existing and future

operations. The NPS preferred alternative is Alternative 3, which is also the environmentally preferred alternative. A summary of the alternatives impact analysis is provided in Table 2-6.

CHAPTER 3: AFFECTED ENVIRONMENT

This "Affected Environment" chapter describes current baseline conditions for those elements of the natural and cultural environments at Big South Fork NRRA that would be affected by implementing the actions considered in this EIS, which includes sites identified in the AML Comprehensive Inventory and Assessment (NPS 2014a). The natural environment components addressed include topography and soils, water resources (water quality, floodplains, and ground water), and biological resources (vegetation, wildlife and aquatic species, and special status species and special habitat areas), and cultural resources (architectural and archeological resources). Also considered are visitor use and experience, and soundscapes and the acoustic environment.

TOPOGRAPHY AND SOILS

Topography

The Big South Fork NRRA includes relatively flat areas of the plateau as well as a deep gorge, created by the Big South Fork River and its tributaries (Figures 3-1, 3-2 and 3-3). The main gorge is characterized by many sheer bluffs at the gorge rim and steep, talus slopes. There is little floodplain development along the Big South Fork River, and valleys within the gorge contain huge boulders calved from cliff faces above. In addition to the natural process of the gorge, topography throughout the gorge has been altered by historic mining activities, including mine tailing and spoil piles present at many of the CMD sites, and former tramways and historic extraction roads throughout the park.

Tributaries are generally characterized by steep densely-vegetated V-shaped gorges. Elevations range from approximately 740 ft AMSL along the Big South Fork River to approximately 1,250 ft AMSL on knolls at the edge of the river gorge. Project sites are located along the Big South Fork River floodplain, lower slopes of the gorge, and in deep V-shaped tributary valleys.

Topography in Big South Fork NRRA also includes "geologic features", the products and physical components of geologic processes, which includes features such as rock houses, canyons, buttes, windows, chimneys, waterfalls, and arches; and dramatic or unusual rock outcrops and formations. NPS policies protect geologic features from unacceptable impacts of human activity while allowing natural processes to continue.

Soils

The soils of the Cumberland Plateau, which are predominantly loamy with moderate infiltration rates, are weathered from the broad area of sandstone cap rock. Some soils are also formed with additions from acidic shales and siltstone, or combinations of these rock types. The depth of the soil to bedrock ranges from about one ft on steep hillsides to about four to five ft on broad, smooth interstream divides. The soil characteristics for Big South Fork NRRA are described in detail in the following sections.

Soils in the vicinity of the project sites are dominated by two major soil associations: Tate-Shelocta association and the Tate-Trappist association. The Tate-Shelocta association consists primarily of deep, well-drained, sloping to steep soils on benches and side slopes. The Tate-Trappist association consists of deep to moderately deep, well-drained, strongly sloping to steep soils on ridge tops and long stony side slopes along narrow drainage ways (USDA 1964).

A study on mine soils within Big South Fork NRRA found that soils directly impacted by CMD had higher levels of organic carbon and metals than native soils. These soils also had significantly more acidic pH levels (Jones 2011).

The following soils are found within the project sites:

- Pope fine sandy loam, 4 to 20% slopes (PoD), occurs along the banks of large streams. This is a strongly-acid soil and commonly has fragments of coal throughout its depth. It is formed from acid sediment that washed from weathered sandstone and shale. Limitations of this soil include the hazard of sloughing and the annual deposition of material washed from coal mines. Small areas of Tate and Elk soils are mapped with this unit (USDA 1964).
- Strip Mines (St) consist of areas where material has been removed from above a coal seam to allow open pit mining (USDA 1964).
- Tate, Shelocta, and Muse stony soils, 12 to 35 % slopes (ToE), occupies benched landforms with a concave appearance. These soils developed from acid colluvium weathered from siltstone, sandstone, and shale. Stones cover 10-30% of the surface (USDA 1964).
- Tate stony sandy loam, 30 to 50% slopes (TmF), occupies concave side slopes below cliffs. This soil is sandier than most Tate soils and contains more course fragments. Stones and steep slopes limit the use of these soils (USDA 1964).
- Tate very stony land complex (Tc) occurs at the foot of sandstone cliffs and along drainageways with steep to very steep, concave side slopes. Slopes range from 20 to 65% and are often 50 to 200 ft long. This complex includes equal areas of Tate soils and very stony areas characterized by sandstone boulders, some rock outcrops, and stones (USDA 1964).

No hydric soils are mapped within or in close proximity to the project sites; however it is possible that hydric inclusions occur within these sites.

WATER RESOURCES

The project sites lie within the Big South Fork of the Cumberland River watershed (U.S. Geological Survey [USGS] Cataloging Unit 05130104). This watershed includes the area drained from the headwaters of the Big South Fork River to its confluence with the Cumberland River. There are 27 rivers and streams within this watershed, totaling approximately 1,906 total river miles. Land area within this watershed totals approximately 1,350 square miles, primarily located in Fentress and Scott Counties, Tennessee; and McCreary County, Kentucky (USEPA 2015).

Water Quality

Regional Water Quality

The states of Kentucky and Tennessee have each declared their portions of the Big South Fork River as an ONRW (NPS 2005). An ONRW is a river that is "of exceptional recreational or ecological significance," per USEPA water quality standards at 40 CFR 131.12. The entire length of the Big South Fork River is included in this designation as an ONRW.

Chapter 4 of the Big South Fork NRRA GMP (NPS 2005) describes the water quality classification process in the following way:

> Kentucky and Tennessee have stream use classification systems to protect surface water quality. Water quality criteria values are specified for each stream use. Tennessee has classified all streams within the [Big South Fork NRRA] for primary contact recreation and fish and aquatic life. Kentucky classifies all [Big South Fork NRRA] streams for primary contact recreation and for either warm-water or cold-water aquatic habitat. A number of streams in the [Big South Fork NRRA] do not meet standards, primarily due to acid mine drainage and/or sediment. Some of the streams have been identified as impaired streams, pursuant to the CWA.

The management plan (NPS 2005) continues to describe the state of water quality within the Big South Fork NRRA:

> [Big South Fork River] waters are generally considered good quality; however, acid mine drainage and excessive sediment from logging, substandard road construction, and other past and present ground disturbing activities significantly affect certain tributary streams and to a lesser extent the Big South Fork [River]. Agricultural chemicals also contribute negatively to water quality. In general, streams in the western portion of [Big South Fork NRRA] are less disturbed than streams in the eastern and southeastern portions. Impacts in the eastern and southern areas are more frequent and severe because coal mining, logging, and storm water runoff are concentrated in these areas (NPS 1986). The Big South Fork River has nearly twice the dissolved solids and suspended solids, and 2.5 times greater sulfate yield as a comparable unmined river basin (Evaldi and Garcia 1991 in NPS 2005a). Acid mine drainage impacts are most notable in Bear Creek and Roaring Paunch Creek. Sediment impacts are evident in these streams, New River, and several others (pages 158–159).

The CWA requires each state in the United States to compile a list of streams that are failing to meet one or more of the "uses" for which they have been designated due to water quality problems. Such a list is called the 303(d) list, named for the section of the CWA that requires these lists to be written. Streams on this list are deemed "impaired" as defined by the CWA, and not by the regulations and policies of the NPS. In the park, Kentucky's 303(d) list has one stream listed (Rock Creek) and Tennessee's 303(d) list has three streams (Rock Creek, Bear Creek, and Pine Creek) (KDOW 2018, TDEC 2017).

Surface coal mining does not currently occur inside the Big South Fork NRRA; however, past coal mining has affected and continues to affect water quality within the area. Mining also has disrupted the flow of underground aquifers. Mining wastes also contribute various elements into the flow of Big South Fork NRRA streams that negatively impact water quality (NPS 1997).

Seeps and springs, occurring where the groundwater table intersects the land, are common in the Big South Fork NRRA, particularly at the base of ledges and bluff shelters. Springs of moderate yield occur at the base of the Hartselle Formation in Kentucky; other low-yield springs occur at the base of thick sandstone beds and along coal bed horizons (NPS 1997).

Local Water Quality

In general, streams in the western portion of the Big South Fork NRRA are less impacted than streams in the eastern and southern portions of the Big South Fork NRRA. However, surface waters in the gorge area and areas that experienced coal mining are severely impacted by CMD. Water quality parameter values associated with CMD impacts include (NPS 1997)*:*

- pH less than 6.0,
- Low alkalinity (the total measure of the substances in water that have acid-neutralizing ability) that is less than acidity,
- Total iron concentration greater than 0.5 milligrams per liter (mg/L),
- Sulfate concentration greater than 75.0 mg/L,
- Aluminum concentration greater than 0.3 mg/L,
- Total hardness greater than 150 mg/L, and
- Turbidity greater than 200 mg/L.

Water quality parameters of the Big South Fork River and tributary streams fluctuate seasonally. The best available water quality data for the abandoned mine sites is from the study conducted by Gannett Fleming, Inc. (1998). They sampled water quality at several sites periodically, including the eight selected remedial sites, from May 1996 to April 1997. Additional sampling was conducted by NPS in the spring of 2014 at the Laurel Branch Confluence and Laurel Branch Spoils sites, along with seeps in the vicinity of these sites. Recent qualitative data collected by NPS on May 17 and 18, 2016, revealed that current parameters are within previously recorded ranges, indicating that the sites are not self-remediating. A summary of selected parameters at the eight selected remedial sites are provided in Table 3-1. Streams at the eight selected remedial sites exhibited low pH, low alkalinity, high iron and aluminum concentrations, and high sulfate concentrations during all or portions of the year. However, it may be necessary to obtain more recent condition data, as required, for enhancing remedial designs and setting targets for monitoring water quality improvements prior to implementation.

Special Designations

The Big South Fork River has the following surface water designations (RM 44.3 to RM 54.8): Warm Water Aquatic Habitat, Primary Contact Recreation, Secondary Contact Recreation, and OSRW (401 KAR 5:026) and ONRW (401 KAR 10:030). In addition, the Big South Fork River is designated as a Kentucky Wild River (Kentucky Revised Statute [KRS] 146.241) from the

Tennessee/Kentucky border to approximately the Devil's Jump area (RM 55.2 to RM 45.5). For reference, the eight selected remedial sites are located from approximately RM 42.0 (Worley Mines) upstream to approximately RM 47.0 (Blair Creek).

Floodplains

Floodplains generally are areas of low, level ground present on one or both sides of a stream channel that are subject to either periodic or infrequent inundation by flood waters. Inundation dangers associated with floodplains have prompted federal, state, and local legislation limiting the development in these areas to recreation, agriculture, and preservation activities. Floodplains are regulated by the Federal Emergency Management Agency (FEMA) with standards outlined in 44 CFR Part 60.3.

EO 11988 (24 May 1977) provides guidance on floodplain management, along with NPS Management Policies and NPS Director's Order 77-2 (DO-77-2) (Floodplain Management), that reiterate the importance of safeguarding floodplains (NPS 2003; 2006a). The EO requires each federal agency to amend existing regulations or procedures to ensure that the potential effects of any action the agency may take in a floodplain is evaluated and that the agency's planning programs and budget requests reflect consideration of flood hazards and floodplain management. Guidance for implementation of EO 11988 is provided in the Floodplain Management Guidelines of the U.S. Water Resources Council (40 CFR 6030, 10 February 1978). It is the intent of this EO and EO 11990 (Protection of Wetlands) for federal agencies to institute these requirements through existing procedures, such as those established to implement NEPA.

The Big South Fork River and its tributaries are deeply incised with limited floodplain development in the project sites. The FEMA determines the 100-year floodplains surrounding water bodies and, FEMA has designated 100-year floodplain areas along Big South Fork River and some of its tributaries. In the headwater areas, slopes are steep and floodplains are not well formed. Minor floodplains generally occur further downstream, including within some of the proposed sites. The proposed remedial activities for the selected sites are excepted from FSOF, but a FSOF evaluation would be completed for programmatic sites on a case-by-case basis once more detail is known.

Specific Study Area Determinations

No detailed floodplain analyses have been conducted for the eight selected remedial sites. A review of FEMA floodplain maps indicates that portions of the Worley Mines #86 and #88, along with Slavey Hollow and Laurel Branch sites could be located within the Big South Fork River floodplain. In addition, portions of the Devils Creek and Nancy Grave sites could be located within the Devils Creek and Nancy Grave drainage floodplain. Portions of the Blair Creek site could be located within both the Big South Fork River and Blair Creek floodplains.

Wetlands

EO 11990 (Protection of Wetlands) requires NPS and other federal agencies to evaluate the likely impacts of their actions on wetlands. The objectives of EO 11990 are to avoid, to the extent possible, the long-term and short-term adverse impacts associated with the occupancy, modification, or destruction of wetlands. NPS Management Policies and NPS Director's Order 77-1 (DO-77-1) (Wetland Protection) reiterate the importance of safeguarding wetlands (NPS

2002; 2006a). NPS Procedural Manual #77-1 provides agency-specific procedures for complying with the EO (NPS 2012b).

The USACE and the USEPA jointly define wetlands as “areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (USACE 1987). Wetlands are classified by the NPS utilizing the Cowardin Classification System, a national wetland classification system adopted by USFWS and used to define wetland system types.

Specific Study Area Determinations

No detailed wetland delineations have been conducted for the eight selected remedial sites, or for potential programmatic sites. However, the park does conduct wetland delineations as required for specific projects. A wetland delineation report was completed for an oil and gas well plugging project near No Business Creek (in Scott County, Tennessee) and Oil Well Branch (in McCreary County, Kentucky), but the site areas are outside currently known programmatic sites and the eight selected remedial sites (Louis Berger Group, Inc. 2009). Similarly, delineations were performed by USACE for the remediation of Blue Heron, but the areas including the selected remedial sites and programmatic sites were not covered under the USACE delineation (USACE 2016). However, future, currently unknown, potential programmatic sites could be covered by these reports, such as additional portions of the Blue Heron CMD site that may not be remediated by the USACE project.

National Wetlands Inventory (NWI) maps (Figure 3-4, 3-5, and 3-6) do not identify any wetlands within the eight selected remedial sites or near the known programmatic sites. However, based on the presence of perennial streams and topography, potentially jurisdictional wetlands may exist at several of the CMD remedial sites. For assessment in this EIS, wetlands are assumed to occur at the eight selected CMD sites based on field observations, either associated with the proposed remediation or along proposed access to the sites. The proposed remedial activities for the selected sites meet the exemption criteria WSOF, but a WSOF evaluation would be completed for programmatic sites on a case-by-case basis once more detail is known.

Groundwater Resources and Withdrawal

The major aquifer in this region is the Cumberland Plateau aquifer, which is comprised of Pennsylvanian age sandstone, shale, and conglomerate. Due to low primary porosity, groundwater primarily occurs in fractures and faults. As a result, groundwater yields in the Cumberland Plateau vary from 5 gpm to up to 300 gpm. Generally, wells do not yield enough water for public supply (Hoos 1990).

Both public and domestic water supply wells occur in the area. One hundred fourteen wells were registered in McCreary County between 1985 and 1996. There are no discharge data available for these wells (NPS 1997).

Specific Study Area Determinations

There is no site-specific groundwater information for the eight selected remedial sites; however, groundwater within the Big South Fork NRRA is generally moderately mineralized, slightly acidic, and may contain high concentrations of iron, sulfate, chloride, and hydrogen sulfide

(Broshears 1986). Both confined and perched aquifers are locally common (Bradley 1982). Seeps and springs are also common, particularly at the base of ledges and bluff shelters, where the groundwater table intersects the land surface (Smith 1978).

BIOLOGICAL RESOURCES

Vegetation

The greater Big South Fork NRRA area is part of the Appalachian Plateau region, which is widely known as one of the most biologically diverse temperate forest regions in the world (NPS 2015a). The heart of the Big South Fork NRRA landscape is the Big South Fork River gorge; a forty-mile rift through the northern Cumberland Plateau. Due to its topographical relief, complex soils, diversity of land surfaces, and its position on the Cumberland Plateau, the park supports an enormous diversity of vegetation (Figures 3-7 to 3-9). Over 95 percent of the Big South Fork NRRA is forested.

In terms of woody plants, Big South Fork NRRA has 52 native families, more than any other park unit in the National Park System. Only the Great Smoky Mountains National Park surpasses the Big South Fork NRRA in the number of overall native woody species, which supports 206 species in 105 genera in 48 families, compared to 186 species in 102 genera in 52 families at Big South Fork NRRA (Shaw and Wofford 2003). The current number of confirmed vascular plant species for Big South Fork NRRA is 1,070 (NPS 2016a), which includes 4 federally-listed species, discussed in the subsequent Special Status Species section.

Though diversity remains high, the composition of forest types in Big South Fork NRRA has been continually altered by nearly a century of land-use. Timber harvesting, pine plantings, agriculture, coal mining, oil and gas extraction, fire, grazing, recreational activities, exotic forest diseases, and introduction of non-native invasive plants have all shaped or continue to shape the plant communities within Big South Fork NRRA. Due to a long history of logging in the park, which began in the early 20th century and continued up until park lands were acquired, most of the upland forest areas are second or third growth, and mature forests are rare. Several small areas containing impressive examples of second growth floodplain, mixed mesic, and hemlock forests still exist, mostly in the more northern coves of the park. The most recent substantial impact to forest composition in Big South Fork NRRA was the widespread damage caused by southern pine beetles between 2000 and 2002. Dead-standing and fallen trees remain virtually everywhere in the park, where shortleaf pine (*Pinus echinata*) and Virginia pine (*Pinus virginiana*) stands existed prior to the infestation (NPS 2012a).

However, the early successional forests are important vegetative communities in Big South Fork NRRA. These forests are particularly important for neotropical migrant bird species. The forests provide breeding, wintering, and migration stopover habitat (NPS 2013a). In addition to successional forests, riparian forests are also important vegetative communities in the park. These forests are important natural bio-filters, protecting aquatic environments from excessive sedimentation, have a prominent role in supporting a diversity of species, and provide shade that limits stream temperature change. Riparian vegetation is particularly important to bats, which utilize the cover to forage and roost in summer months.

The vegetation in Big South Fork NRRA was mapped in October 2006, and ground-truthed from 2008 to 2010. Based on mapping data, Nordman (2011) classified vegetation in Big South Fork NRRA using the National Vegetation Classification System (NVCS). The report identified 14 separate ecological systems containing 47 distinct vegetation associations. Of these, 36 of the communities are considered natural, while the remaining 11 are considered human modified, successional, or exotic species dominated. The ecological systems and their communities are summarized in Table 3-2.

Aquatic Habitat

The Big South Fork River watershed covers approximately 1,123 square miles primarily in Fentress and Scott Counties, Tennessee and McCreary County, Kentucky, with smaller areas of Anderson, Campbell, Morgan and Pickett Counties, Tennessee. Big South Fork NRRA protects the southern 14% of this area, while the Big South Fork River drains the Cumberland Plateau northward, flowing into Lake Cumberland (NPS 2015b).

Tributaries of the Big South Fork River near some of the eight CMD sites (i.e., Worley Branch, Slavey Hollow, Devils Creek, Laurel Branch, and Blair Creek) are primarily first or second order perennial streams characterized by narrow V-shaped gorges created by stream incision (NPS 1997). These streams are impacted by CMD, and many are void of fish and aquatic invertebrates.

Wildlife and Aquatic Species

The terrestrial vegetation types described in the previous sections of this chapter combine with the terrain and aquatic environments at Big South Fork NRRA to provide diverse habitats for fish and wildlife. Many studies of specific habitat types and wildlife groups, such as inventories of mammals, mussels, fish and aquatic life, bats, and vegetation have been performed at the park unit over the past century, with many in the last decade.

Mammals

A total of 48 mammals have been documented in Big South Fork NRRA with nine other mammals possibly present, including eleven species of bats (Britzke 2007). Large native mammals found in the area include white-tailed deer (*Odocoileus virginianus*), the black bear (*Ursus americanus*), released experimentally in the mid-1990's, and elk (*Cervus elaphus*), which migrated into the area from state managed lands. Small mammals ranging from raccoon (*Procyon lotor*) to bobcat (*Lynx rufus*) are abundant throughout the park (NPS 2015c).

A bat survey of abandoned mine workings within and adjacent to the Big South Fork NRRA was completed in 1983. A total of 114 mine openings were inspected between December 10 and February 17, 1983; many of these mine openings occur adjacent or within project sites. Ninety-six of these mine openings were surveyed through physical entry and visual inspection and 18 mines openings were surveyed by mist netting. A total of 351 bats representing six species were observed using abandoned mines in the Big South Fork NRRA: tri-colored bat (*Perimyotis subflavus*), Rafinesque's big-eared bat or eastern big-eared bat (*Corynorhinus rafinesquii*), big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), and eastern small-footed bat (*Myotis leibii*). In addition to the

federally-listed northern long-eared bats observed during this survey, a single federally-listed Indiana bat (*Myotis sodalis*) was observed in a mine near Blue Heron during a preliminary survey in September 1981. This individual was thought to likely be a migrant, using the mine entry as a day roost during migration (USFWS 1983). There are no known Indiana bat hibernacula or roost trees within the park.

A more recent bat survey was conducted as a part of the 2003-2004 mammal survey, which included 18 nights of mist netting and 25 nights of surveying with Anabat II acoustic monitoring equipment (Britzke 2007). Eleven species were observed or detected, including the six species previously documented, along with the silver-haired bat (*Lasionycteris noctivagans*), red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), evening bat (*Nycticeius humeralis*), and the federally-listed gray bat (*Myotis grisescens*) (Britzke 2007).

Birds

In addition to mammal diversity, some 170 species of birds, migratory and resident have been recorded in Big South Fork NRRA in recent years (NPS 2015c). The Migratory Bird Treaty Act (MBTA), 50 CFR 10.13, protects migratory birds, except under the terms of a valid permit. Big South Fork NRRA is located in the Appalachian Mountains Bird Conservation Region (BCR). Priority Birds of Conservation Concern (BCC) in the Appalachian Mountains BCR include cerulean warblers (*Dendroica cerulea*) in low elevation forests, blackthroated blue warblers (*Dendroica caerulescens*) in high elevation forests, golden-winged warblers (*Vermivora chrysoptera*) in early successional areas, and Henslow's sparrows (*Ammodramus henslowii*) in grasslands. However, the Henslow's sparrows are unlikely to occur in the park, as the sparrow's preferred specialized habitats are not common in Big South Fork NRRA.

Birds of the forest interior dominate the landscape in the Big South Fork NRRA. Edge species also find some habitat to suit their needs, but birds of open country are largely excluded from the park, and the degree of exclusion has increased each year as the park's forests mature and their open areas diminish. Based on survey data, the red-eyed vireo (*Vireo olivaceus*) is the most common species reported annually at Big South Fork NRRA. Other common species include American crow (*Corvus brachyrhynchos*), ovenbird (*Seiurus aurocapillus*), indigo bunting (*Passerina cyanea*), and hooded warbler (*Wilsonia citrina*) (Stedman 2006).

Fish

A wide variety of natural conditions have combined to provide a high diversity of aquatic habitats within the watershed. One of the world's richest assemblages of temperate freshwater fish once inhabited the Cumberland River into which the Big South Fork River flows. However, impoundment and coal-mining related impacts have made the Cumberland River one of the nation's most severely altered river systems. Approximately 79 species of fish across twelve different families, including lampreys (*Ichthyomyzon* spp.), darters (*Etheostoma* spp., *Percina* spp.), shiners (*Cyprinella* spp., *Notropis* spp.), minnows (*Pimephales* spp.), suckers (*Catostomus* spp., *Hypentelium* spp., *Moxostoma* spp.), and bass (*Micropterus* spp.) occur in Big South Fork NRRA (Scott 2007).

Mussels

Mussel species are the most jeopardized and rapidly declining faunal group in the United States: 12 of the nation's 300 species are now extinct and over 67% are listed as endangered, threatened, or special concern, or are being considered for listing (NPS 2015b). Of the nearly 300 recorded species of freshwater mussels in the United States, approximately 130 are or were known to occur within the political boundaries of Tennessee. The Big South Fork River currently has 42 documented species, 11 of which are federally listed as endangered and discussed in the Special Status Species and Special Habitat Areas section of this chapter. In the Southeast, only the Duck, Clinch, and Green Rivers contain this level of diversity, and only two other NPS units in the country have greater diversity (NPS 2015b). The NRCA for Big South Fork NRRA (NPS 2013a) indicates that mussel species diversity in the Big South Fork River near the CMD sites in the Kentucky section of the park is lower than the upstream areas (from up to 22 species near Bear Creek, decreasing to 1-7 species in the vicinity of the Devils Jump area). The diversity decrease could be attributable to a number of factors, including a decrease in water quality from CMD in streams.

Reptiles and Amphibians

A total of 28 reptiles (16 snakes, 6 turtles, and 6 lizards) and 28 amphibians (16 salamanders, 8 frogs, 2 toads, 1 mudpuppy, and 1 newt) have been documented at Big South Fork NRRA (Stephens *et al*. 2008).

Special Status Species and Special Habitat Areas

Under the ESA of 1973, the NPS has the responsibility to address impacts to federally listed threatened, endangered, and species proposed for listing. The terms "threatened" and "endangered" describe the official federal status of certain species in the park as defined by the ESA. Under the Act, so-called "candidate" species receive no statutory protection under the ESA, but the USFWS encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA. The term "candidate" is used officially by the USFWS when describing those species for which it has on file sufficient information on biological vulnerability and threats to support issuance of a "proposed rule to list," but for which issuance of the proposed rule is precluded due to other higher priority listings. The term "proposed" describes species for which a "proposed rule to list" has been published in the FR; however, a finalized rule has not yet been issued.

The ESA also requires the designation of "critical habitat" for listed species when "prudent and determinable." Critical habitat includes geographic areas that contain the physical or biological features that are essential to the conservation of the species and may need special management or protection, even if the area is not occupied by the species at the time of listing. Critical habitat designations affect only federal agency actions or federally funded or permitted activities. The ESA requires that such actions avoid "destruction" or "adverse modification" of designated critical habitat (USFWS 2003).

Section 4.4.2.3 of the NPS Management Policies 2006 (Management of Threatened or Endangered Plants and Animals), moreover, directs the agency to consider federally listed threatened, endangered, and candidate species proposed for listing, as well as state-listed species, to the extent practical in its decision making.

The Big South Fork River watershed is a national focus for major conservation efforts because of its aquatic and terrestrial features. The Big South Fork River is particularly significant in that it harbors at least 42 species of mussels. Eleven federally listed or candidate mussel species occur in the river. Three fish, two river-dependent plants, and two upland plants are also federally listed. A single Indiana bat was found during a migration period, in addition to the observation of northern long-eared bats. There are no known Indiana bat hibernacula or roost trees within the park. Gray bats have been captured and detected acoustically at two distant locations, while one gray bat was captured near the Zenith access, and echolocation calls were recorded near Station Camp (Britzke 2007).

The species are presented in Table 3-3 and described in detail below. NPS has records of other federally listed species occurring at Big South Fork NRRA—including eastern cougar (*Puma concolor couguar*), red-cockaded woodpecker (*Picoides borealis*), cracking pearlymussel (*Hemistena lata*), catspaw mussel (*Epioblasma obliquata obliquata*), clubshell mussel (*Pleurobema clava*), orangefooted pimpleback mussel (*Plethobasus cooperianus*), and American chaffseed (*Schwalbea americana*). The eastern cougar, red-cockaded woodpecker, and American chaffseed are not known to occur there today, and are therefore not considered further in this plan/EIS (NPS 2012a). The mussel species are not known to occur downstream of Bear Creek, which is where the eight selected remediation sites are located (NPS 2012a). Therefore, these federally listed freshwater mussels are not expected to occur within the eight selected CMD sites, and are not discussed further in this EIS. However, additional mussel species are known to occur or potentially occur with the proposed project area, and are discussed in the following section.

Federally Listed Mussels

Cumberland bean (*Villosa trabalis*)

This species is a medium-size freshwater mussel or bivalve mollusk with a dingy olive-green shell with numerous faint wavy green lines. It is found in sand, gravel, and cobble substrates in waters with moderate to swift currents and depths less than 3 ft. Mussels are most often observed in clean, fast-flowing water in substrate that contains relatively firm rubble, gravel, and sand swept free from siltation, and are usually buried in shallow riffle and shoal areas (NatureServe 2015).

Freshwater mussels such as the Cumberland bean reproduce when males release sperm into the water column, which are taken in by the females through their siphons during feeding and respiration. The fertilized eggs are retained in the females' gills until the larvae fully develop. The larvae are released into the water where they attach and encyst on the gills or fins of a fish host. When metamorphosis is complete, they drop to the streambed as juvenile mussels (USFWS 1990).

This species was historically known from numerous river systems in the Cumberland region, including the Big South Fork River and Tennessee River basins and is currently reproducing in the Big South Fork River based on data collected by the Kentucky Division of Fish and Wildlife Resources (KDFWR). Although none of the known fish hosts (fantail darter, barcheek darter, striped darter, and Tennessee snubnose darter) are known to occur in the main stem, these fish

are known from the Big South Fork River and its tributaries (NPS 2009b). During surveys from 1999 to 2002, the Cumberland bean was collected at 7 sites in the Big South Fork River (Ahlstedt et.al. 2004). A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land management.

Cumberland elktoe (*Alasmidonta atropurpurea*)

This species is a freshwater mussel with a somewhat shiny and black shell with greenish rays. Habitat ranges from small creeks to medium-sized rivers. The mussel is most common in smaller stream habitats. Preferred habitat appears to be shallow flats or pools with slow current and sand substrate with scattered cobble/boulder material, although it will occur in mud or rocky substrates and faster currents. Native host fish include whitetail shiner (*Cyprinella galactura*), northern hog sucker (*Hypentelium nigricans*), rock bass (*Ambloplites rupestris*), longear sunfish (*Lepomis megalotis*), and rainbow darter (*Etheostoma caeruleum*) (NatureServe 2015).

The Cumberland elktoe, endemic to the upper Cumberland River system, continues to survive throughout the Big South Fork River system. This mussel is known to occur in the Clear Fork River, New River, North White Oak Creek and the main river. The Cumberland elktoe is distributed throughout the Big South Fork NRRA in these streams, and was collected from 1999 to 2002 at 6 sites in the Big South Fork River and 13 sites in tributary streams (Ahlstedt *et.al*. 2004). A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts from poor land use management (NPS 2009b). Critical habitat was designated for this species in 2004, and includes approximately 135 river miles in Kentucky and Tennessee, including 27 miles of Big South Fork River (FR 69 53136-53180, 8/31/2004).

Cumberlandian combshell (*Epioblasma brevidens*)

This species is a freshwater mussel that has a yellow to tawny brown shell with narrow green, broken rays. The habitat ranges from large creeks to large rivers, in substrates ranging from coarse sand to mixtures of gravel, cobble, and boulder-sized particles. Cumberlandian combshell is primarily associated with stream sections exhibiting high-energy flows, high water quality, and rocky substrates. The mussel tends to occur at depths of less than approximately 3 ft, although the relict (and presumably non-reproducing) populations now occur in considerably deeper water (NatureServe 2015). This species spawns in late summer and has been observed to release larvae late the following spring (late May and early June). Based on laboratory studies, larval hosts include greenside darter, spotted darter (*Etheostoma maculatum*), redline darter, wounded darter (*Etheostoma vulneratum*), snubnose darter, logperch (*Percina caprodes*), black sculpin (*Cottus baileyi*), mottled sculpin (*Cottus bairdi*), and banded sculpin (NatureServe 2015).

Relic shells of this species were documented in park surveys between 1999 and 2002 (Ahlstedt *et.al.* 2004), and various annual mussel surveys continue to document occurrence and recruitment in the main stem river. Cumberlandian combshell was historically distributed throughout much of the Cumberland region of the Tennessee and Cumberland River drainages in Alabama, Kentucky, Mississippi, Tennessee, and Virginia. A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of

silt from poor land management. Other than the Clinch River, the Big South Fork River has the best surviving population. Known fish hosts occurring in the Big South Fork River include the greenside darter (NPS 2009b). Critical habitat was designated for this species in 2004, and includes approximately 330 river miles in Alabama, Kentucky, Mississippi, Tennessee, and Virginia, including 27 miles of Big South Fork River (FR 69 53136-53180, 8/31/2004).

KDFWR propagates endangered freshwater mussels for release at select locations within Big South Fork NRRA to augment existing mussel populations. Broodstock collection, survey and monitoring efforts have documented Cumberlandian combshell in the main stem river.

Little-wing pearlymussel (*Pegias fabula*)

This species is a small freshwater mussel that attains an average adult size less than one inch in length. The outer shell is usually eroded away in mature individuals. A few dark rays are apparent along the base of the shell in young individuals. This species is most common at the head of riffles, but is also found in and below riffles on sand and gravel substrates with scattered cobbles. It also inhabits sand pockets between rocks, cobbles, and boulders, and underneath large rocks. It is restricted to small, cool streams. It is usually found lying on top or partially buried in sand and fine gravel between cobbles in only 6 to 10 inches of water. Larval fish hosts include banded sculpin (*Cottus carolinae*), redline darter, emerald darter (*Etheostoma baileyi*), and greenside darter (NatureServe 2015).

The little-wing pearlymussel was historically known from the Cumberland and Tennessee River systems. Currently, it is known from only four rivers in the Tennessee River system and three rivers in the Cumberland River system. Big South Fork River harbors the only known reproducing population. During surveys from 1999 to 2002, the mussel was collected at 7 sites in the Big South Fork River, and two sites were noted as a nursery for the species containing both adults and juveniles (Ahlstedt *et.al.* 2004). The reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land use management. The Big South Fork River has the best remaining population of this species and the KDFWR includes this species in their propagation efforts. Known fish hosts that occur in the Big South Fork River include greenside darter and emerald darter (NPS 2009b).

Tan riffleshell (*Epioblasma florentina walkeri*)

A medium- sized (approximately 3-inch) freshwater mussel with a brown to yellow colored shell with numerous green rays found in headwaters, riffles, and shoals in sand and gravel substrates. Suitable larval hosts include sculpin (*Cottus* spp.), greenside darter (*Etheostoma blennioides*), fantail darter (*Etheostome flabellare*), redline darter (*Etheostoma rufilineatum*), and snubnose darter (*Etheostoma simoterum*) (NatureServe 2015).

The tan riffleshell was historically known from the Cumberland and Tennessee River systems. A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land management. The species historically occurred in the Big South Fork River and still occurs there. DNA results have documented this species as a valid taxon (NPS 2009b). During surveys from 1999 to 2002, the mussel was collected at 6 sites in the Big South Fork River, while two sites were noted as a nursery for the species

containing both adults and juveniles (Ahlstedt *et.al.* 2004). The Big South Fork NRRA contains the only extant population remaining in the Cumberland River system (Ahlstedt *et.al.* 2004).

Similar to Cumberlandian combshell and little-wing pearlymussels, KDFWR propagates little-tan riffleshells for release at select locations within Big South Fork NRRA. Broodstock collection, survey and monitoring efforts have documented this species in the main stem river.

Dromedary pearlymussel (*Dromus dromas*)
This mussel is a riffle-dwelling species that occurs at shoals with sand and gravel and moderate current velocities. It is also found in deeper, slower moving water in Tennessee and is most often observed in clean, fast-flowing water in stable, clean substrates that contain relatively firm rubble and gravel. Females have larvae from October through May, which are released from late March to late April (NatureServe 2015).

This species historically occurred in the Cumberland including the Big South Fork River and Tennessee River systems (Bogan and Parmalee 1983) and has been re-introduced. Known fish hosts that occur in the Big South Fork River include greenside darter and logperch (Comiskey and Etnier 1972; Jones and Neves 2000; NPS 2009b).

Oyster mussel (*Epioblasma capsaeformis*)
This species is associated with riffle areas exhibiting high- energy flows, high water quality, and rocky substrates. It lives in moderate to swift currents in small to large creeks and rivers, with substrates ranging from coarse sand and gravel to boulder-sized particles, rarely mud. Within the Big South Fork River system, this species is not found in mud, but rather under large slab rocks and underwater ledges formed by large rocks. It may be associated with beds of water willow (*Justicia americana*) bordering the main channel of the riffle, and can be found in pockets of gravel between bedrock ledges in areas of swift current. Spawning probably occurs during late summer, and larvae are released during the late spring and early summer of the following year (NatureServe 2015).

The species was historically distributed throughout much of the Cumberland Region of the Tennessee and Cumberland River drainages. A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land management.

Oyster mussels historically occurred in the Big South Fork River and have been reintroduced. Gravid females have been observed from the Big South Fork River and are probably reproducing. Known fish hosts for the oyster mussel include bluebreast darter and dusky darter, which occur in the Big South Fork River (NPS 2009b). Critical habitat was designated for this species in 2004, and includes approximately 201 river miles in Alabama, Kentucky, Mississippi, Tennessee, and Virginia, including 27 miles of Big South Fork River (FR 69 53136-53180, 8/31/2004).

Spectaclecase (*Cumberlandia monodonta*)
The spectaclecase, a candidate for federal protection, is a rare, widespread species in the Tennessee River system, but it is possibly extirpated from the Cumberland River. The species,

known historically from the Big South Fork River, was reintroduced to Big South Fork NRRA. It occurs in large rivers in substrates ranging from mud and sand to gravel, cobble, and boulders, in relatively shallow riffles and shoals with slow to swift current. It is usually found in firm mud between large rocks in quiet water very near the interface with swift currents. Specimens have also been reported in tree stumps, root masses, and in beds of rooted vegetation. The species appears to spawn twice a year during relatively short periods in the autumn (October and November) and spring (April and May). Little else is known about spectaclecase reproduction, including—despite extensive laboratory testing—the larval host fish (NatureServe 2015, NPS 2009b).

Fluted kidneyshell (*Ptychobranchus subtentum*)
This species inhabits small to medium rivers in areas with swift current or riffles, although a few populations have been recorded from larger rivers in shoal areas. The fluted kidneyshell requires flowing, well-oxygenated waters, and it is often found embedded in sand, gravel, and cobble substrates. Spawning is thought to occur in late summer or early fall, and larvae are released the following spring or early summer. Host fishes include barcheek darter, redline darter, fantail darter, and banded sculpin (NatureServe 2015).

The fluted kidneyshell is endemic to the Tennessee and Cumberland River system. It was known historically and recently collected from the Big South Fork River and has been augmented by adding adults to the population. The reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land use management (NPS 2009b). Critical habitat was designated for this species in 2013, and includes approximately 1,380 river miles in Alabama, Kentucky, Mississippi, Tennessee, and Virginia, including 40.7 miles of Big South Fork River (FR 78 59556-59620, 9/26/2013).

Pink mucket (*Lampsilis orbiculata*)
This mussel is found in mud and sand and in shallow riffles and shoals swept free of silt in major rivers and tributaries. This mussel buries itself in sand or gravel, with only the edge of its shell and its feeding siphons exposed. Reproduction requires a stable, undisturbed habitat and a sufficient population of fish hosts to complete the mussel's larval development; black basses typically serve as host fishes (USFWS 1997).

Historically, the pink mucket was mainly found in the Tennessee, Cumberland, and Ohio River drainages, with occasional records from the Mississippi River drainage (USFWS 1985). In 2010, the Tennessee Wildlife Resources Agency reintroduced the pink mucket to the Big South Fork River.

Clubshell (*Pleurobema clava*)
This is a small (up to two inches), thick, freshwater mussel with a tan- colored shell with green rays. It is generally found in clean coarse sand and gravel in runs, often just downstream of a riffle, and cannot tolerate mud or slack-water conditions. Virtually nothing is known about its diet or reproductive habits, although laboratory studies identified the striped shiner, blackside darter, central stoneroller, and logperch as potential fish hosts (NatureServe 2015).

The clubshell historically occurred throughout the Ohio River (including the Big South Fork River) and Lake Erie basins, but it now survives in only a few small, isolated populations in both basins. The current distribution represents a range reduction greater than 95 percent. The reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land use management. Three live specimens tentatively identified as *P. clava* were found in 1999 in the Big South Fork River. Fish species host of the clubshell are unknown (NPS 2009b).

Federally Listed Fish

Duskytail darter (*Etheostoma percnurum*)/Tuxedo darter (*Etheostoma lemniscatum*)

The Big South Fork River population of the duskytail darter was one of four extant populations described in the recovery plan for duskytail darters (USFWS 1994). The populations of duskytail darter are geographically isolated from one another, relatively restricted in size, and differ morphologically. As a result, researchers determined that the four populations of duskytail darters are a complex of four species, denoting the Big South Fork River population as the tuxedo darter (Shute 1997; Blanton and Jenkins 2008). Currently, the tuxedo darter is documented under the duskytail darter species complex nomenclature, recovery plan, and subsequent review documents, though USFWS have recommended the initiation of a new listing action for the tuxedo darter (USFWS 2012).

This darter inhabits pools and riffles of large creeks and small to medium rivers that are approximately 30 to 260 ft wide, of moderate gradient, warm, and usually clear. Young and adults typically are in silt-free rocky pools and slow runs, under or near cover, often among considerable detritus, or among cobbles and small boulders (NatureServe 2015). These fishes occur over heterogeneous mixtures of rock sizes from pea gravel to rubble/cobble, slab-rock, and boulders. They rarely occur in heavily silted areas. Spawning occurs from late April through June. Diet of young mainly consists of microcrustaceans, chironomid larvae, and heptageniid nymphs; larger individuals eat chironomid larvae, mayfly nymphs, microcrustaceans, caddisfly larvae, and sometimes fish eggs (NatureServe 2015).

Because of the water quality issues influencing the Big South Fork River system, the tuxedo darter survives under threat of being wiped out by a single pollution event, which would eliminate the only known population. Tuxedo darters have consistently been found in the Big South Fork River since at least 1998 (USFWS 2012). Dr. Brooks Burr (Southern Illinois University, Carbondale) was contracted by the Kentucky Division of Fish & Game to determine if tuxedo darters might occur within Kentucky's portion of the Big South Fork River system. During the surveys, the known range of the tuxedo darter was extended into Kentucky approximately as far downstream as the confluence with Bear Creek (Shute 1997; NPS 2009b). Conservation Fisheries, Inc. (CFI) was contracted to survey streams within the Big South Fork NRRA and within the Big South Fork River watershed for the presence of tuxedo darters, and subsequently collected darters downstream to Blue Heron (CFI 2003; NPS 2009b). The recent surveys have expanded the known range of the Big South Fork River population to a 14-mile reach of the river, with the core population between Station Camp Creek and Blue Heron on the mainstem of the river (CFI 2003; Davis 2010). Davis (2010) estimated the total population size as approximately 200 in 2008, and approximately 100 in 2009, with ninety percent of tuxedo

darters found within a 4.3-mile reach (Davis 2010; USFWS 2012). However, during a 2013 USACE mussel survey in Big South Fork River, USACE documented the tuxedo darter at seven previously unknown locations downstream of Blue Heron (Simmons and Shaffer 2013). Following the finding, USACE agreed to conduct tuxedo darter and habitat surveys on a portion the Big South Fork River in 2014. This survey documented the species at eight sites along the Big South Fork River from known locations upstream of Devils Jump to areas downstream of Worley #86, indicating a known presence of the species in the vicinity of potential CMD remedial sites along the Big South Fork River corridor (Simmons 2015).

Blackside dace (*Phoxinus cumberlandensis*)
The blackside dace is found in about 30 streams in the upper Cumberland River system, primarily above Cumberland Falls, in southeastern Kentucky and northeastern Tennessee. The species inhabits short stream reaches totaling about 14 stream miles in the following counties: Pulaski, Laurel, McCreary, Whitley, Knox, Bell, Harlan, and Letcher, Kentucky; and Scott, Campbell, and Claiborne, Tennessee. No estimate of total population numbers is available. All but three populations are found in stream reaches less than a mile in length, and some are limited to only a few hundred yards. This fish is found in the Big South Fork NRRA in a small tributary near Yamacraw in Kentucky, but not in the main river.

This fish was not recognized as a distinct species until 1975, and relatively few historic fish collection records exist for the Upper Cumberland River Basin. The blackside dace inhabits small (7 to 15 ft wide) upland streams with moderate flows. The species is generally associated with undercut banks and large rocks and is usually found within relatively stable, well-vegetated watersheds with good riparian vegetation. Stable watersheds help maintain cool temperatures and minimize silt to the benefit of the species. O'Bara *et al.* (1985) also found that the fish's presence was apparently closely correlated with healthy riparian vegetation where canopy cover exceeded 70 percent and with riffles. The fish was found neither in low gradient silty streams nor in high-gradient mountain tributaries. The status of this species is due primarily to the impacts of siltation, and the effects of acid mine drainage. Based on a survey by O'Bara *et al.* (1985), the most frequently cited threats were related to coal mining, followed in order of threat by logging, road construction, agriculture, human development, and natural low flows. Controlling siltation, particularly in relation to surface mining, would be necessary to assure that the species suffers no further population losses or potential loss of genetic variation (NPS 2009b).

Palezone shiner (*Notropis albizonatus*)
The palezone shiner inhabits clean, clear waters of flowing pools and runs found over bottoms with fractured bedrock, cobble, and gravel mixed with clear sand. The palezone shiner reaches a maximum length of less than 6 cm. Highly restricted in distribution, the palezone shiner is found only in the Tennessee River drainage in Alabama and Tennessee and disjunctly to the north in the Cumberland River drainage in Kentucky. It is uncommon and localized throughout its range. In Kentucky, for example, it occurs only in the Little South Fork of the Cumberland River and also in the Rock Creek system in McCreary County, Kentucky.

This rare species, when found, usually occurs in moderately large, high-gradient, clear streams flowing over bedrock, cobble, or gravel mixed with clean sand; it prefers pools and pool runs below riffles. Spawning is thought to occur from early June through July in Alabama, but Etnier and Starnes (1993) report that tuberculate individuals have been collected in May and June in Tennessee. Warren *et al*. (1994) indicate spawning from mid-May to early July, peaking in June, with individuals living between 3 and 4 years. Little else is known about the biology of this species (NPS 2009b).

Federally Listed Plants

The river's terrace, floodplain, and boulder-cobble bars host rare plant species including the federally listed Cumberland rosemary (*Conradina verticillata*) and Virginia spiraea (*Spiraea virginiana*). Several of these species are unique to the Cumberland Plateau. The federally listed Cumberland rosemary is narrowly restricted to the Cumberland River and Tennessee River systems, with a particularly high concentration occurring within Big South Fork River.

Cumberland sandwort (*Arenaria cumberlandensis*)

Cumberland sandwort is a perennial herbaceous plant that grows in cool, humid, rock shelters formed through differential weathering of sandstone strata. This species grows on sandy floors of these rock shelters and in similar situations such as beneath sandstone ledges. The few species that share this habitat with Cumberland sandwort include Lucy Braun's white snakeroot (*Eupatorium luciae-brauniae*) and featherbells (*Stenanthium gramineum*). Cumberland sandwort is narrowly endemic to the Cumberland Plateau of northcentral Tennessee and adjacent Kentucky. There are currently more than 30 occurrences known, but most of them are concentrated within a small portion of the overall range, in the Big South Fork River watershed. Most of the populations within Big South Fork NRRA are located in rock shelters or lower ledges of the sandstone cliffline that rims the Big South Fork River gorge. Additional unmapped populations are likely in the Big South Fork NRRA, particularly west of the Big South Fork River in Scott, Fentress, and Pickett County (NPS 2009b).

Cumberland rosemary (*Conradina verticillata*)

Cumberland rosemary is a low (less than 20 inches), aromatic, perennial evergreen shrub, forming clumps or mats of sprawling branches that root at the nodes. Cumberland rosemary is endemic to the upper Cumberland Plateau in north-central Tennessee and adjacent southeastern Kentucky and restricted to floodplain habitats. Suitable habitats are full to moderate sunlit gravel bars in floodplains of the Big South Fork River and its major tributaries. Substrate can vary from dense deep sands to cobble boulders that are well drained. Populations occur on boulder bars, boulder-cobble-sand bars, sand gravel bars, sand terraces adjacent to the river, and islands with gently sloping sand banks. High quality populations are annually scoured by spring flooding to preserve and restore open conditions. Annual floods also act as a disperser through the transport of viable plant fragments downstream. Common associates include green-headed coneflower (*Rudbeckia laciniata*), along with globally rare plants such as large-flowered Barbara's-buttons (*Marshallia grandiflora*) and Virginia spiraea (*Spiraea virginiana*) (NatureServe 2015).

As of 1996, 91 occurrences were believed to be extant across the range. Most occurrences are very small and isolated from others. Fewer than 4,000 individuals were estimated at the known sites. This species' abundance and distribution has probably been reduced by dam construction and by water pollution from nearby coal mining. Habitat destruction due to intensive recreational use also poses a threat (NPS 2009b).

Virginia spiraea (*Spiraea virginiana*)
Virginia spiraea is a clonal shrub that grows up to approximately 4 ft high. This species occurs along creek edges with margins of exposed rock and piled detritus, bars of gravel, rubble and/or boulders, and including dolomitic limestone. It occurs in alluvial silt collected within cracks in the bedrock that experience a regime of periodic flooding. Elevations range from 850–1,420 ft (NatureServe 2015).

Virginia spiraea occurs along creek edges with margins of exposed rock and piled detritus, bars of gravel, rubble and/or boulders. It occurs in alluvial silt collected within cracks in the bedrock. These sites experience a regime of periodic flooding. Associated species include *Acer pensylvanicum*, *Alnus*, *Arisaema dracontium*, *Arundinaria gigantean*, *Conradina verticillata*, *Dica palustris*, *Ilex vertifillata*, *Juniperus virginiana*, *Liriodendron tulipifera*, *Orontium aquaticum*, *Osmunda regalis*, *O. cinnamomea*, *Phlox amoena*, *Salix*, *Senecia aureus*, *Silene virginica*, *Spiraea japonica*, *Toxicodendron radicans*, *Trautvetteria*, *Tsuga*, *Ulmus*, and *Viburnum dentatum*.

Virginia spiraea is intrinsically threatened by its limited range and small number of populations, making it especially vulnerable to land-use conversion and habitat fragmentation. Populations are isolated, consisting of sterile clones, and damming of rivers has increased this isolation. Many sites are threatened by changes in hydrology through impoundment and by impact from recreation use (fishing and boating).

Roadside maintenance, beaver damage, deer browse, ATVs, and upslope timbering are noted as potential threats. Exotic species (*Rosa multiflora*, *Elaeagnus umbellata*, *Ailanthus altissima*, *Spiraea japonica*, *Alliarai petiolata*, *Albizia julibrissin*, and *Polygonum cuspidatum*) are also a threat.

White fringeless orchid (*Platanthera integrilabia*)
White fringeless orchid is generally found in wet, flat, boggy areas at the head of streams or seepage slopes. The species is often found in association with *Sphagnum* species and *Osmunda cinnamomea*, *Woodwardia areolata*, and *Thelyptris novaboracensis*, in acidic muck or sand, and in partially but not fully shaded areas. Populations of this species are associated with sandstones of the Appalachian Plateaus of Kentucky, Tennessee, and Alabama; the Coastal Plain of Alabama and Mississippi; the Blue Ridge Province of Georgia, North Carolina, and Tennessee; the Ridge and Valley Physiographic Province in Alabama; and the Piedmont of Georgia and South Carolina. White fringeless orchid is currently known from about 50 irregularly scattered occurrences in the southeastern U.S., primarily on the Cumberland Plateau of Tennessee and Kentucky. Many occurrences consist of fewer than100 plants. The orchid, a candidate species, was proposed for listing as threatened in 2015 and is currently under review for final listing (FR 80 55304-55321, 9/15/2015).

Most surviving populations are not vigorous and exhibit very poor seed set and reproduction (reproduction is nearly exclusively sexual). The habitat where this species grows has often been drained or turned into farm ponds or hog lots or has experienced residential and commercial construction. Active management may be required to inhibit woody succession and prevent canopy closure at sites where the species is found; timber harvest must be carried out carefully to protect the species from damage. Development, canopy closure, improper timber harvest techniques, and invasive exotic plants remain threats (NPS 2009b).

Critical Habitats within Big South Fork NRRA

Within Big South Fork NRRA, critical habitat is designated for four federally listed mussels including the Cumberland elktoe mussel, oyster mussel, fluted kidneyshell, and the Cumberlandian combshell mussel. Critical habitat rules were finalized in the FR, August 31, 2004, 50 CFR 17. New River, Clear Fork and North White Oak, along with other tributaries and the main stem Big South Fork River in the NRRA are listed as designated Critical Habitat and should be afforded the protection under the new ruling, as applied by the USFWS. The primary constituent elements of critical habitat for all mussel species discussed herein consist of:

- Permanent, flowing stream reaches with a flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish;
- Geomorphically stable stream and river channels and banks (structurally stable stream cross section);
- Stable substrates, consisting of mud, sand, gravel, and/or cobble/boulder, with low amounts of fine sediments or attached filamentous algae;
- Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal, behavior, growth, and survival of all life stages of the mussels and their host fish; and
- Fish hosts with adequate living, foraging, and spawning areas for them.

All areas designated as critical habitat for the mussels are within the species' historic ranges and contain one or more of the physical or biological features (primary constituent elements) identified as essential for the conservation of these species (NPS 2009b). The critical habitat in Big South Fork River extends from the Laurel Crossing Branch confluence upstream into Tennessee. Blair Creek is the closest CMD site to designated critical habitat of the eight potential sites, and is located approximately 1.5 miles downstream of the designated critical habitat.

Specific Study Area Determinations

No detailed terrestrial or aquatic studies have been conducted for the eight CMD remedial sites. The nearest CMD remedial site to designated critical habitat is within the Big South Fork River, approximately 1.5 river miles south (upstream) from the Blair Creek site.

CULTURAL RESOURCES

Definition

Cultural resources are prehistoric and historic sites, structures, districts, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, or religious reasons. Based on statutory requirements, cultural resources are defined to include:

- Historic properties, as defined in the NHPA of 1966, as amended;
- Cultural items, as defined in the Native American Graves and Repatriation Act (NAGPRA);
- Archeological resources, as defined in the Archeological Resources Protection Act (ARPA);
- Historic and paleontological resources, as defined by the Antiquities Act of 1906, as amended;
- Sites that are scientifically significant, as defined by the Archeological and Historic Data Preservation Act (AHPA);
- Sacred sites, as defined in EO 13007, to which access and use is permitted under the American Indian Religious Freedom Act (AIRFA); and
- Collections, as defined in 36 CFR Part 79, Curation of Federally-Owned and Administered Collections.

The NPS defines cultural resources as "an aspect of a cultural system that is valued by or significantly representative of a culture or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures and objects for the NRHP, and as archeological resources, cultural landscapes, structures, museum objects and ethnographic resources for NPS management purposes." (NPS-28 Appendix A 1998).

NEPA requires that federal entities ensure that cultural resources, as defined by the above-stated regulations, are fully considered when preparing NEPA analyses.

The NHPA establishes the federal government's policy to provide leadership in the preservation and management of historic properties. Under Section 106 of the NHPA, as well as 36 CFR §800, federal agencies are required to identify and protect historic properties included in, or eligible for listing on, the NRHP. Historic properties may be archeological sites (both prehistoric and historic), buildings, structures, objects, or districts. The federal proponent is responsible for seeking the comments of the SHPO under 36 CFR §800 on projects that affect historic properties. In Kentucky, all federal projects are reviewed by the Kentucky Heritage Council within the SHPO. Acting as the SHPO, the Executive Director of the Council directs the federal preservation program in Kentucky including the NRHP, Historic Preservation Tax Credits, NHPA Section 106 Environmental Review, Certified Local Governments, and Preservation Grants-in-Aid.

Significance Criteria

In order for a cultural resource to be considered significant, it must meet one or more of the criteria for inclusion on the NRHP, as described below:

The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

- That are associated with events that have made a significant contribution to the broad patterns of our history; or
- That are associated with the lives or persons significant in our past; or
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- That have yielded, or may be likely to yield, information important in prehistory or history (36 CFR §60:4).

Only significant cultural resources warrant consideration with regard to adverse impacts resulting from implementation of a proposed action. Generally, cultural resources must be more than 50 years old to receive protection under federal laws.

Architectural and Archeological Resources

Numerous surveys pertaining to cultural resources have been completed within the Big South Fork NRRA and indicate that the area has been occupied by humans for over 12,000 years. Although many shallow caves and rock shelters within the Big South Fork NRRA were most likely used by Native Americans, no evidence of permanent Native American settlements has been discovered in the park. Based on sampling, it is estimated that over 10,000 archeological (both historic and prehistoric) sites exist within the boundaries of the Big South Fork NRRA. However, no prehistoric sites are known to occur in close proximity to the project sites (NPS 2005).

Conversely, historic sites are recorded in the vicinity of project sites and are predominantly remnants of past mining operations, mining towns, homesteads, railroad/tramway spurs, and mine portals. Hutchinson *et al*. (1982) completed an inventory and evaluation of architectural and engineering resources within the Big South Fork NRRA and named Worley as one of seven areas identified as highly sensitive in terms of historic archeological resources. In addition, based on topographic maps from the 1930's, Hutchinson *et al*. (1982) identified over 140 potential archeological sites in the Kentucky portion of the Big South Fork NRRA.

As detailed in the intergovernmental correspondence the Kentucky SHPO found that the proposed project has the potential to impact properties eligible for listing in the NRHP. Their review of the projects proposed for analysis within this EIS concluded that the Worley Mine area contains extant features from the mine and associated community, including the old railroad, foundations of buildings, a tipple, and stairways. In addition, the SHPO indicated that there is a potential for archeological sites along the Big South Fork River floodplain.

Specific Study Area Determinations

Phase I archeological surveys have not been conducted at the eight selected remedial sites. Four of the selected remedial sites contain above-ground cultural features associated with the mining era at the Big South Fork NRRA.

1. Worley Mine #86 – Worley Mine #86 is located in the vicinity of possible housing for miners that worked in the coal mines. Stone walls and a concrete stairway are located in this area just north of the Worley Mine #86 site. The above-ground features situated near the Worley Mine #86 site have not been investigated for their NRHP eligibility.
2. Worley Mine #88 – Above-ground features associated with a coal production complex are situated near the mine opening at Worley Mine #88. The above ground features have not been investigated for their NRHP eligibility.
3. Laurel Branch Confluence – Above-ground concrete foundations and a painted historical sign are known to be present at this site. The above ground features situated near the Laurel Confluence site have not been investigated for their NRHP eligibility.
4. Slavey Hollow – Above-ground features associated with a coal production complex include a former scale house foundation. The above ground features have not been investigated for their NRHP eligibility.

VISITOR USE AND EXPERIENCE

Visitor Use

Annual Visitor Statistics

Table 3-4 displays visitation numbers at Big South Fork NRRA, which are based largely on counts taken at the Bandy Creek Visitor Center. While these counts may underestimate the actual number of annual visitors to the park, they record a general trend in visitation. The total number of visitors to Big South Fork NRRA during the period from 2000 to 2014 was approximately 10.4 million. An average of 694,761 visitors come to the park each year. Visitation peaked in 2001 and has generally declined from 2002 to the present, increasing slightly from 2004 to 2005, from 2007 to 2009, and, more recently, from 2013 to 2015.

Seasonal Visitor Statistics

Seasonal visitor use patterns at Big South Fork NRRA are generally predictable throughout the year. Visitation at Big South Fork NRRA increases throughout the summer with peak visitation occurring in October. Spring visitor use is moderate to high, with visitor numbers increasing during the summer months. Winter season use is relatively light, with January and February accounting for the lowest percentage of park visitors over the 27-year period from 1988 through 2015 (NPS 2016b).

Visitor Activities

The Big South Fork NRRA provides river use, trail use, hunting, and various other activities such as rock climbing, nature study, camping, and the Big South Fork Scenic Railway. These recreational opportunities are allowed throughout the Big South Fork NRRA, including within the vicinity of the project sites.

River use within the Big South Fork NRRA includes swimming, rafting, boating, canoeing, kayaking and fishing. All of these activities are allowed along the Big South Fork River in close proximity to the project sites. Swimming, fishing, and motorized boating on Lake Cumberland below Devils Jump are popular among both local and regional visitors, while rafting and kayaking are generally more popular among regional visitors. Fishing is allowed in accordance with state regulations.

Trail use, sight-seeing, and camping are popular within the Big South Fork NRRA. Trail use makes up a large portion of total visitor use within the Big South Fork NRRA. Trails in the vicinity of the project sites include both single-use trails and multi-use trails. Trail use includes hiking, horseback riding, and mountain biking. Both improved and back country camping are available within the Big South Fork NRRA. ATV use is also allowed on designated multiple-use trails only during big game season with a valid hunting license.

Hunting is very popular within the Big South Fork NRRA and occurs in all areas except designated safety zones around developed sites, such as heavily used trails and visitor areas. Hunting for deer, turkey, small game and waterfowl occurs along the Big South Fork River and is managed consistent with state regulations and NPS safety zones. Portions of Devils Creek and Worley Mine #86 are within a safety zone, and it is likely that portions of some of the programmatic locations could be located within a safety zone.

Special Management Areas

The Big South Fork NRRA developed SMAs during the development of the Oil and Gas EIS completed in 2012. The Oil and Gas EIS was a document that developed a framework for private operators to conduct oil and gas production within the Big South Fork NRRA. During the planning process, the park identified certain areas with sensitive ecological and cultural resources (Figure 3-10). In order to protect or lessen impacts to these sensitive park resources, SMAs were identified and afforded protection through park approved stipulations for individual SMAs or through avoidance by the use of “No Surface Use” stipulation where no surface disturbance would be allowed. The “No Surface Use” stipulation could be superseded by the development of an operating plan approved by the park.

In some instances where the “No Surface Use” is applied, there are required setbacks from the boundary of the SMA. The actual distances may vary depending on the specifics of individual projects and resources found at the sites and may be modified by increasing or decreasing the setback distance. The setbacks are variable and are dependent on the mitigation measures are employed to protect resources, values, human health and safety.

A modification of any SMA operating stipulation may be considered by the NPS if site-specific information (such as engineering, geological, biological, or other studies) warrant the change, or if the park could demonstrate that the proposed CMD remediation would meet the goals of protecting resources and values of the individual SMA. SMAs would apply to all new CMD remediation projects.

The park has designated five SMAs for the Big South Fork NRRA.

- **Sensitive Geomorphic Feature SMA** – This SMA includes sensitive geomorphic features and includes rock shelters, arches, chimneys, natural bridges, waterfalls, and windows. Some of these features are in their end stages of existence, are relatively fragile, and are susceptible to erosion. In addition to the geology of the Sensitive Geomorphic Feature SMA, these areas are also important because they provide special habitat for certain plant and animal species, including some rare or unusual vegetation. Rock shelters may contain archeological sites that date to pre-Columbian times and require protection by regulation and/or NPS management policies. A 500-ft setback would be recommended for construction activities (access construction and construction of the remedial approach) based on the sensitivity of the resource.
- **Cliff Edge SMA** – Cliff edges are defined in the GMP for the park unit as the exposed, rocky, sparsely vegetated, sandstone outcrops along the rim of the gorge. They can be found along the main gorge of Big South Fork NRRA and up the valleys of many tributaries. They can run for a mile or more or occur in isolated short lengths. Cliff edges are a recognizable physiographic feature and are not necessarily the same as the "gorge" outlined or defined in the legislation (NPS 2005). These areas are home to threatened, endangered, and/or state-listed species and also provide roosting and nesting sites for birds. Cliff edges are often associated with important archeological resources and sites eligible for listing on the NRHP that contribute to the cultural characteristics of the park unit. Protection of the associated resources and values are required both by regulation and/or NPS management policies. Cliff edges provide a prime scenic resource at the park unit and some natural or developed overlooks would be open to visitor access (NPS 2005). This opportunity is essential to the visitor experience of the gorge at Big South Fork NRRA and must be protected from all potential impacts, including remediation at CMD sites. A 100-ft setback would be recommended for preliminary investigations and a 500-ft setback would be recommended for construction activities (access construction and construction of the remedial approach) based on the sensitivity of the resource.
- **Visitor Experience/Administrative Area SMA** – This SMA includes those areas identified in the park GMP as First Order Development and Visitor Use Zones. The visitor experiences and values occurring in visitor use areas must be protected from all potential impacts, including remediation at CMD sites. Facilities and private in-holdings within the park unit, as well as health and safety of park visitors and staff, must also be protected from all activities, including remediation at CMD sites. A 500-ft setback would be recommended for construction activities (access construction and construction of the remedial approach) based on the sensitivity of the resource. A 100-ft setback would be recommended for preliminary investigations. In some instances, a 1,500-ft setback for construction activities (access construction and construction of the remedial approach) could be implemented based on the sensitivity of the resource. The actual distances for setbacks may vary depending upon the specifics of individual projects and resources found at the sites and may be modified to be either increased or decreased from the figures presented.

- **Trails SMA** – This SMA includes all designated trails identified in the GMP. Visitor experiences and values occurring in visitor use areas, including along trails of the park unit, must be protected from all potential impacts, including CMD remediation.
- **Cultural Landscapes and Cemeteries SMA** – This SMA includes 61 known cemeteries in the park unit and 7 cultural landscapes (including 4 cultural landscapes that are eligible for the NRHP, 1 administrative, and 2 that are unevaluated); additional cemeteries will be added to the list when identified. Facilities and private in-holdings within the park unit, including cemeteries, must also be protected from all activities including CMD remediation. Cemeteries are important to local communities and families often visit graves. Cultural landscapes, including those eligible for listing on the NRHP must be protected from potential impacts related to CMD remediation.

Specific Study Area Determinations

Worley Mines #86 and #88 would be accessed by Worley Road and the existing corridor of the Big South Fork Scenic Railway. Though these sites are not located near trails SMAs, they are in the vicinity of cliff edge SMAs, located to the north and southwest, and near a visitor experience/administrative area SMA, at one of the legislative gorge access routes.

Slavey Hollow would be accessed by Wilson Ridge Road and a non-public access road that are not located near a trail SMA, or in the vicinity of other SMAs.

The Nancy Grave and Devils Creek remediation sites would be accessed through Wilson Ridge Road and Segment C of the Kentucky Trail. In addition to the trail SMA, access to these sites would be in the vicinity of cliff edge SMAs and a sensitive geomorphic feature SMA along Devils Creek.

The Laurel Branch Confluence and Spoils sites would be accessed from Laurel Branch Road and the Lee Hollow Loop Horse Trail. In addition to the trail SMA, these sites and the proposed access to the sites would also be in the vicinity of cliff edge SMAs to the southwest.

The Blair Creek site would be accessed from the Bear Creek Horse Camp and would use portions of the Bear Creek Loop and Lee Hollow Loop horse trails to reach the site. In addition to trail SMAs, this site and the proposed access to the site would also be in the vicinity of cliff edge SMAs, located to the north.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

Under NEPA, the Noise Control Act of 1972 (Public Law 92-574), and EO 12088, the NPS is required to assess the environmental impact of noise produced by its activities. Within such an assessment, strategies are promulgated to protect both on- and off-site receptors from environmental noise.

Noise created by the construction equipment could affect the natural soundscape at localized areas within the Big South Fork NRRA. Natural sounds within Big South Fork NRRA may range from bird calls, insect chirps, and bats to sounds produced by physical processes like wind rushing through leaves on trees, thunder, and rushing and falling water through rivers, creeks,

and streams. The natural soundscapes of Big South Fork NRRA have not been studied and characterized by sound level measurements in the past (NPS 2012a). Soundscape studies from the Great Smoky Mountains National Park are used to make comparisons to Big South Fork NRRA because the parks are similar in geographic location and topography. Data from the Great Smoky Mountains National Park was collected in 2005 and 2006 using an L90 metric. The L90 metric represents the sound level exceeded 90% of the time. Winter daytime L90 levels in the Great Smoky Mountains National Park ranged between 26.3 and 32.2 A-weighted decibels (dBA), and winter nighttime L90 levels ranged between 24.4 and 32.9 dBA. Similarly, summer daytime L90 ranged between 24.9 and 39.0 dBA, while the nighttime L90 ranged between 21.6 and 42.6 dBA. The expected natural ambient noise levels in Big South Fork NRRA would cover similar wintertime and summertime ranges (NPS 2012a).

Noise Sources

As defined in *Director's Order 47: Soundscape Preservation and Noise Management*, noise is defined as, “an unwanted or undesired sound, often unpleasant in quality, intensity or repetition." The noise environment within Big South Fork NRRA includes primarily non-impulse noise generated from continuous low-energy noise sources, such as that produced by vehicles. Sources of noise that affect the existing soundscape at Big South Fork NRRA include vehicular traffic, including off-highway vehicle use; construction and maintenance of park roads; oil and gas operations within and adjacent to park; operation of the Big South Fork Scenic Railway train; visitor uses such as hunting; logging and timber harvesting; industrial activities such as manufacturing, sawmills, and coal mining; and agricultural activities in the area around the park (NPS 2012a). Vehicular access within the gorge section of the park is limited to eleven river accesses to keep noise pollution and other environmental impacts at a minimum. No off-highway vehicle use or mineral extraction is allowed in these areas. Nonetheless, the soundscape in the gorge is impacted by activities in adjacent areas.

Proximate Sensitive Receptors

Sensitive receptors include, but are not limited to, health care facilities, rehabilitation centers, convalescent centers, retirement homes, residences, schools, playgrounds, and childcare centers. With the exception of potential visitors to the Big South Fork NRRA, there are no sensitive receptors within or in the vicinity of the project area; no permanently-located sensitive receptors reside in the immediate vicinity of the proposed project sites. While no detailed noise studies have been conducted for the eight selected remedial sites, all sites are situated in areas where visitor use includes hiking and horse riding.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This "Environmental Consequences" chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this EIS. As required by CEQ regulations implementing NEPA, a summary of the environmental consequences for each alternative is provided in Table 2-6, found in Chapter 2. The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in Chapter 3. A description of the general methodology for estimating impacts and measuring effects by resource is included in Appendix E.

CUMULATIVE IMPACT SCENARIO

The following describes in more detail various cumulative plans, policies, and actions listed in Table 4-1.

NPS Management Actions

Fires and Fire Management, including Prescribed Fires

From 1991 to 2001, 36 wildland fires were suppressed, and 7,317 acres were burned at Big South Fork NRRA. In 2004, the *2006 Big South Fork National River and Recreation Area Fire Management Plan* (NPS 2006b) was developed to guide actions taken in meeting the fire management goals established for the park. These actions include suppression, mechanical hazard fuel reduction, and prescribed fire to achieve cultural and resource management objectives. The plan specifies the use of prescribed fire and mechanical hazard fuel reduction to reduce accumulations around historic structures, developed areas, and near park boundaries to reduce the likelihood of wildland fire negatively impacting park resources or spreading onto other public or private lands. During the first 5 years of the plan, prescribed fire was used to treat an average of 800 acres annually (NPS 2006b).

Fields Management

Big South Fork NRRA contains 102 field units, totaling approximately 740 acres. Although this represents a very small part (less than 1%) of the park, fields are important components of the park's natural and cultural landscape. The 2006 Big South Fork NRRA Fields Management Plan (NPS 2006c) identifies desired resource conditions and the kinds/levels of visitor use for each of the fields in the park, depending on the GMP zone within which it is located. The plan also identifies specific vegetation conditions for each field (e.g., native warm season grasses, tall fescue (*Lolium arundinaceum*) mix, turfgrass, grassy woodland, and forest). The desired conditions, uses in each field, and whether or not the field is included in a designated cultural landscape were all taken into account when developing the management prescriptions for each field. The long-term objectives for this plan are to: (1) restore disturbed lands to natural conditions, (2) enhance habitat for game and non-game wildlife, (3) preserve cultural landscapes, and (4) enhance recreational opportunities (NPS 2006c).

Exotic Plant Species Management

The spread of non-native plant species has historically been occurring, and now represents a serious problem within NPS units. At Big South Fork NRRA, efforts to control exotic vegetation such as multiflora rose have involved the use of herbicides as the primary tool for controlling exotic plant infestations in managed fields. Spot treatments of herbicides applied at labeled rates and various frequencies have been used to control most exotic plant infestations (NPS 2005).

Threatened and Endangered Species Management

Recovery plans for threatened and endangered species carried out under USFWS and efforts to ensure agency cooperation under Section 7(a)-of the ESA are important for managing populations of threatened and endangered species. There are 21 species that occur at Big South Fork NRRA that are listed as threatened or endangered under the ESA. These species include four plants, three bats, eleven mussels, and three fish. As part of these efforts, Big South Fork NRRA staff are working with the USFWS, USGS, Tennessee Wildlife Resources Agency (TWRA), and two mussel hatcheries, Virginia Tech Mussel Facility and Kentucky Center for Mollusk Conservation, to propagate freshwater mussels and reintroduce them into parts of their historical range.

Implementation of the General Management Plan at Big South Fork NRRA

The GMP for Big South Fork NRRA was completed in 2005, and park staff members have begun its implementation. Within the Natural Environment Recreation Zone, natural processes are protected to allow natural succession into mature forest, which contributes to predominantly natural conditions being apparent to park visitors. Resources in the Sensitive Resource Protection Zone reflect natural processes and are carefully protected from unnatural degradation. The All-Terrain Vehicle Planning Area Zone is a use-oriented overlay on the Natural Environment Recreation Zone. A variety of trail types, specific trail locations, and construction and maintenance standards, were established for the entire park to provide for a wide range of recreational uses and visitor experiences

Cemetery Management

Big South Fork NRRA has developed cemetery management guidelines to aid in the preservation of 61 known cemeteries located within the boundary of the NRRA (NPS 2013b). These guidelines allow access for burial, decoration, and visitation, provided these are consistent with the guidelines, the Big South Fork NRRA GMP, and the intent of the enabling legislation for Big South Fork NRRA. NPS will maintain routes intended for the sole purpose of accessing cemeteries based on conditions identified in 1987, unless there are other appropriate routes in place. Private cemetery maintenance and upkeep may be done by family members, while federal cemetery maintenance and upkeep may be done by either family members or by the U.S. government, if the cemetery is determined to have historical significance. No new cemeteries are allowed to be developed, and all cemetery boundaries are those identified at the time of U.S. government acquisition.

Visitor Activities Within/Adjacent to Big South Fork NRRA

Visitor activities, such as swimming, rafting, boating, canoeing, kayaking, fishing, hunting, hiking, horseback riding, mountain biking, rock climbing, nature study, and camping, occur within Big South Fork NRRA and may contribute to cumulative impacts on the resources considered in this EIS. These activities also occur outside Big South Fork NRRA. Overhunting has been an issue in the past, in addition to other unauthorized activities, such as poaching, harassing wildlife, rock gathering, and vandalism at cultural sites. Fishing is a popular recreational activity, and outside Big South Fork NRRA, stocking is used to support fisheries. Although visitor uses are not expected to change, annual visitation over the life of the plan is expected to increase slightly, with some variation from year to year.

The nonprofit McCreary County Heritage Foundation owns and operates a sightseeing train that runs from historic downtown Stearns through Barthell (adjacent to the boundary of Big South Fork NRRA) to the Blue Heron mine. This scenic route takes visitors through the gorge and is seasonally popular. Expansion of the route north to Yamacraw is in planning.

Development and Maintenance Activities Inside Big South Fork NRRA

Big South Fork NRRA has developed numerous features related to park wide administrative, managerial, and support functions, as well as visitor use. Facilities within Big South Fork NRRA are described in detail under the “Visitor Use and Experience” section of Chapter 3 and include such amenities as campgrounds, day use areas, interpretive center/visitor contact stations, river access areas, administration buildings, over 300 miles of trails, and over 275 miles of dirt and gravel roads. Roads in Big South Fork NRRA are open for use by personal vehicles and commercial vehicles (e.g., gravel trucks). Off-road vehicles (ORVs) for hunting big game are only allowed on multiple use trails during the big game hunting season. The NPS routinely maintains these facilities as well as cultural landscapes in Big South Fork NRRA.

Development Outside Big South Fork NRRA

Big South Fork NRRA is within 40 miles of Knox and Cumberland counties, as well as Interstates 75 and 40. Proximity to these developed areas can affect lightscapes and soundscapes. Relatively low-density residential development occurs in various locations surrounding Big South Fork NRRA, and has resulted in the development of infrastructure such as roads, utilities, septic tanks, and water impoundments/intakes for water supply/treatment. More recently, there have been local planning efforts to promote growth surrounding Big South Fork NRRA, and new developments include a federal prison in McCreary County, Kentucky; commercial buildings; and a new industrial park. Other development plans in the vicinity of Big South Fork NRRA include new residential and second-home communities. Industrial activity sites that could contribute to cumulative impacts include power plants, railroads, hardwood flooring factories, sawmills, and other manufacturing facilities. These sites could result in discharges to surface waters as well as nonpoint source pollution from runoff.

Agricultural Activities/Logging

Agriculture other than forestry has occurred on less than 20% of the land in counties adjacent to Big South Fork NRRA. Most of this has been dedicated to hay production and livestock grazing, with minimal row-cropping (NPS 2012a). A plateau area above and to the north of Bear Creek

consists of two large, flat ridges of agricultural lands and hardwood forests (NPS 2005). Because of logging in the early to mid-20th century, most of the forested areas of Big South Fork NRRA are second or third growth. Large portions of the extensive Darrow Ridge area in the southwest, including Tar Kiln Ridge, have undergone logging activities. In addition to continued logging and harvesting, replanting and surface reclamation of logging sites is expected to continue to occur.

Mining and Minerals Management

In addition to active mining operations, approximately 25,100 acres of unreclaimed abandoned coal mines exist in the Tennessee counties adjacent to the Big South Fork NRRA, and there are about 10 abandoned surface coal mine sites in McCreary County, Kentucky. Most of these sites were mined prior to 1977, before the Surface Mining Control and Reclamation Act required reclamation of mine sites (NPS 2005). There are at least 120 underground entries and associated spoil piles clustered along the various coal seams outcropping from the steep slopes of the Big South Fork River gorge (NPS 2015e). Mine reclamation efforts, funded by the Office of Surface Mining, have concentrated on reclamation of former mine sites at areas having visitor access.

As previously noted, impacts on water quality from coal mining include siltation of streams and CMD, which occurs from sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites. During coal mining, acid is formed by the oxidation of the pyrite in tailings exposed during mining activities, resulting in increased acidity, increased heavy metals, and a sterile coating of ferric hydroxide on stream substrate known as “yellow boy” (NPS 1997). Yellow boy is a yellow-orange solid comprised of previously soluble iron ions precipitated as iron hydroxide when the pH of CMD is raised past 3, either through contact with fresh water or neutralizing minerals. Water quality impacts from CMD are particularly notable in Bear Creek, Roaring Paunch Creek, and New River.

As mentioned in Chapter 1, the USACE conducted a CMD remediation effort at three sites in the Blue Heron area, including the Blue Heron Spoils site, covering approximately 10 acres, under a separate NEPA EA. This area received reclamation treatments in the 1980s that stabilized the site but did not effectively remediate CMD or mitigate erosion problems along the river. The area was accessed using historic access roads and is one of the most accessible mine waste sites in the park. The CMD remedial approach outlined in the recent EA is similar in scope to the action alternatives, and would have similar impacts from remedial approach implementation.

The siting, construction, maintenance, and use of roads, wellpads, production facilities, tank batteries, flowlines, and/or pipelines, as well as the presence of abandoned oil and gas wells within and near the park, have the potential to contribute to cumulative impacts. Other potential effects of oil and gas operations include the release of hydrocarbons or other pollutants and potential impacts from well stimulation using hydraulic fracturing in wells outside the park. Past operations also contribute to cumulative impacts. For example, a spill occurred on July 29, 2008, when crude oil was released from an abandoned oil well pit east of the town of Oneida,

Tennessee. The well pit had reached overflow capacity; the abandoned oil well and blowout pit contained approximately 1,000 gallons of oil and rainwater, and released oil to a branch of Paint Rock Creek south of Oneida. During the subsequent cleanup, 30 cubic yards of crude-contaminated soil was removed from the site (USEPA 2008).

Some plans and projects within Big South Fork NRRA would also have cumulative impacts. The NPS has plugged 56 abandoned wells at Big South Fork NRRA through a cooperative agreement with the TDEC Division of Water Pollution Control, and as part of an action funded by the American Recovery and Reinvestment Act (ARRA). NPS may initiate another project to plug and reclaim additional wells at Big South Fork NRRA in 2018. Reclamation of disturbed areas in the park reestablishes natural topographic contours and native vegetation communities. Adverse impacts on vegetation and cover resulting from reclamation operations are temporary and localized, while the land use in Big South Fork NRRA experiences beneficial effects for the foreseeable future.

Wildlife Management

The reintroduction of native wildlife, including deer (1950s to 1960s), turkeys (1970s to 1980s), river otters (1980s), bears (1990s), and elk (1990s), has occurred in the vicinity of Big South Fork NRRA. There have also been introductions of non-native species, such as feral hogs and non-native trout. Hunting and trapping, which are regulated by the state, are allowed in Big South Fork NRRA.

Insect Invasions

Diseases and pests of vegetation, such as the pine bark beetle, have adversely impacted the landscape, causing a demise in vegetation resulting in water temperature increases due to lack of shading and changes to water chemistry due to increased erosion and nutrient-rich sediment loads to streams. Pine bark beetles cause damage to the phloem (the living tissue that carries organic nutrients) through larval and adult feeding. Some bark beetle species also carry a blue stain fungus and introduce it into trees, where it colonizes sapwood and disrupts water flow to the tree crown, hastening tree death. A Southern pine bark beetle infestation occurred in Big South Fork NRRA in 2000/2001 and significant tree mortality occurred in pine stands throughout the park. Extensive tree death can also occur as a result of the hemlock woolly adelgid (*Adelges tsugae*), an exotic insect native to Japan that feeds by sucking sap from young needles, causing them to drop prematurely. It currently occurs park-wide in Big South Fork NRRA. The emerald ash borer (*Agrilus planipennis*) is also currently widespread in the park. The beetle is native to eastern Asia and can cause significant damage to ash species as larvae chew through the bark to the inner phloem, cambium, and outer xylem during development.

Development and Implementation of Water Quality Standards under Section 303(d) of the Clean Water Act

Several 303(d)-listed impaired water bodies exist in the vicinity of both park units. In the 303(d) lists for Kentucky (KDOW 2018) and Tennessee (TDEC 2017), there are a total of three impaired streams that fall within the Big South Fork NRRA: Rock Creek, Bear Creek, and Pine Creek. A total maximum daily load (TMDL) limit must be developed and implemented for these

stream segments. A TMDL study: (1) quantifies the amount of a pollutant in a stream, (2) identifies the sources of the pollutant, and (3) recommends regulatory or other actions necessary for the stream to return to an unpolluted state.

TOPOGRAPHY AND SOILS

The Big South Fork NRRA topography is dominated by a deep gorge, created by the Big South Fork River and its tributaries. In addition to the natural process of the gorge, topography throughout the gorge has been altered by historic mining activities, including mine tailing and spoil piles present at many of the CMD sites, and former tramways and historic extraction roads throughout the park. However, topography also includes geologic features rock houses, canyons, buttes, windows, chimneys, waterfalls, and arches; and dramatic or unusual rock outcrops and formations.

NPS policies protect geologic features from unacceptable impacts of human activity, which also incorporate products and physical components of geologic processes which includes features such as rocks, soils, and minerals. Soils in the vicinity of the project sites are dominated by two major soil associations: Tate-Shelocta association and the Tate-Trappist association. The predominantly loamy soils range from about one ft in depth on steep hillsides to about four to five ft deep on interstream divides.

Alternative 1: No Remediation

Programmatic Impacts

Topography

Area use would remain unchanged under Alternative 1. Maintenance and use of existing access roads and trails could expose soils to erosion, compact and rut soils, introduce non-native construction materials (e.g., gravel), and include minor grading, all of which can affect topography. However, these impacts would be localized and would occur on a small scale. Natural topography affected by abandoned mines and spoil piles would remain in its current state.

Soils

Under Alternative 1, area use would remain unchanged from current utilization. Maintenance and use of existing access roads and trails could expose soils to erosion, contaminate soils from leaking equipment or spills, compact and rut soils, and reduce soil permeability, all of which can affect soil functions and values. Soils exposed to CMD would continue to be exposed to CMD, as remediation of CMD would not occur. As such, soils negatively affected by CMD under current conditions would continue to be locally impacted on a small scale.

Selected Remedial Site Impacts

Topography

Under Alternative 1, topographical impacts would be consistent with the programmatic impacts; existing conditions would remain unchanged and current impacts would continue in their present state.

Soils

Under Alternative 1, soils impacts would be consistent with the programmatic impacts; existing conditions would remain unchanged and current impacts would continue in their present state.

Cumulative Impacts

Under Alternative 1, CMD would not be subjected to remediation and would continue to contribute to cumulative impacts. However, several actions described in the "Cumulative Impacts Scenario" section of this chapter would result in both adverse and beneficial cumulative impacts on topography and soils.

Topography and soils under all alternatives could be adversely affected by agricultural and forestry operations, urban and residential development, road construction, and oil and gas operations within and outside Big South Fork NRRA. Agricultural, forestry, and construction activities may cause compaction and rutting, reduce permeability, and increase erosion. These actions would have potentially widespread temporary and ongoing large adverse impacts on soils. Urban, residential, and agricultural runoff (such as fertilizers and oil, and leachate from septic systems) and accidental leaks and spills of oil, produced water, or other contaminating substances from abandoned, ongoing, and future oil and gas operations could contaminate sediments and soils, resulting in small to very large adverse impacts. Existing and abandoned operations in Big South Fork NRRA would continue to adversely affect soils and topography until the sites are reclaimed. In addition, abandoned coal mining sites would also continue to contribute incrementally to cumulative impacts, resulting in ongoing localized adverse impacts on soils.

There are also some actions with beneficial effects. For example, the NPS completed a revision of 9B regulations, publishing the final rule (81 FR 77972) in November 4, 2016, governing non-federal oil and gas development within the boundaries of NPS units. Generally, the changes focus on improving resource protection aspects of the regulations while accounting for advances in oil and gas technology and industry practices. These changes have lasting beneficial impacts on soils, due to improving resource protection practices. In addition, NPS completed plugging and reclaiming 56 abandoned wells and closing 37 open mine portals in Big South Fork NRRA in 2012 and may initiate another project to plug and reclaim additional wells at Big South Fork NRRA in 2018 to protect resources and provide a safe visitor experience. Surface reclamation that has occurred on these existing access roads and well pads reduces soil erosion and reestablishes surface drainage flows. These actions result in lasting beneficial impacts on soils. Also, the information provided by geologic resource surveys of proposed operations in Big South Fork NRRA would increase NPS awareness and understanding of the resource in Big South Fork NRRA.

Summary of Impacts

Under Alternative 1, not acting to remediate sites would result in ongoing localized impacts on topography and soils. Natural topography affected by abandoned mines and spoil piles would remain in its current state. Alternative 1 would directly impact a localized area, but would contribute to continual impacts from CMD long-term.

Alternative 2: Full Access (Proposed Action)

Programmatic Impacts

Topography

The construction, maintenance, and use of access roads and remediation systems, which could include minor to significant grading that would change relief, would have lasting effects on topography.

As mentioned above, remediation activities would need some level of access to implement the remedial approach at CMD sites, and it might be necessary to clear, widen, construct and/or repair access pathways. If up to 17 access pathways were created, local topography could be altered to allow for appropriate route grades for equipment access. Sites could require preparation and system construction, which could include grading and leveling, wetland filling, dredging, and stream relocation or construction; in addition, some remedial approaches could include removing or regrading spoil piles, all of which could have lasting impacts on localized topographic relief for approximately 89 acres. However, this would only represent approximately 0.07% of the park's 125,310 acres.

Soils

The construction, maintenance, and use of access roads and remediation systems could expose soils to erosion, compact and rut soils, reduce soil permeability, and include minor to significant grading, all of which can affect soil characteristics on up to an estimated 17 access pathways and 89 acres of site footprints. Soils could be contaminated by leaking equipment or spills during construction or O&M, though the adherence to BMPs is designed to avoid, minimize, and/or mitigate these impacts (e.g., daily equipment inspections, emergency spill kits, proper storage and equipment maintenance, etc.). Soil type may require review prior to remedial approach implementation to determine if prime farmlands are present and would be impacted.

Soils could remain affected by CMD under Alternative 2; though CMD would be subjected to a remedial approach, and some soils may no longer be affected by CMD as part of site-specific remedial approaches. As such, soils negatively affected by CMD under current conditions would not be impacted at present levels. Reductions of impacts would vary based on site-specific remedial approaches, and could range from soils being utilized as a portion of the remedial approach (e.g. wetland cells) to soils no longer being subjected to any CMD impacts, such as acidity and contaminant loading.

Selected Remedial Site Impacts

Topography

Under Alternative 2, topography impacts to the selected sites would be similar to the impacts described at the programmatic level, but topography would change based on site-specific remedial approaches, and the subsequent impacts, described below. With all sites accessible for remediation under Alternative 2, this alternative would have the highest potential to impact topography from construction.

The Worley #86 site would change topography along Worley Branch with the installation of two wetland cells, approximately 0.33 acre each, with a total footprint of 7.9 acres. As Worley #86 is directly adjacent to Worley Road, access would not require additional construction and would be limited to improvements, if necessary, to the existing public gravel road. Impacts to local topography would be minimal.

The Worley #88 site would change topography by a generalized footprint of approximately 1.6 acres. In addition, access to Worley #88 would require the improvement of 0.41 mi of new access along the railroad ROW and from the railroad to the site. Impacts to local topography would be minimal.

The Slavey Hollow site would change topography with the installation of two wetland cells, one approximately 0.50 acre and one approximately 0.25 acre, and piping to direct CMD through the cells for treatment before discharging into the Big South Fork River, with a footprint of approximately 7.1 acres. Access to Slavey Hollow would require the improvement of 1.13 mi of former logging road and tram rail bed from Wilson Ridge Road to the site and 0.09 mi of historic extraction road, to include grading, filling washouts, slope cutting for road widening, and four stream crossings which would impact local topography.

The Nancy Grave site would change topography along the Nancy Grave drainage and the Big South Fork River floodplain with the installation of a wetland cell, approximately 2 acres in size, with a footprint of approximately 9.5 acres. In addition, access to Nancy Grave would require the improvement of 0.13 mi of former logging road, widening and improvement of 0.48 mi of the Kentucky Trail, and two stream crossings. Work along the steep slopes could also impact local topography.

The Devils Creek site would change topography with the installation of two wetland cells, approximately 0.75 acre each, and ALDs to direct CMD through the cells for treatment before discharging into Devils Creek, with a footprint of approximately 6.2 acres. In addition, access would require the improvement, as necessary, of 0.13 mi of former logging road, the widening and improvement of 0.84 mi of the Kentucky Trail, and two stream crossings. Work along the steep slopes could impact local topography.

The Laurel Branch Confluence site would change topography with the regrading of approximately 2.6 acres of partially vegetated and pyrolized spoil piles along the Big South Fork River. This remedial approach impact localized topography, though future erosion potential of the spoils piles in a sensitive area (the banks and terraces of Big South Fork River) would be diminished. Access to the site would require the improvement, as necessary, of 1.45 mi of the Lee Hollow Loop Horse Trail, the widening and improvement of 0.09 mi of the Blue Heron Loop Hiking Trail, and four stream crossings.

The Laurel Branch Spoils would impact topography with the installation of box culverts, backfill, and relocation of the horse trail over the culvert to prevent stream crossing at the existing sandstone crossing, impacting a footprint of approximately 1.7 acres. Access to the site would

require the improvement, as necessary, of 1.25 mi of the Lee Hollow Loop Horse Trail, 0.09 mi of new access, and three stream crossings that would impact local topography.

The Blair Creek site would change topography with the excavation of the lower mine level for dewatering, and the construction of a 2- or 3-cell tiered wetland system and associated ALDs and piping, impacting approximately 18.7 acres. Access to the site would require improvements as necessary to 1.72 mi of the Bear Creek Loop and Lee Hollow Loop Horse Trails, including grading, cut and fill, and sloping that would impact local topography.

Soils
Under Alternative 2, soils impacts to the selected sites would be similar to the impacts described on the programmatic level, but existing conditions of soils would change based on site-specific remedial approaches. The breadth of the impacts would be consistent with those described in topography section, but the type of impacts would be erosion, rutting, compaction, and permeability alteration of soils. However, with all sites accessible for remediation under Alternative 2, this alternative would have the highest potential to reduce the impacts of CMD on localized soils, such as acidification and contaminant loading from CMD.

Cumulative Impacts
Impacts on topography and soils from other considered actions under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 2, would result in short- and long-term impacts on topography and soils.

Summary of Impacts
Under Alternative 2, the implementation of remedial approaches would result in short-term and long-term impacts on topography and soils, mainly from disturbance of unpaved surfaces and approximately 145 acres for remedial sites, resulting in changes of relief, along with the crossing of small wetland areas and approximately 44 streams. These impacts could be locally adverse, but the disturbed areas would only represent approximately 0.1% of the park's 125,310 acres, while planning and adherence to BMPs would be designed to avoid, minimize, and mitigate these impacts (e.g., buffer zones, silt fencing and sediment barriers, temporary sediment basins, soil stabilization, matting or cribbing, post-construction grade restoration, revegetation, etc.). In addition, remediating CMD would have a long-term beneficial impact on soils.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Impacts
Topography
Under Alternative 3, topography impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible for the implementation of a remedial approach or the grading of spoil pile contours. Some of the sites could include significant grading. Under Alternative 3, approximately 42 acres would be subjected to impacts associated with remedial approach implementation.

Soils

Under Alternative 3, soils impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, 8 sites would be accessible for the implementation of a remedial approach. Under the alternative, approximately 14 stream crossings and 42 acres would be subjected to erosion, sedimentation, compaction, reduced permeability or other potential impacts associated with remedial approach implementation. Additionally, untreated sites would continue to be negatively affected by ongoing CMD impacts.

Selected Remedial Site Impacts

Topography

Under Alternative 3, topography at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek, which would not be accessible under Alternative 3. As such, approximately 0.5 mi of new access and 15 acres of footprint would not be subjected to impacts associated with remediation. As fewer site would be accessible for remediation under Alternative 3, this alternative would have a lower potential to impact localized topography.

Soils

Under Alternative 3, soils at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek, which would not be accessible under Alternative 3. As such, approximately 0.5 mi of new access and 15 acre of area would not be subjected to impacts associated with remediation. As fewer sites would be accessible for remediation under Alternative 3, this alternative would have a lower potential to impact or improve localized soils.

Cumulative Impacts

Impacts on topography and soils from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 3, would result in short- and long-term impacts on topography and soils. However, the access to implement remedial approaches provided under Alternative 3 would have lower potential for long-term improvements to soils and long-term cumulative benefits than Alternative 2.

Summary of Impacts

Under Alternative 3, the implementation of remedial approaches would result in short-term and long-term impacts on topography and soils. Impacts on topography and soils under Alternative 3 would mainly occur from disturbance of unpaved surfaces and approximately 82 acres for remedial sites, resulting in relief change, along with the crossing of small wetland areas and approximately 22 streams. The access to implement remedial approaches provided under Alternative 3 would have lower potential for long-term improvements to soils than Alternative 2, as 13 sites would be available for remediation under Alternative 3, compared with 25 sites under Alternative 2. These impacts could be locally adverse, but would be slightly less than those of Alternative 2. As with Alternative 2, planning and adherence to BMPs would be designed to avoid, minimize, and mitigate these impacts (e.g., buffer zones, silt fencing and sediment

barriers, temporary sediment basins, soil stabilization, matting or cribbing, post-construction grade restoration, revegetation, etc.).

Alternative 4: Minimal Access

Programmatic Impacts

Topography

Under Alternative 4, the most restrictive means of access, approximately 6 sites would be accessible for the implementation of a remedial approach or the restoration spoil pile contours. Under the alternative, approximately 11 stream crossings and 31 acres of area would be subjected to potential topographic impacts.

Soils

Under Alternative 4, the most restrictive means of access, approximately 6 sites would be accessible for the implementation of a remedial approach. Under the alternative, approximately 11 stream crossings and 31 acres of area would be subjected to potential soils impacts, but limited access would also exclude the remaining sites from being subjected to the benefits of site remediation.

Selected Remedial Site Impacts

Topography

Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation and restoration of contours. Under the alternative, approximately 4.6 mi of access and 31 acres of area would be subjected to potential topography impacts. This alternative would have less impact to topography than from Alternatives 2 or 3.

Soils

Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. Under the alternative, approximately 4.6 mi of access and 31 acres of area would be subjected to potential soils impacts, but the remaining sites would not be subjected to the benefits of site remediation. This alternative would have less impact to soils than from Alternatives 2 or 3, and accordingly, less benefit from reducing CMD discharges to native soils.

Cumulative Impacts

Impacts on topography and soils from other actions that were considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 4, would result in short- and long-term impacts on topography and soils. However, the access to implement remedial approaches provided under Alternative 4 would have lowest potential for long-term improvements to soils and long-term cumulative benefits.

Summary of Impacts

Under Alternative 4, the implementation of remedial approaches would result in minimal short-term and long-term impacts on topography and soils as only 10 sites would be accessible under

Alternative 4. Impacts on topography and soils under Alternative 4 would mainly occur from disturbance of unpaved surfaces and approximately 62 acres for remedial sites, resulting in relief change, along with the crossing of small wetland areas and approximately 18 streams. These impacts could be locally adverse, but would be much less than those of Alternatives 2 and 3. As with Alternatives 2 and 3, planning and adherence to BMPs would be designed to avoid, minimize, and mitigate these impacts.

WATER RESOURCES

The importance of water resources is highlighted in the Big South Fork NRRA purpose statement, which states that the NRRA was established to preserve the free-flowing Big South Fork River, portions of its tributaries, and the natural integrity of the gorge. The following water resource sections include impact analysis for water quality, floodplains, wetlands, and groundwater resources and withdrawal.

Alternative 1: No Remediation

Programmatic Impacts

Water Quality

Surface waters in the Big South Fork NRRA impacted by 7,900 gpm of CMD (from 17 programmatic sites) would continue to be impacted under Alternative 1. Water quality parameter values associated with CMD impacts generally include pH less than 6.0, low alkalinity that is less than acidity, iron >0.5 mg/L, sulfates >75.0 mg/L, aluminum >0.3 mg/L, total hardness >150 mg/L, and turbidity >200 mg/L (NPS 1997). The Big South Fork River has almost twice the level of dissolved solids and suspended solids, and 2.5 times greater sulfate yield than a comparable unmined river basin, and under Alternative 1, short-term and long-term water quality impacts of these parameters would continue (NPS 1997).

Floodplains

Area use within FEMA-designated floodplains would remain unchanged from current utilization. Floodplains receiving CMD would continue to receive CMD; periodic monitoring would continue, but remediation of CMD would not occur. Impacts from CMD would include vegetation mortality and sedimentation. Sedimentation, or precipitation from CMD, includes the deposition of heavy metals and other contaminants, such as yellow boy, onto floodplains. The sedimentation, combined with soil acidification, attribute to preventing vegetation re-growth. In addition, during natural floods, CMD sediments on floodplains are more susceptible to erosion without vegetative cover compared to surrounding soils, were they may be redistributed away from CMD point sources to floodplains, wetlands, or into streams within the Big South Fork River watershed, providing a long-term source of contaminants for the watershed (Marcus, Meyer, and Nimmo 2001). However, floodplains receiving CMD are limited in the Big South Fork NRRA because of the steep terrain. CMD typically flows into a tributary rather than flowing as sheet flow across floodplains.

Wetlands
Wetland area use would remain unchanged from current use for each site. Wetlands receiving CMD would remain the receiving waters for CMD, and would continue to be impacted. Impacts to wetlands from CMD would be similar to those described above for floodplains. Impacts would include reduced functions and values compared to unimpacted wetlands, including plant mortality and reductions in species richness, contaminant precipitation and sedimentation, and an accretion of contaminants (Stephenson *et al* 1995). In addition, CMD is shown to cause reductions in or an absence of an aquatic insect community in wetlands subjected to CMD (David 2003).

No detailed wetland delineations have been conducted for CMD remedial sites. NWI maps include data within Big South Fork NRRA, but they generally contain locations for larger wetland systems and may omit smaller seep wetlands occurring within the Big South Fork River gorge or along the smaller tributaries. However, due to the steep terrain of the gorge, wetlands are not widespread.

Groundwater Resources and Withdrawal
Groundwater resources would remain unchanged, and withdrawals and resources would continue under the current conditions. As potential recharge areas may contain CMD that could impact groundwater, affected groundwater resources would continue to have minimal long term impacts.

Selected Remedial Site Impacts
Water Quality
Under Alternative 1, water quality would be consistent with the programmatic impacts; existing conditions would remain unchanged and current CMD impacts would continue, including the continual discharge of approximately 3,700 gpm of CMD among the 8 selected sites. Streams at the eight selected remedial sites would continue to exhibit low pH, low alkalinity, high iron and aluminum concentrations, and high sulfate concentrations during all or portions of the year. As mentioned in Chapter 3 and indicated in Table 3-1, the eight remedial sites do not meet Kentucky water quality standards. Under Alternative 1, these sites would continue to be impacted by CMD and would likely fail to meet water quality standards.

Floodplains
Under Alternative 1, floodplain impacts from the CMD sites would be consistent with the programmatic impacts; existing floodplain conditions would remain unchanged and current floodplain impacts from CMD would continue.

Wetlands
Under Alternative 1, wetland impacts to the selected sites would be consistent with the programmatic impacts; existing wetland conditions would remain unchanged and current CMD impacts to wetlands would continue.

Groundwater Resources and Withdrawal

Under Alternative 1, groundwater resources and/or withdrawals would be consistent with the programmatic impacts.

Cumulative Impacts

Under Alternative 1, CMD sites would not be subjected to remediation and would continue to contribute to cumulative impacts to water quality. However, several actions described in the "Cumulative Impacts Scenario" section of this chapter would result in both adverse and beneficial cumulative impacts on water resources.

CMD and abandoned mine impacts include contamination of water resources from sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites that can create conditions conducive to the mobilization of metals. CMD can also occur as a result of naturally occurring processes by the oxidation of pyritic or ferrous compounds contained in sandstone or shale when these minerals are exposed to water and air (NPS 2012a). Residential development and industrial activity outside the park unit could also contribute to the potential for contamination by metals and hazardous material from improper handling of hazardous substances and the discharge of potentially contaminated sediments to surface waters through soil erosion. These activities would have long-term localized impacts on water resources.

In addition to historic mining operations within Big South Fork NRRA, approximately 25,100 acres of un-reclaimed abandoned coal mines exist in the Tennessee counties adjacent to the Big South Fork NRRA, and there are about 10 abandoned surface coal mine sites in McCreary County, Kentucky (NPS 1997).

Past and future oil and gas development within and outside Big South Fork NRRA would have short- and long-term adverse impacts on water resources from vegetation clearing, vehicle use, and the construction and maintenance of access roads, wellpads, and flowlines. Contamination of surface and groundwater from leaking wells or well workover operations could also contribute to impacts. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of Big South Fork NRRA, and has similar impacts to traditional oil and gas development.

Visitor activities causing ground disturbance, such as ORV use, and improper refuse disposal would contribute to adverse impacts on water resources. These activities would have clearly discernable impacts on water through increased turbidity and sedimentation from ground disturbance and potential contamination of surface waters from improper refuse disposal.

Fires and fire management activities can also affect water quality. The *2006 Big South Fork National River and Recreation Area Fire Management Plan* (NPS 2006b) recommends using mechanical means in combination with prescribed fire to reduce hazard fuel accumulations, which can result in ground disturbance and temporary loss of vegetation cover. The combustion of fuels may increase the acidity of surface water. These activities would have long-term, localized, minimal adverse impacts on water resources through erosion, sedimentation, turbidity and potential acidification.

At Big South Fork NRRA, efforts to control exotic vegetation (see discussion of non-native species in Chapter 3) have involved the use of herbicides as the primary tool for controlling exotic plant infestations in managed fields. Herbicide spills could have detrimental effects on water resources. ORVs, which could cause erosion (e.g. increased sedimentation and turbidity), could be used to reach areas with exotic species infestations. Exotic species management efforts could result in very noticeable to potentially large localized and temporary (e.g. several seasons) adverse impacts on water resources.

Relatively low-density residential development occurs in the immediate vicinity of Big South Fork NRRA, and has resulted in the development of infrastructure such as roads, utilities, septic tanks, and water impoundments/intakes for water supply/treatment, all of which can contribute to nonpoint source pollution. Industrial activity sites near Big South Fork NRRA that could contribute to cumulative impacts include power plants, railroads, hardwood flooring factories, sawmills, and other manufacturing facilities. These sites could result in discharges to surface waters as well as nonpoint source pollution from runoff, in addition to contributing other pollutants to the environment. Point and nonpoint discharges from these sources would result in widespread long-term minimal to potentially large adverse impacts on water resources.

Big South Fork NRRA has developed numerous features related to park-wide administrative, managerial, and support functions, as well as visitor use. These developed areas require varying levels of maintenance. The NPS routinely maintains trails, buildings, and roads, as well as cultural landscapes, in Big South Fork NRRA. However, these activities are guided by the BMPs and the BO between NPS and USFWS concerning roads, trails, and stream crossings and other activities within the GMP (USFWS 2016). Specifically, the BO outlines the NPS notification process for stream crossings and the process of getting USFWS concurrence with NPS's effect determination; an annual notification to USFWS is required each year and may determine if culverts are allowed under the consultation process. As such, these activities are expected to result in localized long-term minimal adverse impacts on water resources.

Agriculture other than forestry has occurred on less than 20% of the land in counties adjacent to Big South Fork NRRA, though most of the forested areas of Big South Fork NRRA have been logged. Small-scale agriculture and grazing takes place on private lands set back from the rim of the gorge, where mixed hardwood–pine forests have been cleared for cropland and browse (NPS 2012a). Logging and clearing activities on private inholdings could result in increased sedimentation, turbidity, and runoff, with short- and long-term adverse impacts on water resources.

Diseases and insect pests of vegetation, such as the pine bark beetle, and currently the hemlock woody adelgid, have caused a decline in streamside vegetation. Large stands of trees could be affected by infestations, resulting in increased runoff and sedimentation and changes in water temperature and chemistry. This would have a widespread long-term adverse impact on water resources until streamside vegetation recovers through natural succession.

Some plans and projects within Big South Fork NRRA would also have long-term beneficial effects on water resources. The GMP outlines desired resource and visitor experience

conditions protecting water resources in the park. Implementation of an official roads and trails system and standards associated with the GMP would help reduce the potential for increased runoff and associated turbidity and sedimentation by reducing the erosion and compaction of soils. Kentucky and Tennessee are developing TMDLs for impaired waters in the Big South Fork NRRA. The implementation of these TMDLs would have beneficial effects on water resources by reducing pollutants entering streams. Additionally, NPS completed a revision of 9B regulations (81 FR 77972) on November 4, 2016, governing non-federal oil and gas development within the boundaries of NPS units. Generally, the changes focus on improving resource protection aspects of the regulations while accounting for advances in oil and gas technology and industry practices. These changes could have long-term beneficial impacts on water resources, due to improving resource protection practices.

Overall, the impacts of these actions, when combined with the mostly localized short-term noticeable to potentially large adverse impacts, would result in short- and long-term noticeable to potentially large adverse cumulative impacts on water resources in watersheds within and adjacent to Big South Fork NRRA. When compared to the broader area of analysis, Alternative 1 would continue to contribute to the overall cumulative impacts through long-term CMD impacts to Big South Fork River when compared to other alternatives, and represents the least beneficial alternative for water resources.

Summary of Impacts

Under Alternative 1, not acting to remediate sites would result in long-term adverse impacts on water resources. Approximately 11,600 gpm of CMD (from approximately 25 sites) would not be remediated, and continue to impact water quality, floodplains and wetlands, groundwater, and the Big South Fork watershed.

Alternative 2: Full Access (Proposed Action)

Programmatic Impacts

Water Quality

The construction, O&M, and use of access routes, including an estimated 1 to 3 stream crossings per site (an estimated average based on potential impacts at the 8 selected CMD sites), and remediation systems with an estimated footprint of approximately 5 to 6 acres per site (an estimated average based on potential impacts at the 8 selected CMD sites), could expose soils to erosion, reduce soil permeability, and introduce sediments in waterways, which can adversely affect water quality (e.g. increases in trace metals, turbidity, conductivity, hardness, etc.). Up to 17 access routes would be necessary under Alternative 2, however, impacts to water quality from construction, O&M, and use of the roads would be temporary and of a low intensity. Access would include an estimated 30 stream crossings, along with an estimated combined footprint of 89 acres for the 17 programmatic sites. However, assuming an average stream crossing width of 10 ft (conservative estimate based on potential crossings observed during the IDT field visit, the actual average is anticipated to be well under 10 ft given the drainage area and stream grades encountered within the park), the 300 ft of crossings represents less than 0.015% of the over 400 miles of streams in Big South Fork NRRA, and the 89 acres remedial sites would only represent approximately 0.07% of the park's 125,310 acres.

Temporary increases in sedimentation could occur during construction as material is disturbed in streams and along riparian areas, though impacts would be limited by BMPs. In addition, there is the low potential for release of liquid hydrocarbons and/or contaminating or hazardous substances into surface water from vehicles, equipment, CMD sources, or flowlines during remediation activities that could impact water quality.

However, mitigation would be applied during remediation operations to minimize any potential short-term and long-term impacts on surface waters. As mentioned in the previous section, mitigation measures would include conducting activities within previously disturbed areas, limiting ground disturbance, using BMPs and appropriate stream crossings, soil, hydrology, and native vegetation restorations, and reclamation of sites and access roads to pre-disturbance levels. Activities in streams would be segmented (less than 100 feet) into shorter bank sections so that rock placement could be done as quickly as possible to reduce the exposure time of disturbed bank faces. Stream crossings would be designed to limit erosion and sedimentation, using low-water crossings instead of culverts where possible. Low-water crossings would minimize channel changes, which maintains natural steam flow regime, velocity, sedimentation/erosion, and slope, and reduces potential changes to a stream associated with a culvert stream crossing, such as channelization, and increases in velocity and downstream channel scour. Material removed from the existing bank spoil piles would be taken offsite to a commercial landfill or other approved disposal site to prevent erosion or deposition of spoils back into water resources. As portions of banks are graded to design slopes, crushed limestone or rock, then larger rock, would be placed along the slopes to provide long-term bank stabilization. These impacts would ultimately result in positive long-term benefits by aiding in the reduction of CMD influences and sedimentation.

Under Alternative 2, approximately 7,900 gpm of CMD would be subjected to a remedial approach at approximately 17 sites. Currently, many of the stream beds impacted by CMD are covered by yellow boy and are not in pristine condition. The resultant water quality disrupts aquatic trophic levels and adversely impacts the habitats of these streams (NPS 2004). The installation of remedial approaches would improve surface water quality and in-stream conditions. As such, water quality negatively affected by CMD under existing conditions would see a long-term improvement if reduction and treatment of CMD was addressed at the 17 sites. The Big South Fork River has about twice the level of dissolved solids and suspended solids, and approximately 2.5 times greater sulfate yield than a comparable unmined river basin (NPS 1997); implementing this alternative would improve these levels over the long-term. Reductions of impacts would vary based on site-specific remedial approaches, but it is anticipated that the remedial approach would advance conditions towards meeting water quality standards, lowering dissolved solids, suspended solids, turbidity, conductivity, trace metals, and other contaminants associated with CMD. Projects in Ely Creek (Virginia) and Swatara Creek (Pennsylvania) utilizing remedial approaches proposed in this EIS improved water quality and subsequently species diversity and abundance (Simon *et al*. 2012; Cravotta III *et al*. 2010).

With all sites accessible for remediation under Alternative 2, this alternative would have the highest potential to significantly reduce the adverse impacts of 7,900 gpm of CMD and provide

measurable improvements to the water quality; though the Big South Fork River is the receiving waters for the project area, it is the local streams (e.g., Blair Creek, Devils Creek, etc.) that will be the subject of the most immediate and dramatic improvements. It should also be noted that this is a programmatic analysis, and as mentioned previously, additional study of a site, including sampling, would be completed to confirm the remedial option is the most appropriate approach to address the site conditions and improve water quality.

Floodplains

The known programmatic sites are not located within designated floodplains. However, sites are located adjacent to Big South Fork River and its tributaries, and since remedial approach footprints and access have not been determined, it is reasonable to expect some sites would be located partially within the FEMA-designated 100-year floodplain. A FSOF evaluation would be completed on a case-by-case basis once more detail is known.

As previously discussed, the construction, O&M, and use of access roads could affect floodplain functions and values. Under Alternative 2, there would be approximately 17 site access routes and remediation systems with a combined footprint of approximately 89 acres, a portion of which could be located within a floodplain. The most likely potential impacts to floodplains would be the short-term and low intensity impacts from sedimentation and CMD being deposited within floodplains downstream of the proposed sites during construction, though activities would adhere to BMPs. Access roads would be designed to avoid and minimize fill within the floodplains to avoid changes in floodplain elevations. However, implementation of remedial approaches would result in long-term benefits by stabilizing banks and spoils to reduce sedimentation and CMD from being deposited on floodplains found within and downstream of project areas. In addition, activities would adhere to BMPs to minimize and mitigate potential impacts. Activities would avoid or minimize floodplain utilization, including storage of hazardous or contaminating substances within floodplains. Proper siting, engineering design, construction, and maintenance of roads would substantially reduce impacts associated with road construction, use, and maintenance if roads had to cross floodplains. The proper siting and alignment of roads and remedial approach area and the placement of low-water crossing and/or adequate culverts under access roads would minimize changes in surface water flows during flooding, that may otherwise adversely impact natural floodplain functions and flow processes. Any remedial systems would be designed to minimize impacts to FEMA-designated floodplain limits and flood elevations. Significant changes in the flood elevations could impact the operation of the Wolf Creek Dam and Lake Cumberland downstream (USFWS 2014); though significant changes in the flood elevations are not anticipated from Alternative 2.

Wetlands

As with water resource impacts mentioned previously, the construction, maintenance, and use of access roads and remediation systems could affect wetland functions and values. No detailed wetland delineations have been conducted for CMD remedial sites. NWI maps include data within Big South Fork NRRA, but they generally contain locations for larger wetland systems and may omit smaller wetlands that can occur within the Big South Fork River gorge or along the smaller tributaries. Programmatic sites are not located within NWI mapped areas;

however, remedial approach footprints and access locations have not been determined, and impacts to wetland areas from the remediation activities is possible. As projects are developed, detailed wetland delineations at CMD sites would be required.

For the 17 potential programmatic CMD sites that could be implemented under Alternative 2, construction and access would result in wetland impacts at some of the sites. Prior to the implementation of a selected remedial approach, if wetlands are located within the project area and would be impacted, or as required, a wetland delineation would be completed while a WSOF evaluation would be completed on a case-by-case basis.

Access and remedial approach footprints could include stream and wetland crossing, wetland filling, dredging, or construction, and stream relocation, piping, or construction, and clearing vegetation and grading. These activities could temporarily increase localized erosion potential, causing increased turbidity and sedimentation, while there is also potential for release of contaminating or hazardous substances into wetlands from vehicles, equipment, or CMD sources, but would be subject to BMP adherence. In addition, the proper siting, engineering design, construction, and maintenance of roads and footprints would substantially reduce impacts if roads had to cross wetlands or streams; adequate culverts, appropriate drainage, and resource avoidance would minimize adverse impacts to wetlands, such as runoff and sedimentation. In some cases, the installation of a remedial system would require the removal of an existing wetland, impacting a wetland, but would allow for remediation and ultimately would improve water quality; the wetland impact would be a trade-off for water quality improvement.

Mitigation would be utilized to minimize any potential long-term impacts to wetland areas. Mitigation measures would include conducting activities within previously disturbed areas, limiting ground disturbance, using BMPs, and adhering to NPS and USACE wetland guidance. The reclamation and/or restoration of sites and access roads as soon as practicable after stages of completion of the remediation operation would eliminate the adverse impacts caused by operations in approximately 1 to 3 years. Short-term impacted areas would be restored to a natural state and replanted or seeded with species suitable for wetland areas. In addition, compensatory mitigation would be conducted as required to meet the 1:1 ratio under the “no net loss of wetlands” provision of DO-77-1 (Wetland Protection). The success of compensatory mitigation would be dependent on the conditions of the site-specific mitigation plan. If the site is not properly re-contoured and the natural hydrology is altered, or contamination remains and restoration of the natural community is not possible, and there are adverse effects on the functions and values provided by the wetland, a site-specific mitigation plan requiring site cleanup, remediation of contaminated water or soils, restoration of hydrology, and planting of native vegetation could be implemented to reduce adverse impacts.

Wetlands could remain the receiving waters for CMD under Alternative 2, but this alternative would have a majority of the CMD sites subjected to a remedial approach. Some wetlands may no longer receive CMD as part of site-specific remedial approaches. Currently, many of the stream beds and wetlands impacted by CMD are covered by yellow boy and are not in pristine

condition. The installation of remedial approaches would improve wetland conditions for areas impacted by CMD.

Wetlands negatively affected by CMD under existing conditions would see an improvement based on the reduction of CMD; reductions of impacts would vary based on site-specific remedial approaches, and could range from wetlands being utilized as a portion of the remedial approach to wetlands no longer being subjected to any CMD impacts. The benefits of remediation could increase plant species richness and density within previously impacted wetlands (Stephenson *et al* 1995). In addition, similar remediation projects have shown an increase in water quality and subsequently fish and macroinvertebrate species diversity and abundance, increasing community diversity in wetland areas and providing flora and fauna forage for aquatic and terrestrial organisms (Simon *et al*. 2012; Cravotta III *et al*. 2010).

Groundwater Resources and Withdrawal
Where permitted, the construction, maintenance, and use of remedial approaches could influence groundwater resources. With all sites accessible for remediation under Alternative 2, this alternative would have the highest potential to improve the quality of surface water and conditions of the Big South Fork River watershed. This could benefit groundwater resources in downgradient recharge areas and surface water withdrawals downstream of the selected sites. Long-term beneficial impacts to groundwater resources would be expected.

Remedial approaches utilized to seal mine openings or drainages could cause the local water table to rise; in contrast, approaches that defer, ditch, or channelize drainages could cause the local water table to lower. Impacts of the latter would likely be minimal, as most of the sites are located along streams and topographic lows near or at the water table elevation. In contrast, sealing a mine could expand CMD within the mine, which could increase the potential of CMD contacting groundwater that was not hydraulically connected to CMD prior to sealing the mine. As mentioned previously, additional studies would be conducted prior to selecting a final remedial option (e.g. sealing a mine).

Other remedial approaches would likely have limited impacts. Lined constructed wetlands would create small areas of impervious cover and remove the potential for infiltration or recharging, but they would concurrently prevent CMD from infiltrating.

<u>Selected Remedial Site Impacts</u>
Water Quality
Under Alternative 2, water quality impacts to the selected sites would be similar to the impacts described for access and remedial approach construction at the programmatic level. Implementation of CMD remediation at the eight selected sites would include 7.2 mi of access, including an estimated 14 stream crossings, and 55 acres for remedial approach footprints, impacting water quality during construction and O&M from a few weeks to a few months, as described in the programmatic section. However, assuming an averaging crossing of 10 ft (conservative estimate based on potential crossings observed during the IDT field visit, the actual average is anticipated to be well under 10 ft given the drainage area and stream grades encountered within the park), the 14 crossings represents less than 0.006% of the over 400

miles of streams in Big South Fork NRRA, and the 55 acres remedial sites would only represent approximately 0.04% of the park's 125,310 acres. In addition, the remedial approaches for the eight selected sites would have long-term beneficial effects to localized water quality, as described below, and would include the remediation of up to 3,700 gpm of CMD.

The Worley #86 site would have a total footprint of 7.9 acres. No additional access roads would be required at Worley #86, but construction and O&M could impact water quality through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts, but impacts are expected to be limited and short-term. The remedial approach is designed to obtain a net alkaline effluent with iron concentrations below 1.0 mg/L. In addition, the treatment is expected to lower trace metal concentrations by a minimum of 50%. The effluent from the treatment system is anticipated to comply with Ambient Water Quality Criteria (AWQC) benchmarks for all parameters. Compliance with Oak Ridge National Laboratory Water Quality Criteria for Near Complete Protection of Sensitive Aquatic Species (EC_{20}) benchmarks could also be achieved for parameters such as pH, aluminum, and zinc, but likely not for other parameters, such as copper and iron (Gannett Fleming, Inc. 1998).

The Worley #88 site would have a conservative general footprint of approximately 1.6 acres, and 0.41 mi of access along the railroad ROW and from the railroad to the site. Construction, access, and O&M would impact water quality through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts. Though a specific remedial option has not been proposed for Worley #88, a rudimentary remedial option of utilizing an organic/limestone injection into the mine entry was expected to significantly increase pH and lower iron concentrations, and potentially achieve AWQC benchmarks (Gannett Fleming, Inc. 1998). It is reasonable to anticipate that the selected remedial approach would meet or exceed some water quality benchmarks.

The Slavey Hollow site would have a footprint of approximately 7.1 acres, and would require the improvement of 1.13 mi of former logging road and tram rail bed from Wilson Ridge Road to the site, which would include clearing, grading, filling washouts, slope cutting for road widening, and four stream crossings that could impact water quality short-term during construction. Construction, access, and O&M would impact water quality through erosion, sedimentation, increased turbidity, and other impacts as described under the programmatic water quality impacts. Access is very steep and could require significant slope cut/fill, increasing the potential for impacts to water quality. Strict BMPs would need to be implemented to minimize impacts to water quality. The remedial approach for Slavey Hollow could effectively remove iron from CMD, to a concentration less than 1.0 mg/L, and is also expected to lower manganese, copper, and zinc. The proposed treatment will likely result in an effluent in compliance with AQWC for all parameters. In addition, the system could achieve EC_{20} benchmarks, with the possible exceptions of copper and iron (Gannett Fleming, Inc. 1998).

The Nancy Grave site would have a footprint of approximately 9.5 acres. In addition, access to Nancy Grave would require the improvement of 0.13 mi of former logging road, widening and improvement of 0.48 mi of the Kentucky Trail, and two stream crossings. Construction, access,

and O&M would impact water quality temporarily through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts. Access is very steep and could require significant slope cut/fill, increasing the potential for impacts to water quality. Strict BMPs would need to be implemented to minimize impacts to water quality. The remedial approach is expected to produce net alkaline water at average flow conditions, which would result in circumneutral pH, aluminum concentrations less than 0.1 mg/L, and expected iron concentrations below 0.5 mg/L. Trace metals, such as copper and zinc, will be removed in the wetland treatment cells and should decrease by more than 75%. The proposed treatment should result in the majority of the parameters meeting AWQC, while some parameters, such as aluminum and zinc, may also meet EC_{20} benchmarks, though it is not likely that copper and iron will meet EC_{20} benchmarks (Gannett Fleming, Inc. 1998).

The Devils Creek site would have a footprint of approximately 6.2 acres. In addition, access would require the improvement, as necessary, of 0.13 mi of former logging road, the widening and improvement of 0.84 mi of the Kentucky Trail, and one stream crossing, impacting water quality. Construction, access, and O&M would impact water quality temporarily through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts. Access is very steep and could require significant slope cut/fill, increasing the potential for impacts to water quality. Strict BMPs would need to be implemented to minimize impacts to water quality. The proposed treatment should potentially lower chromium, copper, and zinc concentrations to less than AWQC benchmarks, resulting in the majority of parameters to be in compliance with AWQC, as measured at the effluent from the system. Some of the other parameters are also expected to be in compliance with EC_{20}, such as aluminum and zinc, though other parameters, such as copper and iron, are not likely to meet EC_{20} benchmarks (Gannett Fleming, Inc. 1998).

The Laurel Branch Confluence site approach would include the regrading of approximately 2.6 acres of partially vegetated and pyrolized spoil piles along the Big South Fork River. Access to the site would require the improvement, as necessary, of 0.41 miles of Laurel Branch Road and 1.45 mi of the Lee Hollow Loop Horse Trail, the widening and improvement of 0.09 mi of the Blue Heron Loop Hiking Trail, and four stream crossings. Construction, access, and O&M would temporarily impact water quality through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts. This site is immediately adjacent to the Big South Fork River, so strict BMPs should be implemented to minimize impacts to the river. The regrading and remediation of spoils is anticipated to lower CMD discharge volume and strength. The removal and diversion of surface water action could lower discharge volumes by 10% to 25%. The grading and reclamation methods could lower the CMD discharges an additional 30% to 50%, for remedial approach reductions of CMD discharge of 40% to 75%. Simultaneously, CMD concentration strength could decrease from remedial measures, such as potentially reducing chromium and lead, 25% to 50%, while concentrations of copper and zinc could be lowered 50% to 80%, levels approaching AWQC. The approach is expected to reduce acidity by 50% to 95%, while trace metal loading could be decreased up to 100%, depending of the specific trace metal (Gannett Fleming, Inc. 1998).

The Laurel Branch Spoils would have a footprint of approximately 1.7 acres. Access to the site would require the improvement, as necessary, of 0.41 miles of Laurel Branch Road and 1.25 mi of the Lee Hollow Loop Horse Trail, 0.09 mi of new access, and three stream crossings impacting water quality. Construction, access, and O&M would temporarily impact water quality through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts. The proposed lining of Laurel Branch stream flow could eliminate contact with mine spoils within the area and would decrease acid production from the spoils. Water quality data indicates the remediation should substantially improve the water quality, likely eliminating acidity and lowering concentrations of iron to less than 0.5 mg/L, aluminum to less than 0.5 mg/L, thus lowering loading to the Big South Fork River. Limestone added to the stream channel should add alkalinity to neutralize acidity inputs from spoils and upstream CMD sources that cannot be eliminated, and could raise the pH to greater than 6.5. Trace metal concentrations, such as copper and zinc, may be lowered to achieve compliance with AWQC benchmarks and could approach EC_{20} benchmarks (Gannett Fleming, Inc. 1998).

The Blair Creek site would have an approximate footprint of 18.7 acres. Access to the site would require improvements, as necessary to 1.72 mi of the Bear Creek Loop and Lee Hollow Loop Horse Trails, including clearing, grading, cut and fill, and sloping. Construction, access, and O&M would temporarily impact water quality through erosion, sedimentation, and other impacts as described under the programmatic water quality impacts. Access is very steep and could require significant slope cut/fill, increasing the potential for impacts to water quality. Strict BMPs would need to be implemented to minimize impacts to water quality. The remedial approach may be adequate to raise pH above 6.0 at the mouth of Blair Creek. It is anticipated that iron would precipitate to concentrations below 0.5 mg/L, and aluminum to less than 0.1 mg/L. Blair Creek CMD discharge could potentially achieve compliance with AWQC (Gannett Fleming, Inc. 1998).

Floodplains

As mentioned previously, portions of the eight CMD sites are located within FEMA-designated floodplains, with the exception of Laurel Branch Spoils. Under Alternative 2, floodplain impacts to the selected sites would be consistent with the programmatic impacts; floodplains would change based on site-specific remedial approaches and could be impacted by development of access routes and construction of the remediation systems.

The remedial approach at Worley Mines #86 and #88 could impact floodplain resources with the installation of discharge culverts under the Big South Fork Scenic Railway bed to the river. At the Slavey Hollow site, portions of the remedial approach would likely be located within the Big South Fork River floodplain. The Devils Creek remedial approach would likely be located in the Devils Creek floodplain. Laurel Branch Confluence site remediation would require the regrading of spoils adjacent to the Big South Fork River floodplain. The Blair Creek site remedial approach could be located in both the Big South Fork River and Blair Creek floodplains.

Alternative 2 would have the highest potential to impact floodplains short-term from construction and access, but also the highest potential to reduce the impacts of CMD on floodplains long-term through remediation.

Wetlands

Under Alternative 2, wetland impacts to the selected sites would be similar to the impacts described at the programmatic level, but existing wetland conditions would change based on site-specific remedial approaches outlined below. Wetlands that are negatively affected by CMD under existing conditions would see an improvement based on the reduction of CMD. As mentioned in Section 3, NWI maps do not show wetland areas within the eight selected CMD remedial sites, and no detailed wetland delineations have been conducted for these sites. Prior to the implementation of a selected remedial approach, if wetlands would be impacted, or as required, a wetland delineation would be completed. However, during NPS site visits, potential wetlands have been noted at some of the remedial sites:

- Worley Mines #86 and #88 discharge to potential wetland areas prior to flowing into tributaries to the Big South Fork River;
- Slavey Hollow discharges to a small potential wetland area, including a natural seep, prior to flowing into the Big South Fork River;
- The Nancy Grave site includes a potential seep area included in the remedial approach, while areas adjacent to Devils Creek discharge to potential wetland areas;
- Access to the Laurel Branch Confluence and Laurel Branch Spoil sites would utilize an existing horse trail crossing a potential wetland area; and
- The Blair Creek site includes small seeps along the creek that could be potential wetlands.

With all sites accessible for remediation under Alternative 2, this alternative would have the highest potential to impact wetlands for sites that would utilize existing wetlands for a portion of the remedial approach, but would ultimately have the highest potential for improving water quality. In addition, for sites that would not utilize existing wetland areas as a portion of remediation (e.g. CMD redirected into ALDs or piping), this alternative has the highest potential to reduce the impacts of CMD on wetlands.

Groundwater Resources and Withdrawal

Under Alternative 2, groundwater resource impacts to the selected sites would be similar to the impacts described for the programmatic level, but would be consistent with site-specific remedial approaches. As mentioned previously, sealing a mine could expand CMD within the mine, which could increase the potential of CMD contacting groundwater that was not hydraulically connected to CMD prior to sealing the mine (e.g. Worley #88). However, there is no site-specific groundwater information available for the eight selected remedial sites; additional studies would be conducted prior to selecting a final remedial option, and long-term beneficial impacts to groundwater resources would be expected.

Cumulative Impacts

Impacts on water resources from other considered actions under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 2, would result in short- and long-term impacts to water resources. The short-term impacts to water quality related to Alternative 2 would be mitigated through the implementation of BMPs, reducing the transport of soils and sediments to waterbodies and therefore reducing potential impacts due to turbidity, transport of CMD related contaminants, and incidental and accidental releases of hazardous materials from remedial installation operations. Long-term water quality impacts from construction, access, and O&M would be low intensity. The implementation of remedial approaches for CMD under Alternative 2 would have the largest potential for measurable improvements to water resources among the alternatives, and would provide ongoing cumulative benefits.

Summary of Impacts

Under Alternative 2, the implementation of remedial approaches would result in impacts to water resources, mainly from disturbance for access and construction of approximately 145 acres for remedial sites, resulting in road and site runoff, along with the crossing of wetland areas and approximately 44 streams. This would represent approximately 0.1% of the park's 125,310 acres. In addition, planning and adherence to BMPs would avoid, minimize, and mitigate these impacts, and remediation would not be permitted in wetlands, floodplains or streams, unless there was no practicable alternative. The short-term impacts could be significant, but through the use of BMPs, would be mitigated. Long-term water quality impacts from construction, access, and O&M would be low intensity. In addition, remediating up to approximately 11,600 gpm of CMD would have the largest long-term beneficial impact on water resources of the four alternatives, lowering dissolved solids, pH, suspended solids, turbidity, conductivity, trace metals, and other contaminants associated with CMD.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Impacts

Water Quality

Under Alternative 3, water quality impacts would be similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible, compared to 17 sites under Alternative 2, remediating up to approximately 3,700 gpm of CMD compared to the approximately 7,900 gpm of CMD under Alternative 2. Under the alternative, access routes would require an estimated 14 stream crossings and an estimated 42 acres of remedial footprints. Access and remediation construction could result in erosion, sedimentation, minor grading or other potential impacts discussed under Alternative 2, but would also provide benefits from CMD remediation.

As described in Alternative 2, mitigation would be applied during remedial operations to minimize any potential short-term and long-term impacts on surface waters. Stream crossings would be designed to limit erosion and sedimentation, using low-water crossings instead of culverts where possible. Also, under Alternative 3, the installation of remedial approaches would improve surface water quality and in-stream conditions. The benefit would be slightly

less than that expected under Alternative 2. As such, water quality negatively affected by CMD under existing conditions would see a long-term improvement based on the reduction and treatment of approximately 3,700 gpm of CMD at approximately 8 sites, including lowering dissolved solids, pH, suspended solids, turbidity, conductivity, trace metals, and other contaminants associated with CMD.

Floodplains
Under Alternative 3, floodplain impacts at localized sites would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible compared to 17 sites under Alternative 2, a portion of which could be located within a floodplain. Though the distribution of remedial approaches potentially located in a floodplain is unknown, it is expected that adverse floodplain impacts from construction, access, and O&M activities under Alternative 3 would be less than Alternative 2.

Wetlands
Under Alternative 3, wetland impacts at localized sites would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible compared to 17 sites under Alternative 2, a portion of which could contain wetland areas. Though no detailed wetland delineations have been conducted for CMD remedial sites, adverse wetland impacts from construction, access, and O&M activities under Alternative 3 would likely be less than Alternative 2. As projects are developed, detailed wetland delineations at CMD sites could be required.

Groundwater Resources and Withdrawal
Under Alternative 3, groundwater resource impacts at localized sites would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible compared to 17 sites under Alternative 2. Groundwater resources at the untreated sites would continue to be negatively affected by CMD impacts while sealing a mine could increase the potential of CMD contacting groundwater that was not previously hydraulically connected. Additional studies would be conducted prior to selecting a final remedial option, though long-term beneficial impacts to groundwater resources would be expected from remediation.

Selected Remedial Site Impacts
Water Quality
Under Alternative 3, water quality at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek, which would not be accessible under Alternative 3. As such, approximately 0.5 mi of new access and 15 acres of footprint would not be subjected to impacts associated with remediation. As fewer sites would be accessible for remediation under Alternative 3, this alternative would have a lower potential to impact localized water quality short-term from construction and access, or to improve localized water quality long-term from remediating up to approximately 2,000 gpm of CMD, compared to approximately 3,700 gpm under Alternative 2.

Floodplains

Under Alternative 3, floodplains at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2. Worley #88, Slavey Hollow, and Devils Creek sites would not be accessible under Alternative 3. Not remediating the sites would eliminate potential impacts to floodplains in those areas.

Wetlands

Under Alternative 3, wetlands at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek, which would not be accessible under Alternative 3. As such, approximately 0.5 mi of new access and 15 acres of remedial footprint would not be constructed that could have impacted potential wetland seep areas. As fewer sites would be accessible for remediation under Alternative 3, this alternative would have a slightly lower potential to impact wetlands from construction and access, and to improve wetlands long-term by reducing mine pool CMD discharge into wetlands.

Groundwater Resources and Withdrawal

Under Alternative 3, wetlands at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek. As these areas would not be accessible for CMD remediation under Alternative 3, this alternative would have a slightly lower potential to improve groundwater resources. As mentioned previously, sealing Worley #88 could increase the potential of CMD contacting groundwater that was not previously hydraulically connected, which would not occur under Alternative 3. However, there is no site-specific groundwater information available for the eight selected remedial sites; additional studies would be conducted prior to selecting a final remedial option, and long-term improvements to groundwater resources would be expected.

Cumulative Impacts

Impacts on water resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 3, would result in short- and long-term impacts on water resources. The short-term impacts to water quality related to Alternative 3 would be mitigated through the implementation of BMPs, reducing the transport of soils and sediments to waterbodies and therefore reducing potential impacts due to turbidity, transport of CMD related contaminants, and incidental and accidental releases of hazardous materials from remedial installation operations. Long-term water quality impacts from construction, access, and O&M would be low intensity. Remedial approaches provided under Alternative 3 would have slightly lower potential for long-term measurable improvements to water resources and long-term cumulative benefits than Alternative 2.

Summary of Impacts

The access to implement remedial approaches provided under Alternative 3 would have lower potential for long-term improvements to water resources than Alternative 2, as 25 programmatic and specific sites and approximately 11,600 gpm of CMD would be available for remediation

under Alternative 2, compared with 13 programmatic and specific sites and approximately 5,700 gpm of CMD under Alternative 3. Impacts on water resources under Alternative 3 would mainly occur from disturbance of access and 82 acres for remedial sites, resulting in road and site runoff, along with the crossing of wetland areas and approximately 22 streams. The short-term impacts, though less than those of Alternative 2, could be significant, but through the use of BMPs, would be mitigated. Long-term water quality impacts from construction, access, and O&M would be low intensity.

Alternative 4: Minimal Access

Programmatic Impacts

Water Quality

Under Alternative 4, which allows for the most restrictive means of access, approximately 6 sites and approximately 2,800 gpm of CMD would be accessible for the implementation of a remedial approach. Remedial approaches would utilize methods that have low, infrequent, and/or minor O&M, with a preference for passive remedial approaches. Under this alternative, access routes would require an estimated 11 stream crossings and 31 acres of remedial footprints. Access and remediation construction would result in erosion, sedimentation, minor grading, or other potential impacts described under Alternative 2, but would also provide benefits from CMD remediation. Also, because access would be limited mostly to existing roads and larger trails, required land disturbance would be less impactful than construction of many new access routes as indicated under Alternatives 2 and 3.

As described in Alternative 2, mitigation would be applied during remedial operations to minimize any potential short-term and long-term impacts on surface waters. Stream crossings would be designed to limit erosion and sedimentation, using low-water crossings instead of culverts where possible. Water quality benefits would be less than those expected under Alternatives 3 and 4 and would be localized. Water quality negatively affected by CMD under existing conditions would see a long-term improvement based on the reduction and treatment of approximately 2,800 gpm of CMD at approximately 6 sites, including lowering dissolved solids, pH, suspended solids, turbidity, conductivity, trace metals, and other contaminants associated with CMD.

Floodplains

Under Alternative 4, the most restrictive means of access among alternatives, approximately 6 sites would be accessible, compared to 17 sites under Alternative 2 and 8 sites under Alternative 3. Some work would likely be conducted in floodplain areas, but much less than that required under Alternatives 2 and 3. Because of the reduced number of sites treated, it is expected that adverse floodplain impacts from construction, access, and O&M activities under Alternative 4 would be the lowest among the alternatives.

Wetlands

Under Alternative 4, the most restrictive means of access among alternatives, approximately 6 sites would be accessible, compared to 17 sites under Alternative 2 and 8 sites under Alternative 3, a portion of which could contain wetland areas. Though no detailed wetland

delineations have been conducted for CMD remedial sites, it is likely that adverse wetland impacts from construction and O&M activities under Alternative 4 would be lowest among alternatives given a preference for passive remedial approaches. Also, because access would be limited mostly to existing roads and larger trails, potential wetland impacts along existing routes would be less impactful than construction of many new access routes as indicated under Alternatives 2 and 3. As projects are developed, detailed wetland delineations at CMD sites could be required.

Groundwater Resources and Withdrawal
Under Alternative 4, groundwater resource impacts at localized sites would be less that those proposed under Alternatives 2 and 3. Due to the more restrictive means of access under this alternative, approximately 6 sites would be accessible compared to 17 sites under Alternative 2. Groundwater resources at the untreated sites would continue to be negatively affected by CMD impacts.

Selected Remedial Site Impacts
Water Quality
Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation, up to approximately 1,800 gpm of CMD. Construction, access, and O&M for these three sites would be as described under Alternatives 2 and 3. Under this alternative, approximately 4.6 mi of access and 31 acres of remedial footprints would be utilized and could be subject to potential water quality impacts. Water quality improvements at these three sites would be as described for Alternatives 2 and 3. The remaining four sites would continue to discharge untreated CMD into the Big South Fork River watershed. Proposed water quality impacts under this Alternative would be the lowest of the three action alternatives; however, proposed water quality benefits would also be the lowest as a result of only treating four sites.

Floodplains
Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. As such, this alternative would have the lowest potential to impact floodplains. Floodplain impacts to these sites would be as described for the sites under Alternatives 2 and 3.

Wetlands
Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. As such, this alternative would have the lowest potential to impact wetlands and the lowest potential to improve wetlands impacted by CMD long-term. Wetland impacts to these sites would be as described for the sites under Alternatives 2 and 3.

Groundwater Resources and Withdrawal

Under Alternative 4, only Worley #86, Laurel Branch Spoils, and the lower portion of Blair Creek would be accessible for remediation. This alternative would have a much lower potential to improve groundwater resources.

Cumulative Impacts

Impacts on water resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 4, would result in very minimal short- and long-term impacts on water resources. Alternative 4 would have lowest potential for long-term improvements to water resources and may not contribute to measurable long-term cumulative benefits outside of the localized projects.

Summary of Impacts

The access to implement remedial approaches provided under Alternative 4 would have the lowest impacts, and the lowest potential for long-term improvements to water resources. Only 10 programmatic and specific sites and approximately 4,500 gpm of CMD would be treated (as opposed to 25 sites and approximately 11,600 gpm under Alternative 2, and 13 sites and approximately 5,700 gpm under Alternative 3). Impacts to water resources under Alternative 4 would mainly occur from land disturbance for access and approximately 62 acres for remedial sites, resulting in road and site runoff, along with the crossing of small wetland areas and approximately 18 streams. Alternative 4 would result in very minimal short- and long-term impacts on water resources. Alternative 4 would have lowest potential for long-term improvements to water resources and may not contribute to long-term cumulative benefits outside of the localized projects.

BIOLOGICAL RESOURCES

The park relies on natural processes to control populations of native species to the greatest extent possible, and has management goals for wildlife including maintaining components and processes of naturally evolving park ecosystems. However, CMD caused by anthropogenic activities is impacting biological resources within Big South Fork NRRA. The intention of remediation would be to rehabilitate CMD impacted areas similar to a natural condition, and allow for biological resources to recover naturally. The following section includes the impact analysis for biological resources, including vegetation, wildlife and aquatic species, and special status species and special habitat areas.

Remediation that could impact special status species and special habitat areas under each of the action alternatives, for both programmatic and site specific, would be subject to Section 7 of the ESA. Section 7 (a) (2) requires federal agencies to ensure their actions do not jeopardize the continued existence of federally listed species or adversely modify any critical habitat. Prior to the implementation of a remedial approach, NPS would conduct ESA consultation with the USFWS, as appropriate, to ensure compliance with Section 7.

Alternative 1: No Remediation

Programmatic Impacts

Vegetation

Under Alternative 1, area use would remain unchanged from current utilization. Communities receiving CMD would continue receiving CMD, and remediation of CMD would not occur. As mentioned previously, CMD has been shown to decrease plant species richness, and to provide a higher potential for invasive species colonization (Stephenson *et al*. 1985). The deposition of yellow boy, run off from spoil piles, and CMD into the surrounding areas can kill herbaceous vegetation, the woody understory, and trees by smothering roots. Further, the accretion of contaminants and acidification of soils can prevent recovery by inhibiting the regrowth of vegetation. Under Alternative 1, vegetation negatively affected by CMD under current conditions would continue to be impacted.

Wildlife and Aquatic Species

Area use would remain unchanged from current utilization. CMD has been shown to suppress macroinvertebrate and fish communities down to nearly nonexistent status in some streams (O'Bara *et al*. 1982; NPS 1997). CMD is a complex of elements that interact to cause a variety of effects on aquatic life that are difficult to separate into individual components, as toxicity is dependent on discharge volume, pH, total acidity, and concentration of contaminants, though receiving waters may have pH as low as 2.0 to 4.5, levels toxic to most forms of aquatic life (Hill 1974). In addition, deposition from CMD, such as iron hydroxides and oxyhydroxides associated with yellow boy can physically coat the surface of stream sediments and streambeds destroying habitat, diminishing availability of clean gravels used for spawning and forage, and reducing macroinvertebrates (Jennings, Neuman, and Blicker 2008). As impacts increase, intolerant macroinvertebrate species are eliminated (i.e., organisms either move out of the area or are subjected to decreased fitness or mortality), followed by more tolerant species, until there is no longer a macroinvertebrate community present. Fish are impacted similarly, but may temporarily swim through a non-lethal impacted area, or away from a discharge if it has an intermittent duration. However, fish unable to move from an impacted area due to barriers, such as waterfalls or culverts, or due to lower mobility, such as juveniles or eggs, would be subjected to decreased fitness or mortality. Under Alternative 1, waters would continue to receive approximately 7,900 gpm of CMD (from approximately 17 sites), and aquatic species negatively affected by CMD under current conditions would continue to be impacted. CMD also causes a reduction in plant species richness; a decrease in species richness could result in a reduction of cover and forage for wildlife (Stephenson *et al* 1995).

Special Status Species and Special Habitat Areas

Under Alternative 1, area use would remain unchanged from current utilization. Currently, there are no known impacts to special status species within Big South Fork NRRA associated with CMD. However, continued impacts to water quality could degrade habitat that might otherwise be available for the expansion of special status species, though further studies would be required regarding the potential recruitment into areas that are currently impacted by CMD. As described in the wildlife and aquatic species section, areas impacted by CMD can be

uninhabitable, and can form barriers to upstream and downstream migration, which is particularly important for reproduction and recruitment of special status species. USFWS designated critical habitat for special status mussel species (Cumberland elktoe, fluted kidneyshell, Cumberlandian combshell, and oyster mussel) does not extend downstream of the confluence of Laurel Branch Crossing and the Big South Fork River near Big Shoals, where the densest potential CMD remediation sites, and thus CMD impacts, are located. However, approximately 3 programmatic sites are located upstream of Big Shoals along portions of the Big South Fork River that is designated as critical habitat.

Selected Remedial Site Impacts

Vegetation

Under Alternative 1, vegetation impacts would be consistent with the programmatic impacts; existing conditions would remain unchanged and current impacts would continue in their present state. Ecosystems and communities receiving CMD would continue receiving CMD, and vegetation negatively affected by CMD would continue to be impacted.

Wildlife and Aquatic Species

Under Alternative 1, impacts to wildlife and aquatic species would be consistent with the programmatic impacts; existing conditions would remain unchanged and current impacts would continue in their present state. Waters, wetlands, and floodplains receiving CMD would continue receiving approximately 3,700 gpm of CMD (among the 8 selected sites), and wildlife and aquatic species negatively affected by the resulting impacts would continue to be impacted.

Special Status Species and Special Habitat Areas

Under Alternative 1, special status species and habitats would be consistent with the programmatic impacts; existing conditions would remain unchanged and current CMD impacts would continue in their present state. Habitats receiving CMD would continue receiving CMD, and special status species and habitats, particularly aquatic, negatively affected by CMD would continue to be impacted. The nearest CMD remedial site to designated critical habitat is the Blair Creek site, which is located approximately 1.5 river miles north (downstream) of the designated critical habitat within the Big South Fork River.

Cumulative Impacts

Under Alternative 1, CMD would not be subjected to remediation, and would continue to contribute to cumulative impacts. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would result in both adverse and beneficial cumulative impacts on biological resources.

Coal bed methane/shale gas drilling is an ongoing feature in the vicinity of Big South Fork NRRA. Agricultural activities on land adjacent to Big South Fork NRRA, primarily logging activities and hay production, could result adverse impacts on biological resources for the foreseeable future, due to the loss of natural vegetation and habitat, and increased runoff and sedimentation in streams. Small-scale agriculture and grazing takes place on private lands set back from the rim of the gorge, where mixed hardwood–pine forests have been cleared for cropland and browse. Logging activities in park units could result in increased habitat

destruction and have the potential to affect most terrestrial species and runoff and sedimentation impacting aquatic species, resulting in short- and long-term localized to widespread impacts.

The spread of non-native plant species has historically been occurring and now represents a serious problem within Big South Fork NRRA. Fields, roads, trails, and other disturbed areas are often source areas for exotic plants. From these sites, exotic plants can migrate into previously stable vegetation communities, where they displace native plants. NPS staff members at Big South Fork NRRA routinely manage for exotic species. Efforts to control exotic species primarily include spot treatments of herbicide at infested areas. The spread of exotic species has a small adverse effect on native habitat, but the active management of exotic species has an ongoing beneficial effect.

Existing surface disturbances (including existing and abandoned operations), in combination with other park developments and activities (including park roads, visitor use areas, recreational activities, hunting and trapping, and prescribed-fire management practices), have reduced the amount of habitat available for use by wildlife and aquatic species, with periodic (e.g. temporary on a seasonal or annual basis) and ongoing generally localized adverse impacts on wildlife and habitat. However, though the prescribed-fire management program would contribute to temporary habitat loss, wildlife displacement, erosion, and sedimentation, it would provide lasting beneficial cumulative impacts on biological resources. Roads in Big South Fork NRRA are used by personal vehicles and commercial vehicles as well as ORVs for hunting. The NPS routinely maintains trails, buildings, and roads, as well as cultural landscapes in Big South Fork NRRA. Visitor activities such as horseback riding, biking, hunting, recreational rock climbing, swimming, kayaking, and ORV use all occur within Big South Fork NRRA. Park and visitor activities would have ongoing localized impacts on habitat.

Development outside the park, including commercial, industrial, and residential, could contribute adverse cumulative impacts as a result of habitat loss and damage, temporary disturbance and relocation, or incidental take of a species. On lands surrounding Big South Fork NRRA, population growth and continued development (including the construction and operation of reservoirs, pipelines, roads, commercial and private forestry, and residential developments), in combination with natural events such as fire, flood, and drought, could increase displacement of wildlife and aquatic species, and could increase stress, which reduces the resiliency of local populations, resulting in the ongoing incremental loss of wildlife and aquatic species, and habitat decline primarily influenced through changes in water quality and quantity.

Diseases and insect pests of vegetation, such as the pine bark beetle, and currently the hemlock woody adelgid, have caused a decline in streamside vegetation, resulting in increased runoff, sedimentation, and changes in water temperature and other chemistry, impacting vegetation and habitat for wildlife and aquatic species. These effects would continue under this alternative and would have widespread impacts on biological resources.

Some plans and projects within Big South Fork NRRA would also have lasting beneficial effects on biological resources. Wells have been plugged and associated sites reclaimed within or near

Big South Fork NRRA. NPS has completed plugging and reclaiming 56 abandoned wells and closing 37 open mine portals in Big South Fork NRRA in 2012 and may initiate another project to plug and reclaim additional wells at Big South Fork NRRA in 2018. Reclamation of disturbed areas in the park reestablishes natural topographic contours and native vegetation communities, providing for the safe movement of native wildlife and the normal flow of surface waters. Wherever possible, habitats are improved to perpetuate the viability of habitats and increase the survivability of wildlife and aquatic species. Adverse impacts to plants, aquatic species, and wildlife habitat resulting from reclamation operations would generally be temporary and localized, but the lasting beneficial effects of these operations serve to protect wildlife and aquatic species and their habitat in Big South Fork NRRA.

Additional plans and projects within the park would also have beneficial effects on biological resources. The GMP at Big South Fork NRRA outlines desired resource and visitor experience conditions protecting species in the park. Reclamation of disturbed areas in the park would reestablish natural topographic contours and native vegetation communities and provide for the safe movement of native wildlife and the normal flow of surface waters. Wherever possible, habitats would be improved to perpetuate the viability of habitats and increase the survivability of listed species.

Kentucky and Tennessee are developing TMDLs for impaired waters in the Big South Fork NRRA. The implementation of these TMDLs would have beneficial effects on biological resources by reducing pollutants entering streams. Additionally, the NPS completed a revision of 9B regulations (81 FR 77972) on November 4, 2016, governing non-federal oil and gas development within the boundaries of NPS units. Generally, the changes focus on improving resource protection aspects of the regulations while accounting for advances in oil and gas technology and industry practices. These changes could have lasting beneficial impacts on biological resources, due to improving resource protection practices.

Recovery plans for threatened and endangered species carried out under the USFWS, as well as efforts to ensure agency cooperation under section 7(a)(1) of the ESA, are important for managing populations of threatened and endangered species. As part of these efforts, Big South Fork NRRA staff members are working with the USFWS, USGS, TWRA, and two mussel hatcheries (Virginia Tech Mussel Facility and Kentucky Center for Mollusk Conservation) to propagate freshwater mussels and reintroduce them into the wild.

Overall, the impacts of these actions, combined with the short- and long-term impacts, would result in short- and long-term small to large adverse cumulative impacts on biological resources. Protection provided to biological resources under the USFWS Section 7adherence, BMPs, and NPS policies is expected to limit adverse impacts and improve the condition of these resources, but biological resources in the watersheds surrounding the park have been and could continue to be adversely affected. When compared to the broader area of analysis, Alternative 1 would continue to contribute to the overall cumulative impacts by an ongoing localized CMD impact to Big South Fork River when compared to other alternatives, and represents the least beneficial alternative for biological resources.

Summary of Impacts

Under Alternative 1, not acting to remediate sites would result in long-term adverse impacts on biological resources, particularly aquatic habitats and species. Approximately 11,600 gpm of CMD would not be remediated, and continue to impact terrestrial and aquatic communities and the Big South Fork watershed through vegetation loss, decreased species richness, decreased species fitness and increase mortality, habitat loss, sediment and contaminant loading, and impacted water quality.

Alternative 2: Full Access (Proposed Action)

Programmatic Impacts

Vegetation

As with impacts mentioned previously, the construction, maintenance, and use of access roads and remediation systems, with an estimated footprint of 5 to 6 acres per site, would directly remove vegetation, introduce exotic species, cause erosion, and produce vibrations, all of which can affect vegetation, and could cause displacement, decreased production, or increased plant stress and mortality. Assuming 17 CMD sites would be treated under Alternative 2, the estimated total construction footprint would be approximately 89 acres along with 17 access pathways. This would represent approximately 0.07% of the park's acreage.

Depending on the equipment requirements and the condition of the road and trail system, it could be necessary to clear, widen, construct and/or repair the selected access pathway and remedial system location. Construction access, laydown areas, and project footprints would require minor clearing of vegetation in order to construct any of the proposed alternatives. However, following construction, these areas would be revegetated with native species associated with the appropriate community. Some risk of direct mortality of vegetation could occur if toxic materials are spilled from equipment (e.g. diesel fuel). However, the proper siting, engineering design, construction, and maintenance of roads and sites would substantially reduce impacts to terrestrial communities. In addition, construction and O&M activities would adhere to BMPs and NPS policies to avoid, minimize, and mitigate impacts, as described in previous sections.

In addition to BMPs, potential programmatic sites near Yamacraw and Worley West (across the Big South Fork River from Worley #86 and #88), extreme caution will be taken to ensure known populations of Japanese knotweed (*Fallopia japonica*), located in the vicinity of potential project areas, are not spread, and garlic mustard (*Alliara petiolata*), which is also found in the vicinity of potential remediation sites. Special mitigations will be required to protect against the spread of this highly invasive species. Depending on the actual location of the project site and the access to the area, conditions for future monitoring and control of any new populations of Japanese knotweed may be required for up to five years post-project.

Identification of wildlife and terrestrial habitat through biological surveys, as required, would result in development of mitigation measures intended to avoid or minimize impacts caused by habitat removal. The clearing of vegetated areas can create fragmented habitat that could disrupt wildlife movements; however, there is no evidence that fragmentation has become a

widespread problem in Big South Fork NRRA (NPS 2012a). In addition, there are species such as the Tennessee warbler, common yellowthroat, yellow-breasted chat, and white-eyed vireo that prefer brushier, early successional habitat, which could increase along the edges of the disturbed areas and could benefit by an increase in early successional habitat.

Vegetation could also be adversely impacted when human access is increased or becomes easier, especially in areas previously inaccessible. This increases the risk of vegetation mortality, through legal or illegal means. However, as mentioned in Chapter 2, site access roads, not associated with approved trails, would be gated and closed to restrict access following construction to mitigate the effects of increased public access. Alteration of habitat and increased human access and intrusion could also allow for the introduction of non-native species. Ground-disturbing activities in wet soils, including riparian corridors, could increase the possibility for introduction of, and invasion by, non-native vegetation such as the Japanese spiraea and tree-of-heaven. A landscape invaded by non-native species would not support native communities as effectively as a landscape with native vegetation. BMPs would be required to mitigate impacts from invasive species. However, the remediation of some sites would include the removal and/or stabilization of spoil piles and associated slopes, which would improve vegetation following restoration and natural recruitment, and would provide long-term stability for the vegetative community and associated ecosystems.

Ecosystems and communities would remain the receiving waters for CMD under Alternative 2; though CMD would be subjected to a remedial approach and some resources may no longer receive CMD as part of site-specific remedial approaches. As such, the vegetation negatively affected by CMD under current conditions would not be impacted at present levels. Reductions of impacts would vary based on site-specific remedial approaches, and could range from areas being converted to cleared areas associated with the remedial approach to communities no longer being subjected to any CMD impacts. The improvement of water quality from CMD remedial approaches could have very large benefits for communities currently subjected to CMD, as areas impacted by CMD can be uninhabitable for some wildlife and vegetation. Because the access to implement remedial approaches for CMD is greatest under Alternative 2, it would have the largest potential for both impacts and lasting improvements to vegetation.

Wildlife and Aquatic Species
As mentioned previously, the construction, maintenance, and use of access roads and remediation systems could impact vegetation, introduce exotic species, introduce sediments in waterways, cause change in temperature (loss of channel shading) and water chemistry, and produce noise or vibrations, all of which can affect wildlife and aquatic species, and could cause displacement, decreased production, or increased stress and mortality. However, as mentioned previously, construction and O&M activities would adhere to the USFWS BO, NPS policies, and BMPs to minimize and mitigate potential impacts.

Depending on the equipment requirements of the selected remedial approach for a CMD site, and the condition of the road and trail system, it could be necessary to clear, widen, construct and/or repair up to 17 access pathways with an average of 1 to 3 stream crossings per site, and

a remedial system location with an approximate footprint of 5 to 6 acres per site. If remediation were to be implemented at 17 programmatic sites, access would include an estimated 30 stream crossings and approximately 89 acres for remedial system locations. Stream crossings would be designed to limit erosion and sedimentation, using low-water crossings instead of culverts where possible. Low-water crossings minimize channel changes, which maintains the natural steam flow regime, velocity, sedimentation/erosion, and slope, and reduces the potential biological barriers (e.g. culverts) and changes to a stream associated with a culvert stream crossing that can impact aquatic species and habitats. However, when low-water crossings are not practical, placement of adequate and appropriately sized culverts under access roads would allow for organism passage and would have minimal impacts on stream condition. In addition, 30 crossings represent less than 0.015% of the over 400 miles of streams in Big South Fork NRRA, and the 89 acres remedial sites would only represent approximately 0.07% of the park's 125,310 acres. In addition, these activities would be subject to the USFWS BO, NPS policies, BMPs, and planning, such as segmenting work along streams, to avoid, minimize, and mitigate potential impacts to the maximum extent practicable.

Mitigation measures would include conducting activities within previously disturbed areas when possible, using chainsaws and tractors equipped with bush hogs to limit ground disturbance near streams and wetlands, and utilizing other BMPs, as previously noted. In addition, work in streams and along stream bank would be segmented (less than 100 feet) into shorter bank sections to allow quicker rock placement, reducing the exposure time of disturbed bank faces. With combined mitigation measures, potential impacts are not expected to change channel processes or affect viability of the aquatic species populations. In addition, all stream crossings on routes identified in the GMP as part of the trail system would have a subbase of rock and a filter fabric layer installed, or the crossings would be hardened with concrete planks. These crossings would have temporary impacts during installation, but are designed to minimize impacts from subsequent crossings of the stream during construction and O&M. The proper siting and alignment of roads and remedial approach areas and the placement of adequate culverts under access roads and appropriate drainage on and around remedial approach areas would further minimize adverse impacts to aquatic habitats. Required compensatory mitigation for direct and indirect impacts on wetlands could be used to restore wetlands habitats and increase aquatic habitat values.

Aquatic habitat directly affected by CMD would be subjected to a remedial approach under Alternative 2, up to approximately 7,900 gpm of CMD. Currently, many of the stream beds impacted by CMD are covered by yellow boy and are not in pristine condition. Areas impacted by CMD can be uninhabitable, as discussed under Alternative 1, from impacted water quality, such as low pH, increased total acidity and contaminant concentrations, and deposition and accretion associated with CMD, such as yellow boy. These impacts can form barriers to upstream and downstream migration, which is particularly important for reproduction and recruitment. As mentioned in Chapter 1, similar projects to those proposed under Alternative 2, completed at Rock Creek in the Big South Fork River watershed (but outside of the NRRA), have shown significant improvements for aquatic habitat, as fish populations are improving, and areas that previously did not support fish now support fish (USEPA 2005). In addition, projects

in Ely Creek (Virginia) and Swatara Creek (Pennsylvania) utilizing remedial approaches proposed in this EIS improved macroinvertebrate abundance and species richness, including clam survival rates (Simon et al. 2012), and increased water quality and subsequently fish diversity and abundance (Cravotta III et al. 2010). The installation of remedial approaches would improve surface water quality and in-stream conditions, and some aquatic habitats may no longer receive CMD as part of site-specific remedial approaches. As such, the aquatic habitats negatively affected by CMD under current conditions would not be impacted at present levels. Reductions of impacts would vary based on site-specific remedial approaches. The improvement of water quality from CMD remedial approaches could have very large benefits for aquatics habitat. Because the access to implement remedial approaches for CMD is greatest under Alternative 2, it would have the largest potential for lasting improvements to aquatic habitat by treating up to approximately 7,900 gpm of CMD across approximately 17 sites.

Potential impacts could decrease the viability of aquatic populations as a result of increased sedimentation from construction activities over weeks or months, if appropriate mitigation measures are not applied. Sedimentation in the main stem of the Big South Fork River, and at the mouths of tributary streams could impact mussels. Some risk of direct mortality of aquatic species could occur if toxic materials (e.g. diesel fuel) are spilled into streams from vehicles or equipment. However, the proper siting, engineering design, and BMP adherence would substantially reduce aquatic habitat degradation and impacts to aquatic species. In addition to BMPs, protective measures promote the proper protection of water levels, stream temperatures, water quality, and streamflow. As such, potential impacts are not expected to change channel processes or affect viability of the aquatic species populations. Required compensatory mitigation for direct and indirect impacts on wetlands and/or streams could be used to restore wetland and stream habitats and increase wildlife and aquatic species habitat values.

Identification of wildlife and aquatic species habitat through biological surveys, as required, would result in development of mitigation measures intended to avoid or minimize impacts caused by habitat removal on a case-by-case basis. A few examples of potential mitigation options include avoidance of areas by using an alternate access pathways, marking sensitive areas before snow covers the site, vegetation restoration consistent with surrounding communities, use of directional felling techniques to prevent additional vegetation loss, use of stream sediment curtains and streamside management zones, crossing streams based on season and weather conditions, maintaining stream shading where possible, keeping fuels and other chemicals out of the streamside zone, and limiting access or use based on temporal species guidelines.

Temporary impacts to bird species are anticipated during construction due to loss of habitat, forage, and potential displacement. Big South Fork NRRA has extensive contiguous forests and many birds require deep forests, particularly for nesting. The project would include the potential disturbance of these deep forest habitats, thereby displacing forest species, including priority BCC, the blackthroated blue warbler and the cerulean warbler. The clearing of vegetated areas can also create fragmented habitat that could disrupt wildlife movements and provide openings for species utilizing those areas, such as brown-headed cowbirds, known to lay their eggs in

nests of other birds (brood parasitism). This would have the greatest impact on rarer bird species including some neotropical migrants. However, there is no evidence that fragmentation has become a widespread problem in Big South Fork NRRA (NPS 2012a). In addition, there are neotropical migrant species such as the Tennessee warbler, common yellowthroat, yellow-breasted chat, white-eyed vireo, and the golden-winged warbler, a priority BCC, that prefer brushier, early successional habitat, which could increase along the edges of the disturbed areas and could benefit by an increase in early successional habitat.

Impacts to riparian habitats could impact forage, cover, and potential roosting habitat for bats. Bat species could be impacted by the potential loss of roosting trees and foraging habitat from the clearing of vegetation, and increased stress, displacement, or mortality from construction and maintenance noise and vibration during weeks to months of construction. However, noise impacts would be limited to a localized area (though noise could potentially travel through the gorge) during daylight hours and over a relatively short duration. In addition, the benefit of improved water quality has been shown to increase the yield of benthic invertebrates which could subsequently increase forage for bats (Simon et al. 2012). Appropriate mitigation would also substantially reduce impacts and could include bat and bat habitat surveys, the adjusting of construction and maintenance activity periods with winter hibernation periods, the avoidance of clearing near hibernacula, forest management, and limited tree removal. Identification of bat habitat through biological surveys, as required, would result in development of mitigation measures intended to avoid or minimize impacts caused by habitat removal.

Wildlife could also be adversely impacted when human access is increased or becomes easier, especially in areas previously inaccessible. This increases the risk of wildlife and aquatic species mortality, through legal or illegal means. However, as mentioned in Chapter 2, site access roads would be gated and closed to restrict access following construction to mitigate the effects of increased public access. Alteration of wildlife and aquatic species habitat and increased human access and intrusion could allow for the introduction of non-native species. Ground-disturbing activities in wet soils, including riparian corridors, could increase the possibility for introduction of, and invasion by, non-native vegetation such as the Japanese spiraea and tree-of-heaven. A landscape invaded by non-native species would not support native wildlife populations as effectively as a landscape with native vegetation.

All construction activities are likely to displace animals along access roads and near the remedial approaches during construction (from weeks to months), and periodically through the O&M phase of the remedial systems. Noise from construction vehicles during daylight hours would impact wildlife, with noise coming mostly from multiple diesel engines and equipment, though noise impacts would be limited to a localized area and relatively short duration. Displacement would likely be the predominant effect on most wildlife species. Road and remedial approach operations would reduce the usable habitat for large mammals, such as bears, white-tailed deer, and elk. Secure areas for these species would be reduced and the risk of mortality would increase. Access roads may serve as travel corridors for game species, which may increase their risk of mortality from hunting, poaching, or vehicle collisions. Increased access would also result in the same effects on smaller wildlife species, with increases in direct

loss of wildlife through trapping and hunting. However, the low-speed roads are not expected to appreciably increase mortality from roadkill and should not be barriers to movements for wildlife species.

Under Alternative 2, the wildlife and aquatic species negatively affected by CMD under current conditions would not be impacted at present levels, and particularly for aquatic species, conditions could be drastically improved with the remediation of up to approximately 7,900 gpm of CMD across 17 sites.

Special Status Species and Special Habitat Areas
The construction, maintenance, and use of access roads and remediation systems could impact vegetation, introduce exotic species, introduce sediments in waterways, and produce noise or vibrations, all of which can affect special status species, and could cause displacement, decreased production, or increased stress and mortality.

Sensitive riparian habitat and numerous state-and federally-listed plants are known to occur in the vicinity of some of the potential programmatic sites, such as areas near Three West Hollow, Big Spring Hollow, Worley West and Blue Heron West (across the Big South Fork River from Blue Heron). In addition to BMPs, depending on the actual location of a project site and the access to the area, conditions for protection and future monitoring of riparian habitats and known element occurrences of listed plant species may be required.

Depending on the equipment requirements and the condition of the road and trail system, it could be necessary to clear, widen, construct and/or repair up to 17 access pathways and 89 acres for remedial system locations, including an estimated 30 stream crossings. The activities could impact special status species as described in the previous biological resources sections, such as sedimentation in the main stem of the Big South Fork River, and at the mouths of tributary streams impacting mussels or darters.

Special status bat species, as mentioned in the wildlife section, could be impacted by construction and maintenance noise and vibration during weeks to months of construction. However, noise impacts would be limited to daylight hours and in duration. In addition, the benefit of improved water quality has been shown to increase the yield of benthic invertebrates which could subsequently increase forage for protected bats species (Simon et al. 2012). Appropriate mitigation would also substantially reduce impacts and could include bat and bat habitat surveys, the adjusting of construction and maintenance activity periods with winter hibernation periods, the avoidance of clearing near hibernacula, forest management, and limited tree removal. Identification of bat habitat through biological surveys, as required, would result in development of mitigation measures intended to avoid or minimize impacts caused by habitat removal.

Special status species could also be adversely impacted when human access is increased or becomes easier, especially in areas previously inaccessible. This increases the risk of mortality, through legal or illegal means. Alteration of habitat and increased human access and intrusion could allow for the introduction of non-native species. Ground-disturbing activities in wet soils,

including riparian corridors, could increase the possibility for introduction of, and invasion by, non-native vegetation. However, as mentioned in Chapter 2, site access roads would be gated and closed to restrict access following construction to mitigate the effects of increased public access.

Other activities likely to impact special status species include stream and wetland crossing, wetland filling, dredging, or construction, and stream relocation, piping, potential spills (e.g. diesel fuel), or construction. These effects could decrease the viability of special status populations if appropriate mitigation measures are not applied. However, the proper siting, engineering design, USFWS Section 7 and NPS BMPs adherence would substantially reduce aquatic habitat degradation and impacts to special status aquatic species, and are not expected to change channel processes or affect viability of the special status aquatic species populations.

Aquatic habitat utilized by special status species directly affected by CMD would be subjected to a remedial approach under Alternative 2. Currently, many of the stream beds impacted by CMD are covered by yellow boy and are not in pristine condition. The installation of remedial approaches would improve surface water quality and in-stream conditions, and some resources may no longer receive CMD as part of site-specific remedial approaches. As such, the resources negatively affected by CMD under current conditions would not be impacted at present levels, particularly fish and mussel species.

The improvement of water quality from CMD remedial approaches could have very large benefits for special status fish and mussel species. Areas impacted by CMD can be uninhabitable to some aquatics species, and can form barriers to upstream and downstream migration, which is particularly important for reproduction and recruitment. As mentioned previously, similar projects completed at Rock Creek, Ely Creek, and Swatara Creek have shown drastic improvements for aquatic species; relative abundance and species diversity has increased, and areas once supporting no fish are now supporting fish (USEPA 2005; Simon *et al*. 2012; Cravotta III *et al*. 2010). As a result, implementation of remedial approaches could provide new habitat to aid the recovery of special status species, and potentially allow for designated critical habitats for aquatic species to be expanded in the future. Because the access to implement remedial approaches for CMD is greatest under Alternative 2, it would have the largest potential for lasting improvements to special status aquatic species.

Selected Remedial Site Impacts

Vegetation

Under Alternative 2, terrestrial ecosystem and community impacts at the selected sites would be similar to the impacts described for the programmatic level, but with site-specific impacts from remedial approaches as described below. Vegetation clearing would impact several types of habitats, all of which are commonly occurring within Big South Fork NRRA.

Access to Worley #86 would use the existing Worley Road, which would limit impacts to vegetation; however, the remedial footprint would impact the riparian community along Worley Branch with the installation of two wetland cells, which would clear approximately 7.9 acres of lowland-submontane cold deciduous forest (Figure 4-1).

Access to Worley #88 uses Worley Road and existing cleared ROW along the railroad, which would have negligible impacts on vegetation; however, the portion of access from the railroad to the mine would require clearing approximately 0.07 acre of lowland-submontane cold deciduous forest and hemlock-white pine forest (Figure 4-2). In addition, the generalized conservative remedial footprint would impact the riparian community along the unnamed tributary to the Big South Fork River, clearing approximately 1.6 acres of lowland-submontane cold deciduous forest.

Slavey Hollow access would be accomplished through a temporary access road along a former logging road and a former tram rail bed (Figure 4-3). These former pathways are overgrown with a mix of hemlock-white pine forest, pine forest, and lowland-submontane cold deciduous forest, requiring approximately 1.78 acres of clearing. In addition, the remedial approach would require clearing approximately 7.1 acres of mixed pine-oak forest, lowland-submontane cold deciduous forest, and hemlock-white pine forest for the wetland treatment system.

The Nancy Grave access would utilize 0.13 mi of former logging road and 0.48 mi of Segment C of the Kentucky Trail to the site (Figure 4-4). Use of the Kentucky Trail would require temporary widening during construction, requiring clearing approximately 1.15 acres of lowland-submontane cold deciduous forest. As mentioned previously, sections of the Kentucky Trail would be restored to the existing width according to NPS trail standards, allowing for future O&M, and maintained according to trail standards following construction. In addition to access impacts, the Nancy Grave remedial approach would require clearing approximately 9.5 acres of mixed pine-oak forest, lowland-submontane cold deciduous forest, and pine forest along Big South Fork River floodplain.

The Devils Creek access would utilize 0.13 mi of former logging road and 0.84 mi of Segment C of the Kentucky Trail to the site (Figure 4-4). Use of the Kentucky Trail would require temporary widening, including clearing approximately 0.81 acre of lowland-submontane cold deciduous forest. The Kentucky Trail would be restored and maintained to the existing width according to NPS trail standards and to accommodate future O&M access following construction. In addition to access impacts, the remedial approach would require impacts to approximately 6.2 acres of lowland-submontane cold deciduous forest and hemlock-white pine forest along Devils Creek.

In addition to BMPs for exotic plant species, extreme caution shall be taken to ensure known populations of kudzu (*Pueraria lobata*), an exotic, invasive, trailing perennial vine, such as those located in the vicinity of the Slavey Hollow, Nancy Grave, and Devils Creek, are not spread. Special mitigations will be required to protect against the spread of this species, which could include spraying, removal, equipment inspections, area monitoring, etc. Depending on the project site and the access to the area, conditions for future monitoring and control of any new populations of kudzu may be required for up to five years post-project. However, conducting remediation in these areas would also allow the opportunity for kudzu treatment or elimination.

The Laurel Branch Confluence access would be accomplished along 0.41 mi of the existing Laurel Branch Road, 1.45 mi of the Lee Hollow Loop Horse Trail, and 0.09 mi of the Blue Heron Loop Hiking Trail (Figure 4-5). Laurel Branch Road is an existing access road that would likely

require negligible clearing of low hanging branches for access. Use of the Lee Hollow Loop Horse Trail could require temporary widening, including clearing approximately 0.70 acre of lowland-submontane cold deciduous forest. Use of the Blue Heron Loop Hiking Trail would require temporary widening, including clearing approximately 0.09 acre of lowland-submontane cold deciduous forest. Trails would be restored and maintained to the existing width according to NPS trail standards and to accommodate future O&M access following construction. In addition to access impacts, the remedial approach would require clearing approximately 2.6 acres of lowland-submontane cold deciduous forest and mixed pine-oak forest for the regrading of spoils and construction of ditches.

The Laurel Branch Spoils access would be accomplished along 0.41 mi of the existing Laurel Branch Road, and 1.25 mi of the Lee Hollow Loop Horse Trail, and 0.09 mi of new access (Figure 4-5). Laurel Branch Road is an existing access road, and would likely require negligible clearing of low hanging branches for access. Use of the Lee Hollow Loop Horse Trail and new access require temporary widening, including clearing approximately 0.83 acre of mixed pine-oak forest and pine forest. The horse trail would be restored and maintained to the existing width according to NPS trail standards and to accommodate future O&M access following construction. In addition to access impacts, the remedial approach would require clearing approximately 1.7 acre of mixed pine-oak forest.

The Blair Creek access would be accomplished along the Bear Creek Loop Horse Trail and the Lee Hollow Loop Horse Trail for approximately 1.72 mi (Figure 4-6). Use of the horse trails would require temporary widening, including clearing approximately 0.94 acre of a mix of lowland-submontane cold deciduous forest and mixed pine-oak forest, successional forest, shrubland, pine forest, and mixed pine-oak forest. The horse trails would be restored and maintained to the existing width according to NPS trail standards and to accommodate future O&M access following construction. In addition to access impacts, the remedial approach would require clearing approximately 18.7 acres of lowland-submontane cold deciduous forest and mixed pine-oak forest.

For all sites, O&M requirements would require different levels of vegetation clearing, from minor branch-clearing along existing trails, to periodic clearing of access routes that have been left idle for months to years to accommodate O&M activities.

All eight selected CMD sites are accessible for remediation under Alternative 2. Thus, Alternative 2 has the highest potential to impact vegetative communities, but would also have the highest potential to reduce long-term impacts of CMD to local vegetation.

Wildlife and Aquatic Species

Under Alternative 2, impacts at the selected sites would be similar to the impacts described for the programmatic level and in the vegetation section and the water resources section. Impacts would change based on site-specific remedial approaches described below. Implementation of CMD remediation at the eight sites that would include up to approximately 3,700 gpm of CMD. Remediation would include 7.2 mi of access, including an estimated 14 stream crossings, and 55 acres of disturbance for remedial approach footprints. As mentioned previously, 14 crossings

represent less than 0.006% of the over 400 miles of streams in Big South Fork NRRA, and the 55 acres remedial sites would only represent approximately 0.04% of the park's 125,310 acres. In addition, these impacts would be appropriately mitigated by adhering to the USFWS BO, BMPs, and NPS policies.

Access to the Worley Mine #86 would be accomplished along the existing Worley Road. Access along Worley Road is expected to have negligible impacts to aquatic habitat; however, implementation of the remedial approach would require a footprint of approximately 7.9 acres. The remedial approach would significantly benefit habitats long-term by eliminating CMD discharge at Worley #86, and preventing untreated CMD from flowing into Worley Branch.

Access to the Worley Mine #88 site would be accomplished along the existing Worley Road and the existing corridor of the Big South Fork Scenic Railway. The use of Worley Road is expected to have negligible impacts; however, improvement would be required along 0.36 mi of access along the railroad ROW and an additional 0.06 mi from the railway to the site. Some minimal impacts to habitats could occur from clearing vegetation, erosion, sedimentation, fuel spills, or other potential impacts. Additionally, remediation using a generalized footprint would disturb approximately 1.6 acres. The remedial approach, once selected, would likely significantly benefit, particularly to aquatic habitat long-term by treating CMD discharge at Worley #86, and preventing untreated CMD from flowing into the Big South Fork River.

The Slavey Hollow access would be accomplished through a temporary access road along a 0.48 mi former logging road and along 0.66 mi of former tram rail bed. Also, 0.09 mi of new access would be required. Four stream crossings would be required for access, and the remedial approach would require disturbing approximately 7.1 acres for the wetland treatment system. Some minimal impacts to habitats would occur from clearing vegetation, erosion, sedimentation, fuel spills, removal of vegetative shading, or other potential impacts. However, the remedial approach would prevent CMD from directly flowing into Slavey Hollow and Big South Fork River untreated, which could have significant ongoing benefits for surrounding habitats.

The Nancy Grave access would utilize 0.13 mi of former logging road and 0.48 mi of Segment C of the Kentucky Trail to the site. In addition, access to the site would require crossing the Nancy Grave drainage. The Nancy Grave remedial approach would require approximately 9.5 acres of disturbance along Big South Fork River floodplain. Some minimal impacts to habitats could occur from clearing vegetation, erosion, sedimentation, fuel spills, removal of vegetative shading, or other potential impacts. However, the remedial approach would prevent CMD from directly flowing into the Nancy Grave drainage untreated, which could have large ongoing benefits for the habitats in the Nancy Grave drainage and Big South Fork River.

The Devils Creek access would utilize 0.13 mi of former logging road and 0.84 mi of Segment C of the Kentucky Trail to the site. In addition, site access would require crossing the Nancy Grave drainage. The remedial approach would require approximately 6.2 acres of disturbance along Devils Creek. Some minimal impacts to habitats could occur from vegetation clearing, erosion, sedimentation, fuel spills, removal of vegetative shading, or other potential impacts. However,

the remedial approach would prevent CMD from directly flowing into Devils Creek untreated, which could have significant lasting benefits for the habitats of Devils Creek, and subsequently the Big South Fork River.

The Laurel Branch Confluence access use 0.41 mi of the existing Laurel Branch Road, 1.45 mi of the Lee Hollow Loop Horse Trail and the Blue Heron Loop Hiking Trail, which would include four stream crossings. In addition to access impacts, the remedial approach would require disturbing approximately 2.6 acres for the regrading of spoils and construction of ditches. Some minimal impacts to habitats could occur from vegetation clearing, erosion, sedimentation, fuel spills, removal of vegetative shading, or other potential impacts. However, the remedial approach would prevent CMD seepage from flowing directly into the Big South Fork River, which could have significant lasting benefits for habitats.

The Laurel Branch Spoils access would be accomplished along 0.41 mi of the existing Laurel Branch Road, and 1.25 mi of the Lee Hollow Loop Horse Trail, and would require three stream crossings. The Laurel Branch Spoils would change habitats with the installation of box culverts, approximately 120 feet long, to segregate the waters of Laurel Branch from spoils. Some minimal impacts to aquatic habitat could occur from the box culvert installation, erosion, sedimentation, fuel spills, removal of vegetative shading, or other potential impacts. The aquatic habitat in Laurel Branch would benefit long-term by improving water quality of the stream, as well as relocating the horse trail over the culvert to prevent crossing the stream at the existing sandstone crossing to limiting erosion and associated sedimentation, turbidity, and suspended solids impacts.

The Blair Creek access would be accomplished along 1.72 mi of the Bear Creek Loop Horse Trail and the Lee Hollow Loop Horse Trail. In addition to access impacts, the remedial approach would require disturbing approximately 18.7 acres. Some minimal impacts to habitat could occur from vegetation clearing, erosion, sedimentation, fuel spills, removal of vegetative shading, or other potential impacts. However, this remedial approach could provide significant long-term benefits to aquatic habitat by dewatering the mine pool and preventing the various CMD discharge points from flowing directly into Blair Creek and Big South Fork River untreated.

Special Status Species and Special Habitat Areas
Under Alternative 2, special status species impacts at the selected sites would be similar to the impacts described for the programmatic level, but would change based on site-specific remedial approaches and would be consistent with impacts discussed in the previous terrestrial community and aquatic habitat sections for Alternative 2. Sensitive riparian habitat and numerous state-and federally-listed plants occur in the vicinity of proposed project areas, including Laurel Branch. Depending on the project site and the access to the area, conditions for protection and future monitoring of riparian habitats and known element occurrences of listed plant species may be required.

As a result, implementation of remedial approaches could provide new habitat to aid the recovery of special status species, and potentially allow for designated critical habitats for aquatic species to be expanded in the future. Because the access to implement remedial

approaches for CMD is greatest under Alternative 2, it would have the largest potential for lasting improvements to special status aquatic species as documented from the sections of the Big South Fork River in the vicinity of the selected remedial sites.

Cumulative Impacts

Impacts on biological resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 2, would result in short- and long-term minimal impacts to biological resources. The implementation of remedial approaches for CMD under Alternative 2 would have the largest potential for improvements for biological resources among the alternatives, and would provide ongoing cumulative benefits, particularly for aquatic species and habitats.

Summary of Impacts

Under Alternative 2, the implementation of remedial approaches would result in impacts on biological resources, mainly from construction of access routes and approximately 145 acres for remedial sites, resulting in road and site runoff, along with the crossing of wetland areas and approximately 44 streams. This would represent approximately 0.1% of the park's 125,310 acres. In addition, planning and adherence to Section 7 and BMPs would avoid, minimize, and mitigate these impacts. Short and long-term impacts would likely not be significant, and impacts would be mitigated through the use of BMPs. In addition, remediating up to approximately 11,600 gpm of CMD would have a long-term beneficial impact on biological resources.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Impacts

Vegetation

Under Alternative 3, vegetation impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible compared to 17 sites under Alternative 2. Under the alternative, approximately 8 accesses and 42 acres of remedial footprints would be subjected to clearing or other potential impacts, but would also be subjected to the benefits of site remediation.

Wildlife and Aquatic Species

Under Alternative 3, wildlife and aquatic species impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites and approximately 3,700 gpm of CMD would be accessible for remediation, compared to 17 sites and approximately 7,900 gpm of CMD under Alternative 2. Inaccessible sites, based on the access restrictions under Alternative 3, would not be subjected to potential temporary impacts associated with a remedial approach, and thus existing conditions would remain unchanged. However, for these inaccessible sites, ongoing CMD impacts would continue in their present state, and wildlife and aquatic species negatively affected by CMD would continue to be impacted.

Special Status Species and Special Habitat Areas
Under Alternative 3, impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 8 sites would be accessible compared to 17 sites under Alternative 2. Inaccessible sites, based on the access restrictions under Alternative 3, would not be subjected to potential temporary impacts associated with a remedial approach, and special status bat and plant species would not be impacted beyond current conditions. However, for these inaccessible sites, ongoing CMD impacts would continue in their present state, and special status fish and mussel species negatively affected by CMD would continue to be impacted.

Selected Remedial Site Impacts
Vegetation
Under Alternative 3, vegetation at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek sites, which would not be accessible under Alternative 3. As such, approximately 15 acres of the access and remedial footprint would not be subjected to clearing. As these areas would not be accessible for remediation under Alternative 3, this alternative would have a lower potential to impact vegetation. Vegetation clearing would impact several types of habitats, all of which are commonly occurring within Big South Fork NRRA.

Wildlife and Aquatic Species
Under Alternative 3, habitat at the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek sites, which would not be accessible under Alternative 3. As such, approximately 0.5 mi of new access and 15 acres of footprint would not be subjected to disturbance, but approximately 4,100 gpm of CMD would not be subject to remediation. As these areas would not be accessible for remediation under Alternative 3, this alternative would have a lower potential to impact or improve localized wildlife or aquatic species.

Special Status Species and Special Habitat Areas
Under Alternative 3, impacts from the selected sites would be consistent with the site-specific remedial approaches and impacts described for Alternative 2, with the exception of Worley #88, Slavey Hollow, and Devils Creek sites, which would not be accessible under Alternative 3. This alternative would have a lower potential to impact or improve localized for special status species or their habitats.

Cumulative Impacts
Impacts on biological resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 3, would result in short- and long-term impacts on biological resources. However, the access to implement remedial approaches provided under Alternative 3 would have lower potential for long-term improvements for biological resources and long-term cumulative benefits than Alternative 2, particularly for aquatic species and habitats.

Summary of Impacts

The access to implement remedial approaches provided under Alternative 3 would have lower potential for long-term improvements for biological resources than Alternative 2, as 25 sites and approximately 11,600 gpm of CMD would be available for remediation under Alternative 2, compared with 13 sites and approximately 5,700 gpm of CMD under Alternative 3. Impacts on biological resources under Alternative 3 would mainly occur from disturbance of unpaved surfaces and, vegetation clearing and disturbance of approximately 82 acres for remedial sites, along with the crossing of small wetland areas and approximately 22 streams, potentially resulting in road and site runoff, temporary vegetation loss, displacement, decreased production, increased stress and mortality.

Alternative 4: Minimal Access

Programmatic Impacts

Vegetation

Under Alternative 4, the most restrictive means of access, approximately 6 sites would be accessible for the implementation of a remedial approach. Under the alternative, approximately 6 accesses and 31 acres of remedial footprints would be subjected to vegetation impacts, but would also be subjected to the benefits of site remediation.

Wildlife and Aquatic Species

Under Alternative 4, the most restrictive means of access, approximately 6 sites would be accessible for the implementation of a remedial approach for approximately 2,800 gpm of CMD. As the lowest number of sites would be accessible for remediation under Alternative 4, this alternative would have the lowest potential to impact or improve conditions for wildlife or aquatic species.

Special Status Species and Special Habitat Areas

Under Alternative 4, the most restrictive means of access, approximately 6 sites would be accessible for the implementation of a remedial approach. As the lowest number of sites would be accessible for remediation under Alternative 4, this alternative would have the lowest potential to impact or improve special species or their habitats, particularly for aquatic species.

Selected Remedial Site Impacts

Vegetation

Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. Under this alternative, approximately 4.6 mi of access and 31 acres of remedial footprints would be subjected to potential vegetation impacts, but would also be subjected to the benefits of site remediation. Vegetation clearing would impact several types of habitats, all of which are commonly occurring within Big South Fork NRRA. The remaining four sites would continue to discharge untreated CMD into the Big South Fork River watershed.

Wildlife and Aquatic Species

Under Alternative 4, Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation of up to approximately 1,800 gpm of CMD. Under this alternative, approximately 4.6 mi of access and 31 acres of remedial footprints would be subjected to impacts, but would also be subjected to the benefits of site remediation. The remaining four sites would continue to discharge untreated CMD into the Big South Fork River watershed.

Special Status Species and Special Habitat Areas
Under Alternative 4, Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. Under this alternative, approximately 4.6 mi of access and 31 acres of remedial footprints would be subjected to potential impacts, but would also be subjected to the benefits of site remediation.

Cumulative Impacts
Impacts on biological resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the impacts of Alternative 4, would result in short- and long-term impacts on biological resources. However, the access to implement remedial approaches provided under Alternative 4 would have lowest potential for long-term improvements to biological resources and long-term cumulative benefits, particularly for aquatic species and habitats.

Summary of Impacts
The access to implement remedial approaches provided under Alternative 4 would have the lowest impacts, and the lowest potential for long-term improvements to biological resources, as 25 sites and approximately 11,600 gpm of CMD would be accessible for remediation under Alternative 2, and 13 sites and approximately 5,700 gpm of CMD under Alternative 3, compared with 10 accessible sites and approximately 4,600 gpm of CMD under Alternative 4. Impacts on biological resources under Alternative 4 would mainly occur from disturbance of unpaved surfaces and approximately 62 acres for remedial sites, resulting in road and site runoff, along with the crossing of small wetland areas and approximately 18 streams.

CULTURAL RESOURCES

Cultural resources meeting the eligibility criteria for listing on the NRHP are considered “significant” resources and must be taken into consideration during the planning of federal projects, and are part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America’s historic and archeological resources. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects possessing integrity of location, design, setting, materials, workmanship, feeling, and association.

Alternative 1: No Remediation

Programmatic Impacts

Under Alternative 1, area use would remain unchanged from current utilization, and archeological resources, historic structures, cultural landscapes, and ethnographic resources would continue in their current state. Maintenance and use of existing access roads and trails would expose soils to erosion, compaction, and rutting of soils which could affect cultural resources and values, along with potential impacts associated with CMD. However, potential impacts associated with the O&M of existing park areas, roads, and trails are expected to be negligible, as these areas have been previously disturbed. The properties of CMD, as discussed in the soils and water quality sections, could continue to degrade unknown (e.g. buried or unsurveyed) and known (e.g., former mining scales) cultural resources that are exposed to CMD over time.

Selected Remedial Site Impacts
Under Alternative 1, cultural resource impacts would be consistent with the programmatic impacts; existing conditions would remain unchanged.

Cumulative Impacts
Under Alternative 1, CMD would not be subjected to remediation, and would continue to contribute to cumulative impacts. However, several actions described in the "Cumulative Impacts Scenario" section of this chapter would result in both adverse and beneficial cumulative impacts on cultural resources. These include old logging and agricultural operations; abandoned well sites and oil and gas access roads providing unauthorized access to cultural resources; earthmoving activities associated with construction and maintenance of dirt roads and oil and gas well pads; park maintenance activities, including installation and maintenance of roads, trails, developed sites, and cultural structures/landscapes; logging and timber harvesting; abandoned coal mines; agricultural activities; commercial and/or residential development; and the previously completed plugging of 56 orphaned wells at Big South Fork NRRA. All of these actions could involve ground disturbance and destruction of sensitive buried or unsurveyed cultural resources. Similar activities occurring outside the park could affect cultural resources. Cumulatively, these would have a lasting impact on cultural resources.

Impacts to cultural resources are expected to diminish and contribute less to cumulative impacts in the foreseeable future. The information provided by cultural resource surveys required of the NPS prior to carrying out park activities would increase the NPS knowledge of the resources in the park and would be used to preserve cultural resources, a beneficial cumulative effect. Protection provided to cultural resources in the park under current legal and policy requirements (CLPR), particularly the well-defined regulatory process under the NHPA and consultation with SHPOs, would result in the ongoing preservation of important cultural resources and traditional cultural practices, which would have a beneficial cumulative impact on cultural resources in the park.

Summary of Impacts
Under Alternative 1, not acting to remediate sites would result in ongoing impacts on cultural resources. Past, present, and reasonably foreseeable future actions, when combined with the impacts of Alternative 1, would result in short- and long-term cumulative impacts on cultural

resources. When compared to the broader area of analysis, Alternative 1 would directly impact a localized area, but would contribute minimal impacts to the overall cumulative impacts.

Alternative 2: Full Access (Proposed Action)

Programmatic Impacts

Potential adverse impacts on cultural resources from the construction and maintenance of access roads and remedial approaches would occur up to an estimated 17 sites. Disturbances occurring from access and implementation of a remedial approach would largely be located in previously disturbed areas; however, some of these areas could be associated with cultural resources from the previous mining or occupation of Big South Fork NRRA. These impacts would be avoided or mitigated by applying CLPR (e.g., surveys, Section 106 compliance, etc.), particularly those of the NHPA, and through consultation with the SHPO. If buried cultural resources cannot be avoided, impacts would be mitigated by cultural resources oversight, through recovery of data (excavation), preservation of recovered materials, and associated records. However, any loss of undetected buried cultural resources would have an irreversible adverse impact. Increased access to areas could lead to intentional and unintentional vandalism. Illegal collection of or damage to previously unidentified cultural resources listed or eligible for listing on the NRHP would constitute an indirect adverse impact.

It is possible that important cultural sites may not be visible from the surface and could be damaged during construction activities. This would have an adverse impact on individual archeological sites; however, the cumulative impact on archeological resources at the park would be very low. Most of the known archeological sites can be protected from direct impacts by avoidance. When significant sites cannot be avoided, impacts would be mitigated by excavating the site, using methodologies defined in a reviewed and approved research design.

All of the known historic structures are visible and would not be damaged by construction activities associated with access and remedial approach implementation. Impacts relating to noise effects on the visitor experience of viewing historic structures is included in the “Visitor Use and Experience” section of this chapter. With application of the mitigation measure preventing operators from altering, destroying, or collecting any object, structure, or site of historical, archeological, or cultural value, the sites can be protected from direct construction impacts by avoidance. With this mitigation, impacts would likely be negligible.

Visual impacts from construction and O&M on cultural landscapes would be more substantial if remedial approaches were placed in relatively close proximity to the sites where visitors would be able to see the operations. Remedial approach implementation would involve more equipment and traffic, and although this is temporary, it would have impacts. Lasting adverse impacts could occur to cultural landscapes from the visual presence of remedial approaches, and impacts could occur to visitor experience of cultural landscapes, which is included in the “Visitor Use and Experience” section.

Ethnographic resources consist mainly of the cultural values of the tribes claiming traditional associations with the area. Consultation with tribes, as required, would be undertaken as

project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure they are not adversely impacted by construction and O&M. As a result, remediation would likely result in minimal adverse impacts on potential ethnographic resources.

The NPS recognizes that unplanned incidents associated with construction and O&M, such as spills within the boundaries of the park, present a risk of release of contaminants that could adversely impact cultural resources; however, the incident rates for such incidents are low and are not a typical expectation of project implementation. If such an incident did occur, required mitigation measures would result in lessening the potential for spills into the park, and for timely response and cleanup. Therefore, there is a reasonable expectation that lasting adverse impacts would not occur or be at a limited level of intensity, although there could be permanent adverse impacts, since impacts to cultural resources are generally not reversible. In the event that the park's resources or values are damaged, the NPS could seek remedy through damage assessment and restoration under the Park System Resource Protection Act (16 U.S.C.19jj).

Alternative 2 would have the highest potential to reduce the adverse impacts of CMD in former mining areas. Though extent and documentation of cultural resources in these areas is not complete, a portion of these resources are likely located in the vicinity of such resources and are affected by current CMD impacts. Remediation of these areas would benefit potential cultural resources and values by treating CMD and by identifying and documenting resources.

Selected Remedial Site Impacts

Under Alternative 2, cultural resource impacts at the selected sites would be similar to the programmatic impacts, but would change based on site-specific remedial approaches and the areas of disturbance described in previous sections. Examples of cultural resources near the selected sites include a former concrete diversion for Worley Branch and concrete foundation near Worley #86, and former mining scales and carved inscriptions in rock near Laurel Branch, and former scales and tramway rails at Nancy Grave. With all sites accessible for remediation under Alternative 2, this alternative would have the highest potential for impacts from construction, but also the highest potential to reduce the impacts of CMD on potential cultural resources and values.

Cumulative Impacts

Impacts on cultural resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions, when combined with the short- and long-term impacts of Alternative 2, would result in short- and long-term minimal cumulative impacts on cultural resources.

Summary of Impacts

Under Alternative 2, the implementation of remedial approaches could result in impacts on cultural resources, mainly from disturbance of existing unpaved surfaces to access up to 25 sites. In areas where remedial operations would be conducted, the approach implementation result in short-term to long-term impacts from minor grading, ground disturbance and compaction, and erosion. As access to implement remedial approaches for CMD under

Alternative 2 is the greatest, this alternative would have the largest potential to impact or benefit cultural resources.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Impacts

Under Alternative 3, cultural resource impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, an estimated 8 sites would be accessible for the implementation of a remedial approach, compared to 17 under Alternative 2. Sites that are inaccessible based on the access restrictions under Alternative 3 would not be subjected to erosion, sedimentation, compaction or other potential impacts associated with a remedial approach, and existing resource conditions would remain unchanged. However, for these inaccessible sites, ongoing CMD impacts would continue in their present state, and cultural resources negatively affected by CMD would continue to be impacted or degraded further.

Selected Remedial Site Impacts

Under Alternative 3, impacts to cultural resources at the selected sites would be similar to the site-specific remedial approaches of Alternative 2. However, due to the more restrictive means of access under this alternative, the Worley #88, Slavey Hollow, and Devils Creek sites would not be accessible.

Cumulative Impacts

Impacts on cultural resources from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions combined with the effects of Alternative 3, would result in short- and long-term minimal cumulative impacts on cultural resources.

Summary of Impacts

Under Alternative 3, the implementation of remedial approaches could result in impacts on cultural resources, mainly from disturbance of existing unpaved surfaces and site footprints. In areas where remedial operations would be conducted, the approach implementation could result in short-term to long-term impacts from minor grading, ground disturbance and compaction, and erosion. As access to implement remedial approaches for CMD under Alternative 3 is less than Alternative 2, this alternative could have a lower potential to impact or benefit cultural resources.

Alternative 4: Minimal Access

Programmatic Impacts

Under Alternative 4, cultural resource impacts would be very similar to Alternative 3. Due to the most restrictive means of access of the action alternatives, 6 sites would be accessible for the implementation of a remedial approach, compared to 8 sites under Alternative 3, and 17 sites under Alternative 2. The 9 sites inaccessible based on the access restrictions under Alternative 4 would not be subjected to erosion, sedimentation, compaction or other potential impacts associated with a remedial approach, and existing resource conditions would remain

unchanged. However, for these inaccessible sites, ongoing CMD impacts would continue in their present state, and cultural resources negatively affected by CMD would continue to be impacted.

Selected Remedial Site Impacts
Under Alternative 4, due to the most restrictive access means of the action alternatives, the fewest sites would be accessible for the implementation of a remedial approach; only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation.

Cumulative Impacts
Impacts on cultural resources from other actions that were considered under the cumulative impact scenario would be the same as described for Alternative 1. The effects of the cumulative actions combined with the effects of Alternative 4, would result in short- and long-term minimal cumulative impacts on cultural resources.

Summary of Impacts
Under Alternative 4, the implementation of remedial approaches would result in adverse impacts on cultural resources, mainly from disturbance of existing unpaved surfaces. In areas where remedial operations would be conducted, the approach implementation could result in short-term to long-term impacts from minor grading, ground disturbance and compaction, and erosion. As access to implement remedial approaches for CMD under Alternative 4 is the least, this alternative would have the lowest potential to impact cultural resources during construction and O&M.

VISITOR USE AND EXPERIENCE

The importance of visitor use and experience is highlighted in the Big South Fork NRRA purpose, which states that the park will provide healthful outdoor recreation for the enjoyment of the public and for the benefit of the regional economy. The value of the visitor experience is also stated in the park's significance, which emphasizes the broad range of natural- and cultural-resource-based outdoor recreation and educational opportunities within the NRRA.

Alternative 1: No Remediation

Programmatic Impacts
Visitor Use
Under Alternative 1, area use would remain unchanged from current utilization. Visitor use resources impacted by CMD would continue, as remediation of CMD would not occur.

Special Management Areas
Under Alternative 1, area use would remain unchanged from current utilization. Maintenance and use of existing access roads and trails could affect SMAs and SMA values. SMAs impacted by CMD would continue to be impacted, as remediation of CMD would not occur.

Selected Remedial Site Impacts

Visitor Use

Under Alternative 1, visitor use would be consistent with the programmatic impacts; existing conditions would remain unchanged and current impacts would continue in their present state.

Special Management Areas

Under Alternative 1, SMAs would be consistent with the programmatic impacts; existing conditions and designations would remain unchanged and current impacts would continue in their present state.

Cumulative Impacts

Under Alternative 1, CMD would not be subjected to remediation, and would continue to contribute to cumulative impacts. However, several actions described in the "Cumulative Impacts Scenario" section of this chapter would result in both adverse and beneficial cumulative impacts on visitor use resources.

Impacts to visitor use and experience are expected to diminish and contribute less to cumulative impacts in the foreseeable future. NPS completed plugging and reclaiming 56 abandoned wells and closing 37 open mine portals in Big South Fork NRRA in 2012 and may initiate another project to plug and reclaim additional wells at Big South Fork NRRA in 2018, which could result in lasting beneficial impacts on visitor use and experience due to the improved condition of the sites. Additionally, NPS completed a revision of 9B regulations (81 FR 77972) on November 4, 2016, governing non-federal oil and gas development within the boundaries of NPS units. Generally, the changes focus on improving resource protection aspects of the regulations while accounting for advances in oil and gas technology and industry practices. These changes could have lasting beneficial impacts on visitor use and experience, due to improving resource protection practices.

Coal bed methane/shale gas drilling is an ongoing feature in the vicinity of Big South Fork NRRA. These activities could affect visitor use and experience due to noise and visual effects associated with these operations. In addition, CMD associated with active and abandoned mines impacts water resources, which can affect water-based recreation in the park. CMD could pose health and safety risks to visitors if they come into direct contact with such drainage, or indirect contact as a result of polluted water resources.

Visitor uses, such as ORV use, horseback riding, hunting, trapping, and fishing, could contribute to cumulative impacts. These activities create noise and pose health and safety risks to those participating in these activities, as well as those in the vicinity of these activities.

Park operations such as routine park maintenance activities, including installation and maintenance of roads, trails, and developed sites, could affect visitor use and experience due to noise from these operations, the temporary presence of work crews, and access restrictions, resulting in temporary adverse impacts. Another maintenance activity for Big South Fork NRRA is prescribed burning. This activity could have temporary impacts on visitor use and experience due to restricted access and poor air quality because of the smoke, which could also impact

visibility. However, impacts on visitor use and experience would be lasting and beneficial subsequent to the prescribed fires, due to the restoration of native plant communities associated with the fires.

Agricultural activities on land adjacent to Big South Fork NRRA, primarily logging activities and hay production, could result in ongoing minimal adverse impacts on visitor use and experience, due to the visual effects associated with loss of natural vegetation and habitat.

Development outside the park, including commercial, industrial, and residential, could contribute to cumulative impacts. Increased development, including residential communities near the park, could increase outside noise sources and traffic congestion, which could have ongoing impacts on visitor use and experience.

Summary of Impacts

Under Alternative 1, not acting to remediate sites would result in long-term adverse impacts on visitor use resources. The effects of past, present, and reasonably foreseeable future actions, when combined with the long-term impacts of Alternative 1, would result in short- and long-term cumulative impacts on visitor use resources. When compared to the broader area of analysis, Alternative 1 would contribute small impacts to the overall visitor use impacts.

Alternative 2: Full Access (Proposed Action)

Programmatic Impacts

Visitor Use

The operation areas and access (including trail sections) would be temporarily closed to visitor access depending on the selected remedial site access route, and due to safety concerns. These closures would likely last from weeks to months during construction, and from days to weeks during O&M. In particular, 5 of the 17 programmatic sites are located near the Kentucky Trail, and 11 of the 17 sites are located near a hiking or horse trail, and though access has not yet been determined, it is reasonable to assume a portion of these trails would be utilized (and closed to visitors) for site access. NPS would provide visitor notifications, reroutes, and detours along other access routes when possible, but would not construct new trails for rerouting or detours. As such, some trail sections could lose connectivity during temporary construction and O&M, due to the length required for a reroute or detour.

There may be additional stipulations to visitor access adjacent to these sites, similar to current restrictions on access to certain parts of the park (e.g., existing drilling and production operations). Indirect impacts, such as increased traffic, noise, dust, odors, night lighting, and human activity, would not necessarily preclude recreational access, but would decrease the quality of the visitor experience in the vicinity of the operation, especially in more remote portions of the park. Given the limited extent of the sites in Big South Fork NRRA, it is assumed that few visitors would be affected by restricting access temporarily. In addition, reclaiming abandoned mine lands and remediation of CMD could result in ongoing beneficial impacts on visitor use and experience. Additional land and waters would become available to various visitor uses and recreation. For example, increases in water quality and aquatic habitat would

particularly benefit water based users, such as fishermen, boaters, backcountry hikers, and whitewater recreators. Remediation would also result in the improvement and maintenance of trails, and the reduction of health and safety issues related to CMD.

Visual impacts on visitor experience from access and remedial approach implementation would be minimal, especially since remediation approaches would largely be placed in previously disturbed mining areas, though at some sites visitors could be able to see the operation. In addition, negative impacts could occur to visitors expecting a remote backcountry experience if new access roads are constructed, and areas are cleared (though previously disturbed, some sites may be revegetated and may currently appear natural and undisturbed to some visitors). Construction and remedial approaches may also be visible to park visitors in boats on the Big South Fork River or some of its tributaries. In addition, site clearing and access road improvement or maintenance could result in visible cuts through park vegetation, depending on the methods chosen to have the least impact. Lighting of a site could interfere with visitors' night-sky views, depending on when and where the operations are sited.

Remedial approach implementation and O&M would increase the presence of work crews and equipment. In addition, remedial approaches, although having a less intrusive human presence, would be visible for 20 years or longer. Coming across a man-made wetland cell for CMD remediation could be an unpleasant experience for visitors seeking a natural, outdoor experience at the Big South Fork NRRA. The visual presence of remedial approach operations in a natural setting would adversely impact the areas by displacing the visitor or lessening the quality of the visitor experience; however, the visual experience of CMD remediation could be viewed as beneficial and educational by some visitors and increase recreational interest into remedial areas.

Mitigation measures that would reduce visual impacts during remediation include a 500-foot setback for visitor use areas where possible and siting the remedial approach so they are screened from view by vegetation and topography. Sites would be kept clean and orderly, and any spills, waste, or trash would be promptly cleaned up and removed from the operations site. Stream crossings would utilize low-water crossings instead of culverts where possible, appearing less intrusive to a visitor. There are also measures that can be used to mitigate adverse night sky impacts affecting visitor experience in the immediate area. The impacts would be less for some visitors less concerned with the presence of such operations, and where operations are naturally screened from view.

There would be increased noise from construction activities (e.g. vehicles, chainsaws, earthmoving equipment, etc.) that could adversely affect visitor use and experience. Operations would have greater truck traffic and associated vehicular noise, causing temporary (from weeks to months during construction) disturbance to visitors using the same roadways in the park or areas located near these operations, but could also include non-adjacent areas, as noise could travel within the gorge. These noises would be different from the types of noises common in the visitor use areas, or general background noises elsewhere in the park. As a result, there would be temporary adverse impacts from remedial approach implementation if they were close

enough to a visitor use area to cause interference with the enjoyment or use of the area, and could conflict with visitor goals of having a natural outdoor or other desired experience, and temporary impacts related to noise associated with increased vehicular traffic for some operations.

One of the biggest concerns for human health and safety is the potential exposure to hazardous and contaminating materials. During construction, all potentially hazardous materials would be kept in completely enclosed storage containers. Selected sites would not be permitted in floodplains unless there is no practicable alternative. Spill-prevention and control measures and other contingency plans included would provide for protective measures to minimize accidental discharges of hydrocarbons including containment within the operations area, in the event of storms, equipment failure, or operator error. The park staff would be guaranteed access to the site to verify operations are conducted in a manner to minimize the potential for spills and provides for rapid spill response and cleanup. Site inspections and monitoring would be focused on when problems or emergencies are reported or when there are information requests from operators, so there is a risk that unsafe conditions could go unnoticed. However, the incident rates for such incidents are low and are not a typical expectation of project implementation. If such an incident did occur, required mitigation measures would result in lessening the potential for spilled substances to spread into the park, and for timely response and cleanup. Therefore, there is a reasonable expectation that lasting adverse impacts would not occur or be limited to a minimal level of intensity, although there could be temporarily very large adverse impacts during the release.

In general, the required setbacks between remedial approaches and visitor use areas would help to limit visitors seeing and going near these facilities. Other mitigation measures include the use of warning signs and notices, gates on access routes, security guards (as necessary), scheduling of construction during off-peak seasons, secondary containment, and fencing, as required. In some situations, the park superintendent can restrict public access on roads to safeguard human health and safety or to protect park resources.

Special Management Areas

As mentioned in Chapter 2, SMAs include sensitive geomorphic features, cliff edges, visitor experience/administrative areas, trails, and cultural landscapes and cemeteries. Geomorphic feature SMAs, including rock shelters, arches, chimneys, natural bridges, waterfalls, and windows, and cliff edge SMAs would be avoided under the action alternatives as much as possible. Protection of these resources and values are required both by regulation and/or NPS management policies. A 500-foot setback would be recommended for construction activities (access construction and construction of the remedial approach) based on the sensitivity of the resources. Though the access routes to the estimated 17 programmatic sites is unknown, it is reasonable to assume a portion of these sites would be located in the vicinity of a geomorphic feature. Access to remedial sites through or in the close vicinity of these SMAs would utilize existing roads and trails. Impacts are expected to be minimal and limited to maintenance and/or improvements to existing roads and trails.

Visitor experience and trail SMAs could be impacted similarly to visitor use, as trail access would be temporarily limited, along with increased noise and visual impacts from remedial approach implementation. Few visitors are likely to be affected by restricting access temporarily, and current visitor use and experience would remain relatively unchanged. In addition, noise and visual impacts would be mitigated by regulation and/or NPS management policies; a 100-foot to a 1500-foot setback would be recommended for activities near visitor experience SMAs, based on the sensitivity of the resource and the type of work being conducted. Due to the extensive trail system throughout Big South Fork NRRA combined with the protections of CLPR, the impacts to these resources are expected to be temporary and small for all of the action alternatives.

Cultural landscape SMAs include 61 known cemeteries and 7 cultural landscapes in Big South Fork NRRA. Cultural landscapes and cemeteries are protected under regulation and NPS management policies and would be avoided by all action alternatives as much as possible. However, these SMAs could be impacted by potential and temporary noise and visual impacts from construction and O&M of remedial systems in the vicinity of SMAs. Due to the protections of CLPR, the impacts to these resources are expected to be temporary and minimal for all of the action alternatives.

Selected Remedial Site Impacts

Visitor Use

Under Alternative 2, visitor use impacts would change based on site-specific remedial approach access and location, and the degree of visitor access rerouting.

Worley Mines #86 and #88 would be accessed by Worley Road and the existing corridor of the Big South Fork Scenic Railway, while the Slavey Hollow site would be accessed by Wilson Ridge Road and an administrative (Class 6) non-public former logging access road and a former tram rail bed. As these sites would utilize existing public roads and roads not accessible to visitors, access impacts from these sites are expected to be minimal. However, Worley Mine #86 is in a very visible location near an existing gorge access parking area and adjacent to the railroad, so some short-term impacts to visitor experience would be expected. However, once the remediation is completed and the removal of visible CMD, there would be beneficial effects to visitor experience. Worley Mine #88 and Slavey Hollow would not be visible to most park visitors except for those that travel on trails into the backcountry.

The Nancy Grave and Devils Creek remediation sites would be accessed through Wilson Ridge to former logging road to Segment C of the Kentucky Trail. The Laurel Branch Spoils and Confluence sites would be accessed from Laurel Branch Road and 1.45 mi of the Lee Hollow Loop Horse Trail, and 0.09 mi of the Blue Heron Loop hiking trail. As access these sites would utilize existing trails, visitor use would be temporarily impacted with the closure of the trail sections during construction and O&M. However, NPS would mitigate closures with visitor notifications, reroutes, and detours along other access routes when possible, but would not construct new trails for rerouting or detours. Nancy Grave, Devils Creek, and Laurel Branch Spoils would not be visible to most park visitors except for those that travel on trails into the

backcountry. Laurel Branch Confluence would be visible to hikers and horseback riders in the backcountry, as well as boaters on the Big South Fork River.

The Blair Creek site would be accessed from the Bear Creek Horse Camp, and would use 1.72 mi of the Bear Creek Loop and Lee Hollow Loop horse trails to reach the site. As access to the site would utilize existing trails, temporary impacts to visitors are expected, though NPS would mitigate closures where possible. Blair Creek would not be visible to most park visitors except for those that travel on trails into the backcountry.

Special Management Areas
Under Alternative 2, impacts to SMAs would change based on site-specific remedial approach access and location, consistent with impacts to visitor use mentioned above. However, based on the protections of CLPR discussed under programmatic impacts, SMA impacts are expected to be temporary and minimal.

Worley Mines #86 and #88 would be accessed by Worley Road and the existing corridor of the Big South Fork Scenic Railway and are not within or adjacent to an SMA. However, they are in the vicinity of cliff edge SMAs, which are located to the north and southwest, and near a visitor experience/administrative area SMA, at one of the legislative gorge access routes.

Slavey Hollow would be accessed by Wilson Ridge Road and a non-public access road, which are not located near a trail SMA or in the vicinity of other SMAs.

The Nancy Grave and Devils Creek remediation sites are not located within or adjacent to an SMA, though a cliff edge SMA is north of the Nancy Grave site. Access to the sites would utilize Segment C of the Kentucky Trail.

Although the Laurel Branch Confluence site is not located within or adjacent to an SMA, the Laurel Branch Spoils site is located just northeast of a cliff edge SMA. In addition, both sites would be accessed from the Lee Hollow Loop Horse Trail, and the Laurel Branch Spoils site would use a short section of the Blue Heron Loop for access.

The Blair Creek site is not located within or adjacent to an SMA, though the site would be in the vicinity of cliff edge SMAs, located to the north. In addition, access to the site would use portions of the Bear Creek Loop and Lee Hollow Loop horse trails.

<u>Cumulative Impacts</u>
Impacts on visitor use and SMAs from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. However, the reclaiming of some abandoned mine lands and CMD remediation could result in ongoing beneficial impacts on visitor use and experience with additional land and waters becoming available to various visitor uses. Negative impacts could occur to visitors expecting a remote backcountry experience if new access roads are constructed, and areas are cleared. The effects of the cumulative actions combined with the effects of Alternative 2, would result in short- and long-term impacts on visitor use and SMAs. As the access to implement remedial approaches for CMD under Alternative 2

is the greatest, this alternative would have the largest potential for impacts to SMAs, but also for ongoing improvements to visitor use, and would provide lasting cumulative benefits.

Summary of Impacts

Under Alternative 2, the implementation of remedial approaches would result in minimal adverse impacts on visitor use, largely from temporary visual and noise disturbance and limits to access. Alternative 2 would have the highest potential for adverse impacts on remote backcountry visitor use, due to long-term impacts associated with potential new access or construction in previously disturbed that may currently appear natural and undisturbed to some visitors. However, remediation of CMD sites would have an ongoing benefit on visitor use and experience due to the remediation of CMD and additional land and waters becoming available to various visitor uses. As the access to implement remedial approaches for CMD under Alternative 2 is the greatest, this alternative would have the largest potential for impacts to SMAs, but also for ongoing improvements to visitor use.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Impacts

Visitor Use

Under Alternative 3, visitor use impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, approximately 9 of the estimated 17 sites would not be accessible for the implementation of a remedial approach. Visitor access to these sites would not be subjected to temporary limitations or other potential impacts associated with the implementation of the remedial approach, such as negative impacts to a remote backcountry experience.

Special Management Areas

Under Alternative 3, SMA impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, an estimated 9 sites would not be accessible for the implementation of a remedial approach. SMAs near these sites would not be subjected to potential impacts associated with remedial approach implementation.

Selected Remedial Site Impacts

Visitor Use

Under Alternative 3, visitor use impacts at the selected sites would be consistent with the impacts of Alternative 2. Under Alternative 3, the Worley #88, Slavey Hollow, and Devils Creek sites, would not be accessible, would not be remediated, and would not impact visitor access.

Special Management Areas

Under Alternative 3, SMAs impacts at the selected sites would be consistent with the impacts of Alternative 2, as the Worley #88, Slavey Hollow, and Devils Creek sites would not be accessible. The Worley #88 and Slavey Hollow remediation sites, located within or adjacent to an SMA, would not be impacted.

Cumulative Impacts

Impacts on visitor use and SMAs from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. However, the reclamation of some abandoned mine lands and CMD remediation could result in lasting beneficial impacts on visitor use and experience with additional land and waters becoming available to various visitor uses. Negative impacts could occur to visitors expecting a remote backcountry experience if new access roads are constructed, and areas are cleared. The effects of the cumulative actions combined with the effects of Alternative 3, would result in short- and long-term cumulative impacts on visitor use and SMAs.

Summary of Impacts

Under Alternative 3, the implementation of remedial approaches would result in minimal impacts on visitor use, largely from temporary visual and noise disturbance and limits to access. Alternative 3 would have lower potential for adverse impacts on remote backcountry visitor use, compared to Alternative 2. In addition, remediation would have a lasting beneficial impact on visitor use and experience due to the remediation of CMD and additional land and waters becoming available to various visitor uses. As the access to implement remedial approaches for CMD under Alternative 3 is reduced, this alternative would have a lower potential for both temporary impacts and lasting improvements to visitor use compared to Alternative 2.

Alternative 4: Minimal Access

Programmatic Impacts

Visitor Use

Under Alternative 4, due to the most restrictive means of access of the action alternatives, approximately 6 programmatic sites would be accessible for the implementation of a remedial approach, compared to 17 under Alternative 2, and 8 under Alternative 3. In addition, with a preference for passive remedial approaches, impacts related to O&M would be lower than Alternative 3. Visitor access to these sites would not be subjected to temporary limitations or other potential impacts, but would not benefit from reclamation and remediation.

Special Management Areas

Under Alternative 4, SMA impacts would be less than those of Alternative 3. Due to the most restrictive means of access of the action alternatives, approximately 6 programmatic sites would be accessible for the implementation of a remedial approach, and SMAs near these sites would be subjected to potential impacts associated with remedial approach implementation.

Selected Remedial Site Impacts

Visitor Use

Under Alternative 4, due to the most restrictive access means of the action alternatives, the fewest sites would be accessible for the implementation of a remedial approach; only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. In addition, with a preference for passive remedial approaches, impacts related to O&M would be lower than Alternative 3. As such, this alternative would have the lowest potential to impact visitor use, adversely or beneficially, of all the action alternatives.

Special Management Areas
Under Alternative 4, only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. As such, this alternative would have the lowest potential to impact SMAs.

Cumulative Impacts
Impacts on visitor use and SMAs from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. However, the reclamation of some abandoned mine lands and CMD remediation could result in ongoing beneficial impacts on visitor use and experience with additional land and waters becoming available to various visitor uses. Negative impacts could occur to visitors expecting a remote backcountry experience if new access roads are constructed, and areas are cleared. The effects of the cumulative actions combined with the effects of Alternative 4, would result in short- and long-term cumulative impacts on visitor use and SMAs.

Summary of Impacts
Under Alternative 4, the implementation of remedial approaches would result in negligible impacts on visitor use, largely from temporary visual and noise disturbance and limits to access. Alternative 4 would offer the highest protection of the remote backcountry experience among the action alternatives. Remediation would have a lasting beneficial on visitor use and experience due to the remediation of CMD and additional land and waters becoming available to various visitor uses.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

Impacts on the natural soundscape were assessed based on impacts during construction at CMD sites, as well as periodic O&M activities. The specific activities associated with each activity were evaluated and used to determine the degree of impact associated with CMD remediation relative to natural ambient sound levels within the park units. Any proposed short-term or long-term impacts to other impact topics (impacts to wildlife, threatened and endangered species, visitor experience, etc.) from construction- or operation-generated noise is included in the analysis of the appropriate impact topic elsewhere in Chapter 4. As discussed in Chapter 3, data collected at Great Smoky Mountains National Park was used as a comparison for estimating the natural ambient sound levels within Big South Fork NRRA since the natural soundscape has not previously been studied at Big South Fork NRRA. Noise levels generated from common construction equipment are provided in Table 4-2.

Alternative 1: No Remediation

Programmatic Impacts
Area use would remain unchanged under Alternative 1. Implementation of Alternative 1 would have no effects on the local soundscapes. Operations within Big South Fork NRRA would continue under current conditions.

Selected Remedial Site Impacts
Under Alternative 1, soundscape impacts would be consistent with the programmatic impacts; existing conditions would remain unchanged and current impacts would continue in their present state.

Cumulative Impacts
Under Alternative 1, CMD would not be subjected to remediation, so no impacts to soundscapes would occur. However, several actions described in the "Cumulative Impacts Scenario" section of this chapter would result in adverse cumulative impacts to the natural soundscapes.

Construction, use, and maintenance of new and existing unpaved roads; vehicular traffic, including ORV use and gravel hauling; park maintenance activities; logging and timber harvesting; agricultural activities; and visitor activities within the park have the potential to contribute to adverse cumulative impacts by creating elevated human-induced noise levels above the natural ambient noise levels. Use of heavy construction equipment would result in increases in noise within the park.

In addition to activities occurring within park boundaries, development outside of Big South Fork NRRA (including industrial activities and commercial growth, agricultural and forestry operations, road construction, oil and gas operations, coal mining, and surrounding residential development) could contribute to cumulative impacts. Increased numbers of vehicles would potentially result in elevated levels of noise outside, and potentially within, the park boundaries. These activities could create elevated levels of human-induced noise within the park, depending on the proximity of the operations to park boundaries and increased vehicular traffic needed to haul equipment and materials for these operations, as well as the noise levels produced the various sites. These actions could have potentially widespread temporary and ongoing adverse impacts to the natural soundscape that are noticeable within park boundaries.

Overall, the cumulative impacts of these actions would result in short- and long-term cumulative impacts to localized natural soundscapes.

Summary of Impacts
Under Alternative 1, not acting to remediate sites would not result in adverse impacts to the natural soundscape. The adverse effects of past, present, and reasonably foreseeable future actions would result in noticeable short- and long-term adverse cumulative impacts on soundscapes. When compared to the broader area of analysis, Alternative 1 would not impact natural soundscapes.

Alternative 2: Full Access (Proposed Action)

Programmatic Impacts
Construction activities related to CMD remediation and the development of access under all action alternatives would generate short-term noise impacts. At the potential 17 programmatic CMD sites, there would be increased noise from construction activities (e.g. vehicles, chainsaws, earthmoving equipment, etc.) that could adversely affect the natural soundscape in the vicinity of the construction activity. Operations would have greater truck traffic and

associated vehicular noise, which could cause temporary (from weeks to months during construction) disturbance to nearby areas along roadways or areas located near these operations, but could also include non-adjacent areas, as noise can travel within the gorge. These noises would be different from the types of natural soundscapes or general background noises elsewhere in the park and would largely be limited to daylight hours. These negative impacts could particularly affect the remote backcountry experience. As a result, there would be temporary adverse impacts to soundscapes during construction and operation and maintenance.

The long-term operation of CMD sites would not materially affect the local soundscapes. Operation of any active equipment at CMD sites (such as mechanical dosers) would result in infrequent noise impacts. Some changes in the soundscape as a result of construction could be expected, but these changes would be minimal. As an example, construction of wetland cells could create habitat to attract wildlife (birds, frogs) to the area, which could slightly change the pre-construction sounds generated by wildlife. Changes in stream flow patterns or channelization/culverts could also alter the sound generated by flowing water at localized sites. These activities would not materially affect local noise levels within the surrounding community.

Additionally, access to the CMD sites (every 10 to 30 years) for maintenance activities would result in limited temporary noise impacts. These impacts would be similar to those described for construction but would tend to be shorter in duration (several days per site). There is the potential that under Alternative 2, numerous CMD sites could be slated for maintenance all within the same year or season to allow for reduced maintenance cost for a single mobilization. Maintenance activities done at a number of sites along the gorge could have a larger impact to soundscapes in a localized area. To mitigate this aspect of impacts, the park will coordinate maintenance activities to ensure sites undergoing maintenance are separated spatially and temporally, when possible, so as not to amplify effects to soundscapes.

To mitigate potential impacts to natural soundscapes, NPS would implement standard noise abatement measures during construction, maintenance, and for vehicle access. Standard noise abatement measures may include the following elements: a schedule that minimizes impacts on adjacent noise-sensitive uses, the use of best available noise control techniques wherever feasible, the use of hydraulically or electrically powered impact tools when feasible, the use of hand tools when feasible, the placement of stationary noise sources (such as mechanical dosers) as far from sensitive uses as possible, and the use of noise-muffling, shielding, or fencing. Functioning mufflers would be installed and maintained on all motorized equipment. Engine idling would be reduced or eliminated.

Selected Remedial Site Impacts

Under Alternative 2, impacts to the selected sites would be similar to the impacts described at the programmatic level, but soundscape impacts would change based on site-specific remedial approaches, and the subsequent impacts, described below. With all sites accessible for remediation under Alternative 2, this alternative would have the highest potential to impact soundscapes from construction.

The Worley #86 site would include the installation of two wetland cells, approximately 0.33 acre each. The Worley #88 site involves sealing the mine entrance with non-destructive means to divert CMD to the Worley #86 site. Construction at these sites would have very minimal impacts to soundscapes, as the Worley #86 CMD site is located adjacent to an existing gravel roadway. Minimal impacts to the soundscape would be expected from both construction and maintenance activities. Maintenance to Worley #86 and #88 would be accessed from Worley Road and along railroad ROW, and though noises generated from maintenance activities would result in a change to the natural soundscape, vehicles, and activities along the access have already impacted the localized soundscape.

The Slavey Hollow site involves the installation of two wetland cells, one approximately 0.50 acre and one approximately 0.25 acre, and piping to direct CMD through the cells for treatment before discharging into the Big South Fork River. Noticeable temporary impacts to the soundscape would be expected from both construction and maintenance activities, as the Slavey Hollow site is in a remote wooded area, so noise would result in a noticeable effect to the natural soundscape. Sound from the Big South Fork River may provide some mitigating natural sound buffer to equipment noises.

The Nancy Grave site involves the installation of a wetland cell, approximately 2 acres in size. Noticeable temporary impacts to the soundscape would be expected from both construction and maintenance activities, as the Nancy Grave site is in a remote wooded area. The Nancy Grave site and the Devils Creek Site are approximately 1,500 feet apart along the Big South Fork River and would share access corridors, so construction and maintenance noise from the adjacent sites could increase the impacts to soundscapes if they were occurring concurrently. Sound from the Big South Fork River may provide some mitigating natural sound buffer to equipment noises.

The Devils Creek site involves the installation of two wetland cells, approximately 0.75 acre each, and ALDs to direct CMD through the cells for treatment before discharging into Devils Creek. Noticeable temporary impacts to the soundscape would be expected from both construction and maintenance activities, as the Devils Creek site is in a remote wooded area, approximately 1,500 feet from Nancy Grave on the Big South Fork River. As a result, construction and maintenance noise from the adjacent site could increase the impacts to soundscapes if the site were occurring concurrently. Sound from the Big South Fork River may provide some mitigating natural sound buffer to equipment noises.

The Laurel Branch Confluence site involves the regrading of partially vegetated and pyrolized spoil piles along the Big South Fork River. Noticeable temporary impacts to the soundscape would be expected from both construction and maintenance activities; however, after construction, the Laurel Branch Confluence site would require very little maintenance. The Laurel Branch Confluence site is in a remote wooded area, so construction and maintenance noise would result in a noticeable effect to the natural soundscape. The Laurel Branch Confluence site and the Laurel Branch Spoils site are approximately 1,100 feet apart along the Big South Fork River and would share access corridors, so construction and maintenance noise

from the adjacent site could increase the impacts to soundscapes if they were occurring concurrently. Sound from the Big South Fork River may provide some mitigating natural sound buffer to equipment noises.

The Laurel Branch Spoils site involves the installation of box culverts, backfill, and relocation of the horse trail over the culvert to prevent crossing the stream at the existing sandstone crossing. Noticeable temporary impacts to the soundscape would be expected from both construction and maintenance activities. The Laurel Branch Spoils site is located adjacent to an existing horse trail, so some disturbance to the natural soundscape already occurs in the vicinity of the site. The Laurel Branch Confluence site and the Laurel Branch Spoils site are approximately 1,100 feet apart, so the adjacent site could increase the impacts to soundscapes if the sites were occurring concurrently. Sound from the Big South Fork River may provide some mitigating natural sound buffer to equipment noises.

The Blair Creek site involves the excavation of the lower mine level for dewatering, and the construction of a 2- or 3-cell tiered wetland system and associated ALDs and piping. Noticeable temporary impacts to the soundscape would be expected from both construction and maintenance activities. The Blair Creek site is in a remote wooded area, so construction and maintenance noise would result in a noticeable effect to the natural soundscape. Sound from the Big South Fork River may provide some mitigating natural sound buffer to equipment noises.

Cumulative Impacts

Impacts to soundscapes from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The adverse effects of the cumulative actions, when combined with the short-term impacts of Alternative 2, would result in short-term cumulative impacts on soundscapes, including the natural backcountry soundscape.

Summary of Impacts

Under Alternative 2, the implementation of remedial approaches would result in small short-term and long-term adverse impacts on soundscapes, particularly to the natural backcountry soundscapes, from noise generated during construction and periodic maintenance activities. However, as described under the programmatic impacts, mitigation would help minimize impacts to soundscapes. As the access to implement remedial approaches for CMD under Alternative 2 is the greatest, this alternative would have the largest potential for impacts to soundscapes.

Alternative 3: Moderate Access (Preferred Alternative)

Programmatic Impacts

Under Alternative 3, the type of soundscape impacts would be very similar to Alternative 2. Due to the more restrictive means of access under this alternative, some sites would not be accessible for the implementation of a remedial approach, such as negative impacts to the natural backcountry soundscape. Fewer sites, up to 8 sites instead of the 17 sites under Alternative 2, would be subject to remediation, so the resultant impact to soundscapes would be

less. Construction activities related to CMD remediation and the development of access under all action alternatives would generate short term noise impacts. The long-term operation of CMD sites will not materially affect the local soundscapes. Access to the CMD sites, every 10 to 30 years, for maintenance activities would result in limited temporary noise impacts. These impacts would be similar to those described for construction but would tend to be shorter in duration, over days or weeks compared to weeks to months.

As described under Alternative 2, to mitigate potential impacts to natural soundscapes, NPS would implement standard noise abatement measures during construction, maintenance, and for vehicle access. The park would coordinate maintenance activities to ensure that sites undergoing maintenance are separated spatially and temporally, when possible, to minimize the amplification effects to soundscapes.

Selected Remedial Site Impacts

Under Alternative 3, soundscape impacts at the selected sites would be lower than the site-specific remedial approaches and impacts described for Alternative 2. The Worley #88, Slavey Hollow, and Devils Creek sites would not be accessible for remediation. As a result, soundscape impacts to selected sites would be lower under Alternative 3.

Cumulative Impacts

Impacts to soundscapes from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The adverse effects of the cumulative actions, when combined with the short- and long-term impacts of Alternative 3, would result in short- and long-term impacts to soundscapes, including the natural backcountry soundscape.

Summary of Impacts

Under Alternative 3, the implementation of remedial approaches would result in small impacts on soundscapes, particularly to the natural backcountry soundscapes, from noise generated during construction and maintenance activities. Mitigation, as described under the programmatic impacts for Alternative 2, would help minimize impacts to soundscapes. As the access to implement remedial approaches for CMD under Alternative 3 would be reduced, this alternative would have a slightly lower potential to impact soundscapes when compared to the impacts of Alternative 2.

Alternative 4: Minimal Access

Programmatic Impacts

Under Alternative 4, the type of soundscape impacts would be similar to Alternatives 2 and 3. However, with a preference for passive remedial approaches, impacts related to O&M would be less frequent than Alternatives 2 and 3. Due to the more restrictive means of access under this alternative, additional sites would not be accessible for the implementation of a remedial approach. Fewer sites, up to 6 sites instead of the 17 sites under Alternative 2, or 8 sites under Alternative 3, would be subject to remediation, so the resultant impact to soundscapes would be the lowest of the action alternatives. Construction activities related to CMD remediation and the development of access under all action alternatives would generate short term noise impacts.

The long-term operation of CMD sites will not materially affect the local soundscapes. Access to the CMD sites, every 10 to 30 years, for maintenance activities would result in limited temporary noise impacts, but there would be a preference for passive remedial approaches. These impacts would be similar to those described for construction but would tend to be shorter in duration, over days or weeks compared to weeks to months.

As described under Alternative 2, to mitigate potential impacts to natural soundscapes, NPS would implement standard noise abatement measures during construction, maintenance, and for vehicle access, including scheduling construction activities during off-peak times, when possible. The park would coordinate maintenance activities to ensure that sites undergoing maintenance are separated spatially and temporally, when possible, so as not to amplify effects to soundscapes.

Selected Remedial Site Impacts

Under Alternative 4, due to the most restrictive access means of the action alternatives, the fewest sites would be accessible for the implementation of a remedial approach; only Worley #86, Laurel Branch Confluence, Laurel Branch Spoils, and Blair Creek would be accessible for remediation. As the fewest sites could be accessible for remediation under Alternative 4, this alternative would have the lowest potential to impact soundscapes.

Cumulative Impacts

Impacts to soundscapes from other actions considered under the cumulative impact scenario would be the same as described for Alternative 1. The adverse effects of the cumulative actions, when combined with the short- and long-term impacts of Alternative 4, would result in short- and long-term adverse cumulative impacts to soundscapes, including the natural backcountry soundscape.

Summary of Impacts

Under Alternative 4, the implementation of remedial approaches would result in the lowest adverse impacts on soundscapes from noise generated during construction and maintenance activities among the action alternatives. Mitigation, as described under the programmatic impacts for Alternative 2, would help minimize impacts to soundscapes.

CHAPTER 5: CONSULTATION AND COORDINATION

The intent of the NEPA is to encourage the participation of federal and state-involved agencies and affected citizens in the assessment procedure, as appropriate. This section describes the consultation that occurred during development of this EIS, including consultation with scientific experts and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the final document.

HISTORY OF PUBLIC INVOLVEMENT

The public involvement activities for this EIS fulfill the requirements of NEPA and NPS Director's Order 12 (NPS 2011).

The Scoping Process

The NPS divides the scoping process into two parts: internal scoping and external or public scoping. Internal scoping involved discussions among NPS personnel regarding the purpose of and need for management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps provide people with an opportunity to comment and contribute early in the decision-making process. For this impact statement, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views, identifying important issues or even other alternatives.

Taken together, internal and public scoping are essential elements of the NEPA planning process. The following sections describe the various ways scoping was conducted for this impact statement.

Internal Scoping

An internal scoping meeting was held on February 26 and 27, 2014, to discuss the EIS for the Big South Fork NRRA and to identify the purpose, need, objectives, and preliminary alternatives for the park. As part of the internal scoping meeting, a field visit was performed at several of the CMD locations on February 25, 2014.

During the 2-day meeting, NPS employees identified the purpose of and need for action, management objectives, issues, and impact topics; various roles and responsibilities for were also clarified. The results of the meetings were captured in an "Internal Scoping Report" (NPS 2014c).

Public Scoping

Public Notification

The notice of intent to prepare an EIS for CMD was published in the Federal Register on May 12, 2014. A Public Scoping Brochure was provided electronically to the public on July 1, 2014,

through the NPS Planning, Environment, and Public Comment (PEPC) website (NPS 2014d). The brochure included an overview and background of the project, the purpose and need for the plan, management objectives, and elements of CMD treatment options. The public scoping period was open for public review and comment from July 14, 2014 through August 15, 2014.

Public Meetings and Comments
The NPS hosted three open houses to provide the public with opportunities to become involved, learn about the project and the planning process, meet the EIS team members, and submit written comments. The open houses were advertised with news releases, the public scoping brochure, the Big South Fork NRRA website, and on PEPC. Public meetings were held at Big South Fork NRRA in Oneida, Tennessee, and at two nearby locations (Whitley City, Kentucky and Oak Ridge, Tennessee). The meetings were held on July 14, 15, and 17, 2014, respectively. Each scoping meeting began at 5:00 PM and was organized as open house format where the public could review project information and discuss their interests and concerns with NPS staff.

A total of 26 individuals attended the public scoping meetings. The number of attendees at each meeting was as follows:

- Bandy Creek Interpretation and Education Building, July 14: 5 attendees
- McCreary County Senior Citizens Center, Whitley City, July 15: 10 attendees
- Oak Ridge High School, Oak Ridge, July 17: 11 attendees

Members of the public were invited to submit their comments on the project using the NPS PEPC website, in person at the public meetings, by mailing comments to the park, and by emailing comments to the park.

A total of nine pieces of correspondence were received during the public scoping period. The topics receiving the majority of the comments were related to the management strategies (e.g. potential CMD remedial approaches) presented in the brochure and at the meetings. Most of the commenters made recommendations about how various approaches to CMD remediation projects would impact resources, as well as suggestions for elements to be included or excluded in the development of alternatives (NPS 2014e).

Agency Scoping and Consultation
Big South Fork NRRA has communicated with a number of agencies related to this EIS, initiated with notification of the EIS in June and July 2014 (Appendix G). The EIS will be provided to these and other agencies for review and comment. Agencies with interest in the proposed projects that will be notified of the EIS availability include KDEP, TDEC, USFWS, USACE, US Forest Service (USFS), SHPOs, and tribal consultation contacts.

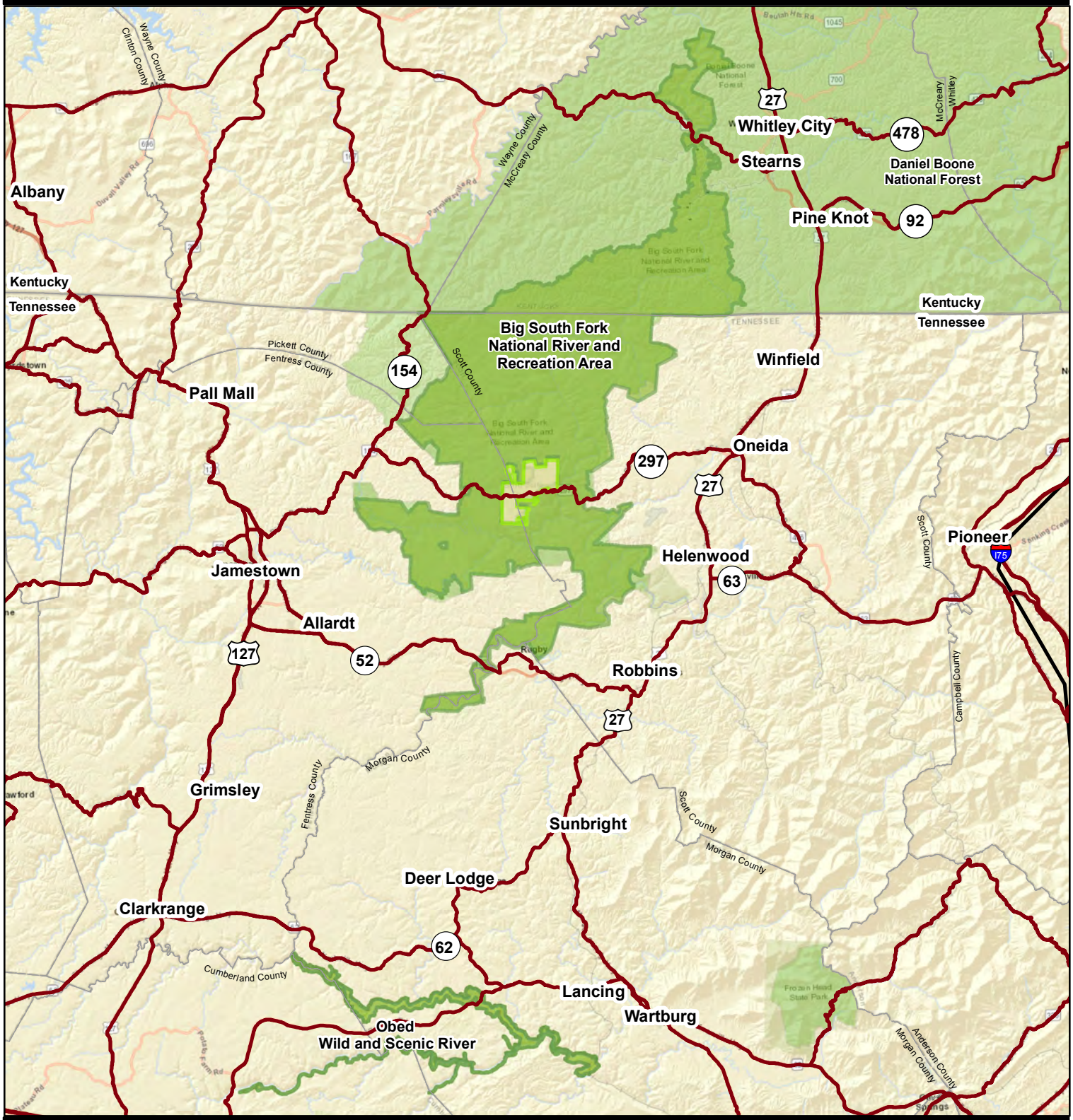
Additional coordination with USFWS and the state SHPOs, and other relevant agencies, would likely be required as individual CMD projects are assessed. However, some agencies, including USACE, OSM, and USFS are cooperating agencies in the development of this EIS (Appendix G).

Interested agencies, organizations, and businesses will be notified of the availability or mailed a copy of this document. Notification will also be made to other entities and individuals, and copies will be sent to those who request one. These may include elected officials, federal departments and agencies, state and local governmental agencies, American Indian tribes, conservation organizations, and other interested parties.

APPENDIX A
FIGURES

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior



Legend

Figure 1-1. Big South Fork National River and Recreation Area and Vicinity Map

US Highway
Interstate
County Boundary
Park Unit Boundary
National Forest

N

0 5 10 Miles

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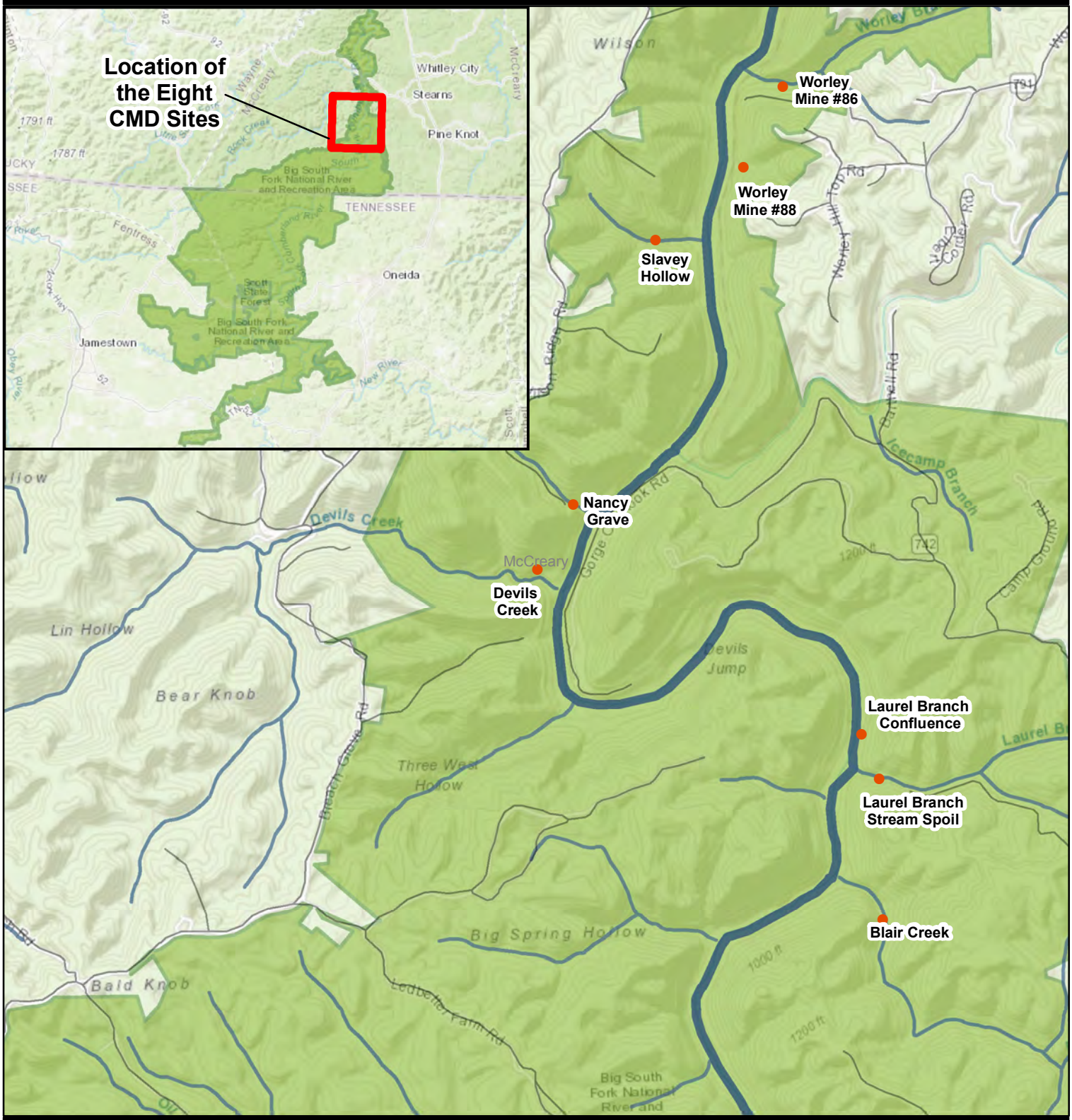
Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior



Legend

Figure 1-2. Big South Fork National River and Recreation Area Eight Selected CMD Sites

- CMD Sites
- Roads
- Rivers/Streams
- Park Unit Boundary
- County Boundary

N

0 2,000 4,000 Feet

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Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior

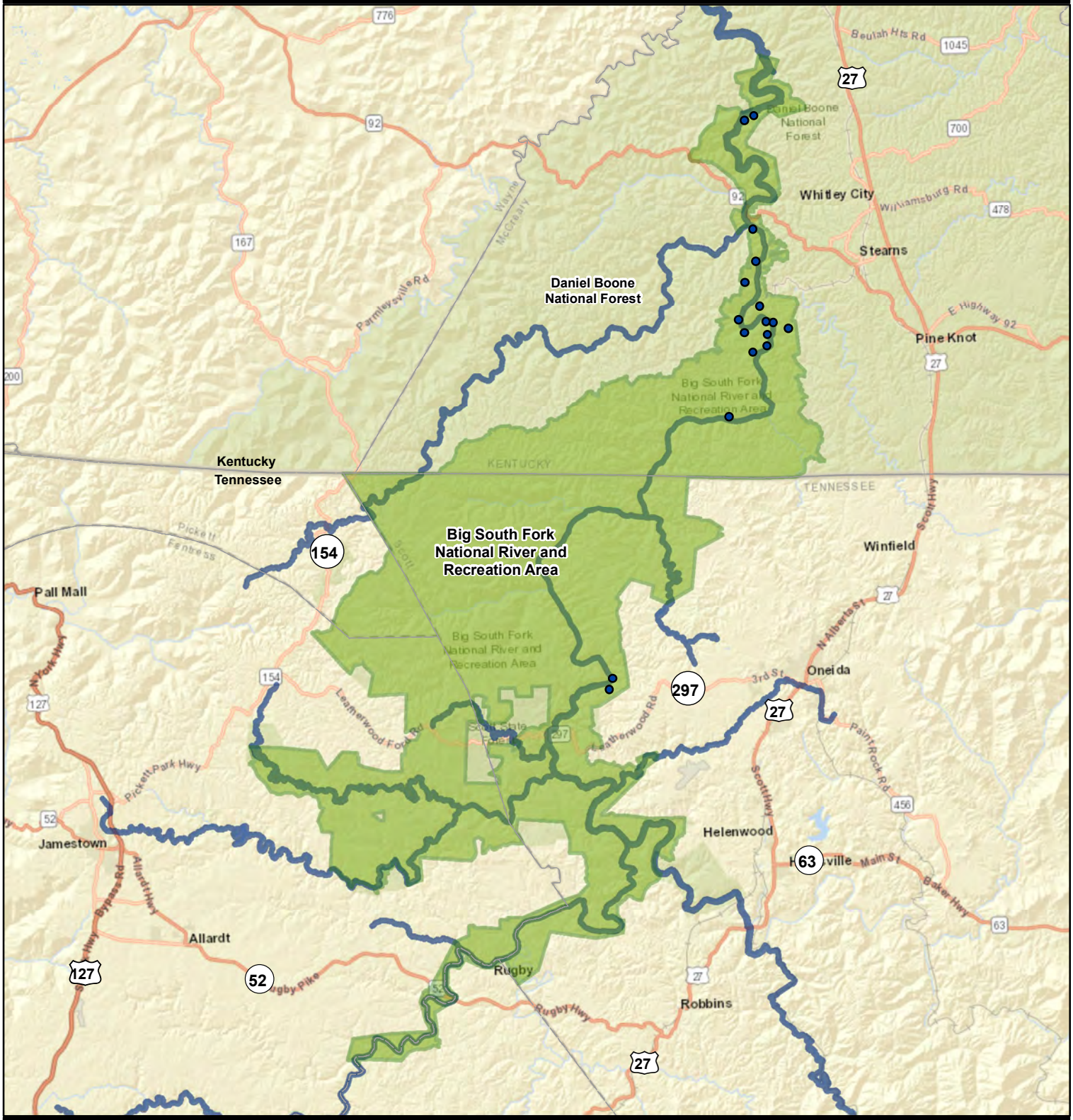

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Figure 1-3. Known Programmatic CMD Sites Within Big South Fork NRRA

- Known Programmatic CMD Sites
- County Boundary
- Park Unit Boundary
- Rivers/Streams

N

0 4 8 Miles

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Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S. Department of the Interior

Legend

Figure 2-1. Worley Mine #86 Proposed Site and Access

- Hiking Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad
- Approximate Site Location and Access
- Park Unit Boundary

N

0 1,000 2,000 Feet

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S. Department of the Interior

Legend

Figure 2-2. Worley Mine #88 Proposed Site and Access

- Access Along RR
- Proposed New Access
- Hiking Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad
- Approximate Site Location and Access
- Park Unit Boundary

N

0 1,000 2,000 Feet

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S. Department of the Interior

Legend

Figure 2-3. Slavey Hollow Proposed Site and Access

- Old Logging Road
- Old Tram Route
- Historic Extraction Road
- Hiking Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad
- Approximate Site Location and Access
- Park Unit Boundary

N

0 1,000 2,000 Feet

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S. Department of the Interior

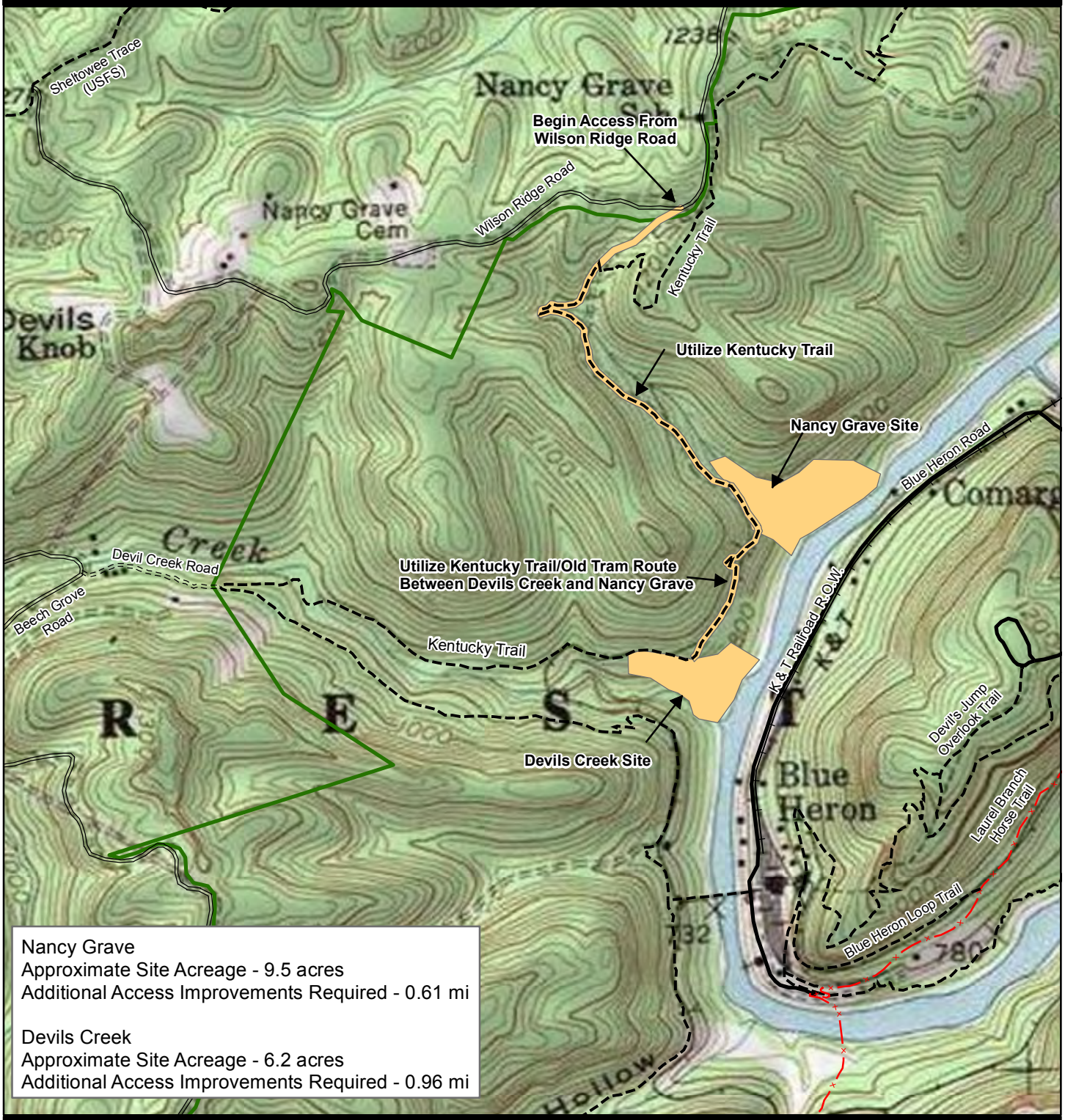

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Figure 2-4. Nancy Grave and Devils Creek Proposed Sites and Access

- Hiking Trail
- Horse Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad
- Approximate Site Location and Access
- Park Unit Boundary

N

0 1,000 2,000 Feet

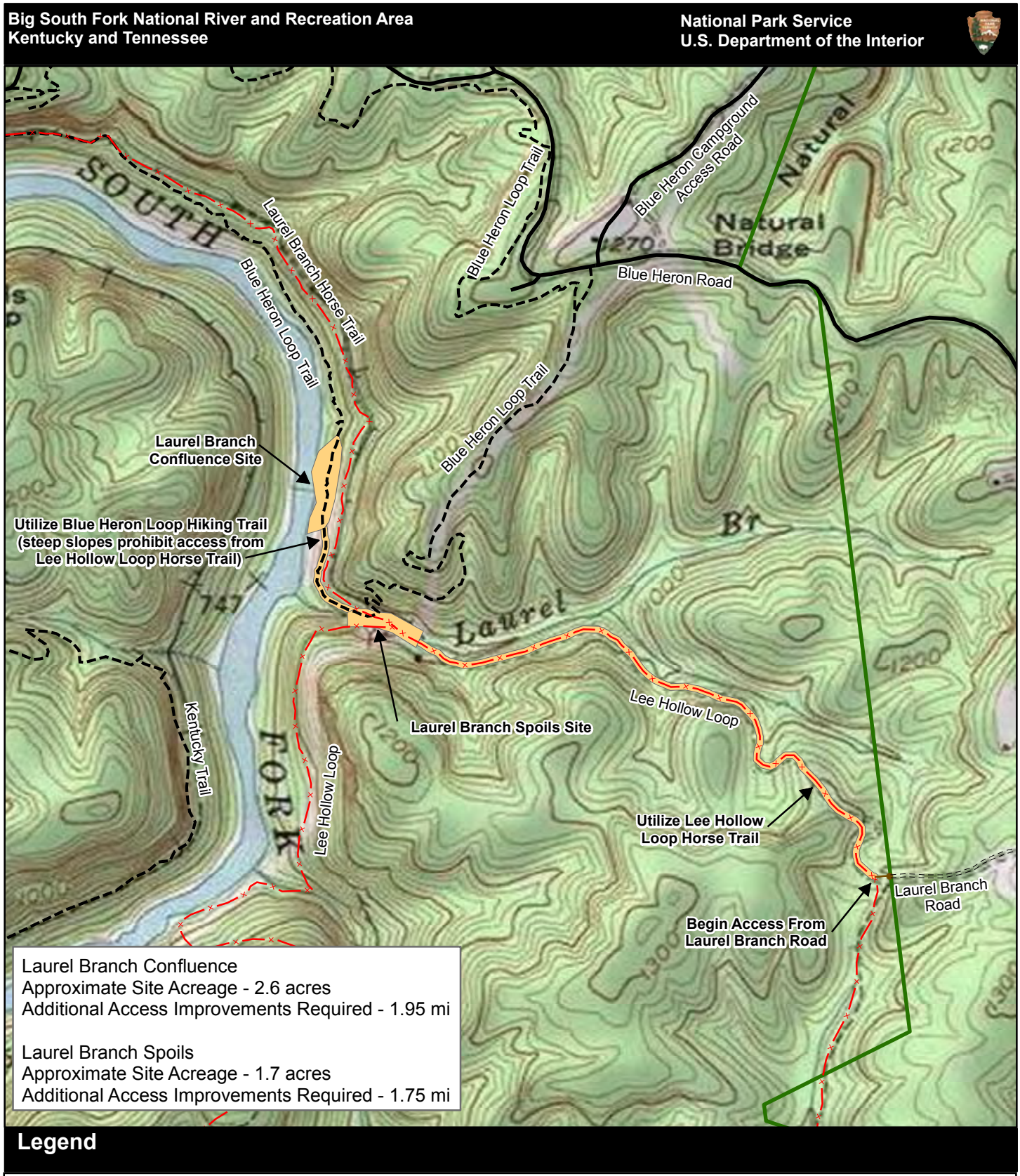
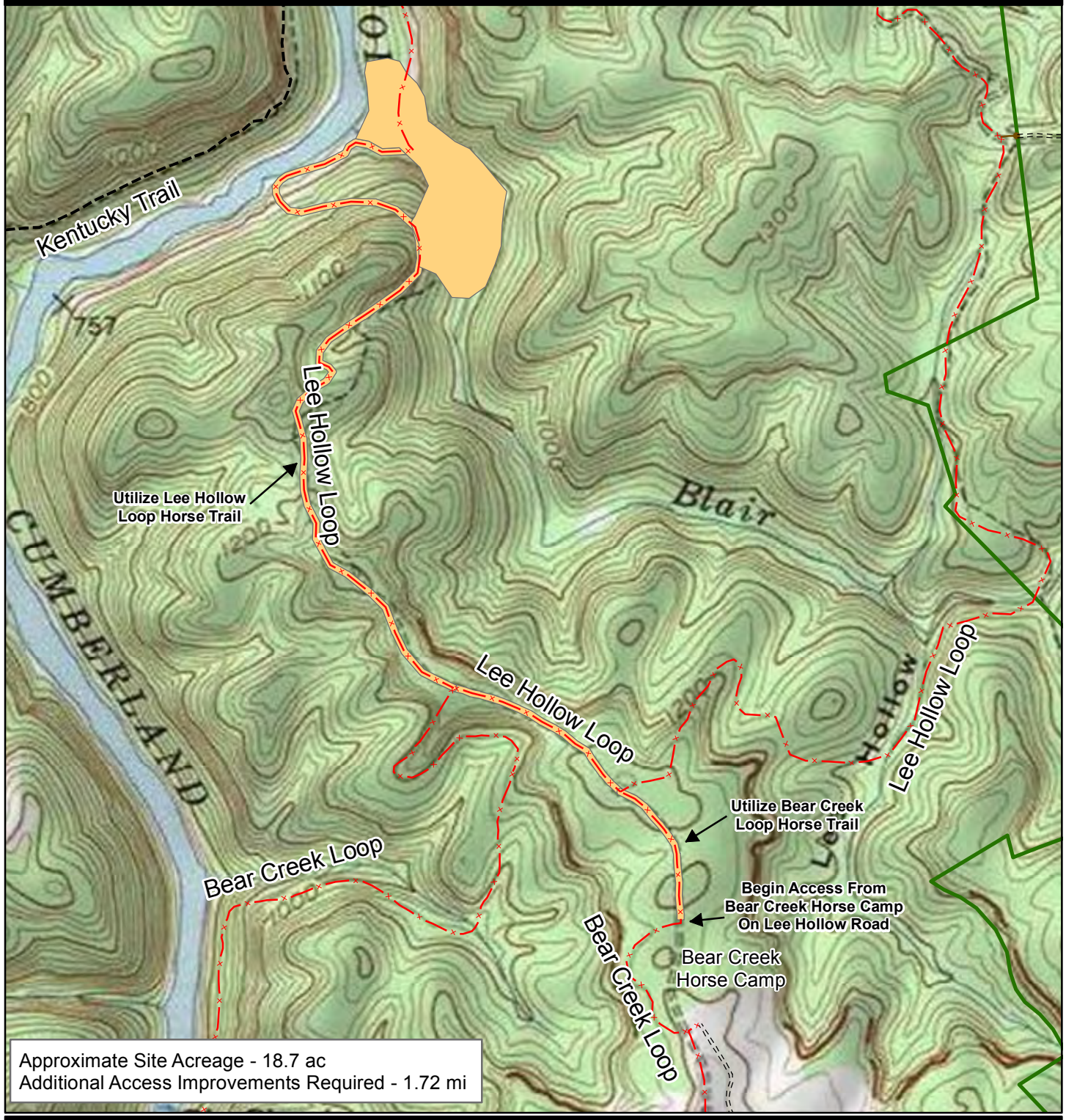


Figure 2-5. Laurel Branch Confluence and Laurel Branch Spoils Proposed Sites and Access

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S. Department of the Interior



Legend

Figure 2-6. Blair Creek Proposed Site and Access

- Hiking Trail
- Horse Trail
- Multiple Use Trail
- Unimproved Road
- Approximate Site Location and Access
- Park Unit Boundary

N

0 1,000 2,000 Feet

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior

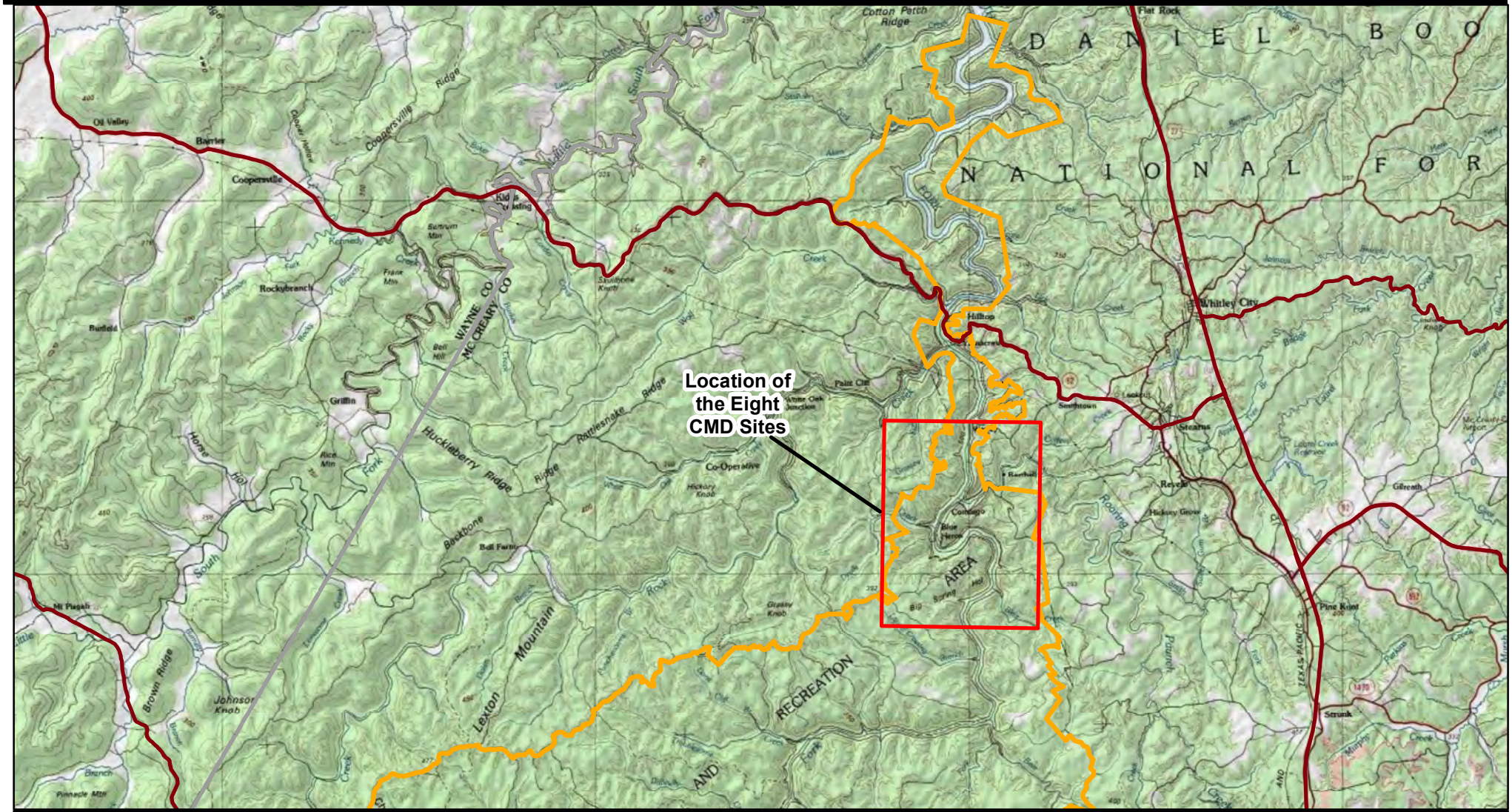


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Figure 3-1. Big South Fork National River and Recreation Area Topographic Map (Northern)

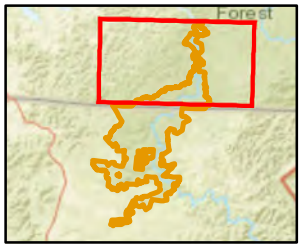
US Highway

Park Unit Boundary

County Boundary

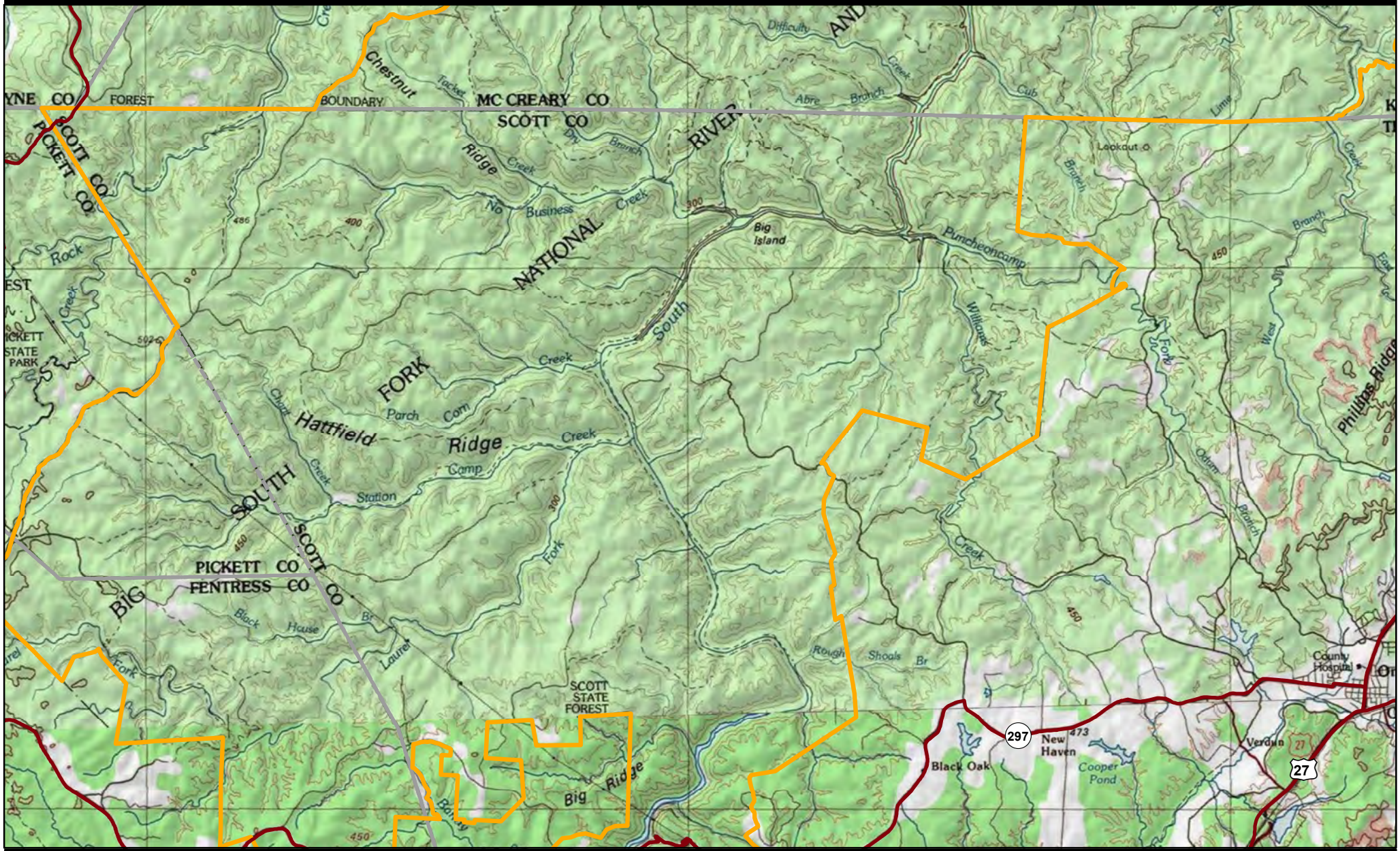
0 2 4 Miles

N



Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior



Legend

Figure 3-2. Big South Fork National River and Recreation Area Topographic Map (Central)

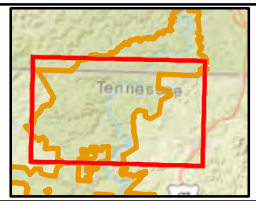
US Highway

Park Unit Boundary

County Boundary

0 2 4 Miles

N



Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior

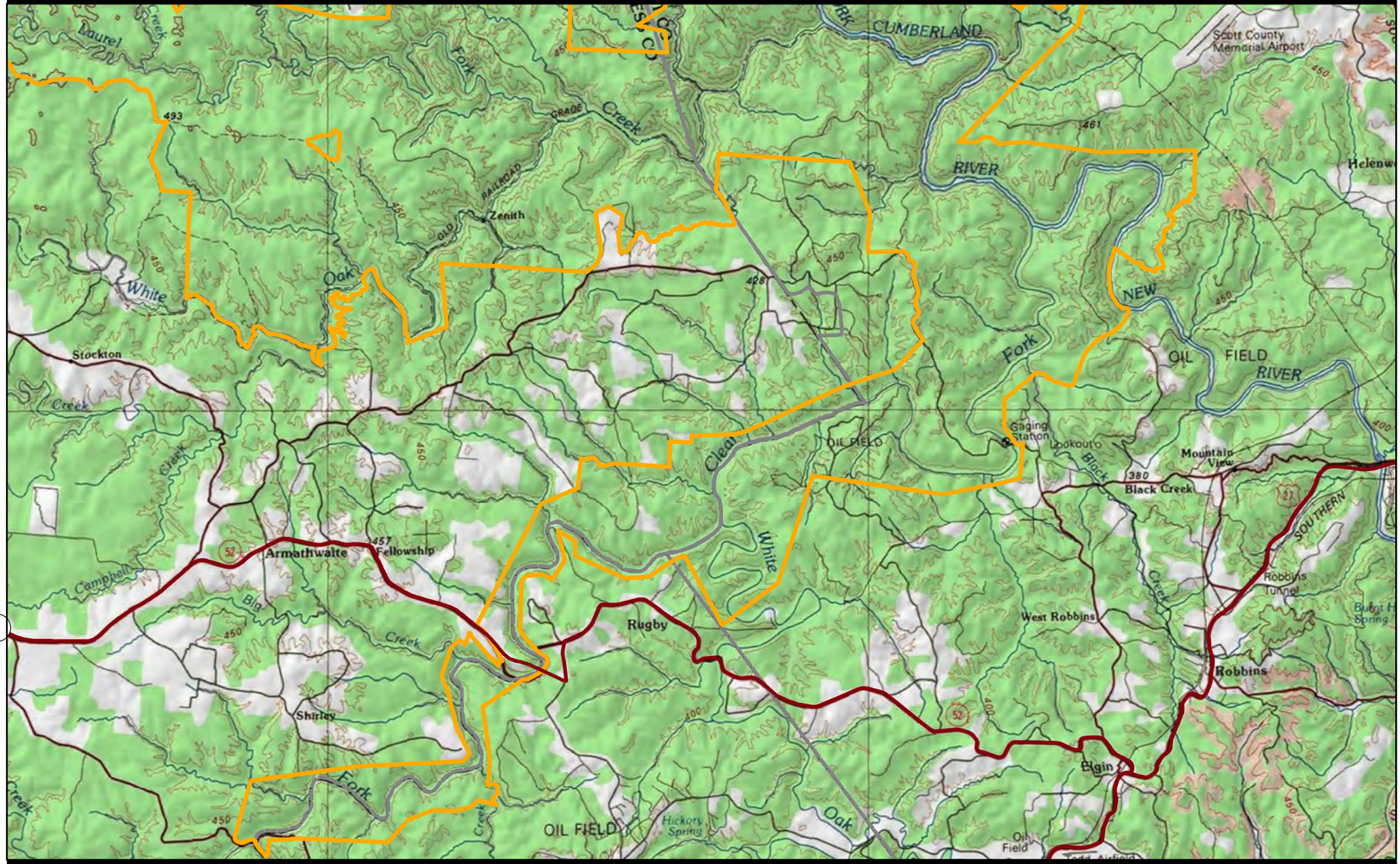


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Figure 3-3. Big South Fork National River and Recreation Area Topographic Map (Southern)

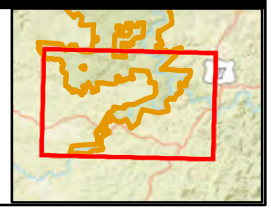
US Highway

Park Unit Boundary

County Boundary

0 2 4 Miles

N



Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior

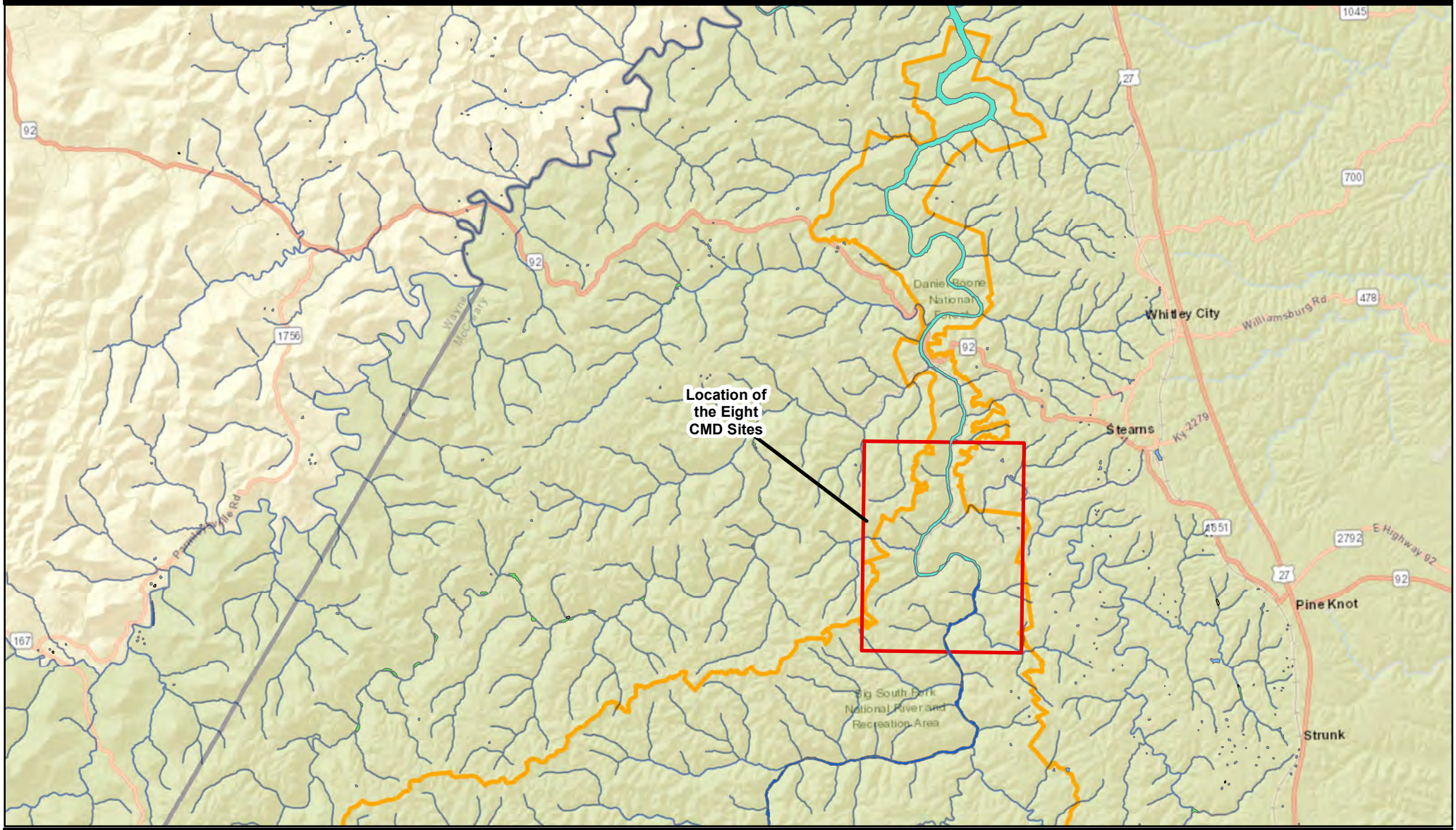


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Figure 3-4 Wetlands and Surface Water of Big South Fork National River and Recreation Area (Northern)

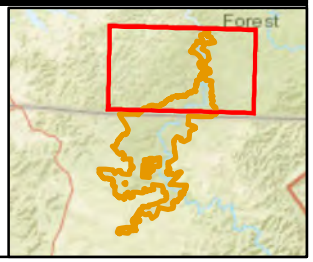
Rivers/Streams
Park Unit Boundary
County Boundary

Wetlands and Surface Water

- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Reservoirs and Impoundments

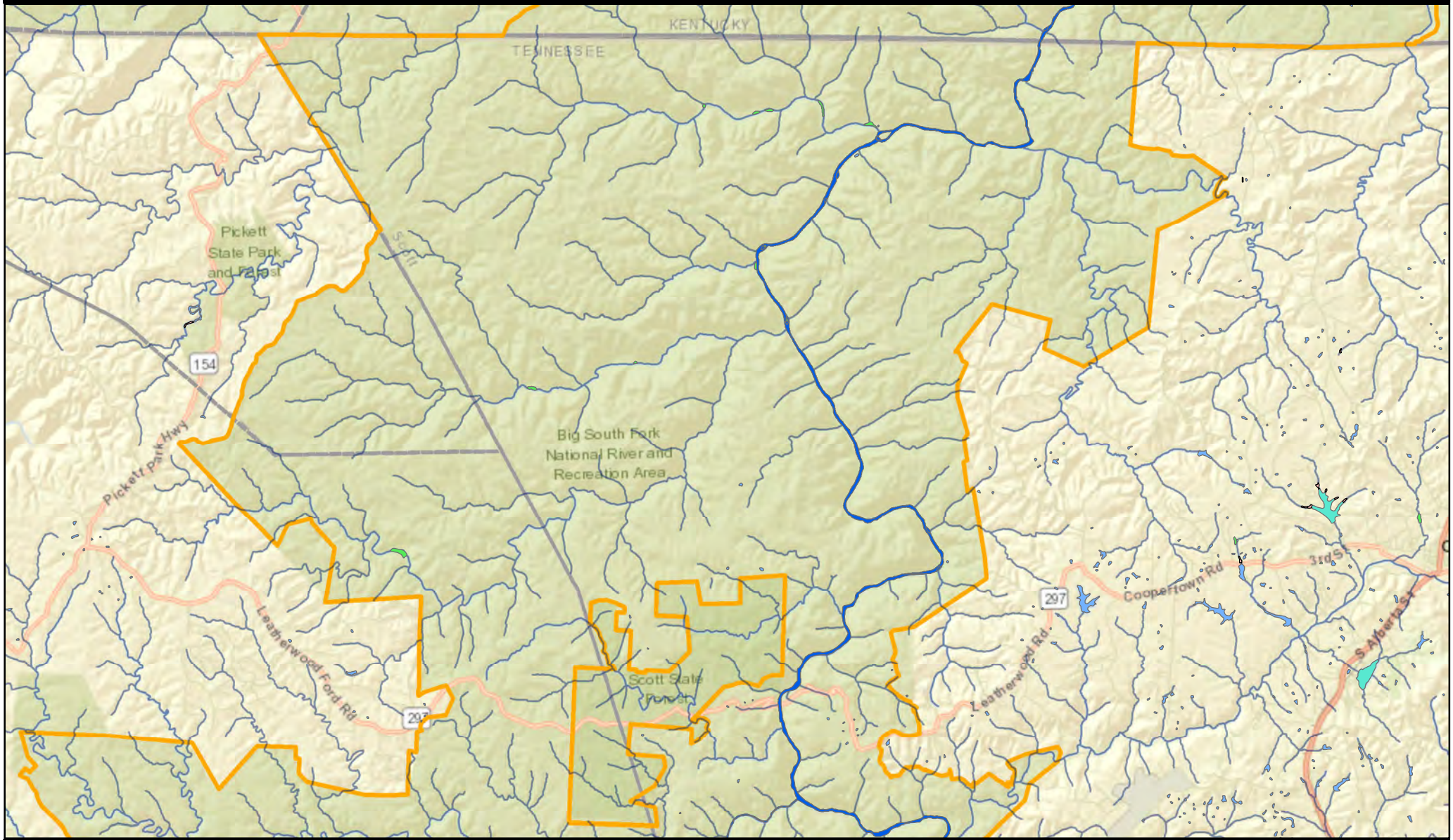
N

0 2 4 Miles



Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior



Legend

Figure 3-5 Wetlands and Surface Water of Big South Fork National River and Recreation Area (Center)

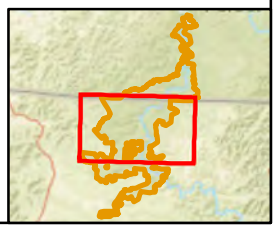
- Rivers/Streams
- Park Unit Boundary
- County Boundary

Wetlands and Surface Water

- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Reservoirs and Impoundments

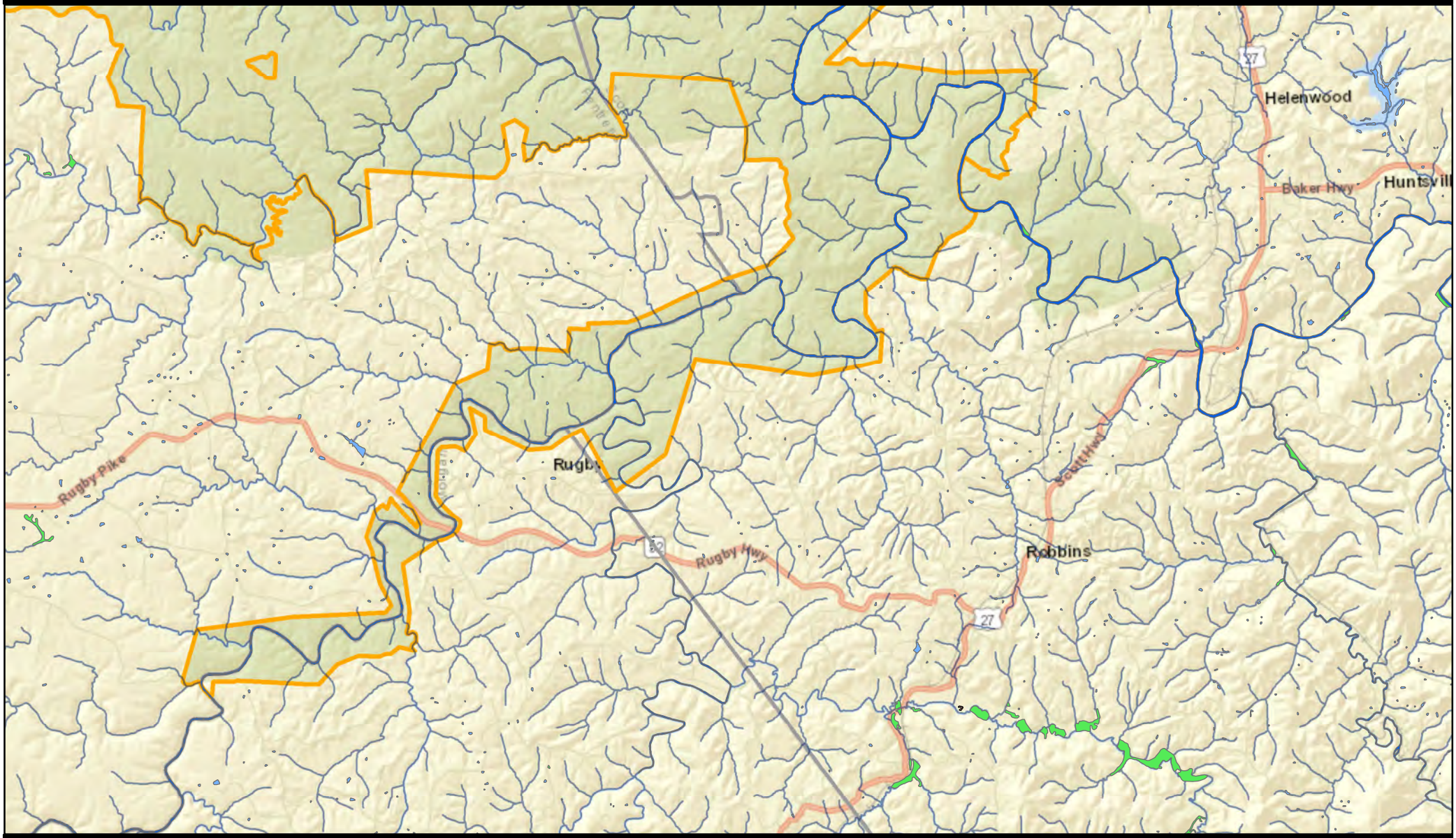
N

0 2 4 Miles



Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S Department of the Interior



Legend

Figure 3-6 Wetlands and Surface Water of Big South Fork National River and Recreation Area (Southern)

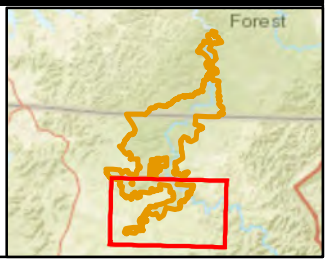
Wetlands and Surface Water

- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Reservoirs and Impoundments

- Rivers/Streams
- Park Unit Boundary
- County Boundary

N

0 2 4 Miles



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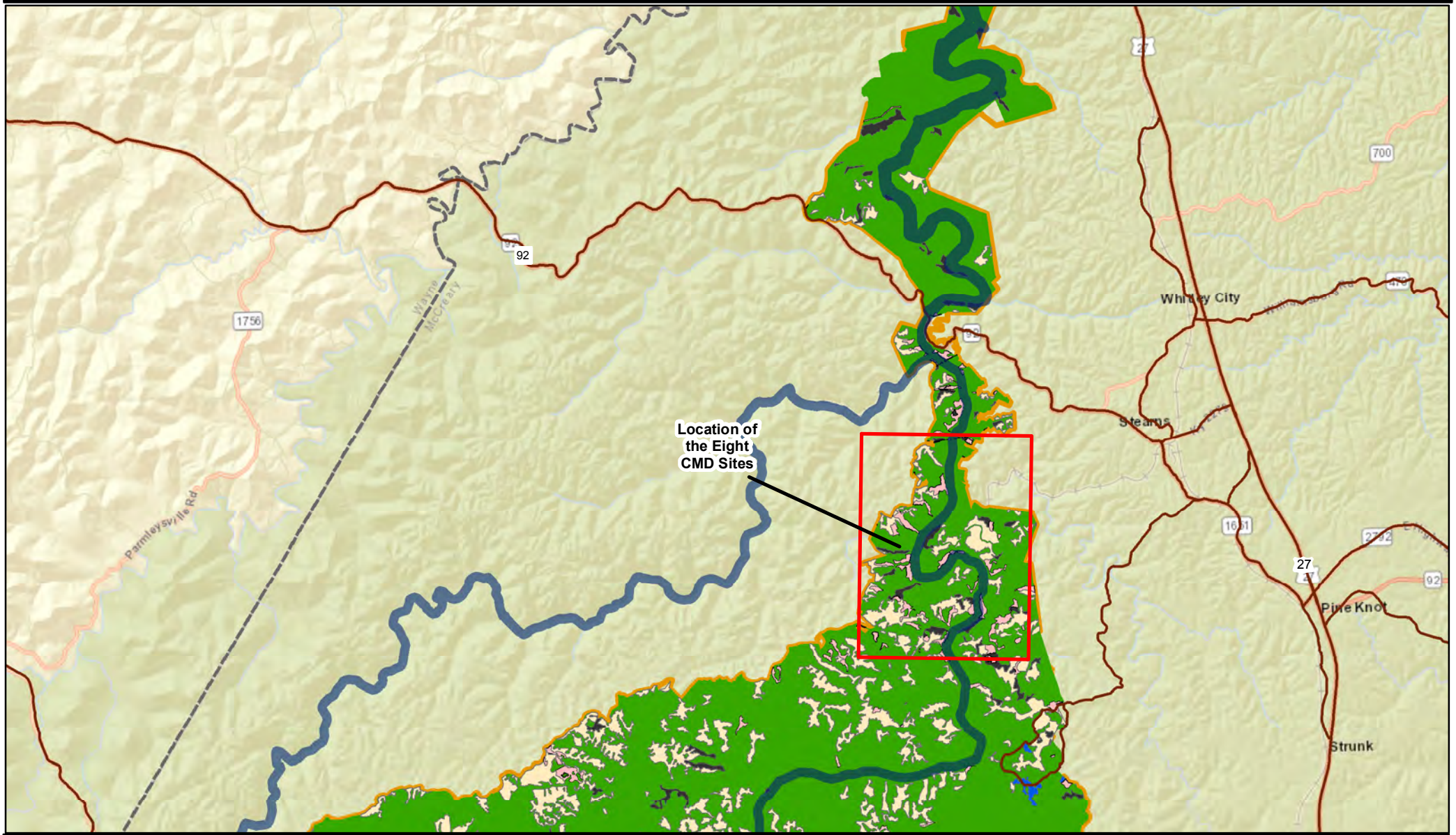


Legend

Figure 3-7 Vegetation of Big South Fork National River and Recreation Area (Northern)

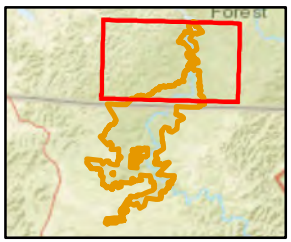
- Rivers/Streams
- US Highways
- County Boundary
- Park Unit Boundary

Vegetation

- Agriculture
- Developed or Disturbed
- Forest
- Herbaceous
- River
- Shrubland
- Water

N

0 2 4 Miles



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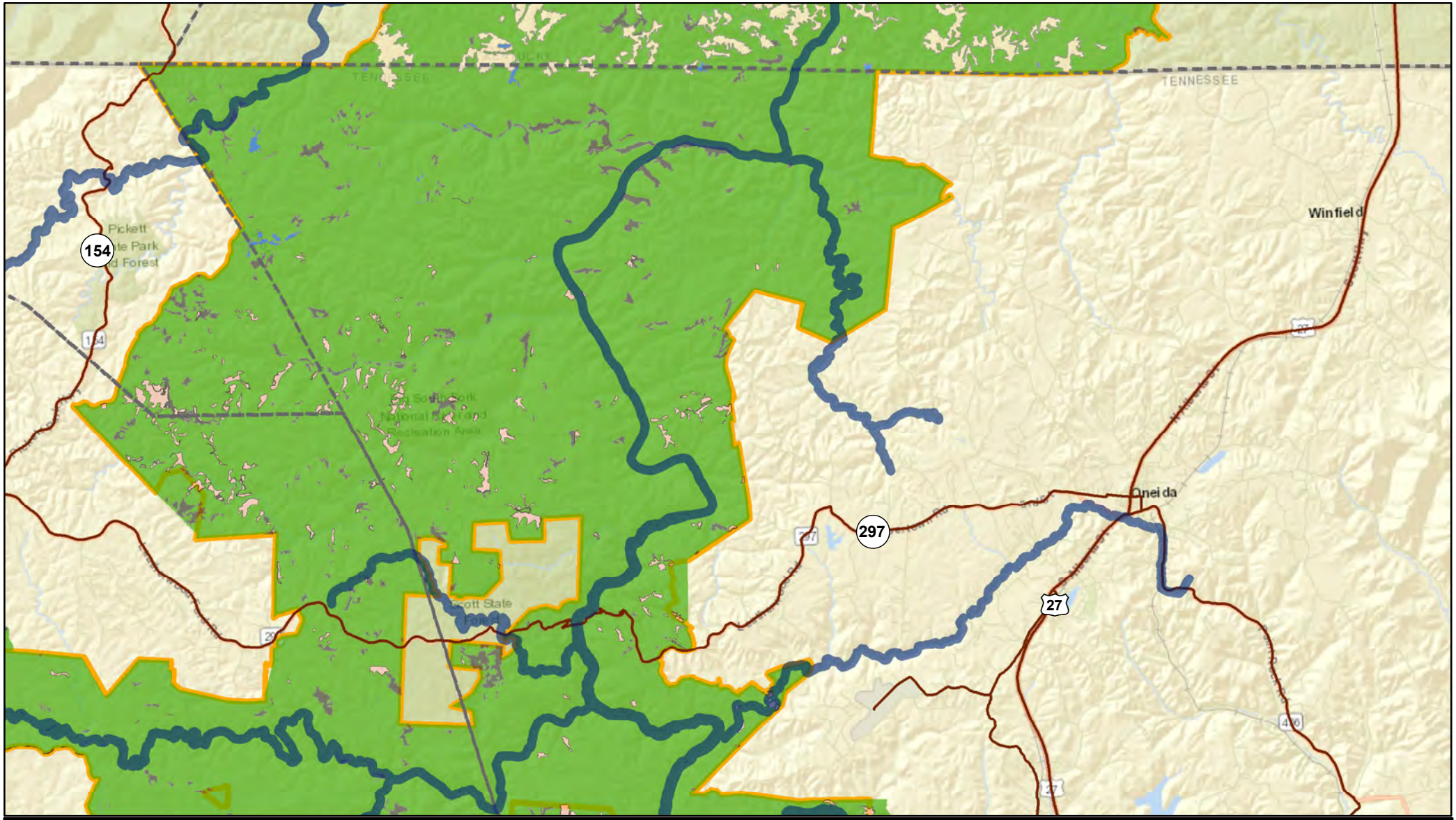


Legend

Figure 3-8 Vegetation of Big South Fork National River and Recreation Area (Central)

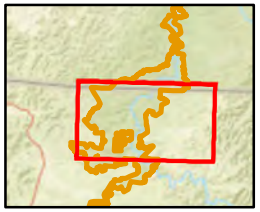
- Rivers/Streams
- US Highways
- County Boundary
- Park Unit Boundary

Vegetation

- Agriculture
- Developed or Disturbed
- Forest
- Herbaceous
- River
- Shrubland
- Water

N

0 2 4 Miles



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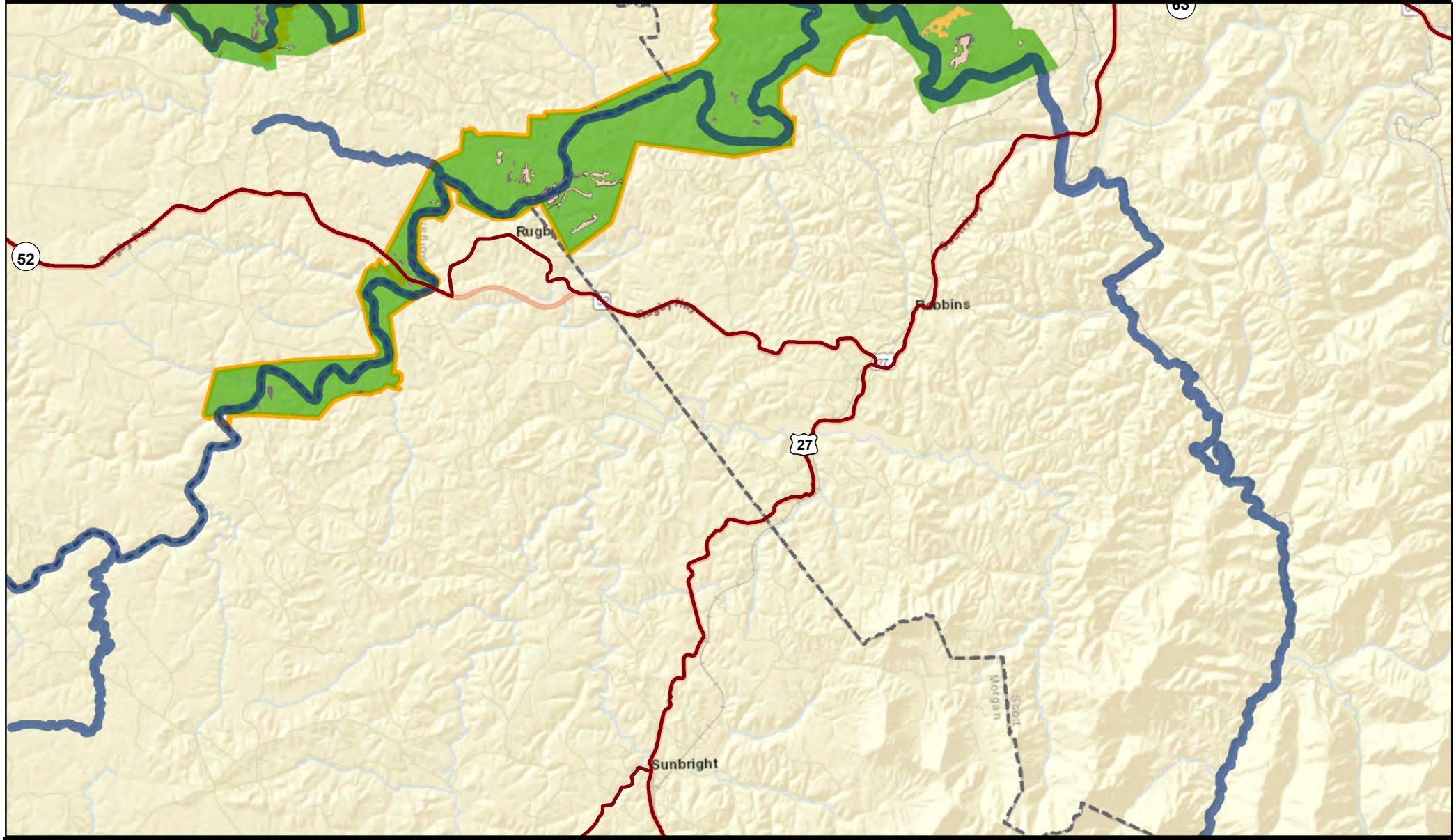


Legend

Figure 3-9 Vegetation of Big South Fork National River and Recreation Area (Southern)

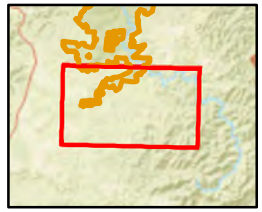
- US Highway
- Rivers/Streams
- County Boundary
- Park Unit Boundary

Vegetation

- Agriculture
- Developed or Disturbed
- Forest
- Herbaceous
- River
- Shrubland
- Water

N

0 2 4 Miles



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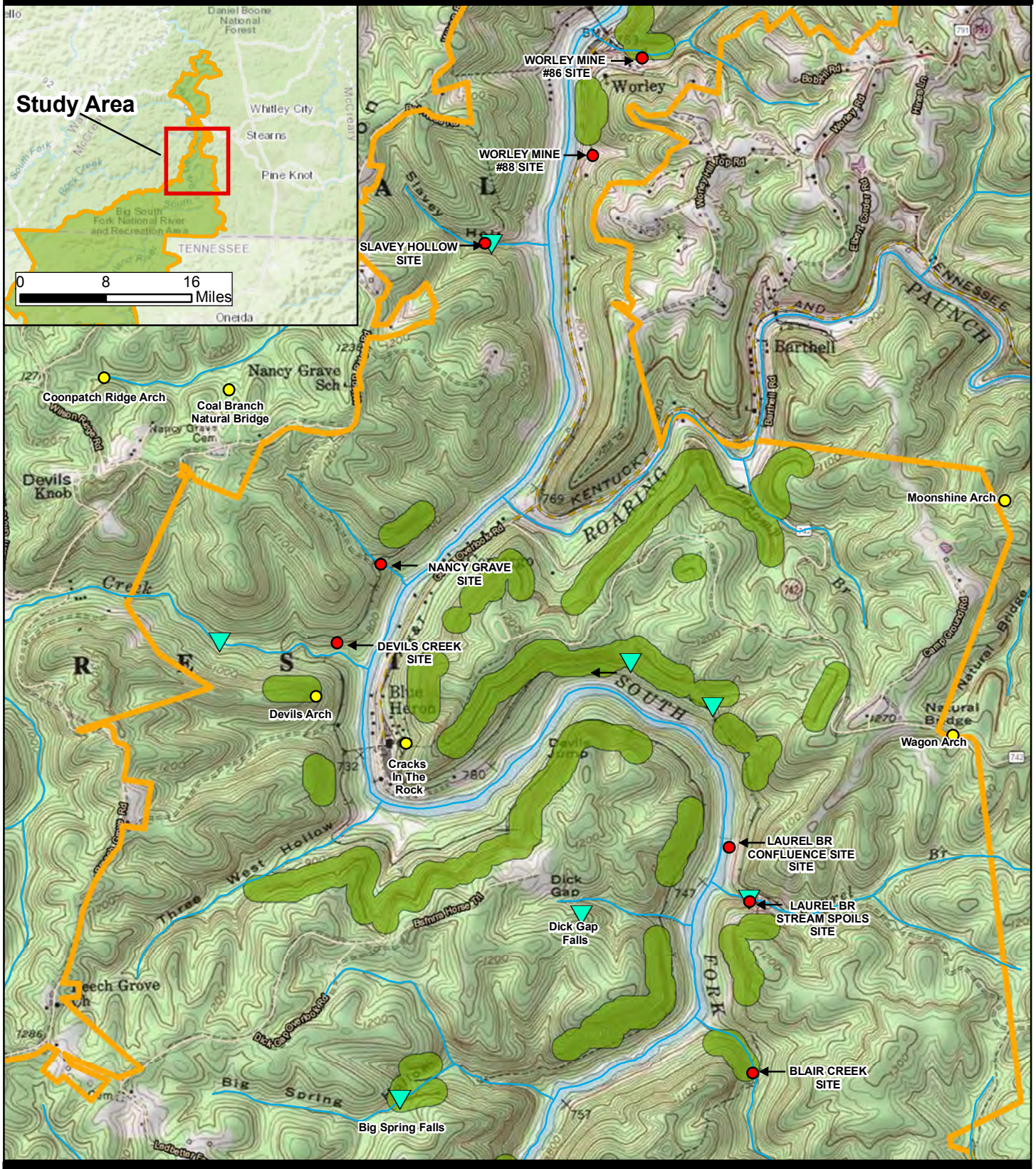

Legend

Figure 3-10 Eight Selected CMD Locations, Cliff Edges, and Geofeatures.

- CMD Locations
- Waterfalls
- Cliff Edges
- Geofeatures
- Streams
- Park Unit Boundary

N

0 2,000 4,000 Feet

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Kentucky and Tennessee

National Park Service
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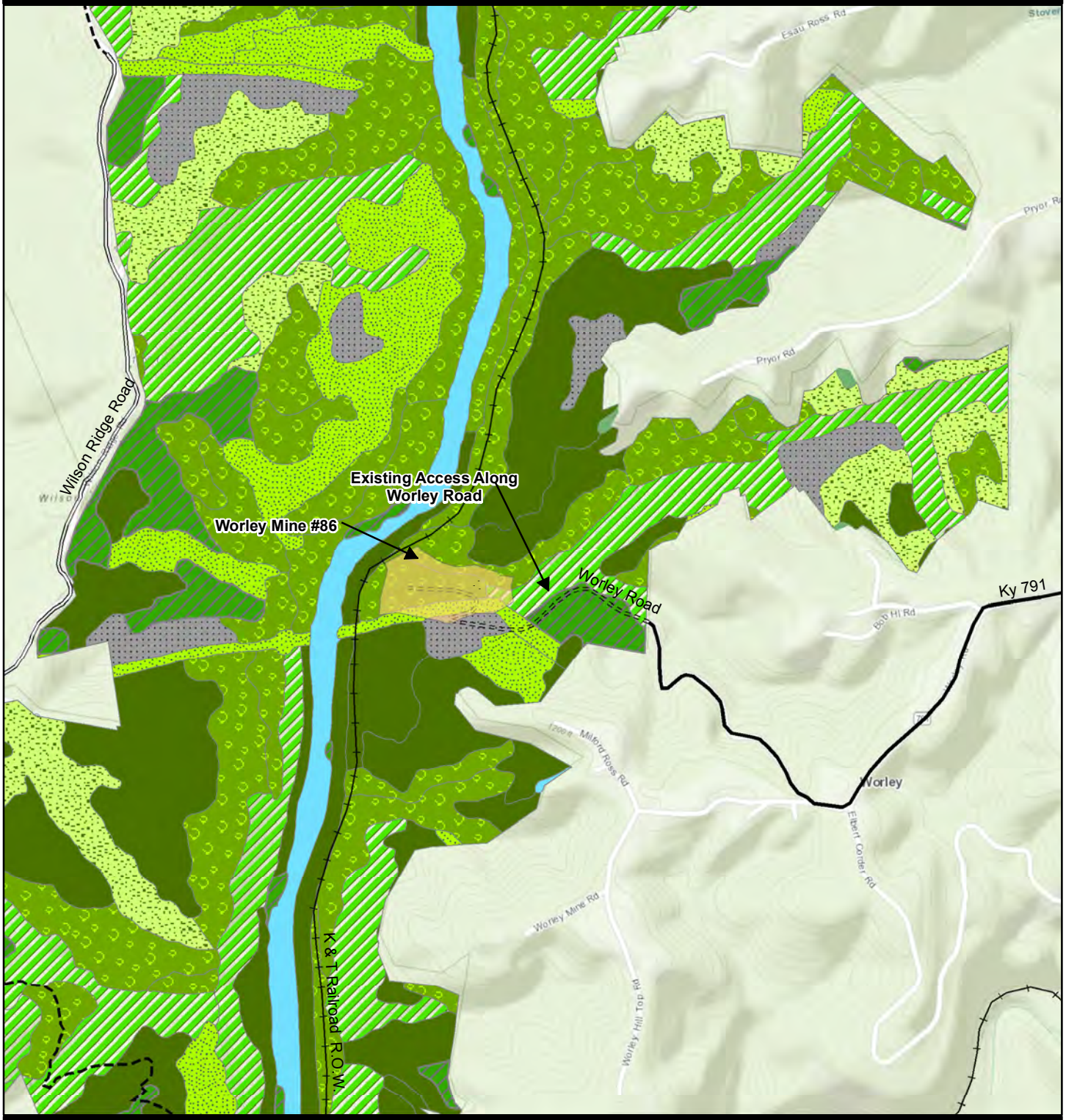

Legend

Figure 4-1. Worley Mine #86 Site Access and Vegetation Types

- Approximate Site Location
- Hiking Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad

Vegetation

- Developed or Disturbed
- Hemlock - White Pine Forest
- Lowland or Submontaine Cold Deciduous Forests
- Pine Forest
- Mixed Pine - Oak Forest
- Successional Forest
- Herbaceous
- Shrubland
- Temporarily Flooded Forest

N

0 1,000 2,000 Feet

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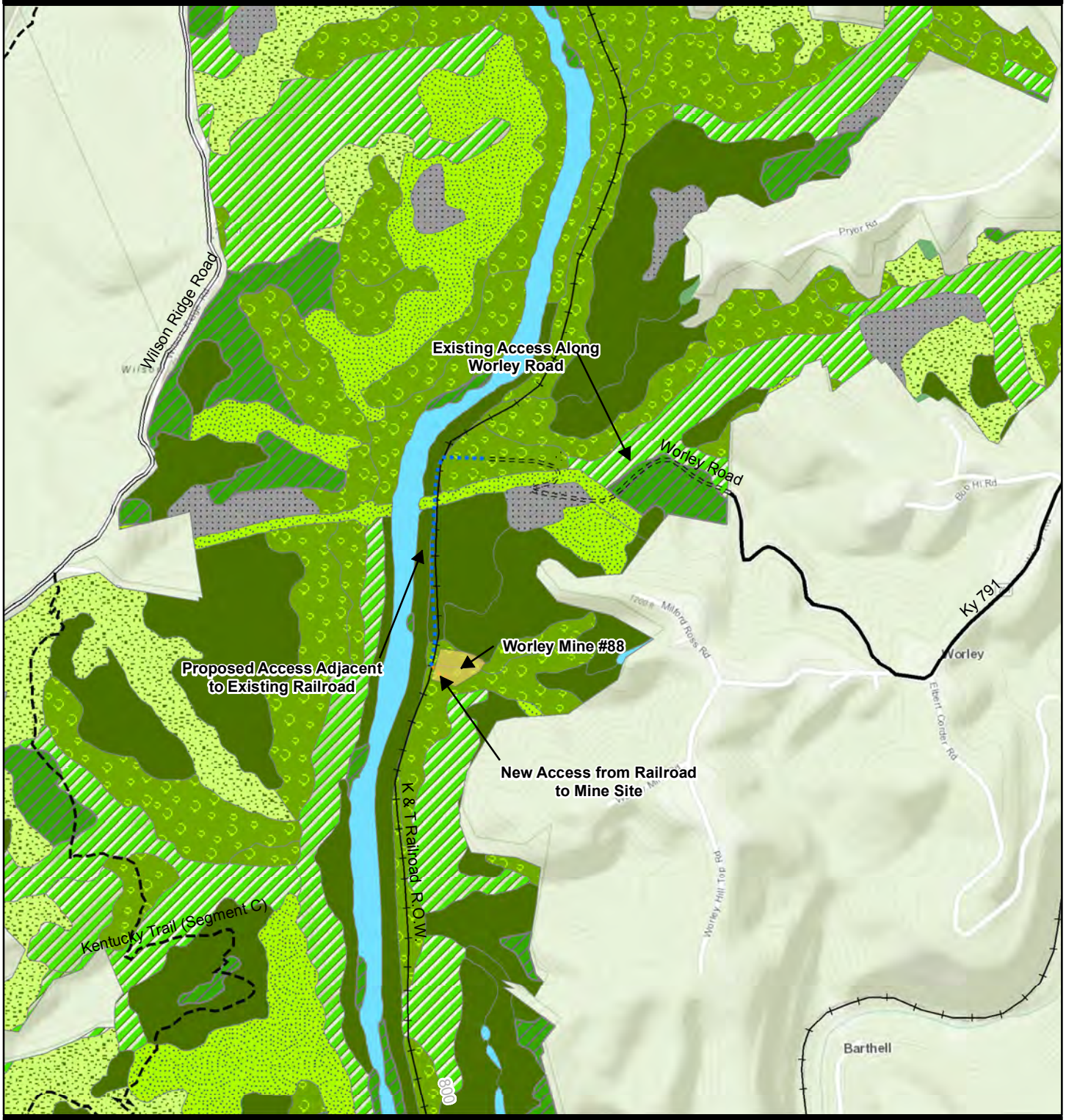

Legend

Figure 4-2. Worley Mine #88 Site Access and Vegetation Types

- Approximate Site Location
- Access Along RR
- Proposed New Access
- Hiking Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad

Vegetation

- Developed or Disturbed
- Hemlock - White Pine Forest
- Lowland or Submontaine Cold Deciduous Forests
- Pine Forest
- Mixed Pine - Oak Forest
- Successional Forest
- Herbaceous
- Shrubland
- Temporarily Flooded Forest

N

0 1,000 2,000 Feet

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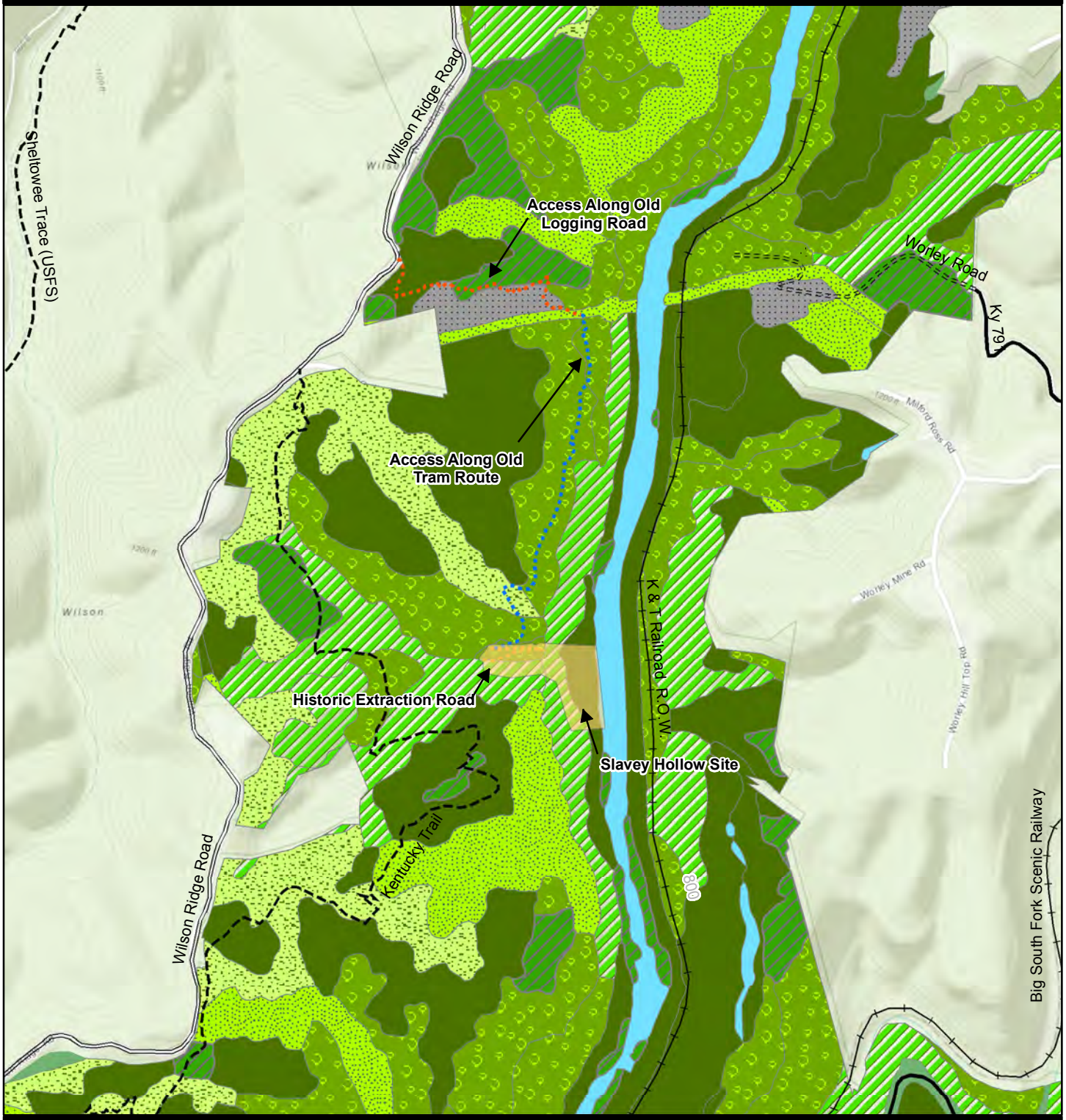

Legend

Figure 4-3. Slavey Hollow Site Access and Vegetation Types

- Approximate Site Location
- **Proposed Access Type**
  - Old Logging Road
  - Old Tram Route
  - Historic Extraction Road
- Hiking Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad
- **Vegetation**
  - Developed or Disturbed
  - Hemlock - White Pine Forest
  - Lowland or Submontaine Cold Deciduous Forests
  - Pine Forest
  - Mixed Pine - Oak Forest
  - Successional Forest
  - Herbaceous
  - Shrubland
  - Temporarily Flooded Forest

N

0 1,000 2,000 Feet

Big South Fork National River and Recreation Area
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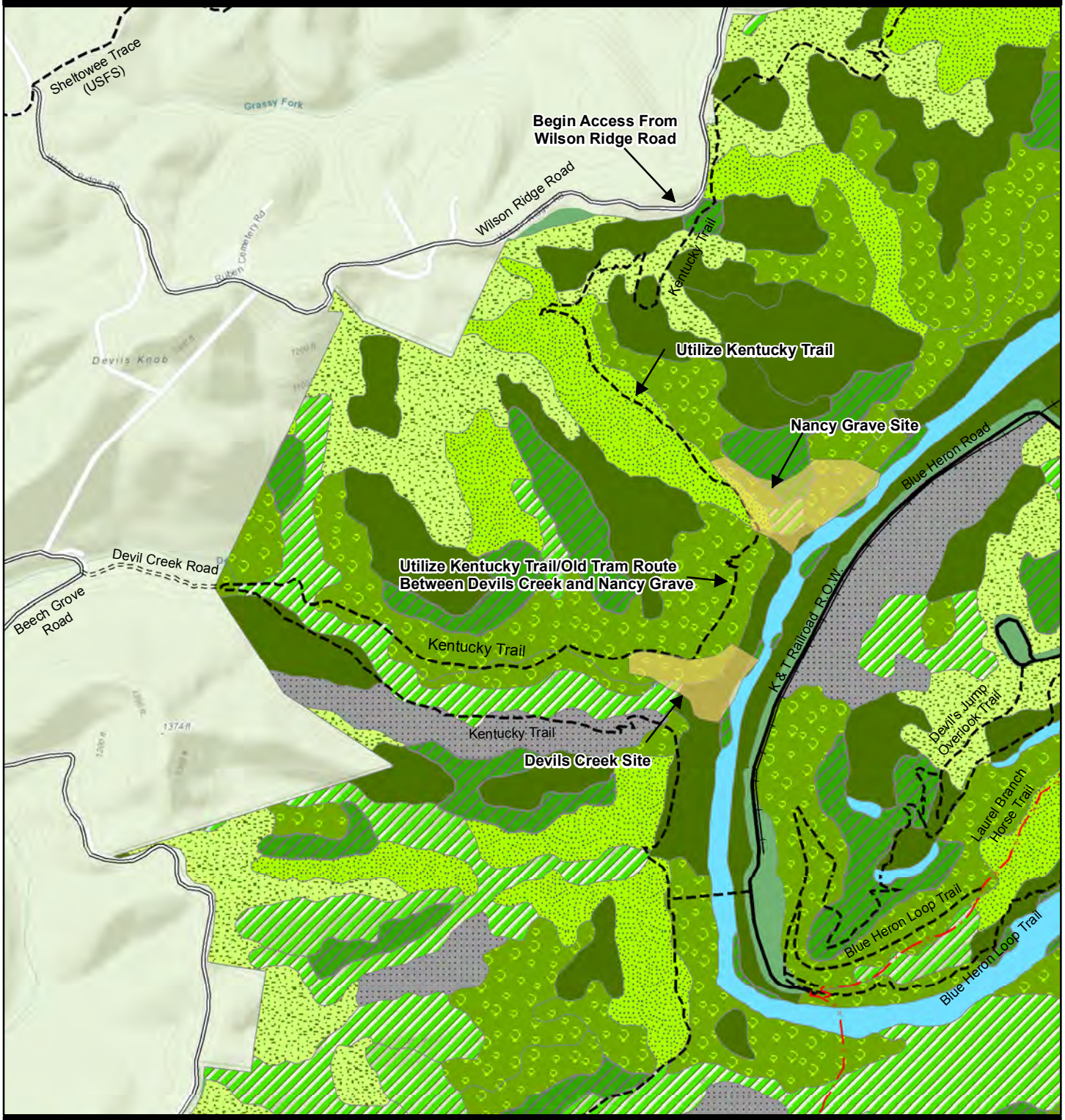

Legend

Figure 4-4. Nancy Grave and Devils Creek Site Access and Vegetation Types

- Approximate Site Location
- Hiking Trail
- Horse Trail
- Paved Road
- Improved Road
- Unimproved Road
- Railroad

Vegetation

- Developed or Disturbed
- Hemlock - White Pine Forest
- Lowland or Submontane Cold Deciduous Forests
- Pine Forest
- Mixed Pine - Oak Forest
- Successional Forest
- Herbaceous
- Shrubland
- Temporarily Flooded Forest

N

0 1,000 2,000 Feet

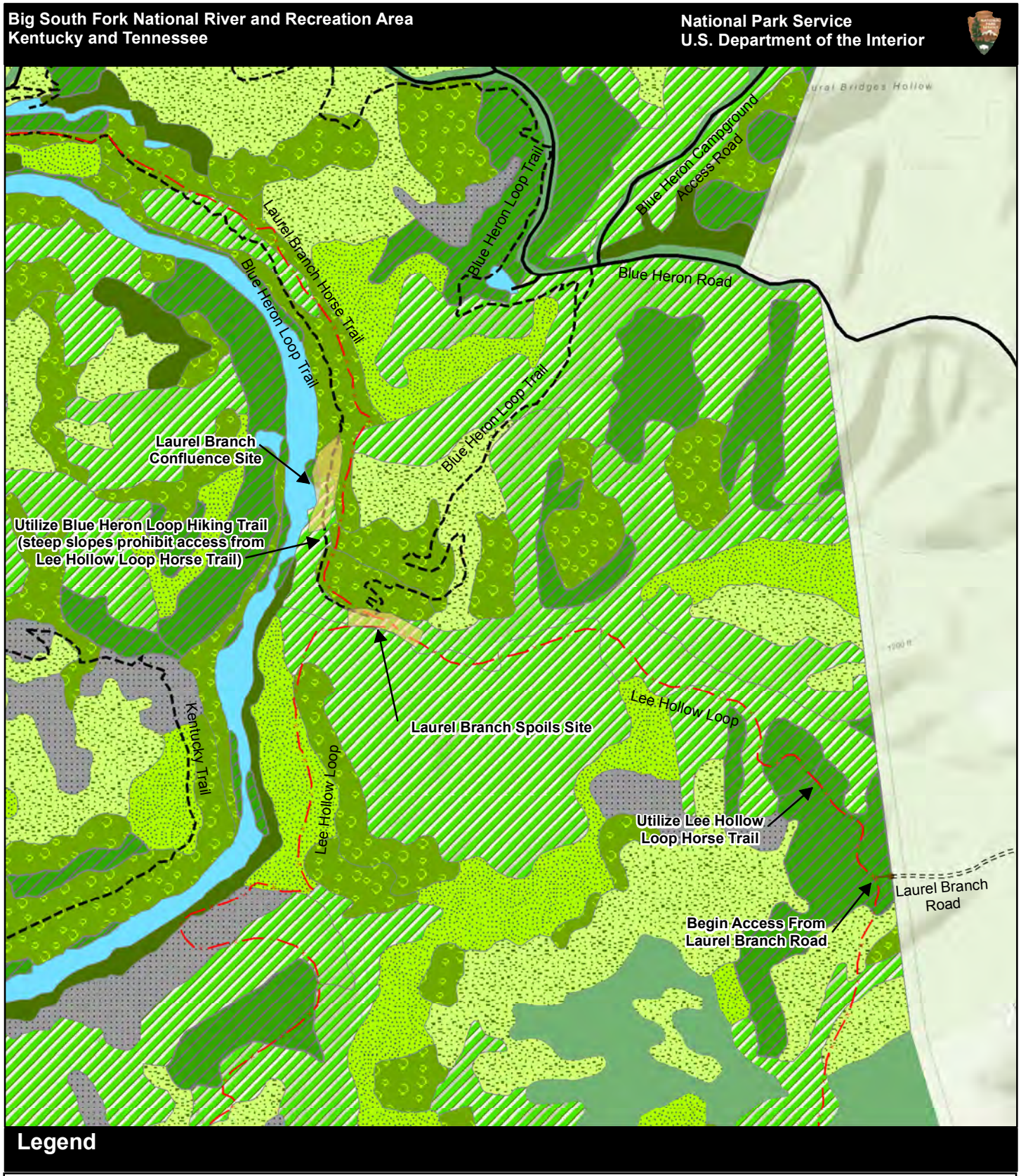

Figure 4-5. Laurel Branch Confluence and Laurel Branch Spoils Site Access and Vegetation Types

- Approximate Site Location
- Hiking Trail
- Horse Trail
- Multiple Use Trail
- Paved Road
- Unimproved Road

Vegetation

- Developed or Disturbed
- Hemlock - White Pine Forest
- Lowland or Submontaine Cold Deciduous Forests
- Pine Forest
- Mixed Pine - Oak Forest
- Successional Forest
- Herbaceous
- Shrubland
- Temporarily Flooded Forest

N

0 1,000 2,000 Feet

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
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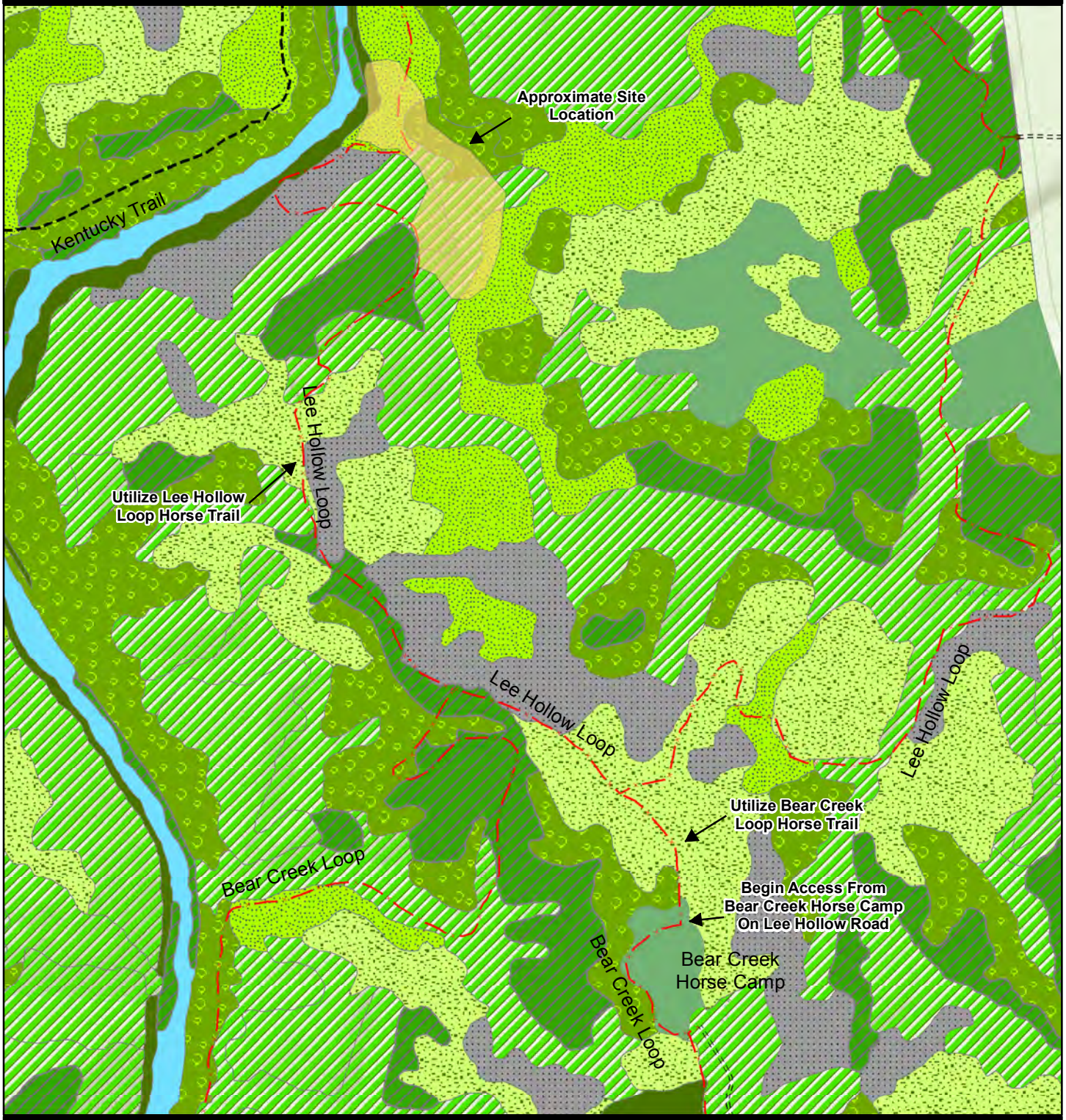


Legend

Figure 4-6. Blair Creek Site Access and Vegetation Types

- Approximate Site Location
- 1 Hiking Trail
- 2 Horse Trail
- 3 Multiple Use Trail
- 7 Unimproved Road

Vegetation

- Developed or Disturbed
- Hemlock - White Pine Forest
- Lowland or Submontaine Cold Deciduous Forests
- Pine Forest
- Mixed Pine - Oak Forest
- Successional Forest
- Herbaceous
- Shrubland
- Temporarily Flooded Forest

N

0 1,000 2,000 Feet

APPENDIX B
TABLES

Table 1-1. Water Quality Parameter Thresholds Indicative of Acid Mine Drainage.

Parameter	Threshold Value[1]	Big South Fork NRRA Measured Values[2]
pH	< 6.0	2.40 – 7.22
Alkalinity (mg/L $CaCO_3$)	< Acidity	< 20 - 180
Iron (mg/L)	> 0.5	< 0.022 – 1,700
Sulfate (mg/L)	> 75.0	< 10 – 9,600
Aluminum (mg/L)	> 0.3	< 0.024 - 480
Hardness (mg/L)	> 150	NA
Turbidity (mg/L)	> 200	NA

Abbreviations:

$CaCO_3$ – calcium carbonate
mg/L – milligrams per liter
NA – data not available from dataset
< – less than
> – greater than

[1] From O'Bara et al. 1982

[2] From Gannett Fleming, Inc. 1998

Table 1-2. Summary of Previous Water Quality Studies in the Big South Fork NRRA.

Study	Source	Year	Number of CMD Sites Investigated[1]
The Effect of Coal Surface Mining on the Water Quality of Mountain Drainage Basin Streams	Roger A. Minear and Bruce A. Tschantz	1976	5
Characterization of Acid Mine Drainage / Big South Fork National River and Recreation Area, Kentucky / Phase 1 Report.	S.S. Papadopulos & Associates, Inc.	1996	14
Characterization and Ranking of Contaminated Mine Drainage Sites: Big South Fork National River and Recreation Area, Kentucky / Phase II Draft Report.	S.S. Papadopulos & Associates, Inc.	1997	13
Feasibility and Conceptual Remediation designs for priority contaminated mine drainage sites in the Big South Fork National River and Recreational Area, Kentucky: Phase III	Gannett Fleming, Inc.	1998	13
Conceptual remediation designs, with costs, for 15 priority mine drainage discharge sites in the Big South Fork NRRA study area	S.S. Papadopulos & Associates, Inc.	1998	15
Environmental Assessment In Support of the Implementation of Remediation Activities for Selected Contaminated Mine Drainage (CMD) Sites at the Big South Fork National River and Recreational Area, McCreary County, KY (draft)	Amec Foster Wheeler (operating as AMEC Earth & Environmental, Inc.)	2003	8

[1] Some reports discuss the same CMD sites, as a result, site numbers are not cumulative.

Table 2-1. CMD Remedial Approaches and Treatment Processes.

CMD Remedial Approach	Treatment Process	Access	Operations and Maintenance	Treatment Footprint
ACTIVE	Chemicals are added directly to the CMD by electrical, solar or water powered chemical dosers or by in-stream activities.	Maintained access is needed to perform frequent O&M.	Frequent O&M needed to recharge chemical dosers and to adjust chemical levels.	Varies from several acres to less than an acre. Access footprint would vary on access needs at individual CMD sites.
PASSIVE	CMD treated through a system of constructed wetland cells that function as filter cells to remove CMD contaminants and raise pH.	Temporary access needed to construct and maintain the CMD technology.	Low level of O&M that occurs in intervals between 10 to 30 years.	Can vary depending upon the type of constructed wetland cells. Typical footprint is less than 3 acres.
SOURCE CONTROL	Separates air, water, and materials that form CMD.	Access needed to install but not for O&M.	O&M consists of annual monitoring, which would be conducted at accessible locations and not require maintained access.	Varies based on site size.

Table 2-2. Treatment Method by Type.

Treatment Method	Type	Treatment Description
Site Reclamation	Source Control	Includes grading, revegetation, capping, and /or spoil removal. Grading activities are generally performed to improve drainage and increase slope stability.
Water Source Controls	Source Control	Water source controls are employed to keep water from contacting and infiltrating acid generating materials on acid mine land to prevent and/or reduce CMD discharges (Gannett Fleming, Inc. 1998). Water source controls include diversion/isolation of water through lined channels, or barriers.
Mine Seals	Source Control	Mine seals exclude the passage of air to mines and are used to prevent or control the flow of water into mine openings. Dry seals prevent the passage of air and water. Wet seals prevent the passage of air but allow the discharge of water.
Chemical Treatment	Active Treatment	Chemical treatment systems use mechanical dosers, mixers, and settling basins to treat CMD. Chemicals typically used to treat CMD include calcium carbonate (limestone), calcium hydroxide (hydrated lime), sodium carbonate (soda ash or briquettes) and sodium hydroxide (caustic soda).
In-stream Alkaline Addition	Active Treatment	In-stream alkaline addition involves adding limestone aggregates that are mechanically distributed directly into CMD affected streams (Gannett Fleming, Inc. 1998).
Anoxic Limestone Drains (ALDs)	Passive Treatment	ALDs function solely to raise the pH of CMD. These systems are limited to drainages that contain no aluminum or ferric iron, because aluminum precipitates in the drain, reducing permeability, while ferric iron precipitates on the limestone surfaces, which reduces its dissolution rate (Watzlaf and Hyman 1995). ALDs are typically used in combination with aerobic and anaerobic surface-flow wetland cells.
Constructed Aerobic Surface-flow Wetland Cells and Settling Ponds	Passive Treatment	Aerobic surface-flow wetland cells are constructed wetlands, not natural systems. They are generally constructed to treat water with a pH above 7, but may be used to treat acidic water if other remedial approaches to raise pH are incorporated into the system. Aerobic wetland cells are often shallow ponds allowing oxygen to transfer and plants such as cattails to flourish. These systems function to promote oxidation, precipitation, and settling of iron and manganese oxyhydroxides (Watzlaf and Hyman 1995).
Constructed Anaerobic Surface-flow Wetland Cells	Passive Treatment	Anaerobic surface-flow wetland cells are constructed wetlands, not natural systems. They vary in depth from approximately one to twelve inches, contain organic substrate, and are planted with emergent vegetation such as cattails. These systems can remove metals such as iron and aluminum, and have had limited success raising pH.

Treatment Method	Type	Treatment Description
Polishing Pond	Passive Treatment	A polishing pond is a shallow surface-flow wetland cell, one to twelve inches deep, that is planted with aquatic and/or wetland vegetation. These systems can remove metals such as iron and aluminum through biological processes and filtration.
Constructed Vertical Flow Wetland Cells	Passive Treatment	Vertical flow wetland cells are constructed wetlands. They can be used to treat highly acidic mine drainage. These systems consist of organic substrate placed over a limestone layer.

Table 2-3. Summary of Site Accessibility by Alternative.

CMD Remediation Site	Access Availability			
	Alt. 1 No Remediation	Alt. 2 Full Access	Alt. 3 Moderate Access	Alt. 4 Minimal Access
Programmatic (Number of Sites)[1]	--	25 (includes 8 of the specific CMD sites)	13 (includes 5 of the specific CMD sites)	10 (includes 4 of the specific CMD sites)
Worley #86	--	✓	✓	✓
Worley #88	--	✓	--	--
Slavey Hollow	--	✓	--	--
Nancy Grave	--	✓	✓	--
Devils Creek	--	✓	--	--
Laurel Branch Confluence	--	✓	✓	✓
Laurel Branch Spoils	--	✓	✓	✓
Blair Creek	--	✓	✓	✓

Notes:

"✓" = site is accessible under the alternative

"--" = site is not accessible under the alternative

[1] The number of sites accessible for remediation represents an estimate based on available data and access type by alternative.

Table 2-4. Summary of Available Access Type by Alternative.

Access Type	Access Availability			
	Alt. 1 No Remediation	Alt. 2 Full Access	Alt. 3 Moderate Access	Alt. 4 Minimal Access
New Administrative Access (>0.1 mile)[1]	--	✓	--	--
New Administrative Access (≤0.1 mile)[1]	--	✓	✓	✓
Public Roads	--	✓	✓	✓
Access Roads	--	✓	✓	✓
Multiuse Trails	--	✓	✓	✓
Horse Trails	--	✓	✓	✓
Mountain Biking Trails	--	✓	--[2]	--
Hiking Trails	--	✓	--[2]	--
Former Logging or Mining Roads	--	✓	✓	--
Former Tramway Rail Bed	--	✓	--	--
Spoil Piles	--	✓	✓	✓

Notes:

"✓" = access type is available under the alternative

"--" = access type is not available under the alternative

[1] Administrative Access can only be constructed when it connects to another access type that is available under the alternative.

[2] Under Alternative 3, mountain biking and hiking trails could be used for access if the trail is located on historic logging road, mining road, or similar feature, but not along a tramway.

Table 2-5. Comparison of the Alternatives by Project Element.

Project Element	Alternative 1 No Action	Alternative 2 Full Access	Alternative 3 Moderate Access	Alternative 4 Minimal Access
Site Access	No remediation planned; however, the park may still conduct remediation at individual CMD sites on a case by case basis.	Under Alternative 2, the park has no restrictions to the development and maintenance of access to CMD sites. The use of existing access or construction of temporary access would be preferred; however, new, maintained access could be constructed if necessary. If existing access is used, there would be no restrictions to the level of upgrades or to the length of new access needed to make existing access usable. Access could be maintained during the life of the CMD technology if necessary. If ongoing access is not required, the access site will be restored to its pre-existing condition. Under Alternative 2, all eight of the specific CMD sites and 17 programmatic sites could be reclaimed.	Under Alternative 3, the park has some restrictions to the development and maintenance of access to CMD sites, as described below: CMD access would be allowed on the following GMP designated routes: roads, multiple-use trails, equestrian trails built on a widened access suitable for motorized equipment, and pre-existing roads not addressed by the GMP (for example, old mining, logging, or oil and gas roads). Hiking and/or biking trails are off limits to CMD access unless the hiking and/or biking trail was built on a widened access suitable for motorized equipment. Tramways would also be off-limits to CMD access, to protect the abundant historic resources on these narrow routes, unless included as part of the 0.1 mile of new access routes, described below. The park could construct up to 0.1 mile of new access routes, which could include minor improvements, upgrades, or new	Under Alternative 4, the park has the most restrictions to the development and maintenance of access to CMD sites, as described below: CMD access would be allowed on the following GMP designated routes: roads, multiple-use trails, and equestrian trails built on a widened access suitable for motorized equipment. New road access and pre-existing roads not addressed by the GMP (for example, old mining, logging, or oil and gas roads), would be limited to 0.1 mile. Access greater than 0.1 mile could be constructed on existing spoil piles not associated with tramways. Hiking and/or biking trails are off limits to CMD access, even if the hiking and/or biking trail was built on a widened access suitable for motorized equipment, unless the trail is built on spoil piles. As in Alternative 3, tramways would also be off-limits to CMD access, to protect the abundant historic resources on these narrow

Project Element	Alternative 1 No Action	Alternative 2 Full Access	Alternative 3 Moderate Access	Alternative 4 Minimal Access
			access. However, access greater than 0.1 mile could be constructed on existing spoil piles not associated with tramways. The use of existing access or construction of temporary access would be preferred; however, new, maintained access less than 0.1 of a mile could be constructed if necessary. Access would be maintained during the life of the CMD technology if necessary. If ongoing access is not required, the access site will be restored to its pre-existing condition. Under Alternative 3, three of the specific CMD sites (Worley #88, Slavey Hollow, and Devils Creek) would not be reclaimed due to access restrictions. In total, 8 programmatic sites and 5 site-specific sites would be reclaimed.	routes, unless included as part of the 0.1 mile of new access routes. Under Alternative 4, four of the specific CMD sites (Worley #88, Slavey Hollow, Devil's Creek, and Nancy Grave) would not be reclaimed due to access restrictions. In total, 6 programmatic sites and 4 site-specific sites would be reclaimed.
CMD Remedial Approach	No remediation planned; however, the park may conduct remediation at individual CMD sites on a case by case basis.	All suitable CMD remedial approaches could be considered. The selection of the CMD approach would be made on a case by case basis considering the balance between impacts to resources and the improvement of water quality. There would be no "Site Access" limitations as described for Alternatives 3 and 4.	Same as Alternative 2, all suitable CMD approaches could be considered. However, O&M technologies utilized must conform to the "Site Access" limitations described above, including the reopening of previously constructed temporary access.	Same as Alternative 2, all suitable CMD approaches could be considered. However, passive remediation is the preferred approach for backcountry sites, whereas the preferred approach for frontcountry sites that are accessible by a main road would use all available technologies. In addition, O&M technologies utilized must conform to the "Site

Project Element	Alternative 1 No Action	Alternative 2 Full Access	Alternative 3 Moderate Access	Alternative 4 Minimal Access
				Access" limitations described above, including the reopening of previously constructed temporary access.
O&M	No remediation planned; however, the park may conduct remediation at individual CMD sites on a case by case basis.	Under Alternative 2, O&M is unrestricted in frequency and timing to achieve the maximum improvement in water quality. All approaches to O&M would be available, and all sites could be reclaimed (there are currently 25 known sites).	Under Alternative 3, all suitable CMD approaches that have a low to high level of O&M could be used to treat individual CMD sites. In total, 8 programmatic sites and 5 site-specific sites would be subject to O&M.	Under Alternative 4, all suitable CMD approaches that have a low to high level of O&M could be used to treat individual CMD sites, though a passive remediation would be the preferred approach. In total, 6 programmatic sites and 4 site-specific sites would be subject to O&M.
Preliminary Investigations to support the selection of remedial action	No remediation planned; however, the park may conduct remediation at individual CMD sites on a case by case basis.	Temporary access may be needed to collect data for developing remediation design. This temporary access could use smaller vehicles and would have more flexibility on access condition compared to the access required to build a CMD approach. Temporary access for data collection would be designed to obtain the maximum information while protecting park resources. Any temporary access for data collection would be allowed to revegetate after the preliminary studies are completed.	Same as Alternative 2. However, any access to sampling sites that requires construction for equipment access must conform to the "Site Access" limitations described above for Alternative 3.	Same as Alternative 2. However, any access to sampling sites that requires construction for equipment access must conform to the "Site Access" limitations described above for Alternative 4.

Table 2-6. Alternatives Impacts Summary.

Impact Topic	Alternative 1: No Remediation	Alternative 2: Full Access	Alternative 3: Moderate Access	Alternative 4: Minimal Access
Topography and Soils	**Topography** – Current conditions would continue, impacts would be associated with the O&M of existing park areas, roads, and trails, including introduction of non-native materials (e.g. gravel), erosion, and minor grading. Impacts would be localized and would occur on a small scale. Topography impacted by CMD sites and spoils piles would not change, but would not be disturbed by remediation activities. **Soils** – Current conditions would continue, impacts to soils would be associated with the O&M of existing park areas, roads, and trails, including exposure of soils to erosion, compaction, minor grading, reduced soil permeability, and contamination from leaking equipment. Impacts to soils by CMD, such as acidification, contamination, would continue. Soils negatively affected by CMD under current conditions would continue to be locally impacted on a small scale, but would not be subjected to impacts associated with remediation activities. **Cumulative Impacts** – Alternative 1 would contribute to continual impacts from CMD long-term, but would contribute minimally to overall cumulative impacts.	**Topography** – Implementation of the alternative would include access improvements of up to approximately 25 sites, including 7.2 mi of access to the 8 site specific sites, resulting in the introduction of non-native materials (e.g. gravel), erosion, and minor to significant grading. In addition, up to approximately 145 acres could require preparation for remediation, which could include grading and leveling, filling, compaction, surfacing or resurfacing. **Soils** – Alternative 2 would include access improvements of up to approximately 25 sites, including approximately 7.2 miles of access and 145 acres requiring preparation for remediation for the 8 site-specific sites. The construction, maintenance, and use of access roads and remediation systems could expose soils to erosion, compact and rut soils, and reduce soil permeability. Where possible, access would be routed across spoil piles to minimize impacts to undisturbed soils. In addition, soils could be subjected to potential contamination from spills or leaking equipment during construction. However, this alternative has the highest potential to reduce the impacts of CMD on soils of all the alternatives, such as soil acidification and contaminant loading. **Cumulative Impacts** – Alternative 2 would have short and long-term impacts to topography and soils, and would contribute minimally to overall cumulative impacts.	**Topography** – Implementation of the alternative would include access improvements of up to approximately 13 sites of the 25 sites from Alternative 2, including 5.2 mi of access to 5 of the 8 site specific sites, resulting in the introduction of non-native materials (e.g. gravel), erosion, and minor grading. In addition, up to approximately 82 acres could require preparation for remediation, which could include grading and leveling, filling, compaction, surfacing or resurfacing. Some of the sites could include significant grading. Impacts to topography would be similar to those under Alternative 2, but on a smaller scale based on fewer number of treated sites. **Soils** – Alternative 3 would include access improvements of up to approximately 13 sites, including approximately 5.2 miles of access and 82 acres requiring preparation for remediation for the 5 site-specific sites, which could expose soils to erosion, compact and rut soils, and reduce soil permeability. Where possible, access would be routed across spoil piles to minimize impacts to undisturbed soils. In addition, soils could be subjected to potential contamination from spills or leaking equipment during construction. However, this alternative has the potential to reduce the impacts of CMD on soils, though the potential would be lower than Alternative 2 due to inaccessible sites. **Cumulative Impacts** – Same as Alternative 2.	**Topography** – Implementation of the alternative would include access improvements of up to approximately 10 sites of the 25 sites from Alternative 2, including 4.6 mi of access to 4 of the 8 site specific sites, resulting in the introduction of non-native materials (e.g. gravel), erosion, and minor grading. In addition, up to approximately 62 acres could require preparation for remediation, which could include grading and leveling, filling, compaction, surfacing or resurfacing. Impacts to topography would be minimal when compared to Alternatives 2 and 3 because of the fewest number of treated sites. **Soils** – Alternative 4 would include access improvements of up to approximately 10 sites, including approximately 4.6 miles of access and 62 acres requiring preparation for remediation for the site-specific sites, which could expose soils to erosion, compact and rut soils, and reduce soil permeability. Where possible, access would be routed across spoil piles to minimize impacts to undisturbed soils. In addition, soils could be subjected to potential contamination from spills or leaking equipment during construction. This alternative has the potential to reduce the impacts of CMD on soils, though the potential would be the lowest among the action alternatives. **Cumulative Impacts** – Same as Alternatives 2 and 3.
Water Resources	**Water Quality** – Current conditions would continue, and impacts associated CMD, such as acidity, low alkalinity, hardness, turbidity, and contaminant loading would persist. Waters would continue to be impacted by CMD. **Floodplains** – Area use within FEMA-designated floodplains would remain unchanged. Floodplains receiving CMD would continue to receive CMD; periodic monitoring would continue, but remediation of CMD would not occur. Impacts from CMD would include vegetation mortality and sedimentation. However, floodplains receiving CMD are limited in the Big South Fork NRRA because of the steep terrain. **Wetlands** – Impacts would be consistent with floodplain impacts from continued exposure to CMD, including acidification, sedimentation, contaminant accretion, and a decrease in species richness. Impacts would include reduced functions and values compared to unimpacted wetlands.	**Water Quality** – Implementation of Alternative 2 would include the treatment of a median flow of up to approximately 12,000 gallons per minute (gpm) of CMD (estimated from Gannett Fleming, Inc. 1998). Remediation activities would include improvements of up to approximately 25 sites, including 7.2 mi of access to the 8 site specific sites, up to approximately 145 acres requiring preparation for remediation, and approximately 44 stream crossings and potential site work in streams, potentially resulting in erosion and sedimentation, and potential spills, or releases of CMD, during construction and O&M. This alternative provides the greatest improvement to water quality for both Lake Cumberland and the free flowing Big South Fork River. Impacts to water quality from construction, O&M, and use of the roads would be temporary, and of a moderate intensity. However, this alternative would have the highest potential to significantly reduce the	**Water Quality** – Implementation of this alternative would include the treatment of a median flow of up to 7,000 gpm of CMD (estimated from Gannett Fleming, Inc. 1998). Access required for the treatment would include improvements of up to approximately 13 sites of the 25 sites from Alternative 2, including 5.2 miles of access to 5 site specific sites. This includes approximately 22 stream crossings, potentially resulting in erosion and sedimentation, and potential spills, or releases of CMD, during construction and O&M. Compared to Alternative 2, this alternative provides less water quality improvement to Lake Cumberland but still improves water quality for the free flowing Big South Fork River. The short-term water quality impacts from construction, O&M, and use of roads would be somewhat less than those of Alternative 2, but through the use of BMPs, would be mitigated. Long-term water quality impacts from	**Water Quality** – Implementation of this alternative would include the treatment of a median flow of up to 4,600 gpm of CMD (estimated from Gannett Fleming, Inc. 1998). Access required for the treatment would include improvements of up to approximately 10 sites of the 25 sites from Alternative 2, including 4.6 miles of access to 4 of the 8 site specific sites. This includes approximately 18 stream crossings, potentially resulting in erosion and sedimentation, and potential spills, or releases of CMD, during construction and O&M. However, this alternative would have the potential to reduce the adverse impacts of CMD in local streams and to potentially have measurable improvements to the water quality of the Big South Fork River (though the smallest improvements to Lake Cumberland. **Floodplains** – Alternative 4 would include access improvements of up to approximately 10 sites, including 4.6 miles of access to 4 of the 8 site specific sites, and the site areas

Impact Topic	Alternative 1: No Remediation	Alternative 2: Full Access	Alternative 3: Moderate Access	Alternative 4: Minimal Access
	Groundwater Resources and Withdrawal – Potential recharge areas may contain CMD impacting groundwater, and affected groundwater resources would continue to have minimal long term impacts. **Cumulative Impacts** – Alternative 1 would contribute to continual impacts from CMD long-term, contributing measurable impacts to the overall cumulative impacts on water resources.	adverse impacts of CMD in local streams and to have measurable improvements to the water quality of the Big South Fork River **Floodplains** – Alternative 2 would include access improvements of up to approximately 25 sites, including 7.2 mi of access to the 8 site specific sites, and the site areas requiring preparation for remediation. Remediation could impact floodplains by crossing or constructing within them, exposing soils to erosion, causing sedimentation, vegetation loss, and reduced soil permeability. The most likely potential impacts to floodplains would be the short-term and low intensity impacts from sedimentation and CMD being deposited within floodplains downstream of the proposed sites during construction, though activities would adhere to BMPs. However, this alternative has the highest potential to reduce the impacts of CMD on floodplains of all the alternatives, such as soil acidification, vegetation loss and contaminant loading. **Wetlands** – Impacts would be similar to floodplain impacts from access and remedial site construction and O&M, though wetlands could also be filled or crossed as part of the remedial process. However, this alternative has the highest potential to improve CMD impacted wetlands, such as soil neutralization, increased vegetation richness, and reduced contaminant loading. No restoration actions at any individual site was found to have more than .25 acres of new, long-term adverse impacts on natural wetlands. **Groundwater Resources and Withdrawal** – Remedial approach impacts are expected to be minimal, but would have the highest potential to benefit downgradient recharge areas and water withdrawals downstream. In contrast, sealing a mine could expand CMD within the mine, which could increase the potential of CMD contacting groundwater that was not hydraulically connected to CMD prior to sealing the mine. Additional studies would be conducted prior to selecting a final remedial option (e.g. sealing a mine). **Cumulative Impacts** - Alternative 2 would contribute to the reduction of CMD long-term, contributing measurable improvements to water resources. Minimal adverse cumulative impacts would be expected.	construction, access, and O&M would be of low intensity. However, this alternative would have the potential to reduce the adverse impacts of CMD in local streams and to have measurable improvements to the water quality of the Big South Fork River (though lower than that of Alternative 2). **Floodplains** – Alternative 3 would include access improvements of up to approximately 13 sites, including 5.2 miles of access to 5 site specific sites, and the site areas that could require preparation for remediation, which could impact floodplains by crossing or constructing within them, exposing soils to erosion, causing sedimentation, vegetation loss, and reduced soil permeability. However, Alternative 3 has the potential to reduce the impacts of CMD on floodplains, though the potential would be lower than Alternative 2 due to inaccessible sites. **Wetlands** – Impacts would be similar with floodplain impacts from access and remedial site construction and O&M, though wetlands could also be filled or crossed as part of the remedial process. However, this alternative has the potential to improve CMD impacted wetlands, though the potential would be lower than Alternative 2 due to inaccessible sites. No restoration actions at any individual site was found to have more than .25 acres of new, long-term adverse impacts on natural wetlands. **Groundwater Resources and Withdrawal** – Remedial approach impacts are expected to be minimal, but would have the potential to benefit downgradient recharge areas and surface water withdrawals downstream, though the potential would be lower than Alternative 2 due to inaccessible sites. **Cumulative Impacts** – Same as Alternative 2, with a slightly lower potential for measurable improvement to cumulative impacts. Minimal adverse cumulative impacts would be expected.	requiring preparation for remediation, which could impact floodplains by crossing or constructing within them, exposing soils to erosion, causing sedimentation, vegetation loss, and reduced soil permeability. However, this alternative has the potential to reduce the impacts of CMD on floodplains, though the potential would be the lowest among the action alternatives. **Wetlands** – Impacts would be similar with floodplain impacts from access and remedial site construction and O&M, though wetlands could also be filled or crossed as part of the remedial process. However, this alternative has the potential to improve CMD impacted wetlands, though the potential would be the lowest among the action alternatives. **Groundwater Resources and Withdrawal** – Remedial approach impacts are expected to be minimal, but would have the potential to benefit downgradient recharge areas and surface water withdrawals downstream, though the potential would be the lowest among the action alternatives. No restoration actions at any individual site was found to have more than .25 acres of new, long-term adverse impacts on natural wetlands. **Cumulative Impacts** – Similar to Alternative 3, Alternative 4 would contribute to the reduction of CMD long-term, but these improvements may be difficult to measure. Minimal adverse cumulative impacts would be expected.

Impact Topic	Alternative 1: No Remediation	Alternative 2: Full Access	Alternative 3: Moderate Access	Alternative 4: Minimal Access
Biological Resources	**Vegetation** – Communities receiving CMD would continue receiving CMD, and remediation of CMD would not occur. The deposition of yellow boy, runoff from spoil piles, and CMD into the surrounding areas can kill herbaceous vegetation, the woody understory, and trees by smothering roots. Further, the accretion of contaminants and acidification of soils can prevent recovery by inhibiting the regrowth of vegetation. Vegetation impacts from CMD would continue and not be reduced. Beneficial impacts to vegetation from no clearing or opening of roads and not construction of remedial approached would occur under the no action alternative. **Wildlife and Aquatic Species** – CMD would continue to impact terrestrial and aquatic communities and the Big South Fork watershed through vegetation loss, decreased species richness, decreased species fitness and increased mortality, habitat loss, sediment and contaminant loading, and impacted water quality. **Special Status Species and Habitat Areas** – Impacts would be consistent with wildlife and aquatic species impacts. Currently, there are no known impacts to special status species within Big South Fork NRRA associated with CMD. However, continued impacts to water quality does occur where special status species have been documented and could degrade habitat that might otherwise be available for the expansion of special status species, though further studies would be required regarding the potential recruitment into areas that are currently impacted by CMD. Mature trees that are growing on CMD sites and are being utilized by bats would not be impacted. **Cumulative Impacts** – Alternative 1 would contribute to continual impacts from CMD long-term, but would contribute minimally to overall cumulative impacts.	**Vegetation** –Implementation of Alternative 2 would include access improvements of up to approximately 25 sites, including 7.2 mi of access to the 8 site specific sites, and up to approximately 145 acres requiring preparation for remediation, mostly through disturbances of forested vegetation. As access to implement remedial approaches for CMD is greatest under Alternative 2, it would have the largest potential to impact vegetation. Also, remediation of some sites would include the removal and/or stabilization of spoil piles and associated slopes, which would improve vegetation following restoration and natural recruitment, and would provide long-term stability for the vegetative community and associated ecosystems. Where possible, access would be routed across spoil piles to minimize impacts to native vegetation. **Wildlife and Aquatic Species** – Impacts would be associated with up to approximately 25 sites, including 7.2 mi of access to the 8 site specific sites, and up to approximately 145 acres requiring preparation for remediation, including approximately 44 stream crossings. The construction, maintenance, and use of access roads and remediation systems could impact vegetation, introduce exotic species, introduce sediments in waterways, cause change in temperature (loss of channel shading) and water chemistry, and produce noise or vibrations, all of which can affect wildlife and aquatic species, and could cause displacement, decreased production, or increased stress and mortality. However, construction and O&M activities would adhere to the USFWS BO, NPS policies, and BMPs to minimize and mitigate potential impacts. Some risk of direct mortality of aquatic species could occur if toxic materials (e.g. diesel fuel) are spilled into streams. However, this alternative would have the highest potential to significantly reduce the adverse impacts of CMD in local streams and to have measurable improvements, particularly for aquatic species. **Special Status Species and Habitat Areas** – Impacts would be similar to wildlife and aquatic species impacts from access and remedial site construction and O&M. Sensitive riparian habitat and numerous state-and federally-listed plants are known to occur in the vicinity of some of the potential programmatic sites, such as areas near Three West Hollow, Big Spring	**Vegetation** – Implementation of Alternative 3 would include access improvements of up to approximately 13 sites of the 25 sites from Alternative 2, including 5.2 mi of access to the 5 site specific sites, and up to 82 acres requiring preparation for remediation, mostly through disturbances of forested vegetation. As access to implement remedial approaches for CMD is more limited than Alternative 2, it would have a lower potential to negatively impact vegetation. **Wildlife and Aquatic Species** – Impacts would be associated with up to approximately 13 sites of the 25 sites from Alternative 2, including 5.2 mi of access to the 5 site specific sites, and approximately 22 stream crossings. Potential negative impacts from remediation activities could decrease the viability of populations as a result of construction and O&M activities from temporary displacement, decreased production, or increased stress and mortality. However, this alternative would have the potential to significantly reduce the adverse impacts of CMD in local streams and to have measurable improvements, particularly for aquatic species, though the potential would be lower than Alternative 2 due to inaccessible sites. This reduction in both construction impacts and O&M required due to inaccessibility would result in fewer impacts to wildlife and aquatic species from CMD remediation efforts. **Special Status Species and Habitat Areas** – Impacts would be similar to those described for vegetation, wildlife and aquatic species from access and remedial site construction and O&M. As under Alternative 2, programmatic methodologies coordinated with USFWS would be adopted. Improvement of water quality from CMD remedial approaches could have measurable benefits for special status fish and mussel species. However, the potential for improvements would be lower than Alternative 2, due to number of sites inaccessible for remediation. Impacts to listed bats and associated habitat would be less than Alternative 2, due to less tree cutting and clearing, and/or habitat loss. **Cumulative Impacts** – Similar to Alternative 2, Alternative 3 will contribute to the reduction of CMD long-term, contributing measurable improvements to the overall cumulative impacts on biological resources. Minimal adverse cumulative impacts would be expected.	**Vegetation** – Implementation of Alternative 4 would include access improvements of up to approximately 10 sites of the 25 sites from Alternative 2, including 4.6 mi of access to 4 of the 8 site specific sites, and up to 62 acres requiring preparation for remediation, mostly through disturbances of forested vegetation. As access to implement remedial approaches for CMD is minimal under Alternative 4, it would have the lowest potential to negatively impact vegetation among the action alternatives. **Wildlife and Aquatic Species** – Impacts would be associated with up to approximately 10 sites of the 25 sites from Alternative 2, including 4.6 mi of access to 4 of the 8 site specific sites, and approximately 18 stream crossings. Potential negative impacts from remediation activities could decrease the viability of populations as a result of construction and O&M activities from temporary displacement, decreased production, or increased stress and mortality. This alternative would have the lowest potential of the action alternatives to significantly reduce the adverse impacts of CMD in local streams and to potentially have measurable improvements, particularly for aquatic species though the potential would be lower than Alternative 3 due to inaccessible sites. This reduction in both construction impacts and O&M required due to inaccessibility would result in fewer impacts to wildlife and aquatic species from CMD remediation efforts. **Special Status Species and Habitat Areas** – Impacts would be similar to wildlife and aquatic species impacts from access and remedial site construction and O&M. As under Alternative 2, programmatic methodologies coordinated with USFWS would be adopted. Improvement of water quality from CMD remedial approaches could have measurable benefits for special status fish and mussel species. However, the potential for improvements would be the lowest among the action alternatives, due to the fewest number of sites accessible for remediation. Impacts to listed bats would be the least among the action alternatives, due to less tree cutting and clearing. **Cumulative Impacts** – Alternative 4 would contribute to the reduction of CMD long-term, but may not contribute measurable improvements to the overall cumulative impacts on biological resources

Impact Topic	Alternative 1: No Remediation	Alternative 2: Full Access	Alternative 3: Moderate Access	Alternative 4: Minimal Access
		Hollow, Worley West and Blue Heron West (across the Big South Fork River from Blue Heron). In addition to BMPs, depending on the actual location of a project site and the access to the area, conditions for protection and future monitoring of riparian habitats and known element occurrences of listed plant species may be required. A programmatic methodology would be coordinated with USFWS to address potential protected species at CMD sites, which would include species surveys prior to land-disturbing activities. Improvement of water quality from CMD remedial approaches could have measurable benefits for special status fish and mussel species. Implementation of remedial approaches could provide new habitat to aid the recovery of special status species. Because the access to implement remedial approaches for CMD is greatest under Alternative 2, it would have the largest potential for lasting improvements to special status aquatic species. **Cumulative Impacts** – Alternative 2 would contribute to the reduction of CMD long-term, contributing measurable improvements to the overall cumulative impacts on biological resources. Minimal adverse cumulative impacts would be expected.		
Cultural Resources	**Cultural Resources** – Current area use would remain unchanged, and archeological resources, historic structures, cultural landscapes, and ethnographic resources would continue in their current state. Potential impacts are expected to be negligible. However, CMD would continue to impact former mining areas, which could affect potential cultural resources and values. Potential impacts to cultural resources may be reduced due to inactivity associated with clearing roads, removing spoils and remedial approach construction. **Cumulative Impacts** – Alternative 1 would contribute to continual impacts from CMD long-term, but would contribute minimally to overall cumulative impacts.	**Cultural Resources** – Cultural resources are known to occur in areas associated with mining, but areas would need to be surveyed on a case-by-case basis prior to any remediation design or implementation. Disturbances that would occur from access and implementation would largely be located in previously disturbed areas, and some of these areas could be associated with cultural resources associated with the previous mining or occupation of Big South Fork NRRA. All of the known historic structures are visible, and disturbance would be avoided and/or minimized during construction activities associated with access and remedial approach implementation Undocumented cultural resources associated with mine works and tram ways would be evaluated by completing site specific archeological surveys. As such, impacts are expected to be negligible. In addition, this alternative would have the highest potential to reduce the adverse impacts of CMD in former mining areas, which could benefit potential	**Cultural Resources** – As under Alternative 2, disturbances that would occur from access and implementation would largely be located in previously disturbed areas. Impacts are expected to be negligible and at a lower magnitude than Alternative 2 because fewer sites would be addressed, resulting in fewer potential negative impacts to cultural resources. **Cumulative Impacts** – Same as Alternative 2.	**Cultural Resources** – As under Alternatives 2 and 3, disturbances that would occur from access and implementation would largely be located in previously disturbed areas. Impacts are expected to be negligible and would be the lowest among the action alternatives, due to the fewest sites accessible for remediation, and thus the fewest potential negative impacts to cultural resources. **Cumulative Impacts** – Same as Alternative 2 and 3.

Impact Topic	Alternative 1: No Remediation	Alternative 2: Full Access	Alternative 3: Moderate Access	Alternative 4: Minimal Access
		cultural resources and values. **Cumulative Impacts** – Alternative 2 could have long-term improvements and impacts to localized cultural resources, but would contribute minimally to overall cumulative impacts or benefits.		
Visitor Use and Experience	**Visitor Use** – Current area use would remain unchanged. Visitor use resources impacted by the unaesthetic nature of CMD sites would continue. Beneficial effects could occur under the No Action alternative. Some visitors would not normally notice impacts from CMD, but they may not want to see construction zones in the park. Visitors would not have their backcountry experiences disturbed by construction or O&M activities. **Special Management Areas** – Current area use would remain unchanged. SMAs impacted by CMD would continue to be impacted, resulting in long-term adverse impacts. **Cumulative Impacts** – Alternative 1 would directly impact a localized area and would contribute to continual impacts from CMD long-term, but would contribute minimally to overall cumulative impacts.	**Visitor Use** – Visitor trail use could be impacted at some or all of approximately 25 CMD sites; in particular, 5 of the 17 programmatic sites are located near the Kentucky Trail, and 11 of the 17 sites are located near a hiking or horse trail, and portions would likely be utilized for site access and subject to temporary closures. In addition, visitor experience could be impacted temporarily by increased traffic, noise, dust, odors, night lighting, and human activity during construction and O&M. Recreational adverse impacts on visitor experience from Alternative 2 would be the greatest among the action alternatives, especially for backcountry visitors. In addition, negative impacts could occur to visitors expecting a remote backcountry experience if new access roads are constructed, and areas are cleared (though previously disturbed, some sites may be revegetated and may currently appear natural and undisturbed to some visitors). Although access will be regulated by the NPS, routes suitable for vehicular access will lead to increased law enforcement requirements due to illegal access use. Remediation of CMD sites would have an ongoing benefit on visitor use and experience due to the treatment of abandoned mines and additional land and waters becoming available to various visitor uses and greater aquatic biodiversity. As Alternative 2 provides access to the largest amount of sites for remediation, it has the highest potential to adversely or beneficially impact visitor use among the action alternatives. **Special Management Areas** – Geomorphic feature SMAs would be avoided as much as possible, and access in the close vicinity of these SMAs would utilize existing roads and trails. Visitor experience and trail SMAs could be impacted, as trail access would be temporarily limited, along with increased noise and visual impacts from remedial approach implementation. It is assumed that few visitors would be affected by restricting access temporarily, and current visitor use and	**Visitor Use** – Visitor trail use could be limited; however, due to the more restrictive means of access, up to approximately 13 of the 25 sites from Alternative 2 could be accessible. In return, fewer trails would likely be subject to closure and visitor experience could be impacted temporarily by lessened increase of traffic, noise, dust, odors, night lighting, and human activity during construction and O&M. Recreational impacts on visitor experience would be less than those of Alternative 2. Visitor experience would change slightly due to widening of some trails to accommodate vehicles and increased access could disrupt users expecting a remote backcountry experience. Remediation of CMD sites would have an ongoing benefit on visitor use and experience due to the treatment of abandoned mines and additional land and waters becoming available to various visitor uses and greater aquatic biodiversity. As Alternative 3 provides less access for remediation, it has a lower potential to adversely or beneficially impact visitor use than Alternative 2. **Special Management Areas** – The type of impacts from implementation of Alternative 3 would be similar to those under Alternative 2, but at fewer CMD sites. As Alternative 3 provides less access to sites for remediation, it has a lower potential to temporary impact and provide long-term benefits to visitor experience and trails SMAs; impacts to geomorphic feature and cultural landscape SMAs are expected to be minimal. **Cumulative Impacts –** Same as Alternative 2.	**Visitor Use** –Visitor trail use could be limited; however, due to the most restrictive means of access, up to approximately 10 of the 25 sites from Alternative 2 could be accessible. In return, fewer trails would likely be subject to closure and visitor experience could be impacted temporarily by lessened increase of traffic, noise, dust, odors, night lighting, and human activity during construction and infrequent O&M. Recreational impacts to visitor experience are expected to be minimal and would be the lowest among the action alternatives. Remediation of CMD sites would have an ongoing benefit on visitor use and experience due to the treatment of abandoned mines and additional land and waters becoming available to various visitor uses. As Alternative 4 provides the least access for remediation, it has the lowest potential to adversely or beneficially impact visitor experience or improve recreational benefits associated with aquatic diversity. **Special Management Areas** – The type of impacts from implementation of Alternative 4 would be similar to those under Alternative 2, but at fewer CMD sites. As Alternative 4 provides the most limited access to sites for remediation, it has the lowest potential for temporary impacts and to provide long-term benefits to visitor experience and trails SMAs; impacts to geomorphic feature and cultural landscape SMAs are expected to be minimal. **Cumulative Impacts** – Similar to Alternative 2 and 3, though the potential to contribute to overall cumulative benefits may be negligible.

Impact Topic	Alternative 1: No Remediation	Alternative 2: Full Access	Alternative 3: Moderate Access	Alternative 4: Minimal Access
		experience would remain relatively unchanged. Cultural landscape SMAs are protected under regulation and/or NPS management policies and would be avoided as much as possible by all action alternatives, though these SMAs could be impacted by potential and temporary noise and visual impacts from construction and O&M. As Alternative 2 provides access to the largest amount of sites for remediation, it has the highest potential to temporarily impact and provide long-term benefits to visitor experience and trails SMAs; impacts to geomorphic feature and cultural landscape SMAs are expected to be minimal. **Cumulative Impacts** - Alternative 2 would contribute to localized long-term improvements and short-term temporary impacts to visitor use and experience, and could contribute to overall cumulative benefits.		
Soundscapes and the Acoustic Environment	**Soundscapes and the Acoustic Environment** – Current area use would remain unchanged under Alternative 1, and operations within Big South Fork NRRA would continue under current conditions. Implementation of the alternative would have no effect to local soundscapes. **Cumulative Impacts** – The impacts of the cumulative actions would result in short- and long-term cumulative impacts to localized natural soundscapes.	**Soundscapes and the Acoustic Environment** – Impacts would be associated with up to approximately 25 sites, including short-term impacts from increased noise from construction vehicles, chainsaws, earthmoving equipment, etc. The long-term operation of CMD sites would not materially affect the local soundscapes. Operation of any active equipment at CMD sites, such as mechanical dosers, would result in infrequent noise impacts. O&M impacts would be similar to those described for construction but would tend to be shorter in duration. Some changes in the soundscape as a result of implementation could be expected, but these changes would be minimal. These activities would not materially affect local noise levels within the surrounding community. **Cumulative Impacts** – Alternative 2 would have localized short-term impacts to soundscapes, but would contribute minimally to overall cumulative impacts to soundscapes.	**Soundscapes and the Acoustic Environment** – Impacts would be associated with up to approximately 13 sites of the 25 sites from Alternative 2, including short-term impacts from increased noise from construction vehicles, chainsaws, earthmoving equipment, etc. The long-term operation of CMD sites would not materially affect the local soundscapes, and operation of any active equipment at CMD sites would result in infrequent noise impacts. As Alternative 3 provides less access for remediation, it has a lower potential for short-term impacts to soundscapes than Alternative 2. **Cumulative Impacts –** Same as Alternative 2.	**Soundscapes and the Acoustic Environment** – Impacts would be associated with up to approximately 10 sites of the 25 sites from Alternative 2, including short-term impacts from increased noise from construction vehicles, chainsaws, earthmoving equipment, etc. The long-term operation of CMD sites would not materially affect the local soundscapes, and operation of any active equipment at CMD sites would result in infrequent noise impacts. As Alternative 4 provides the least access for remediation, it has the lowest potential for short-term impacts to soundscapes among the action alternatives. **Cumulative Impacts** – Same as Alternative 2 and 3.

Table 3-1. Range of Water Quality Parameters (May 1996 to April 1997 and 2014) from the Eight Selected Remedial Sites.

Sample Site	Discharge (cfs)	pH (SU)	Alkalinity (mg/L, $CaCO_3$)	Acidity (mg/L, $CaCO_3$)	Total Iron (mg/L, Fe)	Sulfate (mg/L, SO_4^{-2})	Aluminum (mg/L, Al^{+3})
Water Quality Standards[1,2]	NA	6.0-9.0[1]	20[1]	NA	0.3[1]	250[1]	0.05-0.2[2]
Worley Mine #86	0.005-3.024	5.39-6.14	<20-70	<10-420	0.96-220	48-1700	<0.024-0.16
Worley Mine #88	0.036-0.248	5.28-5.48	<20-60	300-520	210-400	650-2400	0.39-0.72
Slavey Hollow	0.264-4.125	5.95-7.22	51-180	<10	5.3-16	260-520	<0.024-0.26
Nancy Grave	0.005-1.133	2.85-4.11	No Data	18-270	1.1-23	44-980	0.91-17
Devils Creek (mouth)	0.135-28	3.08-7.04	<20-24	ND-140	<0.022-16	<11-470	<0.024-3.2
Laurel Branch (mouth)	0.005-26.1	2.50-5.39	<20-20	<10-78	0.36-7.8	<11-160	0.08-5.6
Laurel Branch Spoils (seep)	0.03	2.52-4.90	No Data	300-1300	11-360	67-1600	11-89
Blair Creek (mouth)	0.033-20.40	3.00-5.81	<20	<10-170	0.64-20	<10-400	<0.024-8.2

Abbreviations:

cfs – cubic foot per second
SU – standard unit
mg/L – milligrams per liter
$CaCO_3$ - calcium carbonate
Fe – iron
SO_4^{-2} – sulfate
Al^{+3} - aluminum

Source: 401 KAR 10:031[1]; 401 KAR 8:026[2]; Gannett Fleming, Inc. 1998; NPS 2014b
Only the Laurel Branch and Laurel Branch Spoils sites were sampled by NPS in 2014.

Table 3-2. Percent cover of Ecosystem Units and associated community types occurring in Big South Fork NRRA.

Ecosystem Units Associated Communities	**Percent Cover in Big South Fork NRRA**
Allegheny-Cumberland Dry Oak Forest and Woodland	**36.9**
8521 - Mixed Oak / Heath Forest (Piedmont/Central Appalachian Low-elevation Type)	24.5
7119 - Appalachian Low-Elevation Mixed Pine/Hillside Blueberry Forest	9.5
8431 - Xeric Ridge Top Chestnut Oak Forest	2.9
8430 - Cumberland Plateau Dry-Mesic White Oak Forest	< 0.1
Southern Appalachian Low-Elevation Pine Forest	**25.6**
7493 - Southern Blue Ridge Escarpment Shortleaf Pine - Oak Forest	11.7
8427 - Appalachian Shortleaf Pine - Mesic Oak Forest	11.3
**2591 - Virginia Pine Successional Forest	1.5
Southern and Central Appalachian Cove Forest	**15.6**
8407 - Cumberland/ Appalachian Hemlock - Hardwood Cove Forest	10.7
7102 - Southern Appalachian Hemlock Forest (White Pine Type)	2.8
7100 - Southern Appalachian White Pine Forest	1.1
8412 - Piedmont Rich Cove/Mesic Slope Forest	1.1
South-Central Interior Mesophytic Forest	**11.5**
7698 - Rich Appalachian Red Oak/Sugar Maple Forest	3.8
7517 - Appalachian White Pine/Mesic Oak Forest	2.5
7881 - Central Interior Beech-White Oak Forest	2.0
2411 - Beech-Maple Unglaciated Forest	1.6
8428 - Southern Ridge and Valley Small Stream Hardwood Forest	1.4
**7879 - Walnut Successional Forest	< 0.1
Southern Ridge and Valley/Cumberland Dry Calcareous Forest	**6.0**
7240 - Ridge and Valley Dry-Mesic White Oak-Hickory Forest	5.8
4793 - Ridge and Valley Limestone Oak-Hickory Forest	0.1
**7124 - Red Cedar Successional Forest	0.1
South-Central Interior Small Stream and Riparian	**3.2**
7312 - River Birch Levee Forest	2.0
7340 - Sycamore - Sweetgum Swamp Forest	0.8
7143 - Montane Alluvial Forest (Small River Type)	0.4
**7330 - Successional Sweetgum Floodplain Forest	< 0.1
8474 - Southeastern Smooth Alder Swamp	< 0.1
Semi-natural/Altered Vegetation and Conifer Plantations	**0.8**
**7221 - Tulip Tree Successional	0.5
**7944 - White Pine Successional Forest	0.2

Ecosystem Units Associated Communities	**Percent Cover in Big South Fork NRRA**
**7220 - Successional Tuliptree Forest (Circumneutral Type)	< 0.1
**7216 - Sweetgum Successional Forest	< 0.1
Successional Shrubland	**0.6**
**4732 - Blackberry - Greenbrier Successional Shrubland	0.6
Cumberland Sandstone Glade and Barrens	**0.6**
7707 - Little Bluestem - Broomsedge Grassland	0.5
8470 - Cumberland Sandstone Glade Heath Shrubland	0.1
4061 - Cumberland Plateau Clifftop Sandstone Barrens	NR
Cumberland Riverscour	**0.2**
8471 - Cumberland River Scour Prairie	0.2
3895 - Rocky Bar and Shore (Alder-Yellowroot Type)	NR
4331 - Rocky Bar and Shore (Riverweed Type)	NR
4286 - Water-willow Rocky Bar and Shore	NR
7312 - River Birch Levee Forest	NR
Successional or Exotic Species Dominated Herbaceous Vegetation	**0.1**
**4048 - Cultivated meadow	0.1
**4404 - Successional Broomsedge Vegetation	< 0.1
Central Interior Highlands and Appalachian Sinkhole and Depression Pond	**NA**
4527 - Watershield Pond	NR
3866 - Southern Woolgrass Bulrush Marsh	NR
Cumberland Seepage Forest	**NA**
7443 - Appalachian Forested Acidic Seep	NR
3737 - Cumberland Open Acidic Seep	NR
Cumberland Acidic Cliff and Rockhouse	**NA**
4301 - Cumberland Plateau Rockhouse	NR
8432 - Cumberland Plateau Wet Sandstone Cliff	NR
4392 - Cumberland Plateau Sandstone Cliff (Dry Type)	NR

Abbreviations:

** – indicates human-modified, successional, or exotic species dominated communities

NR – refers to not represented, or community types which have been documented in the Recreation Area, but were not captured in NatureServe when the vegetation coverage was created.

NA – not applicable, due to associated communities that are designated as NR.

Table 3-3. Federally Listed Species of the Big South Fork National River and Recreation Area.

Common Name	Scientific Name	Federal Status	USFWS List	NPS List	Comments
Mussels					
Cumberland elktoe	*Alasmidonta atropurpea*	E	X	X	
Cumberlandian combshell	*Epioblasma brevidens*	E	X	X	Augmented, 2015
Cumberland bean	*Villosa trabalis*	E	X	X	
Little-wing pearlymussel	*Pegias fabula*	E	X	X	Augmented, 2015
Tan riffleshell	*Epioblasma florentina walker*	E	X	X	Augmented, 2015
Dromeday pearlymussel	*Dromus dromas*	E		X	Reintroduced, 2008
Oyster mussel	*Epioblasma capsaeformis*	E		X	Augmented, 2008
Spectaclecase	*Cumberlandia monodonta*	C		X	Reintroduced, 2008
Pink mucket	*Lampsilis orbiculata*	E		X	Reintroduced, 2010
Clubshell	*Pleurobema clava*	E		X	
Fluted kidneyshell	*Ptychobranchus subtentum*	E		X	Augmented, 2008
Fish					
Duskytail darter	*Etheostoma percnurum*	E	X	X	See tuxedo darter[1]
Tuxedo darter	*Etheostoma lemniscatum*	E	X	X	See duskytail darter[1]
Blackside dace	*Phoxinus cumberlandensis*	T		X	
Palezone shiner	*Notropis albizonatus*	E		X	Found, 2008
Mammals					
Gray bat	*Myotis grisescens*	E		X	
Northern long-eared bat	*Myotis septentrionalis*	T		X	
Indiana bat	*Myotis sodalis*	E		X	
Plants					
Cumberland sandwort	*Minuartia cumberlandensis*	E	X	X	
Virginia spirea	*Spirea virginiana*	E	X	X	
Cumberland rosemary	*Conradina verticillata*	T	X	X	
White fringeless orchid	*Platanthera integrilabia*	PT		X	

Source: NPS 2012a.

[1]The Big South Fork River duskytail darter is one of four duskytail darter populations listed in the 1993 recovery plan; however, researchers have subsequently determined that the Big South Fork River population is a distinct species, the tuxedo darter. See the species description below for additional information.

Table 3-4. Annual Visitation at Big South Fork National River and Recreation Area.

Year	Annual Visitation	% Change
2015	643,135	7.2
2014	599,906	6.2
2013	565,063	-5.8
2012	600,161	-1.1
2011	606,579	-7.6
2010	656,374	-4.4
2009	686,747	1.6
2008	675,928	7.8
2007	626,751	0.6
2006	622,807	−10.9
2005	699,230	0.4
2004	696,114	−7.4
2003	752,140	−11.8
2002	852,873	−6.9
2001	916,548	6.1
2000	864,200	---

Source: NPS 2016b

Table 4-1. Cumulative Impact Scenario.

Impact Topic	Area of Analysis	Past*	Present	Future*
Topography and Soils	Big South Fork NRRA	• Abandoned mines (CMD, landslides) • Old logging and agricultural operations • Abandoned well sites and oil and gas access roads • Construction, use, and maintenance of dirt roads and oil and gas wellpads; leaks and spills of contaminating and hazardous substances from oil and gas development; and blowouts during drilling in and adjacent to park • Plugging and reclamation of oil and gas wells in the park • Park maintenance activities including installation and maintenance of roads, trails, and developed sites • Park prescribed-fire program • Visitor uses such as climbing, ORV use, horseback riding, and mountain biking • Logging and timber harvesting • Coal mining • Agricultural activities • Local planning efforts to promote growth • Commercial and/or residential development • Development, use, and maintenance of county and state roads	Same as past	Same as past, plus: • Surface reclamation of past coal mining activities
Water Resources	Big South Fork River Watershed	• Abandoned mines (CMD) • Old logging and agricultural operations • Erosion from abandoned well sites and oil and gas access roads • Construction, use, and maintenance of dirt roads and oil and gas wellpads; leaks and spills of contaminating and hazardous substances from oil and gas development; and blowouts during drilling in and adjacent to park • Oil and Gas development within and adjacent to the park • Plugging and reclamation of oil and gas wells in the park • Park maintenance activities including installation and maintenance of roads, trails, and developed sites • Park prescribed-fire program • Visitor uses such as ORV use, kayaking, canoeing, boating, fishing, and swimming • Coal mining • Agricultural activities • Park, commercial, and/or residential development and maintenance • Local planning efforts to promote growth • Trail maintenance • Equestrian activities • Industrial discharges • Nonpoint source runoff from industrial and construction sites, roads • Municipal, industrial, and/or park water use and treatment • Impoundments • Septic tanks • Herbicide use • Insect invasions—pine bark beetle, death of vegetation and resultant changes in water temperature and other chemistry • Municipal, industrial, and/or park water use and treatment, including withdrawals for local utility districts (Oneida, Jamestown)	Same as past, plus: o Potential for coal bed methane/shale gas development and withdrawal or disposal of produced water o Logging and timber harvesting • Hemlock woolly adelgid, emerald ash borer	Same as past, plus: o Potential for coal bed methane/shale gas development and withdrawal or disposal of produced water • Development and implementation of water quality standards per 303(d) program o Logging and timber harvesting o Water withdrawals • Surface reclamation of past coal mining activities
Biological Resources	Big South Fork NRRA and up to a 5-mile perimeter	• Abandoned mines (CMD) • Old logging, including clear-cutting, and agricultural operations • Habitat loss and fragmentation • Infestations: pine bark beetle	Same as past, except: • Overhunting Plus: • Hunting	Same as past, except: • Overhunting Plus:

Impact Topic	Area of Analysis	Past*	Present	Future*
		• Overhunting/poaching • Introduction of exotic species, including wildlife • Construction, use, and maintenance of dirt roads and oil and gas wellpads; leaks and spills of contaminating and hazardous substances from oil and gas development; and blowouts during drilling in and adjacent to park • Plugging and reclamation of oil and gas wells • Park maintenance activities including installation and maintenance of roads, trails, and developed sites • Park prescribed-fire program • Visitor uses such as ORV use, kayaking, canoeing, boating, fishing, swimming, horseback riding, and mountain biking • Coal mining • Agricultural activities • Park, commercial, and/or residential development • Local planning efforts to promote growth • Exotic species control in park • Hunting and trapping • Vehicle–wildlife collisions • Harassment • Reintroduction of native wildlife: deer (1950s–1960s), river otters (1980s), turkey (1970s–1980s), and bear and elk (1990s); introduction of non-native species: hogs (1980s) and trout (1970s) • Reintroduction of mussels (in the park) • Fish stocking (outside) • Fields management • Trail maintenance • Equestrian activities • Industrial discharges • Nonpoint source runoff from industrial and construction sites, roads • Impoundments • Motorboat use downstream • Septic tanks • Herbicide use	o New commercial and industrial developments • Development of new residential and second-home communities o Potential for coal bed methane/shale gas development and withdrawal or disposal of water o Logging and timber harvesting • Hemlock woolly adelgid, emerald ash borer	• Wildlife management • Spread of exotics from adjacent lands • Replanting and surface reclamation of logging sites o Potential for coal bed methane/shale gas development and withdrawal or disposal of water o Logging and timber harvesting o Water withdrawals • Spread of exotics from adjacent lands • USFWS recovery plans for threatened and/or endangered species • Section 7(a)(1) of ESA park program • Surface reclamation of past coal mining activities
Cultural Resources	Big South Fork NRRA and adjacent lands	• Abandoned mines • Old logging and agricultural operations • Abandoned well sites and oil and gas access roads, providing unauthorized access to cultural resources • Leaks and spills of contaminating and hazardous substances from past oil and gas development in and adjacent to park • Vandalism • Cemetery management • Fields management • Drilling and production operations within and outside the park that are in close proximity to cultural landscapes and cultural sites • Earth-moving activities associated with construction and maintenance of dirt roads and oil and gas wellpads; leaks and spills of contaminating and hazardous substances from oil and gas development; and blowouts during drilling in and adjacent to park • Park maintenance activities including installation and maintenance of roads, trails, developed sites, cultural structures/landscapes	Same as past	Same as past, plus: • Surface reclamation of past coal mining activities

Impact Topic	Area of Analysis	Past*	Present	Future*
		• Park prescribed-fire program • Visitor uses such as ORV use, horseback riding, and mountain biking • Logging and timber harvesting • Coal mining • Agricultural activities • Commercial and/or residential development • Local planning efforts to promote growth		
Socioeconomics	Big South Fork NRRA and adjacent communities	• Abandoned mines (CMD) • Logging and timber harvesting, including clear-cutting, and agricultural operations • Infestations: pine bark beetle • Overhunting/poaching • Construction, use, and maintenance of dirt roads and oil and gas wellpads • Plugging and reclamation of oil and gas wells • Park maintenance activities including installation and maintenance of roads, trails, and developed sites • Visitor uses such as ORV use, kayaking, canoeing, boating, fishing, swimming, horseback riding, and mountain biking • Coal mining • Agricultural activities • Park, commercial, and/or residential development • Local planning efforts to promote growth • Hunting and trapping • Equestrian activities • Impoundments • Motorboat use downstream • Big South Fork Scenic Railway	Same as past, except: • Overhunting Plus: o New commercial and industrial developments o Development of new residential and second-home communities o Potential for coal bed methane/shale gas development and withdrawal • Hemlock woolly adelgid, emerald ash borer	Same as past, except: • Overhunting Plus: • Replanting and surface reclamation of logging sites o Potential for coal bed methane/shale gas development and withdrawal or disposal of water o Water withdrawals • Surface reclamation of past coal mining activities
Visitor Use and Experience	Big South Fork NRRA and a 1,500-foot setback outside the park	• Abandoned mines (CMD) • Old logging and agricultural operations • The presence of abandoned well sites and oil and gas access roads, resulting in conditions that may adversely affect visitor use and experience, human health and safety, and recreation • Construction and maintenance of dirt roads and oil and gas wellpads; leaks and spills of contaminating and hazardous substances from oil and gas development; and blowouts during drilling in and adjacent to park • Oil and gas developments in proximity to recreational sites, • Park maintenance activities including installation and maintenance of roads, trails, and developed sites • Plugging and reclamation of oil and gas wells • Park prescribed-fire program • Visitor uses such as ORV and equestrian use • Coal mining • Agricultural activities • Commercial, industrial, and/or residential development • Hunting, trapping, and fishing • Big South Fork Scenic Railway	Same as past, plus: o Development of new residential and second-home communities.	Same as past, plus: o Development of new residential and second-home communities. • Surface reclamation of past coal mining activities

Impact Topic	Area of Analysis	Past*	Present	Future*
Soundscapes	The park units and a 1,500-foot setback outside the park units	• Construction, use, and maintenance of new and existing dirt roads within and near the park • Vehicular traffic including ORV use, gravel hauling within and near the park • Oil and gas operations within and in close proximity to the park • Park maintenance activities • Visitor uses such as hunting • Logging and timber harvesting • Industrial activities (sawmill operation) • Coal mining • Agricultural activities • New commercial and industrial developments	Same as past, plus: o Development of new residential and second-home communities.	Same as past, plus: o Development of new residential and second-home communities. • Surface reclamation of past coal mining activities

*The temporal boundary for cumulative impacts extends from the late 1800s (when coal mining activity began to increase in the park) to 10 to 30 years in the future (life of the plan). ESA = Endangered Species Act; GMP = general management plan; ORV = off-road vehicle; USFWS = U.S. Fish and Wildlife Service.

- Activities that occur/would occur in the park

o Activities that occur/would occur primarily outside the park

Table 4-2. Equipment Noise Level Predictions (dBA).

Distance from Source (ft)	Grader/Bulldozer/ Chainsaw	Dump Truck	Front-End Loader	Concrete Mixer Trucks	Diesel Truck
50	85	84	80	82	88
100	79	78	74	76	82
200	73	72	68	70	76
400	67	66	62	64	70
800	61	60	56	58	64
1,600	55	54	50	52	58
3,200	49	48	44	46	52
6,400	43	42	38	40	46
12,800	37	36	32	34	40
25,600	31	30	26	28	34

Notes:
Equipment noise levels represent specification values for a reference distance of 50 ft from the equipment source. Predicted noise levels beyond 50 ft from the source were estimated, assuming a 6 dBA per doubling of distance drop-off rate (NPS 2012a)

Equipment noise levels at the distances shown in this table will vary based on additional attenuation measures, including vegetation, topography, and climate conditions.

Table 5-1. List of EIS Preparers and Consultants.

Name	Title and Organization
NPS Environmental Quality Division	
Michael B. Edwards	Project Manager
Joe Neubauer	Project Manager (former)
Cheryl Eckhardt	Project Manager (former)
NPS Big South Fork NRRA	
Tom Blount	Chief of Resource Management/Park Project Manager
Chad Harrold	GIS Specialist/Geologist/Data Manager
Niki Stephanie Nicholas	Superintendent
Rebecca Schapansky	Resource Management Specialist
Tim Smith	Archeologist/Cultural Resource Specialist
Etta Spradlin	Environmental Protection Specialist/NEPA
NPS Southeast Region	
Jami Hammond	Southeast NEPA Regional Compliance Specialist
NPS Water Resources Division	
Pete Penoyer	Hydrologist/Hydrogeologist
Steve Rice	Geohydrologist
Gary Rosenlieb	Chief Aquatic Manager/hydrologist
NPS Geological Resources Division	
John Burghardt	Abandoned Mineral Lands and Mining Claim Validity Coordinator
Wood Environment & Infrastructure Solutions, Inc.	
Robin Blackstone	Environmental Scientist
Jonathan Bourdeau	Senior Scientist
Emmet Brown	Project Manager (former)
Todd Cloud	Associate Scientist
Jim Feild	Project Manager
K. Paul Haywood	Senior Scientist
Tim Nichols	Senior Scientist
Rani Parks	Project Scientist
Cody Simpson	GIS Specialist
Luke Williams	Senior Engineer

APPENDIX C
PHOTOGRAPHIC LOG

Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment
Programmatic and Site Specific EIS

Photographic Log

Park:
Big South Fork NRRA

Location:
Worley #86

Project:
CMD EIS

Photo No.:
1

Description:
View of a mine adit and CMD discharge at Worley #86 that flow into a wetland area.

Park:
Big South Fork NRRA

Location:
Worley #86

Project:
CMD EIS

Photo No.:
2

Description:
View of CMD wetland area at Worley #86 flowing into Worley Branch.

Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment
Programmatic and Site Specific EIS

Photographic Log

Park: Big South Fork NRRA
Location: Worley #88
Project: CMD EIS
Photo No.: 3
Description: View of a mine adit gated with a bat gate, and CMD discharge at Worley #88 through a weir.

Park: Big South Fork NRRA
Location: Worley #88
Project: CMD EIS
Photo No.: 4
Description: View of CMD-impacted stream that receives flow from Worley #88.

Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment
Programmatic and Site Specific EIS

Photographic Log

Park:
Big South Fork NRRA

Location:
Laurel Branch Spoils

Project:
CMD EIS

Photo No.:
5

Description:
View of Laurel Branch flowing through steep spoils at the Laurel Branch Spoils site.

Park:
Big South Fork NRRA

Location:
Laurel Branch

Project:
CMD EIS

Photo No.:
6

Description:
View of CMD-impacted portion of Laurel Branch downstream of the Laurel Branch Spoils site and upstream of the Laurel Branch Confluence site.

Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment
Programmatic and Site Specific EIS

Photographic Log

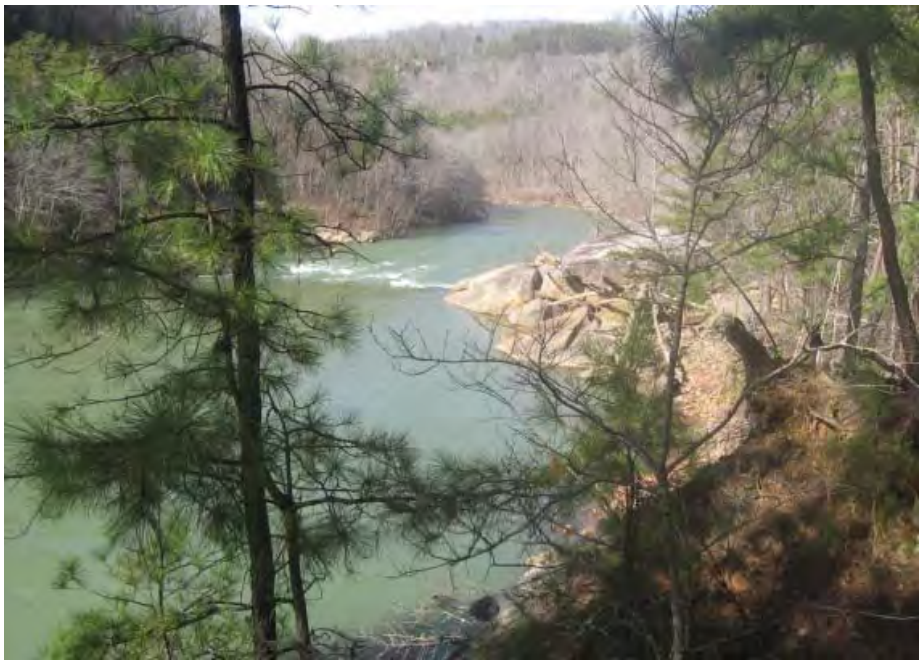
Park:
Big South Fork NRRA

Location:
Laurel Branch Confluence

Project:
CMD EIS

Photo No.:
7

Description:
View of upslope of spoils piles, including a mix of partially pyrolyzed material and loose material along the Big South Fork River.



Park:
Big South Fork NRRA

Location:
Laurel Branch Confluence

Project:
CMD EIS

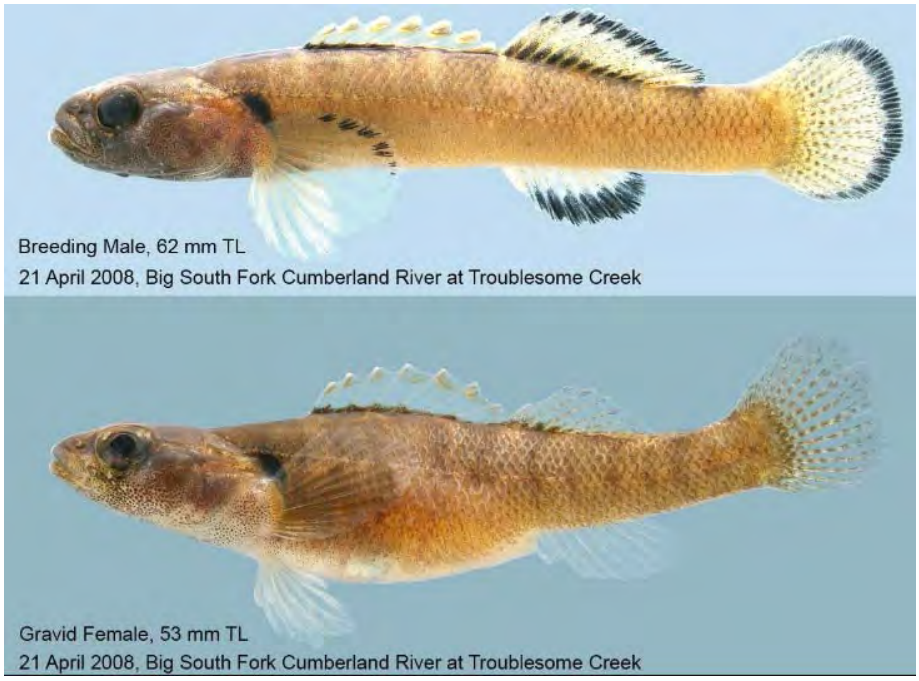
Photo No.:
8

Description:
View downslope of partially vegetated spoil piles, including the steep bank down to the Big South Fork River.

Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment
Programmatic and Site Specific EIS

Photographic Log



Park: Big South Fork NRRA
Location: Big South Fork River
Project: CMD EIS
Photo No.: 9
Description: Tuxedo darters (*Etheostoma lemniscatum*) surveyed in the Big South Fork River in 2008 at Troublesome Creek, formerly classified as the duskytail darter (*Etheostoma percnurum*). Source: Conservation Fisheries

Park: Big South Fork NRRA
Location: Big South Fork River
Project: CMD EIS
Photo No.: 10
Description: Cumberlandian combshell (*Epioblasma brevidens*) known to occur within the Big South Fork NRRA; existing populations were augmented in 2015 by releasing propagated individuals. Source: Gary Peeples, USFWS

Big South Fork National River and Recreation Area

Contaminated Mine Drainage Mitigation and Treatment
Programmatic and Site Specific EIS

Photographic Log

Park:
Big South Fork NRRA

Location:
Blue Heron

Project:
CMD EIS

Photo No.:
11

Description:
View of the tipple house and coal yard at Blue Heron, which processed coal from mines on both sides of the Big South Fork River, some of which now represent selected and programmatic CMD sites.

Park:
Big South Fork NRRA

Location:
Twin Arch Trail

Project:
CMD EIS

Photo No.:
12

Description:
South Twin Arch, an example of a Sensitive Geomorphic Feature SMA within Big South Fork NRRA.

APPENDIX D
TYPES OF CMD REMEDIAL APPROACHES

TYPES OF CMD REMEDIAL APPROACHES

There are three primary remedial approaches that have been developed to treat CMD: active treatment, passive treatment, and source control. Active and passive treatment systems can include constructed wetland cells, the addition of chemicals to the water, or methods to raise the pH of the water which aids the precipitation of the potentially harmful contaminants out of the water column, while source control separates the elements (air, water, and metal and non-metal constituents) that produce CMD (Table 2-1 and 2-2).

Active Treatment System

Active treatment systems improve water quality using chemicals to treat CMD. Chemicals used in active treatment systems include calcium carbonate (limestone), calcium hydroxide (hydrated lime), sodium carbonate (soda ash), and sodium hydroxide (caustic soda) (Gannett Fleming, Inc. 1998). The size and complexity of active systems, and the chemicals used to treat CMD are influenced by initial water quality, desired or required water quality, site topography, and costs associated with O&M.

Active treatment systems can be categorized by two basic types: fixed plant treatment systems, and in situ treatment systems. Fixed plant systems involve the construction of an active treatment plant that receives the CMD and treats the water using a dosing system that mixes dry powder or liquid chemicals with CMD. These plants involve high construction costs and involve a multi-component process to neutralize the CMD, and are typically used for active mining sites (Watzlaf *et al.* 2004). As such, fixed plants may not be applicable or appropriate for CMD remediation at Big South Fork NRRA.

In situ active treatment systems involve the use of mixers, mechanical dosers, or settling basins placed at the discharge point, where chemicals are continually dispersed directly into the CMD. As an example, an in-stream alkaline treatment is an in situ method which uses crushed limestone aggregate stored in dosers that dispenses the limestone directly into a contaminated stream. The limestone aggregate is added to the stream to produce slurry that neutralizes acidity (balancing the pH) but does not remove CMD contaminants (Gannett Fleming, Inc. 1998).

Active treatment systems generally require frequent O&M. O&M may involve weekly or bi-weekly recharging of the chemical dosers and periodic dredging of the settling ponds. The majority of chemical dosers require electricity; however, manual dosers can be used in places where external power sources are unavailable. Manual dosers that use water flow to dispense chemicals have been used to treat CMD, but need a minimum flow rate of at least 0.1 cubic foot per second (cfs) to continually operate. If water flow is below 0.1 cfs, then the doser fails to operate and treatment is not sustained (Gannett Fleming, Inc. 1998).

Passive Treatment System

Passive treatment systems use chemical, biological, and hydrological designs that can remove CMD contaminants and raise the pH in CMD (Gannett Fleming, Inc. 1998). This remedial approach successfully treats CMD at sites with a pH greater than 4.5, but has limitations at CMD sites with a pH of less than 4.5. Passive treatment systems were initially recognized as

viable treatment approaches by researchers from Wright State University and from West Virginia University. Researchers from these universities observed the interaction between CMD and natural wetlands, and observed as mine water flowed through the natural wetlands, the CMD contaminants decreased while pH levels increased. By the 1980s, several passive treatment systems had been developed to treat contaminated water produced at both metal and coal mining operations (Watzlaf *et al.* 2004).

Passive treatment systems typically consist of anoxic limestone drains (ALDs) and constructed wetland cells that function as natural filters. ALDs are ditches or drains that are lined with crushed limestone and sealed with plastic or some type of covering to create an anoxic (oxygen deficient) condition. As mine water drains through the ALD, the dissolution of limestone produces calcium and carbonate, which then combines with the free hydrogen ions (the source of low pH) to produce bicarbonate and increase the pH. ALDs can operate constantly as long as the water flow is adequate and periodic O&M activities are completed. Typically, the treated water would discharge into surface water such as a stream or river, or into a constructed wetland.

Constructed wetland cells are ecologically-based systems that can be engineered to maximize natural and chemical processes to raise pH and remove the load of potentially harmful contaminants from CMD. Constructed wetland cells include aerobic flow wetlands, anaerobic wetlands, and vertical wetlands, where CMD flow is by gravity through the wetland, or through the wetland from top to bottom, or bottom to top, respectively. As the CMD flows through the wetland, metals and other contaminants are filtered or precipitated out of the water and the water becomes less acidic (the pH rises). While passive treatment systems may require more area than active treatment systems for wetland cell construction, they are engineered to have a low O&M requirement, usually requiring dredging every 10 to 30 years.

Aerobic wetland cells are used when the CMD has a net pH greater than 7. Aerobic wetland cells are typically less than 30 centimeters in depth and have a large water surface. This large water surface allows oxidation and the precipitation of metals and other contaminants.

Anaerobic wetland cells are used when the CMD has a net a pH below 7. Alkalinity is produced by passing the mine water through organic substrates in a wetland cell that is typically one inch to a foot in depth. Anaerobic wetland cells are efficient in treating CMD that has a low pH and high iron content.

Source Control

Source control is a remedial approach that prevents or controls the initial creation of CMD by separating one or more of the three primary components of CMD (air, water, or pyritic materials) from coming into contact with each other; source control is the only remedial approach that prevents the generation of CMD. Other approaches treat CMD, but do not address the source, and therefore have long or unending operational lifespans.

Source controls can include the removal of spoil pile material, capping of spoil pile material, water source diversion from acid-producing materials and environments, and mine seals. Mine seals consist of the physical sealing of mine openings to prevent oxygen (air) from contacting

water and/or pyritic materials. Dry mine seals are constructed to prevent the passage of water and air into the mine. Dry seals are appropriate for the closure of vertical mine shafts where there is little to no potential that water flow would cause a failure in the dry seal or that CMD would simply discharge elsewhere. Wet seals are constructed to prevent the movement of air into the mine opening while still allowing the CMD to discharge from the mine opening. Source controls can have limited success in treating CMD if the separation of the CMD elements is not possible. For example, areas where the ground water seeps into abandoned mines would be difficult to treat with source controls because of the inability to separate spoil material from all of the seepage points.

APPENDIX E
GENERAL METHODOLOGY FOR ESTIMATING IMPACTS AND MEASURING EFFECTS BY RESOURCE

GENERAL METHODOLOGY FOR ESTIMATING IMPACTS AND MEASURING EFFECTS BY RESOURCE

The following elements were used in the general approach for estimating impacts and measuring the effects of the alternatives on each resource category:

- Analysis methods, including the context, intensity and duration of environmental effects,
- Assumptions used to formulate the specific methods used in this analysis,
- The impacts analysis method to determine the impact resulting from each alternative, and
- Methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting park resources.

These elements are described in the following sections.

ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines, the NPS NEPA Handbook and supplemental guidance, and Director's Order 12 procedures (NPS 2011, 2015d) and is based on the underlying goal of remediation to protect park resources. For each resource topic addressed in this chapter, the applicable analysis methods are discussed, including assumptions.

NPS IMPACTS ANALYSIS METHOD

The NPS NEPA Handbook directs that reviews must examine impacts in detail that alternatives under consideration would have on the human environment. This includes documentation that the NPS considered all foreseeable direct, indirect, and cumulative impacts, used sound science and best available information, and made a logical, rational connection between the facts presented and the conclusions drawn (NPS 2015d).

Analyzing impacts includes considering how the condition of a resource would change, either negatively or positively, as a result of implementing the alternatives. A written impact analysis, which focuses on significant issues, is included in the environmental consequences section, while organized by impact topic in parallel with the existing conditions section, for ease of comparing the current conditions and potential impacts related to specific resources. The impact analysis should:

- Describe the impacts that each of the alternatives under consideration would have on affected resources;
- Use quantitative data to the extent practicable;
- Discuss the importance of impacts through consideration of their context and intensity; and
- Provide a clear and rational link between the facts presented and the conclusions drawn (NPS 2015d).

Impact analysis must consider the potential direct, indirect, and cumulative impacts of actions, in addition to adverse and beneficial impacts. Subsequently, impact analysis should not combine adverse and beneficial impacts of a proposed action or alternative into a single, net impact. Instead, assessment of adverse and beneficial impacts should be separate, as an action may result in a significant adverse impact even though there may be an overall beneficial effect (NPS 2015d). If an impact to a resource from the action would be considered significant, the analysis will state that the impact level is significant; if it is not indicated that the impact is significant, the impact is not considered to reach the level of significance.

Differentiation of direct impacts from indirect impacts is not required; however, a distinct description of all impacts that could occur, whether direct or indirect impacts, should be included (NPS 2015d).

ASSUMPTIONS

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

Analysis Period

Goals, objectives, and specific implementation actions are needed to manage abandoned mines and associated CMD for the next 15 to 30 years or until conditions change and warrant an update. Some of the O&M requirements for wetland cells require a 10 to 30 year time frame. Therefore, for the purposes of the analysis, the life of the plan and period used for assessing impacts is for up to 30 years.

Geographic Area Evaluated for Impacts (Area of Analysis)

The geographic study area (or area of analysis) for this plan includes Big South Fork NRRA. The area of analysis may extend beyond the parks' boundaries for some cumulative impact assessments. The specific area of analysis for cumulative impacts is described in Table 4-1.

Duration and Type of Impacts

The following assumptions are used for all impact topics (the terms "impact" and "effect" are used interchangeably throughout this document):

- *Short-term impacts*: Impacts would occur from a few days to a few years, without lasting effects. Examples include impacts on native wildlife and visitors from O&M and construction activities.
- *Long-term impacts*: Impacts would last longer than a few years, with potentially permanent effects. Examples include the beneficial effects of CMD remediation and the long-term effects of creating access roads.
  NOTE: All impacts on archeological resources are considered long-term.
- *Direct impacts*: Direct impacts are impacts caused by an action/alternative and occur at the same time and place. For example, at a CMD remediation site that would involve the construction of a wetland treatment cell, construction activities might directly affect wildlife due to noise and vegetation clearing, and air quality through equipment-related exhaust emissions and production of fugitive dust. In

this EIS, direct impacts are those impacts occurring as a direct result of remediation actions.

- *Indirect impacts*: Indirect impacts are impacts that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. For example, consider the CMD wetland treatment cell above. A reasonably foreseeable consequence of taking the action might be a reduction in CMD reaching the Big South Fork River, resulting in a direct improvement in the water quality downstream from the cell, resulting in conditions that allow for the return of aquatic species. The resulting species colonization would represent an indirect impact. It would occur later in time and at a greater distance than the area of construction, but would nonetheless be a consequence of the proposal. In this EIS, indirect impacts are those that would occur from remediation actions and would occur later in time or farther in distance from the action.
- *Significant impacts*: If an impact is expected to be significant it will be stated as such; if no statement is made regarding significance then the impact is not considered to be significant.
- *Cumulative Impacts*. The CEQ regulations for implementing NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). As stated in the CEQ handbook, "Considering Cumulative Effects under the National Environmental Policy Act" (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful. Cumulative impacts are considered for all alternatives, including Alternative 1 (the no-action alternative). Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the park and, if applicable, the surrounding area. Table 4-1 summarizes these actions that could affect the various resources at the park.

Programmatic Sites

As mentioned previously, the eight sites selected for remediation in this EIS were chosen based upon available data; similarly, the number of programmatic sites was estimated based on the AML inventory survey and other available data. As such, the list of programmatic sites will likely remain flexible over the analysis period as additional investigations are completed, sites are dismissed, new sites are discovered, and new data becomes available. However, the 17 programmatic sites represent the current best estimate of the number of programmatic sites based on the data available during the development of this EIS.

It should be reiterated that the impact analysis for programmatic sites in this EIS is intended to provide a basis for a broad decision, and later, site-specific NEPA reviews would be conducted

on a per-site basis to provide compliance for implementing a remedial option; a stepwise approach to planning and compliance referred to as “tiering” (SEQ 1508.28; 46.140). As a result, the assessment of impacts will be broader for programmatic sites than for the 8 specific sites, with subsequent tiered documents containing a higher level of detail when a programmatic site turns into a specific site.

The access pathways for programmatic sites have not been determined. The estimated number of stream crossings presented for the following sections is based on the average number of stream crossings for the eight selected sites, of one to three streams per site. Similarly, the estimated footprint for programmatic remedial options is based on the average remedial footprint for the eight selected sites, 5 to 6 acres. These numbers represent rough estimates of potential impacts for the comparison of alternatives. Prior to implementation of a remedial option at a programmatic site, appropriate studies would be conducted to determine if access is possible under the selected alternative and the appropriate remedial option to address site conditions, which would accurately delineate the scope of impacts for a particular programmatic site.

Remedial Approach Selection

The remedial options selected for the eight sites in this EIS were chosen based upon available data and preliminary studies. Following the completion of this EIS and prior to the implementation of a remedial approach, additional study of a site (remedial determinations, sampling, planning, and design, as required) would be completed to confirm that the remedial approach outlined in this EIS is appropriate, or to develop the most appropriate alternate remedial approach for the site conditions.

Future Trends

Although there have been increases and decreases from year to year, from 2000 to 2014 an average of 694,761 people per year visited Big South Fork NRRA. Considering past visitation trends and a likely continued increase in visitation from local/regional areas within driving distance of the park, annual visitation over the life of the plan is expected to increase slightly, with some variation from year to year.

SMA Restrictions

In the impact analysis, restrictions due to SMAs are analyzed based on the setbacks and limitations described in Chapter 3 of this document. However, it is recognized that these setbacks are variable and are dependent upon the mitigation measures employed to protect resources, values, and human health and safety. As noted in Chapter 3, although specific setback distances are described for SMAs, they do not represent a strict prescription. The actual distances for setbacks may vary depending upon the specifics of individual projects and resources found at the sites and may be modified to be either increased or decreased from the figures presented.

The estimation of impacts associated with trails assumes that trails would be expanded to a 12-ft road bed, as defined for Class 6 (non-public) administrative roads in the GMP. Current

condition of horse trails are conservatively assumed to be 8 ft wide including tread and clearing, while hiking trails are conservatively assumed to be 4 ft wide including tread and clearing.

APPENDIX F
BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs)

Standard BMP measures for construction activities recommended by the Kentucky Department for Environmental Protection (KDEP) and TDEC (KDEP 2009; TDEC 2012) would be followed on all sites as applicable. Examples include, but are not limited to:

1. Preparation of a soil erosion and sedimentation (E&S) control plan for potential projects. This would involve preparation, as well as approval and implementation, of an E&S control plan, as appropriate, including use of general soil erosion control and soil stabilization BMPs.

   During construction activities, soil disturbance in construction zones would result in exposure of unvegetated soil, as well as the direct potential to erode soils.

   To minimize this potential, specific activities to control and minimize construction impacts would be identified in an appropriate, project-specific E&S Control Plan, approved by either KDEP or TDEC Division of Water, in conjunction with local county soil and water conservation districts and the NRCS, and implemented by the NPS prior to initiation of and during construction, in accordance with applicable Kentucky and/or Tennessee regulations. Specific activities addressed within a specific plan could include:

   - Improving certain existing and newly constructed access routes using stone and geotextile materials to prevent and reduce trail degradation and associated soil erosion.
   - Installing and monitoring erosion-prevention measures such as silt fences and water breaks, sedimentation basins, filter fences, sediment berms, interceptor ditches, straw bales, rip-rap, and/or other sediment control structures prior to construction, and modified as necessary during construction to prevent erosion; re-spreading of stockpiled topsoil; and seeding/revegetation of areas temporarily cleared of vegetation.
   - Retaining forest vegetation and riparian vegetation to the maximum extent possible.
   - Planting and maintaining soil-stabilizing vegetation on and adjacent to disturbed areas.
   - Using native grasses to revegetate disturbed soils.
   - Revegetating during the optimum seeding periods (February 1 -May 15 or August 1 -October 31 for cool season grasses and April 15- June 1 for warm season grasses).
   - A long-term monitoring component to ensure that the various proposed actions are monitored for resultant erosion and periodically maintained/repaired to ensure minimization of operational erosion and sedimentation.
   - Low water crossings would be implemented on access routes instead of culverts, where possible. Low-water crossings are desirable alternatives to culverts on very low-volume roads and trails, as they are less expensive to construct, require less maintenance, and can be designed to allow for passage of aquatic organisms.

2. Acquisition of land disturbance permit(s) associated with the National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharges from construction activities. In order to minimize the potential impacts to land and aquatic systems within Big South Fork NRRA, the NPS would obtain all required permits before the commencement of any proposed construction activities. This may include an NPDES Permit for Storm Water Discharges Associated with or from Construction Activities (40 CFR 122.26).

   The NPDES program within the State of Kentucky is administered by the KDEP Division of Water, and in Tennessee by the TDEC Division of Water Pollution Control. Permit acquisition should be coordinated with these agencies at the earliest time possible prior to construction activities, in order to ensure that activities are consistent with Federal and State regulatory standards. Permit standards should be adhered to during all on-site construction activities.

3. Airborne dust control. Construction of each proposed action would involve earth movement and re-grading, among other typical construction activities. Emissions of airborne particulate matter (dust) are usually associated with wind-oriented soil erosion, resultant from disturbance of on-site soils. The NPS will ensure that dust control associated with construction of the proposed facilities within Big South Fork NRRA is conducted in accordance with applicable State regulations. NPS would ensure that appropriate dust suppression methods are utilized during on-site construction activities. Available methods include application of water, soil stabilizers, or vegetation; use of enclosures, covers, silt fences, or wheel washers and suspension of earth-movement activities during high wind conditions.

4. Spill prevention. Construction activities typically generate wastes and disturb soil in localized areas during construction. These construction activities may result in spills or leaks to the environment. However, measures would be implemented to prevent spills and that if any occur they are expected to be small and will be addressed immediately. The NPS should, during any on-site construction activities within a specific project area, implement the following measures to minimize the potential for spills or other harm to the environment:

   - Implement applicable spill response and contingency plans following any release to the environment. This includes reporting spills to the appropriate local, state, and federal government agencies, as required based on the type and volume of the release.
   - Implement storm water BMPs, as required (see #2, above).
   - Refuel construction equipment on relatively flat, paved surfaces when possible. Transfers should be conducted during periods when atmospheric precipitation is not occurring. Secondary containment should surround the transfer area to prevent an accidental release from leaving the immediate area. Transfers should not be conducted near navigable bodies of water, including storm sewer inlets, unless absolutely necessary.

- Maintain construction equipment to prevent drips or leaks from hoses or reservoirs which contain hazardous materials or substances.
- Maintain appropriate on-site solid waste disposal receptacles to prevent the release of pollutants into the environment from demolition and construction activities.
- Update or prepare required spill prevention containment and countermeasures (SPCC) plans (40 CFR Part 112), contingency plans, and/or other pollution prevention plans, as required, for the proposed facilities, as applicable.

5. Disturbance of native vegetation. Disturbed ground will be reclaimed using appropriate BMPs, which may include planting or seeding with native vegetation, or in the case of small treatment areas, allowing native vegetation to reclaim the area naturally; in such cases, disturbed areas will be mulched with weed-free mulch/hay that has been obtained from sources approved by Resource Management. Project leaders will consult with the NPS Botanist to determine the best methods for restoration.

   Only park-approved native plant species and/or native seed mixtures will be used. The NPS Botanist will inspect and approve species lists and seed sources before revegetation commences. Seedings will meet the NPS standard of 80% survival rate guaranteed for two years; plant material not meeting this survival period will be reseeded.

6. Endangered, threatened and rare plant species and habitat. Project areas will be surveyed by the park Botanist, or a designated park employee, to identify the presence of endangered, threated, or rare plant, wildlife, and aquatic species and associated habitats. If any such species or habitats are identified, appropriate mitigations to protect them must be in place prior to commencing with the project. Projects are subject to terms of the Endangered Species Act as well as any other federal, state and local regulations regarding vegetation protection and management.

7. Exotic species. Due care will be taken to minimize disturbance and to ensure that non-native plants species, or any propagules of such, are not introduced or spread in the project areas. Soil disturbance will be minimized to the greatest extent possible to reduce disturbance to native plants and reduce the potential for the introduction or spread of invasive non-native plant species.

   To prevent the transport of non-native species, equipment and vehicles will be pressure cleaned and free of seeds, debris and mud to prevent the introduction and/or spread of non-native plant species. Equipment will be inspected by resource management personnel before deploying to the project area. Equipment that is deemed in need of additional cleaning must be moved to a designated washdown location and recleaned prior to entering the work area.

8. Fill material and gravel. Only clean fill material and gravel, preferably from a designated site within the Big South Fork NRRA, will be used for the implementation of remedial options and site access. Stone aggregate material being brought into the park shall be certified clean. The NPS staff will inspect any proposed fill materials, including source sites of the materials, before they are deployed for project use.

These BMPs have been determined as necessary for all phases of construction, and in certain cases, necessary to maintain or protect sensitive resources permanently. Additional BMPs may be required on a site-specific basis.

APPENDIX G
AGENCY SCOPING AND CONSULTATION

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United States Department of the Interior

NATIONAL PARK SERVICE
Big South Fork
National River and Recreation Area
4564 Leatherwood Road
Oneida, TN 37841

IN REPLY REFER TO:
1.B(L7617)

JUN 19 2014

Mr. Heinz Mueller
Environmental Protection Agency Region 4
NEPA Program Office
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Mueller:

The Big South Fork National River and Recreation Area is developing a Contaminated Mine Drainage Environmental Impact Statement (EIS). The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the entire park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a Draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final document.

An important audience to initiate discussions with is the federal agencies that have an association with or interest in Big South Fork National River and Recreation Area. Your agency is an important member of that audience and the National Park Service would like to invite you to be a cooperating agency for the development of this EIS.

We look forward to your response to this request and your role as a cooperating agency on this project. If you have questions or would like to discuss the project or our agencies' respective roles and responsibilities during the preparation of this EIS, please contact Tom Blount, Chief of Resource Management. He can be reached at (423)569-2404, ext. 252 or via email at tom_blount@nps.gov.

Sincerely,

Niki Stephanie Nicholas, Ph.D.

cc: Tom Blount, Chief of Resource Management

COPY

United States Department of the Interior

NATIONAL PARK SERVICE
Big South Fork
National River and Recreation Area
4564 Leatherwood Road
Oneida, TN 37841

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JUN 19 2014

Ms. Mary Jennings
Field Supervisor
Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501

Dear Ms. Jennings:

The Big South Fork National River and Recreation Area is developing a Contaminated Mine Drainage Environmental Impact Statement (EIS). The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the entire park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a Draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final document.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.

cc: Tom Blount, Chief of Resource Management

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JUN 1 9 2014

Mr. Earl Bandy
Director, Knoxville Field Office
Office of Surface Mining Reclamation Enforcement
710 Locust Street, 2nd Floor
Knoxville, TN 37902

Dear Mr. Bandy:

The Big South Fork National River and Recreation Area is developing a Contaminated Mine Drainage Environmental Impact Statement (EIS). The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the entire park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a Draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final document.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.

cc: Tom Blount, Chief of Resource Management

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JUN 19 2014

Lieutenant Colonel John L. Hudson
U. S. Army Corps of Engineers
P. O. Box 1070
Nashville, TN 37202

Dear Lieutenant Colonel Hudson:

The Big South Fork National River and Recreation Area is developing a Contaminated Mine Drainage Environmental Impact Statement (EIS). The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the entire park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a Draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final document.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.

cc: Tom Blount, Chief of Resource Management

United States Department of the Interior

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Big South Fork
National River and Recreation Area
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JUL 0 1 2014

Principal Chief Michell Hicks
Eastern Band of Cherokee Indians
P. O. Box 455
Cherokee, NC 28719

Dear Principal Chief Hicks;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final Contaminated Mine Drainage Mitigation and Treatment System EIS. More information about the Plan/EIS can be found at our Planning, Environment, and Public Comment (PEPC) website: http://parkplanning.nps.gov/biso.

If you wish to provide input to the National Park Service regarding the development of this EIS, please contact me at the address above, by phone at 423-569-9778 or email at biso_superintendent@nps.gov. We are looking forward to your reply and to maintaining a continuing relationship with the tribal government.

Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Mr. Russell Townsend, THPO, Eastern Band of Cherokee Indians

United States Department of the Interior

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Big South Fork
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JUL 0 1 2014

Chairman Ron Sparkman
Shawnee Tribe
P. O. Box 189
Miami, OK 74355

Dear Chairman Sparkman;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final Contaminated Mine Drainage Mitigation and Treatment System EIS. More information about the Plan/EIS can be found at our Planning, Environment, and Public Comment (PEPC) website: http://parkplanning.nps.gov/biso.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Rosanna Sheppard, Director of Environmental and Natural Resources Dept.

United States Department of the Interior

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JUL 0 1 2014

Governor George Blanchard
Absentee Shawnee Tribe
2025 S. Gordon Cooper Drive
Shawnee, OK 74801

Dear Governor Blanchard;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Mr. Joseph H. Blanchard, THPO, Absentee Shawnee Tribe

United States Department of the Interior

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JUL 0 1 2014

Governor George Wickliffe
United Keetoowah Band of Cherokee
P. O. Box 746
Tahlequah, OK 74465

Dear Chief Wickliffe;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Ms. Lisa Baker, THPO, United Keetoowah Band of Cherokee

United States Department of the Interior

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JUL 0 1 2014

Governor Bill Anoatubby
Chickasaw Nation
P. O. Box 1548
Ada, OK 74821

Dear Governor Anoatubby;

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Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Chickasaw Nation Tribal Historic Preservation Office

United States Department of the Interior

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JUL 0 1 2014

Chief Glenna J. Wallace
Eastern Shawnee Tribe
P. O. Box 350
Seneca, MO 64865

Dear Chief Wallace;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Ms. Robin Dushane, THPO, Eastern Shawnee Tribe

United States Department of the Interior

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JUL 0 1 2014

Principal Chief Bill John Baker
Cherokee Nation
P. O. Box 948
Tahlequah, OK 74465

Dear Principal Chief Baker;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

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Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

cc: Cherokee Nation Tribal Historic Preservation Office

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JUL 07 2014

Mr. Craig Potts
Kentucky Heritage Council
Kentucky State Historic Preservation Office
300 Washington Street
Frankfort, KY 40601

Dear Mr. Potts;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

The purpose of this project is to address contaminated mine drainage at nine sites within the McCreary County, Kentucky portion of the park and to create a programmatic approach to considering future treatment options at former mining sites throughout the park. These actions will address the need to improve water quality in tributaries of the Big South Fork River. Ultimately, a draft EIS will be prepared and presented to the public for review and comment, followed by preparation and availability of the Final Contaminated Mine Drainage Mitigation and Treatment System EIS. More information about the Plan/EIS can be found at our Planning, Environment, and Public Comment (PEPC) website: http://parkplanning.nps.gov/biso.

If you wish to provide input to the National Park Service regarding the development of this EIS, please contact me at the address above, by phone at 423-569-9778 or email at biso_superintendent@nps.gov.

Sincerely,

Niki Stephanie Nicholas, Ph.D.
Superintendent

United States Department of the Interior

NATIONAL PARK SERVICE
Big South Fork
National River and Recreation Area
Obed Wild and Scenic River
4564 Leatherwood Road
Oneida, TN 37841

IN REPLY REFER TO:
1.B(L7617)

JUL 07 2014

Mr. Joseph Garrison, Ph.D.
Review and Compliance Coordinator
Tennessee Historical Commission
2941 Lebanon Road
Nashville, TN 37243-0442

Dear Mr. Garrison;

The National Park Service is initiating the development of a Contaminated Mine Drainage Environmental Impact Statement for Big South Fork National River and Recreation Area (EIS). A Notice of Intent for the development of this document was announced in the Federal Register on May 12, 2014.

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Niki Stephanie Nicholas, Ph.D.
Superintendent

United States Department of the Interior

NATIONAL PARK SERVICE
Big South Fork
National River and Recreation Area
4564 Leatherwood Road
Oneida, TN 37841

IN REPLY REFER TO:
L76

MAY 1 1 2016

Elizabeth Robinson
Forest Planner and Environmental Coordinator
U. S. Forest Service
Daniel Boone National Forest
1700 Bypass Road
Winchester, KY 40391

Dear Ms. Robinson,

Thank you so much for agreeing to be a cooperating agency for the development of the Big South Fork National River and Recreation Contaminated Mine Drainage Environmental Impact Statement (EIS). We have been quite busy with the development of this document. The DRAFT EIS (DEIS) is currently being reviewed internally by National Park Service personnel and a final draft is nearly complete. Enclosed is a compact disk with the internal draft of the Contaminated Mine Drainage Mitigation and Treatment EIS dated March 7, 2016.

The National Park Service and the contractor will be meeting during the week of May 16, 2016 for a roundtable discussion to review internal edits and comments that have been made to the draft. We would like to invite you to join us for this discussion. For reference, the internal DEIS is attached for your review should you decide to attend the roundtable discussions. The agenda for the meeting is not yet finalized, but field trips to contaminated mine sites are tentatively scheduled for May 17 and 18 and the roundtable discussions will be May 19 and 20. Times and locations of field trips and discussions will be forwarded to you as soon as determined. Please contact Tom Blount, Chief of Resource Management for questions. He can be reached at (423)569-2404, ext. 252 or via email at tom_blount@nps.gov.

Thank you and we look forward to meeting with you.

Sincerely,

Niki Stephanie Nicholas
Superintendent

Enclosure

cc: Richard Neubauer, Environmental Protection Specialist, Environmental Quality Division
Etta Spradlin, Environmental Protection Speciallist, Big South Fork NRRA

United States Department of the Interior

NATIONAL PARK SERVICE
Big South Fork
National River and Recreation Area
4564 Leatherwood Road
Oneida, TN 37841

IN REPLY REFER TO:
L76

MAY 1 1 2016

Lieutenant Colonel Stephen F. Murphy
U. S. Army Corps of Engineers
P. O. Box 1070
Nashville, TN 37202

Dear Lieutenant Colonel Murphy,

Thank you so much for agreeing to be a cooperating agency for the development of the Big South Fork National River and Recreation Contaminated Mine Drainage Environmental Impact Statement (EIS). We have been quite busy with the development of this document. The DRAFT EIS (DEIS) is currently being reviewed internally by National Park Service personnel and a final draft is nearly complete. Enclosed is a compact disk with the internal draft of the Contaminated Mine Drainage Mitigation and Treatment EIS dated March 7, 2016.

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Thank you and we look forward to meeting with you.

Sincerely,

Niki Stephanie Nicholas
Superintendent

Enclosure

cc: Richard Neubauer, Environmental Protection Specialist, Environmental Quality Division
Etta Spradlin, Environmental Protection Specialist, Big South Fork NRRA

United States Department of the Interior

NATIONAL PARK SERVICE
Big South Fork
National River and Recreation Area
4564 Leatherwood Road
Oneida, TN 37841

IN REPLY REFER TO:
L76

MAY 1 1 2016

Thomas D. Shope
Regional Director, Appalachian Region
Office of Surface Mining Reclamation and Enforcement
Three Parkway Center
Pittsburg, PA 1522

Dear Mr. Shope,

Thank you so much for agreeing to be a cooperating agency for the development of the Big South Fork National River and Recreation Contaminated Mine Drainage Environmental Impact Statement (EIS). We have been quite busy with the development of this document. The DRAFT EIS (DEIS) is currently being reviewed internally by National Park Service personnel and a final draft is nearly complete. Enclosed is a compact disk with the internal draft of the Contaminated Mine Drainage Mitigation and Treatment EIS dated March 7, 2016.

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Thank you and we look forward to meeting with you.

Sincerely,

Niki Stephanie Nicholas
Superintendent

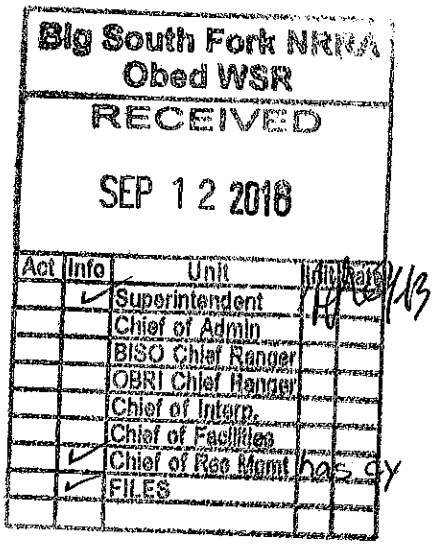
Enclosure

cc: Richard Neubauer, Environmental Protection Specialist, Environmental Quality Division
Etta Spradlin, Environmental Protection Specialist, Big South Fork NRRA

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468



September 7, 2016

Mr. Tom Blount
Big South Fork
National River and Recreation Area
4564 Leatherwood Rd.
Oneida, TN 37841

Subject: FWS 2016-B-0763; Species List Request for the Development of the Big South Fork National River and Recreation Area Contaminated Mine Drainage Environmental Impact Statement; McCreary County, Kentucky

Dear Mr. Blount

We have received your request for a species list for the above-referenced project. The Kentucky Field Office (KFO) is directing project proponents to obtain species lists for proposed projects from the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) system located at: https://ecos.fws.gov/ipac/. IPaC will immediately provide you with a current species list appropriate for your proposed project and an official letter on USFWS letterhead. This list will include species currently listed as threatened or endangered, species proposed for listing, critical habitat for listed species, and bird species of conservation concern.

When you open the IPaC site, you will be asked to input a location for your proposed project. The location can be input in different ways. Often, the easiest way is to zoom into the vicinity of the project area on the map and use the sketch tool to approximate the boundaries of the proposed project site, plus an appropriate buffer. This location that you input should represent the entire "action area" of your proposed project by considering all the potential "effects of the action," including potential direct, indirect, and cumulative effects to federally-listed species or their critical habitat as defined in 50 CFR 402.02. This includes effects of any "interrelated actions" that are part of a larger action and depend on the larger action for their justification and "interdependent actions" that have no independent utility apart from the action under consideration (e.g.; utilities, access roads, etc.) and future actions that are reasonably certain to occur as a result of the proposed project (e.g.; development in response to a new road).

IPaC will generate a species list specific to the action area of the proposed project, as you defined it. You can then request an official species list under the "Regulatory Documents" tab. This species list fulfills the requirements of the USFWS under section 7(c) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) to provide information as to

whether any proposed or listed species may be present in the area of a proposed action. The letter generated by IPaC will explain how to request an updated list or a revised list based on project modifications.

The official species list is not a concurrence letter; additional coordination with the KFO may be necessary to ensure ESA compliance. Please read the letter that accompanies the species list for further direction as to how to request technical assistance or section 7 consultation from the KFO. Please include the consultation tracking number on the IPaC-generated letter in all your future correspondences with the KFO. The KFO will be able to retrieve the information that you input into IPaC; there is no need to include a printed copy of your IPaC- generated letter or species list with your correspondence.

Thank you for your request. Your concern for the protection of endangered and threatened species is greatly appreciated. If you have any questions or problems obtaining a species list from IPaC, please contact Carrie Allison at (502) 695-0468 extension 103 or carrie_allison@fws.gov.

Sincerely,

Jennifer Garland

for Virgil Lee Andrews, Jr.
Field Supervisor

cc: Mary Jennings, Cookeville ES

APPENDIX H
REFERENCES

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APPENDIX I
ACRONYMS

AADT	Annual Average Daily Traffic
AHPA	Archeological and Historic Data Preservation Act
AIRFA	American Indian Religious Freedom Act
ALD	anoxic limestone drain
AML	abandoned mineral lands
AMSL	above mean sea level
ARPA	Archeological Resources Protection Act
ARRA	American Recovery and Reinvestment Act
ATV	all-terrain vehicle
AWQC	Ambient Water Quality Criteria
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
Big South Fork River	Big South Fork of the Cumberland River
BO	Biological Opinion
BP	Before Present
BMP	Best Management Practice
CEQ	Council on Environmental Quality
cfs	cubic foot per second
CFI	Conservation Fisheries, Inc.
CLPR	current legal and policy requirements
CMD	contaminated mine drainage
CFR	Code of Federal Regulations
CWA	Clean Water Act
dBA	A-weighted decibels
DOI	U.S. Department of the Interior
E&S	Erosion and Sedimentation
EA	Environmental Assessment
EC_{20}	Oak Ridge National Laboratory Water Quality Criteria for Near Complete Protection of Sensitive Aquatic Species
EIS	Programmatic and Site Specific Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FR	Federal Register
ft	feet or foot
FSOF	floodplain statement of findings
GIS	Geographic Information System
GMP	General Management Plan
gpm	gallons per minute
HDPE	high-density polyethylene
IDT	interdisciplinary team
K & T	Kentucky and Tennessee
KAR	Kentucky Administrative Regulation

KDEP	Kentucky Department for Environmental Protection
KDFWR	Kentucky Division of Fish and Wildlife Resources
KRS	Kentucky Revised Statute
KYTC	Kentucky Transportation Cabinet
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
NAGPRA	Native American Graves and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRCA	Natural Resource Condition Assessment
NRCS	USDA Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRRA	National River and Recreation Area
NVCS	National Vegetation Classification System
NEPA	National Environmental Policy Act
NWI	National Wetlands Inventory
O&M	operations and maintenance
ONRW	Outstanding National Resource Water
OSRW	Outstanding State Resource Water
OSM	U.S. DOI Office of Surface Mining
PEPC	Planning, Environment, and Public Comment
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RM	River Mile
ROW	right of way
SHPO	State Historic Preservation Office
SKRECC	South Kentucky Rural Electric Cooperative Corporation
SMA	Special Management Area
SPCC	Spill Prevention, Containment, and Countermeasures
SR	State Route
SU	Standard Unit
TDEC	Tennessee Department of Environment and Conservation
TMDL	Total maximum daily load
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WSOF	Wetland Statement of Findings
WSR	Wild and Scenic River

APPENDIX J
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