

## **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 Non-federal Oil and Gas Management Plan/Environmental Impact Statement (plan/EIS). This chapter also includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds (i.e., negligible, minor, moderate, and major), and the methods used to analyze impacts and determine cumulative impacts. As required by the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Protection Act (NEPA), a summary of the environmental consequences for each alternative is provided in table 10, which can be found in “Chapter 2: Alternatives.” The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in “Chapter 3: Affected Environment.”

### **SUMMARY OF LAWS AND POLICIES**

Three overarching environmental protection laws and their implementing policies guide the actions of the National Park Service (NPS) in the management of parks and their resources: the NPS Organic Act of 1916, NEPA and its implementing regulations, and the Omnibus Management Act. For a complete discussion of these and other guiding authorities, refer to the section titled “Related Laws, Policies, Plans, and Constraints” in “Chapter 1: Purpose of and Need for Action.” These guiding authorities are briefly described below.

The NPS Organic Act of 1916 (16 USC 1), as amended or supplemented, commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

The National Environmental Policy Act of 1969 is implemented through regulations of the CEQ (40 CFR 1500–1508). The NPS has, in turn, adopted procedures to comply with these requirements, as found in Director’s Order 12 (NPS 2001) and its accompanying handbook.

The Omnibus Management Act (16 USC 5901 et seq.) underscores the NEPA provisions in that both acts are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts and communicating the impacts of those decisions to the public, using appropriate technical and scientific information. Both acts also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

Section 4.5 of Director’s Order 12 (NPS 2001) adds to this guidance by stating, “when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the NPS will follow the provisions of the CEQ regulations (40 CFR 1502.22).” In summary, the NPS must state in an environmental assessment or EIS (1) whether such information is incomplete or unavailable, (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment, (3) a summary of existing credible scientific adverse impacts that are relevant to evaluating the reasonably foreseeable significant adverse impacts, and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community. Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this draft EIS.

## **GENERAL METHODOLOGY FOR ESTABLISHING IMPACT THRESHOLDS AND MEASURING EFFECTS BY RESOURCE**

The following elements were used in the general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category:

- General analysis methods as described in guiding regulations, including the context and duration of environmental effects
- Basic assumptions used to formulate the specific methods used in this analysis
- Thresholds used to define the level of intensity of the impact resulting from each alternative
- Methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting park resources
- Methods and thresholds used to determine if impairment of specific resources would occur under any alternative

These elements are described in the following sections.

### **GENERAL ANALYSIS METHODS**

The analysis of impacts follows CEQ guidelines and Director's Order 12 procedures (NPS 2001) and is based on the underlying goal of managing non-federal oil and gas operations to protect park resources.

For each resource topic addressed in this chapter, the applicable analysis methods are discussed, including assumptions and impact intensity thresholds.

### **BASIC 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 non-federal oil and gas operations for the next 15 to 20 years or until conditions change and warrant an update. Therefore, for the purposes of the analysis, the life of the plan and period used for assessing impacts is up to 20 years.

#### **Geographic Area Evaluated for Impacts (Area of Analysis)**

The geographic study area (or area of analysis) for this plan includes Big South Fork National River and Recreation Area (NRRA) and Obed Wild and Scenic River (WSR). 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 31.

## 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 for a matter of weeks up to three years, without lasting effects. Examples include impacts on native wildlife and visitors from drilling operations, construction activities, or geophysical operations.
- *Long-term impacts:* Impacts would last for longer than three years, with potentially permanent effects. Examples include the beneficial effects of plugging and reclaiming wells and the longer term effects of roads and on-going production.

NOTE: All impacts on archeological resources are considered long term.

- *Direct impacts:* Impacts would occur as a direct result of non-federal oil and gas management actions.
- *Indirect impacts:* Impacts would occur from non-federal oil and gas management actions and would occur later in time or farther in distance from the action.

## Future Trends

Visitor use and demand are anticipated to remain relatively steady over the life of the plan. Although there have been increases and decreases from year to year, from 1990 to 2009 an average of 783,090 and 207,613 people per year visited Big South Fork NRR and Obed WSR, respectively. Considering past visitation trends and a likely continued increase in visitation from local/regional areas within driving distance of the park, it is expected that annual visitation over the life of the plan would increase slightly, with some variation from year to year.

## IMPACT THRESHOLDS

Determining impact thresholds is a key component in applying NPS *Management Policies 2006* (NPS 2006c) and Director's Order 12 (NPS 2001). These thresholds provide the reader with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. In all cases, the impact thresholds are defined for adverse impacts. Beneficial impacts are addressed qualitatively.

## CUMULATIVE IMPACTS ANALYSIS METHOD

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 A (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 31 summarizes these actions that could affect the various resources at the park. Those requiring additional explanation are discussed in the narrative that follows the table or in chapter 1.

The analysis of cumulative impacts was accomplished using four steps:

- *Step 1—Identify resources affected.*  
Fully identify resources affected by any of the alternatives. These include the resources addressed as impact topics in chapters 3 and 4 of the document.
- *Step 2—Set boundaries.*  
Identify an appropriate spatial and temporal boundary for each resource.
- *Step 3—Identify cumulative action scenario.*  
Determine which past, present, and reasonably foreseeable future actions to include with each resource. These are listed in table 31 and described below.
- *Step 4—Perform cumulative impact analysis.*  
Summarize the impacts of these other actions (x) plus the impacts of the proposed action (y), to arrive at the total cumulative impact (z). This analysis is included for each resource in chapter 4.

TABLE 31. CUMULATIVE IMPACT SCENARIO

Impact Topic	Area of Analysis	Past*	Present	Future*
Geology/soils geologic features	Big South Fork of Cumberland Watershed, Emory River Watershed	<ul style="list-style-type: none"><li>Abandoned mines (acid mine drainage, landslides)</li><li>Old logging and agricultural operations</li><li>Abandoned well sites and oil and gas access roads</li><li>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</li><li>Plugging and reclamation of oil and gas wells in the park (beneficial)</li><li>Park maintenance activities including installation and maintenance of roads, trails, and developed sites</li><li>Park prescribed-fire program</li><li>Visitor uses such as climbing, ORV use, horseback riding, and mountain biking</li><li>Logging and timber harvesting</li><li>Coal mining</li><li>Agricultural activities</li><li>Local planning efforts to promote growth</li><li>Commercial and/or residential development</li><li>Development, use, and maintenance of county and state roads</li></ul>	Same as past	Same as past, plus: <ul style="list-style-type: none"><li>Future coal mining and surface reclamation</li><li>Changes to 9B regulations</li></ul>
Water resources/ floodplains/ wetlands	Watersheds	<ul style="list-style-type: none"><li>Abandoned mines (acid mine drainage)</li><li>Old logging and agricultural operations</li><li>Erosion from abandoned well sites and oil and gas access roads</li><li>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</li><li>Oil and Gas development within and adjacent to the parks</li><li>Plugging and reclamation of oil and gas wells in the park (beneficial)</li><li>Park maintenance activities including installation and maintenance of roads, trails, and developed sites</li><li>Combustion of fossil fuels contributing to acidity of water</li><li>Park prescribed-fire program</li><li>Visitor uses such as ORV use, kayaking, and swimming</li><li>Coal mining</li><li>Agricultural activities</li><li>Park, commercial, and/or residential development and maintenance</li><li>Local planning efforts to promote growth</li><li>Trail maintenance</li><li>Equestrian activities</li><li>Industrial discharges</li><li>Nonpoint source runoff from industrial and construction sites, roads</li><li>Municipal, industrial, and/or park water use and treatment, including withdrawals for local utility districts (Oneida, Jamestown)</li><li>Impoundments</li><li>Motorboat use downstream</li><li>Septic tanks</li><li>Sand and gravel mining</li><li>Herbicide use</li><li>Insect invasions—pine bark beetle,—death of vegetation—resultant changes in water temperature and other chemistry</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Potential for coal bed methane/shale gas development and withdrawal or disposal of produced water</li><li>Logging and timber harvesting</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Potential for coal bed methane/shale gas development and withdrawal or disposal of produced water</li><li>Development and implementation of water quality standards per 303(d) program (beneficial)</li><li>Logging and timber harvesting</li><li>Hemlock woolly adelgid</li><li>Changes to 9B regulations</li></ul>

TABLE 31. CUMULATIVE IMPACT SCENARIO

Impact Topic	Area of Analysis	Past*	Present	Future*
Vegetation	The park units and a 1,500-foot setback outside the park units	<ul style="list-style-type: none"><li>Well workovers, access road and wellpad maintenance activities</li><li>Abandoned mines (acid mine drainage)</li><li>Old logging, including clear-cutting, and agricultural operations</li><li>Abandoned well sites and oil and gas access roads, which create disturbances susceptible to invasion of non-native species</li><li>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</li><li>Plugging and reclamation of oil and gas wells in the parks</li><li>Park maintenance activities including installation and maintenance of roads, trails, and developed sites</li><li>Park prescribed-fire program</li><li>Visitor uses such as ORV use</li><li>Coal mining</li><li>Agricultural activities</li><li>Local planning efforts to promote growth</li><li>Commercial and/or residential development</li><li>Exotic species control in and adjacent to park</li><li>Insect invasions—pine bark beetle</li><li>Fields management</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Logging and timber harvesting</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Replanting and surface reclamation of logging sites (beneficial)</li><li>Spread of exotics from adjacent lands</li><li>hemlock woolly adelgid</li><li>Logging and timber harvesting</li><li>Changes to 9B regulations</li></ul>
Wildlife and aquatic species	The park units and 1 to 5 miles around perimeter	<ul style="list-style-type: none"><li>Abandoned mines (acid mine drainage)</li><li>Old logging, including clear-cutting, and agricultural operations</li><li>Habitat loss and fragmentation</li><li>Infestations: pine bark beetle,</li><li>Overhunting/poaching</li><li>Introduction of exotic species, including wildlife</li><li>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</li><li>Plugging and reclamation of oil and gas wells</li><li>Park maintenance activities including installation and maintenance of roads, trails, and developed sites</li><li>Park prescribed-fire program</li><li>Visitor uses such as ORV use</li><li>Coal mining</li><li>Agricultural activities</li><li>Commercial and/or residential development</li><li>Local planning efforts to promote growth</li><li>Exotic species control in park (beneficial)</li><li>Hunting and trapping</li><li>Poaching</li><li>Vehicle–wildlife collisions</li><li>Harassment</li><li>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)</li><li>Fields management</li></ul>	Same as past, except: <ul style="list-style-type: none"><li>Overhunting</li></ul> Plus: <ul style="list-style-type: none"><li>Hunting</li><li>New commercial and industrial developments</li><li>Development of new residential and second home communities</li></ul>	Same as past, except: <ul style="list-style-type: none"><li>Overhunting</li></ul> Plus: <ul style="list-style-type: none"><li>Wildlife management</li><li>Spread of exotics from adjacent lands</li><li>Replanting and surface reclamation of logging sites (beneficial)</li><li>Changes to 9B regulations</li></ul>

TABLE 31. CUMULATIVE IMPACT SCENARIO

Impact Topic	Area of Analysis	Past*	Present	Future*
Federally and state-listed or special-status species	Watersheds	<ul style="list-style-type: none"><li>Abandoned mines (acid mine drainage)</li><li>Old logging and agricultural operations</li><li>Erosion from abandoned well sites and oil and gas access roads</li><li>Habitat loss and fragmentation</li><li>Infestations: pine bark beetle,</li><li>Overhunting/poaching</li><li>Introduction of exotic species, including wildlife</li><li>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</li><li>Plugging and reclamation of oil and gas wells in the park (beneficial)</li><li>Park maintenance activities including installation and maintenance of roads, trails, and developed sites</li><li>Combustion of fossil fuels contributing to acidity of water</li><li>Park prescribed-fire program</li><li>Visitor uses such as ORV use, kayaking, and swimming</li><li>Coal mining</li><li>Agricultural activities</li><li>Park, commercial, and/or residential development and maintenance</li><li>Local planning efforts to promote growth</li><li>Trail maintenance</li><li>Equestrian activities</li><li>Industrial discharges</li><li>Nonpoint source runoff from industrial and construction sites, roads</li><li>Municipal, industrial, and/or park water use and treatment, including withdrawals for local utility districts (Oneida, Jamestown)</li><li>Impoundments</li><li>Motorboat use downstream</li><li>Septic tanks</li><li>Sand and gravel mining</li><li>Herbicide use</li><li>Exotic species control in park (beneficial)</li><li>Hunting and trapping</li><li>Poaching</li><li>Vehicle–wildlife collisions</li><li>Harassment</li><li>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)</li><li>Reintroduction of mussels (in the park)</li><li>Fish stocking (outside)</li><li>Fields management</li></ul>	<p>Same as past, plus:</p> <ul style="list-style-type: none"><li>Potential for coal bed methane/shale gas development and withdrawal or disposal of water</li><li>Logging and timber harvesting</li><li>New commercial and industrial developments.</li><li>Development of new residential and second home communities.</li></ul>	<p>Same as past, plus:</p> <ul style="list-style-type: none"><li>Potential for coal bed methane/shale gas development and withdrawal or disposal of water</li><li>Logging and timber harvesting</li><li>Spread of exotics from adjacent lands</li><li>USFWS recovery plans for threatened and/or endangered species (beneficial)</li><li>Section 7(a)(1) of ESA park program (beneficial)</li><li>Changes to 9B regulations</li></ul>

TABLE 31. CUMULATIVE IMPACT SCENARIO

Impact Topic	Area of Analysis	Past*	Present	Future*
Soundscapes	The park units and a 1,500-foot setback outside the park units	<ul style="list-style-type: none"><li>• Construction, use, and maintenance of new and existing dirt roads within and near the park</li><li>• Vehicular traffic including ORV use, gravel hauling within and near the park</li><li>• Oil and gas operations within and in close proximity to the park</li><li>• Plugging and reclamation of oil and gas wells</li><li>• Park maintenance activities</li><li>• Visitor uses such as hunting</li><li>• Logging and timber harvesting</li><li>• Industrial activities such as hardwood flooring production, other manufacturing, and sawmill operation</li><li>• Coal mining</li><li>• Agricultural activities</li><li>• Big South Fork scenic railway</li><li>• New commercial and industrial developments</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>• Development of new residential and second home communities.</li></ul>	Same as present, plus: <ul style="list-style-type: none"><li>• Changes to 9B regulations</li></ul>
Cultural resources	The park units and adjacent lands	<ul style="list-style-type: none"><li>• Abandoned mines</li><li>• Old logging and agricultural operations</li><li>• Abandoned well sites and oil and gas access roads, providing unauthorized access to cultural resources</li><li>• Leaks and spills of contaminating and hazardous substances from past oil and gas development in and adjacent to park</li><li>• Vandalism</li><li>• Cemetery management</li><li>• Fields management</li><li>• Drilling and production operations within and outside the park that are in close proximity to cultural landscapes and cultural sites</li><li>• 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</li><li>• Park maintenance activities including installation and maintenance of roads, trails, developed sites, cultural structures/landscapes</li><li>• Park prescribed-fire program</li><li>• Visitor uses such as ORV use</li><li>• Logging and timber harvesting</li><li>• Coal mining</li><li>• Agricultural activities</li><li>• Commercial and/or residential development</li><li>• Local planning efforts to promote growth</li></ul>	Same as past	Same as past, plus: <ul style="list-style-type: none"><li>• Changes to 9B regulations</li></ul>



TABLE 31. CUMULATIVE IMPACT SCENARIO

Impact Topic	Area of Analysis	Past*	Present	Future*
Visitor use and experience	The park units and a 1,500-foot setback outside the park units	<ul style="list-style-type: none"><li>Abandoned mines (acid mine drainage)</li><li>Old logging and agricultural operations</li><li>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</li><li>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</li><li>Oil and gas developments in proximity to recreational sites, such as the Howard/White Unit No. 1 oil well on the boundary of Obed WSR</li><li>Park maintenance activities including installation and maintenance of roads, trails, and developed sites</li><li>Plugging and reclamation of oil and gas wells</li><li>Park prescribed-fire program</li><li>Visitor uses such as ORV and equestrian use</li><li>Logging and timber harvesting</li><li>Coal mining</li><li>Agricultural activities</li><li>Commercial, industrial, and/or residential development</li><li>Hunting, trapping, and fishing</li><li></li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Development of new residential and second home communities.</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Changes to 9B regulations</li></ul>
Park management and operations	The park units	<ul style="list-style-type: none"><li>Abandoned mine reclamation</li><li>Plugging and reclamation of oil and gas wells</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Oil and gas operations</li><li>Visitor uses such as ORV use</li><li>Implementation of GMP</li></ul>	Same as past, plus: <ul style="list-style-type: none"><li>Oil and gas operations</li><li>Visitor uses such as ORV use</li><li>Implementation of GMP</li><li>Increased visitation</li><li>Changes to 9B regulations</li></ul>

\*The temporal boundary for cumulative impacts extends from the late 1960s (when oil and gas activity began to increase in the park) to 15 to 20 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.



## CUMULATIVE IMPACT SCENARIO

The following describes in more detail various cumulative plans, policies, and actions listed in table 31.

### 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 NRRRA. In 2004, the Big South Fork NRRRA Fire Management Plan (NPS 2006e) 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 2006e).

#### Fields Management

Big South Fork NRRRA 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 NRRRA Fields Management Plan (NPS 2006d) identifies desired resource conditions and the kinds/levels of visitor use for each of the fields in the park, depending on the General Management Plan (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 2006d).

#### Exotic Species Management

The spread of non-native plant species has historically been occurring, and now represents a serious problem within the national park units. At Big South Fork NRRRA, 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 2005a).

#### Threatened and Endangered Species Management

Recovery plans for threatened and endangered species carried out under the U.S. Fish and Wildlife Service (USFWS) and efforts to ensure agency cooperation under Section 7(a)(1) of the Endangered Species Act (ESA) are important for managing populations of threatened and endangered species. There are eight recovery plans in place for 12 species that occur at Big South Fork NRRRA or Obed WSR and that are listed as threatened or endangered under the ESA. These species include three plants (Virginia spiraea, Cumberland rosemary and Cumberland sandwort), five mussels (Cumberland elktoe, oyster mussel, Cumberland combshell, purple bean, and rough rabbitsfoot), and four fish (spotfin chub, duskytail darter, blackside dace, and palezone shiner). Please refer to the chapter 1 section "Threatened

and Endangered Species Recovery Plans” for detailed descriptions of species recovery plans. As part of these efforts, Big South Fork NRR staff are working with the USFWS, U.S. Geological Survey (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 the wild.

### **Implementation of the General Management Plan at Big South Fork NRR**

The GMP for Big South Fork NRR was completed in 2005, and park staff members have begun its implementation. More details about this plan are provided in the “Relationship to Planning Documents for Big South Fork National River and Recreation Area” section of chapter 1. The Natural Environment Recreation Zone, the Sensitive Resource Protection Zone, and the All-Terrain Vehicle Planning Area are the three zones in which the GMP identifies specific management priorities given the potential for oil and gas activities (see Zone Maps 1-7 in GMP for additional detail). Within the Natural Environment Recreation Zone, natural processes are protected that would allow natural succession into mature forest, which would contribute 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. Within this zone, the desired resource conditions remain the same as described above for the Natural Environment Recreation Zone, but the need for further planning to address the conflicts between this potential experimental area and oil and gas operations is identified as a priority.

### **Cemetery Management**

Big South Fork NRR is in the process of developing a cemetery management plan to aid in the preservation of the 25 privately owned cemeteries and the 33 federally owned cemeteries located within the boundary of the National River and Recreation Area. In the interim the park follows a draft standard operating procedure (Big South Fork NRR Draft SOP, B-2 (NPS n.d.a)) that allows access for burial, decoration, and visitation, provided these are consistent with the Big South Fork NRR GMP and the intent of the enabling legislation for Big South Fork NRR. Generally, all cemetery access roads are being kept open and in the condition at which they were being maintained at the time of federal acquisition and consistent with access as defined in the 2005 GMP. 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. No new burials are allowed outside of cemetery boundaries on government land.

### **Visitor Activities Within/Adjacent To the Park Units**

Visitor activities such as horseback riding, biking, hunting, recreational rock climbing, swimming, kayaking, and off-road vehicle (ORV) use all occur within Big South Fork NRR and/or Obed WSR and may contribute to cumulative impacts on the resources considered in this plan/EIS. These activities, as well as the use of motorboats, also occur outside the park units. 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 another popular recreational activity, and outside the park units, 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 (which is adjacent to the boundary of Big South Fork NRA) 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 the Park Units**

Big South Fork NRA and Obed WSR have developed numerous features related to parkwide administrative, managerial, and support functions, as well as visitor use. Facilities within Big South Fork NRA are described in detail under the “Visitor Use” 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. Facilities in the Obed WSR include a campground and a picnic area. Roads in Big South Fork NRA are open for use by personal vehicles, commercial vehicles (e.g., gravel trucks), and ORVs for hunting and other recreational opportunities. The NPS routinely maintains these facilities as well as cultural landscapes in the park units.

### **Development Outside the Park Units**

Big South Fork NRA and Obed WSR are both 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 the park units, 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 the park units, 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 NRA 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 result in discharges to surface waters as well as nonpoint source pollution from runoff. Southwest of Obed WSR, two industrial parks have been developed in the Crossville area. The Davis Road Park consists of 189 acres of industrial sites. Another 70-acre industrial park is located on Genesis Road in Crossville near Interstate 40 (NPS 1998b).

### **Oil and Gas Operations**

Please refer to the chapter 1 sections “Non-Federal Oil and Gas Development/Management at Big South Fork National River and Recreation Area” and “Non-Federal Oil and Gas Development/Management at Obed Wild and Scenic River” for detailed descriptions of oil and gas operations within and near both park units.

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 parks, have the potential to contribute to cumulative impacts. Other potential effects of oil and gas operations include the release of hydrocarbons or other pollutants. Present and future oil and gas operations are addressed within the analysis of the proposed alternative in this plan. Past operations also contribute to cumulative impacts. For example, well blowouts have occurred in Tennessee in the last 10 years. Spills and leaks from the Howard/White Unit No. 1 have caused impacts (e.g., soil and water contamination or harm to vegetation) to floodplains and/or wetlands at Obed WSR. The blowout at the Howard/White Unit No. 1 on July 19, 2002, at Obed WSR was particularly notable for the extent of the damage it caused to adjacent lands. During this incident, oil pressures increased to a point at which an oil

spill developed around the well and outside the containment area at an estimated 200–500 barrels per hour. The oil well then caught fire, and the spilled oil flowed downhill from the wellhead into White Creek and also into Clear Creek. The fire followed both oiled paths, burning the vegetation and the oil-soaked soil, and the oil adjacent to the banks in both creeks caught fire as well. After the initial spill, oil continued to seep from the creek bank into Clear Creek, with sheens continuing to be released as late as April 2003 (NPS 2003a). A more recent spill occurred on July 29, 2008, when crude oil was released from an abandoned oil well pit east of the town of Oneida, Tennessee (outside the park). 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 (U.S. EPA 2008).

### **Plugging and Reclamation**

In addition to oil and gas development, there are also wells that have been or are in the process of being plugged and reclaimed in or near the park units. The NPS plans to plug and reclaim 14 abandoned wells at Big South Fork NRRRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. These wells will be plugged in order to protect zones of freshwater from pollution and to prevent the escape of oil, gas, brine, or other fluids to the surface or other zones. The NPS has placed these 14 wells high on an NPS plugging priority list because they are known to leak hydrocarbons, are located near heavy visitor use areas, have seriously worn and unreliable control equipment, have unknown downhole conditions, and/or lie near drinking water sources (NPS 2008a). In addition, the NPS has also recently received funding under the American Recovery and Reinvestment Act (ARRA) to plug and reclaim an additional 39 wells at Big South Fork NRRRA to protect resources and provide a safe visitor experience. An environmental assessment addressing this action was completed in early 2010 (NPS 2010a). One other well was plugged with NPS funds in 2005.

### **Changes to 9B Regulations**

On November 25, 2009, the NPS published an advance notice of proposed rulemaking in the Federal Register, seeking comments to assist the agency in developing a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed changes focus on improving resource protection aspects of the regulations while accounting for advances in oil and gas technology and industry practices. Changes being considered include bringing exempted operations under the scope of the regulations, including compliance with operating standards and financial assurances; retaining or enhancing incentives for operators to conduct directional drilling while minimizing indirect impacts of such operations; incorporating updated, effective operating standards in line with those of other agencies and industry groups; requiring access fees; and assessing monetary penalties for noncompliant operations. Although these changes are still in the proposed stage, if adopted, they would result in more protection for park resources and a greater regulatory effort, which may require revising or supplementing this plan/EIS.

### **Agricultural Activities/Logging**

Agriculture other than forestry has occurred on less than 20% of the land in counties adjacent to Big South Fork NRRRA and Obed WSR. Most of this has been dedicated to hay production, livestock grazing, and only a very little row-cropping. A plateau area above and to the north of Bear Creek consists of two large, flat ridges of agricultural lands and hardwood forests (NPS 2005a). Because of logging in the early to mid-20th century, most of the forested areas of Big South Fork NRRRA are second or third growth. Large portions of the extensive Darrow Ridge area in the southwest (including Tar Kiln Ridge) have undergone logging activities.

At Obed WSR, clearing and harvesting from logging and agriculture is particularly evident. 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. Easements on some private lands prohibit livestock operations with large populations of animals. Approximately 3% of the land area in the Obed/Emory River watershed is in agricultural production, primarily livestock production, corn, snap peas, and tobacco. Pasture areas comprise 25% of the land use in the Obed River and upper Emory River watersheds (NPS 1998b).

In addition to continued logging and harvesting, it is expected that replanting and surface reclamation of logging sites would continue to occur.

## **Mining**

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 NRR, 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 2005a). There are an estimated 100 abandoned deep coal mine openings and associated spoil piles within Big South Fork NRR. Mine reclamation efforts, funded by the Office of Surface Mining, have concentrated on reclamation of former mine sites at areas having visitor access. Threats continue, however, in the New River headwaters due to a recent resurgence in coal mining activities.

Impacts on water quality from coal mining include siltation of streams and acid mine drainage, 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 sulfur in tailings exposed during mining activities, which results in increased acidity, increased heavy metals, and a sterile coating of ferric hydroxide on stream substrate (NPS 1997). Water quality impacts from acid mine drainage are particularly notable in Bear Creek, Roaring Paunch Creek, and New River. Impacts are also evident in the former mining community of Worley.

Impacts on soils and vegetation can occur from strip mining activities. Although extensive coal mining occurs in the Obed/Emory River watershed, there are no active coal mine operations in the Obed WSR. Abandoned strip mines located on the Obed River have revegetated with scrub vegetation. Currently operating quarries in areas of the Obed/Emory River watershed mine primarily fieldstone and Crab Orchard stone. Sand mining also occurs in limited areas of the watershed: two mines are located on a tributary to Island Creek. Some limited impacts from sedimentation occur due to these mines (NPS 1998b).

Steep slopes of the rugged mountains in the area are prone to naturally occurring landslides. In 2005 a massive landslide originating at the site of a reclaimed strip mine occurred in the remote mountains of Scott County, covering 25 acres and affecting a tributary to the New River (Barker 2005).

## **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 NRR and Obed WSR. 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 both Big South Fork NRR and Obed WSR. See the “Visitor Use and Experience” section of chapter 3 for more details.

## **Insect Invasions**

Diseases and pests of vegetation, such as the pine bark beetle, have adversely impacted the landscape, causing a demise in vegetation that has resulted 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 NRR 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, an exotic insect native to Japan that feeds by sucking sap from young needles, causing them to drop prematurely. While it is suspected to occur in Big South Fork NRR, this species is not yet confirmed to exist in the park.

## **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 and Tennessee for the year 2008, there are a total of four impaired streams that fall within the Big South Fork NRR. Within the Obed WSR, there is one stream that was listed in the 303(d) report for Tennessee in 2008. Please refer to Water Resources, in chapter 3 of this document, for more information on these impairments. A total maximum daily load (TMDL) limit must be developed and implemented for these stream segments. A TMDL is a study that (1) quantifies the amount of a pollutant in a stream, (2) identifies the sources of the pollutant, and (3) recommends regulatory or other actions that may need to be taken in order for the stream to return to an unpolluted state. Currently, there are approved TMDLs for two of the four impaired waters in Big South Fork NRR (Pine Creek and Rock Creek) (TDEC 2008a); a TMDL is still needed for the other two impaired waters, but the schedule for these TMDLs is unknown. A TMDL is also needed for the impaired water at Obed WSR; however, it is considered low priority in the 2008 Tennessee 303(d) report, which indicates the TMDL would be prepared some time before 2020 (TDEC 2008a).

## **SUMMARY OF OIL AND GAS RESTRICTIONS IN ALTERNATIVES A, B, AND C**

For the reader's convenience, the following summarizes the areas subject to oil and gas operations restrictions under each alternative, unless authorized in an approved plan of operations. These descriptions apply to all topics discussed and are not repeated in each analysis.

**Alternative A: No Action (Current Management Continued)**—Under alternative A, operations associated with geophysical exploration, drilling, and production could be allowed in all areas of the park units where non-federal oil and gas rights exist, with the exception of protected areas identified by current legal and policy requirements (CLPRs), including the 9B regulations, the gorge restrictions at Big South Fork NRR, and deed restrictions at Obed WSR, unless authorized in an approved plan of operations. However, while an approved plan of operations could relax SMA restrictions, it would not supersede applicable statutes such as gorge restrictions and deed restrictions. Based on a comparison of known private mineral rights and the extent of these protected areas, geophysical exploration and drilling/production may be restricted on approximately 8,413 acres of land that overlies the approximately 17,477 acres of private minerals at Big South Fork NRR (unless otherwise approved in a plan of operations and not subject to gorge or deed restrictions). Because of the restrictions at Obed WSR, these operations would not be allowed within the park unit.



**Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**—

Under alternative B, (similar to alternative A), operations associated with geophysical exploration, drilling, and production could be allowed in all areas of the park units where non-federal oil and gas rights exist, with the exception of protected areas identified by CLPRs, including the 9B regulations, the gorge restrictions at Big South Fork NRRRA, and deed restrictions at Obed WSR. Based on a comparison of known private mineral rights and the extent of these protected areas, geophysical exploration and drilling/production may be restricted on approximately 8,413 acres of land that overlies the approximately 17,477 acres of private minerals at Big South Fork NRRRA (unless otherwise approved in a plan of operations). Because of the restrictions at Obed WSR, which include a No Surface Use stipulation for the gorge area under alternative B, these operations would not be allowed within the park unit. In addition, under alternative B the NPS would implement this oil and gas management plan that clearly articulates and proactively enforces the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR, as described in detail in chapter 2.

**Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**—

Operations associated with geophysical exploration, drilling, and production could be allowed in all areas of the park units as described for alternatives A and B; however, under alternative C, Special Management Areas (SMAs) with surface use and timing stipulations would also be formally designated, and operations would be limited in SMAs (see table 8 for details) unless authorized in an approved plan of operations. As a result, under alternative C geophysical exploration may be restricted on approximately 10,943 acres of land that overlies the approximately 17,477 acres of private minerals at Big South Fork NRRRA, and drilling/production may be restricted on 11,587 acres of land that overlies the approximately 17,477 acres of private minerals at Big South Fork NRRRA (unless otherwise approved in a plan of operations). Establishing the Obed WSR SMA would preclude non-federal oil and gas operations (exploration, drilling, and production) on all federal lands in the park unit. In addition, similar to alternative B, the NPS would implement this oil and gas management plan that clearly articulates and proactively enforces the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR, as described in detail in chapter 2.

## **GEOLOGY AND SOILS**

### **GUIDING REGULATIONS AND POLICIES**

NPS *Management Policies 2006* (NPS 2006c) address soils and geologic resources under several sections: Section 4.8.2—Management of Geologic Features states that the NPS will protect geologic features from unacceptable impacts of human activity while allowing natural processes to continue. The term “geologic features” describes the products and physical components of geologic processes and includes features such as rocks, soils, and minerals; canyons and arches; and dramatic or unusual rock outcrops and formations. Section 4.8.2.4—Soil Resource Management states that the NPS will actively seek to understand and preserve the soil resources of park units, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources. Management action will be taken by park superintendents to prevent, or at least minimize, adverse, potentially irreversible impacts on soils.

## Methodology, Assumptions, and Impact Thresholds

The impact intensity threshold definitions are based on the potential for changes to geology and soils characteristics, as follows:

- Negligible:* Impacts would result in a change to geologic or soil resources, but the change would be so slight that it would not be of any measurable or perceptible consequence. Erosion rates, soil productivity, and soil stability would remain consistent with current conditions.
- Minor:* Impacts would result in a change to geologic or soil resources, including a change to erosion rates, soil productivity, and soil stability, which would be detectable. The disturbance would be expected to be nearly indiscernible, of little consequence, and localized. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:* Impacts would result in a change to geologic or soil resources, including a change to erosion rates, soil productivity, and soil stability, which would be readily detectable. The disturbance would be expected to be relatively small and localized. Local geomorphologic features would be affected. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.
- Major:* Impacts would result in a long-term or permanent change to geologic or soil resources that would result in the loss of local geomorphologic features, or would have substantial consequences on a regional scale. The disturbance would be expected to be large and many geologic features would be lost. Extensive mitigation measures would be needed to offset any adverse effects, and the success of these measures would not be guaranteed.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—The primary impacts on soils from geophysical exploration would result from vegetation clearing and use of seismic vibrator technology. Removal of vegetation increases the potential for soil erosion. Surface disturbances from survey crews traversing the area during geophysical exploration could also cause soil compaction, reducing the soil's water-holding and infiltration capacities. Compacted soils increase runoff of surface waters and accelerate soil erosion.

There is the possibility that use of seismic vibrator technology could cause disturbance to soils or geologic features from soil movement or settling or ground vibrations. However, mitigation would include the proper selection of vibrator system, setbacks from sensitive resources, adjustments in the energy source, timing during the dry period, and erosion control as needed. Surveys would typically last only 1 to 3 days, and laying of recording devices would also be along designated roads and trails with use of vehicles similar to those used by the public or park maintenance/enforcement staff (all terrain vehicles or 4×4 pickup trucks). Any off road access would be by foot. Vibroseis® units can adjust the amplitude and/or the frequency of the energy source so they can obtain the best imaging of the target formations. That capability can also be used if necessary to help prevent damage to sensitive surface structures or

geologic formations. In addition, seismic surveys would be conducted under an approved plan of operations for all alternatives. Natural resource surveys would be conducted as deemed necessary by resource specialists, and appropriate mitigation applied, including offsets from sensitive features determined on a case-by-case basis. As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRRRA,. Therefore, with the proper selection of the vibrator system and application of mitigation as described above, impacts to soils and geology would be localized, negligible, and adverse.

**Drilling and Production**—Drilling and production operations would not directly impact soils or geologic resources in protected areas where operations would not be permitted under CLPRs. Where permitted, the construction, maintenance, and use of access roads, wellpads, flowlines, and pipelines could increase soil erosion and affect soil productivity from vehicle compaction and vegetation clearing, and soils could be adversely affected by soil contamination from leaking equipment or spills.

Surface disturbances during drilling and production activities could cause soil compaction, thereby reducing the soil's water-holding and infiltration capacities. This would in turn reduce the root-penetration capabilities of vegetation and hinder plant growth and further soil formation. These compacted soils would also increase runoff of surface waters and accelerate soil erosion. Soil hydrologic groups C and D, which are typically found in lowland areas (wetlands and floodplains), are very susceptible to adverse impacts from oil and gas operations. These soils have moderate to high erodibility and are especially susceptible to vehicle use.

Where new wells could be located, the construction and maintenance of access roads, wellpads, flowlines, and pipelines would require vegetation clearing, and could erode, compact, and rut soils, thereby reducing soil permeability. To accommodate the well drilling rig and accompanying equipment, the drill site must first be prepared. Site preparation may include extensive clearing, grading, cutting, filling, and leveling of the pad using heavy construction equipment. Soil material suitable for plant growth is often removed first and stockpiled for later use in reclamation. Under CLPRs the NPS does not permit digging reserve pits within the parks. The operator must use a containerized mud system. There are, however, many reserve pits at Big South Fork NRRRA from previously existing operations. Slopes are particularly susceptible to erosion caused from road and wellpad construction. Avoidance of steep slopes and sensitive soils is required under CLPRs and is the most cost-effective and sensible approach that would avoid adverse impacts. Soil displacement and losses cannot be predicted with any degree of accuracy until soil studies have been done for a plan of operations. If there are no other practicable alternatives to constructing roads and pads on slopes, construction would be permitted if least damaging methods are used. In all areas of the park units, and particularly for operations constructed on slopes greater than 3%, establishment of 70% native grass cover would be required within 3 months of initiating reclamation to minimize soil erosion.

In the case of Big South Fork NRRRA, where new drilling and production operations would be allowed, a 14-foot-wide road (including shoulders and turnouts) 1/4 mile in length would disturb approximately 0.85 acre of soil. Elevated pads for drilling and production operations may disturb as much as 1.5 acres of soil per site. Under the forecast of oil and gas activities, this would result in approximately 36 acres of new disturbance at Big South Fork NRRRA, resulting in localized, short-term (construction activities and drilling operations) to long-term (roads, production operations, and flowlines and pipelines), moderate, adverse impacts from construction of oil and gas facilities.

In addition to construction-related impacts associated with development of the access roads and wellpads, another primary impact on soils is the potential for releases of hazardous or contaminating substances during drilling or production operations, including well workovers and servicing. In most cases, primary and secondary containment on a wellpad should prevent the release of drilling muds, diesel fuel, oil and

gas, and other substances beyond the wellpad. The composition of the drilling mud depends on the types of formations being drilled as well as other project-specific factors. Mud is often composed of water, and chemical additives such as alkalis, bactericides, soluble chromates, and corrosion inhibitors are often used to optimize well drilling. The drilling mud and cuttings from the well account for the largest volume of waste generated at the well site and, according to CLPRs, the drilling mud (including drill cuttings and waste fluids) must be completely containerized in tanks for off-site disposal at a state-approved facility. Drilling operations in the park units should not encounter formations with H<sub>2</sub>S, or with high pressures and associated uncontrolled flows of oil, gas, brine, or freshwater. Safety precautions such as the use of properly weighted drilling muds and blowout preventers are expected to promote safe drilling operations that would prevent blowouts and the release of contaminants.

However, the NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact soils and geological 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 such as use of blowout preventers and implementation of Spill Prevention, Control, and Countermeasure (SPCC) plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park's resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

Since production operations could continue for multiple years, the potential for leaks and spills of hazardous or contaminating substances from these operations (including flowlines and pipelines) is greater than for any other type of oil and gas operation. Impacts on soils may occur from accidental discharge of drilling fluids during workovers, hazardous waste spills (including diesel fuel), well blowouts, and rupture of flowlines and pipelines. Chronic small leaks and spills could spread through various pathways and over an extended period of time could become substantial and costly to remediate. The intensity of the impacts resulting from this scenario would depend on the type of substance spilled (hydrocarbons, produced waters, chemicals, solvents, and fuels) and the size of the area impacted. Releases of contaminating or hazardous substances normally require in situ treatment or the removal of all of the contaminated soil and replacement with soil brought in from outside the park unit. The chances of undetected spills are greater under this alternative because routine inspections would not occur beyond base workload levels, which increases the potential for a more severe or widespread adverse impact.

Under CLPRs, risks associated with accidental releases of hazardous and contaminating substances are reduced by a variety of operating stipulations. Careful siting of operations would avoid moderate or steep slopes, reducing the potential for downslope contamination with oil, gas, or other hazardous substances. Other considerations for locating a production site would include avoiding close proximity to wetlands, floodplains, or waterways. Other mitigation techniques include the use of less toxic or hazardous substances, storing the minimum quantity of contaminating and hazardous substances at operations locations, storing barrels or smaller containers of chemicals with secondary containment, using automatic shutoff valves on wells and on flowlines on each side of crossings of waterways and other sensitive resource areas, constructing berms and installing liners at production tank facilities and increasing their capacity to accommodate high precipitation events, and including a spill notification and response plan in the plan of operations.

Although the NPS would not monitor and inspect wells as frequently, it would typically be notified when a problem was discovered, and would take steps to minimize adverse impacts from leaks and spills of hazardous and contaminating substances. Given the operating stipulations and mitigation under CLPRs,

as well as the limited number of new operations projected in the forecast of oil and gas activities, there would be localized short- to long-term minor to moderate adverse impacts on soils from drilling and production operations in the park units, although the potential for a major adverse impact from an undetected spill or release is more likely under this alternative.

**Plugging and Reclamation**—As described in the forecast of oil and gas activities, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land. Well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion and could disturb and contaminate soils. Most plugging jobs would be in the 2- to 3-day range from rig up to rig down. Equipment and materials to be used during the plugging operations may consist of cement trucks, pulling rigs, water trucks, personal vehicles, and tanks for holding well material.

Incorrectly removing fill materials could result in exposure and erosion of the underlying soils. Contamination from hydrocarbons and produced water persists at several of these inactive and abandoned oil and gas operations. Until cleanup is successfully completed, there would be adverse impacts on geologic resources. CLPRs require the operator to conduct baseline soil chemical analyses so that if there were a release of hazardous or contaminating substances, the operator could remove or remediate the contaminants to acceptable levels and reclaim the site to predisturbance conditions. Predisturbance conditions would most often not be known with certainty; however, cut-and-fill areas of original road and pad construction would often be readily apparent. Surrounding plant communities are strong indicators of predisturbance vegetation conditions. Decisions on returning a site to its original contours would take into consideration current conditions of plant communities and soils/slope stability. Typically, small earthmoving equipment (small bulldozer or backhoe) would be used to restore contours, remove pit contents if necessary, etc. Erosion-control measures would be used to prevent soil movement off the site. Considering these factors, plugging and reclamation activities would result in localized short-term negligible to minor adverse impacts on soils.

Once plugging and reclamation is complete, there would be long-term beneficial impacts on geology and soils across approximately 87 acres of the park units. Plugging and reclamation of wells would allow vegetation in disturbed areas to recover and provide erosion control in areas of previous impacts from oil and gas operations. Plugging and reclamation would also remove sources of potential leakage such as wellhead equipment and flowlines.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact soils and other geologic resources in the park units. The types of impacts related to soil erosion and runoff are expected to be similar to those described above for operations inside the park units, but the intensity of impacts could increase for operations sited closer to park boundaries, where water and sediment can be transported downslope into park units through gullies or overland flow. Impacts would depend on proximity of operations to the park units; site-specific environmental conditions, such as steepness and direction of slope, and surface hydrology; and mitigation measures being employed. Based on these factors, indirect impacts on geologic resources in the park units would range from no impact to localized, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production,

impacts to geology and soils are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would result in both adverse and beneficial cumulative impacts on soils and geology at the park units.

Geologic resources (primarily 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 the park units. Agricultural, forestry, and construction activities may cause compaction and rutting, reduce permeability, and increase erosion. These actions would have potentially widespread short- and long-term minor to moderate adverse impacts on soils and geology.

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 minor to major adverse impacts. Existing and abandoned operations in the park units would continue to adversely affect geologic resources until the sites are reclaimed. Existing and future coal mining would also contribute incrementally to cumulative impacts in the study area, resulting in long-term minor to major localized adverse impacts on soils and geology.

In addition to cumulative actions that have negative effects on soils and geology, there are also some actions that have beneficial effects. For example, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 soils and geology, due to improving resource protection practices. The NPS has plugged one well and is in the process of plugging and reclaiming 14 abandoned wells at Big South Fork NRRRA and also recently received funding to plug and reclaim an additional 39 wells at Big South Fork NRRRA to protect resources and provide a safe visitor experience. Surface reclamation that has occurred or would occur on these existing access roads and wellpads would reduce soil erosion and reestablish surface drainage flows. These actions would result in long-term beneficial impacts on soils and geology. The information provided by geologic resource surveys of proposed operations in the park units would increase NPS knowledge of the resource in the park units, a negligible beneficial impact.

Overall, the impacts of these actions, when combined with the localized short-term negligible to moderate adverse impacts and the beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on soils and geological resources. Alternative A would directly impact a relatively small area and would contribute a minimal amount to overall adverse cumulative impacts.

## **Conclusion**

Under alternative A geophysical exploration, including soil compaction and use of seismic vibrator technology, would result in short-term localized negligible adverse impacts on geology and soils. During drilling, production, or transport, hydrocarbons, produced waters, or treatment chemicals could be released with short- to long-term minor to moderate adverse impacts, but with a risk for more widespread or severe adverse impacts from leaks and spills that could go undetected. Pad construction would result in localized long-term moderate adverse impacts. Well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities would result in localized short-term negligible to minor adverse impacts at sites throughout the park units. Once plugging and reclamation is complete, however, there would be long-term beneficial impacts on geology and soils in areas where drilling had occurred, allowing vegetation in disturbed areas to recover and

provide erosion control in areas of previous impacts from oil and gas operations. Indirect impacts on geologic resources in the park units from directionally drilled wells outside the units would range from no impact to localized, short- to long-term, minor adverse impacts. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on soils and geologic resources. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and contribute minimally to overall adverse cumulative impacts.

### **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

#### **Analysis**

**Geophysical Exploration**—Similar to alternative A, minimal geophysical exploration is expected at Big South Fork NRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B from vegetation clearing, crew access and seismic vibrator use would be very similar to the impacts described in alternative A, and would be localized, short term, negligible, and adverse.

**Drilling and Production**—Drilling and production activities under alternative B would result in no direct impacts on geologic resources covered by the No Surface Use stipulation described previously. In all other areas of the park units where drilling and production operations could be permitted, the construction and maintenance of access roads, wellpads, flowlines, and pipelines could erode, compact, and rut soils; introduce non-native construction materials; and reduce soil permeability. Releases of hazardous or contaminating substances during drilling or production operations could also adversely affect soils, and well blowouts, fires or large uncontrolled releases could cause short-term major adverse impacts. However, under alternative B the NPS would implement an oil and gas management plan that clearly communicates and proactively enforces the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRA and Obed WSR. Additionally, increased inspections and monitoring under alternative B would reduce the chance of leaks or releases going undetected and affecting a large area of soils, and would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term adverse impacts from drilling and production would still occur, this alternative would protect park resources and values, including soils, better than alternative A. Therefore, alternative B would have short-term and long-term minor adverse impacts.

**Plugging and Reclamation**—Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land. Similar to alternative A, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion and could disturb and contaminate soils. However, under alternative B the NPS would implement an oil and gas management

plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRA and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. Coupled with the mitigation described for alternative A and in appendix B, there would be localized short-term negligible to minor adverse impacts.

Once plugging and reclamation is complete, there would be long-term beneficial impacts on soils and geology from removing sources of erosion and releases of hydrocarbons or toxic substances. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, long-term beneficial effects would be more likely to be realized sooner.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact geology and soils in the park units. For the three wells directionally drilled from outside the park unit at Obed WSR, impacts would be very similar to the impacts described under alternative A. The intensity of impacts on park resources would depend on the proximity of operations to the park and site-specific conditions. Adverse impacts on geology and soils in the park would range from no impact to localized, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts.

### **Cumulative Impacts**

Impacts on soils and geology from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on soils and geology in the watersheds. The more proactive enforcement of CLPRs and increased inspections/monitoring would limit adverse impacts, but the majority of the impacts on soils and geology of the watershed lie outside the park units, where impacts may or may not be mitigated. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Conclusion**

Similar to alternative A, limited exploration operations would result in localized short-term negligible adverse impacts on soils and geology from vegetation clearing, crew access, and seismic vibrator technology. The construction and maintenance of drilling and production operations would result in localized short- and long-term minor adverse impacts in Big South Fork NRRA where such activities would be permitted. Plugging and reclamation of new and existing and abandoned operations would result in localized short-term negligible to minor adverse impacts on geologic resources. Indirect impacts on geologic resources in Obed WSR from drilling and production of directional wells drilled from outside the park unit to bottomholes beneath the park unit would range from no impact to localized short to long-term minor adverse impacts. Once plugging and reclamation is complete, there would be long-term beneficial impacts on soils and geology from removing sources of erosion and releases of hydrocarbons or toxic substances. Although up to major short-term adverse effects could occur in the unlikely event of a



well blowout, fire, or uncontrolled release from any well, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on soils and geologic resources. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Similar to alternative A, minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively using seismic vibrator technology. With the addition of the Sensitive Geomorphic Feature and Cliff Edge SMAs under alternative C, potential impacts on sensitive geomorphic features would be identified early on and avoided. As a result, impacts associated with geophysical exploration in alternative C from vegetation clearing, crew access and seismic vibrator use would be very similar to the impacts described in alternative A, and would be localized, short term, negligible, and adverse.

**Drilling and Production**—Although the forecast of oil and gas activities accounts for 36 acres of disturbance associated with new drilling and production operations, the designation of SMAs would limit the effects on geology and soils within SMA boundaries. Limiting drilling and production operations in the Sensitive Geomorphic Feature and Cliff Edge SMAs would reduce the degree of adverse impacts on soils and sensitive geomorphic features susceptible to adverse impacts from oil and gas operations. Impacts on soils and geology in areas of the park where drilling and production would be permitted would be essentially the same as described for alternative B: the construction and maintenance of access roads, wellpads, flowlines, and pipelines could erode, compact, and rut soils; introduce non-native construction materials; and reduce soil permeability; and releases of hazardous or contaminating substances during drilling or production operations could adversely affect soils. Well blowouts, fires, or large releases could cause short-term major adverse impacts, but the probability of occurrence would be low. Overall, impacts on geology and soils at Big South Fork NRRRA from drilling and production under alternative C would be localized, short to long term, negligible to minor, and adverse.

**Plugging and Reclamation**—As with alternatives A and B, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land. Similar to alternative B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion and could disturb and contaminate soils, but with mitigation and the new management framework for plugging and reclamation of wells, there would be localized short-term negligible to minor adverse impacts.

Once plugging and reclamation is complete, there would be long-term beneficial impacts on soils and geology from removing sources of erosion and releases of hydrocarbons or toxic substances. Because SMAs would be used to prioritize wells for plugging, those in proximity to sensitive geomorphic features and cliff edges could be plugged sooner. Additionally, the new management framework for plugging and

reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards. Therefore, long-term beneficial effects would be more likely to be realized sooner.

**Directionally Drilled Wells**—Under alternative C some wells may be directionally drilled from outside the SMAs or outside the park units to develop hydrocarbons underlying the SMAs. The intensity of impacts on soils is dependent on where the operation is located with respect to soil type, whether the operation is sited inside or outside of the park unit, and on the resource protection measures that are employed. Indirect impacts on geologic resources in the park units from drilling and production of directional wells from outside the park or SMA boundaries could range from no impact to short- to long-term, negligible to minor, adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. Reclamation of directionally drilled wells would result in long-term beneficial impacts.

### **Cumulative Impacts**

Cumulative impacts on soils and geology in the area of analysis from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate adverse cumulative impacts on soils and geology in the watersheds. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

### **Conclusion**

Under alternative C, limited exploration operations would result in localized short-term negligible adverse impacts on soils and geologic resources in the park units from vegetation clearing, crew access, and use of seismic vibrator technology. Drilling and production would be permitted in areas of Big South Fork NRR outside of established SMAs (or as approved in a plan of operations that protects SMA resources and values), with localized short- to long-term negligible to minor adverse impacts. Plugging, abandonment, and reclamation of existing and abandoned operations throughout the park units and of new operations located outside SMAs would result in localized short-term negligible to minor adverse impacts on geologic resources. Once plugging and reclamation is complete, there would be long-term beneficial impacts on soils and geology, as described in the previous section. Impacts from directional drilling from outside SMAs could range from no impact to localized, short- to long-term, negligible to minor, adverse impacts. Reclamation of directionally drilled wells would result in long-term beneficial impacts. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release from any well, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts would be similar to those described for alternative B, with short- and long-term minor to moderate adverse cumulative impacts on soils and geology. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, SMA identification and protection, and expedited well plugging.

## WATER RESOURCES

### GUIDING REGULATIONS AND POLICIES

The importance of water resources is highlighted in the Big South Fork NRRA purpose, which states that the NRRA was established to preserve the free-flowing Big South Fork and portions of its tributaries and to preserve the natural integrity of the gorge, and is also highlighted in the Obed WSR purpose, which states that the purpose of this park service unit is to preserve and protect the Obed WSR system and the surrounding area in an essentially primitive condition, with unpolluted waters, for the benefit and enjoyment of present and future generations (NPS 2005b).

The NPS *Management Policies 2006*, section 4.6.1 (NPS 2006c), addresses water resource management and states that the NPS will perpetuate surface and groundwater as integral components of park ecosystems and avoid the pollution of park waters by human activities occurring in and outside the park units. The NPS will take all necessary actions to maintain or restore the quality of surface and groundwater within the park units in a manner consistent with all applicable regulations.

The Water Resources Development Act of 1974 states:

...the Big South Fork NRRA was created: for the purposes of ... 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 recreation.

Other guiding regulations and policies that pertain to water resources include numerous federal and state statutes, as described in appendix F.

### METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

Given the programmatic nature of this plan/EIS, the exact locations of oil and gas operations associated with the reasonably foreseeable development (RFD) scenario and the forecast of oil and gas activities are unknown. The degree of potential impacts on water resources from oil and gas development would depend on the types and locations of operations and the mitigation measures used to reduce impacts. As a result, a qualitative analysis of the potential impacts of oil and gas operations on surface and groundwater was conducted based on best professional judgment and discussions with NPS staff and consultants.

The impact intensity threshold definitions are based on the potential for changes to water resource characteristics, as follows:

*Negligible:* Impacts would result in a change to water resources but the change would be so slight that it would not be of any measurable or perceptible consequence. Water quality and streamflows would be consistent with historical or baseline conditions. These changes would not affect the main stems of the Big South Fork of the Cumberland River or Obed WSR or wild and scenic river values.

*Minor:* Impacts would result in a change to water resources of the main stems of the Big South Fork of the Cumberland River or Obed WSR, whether they are detectable or not. For other waters, impacts would result in a detectable change to water resources, but the change would be expected to be small, of little consequence, and

localized. Water quality and streamflows would be consistent with historical or baseline conditions, and the impacts would not affect wild and scenic river values. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

*Moderate:* Impacts would result in a change to water resources that would be readily detectable and localized. Occasional alterations of historical or baseline water quality or streamflow conditions may occur, but would not affect wild and scenic river values. Mitigation measures, if needed to offset adverse effects, could be extensive but would likely be successful.

*Major:* Impacts would result in a change to water resources that would have substantial consequences on a regional scale, including the potential for affecting wild and scenic river values. Frequent alterations in the historical or baseline water quality and streamflow conditions would occur over a large area and could result in modifications to the natural stream channel and instream flow characteristics. Extensive mitigation measures would be needed to offset any adverse effects, and the success of these measures would not be guaranteed.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used, receiver lines would be laid on foot, and no explosives would be used, there would be very limited impacts on water quality. Where the use of existing roads would disturb existing unpaved surfaces and could result in increased road runoff or would include driving across small streams or gullies, CLPRs would also protect water resources, since the 9B regulations require that “Surface operations shall at no time be conducted within 500 feet of the banks of perennial, intermittent, or ephemeral watercourses” (36 CFR 9B). Natural drainage paths would be avoided when possible, and refueling of vehicles would not be done near surface waters to reduce the chances for spills. These stipulations would minimize impacts on surface water resources, which would be localized, short term, negligible, and adverse.

**Drilling and Production**—Drilling and production operations would not directly impact water resources in protected areas where operations would not be permitted under CLPRs. Where permitted, the construction, maintenance, and use of access roads, wellpads, flowlines, and pipelines could increase turbidity, sedimentation, and soil erosion, and could alter flow characteristics and hydrologic functions of surface waters. Clearing of vegetation for these activities would expose soils to erosion, which could move downslope and increase turbidity and sedimentation in nearby surface waters. This could also create ruts or gullies that channel surface water flows. Road construction and the use of compacted road fill could also reduce infiltration rates on road surfaces, increasing surface runoff. Access roads and pads could also disrupt natural surface flow patterns and might result in an increase or decrease in the amount of water in some areas. Additional roads in the park could increase access, which in turn could result in additional land disturbance and erosion. If roads are used during wet conditions, rutting could occur and might concentrate surface water flows.

Water resources could become contaminated if hazardous or contaminating substances are released during drilling, production, servicing, or transport. Although drilling operations in the park should not encounter formations with H<sub>2</sub>S or high pressures and associated uncontrolled flows of oil, gas, brine, or freshwater, blowouts could occur during drilling and release hydrocarbons, water, and drilling mud. There could also be accidental spills of drilling mud, diesel fuel, and other chemicals during drilling operations. If drilling mud, fuels, or other chemicals are spilled on the ground and there is no impermeable liner on the wellpad, the fluids could infiltrate into shallow aquifers or reach nearby surface waters, resulting in potentially major adverse impacts if these are not detected and remediated.

The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact water 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park's resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

Because production operations could continue for 20 years or longer, the potential for leaks and spills of hazardous or contaminating substances from production operations (including flowlines and pipelines) is greater than for any other phase of oil and gas operations. Adverse impacts on water quality might occur from accidental leaks and spills of drilling fluids during workovers, hazardous waste spills (including diesel fuel), well blowouts, ruptures of flowlines and pipelines, and spills from tanker trucks. Chronic small leaks and spills could spread through various pathways, and over an extended period of time could become substantial and costly to remediate. The chances of undetected spills, which increase the potential for a major adverse impact, are greater under this alternative than under the action alternatives because routine inspections would be limited to base workload levels. Faulty installation or corrosion of production casing might go undetected and could adversely impact groundwater, if hydrocarbons and/or produced waters migrate into an aquifer and contaminate groundwater. The intensity of the impact would depend on the type of substance spilled (hydrocarbons, produced waters, chemicals, solvents, and fuels) and the size of area impacted, but, as noted above, could reach the level of major adverse impacts.

The transport of hydrocarbons also has the potential to adversely affect water quality. Production pipelines can rupture from corrosion of the pipe, or from failure of a flange, valve, or seal. Oil and gas pipelines are generally larger in diameter and under more pressure than the smaller flowlines and therefore pose the potential for a large-volume release. The escaping fluids could contaminate surface and groundwater and could have adverse impacts on water quality. In lieu of transporting hydrocarbons via pipelines, the product could be transported by tanker truck. This method has a greater potential for leaks and spills during transfer of fluids to the tanker, in addition to the potential for vehicular accidents in which the tank contents could be spilled.

Although the potential for water quality impacts would exist, as described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRR and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR. In addition, measures to be implemented under CLPRs are expected to prevent the contamination of surface and groundwater. For new operations, siting drilling and production operations 500 feet from waterways as required under 36 CFR 9.41(a), unless specifically authorized by an approved plan of operations, would reduce the likelihood of spills entering waterways. Also, careful siting of wellpads away from moderate or steep slopes would minimize the potential of contaminating or hazardous substances being transported

downslope into adjacent waters. The use of automatic shutoff valves on flowlines and pipelines on each side of any water-body crossing would reduce the volume of a hydrocarbon release. Additional mitigation measures that would protect water resources include using the least contaminating and hazardous substances, storing the minimum quantity of contaminating and hazardous substances at operations locations, storing barrels or smaller containers of chemicals in “coffins” or other secondary containment, constructing berms and installing liners at drilling operations and at production facilities, increasing capacity within the firewall to accommodate high precipitation events, and including a spill notification and response plan in the plan of operations. In addition, safety precautions, such as the use of properly weighted drilling muds and blowout preventers, are expected to promote safe drilling operations, avoiding blowouts and the release of contaminants. Primary and secondary containment systems, such as containerized mud systems, impermeable wellpad liners, and berms around the perimeter of the wellpad, should prevent the release of hazardous and contaminating substances into surface and groundwater. Proper site containment and placement and cementing of casing through all usable aquifers according to the minimum standards should adequately protect groundwater from contamination with hydrocarbons and produced waters.

Although the NPS would not routinely monitor and inspect wells as frequently as desired under this alternative, it would typically be notified when a problem was discovered, and would take steps to minimize adverse impacts from leaks and spills of hazardous and contaminating substances. Releases of contaminating or hazardous substances normally require in situ treatment of soils and surface and groundwater, or the removal of all the contaminated soil and replacement with soil brought in from outside the park. Cleanup attainment levels are to the baseline surface- and groundwater chemistry, which is determined prior to beginning operations.

Given the above operating standards and other mitigation under CLPRs, as well as the limited number of new operations projected in the forecast of oil and gas activities, there would be localized short- to long-term negligible to moderate adverse impacts from drilling and production operations in the park units, although the potential for a major adverse impact from a spill or release would be more likely under this alternative.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Clearing vegetation from oil and gas access roads and wellpads and the use of heavy equipment and vehicles would temporarily increase localized erosion potential, which could result in turbidity and sedimentation in nearby waterways. In addition, there is the potential for release of liquid hydrocarbons and/or contaminating or hazardous substances into surface and groundwater from vehicles, wellhead equipment, or flowlines during well plugging and reclamation activities. These temporary activities could cause detectable, localized changes to water quality in the case of wells located near surface waters.

However, mitigation measures would be applied during plugging and reclamation operations to minimize potential long-term impacts on water resources. These measures include conducting activities within previously disturbed areas, using chainsaws and tractors equipped with bush hogs to limit ground disturbance, using erosion-control structures (straw bales and silt fences), placing tanks at each well to capture any well fluids produced during plugging, and placing a liner around the wellhead and under all service vehicles to prevent contamination. 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. Soil, hydrology, and native vegetation communities would be restored as soon as practicable after completion of the plugging operation to limit erosion and runoff. Reclamation of

wellpads and access roads would reduce erosion rates to predisturbance levels. Over time, these practices could eliminate the adverse impacts caused by original drilling and production operations, if fill materials are completely removed, sites are properly prepared, sites are stabilized to match original contours, and proper seed mixtures and revegetation techniques are used. Therefore, plugging and reclamation activities would have localized short-term minor adverse impacts on water resources.

There are currently a number of known well sites with the potential to adversely affect surface water as a result of leaking fluids, past or present spills, and poor condition of existing structures at orphaned well sites. During plugging operations, park staff would conduct a more thorough testing for contamination at each site. If contamination is found, subsequent steps would be taken to remove or neutralize contaminating substances. In addition, reclaiming the wellpads and access roads would have a beneficial impact on water resources by reducing soil erosion and reestablishing surface drainage flows, once recontouring and planting and establishment of native vegetation in disturbed areas is complete. As a result, there would be long-term beneficial effects on water resources once reclamation is complete.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact water resources in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park waters. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors, and with implementation of required spill-prevention features and plans under state regulations, indirect impacts on water resources in the park could range from no impact to indirect, localized to widespread, short- to long-term, minor to moderate, adverse impacts, but with the potential for major impacts in the case of a well blowout, fire, or large uncontrolled release especially from locations where runoff can reach park waters. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to water resources are expected to diminish and contribute less to cumulative impacts over time. 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. Past and future oil and gas development within and outside Big South Fork NRRRA would have short- and long-term minor to moderate 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 would also contribute to impacts. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of Big South Fork NRRRA, and it has similar impacts to traditional oil and gas development.

Acid mine drainage and abandoned mine impacts include contamination of water resources from sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites. Acidic drainage 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. Residential development and industrial activity outside the park unit would also contribute to the potential for contamination from improper handling of hazardous substances and the discharge of sediments to surface waters through soil erosion. These activities would have long-term localized negligible to moderate adverse impacts on water resources.

Visitor activities that include ground disturbance, such as ORV use, and improper refuse disposal would contribute to adverse impacts on water resources. These activities would have negligible to minor 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 2006e) 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 negligible to minor adverse impacts on water resources.

At Big South Fork NRRRA, 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, could be used to reach areas that have exotic species infestations. Exotic species management efforts could result in localized short-term negligible to minor adverse impacts on water resources.

Relatively low-density residential development occurs in the immediate vicinity of the park units, 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 the park units that could contribute to cumulative impacts include power plants, railroads, hardwood flooring factories, sawmills, and other manufacturing facilities. These sites result in discharges to surface waters as well as nonpoint source pollution from runoff, in addition to contributing other pollutants to the environment. Southwest of Obed WSR, two industrial parks have been developed in the Crossville area. Point and nonpoint discharges from these sources would result in widespread long-term negligible to moderate adverse impacts on water resources.

Big South Fork NRRRA and Obed WSR have developed numerous features related to parkwide administrative, managerial, and support functions, as well as visitor use. Developed areas exist within both park units that require varying levels of maintenance. The NPS routinely maintains trails, buildings, and roads, as well as cultural landscapes, in the park units. These activities would result in localized long-term negligible to minor 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 NRRRA and Obed WSR, and most of the forested areas of Big South Fork NRRRA have been logged. At Obed WSR, logging and clearing for agriculture is particularly evident. 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 and clearing activities on private inholdings could result in increased sedimentation and runoff, with short- and long-term localized to widespread minor adverse impacts on water resources.

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 NRRRA, and there are about 10 abandoned surface coal mine sites in McCreary County, Kentucky. The Big South Fork NRRRA has undertaken remediation studies of selected sites where contaminated mine drainage is of concern. The Worley riverside area is a former mining community where remnants of mining operations, including mine tailings, are evident. Water quality on the site is an issue due to acid mine drainage, as discussed previously, and remediation of mine effects is being planned at this site.



Diseases and insect pests of vegetation, such as the pine bark beetle, have caused a decline in streamside vegetation. Large stands of trees could be affected by infestations, which would result in increased runoff and sedimentation and changes in water temperature and chemistry. This would have a widespread long-term minor adverse impact on water resources.

Some plans and projects within the park would also have long-term beneficial effects on water resources. The GMP at Big South Fork NRRA outlines desired resource and visitor experience conditions that would protect 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, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 minor to moderate adverse impacts and the beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on water resources in watersheds within and adjacent to the park units. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## Conclusion

Under alternative A, limited geophysical operations would result in short-term negligible adverse impacts on water resources from erosion and runoff. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short-term to long-term minor to moderate adverse impacts related to site and access road clearing and construction and associated ground disturbance, compaction, and/or erosion, but with a risk of major adverse impacts from leaks and spills that could go undetected. Impacts from plugging and reclamation of wells at either park would be localized, short term, negligible to minor, and adverse. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on water resources by reducing soil erosion and reestablishing surface drainage flows. Wells directionally drilled and produced from outside the park units would have indirect impacts on water resources in the park that could range from no impact to indirect, localized to widespread, short- to long-term, minor to moderate, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term minor to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on water resources in regional watersheds. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, and would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A, with negligible to moderate adverse effects. As described under alternative A, the construction and maintenance of access roads, wellpads, flowlines, and pipelines could increase turbidity, sedimentation, and soil erosion, and could alter flow characteristics and hydrologic functions of surface waters of the park for wells and access. Leaks and spills during construction activities or drilling or production operations, and blowouts during drilling operations, could adversely impact water resources in the park. The intensity of the impact would depend on the type of substance spilled (hydrocarbons, produced waters, chemicals, solvents, and fuels) and the size of the area impacted, with a risk of short-term major impacts from blowouts or large uncontrolled releases.

However where drilling and production operations would be permitted, mitigation measures (as described under alternative A) would help to avoid or minimize adverse impacts on water resources. Also, under alternative B the NPS would implement an oil and gas management plan that proactively communicates and enforces the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR, including spill prevention and response responsibilities. Additionally, increased inspections and monitoring under alternative B would reduce the chance of leaks or releases going undetected and reaching surface or groundwater and would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term adverse impacts from drilling and production would still occur, compared to alternative A, this alternative would result in increased protection of park resources and values, including water resources. Therefore, alternative B would have short-term and long-term negligible to potentially moderate adverse impacts, with a reduced probability of long-term major adverse impacts associated with potential leaks and spills.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed resulting in the reclamation of approximately 87 acres of land.

Similar to alternative A, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion, increase sedimentation in waterways, alter surface water flows, and contaminate surface and groundwater.

However, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. This includes a new management framework for

plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. Coupled with the same mitigation measures described for alternative A and in appendix B, there would be localized short-term negligible to minor adverse impacts. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—As described under alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact water resources in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park waters. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors, indirect impacts on water resources in the park could range from no impact to indirect, localized to widespread, short- to long-term, minor to moderate adverse impacts, but with the potential for major impacts in the case of a well blowout, fire, or large uncontrolled release especially from locations where runoff can reach park waters. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on water resources from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on water resources. The increased enforcement and inspections/monitoring under alternative B would better promote protection of water quality, but the majority of impacts on the water quality of the watersheds in the area of analysis would lie outside the park, where impacts may or may not be mitigated. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Conclusion**

Similar to alternative A, limited geophysical operations would result in short-term negligible adverse impacts on water resources from erosion and runoff. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short-term to long-term negligible to moderate adverse impacts on water resources related to site and access road clearing and construction and the associated ground disturbance, compaction, and/or erosion. Leaks and spills from wells, transport, or pipelines could result in severe adverse impacts; however, in most cases with the application of mitigation measures, increased inspections, and prompt response in the event of a spill, these impacts would be reduced to minor to moderate adverse levels. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts on water resources. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, long-term beneficial effects described under alternative A would be more likely to be realized

sooner. Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact water resources in the park. Effects on park resources could range from no impact to indirect, localized to widespread, short- to long-term, minor to moderate but potentially major, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout or uncontrolled release from any well, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on water resources. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C, SMAs would be established to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR, with the exception of the Special Scenery SMA unless otherwise approved in a plan of operations. While none of the SMAs were developed to specifically protect water resources, water resources would indirectly benefit from the SMAs and associated setbacks if water resources are located in or near these areas. Since minimal geophysical exploration is expected and would include use of existing roads and access on foot, impacts associated with geophysical exploration in alternative C would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be similar to the impacts described in alternatives A and B. Well blowouts or large uncontrolled releases could cause short-term major adverse effects. However, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRR and Obed WSR where resources and values would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, unless otherwise approved in a plan of operations, drilling and production would not be allowed in any of the SMA-associated setbacks at the park units. In the Cliff Edge, Visitor Use, and Cultural Landscape SMAs drilling would only be allowed during dry periods to minimize impacts on soil from rutting. This would minimize erosion and sedimentation and would minimize impacts on nearby water resources. The Cliff Edge and Sensitive Geomorphic Feature SMAs and setbacks would protect water resources by precluding drilling and production on the edge of the gorge or for features within the gorge. As result, construction and maintenance of drilling and production operations would result in short- to long-term negligible to mostly minor adverse impacts on water resources, with a more limited risk of major adverse effects from spills or leaks.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land. Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion, increase sedimentation in waterways, alter surface water flows, and contaminate surface and groundwater.

However, as with alternative B, the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRA and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. As a result, although short-term impacts from these operations would still occur, the intensity would be less than described for alternative A.

Similar to alternative B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities outside the SMAs could cause soil erosion, increase sedimentation in waterways, alter surface water flows, and contaminate surface and groundwater. However, with mitigation, these activities would result in localized short-term negligible to minor adverse impacts at sites throughout the park. Once plugging and reclamation is complete, there would be long-term beneficial impacts on water resources through removing sources of pollutants. Because SMAs would be used to prioritize wells for plugging, wells in proximity to sensitive geomorphic features and cliff edges could be plugged sooner, which would minimize the potential for them to affect downstream water resources.

**Directionally Drilled Wells**—As described under alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact water resources in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park waters. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors, indirect impacts on water resources in the park could range from no impact to indirect, localized to widespread, short- to long-term, minor to moderate, adverse impacts but with the potential for major impacts in the case of a well blowout, fire, or large uncontrolled release especially from locations where runoff can reach park waters. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Cumulative impacts on water resources in the area of analysis from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate cumulative impacts on water resources in watersheds within and adjacent to the park units in the area of analysis. The SMA restrictions would provide more consistent protection of water resources located in and downstream from SMAs, and enforcement of CLPRs is expected to limit adverse impacts on water resources, but off-park sources and other cumulative actions

would continue to adversely impact water quality in the regional watersheds. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

## **Conclusion**

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible adverse impacts on water resources from erosion and runoff. Under alternative C, with adequate setbacks, implementation of mitigation measures, and the establishment of SMAs, impacts on water resources in the park from drilling and production, related site and access road clearing and construction, and the associated ground disturbance, compaction, and/or erosion would be localized, short to long term, negligible to mostly minor, and adverse. Leaks and spills could result in minor to major adverse impacts; however, with the application of mitigation measures and prompt response in the event of a spill, these impacts would be limited in duration and reduced. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts on water resources. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact water resources in the park. Effects on park resources could range from no impact to indirect, localized to widespread, short- to long-term, minor to moderate but potentially major, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout or large uncontrolled release from any well, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts would be similar to those described for alternative B, with short- and long-term minor to moderate adverse cumulative impacts on soils and geology. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, SMA identification and protection, and expedited well plugging.

## **FLOODPLAINS**

### **GUIDING REGULATIONS AND POLICIES**

The NPS *Management Policies 2006*, section 4.6.4 (NPS 2006c), requires the NPS to manage for the preservation of floodplain values and minimize potentially hazardous conditions associated with flooding. The policies support avoiding environmental effects associated with the occupancy or modification of floodplains and avoiding locating development in floodplains unless that is not practicable. NPS Director's Order 77-2: Floodplain Management (NPS 2003d) requires that oil and gas operations not be permitted within the floodplain unless there is no practicable alternative. Executive Order 11988—Floodplain Management, directs federal agencies to avoid to the extent possible adverse impacts associated with the occupancy and modification of floodplains and to avoid floodplain development wherever there is a practicable alternative. Other guiding regulations and policies that pertain to floodplains include federal and state statutes, as described in appendix F.

## METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

Given the programmatic nature of this plan/EIS, the exact locations of oil and gas operations associated with the RFD scenario and the forecast of oil and gas activities are unknown. The degree of potential impacts on floodplains from oil and gas development would depend on the types and locations of operations and the mitigation measures used to reduce impacts. As a result, a qualitative analysis of the potential impacts of oil and gas operations on floodplains was conducted based on best professional judgment and discussions with NPS staff and consultants.

The impact intensity threshold definitions are based on the potential for changes to floodplain characteristics, as follows:

*Negligible:* Impacts would result in a change to floodplain functions and values, but the change would be so slight that it would not be of any measurable or perceptible consequence.

*Minor:* Impacts would result in a detectable change to floodplain functions and values, but the change would be expected to be small, of little consequence, and localized. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

*Moderate:* Impacts would result in a change to floodplain functions and values that would be readily detectable, measurable, and consequential, but relatively localized. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

*Major:* Impacts would result in a change to floodplain functions and values that would have substantial consequences on a regional scale. Extensive mitigation measures would be needed to offset any adverse effects, and the success of these measures would not be guaranteed.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used and receiver lines would be laid on foot, there would be very limited impacts on floodplains, except where the use of existing roads would disturb existing unpaved surfaces and result in increased road runoff or would include the crossing of small areas of floodplains along tributary streams. The NPS Non-federal Oil and Gas Rights Regulations, at 36 CFR 9.41(a), require that “operations shall at no time be conducted within 500 feet of waterways, unless specifically authorized by an approved plan of operations.” This operating requirement would substantially reduce the potential for adverse impacts on some of the more sensitive areas of park floodplains. These stipulations would minimize impacts on floodplains, which would be localized, short term, negligible, and adverse.

**Drilling and Production**—Where permitted, the construction, maintenance, and use of access roads, wellpads, flowlines, and pipelines could harm vegetation, expose soils to erosion, compact and rut soils, introduce non-native construction materials (i.e., gravel) and exotic vegetation, reduce soil permeability, and introduce sediments in waterways, all of which can affect floodplain functions and values. Spills or releases can also damage floodplain soils and vegetation. Drilling and production would affect floodplains if new facilities were sited in floodplains; however, this would not be very likely, given the limited number of wells to be drilled and the lack of defined floodplains in the park units except in and around the gorges, which are protected. Gorge restrictions at Big South Fork NRR, deed restrictions at Obed WSR, and the regulatory requirement that surface operations shall at no time be conducted within 500 feet of the banks of perennial, intermittent, or ephemeral watercourses or within 500 feet of the high pool shoreline of natural or man-made impoundments (36 CFR 9.41(a)) would provide protection for floodplains. Even more specific floodplain protection is provided in the NPS Director's Order 77-2: Floodplain Management (NPS 2003d), which requires that oil and gas operations not be permitted within the floodplain unless there is no practicable alternative. The intent of the directive is to recognize and protect beneficial floodplain values and to avoid long-term surface occupancy in floodplains, and to minimize impacts when there is no practicable alternative to locating operations in a regulatory floodplain. In interpreting Director's Order 77-2, the NPS directive requires operators to avoid or minimize developments and activities, including storage of hazardous or contaminating substances within 100- and 500-year floodplains, which could result in increasing flood hazards and reducing the beneficial value of floodplains. However, surface occupancy is permitted for limited phases of operations if there is no other practicable alternative and if floodplain/riparian impacts are minimized.

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 pads and the placement of adequate culverts under access roads and appropriate drainage on and around drilling and production pads would minimize changes in surface water flows that could adversely impact floodplains.

If there were no other practicable alternative, and for any existing facilities already located in floodplains, impacts on floodplain resources from drilling and production or well servicing would be short term (weeks to months) for construction activities and drilling operations and long-term (extending up to 20 years or more) for roads, production operations, and flowlines and pipelines. Mitigation measures that are required to "floodproof" drilling and production operations include shutting in the well, securing storage tanks, removing hydrocarbons from storage tanks and replacing them with water, and removing excess containers of contaminating and hazardous chemicals from the site. The approach of flooding events would provide the park and operators with sufficient time to take reasonable actions at oil and gas facilities necessary to avoid or reduce the potential impacts of flooding or hurricanes, such as securing tanks, removing product from tanks and replacing with water, shutting in wells, and removing excess containers of contaminating or hazardous chemicals. With the implementation of emergency-preparedness plans that are required of all operations, impacts related to flooding events should be limited to short-term minor adverse impacts.

Given these requirements and other mitigation measures identified in appendix B, as well as the limited extent of new drilling operations described in the forecast of oil and gas activities, there would be localized, negligible to minor, adverse impacts on floodplains from drilling and production operations.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.



Where plugging and reclamation activities are completed, the primary impacts on floodplains would be from the use of ORVs to transport equipment and personnel and from the use of heavy equipment. Vehicles could damage and kill plants, reduce the soil's water-holding and infiltration capacities, compact and rut soils, reduce the vegetation's root-penetration capabilities, and hinder plant growth and soil formation. Exposed, compacted soils increase runoff of surface waters and accelerate soil erosion. Erosion of floodplain soils could increase turbidity and sedimentation in nearby surface waters. Leaks and spills from ORVs could harm or kill vegetation and contaminate soils and surface and groundwater. Several mitigation measures provided for under CLPRs would help to minimize impacts on floodplain resources. With required mitigation there would be localized, short-term negligible to minor adverse impacts on floodplain resources from plugging and reclamation. In addition, plugging and reclamation of wells in or near floodplains would eliminate the issues associated with the presence of production facilities, as described for drilling and production. As a result, there would be long-term beneficial impacts on floodplains.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact floodplains in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park floodplains. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors, and with implementation of required spill-prevention features and plans under state regulations, indirect impacts on floodplains in the park could range from no impact to indirect, localized, short- to long-term, negligible to minor, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to floodplains are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would result in both adverse and beneficial cumulative impacts on floodplains. Past and future oil and gas development within and outside Big South Fork NRRRA would have short- and long-term minor adverse impacts from vegetation clearing, ORV use, and the construction and maintenance of access roads, wellpads, and flowlines. In addition, potential contamination of surface and groundwater from leaking wells would also contribute to impacts. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of Big South Fork NRRRA, and it has similar impacts to traditional oil and gas development.

Many impacts on water quality also affect floodplain functions and values. Acid mine drainage and abandoned mine impacts include contamination of water resources by sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites. Residential development, agriculture, logging, and industrial activity outside the park unit would also contribute to the potential for construction within floodplains, discharge of sediments to surface waters through soil erosion, or the discharge of pollutants that could affect the ecological health of floodplain resources, with short- and long-term minor to moderate adverse effects. Loss of trees due to insect infestations or disease may affect floodplain vegetation, which would have long-term localized negligible to minor adverse cumulative impacts on floodplains.

Some plans and projects within the park would also have long-term beneficial effects on floodplains, including implementation of the GMP at Big South Fork NRRRA. This plan outlines desired resource

conditions that would protect natural resources, including floodplains, 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. Reclamation of abandoned mines would also have long-term beneficial effects on floodplains, as would the plugging and reclamation of other wells, including the orphaned wells that are known to exist in the park and being plugged under the TDEC and ARRA projects. In addition, 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 floodplains by reducing pollutants entering streams.

Additionally, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 floodplains, due to improving resource protection practices.

Overall, the impacts of these actions, combined with the negligible to minor adverse impacts and beneficial effects of alternative A, would result in short- and long-term minor adverse cumulative impacts on floodplains. Protection provided to floodplains in the park under CLPRs, especially NPS Floodplain Management directives and policies, would minimize adverse effects, but floodplains in the remainder of the watersheds would continue to be adversely affected. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and contribute minimally to overall adverse cumulative impacts.

## **Conclusion**

Under alternative A, limited geophysical operations would result in short-term negligible adverse impacts on floodplains from increased road runoff and crossing of small areas of floodplains along tributary streams,. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells and the associated land disturbance and construction of facilities would result in short-term to long-term negligible to minor adverse impacts, since new oil and gas operations would not be permitted in floodplains unless there was no practicable alternative, floodplains could likely be avoided, and mitigation for floodproofing would be required. Impacts from plugging and reclamation of wells at either park would be localized, short term, negligible to minor, and adverse. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on floodplains. Indirect impacts from wells directionally drilled and produced from outside the park units could range from no impact to localized, short- to long-term, negligible to minor, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor adverse cumulative impacts on floodplains. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and contribute minimally to overall adverse cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, related primarily to road use and possible crossing of small areas of tributary floodplains, and would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. CLPRs would protect floodplains in these areas by requiring 500-foot setbacks from the banks of perennial, intermittent, or ephemeral watercourses. In addition, implementation of a comprehensive oil and gas management plan, including increased inspections and monitoring, under alternative B would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production could still occur, this alternative would protect park resources and values better than alternative A. Therefore, there would be localized short-term to long-term negligible adverse impacts on floodplains.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternative A, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause short-term adverse impacts if wells are located in floodplains. However, the implementation of the new management framework for plugging and reclamation of wells would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. With application of the same mitigation measures described for alternative A, there would be localized short-term negligible to minor adverse impacts at sites throughout the park units. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—Similar to alternative A, wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact floodplains in the park, as described for alternative A. Impacts on floodplains in the park units could range from no impact to indirect, localized, short- to long-term, negligible to minor, adverse impacts. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts.

### **Cumulative Impacts**

Impacts on floodplains from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor adverse cumulative impacts on floodplains. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute a minimal amount to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Conclusion**

Similar to alternative A, limited geophysical operations would result in short-term negligible adverse impacts on floodplains from increased road runoff, crossing of small areas of floodplains along tributary streams. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short-term to long-term negligible adverse impacts, since new oil and gas operations would not be permitted in floodplains unless there was no practicable alternative, so floodplains could probably be avoided, and inspections would prevent floodplain impacts. Impacts from plugging and reclamation of wells at either park would be localized, short term, negligible to minor, and adverse. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on floodplains. Wells directionally drilled and produced from outside the park units could result in localized short- to long-term negligible to minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor adverse cumulative impacts on floodplains. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute a minimal amount to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C, SMAs would be established to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR, with the exception of the Special Scenery SMA, unless otherwise approved in a plan of operations. While none of the SMAs were developed to specifically protect floodplains, floodplains would indirectly benefit from the SMAs and associated setbacks if SMAs are located in or near floodplains. Since minimal geophysical exploration is expected and would include

use of existing roads and pedestrian access, impacts associated with geophysical exploration in alternative C would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. Impacts associated with drilling and production under alternative C would be similar to the impacts described in alternatives A and B. The establishment of SMAs would further protect natural areas, including areas of Big South Fork NRRRA and Obed WSR where resources and values would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C drilling and production would not be allowed in any of the SMAs (with the exception of the Special Scenery SMA) and associated setbacks at the park units, unless otherwise approved in a plan of operations. In the Cliff Edge, Visitor Use, and Cultural Landscape SMAs, drilling would only be allowed during dry periods to minimize impacts on soil from rutting. This would minimize erosion and sedimentation and would benefit floodplains. The Cliff Edge and Sensitive Geomorphic Feature SMAs and setbacks would protect floodplains by precluding drilling and production on the edge of the gorge or for features within the gorge. As result, construction and maintenance of drilling and production operations would result in short- to long-term negligible adverse impacts on floodplains.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion, increase sedimentation in waterways, alter surface water flows, and contaminate surface and groundwater. However, under alternative C the NPS would implement a comprehensive oil and gas management plan that includes a new management framework for plugging and reclamation of wells. This would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. As a result, when this management plan is combined with mitigation, there would be localized short-term negligible to minor adverse impacts at sites throughout the park. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—Similar to alternatives A and B, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact floodplains in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park waters. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors, and with implementation of required spill-prevention features and plans under state regulations, indirect impacts on floodplains in the park could range from no impact to indirect, localized to widespread, short- to long-term, negligible to minor, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

## **Cumulative Impacts**

Impacts on floodplains from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor adverse cumulative impacts on floodplains. The SMA restrictions would provide more consistent protection of floodplains in the SMAs, and protection provided under CLPRs is expected to promote protection of floodplain resources, but adjacent lands could continue to be developed, with adverse impacts on floodplains. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, SMA identification and protection, and expedited well plugging.

## **Conclusion**

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible adverse impacts on floodplains from increased road runoff and crossing of small areas of floodplains along tributary streams. Under alternative C, with adequate setbacks, implementation of mitigation measures, and the establishment of SMAs, impacts on floodplains in the park from drilling and production would be localized, short to long term, negligible, and adverse. Establishment and avoidance of SMAs would minimize erosion and sedimentation and would benefit floodplains. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts on floodplains. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact park floodplains. Impacts on floodplains could range from no impact to indirect, localized, short- to long-term, negligible to minor, adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

Cumulative impacts would be similar to those described for alternative B, with short- and long-term minor adverse cumulative impacts on floodplains. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, SMA identification and protection, and expedited well plugging.

## **WETLANDS**

### **GUIDING REGULATIONS AND POLICIES**

The NPS *Management Policies 2006*, section 4.6.5 (NPS 2006c), requires the NPS to prevent the destruction, loss, or degradation of wetlands, to preserve the natural and beneficial values of wetlands, and to avoid new construction in wetlands unless there is no practicable alternative and the proposed action takes all practicable measures to minimize harm. Director's Order 77-1 (NPS 2002b) reiterates this position and states that the NPS will first avoid wetland impacts, then minimize impacts, and then compensate for remaining unavoidable adverse wetland impacts. Executive Order 11990—Protection of Wetlands also directs federal agencies to avoid adverse impacts on wetlands and to avoid new construction in wetlands wherever there is a practicable alternative. Other guiding regulations and policies that pertain to wetlands include federal and state statutes, as described in appendix F.

## METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

Given the programmatic nature of this plan/EIS, the exact locations of oil and gas operations associated with the RFD scenario and the forecast of oil and gas activities are unknown. The degree of potential impacts on wetlands from oil and gas development would depend on the types and locations of operations and the mitigation measures used to reduce impacts. As a result, a qualitative analysis of the potential impacts of oil and gas operations on wetlands was conducted based on best professional judgment and discussions with NPS staff and consultants.

The impact intensity threshold definitions are based on the potential for changes to wetland characteristics, as follows:

- Negligible:* Impacts would result in a local effect on wetlands but would not change wetland values and functions. The effect would be so slight that it would not be of any measurable or perceptible consequence.
- Minor:* Impacts would result in a local effect on wetlands, but it would require considerable scientific effort to measure any consequent changes in wetland values and functions. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:* Impacts would result in a change to wetland values and functions that would be readily detectable but localized. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- Major:* Impacts would result in a change to wetland values and functions that would have substantial consequences on a regional scale. Extensive mitigation measures would be needed to offset any adverse effects, and the success of these measures would not be guaranteed.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used, receiver lines would be laid on foot, and no shotholes would be drilled, there would be very limited impacts on wetlands, except where the use of existing roads would disturb existing unpaved surfaces and result in increased road runoff or would include the crossing of small areas of wetlands along tributary streams. No effect on wetland economic values (fisheries, tourism) would be expected, and there are no known cultural wetland values that would be disturbed by the limited area of disturbance. Vegetation trimmed during line placement would also be expected to recover over the short term. Natural drainage paths would be avoided when possible, and efficient refueling of vehicles would be used to reduce the chances for spills. The NPS Non-federal Oil and Gas Rights Regulations, at 36 CFR 9.41(a), require that “operations shall at no time be conducted within 500 feet of waterways, unless specifically authorized by an approved plan of operations.” This operating requirement would substantially reduce the

potential for adverse impacts on wetlands adjacent to streams. These stipulations would minimize impacts on wetlands, which would be localized, short term, negligible, and adverse.

**Drilling and Production**—Where permitted, the construction, maintenance, and use of access roads, wellpads, flowlines, and pipelines could harm vegetation, expose soils to erosion, compact and rut soils, introduce non-native construction materials (i.e., gravel) and exotic vegetation, reduce soil permeability, and introduce sediments in waterways, all of which can affect wetland functions and values. Spills or releases can also damage wetland soils and vegetation. Wetlands could become contaminated if hazardous or contaminating substances are released during drilling, production, or transport. Although drilling operations in the park should not encounter formations with H<sub>2</sub>S or high pressures and associated uncontrolled flows of oil, gas, brine, or freshwater, blowouts could occur during drilling and release hydrocarbons, water, and drilling mud. There could also be accidental spills of drilling mud, diesel fuel, and other chemicals during drilling operations. If drilling mud, fuels, or other chemicals are spilled on the ground and there is no impermeable liner on the wellpad, the fluids could infiltrate into shallow aquifers or reach nearby surface waters and wetlands.

The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact wetlands. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park's resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

Drilling and production would affect wetlands if new facilities were sited in wetlands; however, this would not be very likely, given the limited number of wells to be drilled and the location of many wetlands in and around the gorges and the rivers, which are protected. Gorge restrictions at Big South Fork NRR, deed restrictions at Obed WSR, and the regulatory requirement that surface operations shall at no time be conducted within 500 feet of the banks of perennial, intermittent, or ephemeral watercourses or within 500 feet of the high pool shoreline of natural or man-made impoundments (36 CFR 9.41(a)) would provide protection for park wetlands, most of which are palustrine or riverine wetlands associated with river and stream channels. Even more specific wetland protection is provided in the NPS Director's Order 77-1, Wetland Management (NPS 2002b), which requires that oil and gas operations not be permitted within wetlands unless there is no practicable alternative. In interpreting Director's Order 77-1, the NPS directive requires operators to avoid or minimize developments and activities that could result in adverse impacts on wetlands. If there is no practical alternative, then NPS mitigation requirements for direct and indirect adverse impacts on wetlands also requires a minimum compensation prior to or concurrent with starting permitted operations. The minimum compensation ratio is 1:1; however, a higher ratio may be required if (1) the functional values of the site being impacted are determined to be high and the restored wetlands would be of lower value, (2) it would take a number of years for the restored site to become fully functional, or (3) the likelihood of full restoration success is unclear. As soon as possible after completing a permitted operation (but no later than 6 months afterward), reclamation of the disturbed wetlands site, which would result in restoring wetland functions and values, must begin.

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 small areas of wetlands. The proper siting and alignment of roads and pads and the placement of adequate culverts under access roads and appropriate drainage on and around drilling and production pads would minimize



changes in surface water flows that could adversely impact wetlands. Also, careful siting of wellpads away from moderate or steep slopes would minimize the potential of contaminating or hazardous substances being transported downslope into adjacent wetlands.

Because production operations could continue for 20 years or longer, the potential for leaks and spills of hazardous or contaminating substances from production operations (including flowlines and pipelines) is greater than for any other phase of oil and gas operations. Adverse impacts on wetlands may occur from accidental leaks and spills of drilling fluids during workovers/servicing, hazardous waste spills (including diesel fuel), well blowouts, rupture of flowlines and pipelines, and spills from tanker trucks. Chronic small leaks and spills could spread through various pathways, and over an extended period of time could become substantial and costly to remediate. The chances of undetected spills would be greater under this alternative because routine inspections would not occur beyond base workload levels, which would increase the potential for a more substantial adverse impact at well locations in or upgradient from wetlands. Faulty installation or corrosion of production casing might go undetected and could adversely impact groundwater if hydrocarbons and/or produced waters migrated into an aquifer and contaminated the groundwater. The intensity of the impact would depend on the type of substance spilled (hydrocarbons, produced waters, chemicals, solvents, and fuels) and the size of area impacted, but, as noted above, could reach the level of major adverse impacts.

The transport of hydrocarbons also has the potential to adversely affect wetlands. Production pipelines can rupture from corrosion of the pipe or from failure of a flange, valve, or seal. Oil and gas pipelines are generally larger in diameter and under more pressure than the smaller flowlines and pose the potential for a large-volume release. The escaping fluids could contaminate surface and groundwater and could have major adverse impacts on water quality. In lieu of transporting hydrocarbons via pipelines, the product could be transported by tanker truck. This method has a greater potential for leaks and spills during transfer of fluids to the tanker, in addition to the potential for vehicular accidents in which the tank contents could be spilled.

The use of automatic shutoff valves on flowlines and pipelines on each side of any water-body crossing would reduce the volume of a hydrocarbon release. Additional mitigation measures that would protect wetlands include using the least contaminating and hazardous substances, storing the minimum quantity of contaminating and hazardous substances at operations locations, storing barrels or smaller containers of chemicals in “coffins” or other secondary containment, constructing berms and installing liners at drilling operations and at production facilities, increasing capacity within the firewall to accommodate high precipitation events, and including a spill notification and response plan in the plan of operations. Although the NPS does not routinely monitor and inspect producing wells, it is typically notified when a problem is discovered, and takes steps to minimize adverse impacts from leaks and spills of hazardous and contaminating substances.

If there were no other practicable alternative, and for any existing facilities already located in wetlands, impacts on wetlands from drilling and production would be short term (weeks to months) for construction activities and drilling operations and long term (extending up to 20 years or more) for roads, production operations, and flowlines and pipelines. Given these requirements and other mitigation measures identified in appendix B, as well as the limited extent of new drilling operations described in the forecast of oil and gas activities, there would be localized short- to long-term negligible to moderate adverse impacts from drilling and production operations.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Clearing vegetation from oil and gas access roads and wellpads and the use of heavy equipment and vehicles would temporarily increase localized erosion potential, causing increased turbidity and sedimentation. In addition, there is the potential for release of liquid hydrocarbons and/or contaminating or hazardous substances into wetlands from vehicles, wellhead equipment, or flowlines during well plugging and reclamation activities. These temporary activities could cause detectable, localized changes to wetlands for wells located near surface waters.

However, mitigation would be applied during plugging and reclamation operations to minimize any potential long-term impacts on wetlands. Mitigation measures would include conducting activities within previously disturbed areas, using chainsaws and tractors equipped with bush hogs to limit ground disturbance, using erosion-control structures (straw bales and silt fences), placing tanks at each well to capture any well fluids produced during plugging, and placing a liner around the wellhead and under all service vehicles to prevent contamination. 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. Soil, hydrology, and native vegetation communities would be restored as soon as practicable after completion of the plugging operation. Reclamation of wellpads and access roads would reduce erosion rates to predisturbance levels. Over time, these practices could eliminate the adverse impacts caused by original drilling and production operations, if fill materials are completely removed, sites are properly prepared, sites are stabilized to match original contours, and proper seed mixtures and revegetation techniques are used. During plugging operations park staff would conduct more thorough testing for contamination at each site. If contamination is found, subsequent steps would be taken to remove or neutralize contaminating substances.

For impacts on wetlands, compensatory mitigation involves restoration as described above. Proper plugging of the wells would ensure that hydrocarbon contamination would not occur in the future. The success of compensatory mitigation would be dependent on the conditions of the site-specific mitigation plan. If the site is not properly recontoured 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 that requires site cleanup, remediation of contaminated water or soils, restoration of hydrology, and planting of native vegetation should be implemented to reduce adverse impacts to negligible to minor, unless important wetland function and values are jeopardized.

Reclaiming the wellpads and access roads would have a beneficial impact on wetlands by reducing soil erosion and reestablishing surface drainage flows, once recontouring and planting and establishment of native vegetation in disturbed areas is complete. As a result, there would be long-term beneficial effects on wetlands once reclamation is complete.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact wetlands in the park if wetlands are close enough to be affected by runoff. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park wetlands. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors and the location of wetlands in the park units and with implementation of required spill-prevention features and plans under state regulations, indirect impacts on wetlands in the park could range from no impact to indirect, localized, short- to long-term, mostly negligible to minor adverse impacts, although major adverse effects could occur if there were a blowout, fire or large uncontrolled release close to and/or upgradient of park wetlands. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

## Cumulative Impacts

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to wetlands are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would result in both adverse and beneficial cumulative impacts on wetlands. Past and future oil and gas development within and outside Big South Fork NRRRA would have short- and long-term minor to moderate adverse impacts on wetlands from vegetation clearing, ORV use, and the construction and maintenance of access roads, wellpads, and flowlines. In addition, potential contamination of surface and groundwater from leaking wells would also contribute to impacts. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of Big South Fork NRRRA, and it has similar impacts to traditional oil and gas development.

Many impacts on water quality also affect wetland functions and values. Acid mine drainage and abandoned mine impacts include contamination of water resources by sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites. Residential development, agriculture, logging, and industrial activity outside the park unit would also contribute to the potential for the discharge of sediments to surface waters through soil erosion or the discharge of pollutants that could affect the ecological health of wetlands. Ground disturbances during development and routine maintenance of facilities would increase soil erosion potential. Insect infestations or disease may affect wetland vegetation or vegetation in riparian buffers. These activities would have long-term localized negligible to moderate adverse cumulative impacts on wetlands associated with the receiving waters or directly affected by development.

The spread of non-native plant species such as multiflora rose has historically been occurring over large areas and now represents a serious problem within the national park units. At Big South Fork NRRRA, efforts to control exotic vegetation have involved the use of herbicides as the primary tool for controlling exotic plant infestations in managed fields. Herbicide spills would have detrimental effects on wetlands. ORVs, which can cause soil compaction and rutting, could be used to get to areas that have exotic species infestations. Exotic species management efforts could result in localized short-term negligible to minor adverse impacts.

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 NRRRA, and there are about 10 abandoned surface coal mine sites in McCreary County, Kentucky. The Big South Fork NRRRA has undertaken remediation studies of selected sites where contaminated mine drainage is of concern. The Worley riverside area is a former mining community where remnants of mining operations, including mine tailings, are evident. Water quality on the site is an issue due to acid mine drainage, as discussed previously, and water quality directly influences the health of park wetlands located in the river and stream valleys.

Some plans and projects within the park would also have long-term beneficial effects on wetlands, including implementation of the GMP at Big South Fork NRRRA. This plan outlines desired resource conditions that would protect natural resources, including wetlands, 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. Reclamation of abandoned mines would also have beneficial long-term effects on wetlands, as would the plugging and reclamation of other wells, including many orphaned wells that are known to exist in the park that will be plugged under TDEC and ARRA projects. In addition, Kentucky and

Tennessee are developing TMDLs for impaired waters in the Big South Fork NRRRA. The implementation of these TMDLs would have beneficial effects on wetlands by reducing pollutants entering streams.

Additionally, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 wetlands, due to improving resource protection practices.

Overall, the impacts of these actions, combined with the localized short-term negligible to moderate adverse impacts and the beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on wetlands. Protection provided to wetlands in the park under CLPRs, especially NPS wetlands policies, would minimize adverse impacts and improve the condition of wetlands in the park units, but wetlands in other areas of the watersheds have been and could continue to be adversely affected. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## **Conclusion**

Under alternative A, limited geophysical operations would result in short-term negligible adverse impacts on wetlands, mainly from disturbance of existing unpaved surfaces and resultant road runoff or from the crossing of small areas of wetlands along tributary streams. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short-term to long-term negligible to moderate adverse impacts from vegetation clearing, ground disturbance or rutting, erosion, and runoff; however, new oil and gas operations would not be permitted in wetlands unless there was no practicable alternative, and wetlands could likely be avoided, but moderate adverse impacts could result at existing well locations in wetlands due to possible releases of hazardous substances and leaks that could go undetected. Impacts from plugging and reclamation of wells at either park would be localized, short term, negligible to minor, and adverse. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on wetlands by reducing soil erosion and reestablishing hydrology and surface drainage flows, once recontouring and planting and establishment of native vegetation in disturbed areas is complete. Wells directionally drilled and produced from outside the park units could result in no impact to localized short- to long-term negligible to minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on wetlands. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, stemming mainly from disturbance of existing unpaved surfaces and resultant road runoff or the crossing of small areas of wetlands along tributary streams, and would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. CLPRs would protect wetlands in these areas by requiring 500-foot setbacks from the banks of perennial, intermittent, or ephemeral watercourses. In addition, implementation of a comprehensive oil and gas management plan, including increased inspections and monitoring, under alternative B would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production associated with vegetation removal, land disturbance, and spills or releases could still occur, this alternative would protect park resources and values better than alternative A. Therefore, there would be mostly localized short-term to long-term negligible to minor adverse impacts on wetlands, with a reduced chance of a short-term major impact from well blowouts, fires, or large uncontrolled releases.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternative A, well plugging, shutting down and abandoning/removing flowlines and pipelines, and the use of heavy equipment and vehicles during reclamation activities could cause short-term, adverse impacts if wells are located in or near wetlands. However, under alternative B the NPS would implement a comprehensive oil and gas management plan that includes a new management framework for plugging and reclamation of wells. This would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. Coupled with the same mitigation measures described for alternative A and in appendix B, there would be localized short-term negligible to minor adverse impacts. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—Similar to alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact wetlands in the park if wetlands are close enough to be affected by runoff. The types of impacts are expected to be similar to

those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park wetlands. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors and the location of wetlands in the park units, and with implementation of required spill-prevention features and plans under state regulations, indirect impacts on wetlands in the park could range from no impact to indirect, localized, short- to long-term, negligible to minor adverse impacts, although major adverse effects could occur if there were a blowout, fire, or large uncontrolled release close to and/or upgradient of park wetlands. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on wetlands from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on wetlands. The increased enforcement and inspections/monitoring under alternative B would better promote wetlands protection, but the majority of impacts on wetlands in the area of analysis would lie outside the park, where impacts may or may not be mitigated. Therefore, when compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging

### **Conclusion**

Similar to alternative A, limited geophysical operations would result in short-term negligible adverse impacts on wetlands, mainly from disturbance of existing unpaved surfaces and resultant road runoff or from the crossing of small areas of wetlands along tributary streams. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short-term to long-term negligible to minor adverse impacts from vegetation clearing, ground disturbance and compaction, and erosion/runoff; however, new oil and gas operations would not be permitted in wetlands unless there was no practicable alternative, wetlands could likely be avoided, and inspections would detect leaks that could damage wetlands, limiting the extent of impacts. Impacts from plugging and reclamation of wells at either park would be localized, short term, negligible to minor, and adverse. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on wetlands by reducing soil erosion and reestablishing hydrology and surface drainage flows, once recontouring and planting and establishment of native vegetation in disturbed areas is complete. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park units could result in no impact to localized short- to long-term negligible to minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would have short- and long-term minor to moderate adverse cumulative impacts on wetlands. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and

would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C SMAs would be established to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRRRA, with the exception of the Special Scenery SMA, unless otherwise approved in a plan of operations. While none of the SMAs were developed to specifically protect wetlands, wetlands would indirectly benefit from the SMAs and setbacks located in or near wetlands, or on the edges of the gorge, where spills could reach wetlands in the gorge. Since minimal geophysical exploration is expected and would include use of existing roads and pedestrian access, impacts associated with geophysical exploration in alternative C related to vegetation clearing, ground disturbance, and crossing of small wetlands, would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A.

Impacts associated with drilling and production under alternative C would be associated with vegetation removal, land disturbance/compaction, erosion, and spills or releases and would be similar to the impacts described in alternatives A and B. Well blowouts or uncontrolled releases could cause short-term major adverse effects. However, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRRRA and Obed WSR where resources and values would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C drilling and production would not be allowed in any of the SMA-associated setbacks at the park units unless otherwise approved in a plan of operations. In the Cliff Edge, Visitor Use, and Cultural Landscape SMAs, drilling would only be allowed during dry periods to minimize impacts on soil from rutting. This would reduce erosion/sedimentation and would minimize impacts on any nearby wetlands. As result, construction and maintenance of drilling and production operations would result in short- to long-term negligible to minor adverse impacts on wetlands.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause soil erosion, increase sedimentation in waterways, alter surface water flows, and contaminate wetlands. However, under alternative C the NPS would implement a comprehensive oil and gas management plan that includes a new management framework for plugging and reclamation of wells. This would allow the NPS

and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. As a result, there would be localized short-term negligible to minor adverse impacts at sites throughout the park. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—Similar to alternatives A and B, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact wetlands in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where erosion or leaks and spills could affect adjacent park waters. Impacts would depend on proximity to the park units; site-specific environmental conditions, particularly surface hydrology and slopes; and mitigation measures being employed. Based on these factors, and with implementation of required spill-prevention features and plans under state regulations, indirect impacts on wetlands in the park could range from no impact to mostly indirect, localized to widespread, short- to long-term, negligible to minor adverse impacts, although major adverse effects could occur if there were a blowout, fire, or large uncontrolled release close to and/or upgradient of park wetlands. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on wetlands from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate adverse cumulative impacts on wetlands. The SMA restrictions would provide more consistent and more certain protection of wetlands in the SMAs, and proactive planning and enforcement of CLPRs is expected to promote protection of wetland resources, but adjacent lands could continue to be developed and impacts from outside the park boundaries would continue, often adversely impacting wetlands without adequate mitigation. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

### **Conclusion**

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible adverse impacts on wetlands from disturbance of existing unpaved surfaces and resultant road runoff or from the crossing of small areas of wetlands along tributary streams. Under alternative C, with adequate setbacks, implementation of mitigation measures, and the establishment of SMAs, impacts on wetlands in the park from drilling and production would be localized, short to long term, negligible to minor, and adverse. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts on wetlands. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact park wetlands. These effects could range from no



impact to indirect, localized, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts would be similar to those described for alternative B, with short and long term minor to moderate adverse cumulative impacts on wetlands. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

## VEGETATION

### GUIDING REGULATIONS AND POLICIES

The NPS *Management Policies 2006* (NPS 2006c) addresses biological resource management, which includes the management of native and exotic plant species. NPS *Management Policies 2006* state that the NPS will maintain all plants native to the park ecosystem by preserving and restoring natural abundances, diversities, dynamics, and distributions of native plants and the communities and ecosystems in which they occur, and by minimizing human impacts on native plants, populations, communities, and ecosystems, and the processes that sustain them. Further, the NPS will not allow exotic species to displace native species if displacement can be prevented.

The importance of vegetation is also stated in the park's purpose and significance, which emphasizes the wide variety of habitats, with associated flora and fauna, of the Cumberland Plateau in a limited geographic area.

Other guiding regulations and policies for vegetation are presented in appendix F.

### METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

Given the programmatic nature of this analysis, the exact locations of future operations are unknown. As a result, actions under the RFD scenario and the forecast of oil and gas activities were analyzed qualitatively against the types of vegetation in Big South Fork NRR and Obed WSR that could be impacted. The vegetation types were defined and described based on the sources cited in chapter 3. The assessment of impacts is based on best professional judgment and was developed through discussions with park staff and EIS team members. Because of the extensive vegetation cover in Big South Fork NRR and Obed WSR, it was assumed any oil and gas activity would most likely result in some adverse impact on vegetation, since it would be almost impossible to avoid vegetated areas.

The impact intensity threshold definitions are based on the potential for changes to native vegetation characteristics, as follows:

*Negligible:* Impacts would result in a change to native vegetation, but the change would have no measurable or perceptible effects on plant community size, integrity, or continuity.

*Minor:* Impacts would result in a measurable or perceptible change to native vegetation types, their habitats, or the natural processes sustaining them, but the changes would

be localized within a relatively small area. The overall viability of a plant community would not be affected and, if left alone, the community would recover. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

*Moderate:* Impacts would result in effects on native vegetation types, their habitats, or the natural processes sustaining them, and would cause a measurable change in a plant community (e.g., abundance, distribution, quantity, or quality); however, the impact would remain localized. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

*Major:* Impacts would result in a change that would contribute substantially to the deterioration of park vegetation to the extent that the park's vegetation would no longer function as a natural system. Extensive mitigation measures would be needed to offset any adverse effects, and the success of these measures would not be guaranteed.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used, receiver lines would be laid on foot, and no shotholes would be drilled, there would be limited impacts on vegetation, except where vegetation could be cut or trimmed during seismic surveying and cable laying.

CLPRs provide for use of mitigation to limit the impacts on vegetation associated with seismic surveys. Activities would be conducted during dormant seasons when possible; vegetation would only be trimmed along receiver lines, setbacks, and access routes; and activities would be in accordance with the park's current vegetation and management plans or policies. The use of global positioning systems could also be encouraged to reduce the need for line-of-sight surveys. Given application of these mitigation measures, the limited amount of geophysical exploration expected during the life of this plan, the minimal amount of disturbance, and the limited duration (weeks) of seismic surveys, there would be short-term negligible adverse impacts on vegetation.

**Drilling and Production**—Drilling and production operations would not directly impact vegetation in protected areas where operations would not be permitted under CLPRs. However, where permitted, drilling and production of oil and gas would cause direct loss of vegetation and habitat as a result of clearing, contouring, construction, and maintenance of the pads, roads, flowlines, pipelines, and other ancillary facilities. Site preparation may include clearing, grading, cutting, filling, and leveling of the pad using heavy construction equipment. Ground disturbance could also promote the introduction of exotic species. However, these long-term effects could be minimized by using already disturbed areas (including existing pads) for wellpad sites and using existing access roads. In addition, exotic-vegetation-control plans should be part of every plan of operations. In environmentally sensitive areas, a large effort would be made not to alter the surface area comprising the drill site more than necessary.

Use of truck-mounted drill rigs and water trucks could cause compaction and rutting of soils. Soil compaction related to road and wellpad construction reduces porosity and increases the soil's bulk density. A decrease in soil porosity causes a reduction of available water and oxygen for plant growth. The use of fill materials for the construction of access roads, wellpads, and berms around wellpads is required to protect soils in the park units. Use of fill materials would protect the soils from erosion and would maintain the soil structure that is essential for reestablishment of vegetation following the completion of operations. Once drilling and production operations are completed, the fill would be removed, exposing the underlying, undisturbed soils.

Indirect effects on vegetation include a potential for leaks and spills of drilling muds, hydrocarbons, produced waters, or treatment chemicals during drilling, production, servicing, or transport that could impact on-site or off-site soil and groundwater and associated vegetation. The chances of undetected spills would be greater under this alternative because routine inspections would not occur beyond base workload levels, which would increase the potential for a more severe impact on nearby off-site vegetation. Herbicides used to control site vegetation could drift or migrate off site, causing damage to nontarget vegetation in nearby areas. Observation of areas with high soil chloride levels from spills of produced water suggest that these spills are lethal to vegetation and can persist for many years, if not remediated. Other indirect adverse impacts impacting off-site vegetation include the possibility of erosion and sedimentation if runoff from the site occurs, burying nearby vegetation.

The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact vegetation. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park's resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

Mitigation measures could be implemented to minimize the potential indirect effects on vegetation, including using closed-loop drilling fluid systems and tanks to hold cuttings and fluids, which are then disposed of offsite. In addition, indirect impacts from leaks and spills could be limited by using automatic shutdown, blowout preventers, drip pans, berms, liners, cleanup plans and equipment, and regular flowline testing. Herbicides used to keep vegetation off the site should be limited and/or restricted to those that do not readily drift or migrate off site. Silt fences or barriers should be used to eliminate off-site sedimentation.

Although the potential for vegetation impacts would exist, as described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRRA and up to 5 wells directionally drilled from outside the park unit are expected in Obed WSR. Vegetation clearing would be limited in extent, and mitigation would require that least damaging methods are used for site preparation. As a result, drilling and production could result in localized short-term to long-term minor adverse impacts from the loss and maintenance of vegetation, including approximately 36 acres disturbed for new wells and access.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

This alternative would require clearing vegetation at the well and access roads, which would temporarily affect vegetation communities. The use of heavy equipment and vehicles during plugging and reclamation activities could release oil and other contaminating and hazardous substances, which could harm or kill vegetation. With minimal use of equipment used to clear wellpads and access roads and revegetation of the area with weed-free native seed mix, the area affected would be small; there would be few effects on plant community size, integrity, or continuity; and impacts would not affect the overall viability of plant communities. Therefore, alternative A would result in localized short-term negligible to minor adverse impacts on vegetation at sites throughout the park units.

During reclamation operations, sites are reclaimed by removing any contaminated soil or materials, grading the site to promote drainage and site reclamation, replacing topsoil, seeding with a selected mix of native herbaceous vegetation, and possibly planting. Weed-free native seed mixtures would be used to revegetate well sites and access roads following ground disturbance and, where possible, forest duff would be blown into areas to aid in revegetation of these areas. Site recovery is monitored and success is determined by measuring species survival, native vegetation density and diversity, percent cover, etc. Site monitoring also includes monitoring by the Big South Fork NRR and Obed WSR botanist and staff for exotic species and follow-up treatment if required.

Recovery of vegetation communities would be primarily dependent on location, soil conditions, precipitation, and type of community desired. Most vegetation communities in the park units would be expected to reestablish vegetation in a relatively short time period. If access roads are not reclaimed, but continue to be used for other administrative purposes, adverse impacts on vegetation could occur if visitors travel off established routes. Despite this potential effect, restoration of native vegetation communities associated with plugging and reclamation would ultimately have long-term beneficial impacts.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact vegetation in the park. Some impacts, such as from soil erosion, contaminant release, or herbicide use, are expected to be similar to those described above for operations inside the park units, but the intensity of impacts could increase for operations sited closer to the park boundary. Impacts would depend on the proximity of operations to the park units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures being employed. Based on these factors, indirect impacts on vegetation in the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to vegetation are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter have the potential to result in adverse cumulative effects on vegetation at the park units. Past and future oil and gas development within and outside Big South Fork NRR would have short- and long-term minor to moderate adverse impacts on vegetation from clearing during siting, construction, maintenance, and use of roads, wellpads, production facilities, tank batteries, flowlines, and/or pipelines. The presence of abandoned oil and gas wells has the potential to contribute to adverse cumulative impacts, mainly due to potential leaks over time and the past clearing of vegetation.

In addition to traditional oil and gas development, coal bed methane/shale gas drilling is an ongoing feature in the vicinity of the park units, which can result in vegetation loss and damage. There are also ongoing mining operations around the park units, which have resulted in removal of vegetation, and acid mine drainage associated with active and abandoned mines impacts water resources, which can affect vegetation in the park units. Acid mine drainage and abandoned mine impacts include contamination of resources by sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites, as well as clearing of vegetation at active mine sites, with long-term minor to moderate adverse impacts. The Big South Fork NRRRA has undertaken remediation studies of selected sites where contaminated mine drainage is of concern. One such area studied is the Worley riverside area, where remediation of mine effects is being planned, which would have long-term beneficial effects on vegetation.

Agricultural activities on land adjacent to the park units, primarily logging activities and hay production, cause the loss of natural vegetation and habitat, with long-term minor adverse impacts. Because of logging in the early to mid-20th century, most of the forested areas of Big South Fork NRRRA are second or third growth. At Obed WSR, clearing and harvesting from logging and agriculture is particularly evident.

Fields, roads, trails, and other disturbed areas are often source areas for exotic plants. The abandonment of well sites and oil and gas access roads creates disturbances that increase the invasion and migration of non-native plant species into previously stable communities, where they displace native plants. NPS staff members at Big South Fork NRRRA and Obed WSR 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 minor adverse effect on native vegetation, but the active management of exotic species has a long-term localized beneficial effect.

Other cumulative actions that would contribute to impacts on vegetation include visitor activities such as horseback riding, biking, hunting, and ORV use, all of which occur within Big South Fork NRRRA and/or Obed WSR. Development and routine maintenance of facilities, including installation and maintenance of roads, trails, and developed sites within the park, would also disturb vegetation locally due to the presence of work crews and clearing of vegetation. These activities would have long-term localized negligible adverse cumulative impacts on vegetation.

Development outside the park, including commercial, industrial, and residential, could contribute moderate adverse cumulative impacts as a result of vegetation loss and damage.

Diseases and insect pests of vegetation, such as the pine bark beetle, have caused a decline in streamside vegetation, with large stands of trees affected by infestations causing widespread long-term minor adverse impacts on vegetation.

In addition to cumulative actions that have adverse effects on vegetation, there are also some actions that have beneficial effects. Reclamation of abandoned mines would have long-term beneficial effects on vegetation, as would the plugging and reclamation of other wells, including 14 orphaned wells that are known to exist in the park. The NPS has also recently received funding under the ARRA to plug and reclaim an additional 39 wells at Big South Fork NRRRA to protect resources that would help restore and protect native vegetation in and around the park units.

Fire management activities can also affect water quality. The 2006 *Big South Fork NRRRA Fire Management Plan* (NPS 2006e) 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 implementation of a fire management plan would have long-term beneficial effects on vegetation within the Big South Fork NRRRA and the Obed WSR by reducing hazard fuel

accumulations around oil and gas well facilities and aiding in fire suppression activities by reducing fire intensity and severity, protecting existing native vegetation.

The 2006 *Big South Fork NRRRA Fields Management Plan* (NPS 2006d) identifies desired resource conditions, including specific vegetation conditions for each field managed as native fields, grassy woodlands, and forests, helping restore native plant communities. Additionally, the revised 9B regulations (36 CFR 9B) governing non-federal oil and gas development within the boundaries of NPS units focuses 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 vegetation, due to improving resource protection practices.

Overall, the impacts of these actions, combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on vegetation. Protection provided to vegetation in the park units under CLPRs would minimize adverse impacts and gradually improve the condition of vegetation through reclamation, but vegetation in areas surrounding the park units has been and could continue to be adversely affected. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute a minimal amount to the overall cumulative impacts.

## Conclusion

Given application of the mitigation measures, the limited amount of geophysical exploration expected during the life of this plan, the minimal amount of disturbance, and the limited duration (weeks) of seismic surveys, there would be short-term negligible adverse impacts on vegetation from geophysical exploration due to vegetation clearing and effects on soils. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production operations could result in localized short-term to long-term minor adverse impacts from the loss of vegetation and ground disturbance/soil erosion and compaction, but with a risk of more severe adverse impacts from leaks and spills that could go undetected or migrate off site. Impacts on vegetation during implementation from plugging and reclamation activities at either park under alternative A would be localized, short term, negligible to minor, and adverse. However, there would be long-term beneficial effects under alternative A from site reclamation and removing the risks associated with unplugged wells. Indirect impacts on vegetation in the park units could range from no impact to localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on vegetation. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute a minimal amount to the overall cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—Minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Given the restrictions at Obed WSR, including the No Surface Use stipulation for the gorge, these operations would not be allowed within the park unit under alternative B. Under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. This plan would ensure that geophysical exploration is conducted in a way that best protects park resources and values, including vegetation. As a result, impacts associated with geophysical exploration in alternative B from vegetation removal and effects on soils would be very similar to the impacts described in alternative A, and would be localized, short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR would be very similar to the impacts described in alternative A. It is also assumed that 125 wells at Big South Fork NRRRA and 2 wells at Obed WSR would be worked over or serviced, as staffing limitations and resources allow for review of the proposed projects.

As described for alternative A, where drilling and production operations could be permitted, these activities could harm or kill vegetation or cause the direct loss of vegetation as described for alternative A. However, mitigation measures described under alternative A would be applied, such as the use of previously disturbed areas, non-native species control, implementation of spill prevention and response measures, and erosion control. Also, under alternative B the NPS would implement a comprehensive oil and gas management plan and would increase inspections and monitoring. This would reduce the chance of leaks or releases going undetected and reaching vegetation, and would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production would still occur, this alternative would protect park resources and values, including vegetation, better than alternative A. Therefore, there would be short- to long-term minor adverse impacts from drilling and production activities with a reduced chance of a short-term major impact from well blowouts, fires, or large uncontrolled releases.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Under alternative B plugging and reclamation procedures would apply the same mitigation measures as described for alternative A. Sites would be reclaimed by removing any contaminated soil or materials, grading the site to promote drainage and site reclamation, replacing topsoil, seeding with a selected mix of native herbaceous vegetation, and possibly planting. Weed-free native seed mixtures would be used to revegetate well sites and access roads, and site recovery would be monitored. In addition, under alternative B the NPS would implement a comprehensive oil and gas management plan that includes a

new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. As a result, alternative B would result in negligible to minor adverse impacts on vegetation from plugging and reclamation. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative B would be more likely to be realized sooner.

**Directionally Drilled Wells**—Similar to alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact vegetation in the park. The types of impacts are expected to be similar to those described above for operations inside the park units, but the intensity of impacts could increase for operations sited closer to the park boundary. Impacts would depend on the proximity of operations to the park units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures being employed. Based on these factors, indirect impacts on vegetation in the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on vegetation from other actions that were considered under the cumulative impacts scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on vegetation. The more proactive enforcement of CLPRs and increased inspections/monitoring would limit adverse impacts on vegetation in the park units, but the majority of the impacts on vegetation in the region lie outside the park units, where impacts may or may not be mitigated. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to the overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

### **Conclusion**

Similar to alternative A, limited geophysical operations would result in short-term negligible adverse impacts on vegetation from clearing and effects on soils. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short- to long-term minor adverse impacts from the loss of vegetation, ground disturbance with resultant soil erosion or compaction, or leaks and spills. With applied mitigation and the implementation of a comprehensive oil and gas management plan, the risks of vegetation damage from spills or releases would be reduced. Impacts from plugging and reclamation of wells at either park would result in negligible to minor impacts on vegetation. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Indirect impacts on vegetation in the park units from wells directionally drilled and produced from outside the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a



result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would have short- and long-term minor to moderate adverse cumulative impacts on vegetation. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR, with the exception of the Special Scenery SMA unless otherwise approved in a plan of operations. The SMA for Honey Creek and Twin Arches state natural areas was set aside primarily because of their rich undisturbed forest communities and their high diversity of forest species. The Sensitive Geomorphic Feature and Cliff Edge SMAs would also protect some unusual vegetation, along with geology. Given the areas protected by SMA restrictions and the limited extent of geophysical exploration anticipated during the life of this plan, including the use of existing roads and access on foot, impacts associated with geophysical exploration in alternative C would result in localized short-term negligible adverse impacts on vegetation at Big South Fork NRR.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternatives A and B. Similar to alternatives A and B, impacts from the construction and maintenance of drilling and production operations sited in uplands would result in impacts on vegetation, such as the direct loss of vegetation as a result of clearing, contouring, and maintenance activities. Well blowouts, fires, or large uncontrolled releases could occur and cause short-term major adverse effects.

However, mitigation measures described under alternatives A and B would be applied, such as the use of previously disturbed areas, non-native species control, implementation of spill prevention and response measures, and erosion control. Similar to alternative B, under alternative C the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the production and transportation of non-federal oil and gas resources and would implement increased inspections and monitoring. This would reduce the chance of leaks or releases going undetected and reaching vegetation, and would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51).

In addition, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRR and Obed WSR where resources and values are particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, drilling and production would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR unless otherwise approved in plan of operations. Drilling and production would be precluded in Obed WSR.

Due to the designation of the State Natural Area, Managed Fields, and Obed WSR SMAs, it is likely under alternative C that some wells may be directionally drilled from outside the SMAs, or possibly outside the park, to develop underlying hydrocarbons. The intensity of impacts on vegetation would be dependent upon where the operation is located with respect to vegetation type, whether the operation is sited inside or outside the park, and on the resource protection measures that are employed.

Although short-term and long-term impacts from drilling and production would still occur, alternative C would protect vegetation better than alternatives A and B because of the SMA restrictions and other mitigation included in this alternative. Therefore, there would be short- to long-term negligible to minor adverse impacts from drilling and production activities with a more limited risk of major adverse effects from spills or leaks.

**Plugging and Reclamation**—Similar to alternatives A and B, this alternative would require clearing vegetation at the well and access roads that would temporarily affect vegetation communities by the use of heavy equipment and vehicles that could release oil and other contaminating and hazardous substances, which could harm or kill vegetation. Sites would be reclaimed by removing any contaminated soil or materials, grading the site, replacing topsoil, seeding with a selected mix of native herbaceous vegetation, and possibly planting, and most vegetation communities would be expected to reestablish vegetation in a relatively short time period. Site-specific monitoring would be done to ensure successful reclamation. If access roads are not reclaimed, but continue to be used for other administrative purposes, adverse impacts on vegetation could occur if visitors travel off established routes.

However, as with alternative B, the NPS would implement a comprehensive oil and gas management plan that includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. Also, SMAs would be used under alternative C to set priorities for plugging, which would better protect vegetation at those SMAs that receive priority for action. Overall, alternative C would result in negligible to minor adverse impacts on vegetation at sites throughout the park units. Despite this potential effect, restoration of native vegetation communities associated with plugging and reclamation would ultimately have long-term beneficial impacts, which would be more likely to be realized sooner given the implementation of the new management framework for plugging and reclamation.

**Directionally Drilled Wells**—Indirect impacts on vegetation in the park units from drilling and production of wells directionally drilled from outside the park units to bottomholes beneath the park units would be similar to those described above for alternatives A and B, and could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

## Cumulative Impacts

Impacts on vegetation from other actions that were considered under the cumulative impacts scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate cumulative adverse impacts on vegetation. The SMA restrictions would provide more consistent protection of vegetation in the SMAs, and protection provided to vegetation in the park under CLPRs and increased inspections and enforcement is expected to limit adverse impacts and improve conditions through reclamation. However, adjacent lands could continue to be developed, adversely impacting vegetation without adequate mitigation in the area of analysis. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

## Conclusion

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible adverse impacts on vegetation from clearing and effects on soils. Under alternative C, with adequate setbacks, application of mitigation measures, and the establishment of SMAs, impacts on vegetation in the park from drilling and production would be short- to long-term negligible to minor adverse impacts from the loss of vegetation or leaks and spills. Impacts from plugging and reclamation of wells at either park would result in negligible to minor impacts on vegetation. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled from outside the park units to bottomholes beneath the park units could result in effects ranging from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts under alternative C would be similar to those described for alternative B, with short- and long-term minor to moderate cumulative adverse impacts on vegetation. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

# WILDLIFE AND AQUATIC SPECIES

## GUIDING REGULATIONS AND POLICIES

The NPS Organic Act of 1916 and NPS *Management Policies 2006* (NPS 2006c) direct NPS managers to provide for the protection of park resources. The Organic Act requires that wildlife be conserved unimpaired for future generations, which has been interpreted to mean that native animal life is to be protected and perpetuated as part of a park unit's natural ecosystem. Parks rely on natural processes to control populations of native species to the greatest extent possible; otherwise, they are protected from harvest, harassment, or harm by human activities. The NPS *Management Policies 2006* make restoration

of native species a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and ecological integrity of plants and animals (NPS 2006c).

## **METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS**

Given the programmatic nature of this analysis, the exact locations of future operations are unknown. As a result, actions under the RFD scenario and the forecast of oil and gas activities were analyzed qualitatively against the types of wildlife and wildlife habitat in Big South Fork NRRA and Obed WSR that could be impacted. The wildlife and aquatic species were defined and described based on the sources cited in chapter 3. The assessment of impacts is based on best professional judgment and was developed through discussions with park staff and EIS team members.

The impact intensity threshold definitions are based on the potential for changes to wildlife and aquatic species characteristics, as follows:

- Negligible:* There would be no observable or measurable impacts on native species, their habitats, or the natural processes sustaining them.
- Minor:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable on a local level. Occasional responses to disturbance by some individuals could be expected, but without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all native species. Impacts would be outside critical reproduction periods or key habitat.
- Moderate:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and changes to population numbers, population structure, genetic variability, and other demographic factors could occur on a local level. Responses to disturbance by some individuals could be expected and could have negative impacts on factors affecting local population levels, but species would remain stable and viable. Sufficient habitat would remain functional to maintain the viability of all native species, but habitat quality could be affected. Some impacts might occur during critical periods of reproduction or in key habitat.
- Major:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and population numbers, population structure, genetic variability, and other demographic factors might experience large declines over a wide geographic area. Responses to disturbance by some individuals would be expected, with negative impacts resulting in a decrease in population levels. Loss of habitat might affect the viability of some native species. Impacts would regularly occur during critical periods of reproduction or in key habitat.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used, receiver lines would be laid on foot, and no shot holes would be drilled, there would be very limited impacts on wildlife and aquatic species. Wildlife and aquatic species could be displaced or could experience increased stress and mortality and decreased production as a result of work crews trimming vegetation, or laying lines, and there could be temporary disturbance during the use of the seismic vibrator due to noise and ground vibration. Operations would avoid critical reproduction periods or key habitat. Impacts related to noise are usually temporary, with wildlife and aquatic species avoiding or moving away from the source but returning after noise is reduced or eliminated. Seismic survey disturbance would be very localized and intermittent, with the level of impact dependent on the strength of the vibration and proximity to the source.

However, under any alternative, protection of water quality and aquatic species and wildlife would be provided by CLPRs, which require operations to maintain a 500-foot setback from rivers, streams, and other water bodies, unless specifically authorized by an approved plan of operations. The setback would avoid or substantially reduce sedimentation and turbidity and vibration impacts. The 500-foot setback from water bodies would protect wildlife and aquatic species using water and the immediate riparian areas within this protective zone. Protection of aquatic habitats would also be provided by the wetlands and floodplains permitting and compliance requirements. Also, natural resource surveys would be conducted as deemed necessary by resource specialists, and appropriate mitigation applied.

As a result, geophysical operations under alternative A could result in localized short-term negligible to minor adverse impacts on wildlife and aquatic species.

**Drilling and Production**—Where drilling and production operations would be permitted, the construction and maintenance of roads, wellpads, and production pads could result in the direct loss of habitat. Increased wildlife and aquatic species mortality could result from vehicles, construction activities, and increased access into previously inaccessible areas, resulting in localized short-term (construction and well drilling) to long-term (road, flowline, pipeline, well, and production operations) minor adverse impacts. Drilling muds, hydrocarbons, produced waters, or treatment chemicals could be released during drilling, production, or transport, with minor to potentially major adverse impacts, but with mitigation and prompt response in the event of a spill, the intensity of long-term adverse impacts would be minor to moderate.

Many of the impacts on wildlife and aquatic species from drilling and production are associated with construction activities. Wildlife and aquatic species, particularly small mammals, invertebrates, and herpetofauna (reptiles and amphibians), that cannot escape an area during construction could be killed, and increased mortality of small mammals is also likely to occur along access roads.

Aquatic species could experience habitat degradation from road construction and use, construction of wellpads, and placement of pipelines in drainages where these species occur. These effects could decrease the long-term viability of populations as a result of increased sedimentation from construction activities and long-term use, if appropriate mitigation measures are not applied. Some risk of direct mortality of

aquatic species could occur if a pipeline ruptures at a stream crossing or if toxic materials (such as diesel fuel) are spilled into streams. In some cases, improved human access to remote streams could result in greater fish mortality from licensed fishing or poaching, which would constitute an indirect effect. These effects would depend on where new production ultimately occurs, and careful siting of developments could avoid or minimize these impacts substantially. Because waterways are inherently a part of floodplains (riparian corridors) and wetland areas, they receive added protection under the Executive Orders and NPS implementing guidelines for protection of wetlands and floodplains, and are protected by a 500-foot setback under the NPS Non-federal Oil and Gas Rights Regulations at 36 CFR 9.41(a) (unless specifically authorized by an approved plan of operations). These protective measures promote the proper protection of water levels, stream temperatures, water quality, and streamflow. When there are no practicable alternatives to locating an operation or activity in floodplains and wetlands, careful siting of facilities and application of stringent mitigation measures are expected to minimize potential impacts. Therefore, the sediment increases 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 could be used to restore wetlands habitats and increase wildlife and aquatic species habitat values.

Construction of oil and gas-related roads, wellpads, or flowlines would result in direct loss of habitat. However, identification of wildlife and aquatic species habitat through biological surveys, if needed, would result in development of mitigation measures intended to avoid or minimize impacts. These surveys must be performed by biologists who have sufficient technical knowledge and/or experience to appropriately time when and how surveys are performed, and who are qualified to identify the species (and habitat of the species) that are present or may potentially use the area.

Wildlife could also be adversely impacted when human access is increased or becomes easier, especially in areas that were previously inaccessible. This increases the risk of wildlife and aquatic species mortality, through legal or illegal means. The park superintendent can close or restrict motorized public access on roads that are to be used for oil and gas development, if necessary. With this authority, the NPS can mitigate the effects of increased public access via oil and gas access roads.

Alteration of wildlife and aquatic species habitat and increased human access and intrusion can also allow for the introduction of non-native species. Ground-disturbing activities in wet soils, such as in floodplains and wetlands areas (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 corridors and near the wellpads during construction, and through the exploration and production phase of the wells. Displacement is the predominant effect on most wildlife species. Displacement of wildlife would continue from the initial wellpad construction phase into exploratory drilling, and if the well is placed in production, during the potentially long life of the producing well. Road and pad development and drilling operations would reduce the usable habitat for large carnivores as well as their prey species. Secure areas for large carnivores and prey species would be reduced and the risk of mortality would increase. The increase and ease of public access routes would serve to increase public motorized travel, or if the roads are closed to public motorized travel, they would still serve as access routes on foot, horseback, and mountain bike. New access roads may even serve as travel corridors for large carnivores, 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. Low-speed roads are not expected to appreciably increase mortality from roadkill and should not be barriers to movements of smaller wildlife species.

Noise from drilling or well servicing operations would also impact wildlife. Drilling operations introduce noise with the highest measurements in the 90 dBA (A-weighted decibel) range for a period of a week or two up to a few months, with noise coming mostly from multiple diesel engines (see table 32 in the “Soundscapes” analysis). Therefore, noise impacts could be severe, but limited to a localized area and relatively short duration.

Also, in spite of careful best management practices to minimize the release of oil and other contaminating and hazardous substances, in the worst-case scenario, releases could potentially escape primary and secondary containment systems and species inhabiting the area could be harmed. If releases are transported into waterways, fish and other species occupying or using the water could be impacted. The severity of impacts would depend on the type and amount of pollutant released, physical and environmental factors of the site, the method and speed with which cleanup occurs, and the sensitivity of wildlife and aquatic species to these impacts during different stages of their life cycle. The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact wildlife and aquatic species. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park’s resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

Some facilities associated with production operations (i.e., heater treater units/separator units) could kill bats, migratory birds, and raptors through asphyxiation or incineration. To mitigate the residual impacts from these facilities, mitigation such as a cone device, placed on top of all vent stacks to prevent perching and access, may be required under CLPRs. Inaccessibility to the vent stacks would curtail any potential mortality of bats and birds.

Another protective measure that may be required is netting or covering open containers that collect stormwater. This requirement prevents bird and other wildlife species from accessing stormwater that has come in contact with and mixed with oil, gas, and other contaminating and hazardous substances.

Selection and use of herbicides and pesticides must be approved by the NPS Integrated Pest Management Coordinator to avoid adverse effects on non-target species.

Existing and future oil and gas operations would comply with CLPRs to protect wildlife and aquatic species. Operating stipulations may include biological surveys performed by a qualified biologist when this information is determined to be necessary for the NPS to evaluate the potential impacts of the proposed operation on wildlife and aquatic species. The biologist conducting the field surveys must have sufficient technical knowledge and/or experience to appropriately time when and how biological surveys shall be performed and to identify species and habitat of wildlife and aquatic species that may occur or be potentially impacted in and adjacent to the proposed operations area. The information provided by biological resource surveys of proposed operations in the park units would increase the NPS knowledge of the resource in the park units, which would have a negligible beneficial impact.

Considering the potential lack of frequent inspections and monitoring of all operations, but also the above operating standards and mitigation measures and the limited extent of new drilling and production operations, there would be short- to long-term minor to moderate adverse impacts on wildlife and aquatic species. The chances of undetected spills would be greater under this alternative because routine inspections

would not occur beyond base workload levels, which would increase the potential for a moderate or even major adverse impact on affected wildlife and aquatic species, especially those that are not mobile and cannot leave the affected area.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Plugging and abandonment operations and site preparation during reclamation would introduce heavy equipment, along with increased noise levels, for a short time. This could disturb wildlife and aquatic species and cause them to temporarily avoid the area. Vehicle use on and vegetation clearing of access roads and wellpads may adversely affect wildlife and aquatic species by increasing poaching in open areas and may temporarily disrupt feeding, denning, spawning/reproduction, and other wildlife behaviors. Plugging and reclamation activities may increase human access and edge effects and temporarily alter wildlife and aquatic species composition and migration. The use of heavy equipment and vehicles to plug and reclaim sites could have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill aquatic and wildlife species, but would be minimized with mitigation. These operations would cause occasional responses by wildlife and aquatic species, but would not cause observable or measurable impacts on native species populations. Sufficient habitat would be available to support these species, and operations would be timed to avoid critical reproduction periods. Therefore, there would be localized short-term negligible to minor adverse impacts at sites throughout the park during plugging and reclamation activities.

Wherever access roads have been built or are used for the primary purpose of allowing access for oil and gas operations, access roads would be reclaimed at the completion of operations. This would return the area to its natural conditions, thereby having a beneficial impact on the park environment. As oil and gas operations are plugged and abandoned, wildlife and aquatic species habitat would be reclaimed. Wherever possible, habitats would be improved to perpetuate the viability of habitats and increase the survivability of species. The reclamation of the previously disturbed areas, including monitoring for exotic species, would also enhance native plant communities in the project areas, and over time, reduce fragmentation. This would result in long-term beneficial impacts on native species, their habitat, and the natural processes sustaining them.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact wildlife and aquatic species in the park units. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, especially due to noise that can affect species in the park unit or runoff of contaminants. Impacts would depend on the proximity of operations to the park; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures being employed. Based on these factors, indirect impacts on wildlife and aquatic species in the park could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production,



impacts to wildlife and aquatic species are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter have the potential to contribute to adverse cumulative effects on wildlife and aquatic species at the park units. In addition to traditional oil and gas development, coal bed methane/shale gas drilling is an ongoing feature in the vicinity of the park units. There are also ongoing mining operations around the park units, and acid mine drainage associated with active and abandoned mines impacts water resources, which have both adversely affected wildlife and aquatic species in the area. Acid mine drainage and abandoned mine impacts include contamination of resources by sulfuric acid and ferric hydroxide runoff at active and abandoned coal mining sites, as well as clearing of vegetation at active mine sites, with long-term minor to moderate adverse effects. The Big South Fork NRRRA has undertaken remediation studies of selected sites where contaminated mine drainage is of concern, including the Worley riverside area. Water quality on the site is an issue due to acid mine drainage. This is a site where remediation of mine effects is being planned, which would have long-term beneficial effects on wildlife and aquatic species.

Agricultural activities on land adjacent to the park units, primarily logging activities and hay production, could result in negligible to minor long-term adverse impacts on wildlife and aquatic species, due to the loss of natural vegetation and habitat. Most of the forested areas of Big South Fork NRRRA have been logged. At Obed WSR, clearing and harvesting from logging and agriculture is particularly evident.

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 2005a). NPS staff members at Big South Fork NRRRA and Obed WSR 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 minor adverse effect on native habitat, but the active management of exotic species has a long-term localized beneficial effect.

Existing surface disturbances (including existing and abandoned operations and transpark oil and gas pipelines), 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 short- and long-term minor to moderate and generally localized adverse impacts on wildlife and habitat. Roads in Big South Fork NRRRA are used by personal vehicles and commercial vehicles (e.g., gravel trucks) as well as ORVs for hunting and other recreational opportunities. The NPS routinely maintains trails, buildings, and roads, as well as cultural landscapes in the park units. Visitor activities such as horseback riding, biking, hunting, recreational rock climbing, swimming, kayaking, and ORV use all occur within Big South Fork NRRRA and/or Obed WSR. Park and visitor activities would have long-term localized negligible adverse impacts on habitat.

Development outside the park, including commercial, industrial, and residential, could contribute minor to moderate adverse cumulative impacts as a result of habitat loss and damage, temporary disturbance and relocation, or incidental take of a species. On lands surrounding the park units, 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 long-term 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, have caused a decline in streamside vegetation, resulting in increased runoff, sedimentation, and changes in water temperature and other chemistry, reducing potential habitat for wildlife and aquatic species. These effects would continue under

this alternative and would have widespread long-term minor adverse impacts on wildlife and aquatic species.

In addition to cumulative actions that would have negative effects on wildlife and aquatic species, there are also some actions that would have beneficial effects. In addition to new oil and gas development, there are wells that have been plugged and reclaimed in or near the park units. The NPS plans to plug and reclaim 14 abandoned wells at Big South Fork NRRRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control, and 39 other wells would soon be plugged as part of an action funded by the ARRA. 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 wildlife and aquatic species. Adverse impacts on plants, aquatic species, and wildlife habitat resulting from reclamation operations would be short term and minor, while the long-term protection of wildlife and aquatic species and their habitat in the park units would provide beneficial impacts.

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 NRRRA and Obed WSR and has had an overall beneficial impact on wildlife, while the introduction of non-native species has resulted in long-term minor adverse impacts.

The 2006 *Big South Fork NRRRA Fire Management Plan* (NPS 2006e) 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 implementation of a prescribed-fire plan would have long-term beneficial effects on wildlife and aquatic species within the Big South Fork NRRRA and the Obed WSR by reducing hazard fuel accumulations around oil and gas well facilities and aiding in fire-suppression activities by reducing fire intensity and severity, and protecting wildlife and aquatic species and habitat. The park units' prescribed-fire management program could contribute to short-term habitat loss and wildlife displacement, and could increase erosion and sedimentation, but would result in long-term beneficial impacts on park vegetation and improved habitat for protected wildlife species.

Additionally, the revised 9B regulations governing non-federal oil and gas development within the boundaries of NPS units 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 wildlife and aquatic species, due to improving resource protection practices.

Overall, the impacts of these actions, combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on wildlife and aquatic species. Protection provided to wildlife and aquatic species in the park units under CLPRs is expected to limit adverse impacts and improve the condition of these resources, but wildlife and aquatic species in the watersheds surrounding the park units have been and could continue to be adversely affected. When compared to the broader area of analysis, alternative A would directly impact a relatively small amount of habitat and would contribute minimally to the overall cumulative impacts.

## Conclusion

Under alternative A, limited geophysical exploration would result in localized short-term negligible to minor adverse impacts on wildlife and aquatic species from habitat removal and disturbance, particularly short-term noise. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production operations could result in localized short- to long-term minor to moderate adverse

impacts on wildlife and aquatic species from loss or disruption of habitat due to vegetation and site clearing, possible injury to or mortality of less mobile species, noise and associated species displacement or stress, and spills or releases of harmful substances. Impacts from plugging and reclamation of wells at sites at either park could also cause injury to or mortality of wildlife and aquatic species, but with mitigation, there would be localized short-term negligible to minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites. The long-term effect of these activities would be to return the area to natural conditions, which would have a beneficial impact on wildlife and aquatic species. Indirect impacts on wildlife and aquatic species in the park units from directionally drilled wells outside the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on wildlife and aquatic species. When compared to the broader area of analysis, alternative A would directly impact a relatively small amount of habitat and would contribute minimally to the overall cumulative impacts.

### **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

#### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Because of the restrictions at Obed WSR, including the no surface use of the gorge, these operations would not be allowed within the park unit under alternative B.

Under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRR and Obed WSR. This plan would ensure that geophysical exploration is conducted in a way that best protects park resources and values as well as wildlife and aquatic species, including avoidance of critical reproduction periods or key habitat. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, stemming from habitat disturbance and vegetation removal and noise, and would be localized, short term, negligible to minor, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. However, implementing a comprehensive oil and gas management plan, including increased inspections and monitoring that would reduce the chance of leaks or releases going undetected and reaching wildlife and aquatic species or their habitat, and would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area, would minimize impacts. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a

result, although short- and long-term impacts associated with the noise and disturbance, habitat loss, direct injury and mortality, and possible releases of hazardous substances of drilling and production would still occur, this alternative would protect park resources and values, as well as wildlife and aquatic species, better than alternative A. Therefore, there would be short- to long-term minor adverse impacts from drilling and production activities with a reduced probability of long-term major adverse impacts associated with potential leaks and spills.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternative A, well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles to reclaim sites would have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill protected plants, fish, and wildlife. However, under alternative B the NPS would implement a comprehensive oil and gas management plan including a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. Therefore, short-term adverse impacts on wildlife and aquatic species would be negligible to minor, and over the long term, it is anticipated that fragmentation could be reduced and wildlife and aquatic species habitat could be improved. Additionally, these beneficial impacts would be more likely to be realized sooner under this alternative as compared to alternative A, given the implementation of the new management framework for plugging and reclamation.

**Directionally Drilled Wells**—Similar to alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact wildlife and aquatic species in the park units. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary. Impacts would depend on the proximity of operations to the park; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures being employed. Based on these factors, indirect impacts on wildlife and aquatic species in the park could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on wildlife and aquatic species from other actions that were considered under the cumulative impacts scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate cumulative impacts on wildlife and aquatic species. The more proactive enforcement of CLPRs and increased inspections/monitoring would improve the condition of these resources, but the majority of the impacts on wildlife and aquatic species in the region occur outside the park units, where impacts may or may not be mitigated. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to the overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

## Conclusion

Similar to alternative A, limited geophysical operations would result in short-term negligible to minor adverse impacts on wildlife and aquatic species from habitat removal and disturbance as well as noise. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells would result in short- to long-term minor adverse impacts on wildlife and aquatic species from the direct loss of habitat, injury and mortality, or displacement of wildlife and aquatic species. Impacts would be similar to those under alternative A, but with applied mitigation and implementation of a comprehensive oil and gas management plan, the risks of injury and other impacts would be reduced. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections. Impacts from plugging and reclamation of wells at either park would result in short-term negligible to minor adverse impacts on wildlife and aquatic species. The new management framework for plugging and reclamation would increase the certainty that the wells and access roads would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Indirect impacts on wildlife and aquatic species in the park units from directionally drilled wells outside the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, there would be short- and long-term minor to moderate cumulative adverse impacts on wildlife and aquatic species. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

## **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

### Analysis

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C the NPS would implement a comprehensive oil and gas management plan that includes the establishment of SMAs to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR, with the exception of the Special Scenery SMA unless otherwise approved in a plan of operations. The SMA for Honey Creek and Twin Arches state natural areas was set aside primarily because of their rich, undisturbed forest communities and their high diversity of forest species. The SMAs for Sensitive Geomorphic Features and Cliff Edges would also protect some wildlife species along with geology.

Given the limited extent of geophysical exploration anticipated during the life of this plan, mitigation to avoid critical reproduction periods or key habitat, and the use of existing roads and pedestrian access,

impacts associated with geophysical exploration in alternative C would result in localized short-term negligible to minor adverse impacts on wildlife and aquatic species at Big South Fork NRR.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternatives A and B. In addition, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRR and Obed WSR where resources and values would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, drilling and production would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR unless otherwise approved plan of operations, and mitigation would include avoidance of critical reproduction periods or key habitat. Drilling and production would be precluded in Obed WSR.

In smaller SMAs, the added protection would primarily be provided for small mammals and invertebrates that occupy these areas. In larger SMAs, protection from additional habitat fragmentation would benefit all fish and wildlife species. The increased setback from visitor use and administrative areas, from a 500-foot setback to a 1,500-foot setback, would further reduce the potential impacts of oil and gas operations and activities in these areas. The 1,500-foot setback from rivers and streams that are habitat for listed mussel species and their fish hosts would reduce the possibility of impacts on mussels and other wildlife using these areas during nesting, breeding, and migration.

The designation of Obed WSR SMA, the Cliff Edge SMA, the Sensitive Geomorphic Feature SMA, the Managed Fields SMA, and the State Natural Area SMA would increase protection and improve habitat for terrestrial and aquatic species that use these areas. Some wells may be directionally drilled from outside the SMAs, or even outside the park, to develop underlying hydrocarbons.

As a result, although short-term and long-term impacts from the noise and disturbance, habitat loss, direct injury or mortality, and possible releases of hazardous substances of drilling and production would still occur, this alternative would protect park resources and values better than alternatives A and B. Therefore, there would be short- to long-term negligible to minor adverse impacts from drilling and production activities with a more limited risk of major adverse effects from spills or leaks.

**Plugging and Reclamation**—Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles to reclaim sites would have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill wildlife and aquatic species. With mitigation, these effects would result in localized short-term negligible to minor adverse impacts on wildlife and aquatic species at sites throughout the park, some of which are located within SMAs.

The establishment of SMAs would further protect natural areas, including areas of Big South Fork NRR and Obed WSR where resources and values, including wildlife and aquatic species, would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Park staff would evaluate all wells that are candidates for plugging and reclamation to determine their potential for impacts on park unit resources and values. Sites would be prioritized for plugging and reclamation based on a number of factors, including the proximity of well sites to SMAs.

**Directionally Drilled Wells**—Similar to alternatives A and B, indirect impacts on wildlife and aquatic species in the park units from drilling and production of wells directionally drilled from outside the park

units to bottomholes beneath the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on wildlife and aquatic species from other actions that were considered under the cumulative impacts scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate adverse cumulative impacts on wildlife and aquatic species. The SMA restrictions would provide more consistent and more certain protection of wildlife and aquatic species in the SMAs, and protection provided to these species in the park under CLPRs and increased inspections and enforcement would limit adverse impacts, but actions on adjacent lands have adversely affected and could continue to adversely affect wildlife and aquatic species and habitat, often without adequate mitigation. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

### **Conclusion**

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible to minor adverse impacts on wildlife and aquatic species from habitat removal and disturbance as well as noise. Under alternative C, with adequate setbacks, implementation of mitigation measures, and the establishment of SMAs, effects from drilling and production would be short- to long-term negligible to minor adverse impacts on wildlife and aquatic species in the park. Plugging and reclamation of wells at either park would result in short-term negligible to minor adverse impacts on wildlife and aquatic species. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled from outside the park units to bottomholes beneath the park units could range from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts under alternative C would be similar to those described for alternative B, with short- and long-term minor to moderate cumulative adverse impacts on wildlife and aquatic species. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

## FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

### GUIDING REGULATIONS AND POLICIES

The ESA (16 USC 1531 et seq.) and amendments mandate that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely affect a federally listed species, consultation with the USFWS is required to ensure that the action would not jeopardize the species continued existence or result in the destruction or adverse modification of critical habitat. The NPS *Management Policies 2006* (NPS 2006c) section 4.4.2.3 states that the NPS will protect all species native to national park system units that are listed under the ESA and will proactively conserve listed species and prevent detrimental effects on these species.

### METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

Given the programmatic nature of this analysis, the exact locations of future operations are unknown. As a result, actions under the RFD scenario and the forecast of oil and gas activities were analyzed qualitatively against the federally listed threatened and endangered species in Big South Fork NRR and Obed WSR that could be affected. The species were defined and described based on the sources cited in chapter 3. The assessment of impacts is based on best professional judgment and was developed through discussions with park staff and EIS team members. For federally listed species, the terms “threatened” and “endangered” describe the official federal status of vulnerable species as defined by the ESA of 1973. The term “candidate” is used officially by the USFWS when describing those species for which sufficient information exists about the biological vulnerability and threats to the species to support a proposed rule to list; however, issuing the rule is precluded for some reason. Federal “species of concern” are those for which listing may be warranted, but further biological research and field study are needed to clarify their conservation status.

The USFWS and National Oceanic and Atmospheric Administration Fisheries guidance for implementing section 7 consultation under the ESA defines the terminology used to assess impacts on listed species as follows:

*No effect:* the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or listed critical habitat.

*May affect, is not likely to adversely affect:* the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect or evaluate insignificant effects; or (2) expect discountable effects to occur.

*May affect, likely to adversely affect:* the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of “is not likely to adversely affect”). In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, an “is likely to



adversely affect” determination should be made. An “is likely to adversely affect” determination requires the initiation of formal section 7 consultation.

The NPS developed the following thresholds under the NEPA guidelines to determine the magnitude of effects on federally listed special-status species and their associated habitat, including designated critical habitat, that would result from implementation of any of the alternatives.

*Negligible:* Impacts would result in a change to a population or individuals of a federal listed threatened and endangered species, but the change would be well within the range of natural fluctuations.

*Minor:* An action that would affect a few individuals of a federal threatened and endangered species or have very localized impacts upon their habitat. The change would have barely perceptible consequences to the species or habitat function. Sufficient habitat would remain functional to maintain species viability. Impacts would be outside of critical reproduction periods. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

*Moderate:* An action that would cause measurable effects on: (1) a relatively small percentage of the species population, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or (3) a relatively large habitat area or important habitat attributes. A population or habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable within the park. Response to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors impacting short-term population levels. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

*Major:* An action that would have drastic and permanent consequences for a species population, dynamics between multiple species, or almost all available unique habitat. A population or its habitat would be permanently altered from normal levels under existing conditions, and the species would be at risk of extirpation from the park. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in population levels. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Because of the restrictions at Obed WSR, these operations would not be allowed within the park unit.

Where exploration operations could be permitted, these operations would avoid impacting federally listed species and their habitat, which would be identified through consulting park biologists, or biological surveys, if determined to be necessary by the NPS through consultation with the USFWS, and through scoping with the TWRA or other state agency biologists. When federally listed species and their habitat are found to be within the project area, mitigation measures, including sufficient setbacks and/or timing restrictions for nesting and other sensitive periods in a given species' life cycle, would result in avoiding or minimizing potential adverse effects.

Potential effects from exploration operations could include increased displacement, increased risk of mortality, decreased production, and increased stress levels from the noise and disturbance associated with seismic survey activities. These effects could be caused by seismic crews traveling to access the area to be surveyed and by pedestrian travel along receiver lines, as well as the vibrations from the seismic operations, trimming vegetation, and using vehicles on existing roads. Types of species that could be affected by these activities are the listed plant and mammal species described in chapter 3, including the gray bat and Indiana bat, Cumberland rosemary, and the white fringeless orchid. The mussel and fish species described in chapter 3 would not likely be affected because none of these activities would be performed in aquatic habitat. Listed species could be particularly impacted by the noise associated with seismic survey work, especially vehicle noise. Impacts related to noise are usually temporary, with nearby species avoiding or moving away from the source but returning after noise is reduced or eliminated. Geophysical operations are short term and would have very limited impact on animals given the short duration of operations and pre-operations surveys.

Under alternative A, protection of water quality is provided by 36 CFR 9.41(a), which requires operations to be offset 500 feet from the banks of perennial, intermittent, or ephemeral watercourses, unless specifically authorized by an approved plan of operations, which would minimize erosion and sedimentation and other impacts on water quality and quantity that could adversely impact aquatic species. The standard 500-foot setback from water bodies would protect fish, wildlife using water, and wetland vegetation within this protective zone, which supports many listed species. Through project-specific consultation with USFWS under the ESA, and scoping with or other state agency biologists, the setback could be increased. The 500-foot standard setback would provide primary protection to all of the fish and mussel species described in chapter 3, including the duskytail darter, blackside dace, spotfin chub, Cumberland bean, little-winged pearlymussel, purple bean, dromedary pearlymussel, and the spectaclecase. Additional protection to these habitats would be provided by the wetlands and floodplains Executive Orders, NPS Director's Orders, and project-specific permitting requirements.

Listed species that occupy upland areas outside the 500-foot shoreline setbacks include bats (gray bat) and upland plants (Cumberland sandwort). Bat species could be affected by the presence of seismic crews and the noise associated with the surveys, but there would be little if any trimming of vegetation or clearing required. All these species would be protected under the required consultation in the ESA.

Under alternative A, non-federal oil and gas operations could be developed under CLPRs, which include consultation under the ESA if operations are in an area where threatened and endangered species are known to occur or could impact listed species. Mitigation measures, including setbacks and/or timing restrictions, would result in avoiding or minimizing potential adverse effects. Additionally, upon the completion of operations, reclamation of disturbed areas would be required, and recovery of any vegetation disturbed is expected to occur over the short term. Application of these requirements would result in short-term negligible adverse impacts on federally listed species or their habitat from geophysical exploration.

**Drilling and Production**—Drilling and production operations (surface uses for drilling and production operations, including the placement of flowlines) would not directly impact listed species or their habitat in protected areas where operations would not be permitted under CLPRs, including the 9B regulations,

the gorge restrictions at Big South Fork NRR, and deed restrictions at Obed WSR. As described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRR, and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR. It is also assumed that 125 wells at Big South Fork NRR and 2 wells at Obed WSR would be worked over or serviced.

Existing operations have little ongoing effect on habitat other than the threat of spills or leaks and any maintenance activities that are needed on infrastructure. The chances of undetected spills are greater under this alternative because routine inspections and monitoring would not occur, which may increase the potential for a major adverse impact if spills should reach susceptible endangered or threatened species such as the federally listed mussels or fish. The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact listed species. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park's resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

However, most impacts from oil and gas operations would come from the construction of new access roads and wellpads. Drilling and production operations could range in duration from short term (weeks or months for well drilling and construction of roads, wellpads, flowlines, and pipelines) to long term (lasting 20 years or more for road, flowline, pipeline, well, and production operations). Construction and maintenance of roads, pads, flowlines, and pipelines could require vegetation clearing and could result in habitat loss. Potential effects on listed species would depend on where drilling and production operations are located. Careful siting of developments based on biological survey and/or assessment results could avoid or minimize these impacts substantially. Through the required biological surveys and/or assessments and consultations with USFWS and TWRA or other state agency biologists, potential impacts on federally listed species and their habitat would be identified, and the application of appropriate mitigation measures would result in minor adverse impacts.

Water-dependent species (including fluted kidneyshell, clubshell, spectaclecase, dusky-tailed darter, Cumberland elktoe, palezone shiner, and blackside dace) could be impacted by the construction and long-term maintenance of roads, pads, flowlines, and pipelines if stream crossings result in increased sedimentation or alteration of streamflow, water quality, or temperature. Under all alternatives, waterways are protected by a 500-foot setback under 36 CFR 9.41(a), unless specifically authorized by an approved plan of operations; and because waterways are inherently a part of floodplains (riparian corridors) and wetland areas, and receive added protection under various regulatory and policy requirements, streamflows, water quality, and temperature would be protected from disturbance and water levels would be maintained. When there are no practicable alternatives to locating an operation or activity in floodplains and wetlands, careful siting of facilities and application of stringent mitigation measures are expected to avoid potential adverse impacts. Required mitigation for direct and indirect impacts on wetlands could be used to restore wetland habitats and increase listed species' habitat values.

Displacement of wildlife would continue from initial wellpad construction into exploratory drilling, and if the well is placed in production, during the life of the producing well. The increase and ease of public access routes may serve to increase public motorized travel, or if the roads are closed to public motorized

travel, they would still serve as access routes on foot, horseback, and mountain bike, which could result in indirect negligible to minor adverse effects on certain species, such as the listed bats.

Noise from drilling operations would also impact protected wildlife species such as the gray bat and the Indiana bat. Drilling operations introduce noise with the highest measurements in the 90 dBA range for a period of a week or two up to a few months, with noise coming mostly from multiple diesel engines (see table 32 in the “Soundscapes” section). Therefore, noise impacts could be of concern, but limited to a localized area and relatively short duration, and surveys for listed species would ensure that noise would not cause adverse impacts, limiting impacts to minor levels.

Some facilities associated with production operations (i.e., heater treater units/separator units) could cause the mortality of bats through asphyxiation or incineration. To mitigate the residual impacts from these facilities, mitigation could include a cone device placed on top of all vent stacks. The cones would be constructed in a manner that would prevent perching on the vent stacks and subsequent asphyxiation, and would eliminate all access into the vent stack pipes. Inaccessibility to the vent stacks would curtail any potential mortality of listed bat species.

Another operating stipulation may require that all open containers that collect stormwater be netted or covered. This requirement prevents wildlife species from accessing stormwater that may have contacted and mixed with oil, gas, and other contaminating and hazardous substances.

Selection and use of any herbicides and pesticides must be approved by the NPS Integrated Pest Management Coordinator, and use of such chemicals must be kept to a minimum. All chemicals must be used in accordance with label instructions and areas of sensitive habitat or species presence would be avoided. With appropriate use and mitigation, any adverse effects on listed species would be negligible to minor.

Given the above operating standards and other mitigation under CLPRs, as well as the limited number of new operations projected in the forecast of oil and gas activities, there would be localized short-term negligible to minor adverse impacts from drilling and production operations in the park units, although the potential for a major adverse impact (injury to or mortality of individuals of listed species) from a spill or release is more likely under this alternative.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles to reclaim sites could have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill protected plants, fish, and wildlife. However, adhering to the consultation requirements under the ESA; performing biological surveys of the area that could be potentially impacted by proposed plugging, abandonment, and reclamation operations; identifying listed species; and applying appropriate mitigation would result in localized short-term negligible to minor adverse impacts on listed species.

Plugging operations and site preparation during reclamation would introduce heavy equipment and people, along with increased noise levels, for a short time, resulting in short-term localized negligible to minor adverse impacts, depending on the season, the background soundscape, and the proximity of operations to the species. Seasonal restrictions would include delaying activities until after a species' nesting or spawning seasons. Access roads that have been developed or allowed to remain open for the

primary purpose of allowing access for oil and gas operations would be reclaimed at the completion of operations, returning the area to its natural conditions. Wherever possible, habitats would be improved to perpetuate the viability of habitats and increase the survivability of listed species. The outcome of these activities, in returning natural conditions to the operations area, would have long-term beneficial impacts.

**Directionally Drilled Wells**—It is possible that some wells may be directionally drilled from outside the park units to develop hydrocarbons underlying the park units. The intensity of impacts on listed species would be dependent on where the operation is located with respect to species and their habitats, whether the operation is sited inside or outside the park, and on the resource protection measures that are employed. For wells directionally drilled and produced from outside the park units to bottomholes beneath the park units, the connected actions occurring outside the park boundaries could include constructing and maintaining access roads, well/production pads, and flowlines/pipelines; drilling the well; producing the well; plugging and abandoning the well; and site reclamation. The in-park operations associated with directional wells would consist of the wellbore crossing into the park units, usually several thousand feet or more below the surface. Therefore, for most directional wells drilled that are exempted under 36 CFR 9.32(e), the NPS regulatory authority would be limited to applying mitigation to the in-park operations to provide protection of groundwater resources beneath the park. Because the in-park operations would typically have no effect on listed species or their habitats on the surface, the NPS would have no section 7 responsibilities under the ESA. However, for the connected actions proposed outside the park, the NPS would assume the lead role in carrying out section 7 responsibilities under the ESA if there are no other federal entities with broader regulatory involvement. The USFWS may not require oil and gas operators outside the park units to apply the same degree of mitigation as the NPS applies on parklands. Further, oil and gas operators outside the park units are not required to survey for or protect federally listed species. Given that most impacts on listed species are from wellpad and access-road construction, the impacts on listed species and their habitats in the park units from drilling and production of wells drilled from surface locations outside the park units to reach bottomholes beneath the park units could result in indirect adverse impacts ranging from no impact to localized to widespread, short- to long-term, minor adverse impacts with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### Cumulative Impacts

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to Federally-listed threatened and endangered species are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would contribute to both adverse and beneficial cumulative impacts on listed species. Past oil and gas development within and outside Big South Fork NRRRA has had short- and long-term minor to moderate adverse impacts on listed species from vegetation clearing, vehicle use, and the construction and maintenance of access roads, wellpads, and flowlines. Contamination of surface and groundwater from leaking wells would also contribute to impacts. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of Big South Fork NRRRA, and has similar impacts to traditional oil and gas development.

Existing surface disturbances (including existing and abandoned operations) and transpark oil and gas pipelines, 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 listed species. It is difficult to accurately determine what types of habitat existed before being affected by development prior to the establishment of the park units. Since the establishment of the park units, however, development decisions have been applied under

a well-defined regulatory process that has limited any additional impacts on listed species. Visitor activities such as horseback riding, biking, hunting, recreational rock climbing, swimming, kayaking, and ORV use all occur within Big South Fork NRR and/or Obed WSR and may contribute to short-term localized negligible to minor adverse impacts on the federally listed species considered in this plan/EIS.

Agriculture other than forestry has occurred on less than 20% of the land in counties adjacent to Big South Fork NRR and Obed WSR, and most of the forested areas of Big South Fork NRR have been logged. At Obed WSR, clearing and harvesting from logging and agriculture is particularly evident. 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 listed terrestrial species, resulting in short- and long-term localized to widespread minor adverse impacts.

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 NRR, and there are about 10 abandoned surface coal mine sites in McCreary County, Kentucky. The Big South Fork NRR has undertaken remediation studies of selected sites where contaminated mine drainage is of concern. The Worley riverside area is a former mining community where remnants of mining operations, including mine tailings, are evident. Water quality on the site is an issue due to acid mine drainage. Remediation of mine effects is being planned for this site.

Relatively low-density residential development occurs in the immediate vicinity of the park units, 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 and listed species habitat destruction. Industrial activity sites near the park units that could contribute to cumulative impacts include power plants, railroads, hardwood flooring factories, sawmills, and other manufacturing facilities. Southwest of Obed WSR, two industrial park units have been developed in the Crossville area. Habitat destruction and disturbances, temporary disturbance and relocation, or incidental take of a species from these sources would result in widespread long-term negligible to moderate adverse impacts on listed species.

The spread of non-native plant species has historically been occurring and now represents a serious problem within the national park units. 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 2005a). The abandonment of well sites and oil and gas access roads creates disturbances that increase the invasion of non-native plant species. At Big South Fork NRR, efforts to control exotic vegetation 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. The spread of non-native plant species in park units could result in increased habitat destruction and has the potential to affect most listed terrestrial species, resulting in short- and long-term localized to widespread minor adverse impacts.

Other activities in the park units that could impact protected plants, fish, and wildlife include wildlife harvest (hunting and trapping), nonconsumptive recreation, and the Big South Fork NRR prescribed-fire management program. Recreational activities in the park units are focused near developed visitor-use areas, trails, canoe routes, and roads. These developments and activities have a negligible adverse impact on protected plants, fish, and wildlife. The prescribed-fire management program could contribute to short-term habitat loss and wildlife displacement, and could increase erosion and sedimentation, but would provide long-term beneficial cumulative impacts on park vegetation and improved habitat for protected wildlife species.

Diseases and insect pests of vegetation such as the pine bark beetle have caused a decline in streamside vegetation. Large stands of trees could be affected by infestations, which would result in habitat destruction, and changes in water temperature and chemistry due to reduced shading of waterways. This would have a widespread long-term minor adverse impact on aquatic habitat.

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 NRA and Obed WSR, and non-native species (feral hogs, trout) were also introduced in the later 1970s–1980s. This has resulted in these species occupying habitat also occupied by listed species, with uncertain effects.

In addition to actions that would have negative effects on listed species, there are also some actions that would have beneficial effects. In addition to new oil and gas development, there are also wells that have been plugged and reclaimed in or near the park units. The NPS plans to plug and reclaim 14 abandoned wells at Big South Fork NRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. The NPS has also recently received funding under the ARRA to plug and reclaim an additional 39 wells at Big South Fork NRA to protect resources, including listed species. These and other oil and gas reclamation projects, as well as mine reclamation projects, help restore and protect listed species in and around the park units. Surveys would be conducted and mitigation applied to ensure that listed species are not adversely affected by these actions, which would have long-term beneficial impacts.

Other plans and projects within the park would also have long-term beneficial effects on listed species. The GMP at Big South Fork NRA outlines desired resource and visitor experience conditions that would protect 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.

The 2006 *Big South Fork NRA Fields Management Plan* (NPS 2006d) identifies desired resource conditions and the kinds/levels of visitor use for each of the fields in the park, depending on the GMP zone in which they fall (e.g., Natural Environment Recreation Zone, Cultural Spaces, First- or Second-Order Development, and Visitor Use Zones). 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). Although the fields management plan does not specifically address oil and gas operations, the actions proposed in the oil and gas management plan have been developed while taking into consideration the objectives of this plan and desired conditions for the fields.

Kentucky and Tennessee are developing TMDLs for impaired waters in the Big South Fork NRA. The implementation of these TMDLs would have beneficial effects on listed species by reducing pollutants entering streams. Additionally, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 listed species, 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. There are four recovery plans in place for eight species that occur at Big South Fork NRA or Obed WSR and are listed as threatened or endangered under the ESA. As part of these efforts, Big South Fork NRA 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 localized short-term and long-term negligible to minor adverse impacts and the beneficial negligible to minor effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on listed species. Protection provided to listed species in the park under CLPRs, including ESA Section 7 consultation requirements, would minimize adverse impacts and result in maintaining and improving habitat for listed species, but development and other actions outside the park would be expected to continue to adversely affect listed species or their habitat, often without mitigation. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## **Conclusion**

Under alternative A, limited geophysical operations would result in short-term negligible adverse impacts on listed species from vegetation trimming, disturbance and noise during access, as well as from vibrator truck use. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short-term negligible to minor adverse impacts, primarily from the noise and disturbance related to construction of new wellpads, access roads, flowlines, and pipelines, which would require vegetation clearing and could result in habitat loss or erosion/sedimentation into park waters. There would also be a risk for up to major adverse impacts from leaks and spills that could go undetected and could reach listed species, especially immobile species such as mussels. Impacts from plugging and reclamation of wells at either park would be localized, short term to long term, negligible to minor, and adverse. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on listed species. Wells directionally drilled and produced from outside the park units could result in indirect adverse impacts ranging from no impact to localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on listed species. When compared to the broader area of analysis, alternative A would directly impact a relatively small amount of habitat and would contribute minimally to the overall cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, resulting from vegetation clearing, ground disturbance, vibrations, and especially noise from survey crews and vehicles, and would be short-term negligible adverse impacts on listed species.



**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. As described under alternative A, the construction and maintenance of access roads, wellpads, flowlines, and pipelines could disturb or destroy habitats and routines of listed species in the park. Because of the restrictions at Obed WSR, including the No Surface Use restriction at the gorge, these operations would not be allowed within the park unit under alternative B.

However, where drilling and production operations would be permitted, impacts could occur from noise and disturbance related to construction and maintenance of wellpads, access roads, flowlines, and pipelines, especially new construction which would require vegetation clearing and could result in habitat loss or erosion/sedimentation into park waters. There would also be potential adverse impacts from leaks and spills and the chance of a short-term major impact from well blowouts, fires, or large uncontrolled releases. However, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. Additionally, increased inspections and monitoring under alternative B would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area, which would help limit impacts from spills and leaks through timely detection. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). Through required biological surveys and/or assessments and consultations with USFWS and TWRA or other state agency biologists, potential impacts on federally listed species and their habitat would be identified, and the application of appropriate mitigation measures would result in short- to long-term, negligible to minor adverse impacts on listed species, with a more limited risk of major adverse effects from spills or leaks.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternative A, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill protected plants, fish, and wildlife. However, applying the consultation requirements under the ESA; performing biological surveys of the area that could be potentially impacted by proposed plugging, abandonment, and reclamation operations; identifying listed species; and applying appropriate mitigation would limit adverse impacts on listed species. Under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. Coupled with the mitigation described for alternative A and in appendix B, there would be localized short-term negligible to minor adverse impacts. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—As described under alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact listed species in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where habitat disturbance or destruction could affect listed species. Impacts would depend on proximity to the park units, site-specific environmental conditions, and mitigation measures being employed. Based on these factors, indirect impacts on listed species in the park could range from no impact to localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on listed species from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on listed species. The more proactive planning and enforcement of CLPRs and increased inspections/monitoring would limit adverse impacts, but the majority of the impacts on listed species in the region would occur outside the park units, where impacts may or may not be mitigated. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall cumulative impacts.

### **Conclusion**

Similar to alternative A, limited geophysical operations would result in short-term negligible adverse impacts on listed species from vegetation clearing, ground disturbance, vibrations, and especially noise from survey crews and vehicles. In areas where non-federal oil and gas operations would be permitted in the park, effects from drilling and production activities could range from short- to long-term, negligible to minor adverse impacts on listed species from the direct loss of vegetation and habitat as a result of clearing, contouring, and construction and maintenance of the pads, roads, flowlines, pipelines, and other ancillary facilities. Mitigation, implementation of the oil and gas management plan, and identification of potential impacts on federally listed species and their habitat during biological surveys would keep impacts to a minor level. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact listed species in the park, resulting in effects ranging from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate cumulative adverse impacts on listed species. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and

would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C, SMAs would be established to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRRRA, with the exception of the Special Scenery SMA, unless otherwise approved in a plan of operations. The SMA for Honey Creek and Twin Arches state natural areas was set aside primarily because of their rich, undisturbed forest communities which provide important habitat for listed species. The SMAs for Sensitive Geomorphic Features and Cliff Edges would also protect some unusual listed species along with geology. With the additional protection of SMAs, and since minimal geophysical exploration is expected and would include use of existing roads and pedestrian access, actions associated with geophysical exploration (vegetation clearing, ground disturbance, and especially noise from survey crews and trucks) would have short-term negligible adverse impacts on listed species.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be similar to the impacts described in alternatives A and B. In addition, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRRRA and Obed WSR where resources and values would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C drilling and production would not be allowed in any of the SMA-associated setbacks at the park units unless otherwise approved in a plan of operations.

The increase of the standard 500-foot setback under 9.41(a) (unless specifically authorized in an approved plan of operations) to a 1,500-foot setback where no oil and gas operations may occur for visitor-use, administrative, and other use areas, including water-oriented visitor-use areas, in addition to the designation of Obed WSR SMA, the Cliff Edge SMA, the Sensitive Geomorphic Feature SMA, the State Natural Area SMA, and the Managed Fields SMA, would increase protection and improve habitat for the dromedary pearlymussel and other mussel species, fish (palezone shiner, blackside dace, duskytail darter, spotfin chub), and listed plant species (e.g., Cumberland rosemary and Virginia spiraea) that use these areas. In smaller SMAs, the added protection would primarily be provided for small mammals and invertebrates that occupy these areas. In larger SMAs, protection from additional habitat fragmentation would benefit all fish and wildlife species listed in chapter 3. The increased setback from visitor-use and administrative areas, from a 500-foot setback to a 1,500-foot setback, would further reduce the potential impacts of oil and gas operations and activities in these areas. The 1,500-foot setback from rivers and streams that are habitat for listed mussel species and their fish hosts would reduce the possibility of impacts on mussels and other wildlife using these areas during nesting, breeding, and migration. Well blowouts, fires, or large uncontrolled releases could occur and cause short-term major adverse effects; however this would be an unlikely occurrence.

Through the regulatory process under the ESA, required biological surveys and consultations with USFWS and TWRA or other state agency biologists would result in identification of potential impacts on listed species and their habitat, and the implementation of an oil and gas management plan, the designation of SMAs, and the application of mitigation measures would result in short- to long-term negligible adverse impacts on listed species with a more limited risk of major adverse effects from spills or leaks.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land. Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause harm to or mortality of listed species of plants, fish, and wildlife. Through the well-defined regulatory process under the ESA, required biological surveys and consultations with USFWS and TWRA or other state agency biologists would result in identification of potential impacts on listed species and their habitat, and the application of mitigation measures would result in negligible to minor adverse impacts on listed species.

Similar to alternative B, the NPS would implement an oil and gas management plan under alternative C that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRA and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. In addition, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRRA and Obed WSR where resources and values, including listed species, would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Park staff would evaluate all wells that are candidates for plugging and reclamation to determine their potential for impacts on park unit resources and values. Sites would be prioritized for plugging and reclamation based on a number of factors, including the proximity of well sites to SMAs. As a result, the new management framework and use of SMAs to prioritize actions would help to ensure that the long-term beneficial effects described under alternative A would be realized sooner.

**Directionally Drilled Wells**—As described under alternatives A and B, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact listed species in the park. It is also possible that some wells may be directionally drilled from outside the SMAs to develop hydrocarbons underlying the SMAs. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park or SMA boundary, where habitat disturbance or destruction could affect listed species. Impacts would depend on proximity to the park units, site-specific environmental conditions, and mitigation measures being employed. Based on these factors, indirect impacts on listed species in the park could range from no impact to localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

## **Cumulative Impacts**

The same actions identified as contributing cumulative effects under alternative A would apply to alternative C. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate adverse cumulative impacts on listed species. Designation of SMAs under alternative C would minimize adverse impacts on listed species in the SMAs and their setbacks, providing more consistent and certain protection in these areas, and would benefit several species dependent on geology, rivers, streams, wetlands, and forested areas. However, actions on adjacent lands have adversely affected and could continue to adversely affect listed species or their habitat, often without adequate mitigation. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

## **Conclusion**

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible adverse impacts on listed species from vegetation clearing, ground disturbance, vibration, and especially noise from seismic crews and vehicles. Under alternative C, with adequate setbacks, implementation of mitigation measures, and the establishment of SMAs, impacts on listed species in the park from drilling and production would be short to long term, negligible, and adverse. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts on listed species. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact listed species, resulting in effects ranging from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts under alternative C would be similar to those described for alternative B, with short- and long-term minor to moderate cumulative adverse impacts on listed species. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

# **SPECIES OF SPECIAL CONCERN**

## **GUIDING REGULATIONS AND POLICIES**

The Kentucky Rare Plant Recognition Act (KRS 146.600–619) has additional regulations for plants that may not be federally listed, but that Kentucky has deemed to be special status. The statute states that “lists of plant species which may become threatened in the future through habitat loss, commercial exploitation, or other means, or which are presumed to be extirpated within the Commonwealth” will be provided. Under this statute the state of Kentucky may “conduct investigations, with the permission of the

landowner, on any species of plants indigenous to the Commonwealth necessary to develop information relating to population, distribution, habitat needs, limiting factors, and other biological and ecological data, and to determine protective measures and requirements necessary for its survival.”

The Kentucky Endangered Species of Fish and Wildlife regulation (301 KAR 3:061.) states that “The function of this administrative regulation is to protect and conserve those endangered fish and wildlife species appearing on present and revised future lists issued by the state and federal governments.” Under this regulation “any species or subspecies designated as endangered by the Secretary of the Interior on a current United States List of Endangered and Threatened Wildlife as recorded in 50 Code of Federal Regulations, Part 17, is considered an endangered species in Kentucky under the provisions of KRS 150.183. Those species described as “threatened” on the above federal list are not included under KRS 150.183 or this administrative regulation.”

The state of Tennessee has a similar statute, which is known as the Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974 (Acts 1974, ch. 769, § 1; T.C.A., § 51-901). The statute states “after consultation with other state wildlife agencies, appropriate federal agencies, and other interested persons and organizations ... the wildlife resources commission shall by regulation propose a list of those species or subspecies of wildlife indigenous to the state that are determined to be endangered and threatened within this state.” Under another section of this statute, the Tennessee Rare Plant Protection and Conservation Act of 1985, the state of Tennessee may “conduct investigations on species of rare plants throughout the state of Tennessee in order to develop information relative to the biology, ecology, population status, distribution, habitat needs, and other factors and to determine conservation measures necessary for rare plants” (Acts 1985, ch. 242, § 1; T.C.A., § 70-8-304).

The NPS *Management Policies 2006* (NPS 2006c) Section 4.4.2.3 states that the NPS will manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible.

## **METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS**

Given the programmatic nature of this analysis, the exact locations of future operations are unknown. As a result, actions under the RFD scenario and the forecast of oil and gas activities were analyzed qualitatively against species of special concern in Big South Fork NRR and Obed WSR that could be impacted. The species were defined and described based on the sources cited in chapter 3. The assessment of impacts is based on best professional judgment and was developed through discussions with park staff and EIS team members.

As stated above, NPS policy requires that state-listed species, and others identified as species of special concern by the park, are to be managed in park units in a manner similar to those that are federally listed (NPS 2006c). The Tennessee Division of Natural Areas and Kentucky State Nature Preserves Commission maintain county lists of rare species (Tennessee Division of Natural Areas 2007; Kentucky State Nature Preserves Commission 2009). The lists for the counties that encompass the park units were compared with species lists from the NPS (Britzke 2007; NPS 2007b; R. Schapansky, pers. comm., 2008a, 2008b, 2008c; Scott 2007; Stedman 2006; Stephens et al. 2008) to identify those that are known to occur in Big South Fork NRR and Obed WSR (listed as “present in the park” on NPS lists). Based on this comparison, 68 state-listed species were identified for consideration in this plan/EIS. These include mammals, birds, reptiles, amphibians, fish, plants, and invertebrates, including many mussel species, as described in chapter 3. In addition, some state sensitive species known to occur in the park units but not included on the county lists are also considered. A summary of information regarding these species, including the park unit where they are known to occur, and a brief description of their habitat is included in chapter 3 in the “Species of Special Concern” section.

The impact intensity threshold definitions are based on the potential for changes to species of special concern characteristics, as follows:

- Negligible:* There would be no observable or measurable impacts on native species, their habitats, or the natural processes sustaining them.
- Minor:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable at a local level. Occasional responses to disturbance by some individuals could be expected, but without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all native species. Impacts would be outside critical reproduction periods or key habitat.
- Moderate:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and changes to population numbers, population structure, genetic variability, and other demographic factors would occur at a local level. Responses to disturbance by some individuals could be expected and could have negative impacts on factors affecting local population levels, but species would remain stable and viable. Sufficient habitat would remain functional to maintain the viability of all native species, but habitat quality could be affected. Some impacts might occur during critical reproduction periods or in key habitat.
- Major:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and population numbers, population structure, genetic variability, and other demographic factors might experience large declines over a wide geographic area. Responses to disturbance by some individuals would be expected, with negative impacts to factors resulting in a decrease in population levels. Loss of habitat might affect the viability of some native species. Impacts would regularly occur during critical reproduction periods or in key habitat.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used, receiver lines would be laid on foot, and no shotholes would be drilled, there would be very limited impacts on species of special concern or their habitat. Potential effects from exploration operations could include increased displacement, increased risk of mortality, decreased production, and increased stress levels from the noise and disturbance associated with seismic survey activities. These effects could be caused by seismic crews traveling to access the area to be surveyed and pedestrian travel along receiver lines, as well as vibrations from the seismic vibrator, trimming vegetation, and using vehicles on existing roads. Types of species that could be affected by these activities are the plant, reptile, amphibian, bird, and mammal species described in chapter 3. The mussel and fish species described in chapter 3 would not likely be affected because none of these activities would be performed in aquatic habitat. Any species near any noise associated with seismic survey work, particularly vehicle noise, could

be impacted by such activities. Impacts related to noise are usually temporary, with nearby species avoiding or moving away from the source but returning after noise is reduced or eliminated.

Under alternative A, protection of water quality is provided by 36 CFR 9.41(a), which requires operations to be offset 500 feet from the banks of perennial, intermittent, or ephemeral watercourses, unless specifically authorized by an approved plan of operations, which would minimize erosion and sedimentation and other impacts on water quality and quantity that could adversely impact aquatic species. The standard 500-foot setback from water bodies would protect fish, wildlife using water, and wetland vegetation within this protective zone, which supports many species of special concern. Through project-specific consultation with TWRA or other state agency biologists, the setback could be increased. The 500-foot standard setback would provide some primary protection to fish, mussel, and some amphibian species described in chapter 3. Additional protection to these habitats would be provided by the wetlands and floodplains Executive Orders, NPS Director's Orders, and project-specific permitting requirements.

Types of species that occupy upland areas outside the 500-foot shoreline setbacks include bats, rodents, birds, reptiles, and upland plants. These types of species could be affected by the presence of seismic crews and the noise associated with the surveys, but there would be minimal trimming of vegetation or clearing required. If geophysical operations were to be proposed in areas where species of special concern or their habitat are known to occur under alternative A, there would be seasonal limitations and setbacks to protect those species during prime breeding season.

Where exploration operations could be permitted, these operations would avoid impacting species of special concern and their habitat, which would be identified through consulting park biologists or biological surveys, if determined necessary by the NPS through consultation with state agency biologists. When species of special concern and their habitat are found to be within the project area, application of mitigation measures, including sufficient setbacks and/or timing restrictions for nesting and other sensitive periods in a given species' life cycle, would result in avoiding or minimizing potential adverse effects. Additionally, upon the completion of operations, reclamation of disturbed areas would be required, and recovery of any vegetation disturbed is expected to occur over the short term. Application of these requirements would result in short-term negligible adverse impacts on species of special concern or their habitat from geophysical exploration.

**Drilling and Production**—Drilling and production operations would not directly impact species of special concern or their habitat in protected areas, where operations would not be permitted under CLPRs, including the 9B regulations, the gorge restrictions at Big South Fork NRRA, and deed restrictions at Obed WSR. As described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRRA, and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR. It is also assumed that 125 wells at Big South Fork NRRA and 2 wells at Obed WSR would be worked over or serviced under this alternative, as staffing limitations and resources allow for review of the proposed projects.

Existing operations have little ongoing effect on habitat other than the threat of spills or leaks and any maintenance activities that are needed on infrastructure. The chances of undetected spills are greater under this alternative because routine inspections and monitoring would not occur, which may increase the potential for a major adverse impact if spills should reach susceptible species including state-listed mussels or fish. The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact listed species. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response



and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release. In the event that the park's resources or values are damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation.

However, most impacts from oil and gas operations come from the construction of new access roads and wellpads. Drilling and production operations could range in duration from short term to long term (lasting 20 years or more). Construction and maintenance of roads, pads, flowlines, and pipelines could require the clearing of vegetation and could result in habitat loss. Potential effects on species of special concern would depend on where drilling and production operations are located. Careful siting of development based on biological survey and/or site assessment results could avoid or minimize these impacts substantially. Implementing the required biological surveys and consultations with TWRA or other state agency biologists would result in identification of potential impacts on species of special concern and their habitat, and the application of mitigation measures.

Water-dependent species (including fluted kidneyshell, spectaclecase, Cumberland elktoe, ashy darter, and mountain brook lamprey) could be impacted by the construction and long-term maintenance of roads, pads, flowlines, and pipelines if stream crossings result in alteration of streamflow, water quality, or temperature or in increased sedimentation. Under all alternatives, waterways would be protected by a 500-foot setback under 36 CFR 9.41(a), unless specifically authorized by an approved plan of operations; also, because waterways are inherently a part of floodplains (riparian corridors) and wetland areas, and receive added protection under various regulatory and policy requirements, streamflows, water quality, and water temperature would be protected from disturbance and water levels would be maintained. When there are no practicable alternatives to locating an operation or activity in floodplains and wetlands, careful siting of facilities and application of stringent mitigation measures would be expected to avoid potential adverse impacts. Required mitigation for direct and indirect impacts on wetlands could be used to restore wetland habitats and increase species of special concern habitat values.

Displacement of wildlife would continue from initial wellpad construction into exploratory drilling, and if the well is placed in production, during the life of the producing well. The increase and ease of public access routes may serve to increase public motorized travel, or if the roads are closed to public motorized travel, they would still serve as access routes on foot, horseback, and mountain bike.

Noise from drilling operations would also impact protected wildlife species such as the American black bear and the cerulean warbler. Drilling operations introduce noise with the highest measurements in the 90 dBA range for a period of a week or two up to a few months, with noise coming mostly from multiple diesel engines (see table 32 in the "Soundscapes" section). Therefore, noise impacts on terrestrial species would be moderate, but limited to a localized area and of relatively short duration. Preconstruction surveys would be done to ensure that impacts on species of special concern would not be excessive.

Some facilities associated with production operations (i.e., heater treater units/separator units) could cause the mortality of special-status bats or birds through asphyxiation or incineration, and mitigation such as a cone device placed on top of all vent stacks could be required to prevent perching and access. Open containers that collect stormwater may be required to have netting or covers to prevent wildlife species from accessing stormwater that may have contacted and mixed with oil, gas, and other contaminating and hazardous substances. Also, selection and use of herbicides and pesticides on the site must be approved by the NPS Integrated Pest Management Coordinator, and use of such chemicals would be kept to a minimum and done following label instructions and avoiding sensitive habitats or species locations, so that any adverse impacts would be minor.

Given the above operating standards and other mitigation under CLPRs, as well as the limited number of new operations projected in the forecast of oil and gas activities, there would be localized short-term negligible to minor adverse impacts from drilling and production operations in the park units, although the potential for a major adverse impact from a spill or release is more likely under this alternative.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles to reclaim sites could have the potential for release of oil and other contaminating and hazardous substances, which could harm or kill protected plants, fish, and wildlife. However, performing biological surveys of the area that could be potentially impacted by proposed plugging, abandonment, and reclamation operations; identifying species of special concern; and applying appropriate mitigation would result in short-term localized negligible to minor adverse impacts on species of special concern.

Plugging operations and site preparation during reclamation would introduce heavy equipment and people, along with increased noise levels, for a short time. These operations would result in short-term localized negligible to minor adverse impacts, depending on the season, the background soundscape, and the proximity of operations to species of special concern. Seasonal restrictions would include delaying activities until after a species' nesting or spawning seasons. Access roads that have been developed or allowed to remain open for the primary purpose of allowing access for oil and gas operations would be reclaimed at the completion of operations, returning the area to its natural condition. Wherever possible, habitats would be improved to perpetuate the viability of habitats and increase the survivability of species of special concern. The outcome of these activities, in returning natural conditions to the operations area, would have long-term beneficial impacts.

**Directionally Drilled Wells**—It is possible that some wells may be directionally drilled from outside the park units to develop hydrocarbons underlying the park units. The intensity of impacts on species of special concern would be dependent on where the operation is located with respect to species and their habitats, whether the operation is sited inside or outside the park, and on the resource-protection measures that are employed. For wells directionally drilled and produced from outside the park units to bottomholes beneath the park units, the connected actions occurring outside the park boundaries could include constructing and maintaining access roads, well/production pads, and flowlines/pipelines; drilling the well; producing the well; plugging and abandoning the well; and site reclamation. The in-park operations associated with directional wells would consist of the wellbore crossing into the park units, usually several thousand feet or more below the surface. Therefore, for most directional wells drilled that are exempted under 36 CFR 9.32(e), the NPS regulatory authority would be limited to applying mitigation to the in-park operations to promote protection of groundwater resources beneath the park. The in-park operations would typically have no effect on species of special concern or their habitats on the surface. Oil and gas operators outside the park units are not required to survey for or protect species of special concern. Given that most impacts on species of special concern would be from wellpad and access-road construction, the impacts on these species and their habitats in the park units from drilling and production of wells drilled from surface locations outside the park units to reach bottomholes beneath the park units could result in indirect adverse impacts ranging from no impact to localized to widespread, short- to long-term, minor adverse impacts with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

## Cumulative Impacts

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to species of special concern are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would contribute both adverse and beneficial cumulative impacts on species of special concern. Past oil and gas development within and outside Big South Fork NRRRA has had short- and long-term minor to moderate adverse impacts on species of special concern from vegetation clearing, vehicle use, and the construction and maintenance of access roads, wellpads, and flowlines. Contamination of surface and groundwater from leaking wells would also contribute to impacts. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of Big South Fork NRRRA, which has similar impacts to traditional oil and gas development.

Existing surface disturbances (including existing and abandoned operations) and transpark oil and gas pipelines, 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 species of special concern. It is difficult to accurately determine what types of habitat existed before being affected by development prior to the establishment of the park units. Since the establishment of the park units, however, development decisions have been applied under a well-defined regulatory process that has limited any additional impacts on species of special concern. Visitor activities such as horseback riding, biking, hunting, recreational rock climbing, swimming, kayaking, and ORV use all occur within Big South Fork NRRRA and/or Obed WSR and may contribute to short-term localized negligible to minor adverse impacts on the resources considered in this plan/EIS.

Agriculture other than forestry has occurred on less than 20% of the land in counties adjacent to Big South Fork NRRRA and Obed WSR, and most of the forested areas of Big South Fork NRRRA have been logged. At Obed WSR, clearing and harvesting from logging and agriculture is particularly evident. 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 of special concern, resulting in short- and long-term localized to widespread minor to moderate adverse impacts.

In addition to active mining operations, approximately 25,100 acres of unreclaimed abandoned coal mines exist in the Tennessee counties adjacent to Big South Fork NRRRA, and there are about 10 abandoned surface coal mine sites in McCreary County, Kentucky. Big South Fork NRRRA has undertaken remediation studies of selected sites where contaminated mine drainage is of concern. The Worley riverside area is a former mining community where remnants of mining operations, including mine tailings, are evident. Water quality on the site is an issue due to acid mine drainage. Remediation of mine effects is being planned for this site.

Relatively low-density residential development occurs in the immediate vicinity of the park units, 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 and species of special concern habitat destruction. Industrial activity sites near the park units that could contribute to cumulative impacts include power plants, railroads, hardwood flooring factories, sawmills, and other manufacturing facilities. Southwest of Obed WSR, two industrial park units have been developed in the Crossville area. Habitat destruction and disturbances, temporary disturbance and

relocation, or incidental take of a species from these sources would result in widespread long-term negligible to moderate adverse impacts on species of special concern.

Fields, roads, trails, and other disturbed areas are often source areas for exotic plants. From these sites, exotic plants can migrate into previously stable communities, where they displace native plants (NPS 2005a). The abandonment of well sites and oil and gas access roads creates disturbances that increase the invasion of non-native plant species. At Big South Fork NRRRA, efforts to control exotic vegetation 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. The spread of non-native plant species in park units could result in increased habitat destruction and has the potential to affect most listed terrestrial species, resulting in short- and long-term localized to widespread minor adverse impacts.

Other activities in the park units that could impact protected plants, fish, and wildlife include wildlife harvest (hunting and trapping), nonconsumptive recreation, and the park units' prescribed-fire management program. Over the long term, hunting and trapping could have beneficial impacts on wildlife populations. Recreational activities in the park units are focused near developed visitor-use areas, trails, canoe routes, and roads. These developments and activities would have a negligible adverse impact on protected plants, fish, and wildlife. The park units' prescribed-fire management program could contribute to short-term habitat loss and wildlife displacement and could increase erosion and sedimentation, but would provide long-term beneficial cumulative impacts on park vegetation and improved habitat for protected wildlife species such as those described in chapter 3.

Diseases and insect pests of vegetation, such as the pine bark beetle, have caused a decline in streamside vegetation. Large stands of trees could be affected by infestations, which would result in habitat destruction and changes in water temperature and chemistry due to reduced shading of waterways. This would have a widespread long-term minor adverse impact on water resources. 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 NRRRA and Obed WSR, and non-native species (feral hogs, trout) were also introduced in the later 1970s–1980s. This has resulted in uncertain impacts on special-status species.

In addition to cumulative actions that would have negative effects on species of special concern, there are some actions that would have beneficial effects. In addition to new oil and gas development, there are wells that have been plugged and reclaimed in or near the park units. The NPS plans to plug and reclaim 14 abandoned wells at Big South Fork NRRRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. The NPS has also recently received funding under the ARRA to plug and reclaim an additional 39 wells at Big South Fork NRRRA to protect resources, including species of special concern. These and other oil and gas reclamation projects, as well as mine reclamation projects, would help restore habitat and protect special-status species in and around the park units. Surveys would be conducted and mitigation applied to ensure that these species would not be adversely affected by these actions, which would have long-term beneficial impacts.

Other plans and projects within the park would also have long-term beneficial effects on species of special concern. The GMP at Big South Fork NRRRA outlines desired resource and visitor experience conditions that would protect species in the park. Under the guidelines of the GMP, 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 species of special concern.

The 2006 *Big South Fork NRRRA Fields Management Plan* (NPS 2006d) identifies desired resource conditions and the kinds/levels of visitor use for each of the fields in the park, depending on the GMP zone in which they fall (e.g., Natural Environment Recreation Zone, Cultural Spaces, First- or Second-Order Development, and Visitor Use Zones). 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). Although the fields management plan does not specifically address oil and gas operations, the actions proposed in the oil and gas management plan have been developed while taking into consideration the objectives of this plan and desired conditions for the fields.

Kentucky and Tennessee are developing TMDLs for impaired waters in the Big South Fork NRRRA. The implementation of these TMDLs would have beneficial effects on species of special concern from reducing pollutants entering streams. Additionally, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 species of special concern, due to improving resource protection practices.

Overall, the impacts of these actions, combined with the localized short-term and long-term negligible to minor adverse impacts and the beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on species of special concern. Protection provided to special-status species in the park under CLPRs, especially NPS management policies for state-listed species, would minimize adverse impacts and result in maintaining and improving habitat for these species; however, development and other actions outside the park would be expected to continue to adversely affect these species or their habitat, often without mitigation. When compared to the broader area of analysis, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## Conclusion

Under alternative A, limited geophysical operations would result in short-term negligible adverse impacts on species of special concern from vegetation trimming, disturbance and noise during access and operations, and vibrations. In areas where non-federal oil and gas operations would be permitted in the park units, drilling and production of wells could result in short- to long-term negligible to minor adverse impacts, primarily from the noise and disturbance related to construction of new wellpads, access roads, flowlines, and pipelines, which would require vegetation clearing and could result in habitat loss or erosion/sedimentation into park waters. There would be a risk for moderate or even major adverse impacts from leaks and spills that could go undetected or migrate off site. Impacts from plugging and reclamation of wells at either park would be short term, negligible to minor, and adverse. In addition, reclaiming the wellpads and access roads would have a long-term beneficial impact on species of special concern. Wells directionally drilled and produced from outside the park units could result in indirect adverse impacts ranging from no impact to localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on species of special concern. When compared to the broader area of analysis,

alternative A would directly impact a relatively small amount of habitat and would contribute minimally to the overall cumulative impacts.

### **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

#### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, resulting from vegetation clearing, ground disturbance, vibrations, and especially noise from survey crews and vehicles, and would be short-term negligible adverse impacts on species of special concern.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. As described under alternative A, the construction and maintenance of access roads, wellpads, flowlines, and pipelines could destroy habitat and disturb or displace species of special concern in the park. Because of the restrictions at Obed WSR, including the No Surface Use restriction in the gorge, these operations would not be allowed within the park unit under alternative B. There would also be potential adverse impacts from leaks and spills and the chance of a short-term major impact from well blowouts, fires, or large uncontrolled releases.

However, where drilling and production operations would be permitted, mitigation measures (as described under alternative A) would avoid or minimize adverse impacts on species of special concern. Also, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRA and Obed WSR. Additionally, increased inspections and monitoring under alternative B would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). The required biological surveys and/or assessments and consultations with state biologists would result in identification of potential impacts on species of special concern and their habitat, and the application of mitigation measures would result in short- to long-term negligible to minor adverse impacts on species of special concern with a more limited risk of major adverse effects from spills or leaks.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Similar to alternative A, well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles to reclaim sites would have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill protected plants, fish, and wildlife. However, performing biological surveys of the area that could be potentially impacted by proposed plugging, abandonment, and reclamation operations; identifying species of special concern; and applying appropriate mitigation, would result in reduced adverse impacts on species of special concern.

Under alternative B, plugging and reclamation procedures would follow the same mitigation as described for alternative A. Sites would be reclaimed by removing any contaminated soil or materials, grading the site to promote drainage and site reclamation, replacing topsoil, seeding with a selected mix of native herbaceous vegetation, and possibly planting. Weed-free native seed mixtures would be used to revegetate well sites and access roads, and site recovery would be monitored. In addition, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRR and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. Coupled with the mitigation described for alternative A and in appendix B, there would be localized short-term negligible to minor adverse impacts. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—As described under alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact species of special concern in the park. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park boundary, where habitat disturbance or destruction could affect species of special concern. Impacts would depend on the proximity of operations to the park units, site-specific environmental conditions, and mitigation measures being employed. Based on these factors, indirect impacts on species of special concern in the park could range from no impact to localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on species of special concern from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, would result in short- and long-term minor to moderate adverse cumulative impacts on species of special concern. The more proactive planning and enforcement of CLPRs and increased inspections/monitoring would limit adverse impacts, but the majority of the impacts on species of special concern in the region would occur outside the park units, where impacts may or may not be mitigated. When compared to the broader area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall cumulative impacts.

### **Conclusion**

Similar to alternative A, limited geophysical operations under alternative B would result in short-term negligible adverse impacts on species of special concern from vegetation trimming, disturbance and noise during access and operations, and vibrations. In areas where non-federal oil and gas operations would be permitted in the park, drilling and production activities could result in short- to long-term negligible to minor adverse impacts on species of special concern from the direct loss of vegetation and habitat as a result of clearing, contouring, and construction and maintenance of the pads, roads, flowlines, pipelines,

and other ancillary facilities. Mitigation, implementation of the oil and gas management plan, and identification of species of special concern and their habitat during biological surveys would serve to limit adverse impacts. Impacts from plugging and reclamation of wells at either park would result in localized short-term negligible to minor adverse impacts. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact species of special concern in the park, resulting in impacts ranging from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections

The adverse and beneficial effects of the cumulative actions, when combined with the short- to long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative B, there would be short- and long-term minor to moderate cumulative adverse impacts on species of special concern. When compared to the larger area of analysis, alternative B would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C, SMAs would be established to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR, with the exception of the Special Scenery SMA unless otherwise approved in a plan of operations. The SMA for Honey Creek and Twin Arches state natural areas was set aside primarily because of their rich, undisturbed forest communities that provide important habitat for many species of special concern. The SMAs for Sensitive Geomorphic Features and Cliff Edges would also protect species of special concern along with geology.

Since areas are protected by SMA restrictions and minimal geophysical exploration is expected and would include use of existing roads and pedestrian access, actions associated with geophysical exploration in alternative C (vegetation clearing, ground disturbance, vibrations, and especially noise from survey crews and vehicles) would have short-term negligible adverse impacts on listed species of special concern.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be similar to the impacts described in alternatives A and B. In addition, the establishment of SMAs would further protect natural areas, including areas of Big South Fork NRR and Obed WSR where resources



and values would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, drilling and production would not be allowed in any of the SMA-associated setbacks at Big South Fork NRRRA unless otherwise approved in a plan of operations. Drilling and production would be precluded in Obed WSR.

The increase of the standard 500-foot setback under section 9.41(a) (unless specifically authorized in an approved plan of operations) to a 1,500-foot setback where no oil and gas operations may occur for visitor-use, administrative, and other use areas, including water-oriented visitor use areas, in addition to the designation of Obed WSR SMA, the Cliff Edge SMA, the Sensitive Geomorphic Feature SMA, the State Natural Area SMA, and the Managed Fields SMA, would increase protection and improve habitat for species of special concern taxonomic groups such as fishes, amphibians, reptiles, and birds, as well as water-dependent invertebrate and plant species of concern that use these areas. In smaller SMAs, the added protection would primarily be provided for small mammals and invertebrates that occupy these areas. In larger SMAs, protection from additional habitat fragmentation would benefit all species of special concern listed in chapter 3. The increased setback from visitor-use and administrative areas, from a 500-foot setback to a 1,500-foot setback, would further reduce the potential impacts of oil and gas operations and activities on these areas. The 1,500-foot setback from rivers and streams that are habitat for mussel species of special concern and their fish hosts would reduce the possibility of impacts on mussels and other wildlife using these areas during nesting, breeding, and migration. Well blowouts, fires, or large uncontrolled releases could occur and cause short-term major adverse effects; however this would be an unlikely occurrence.

Undertaking the required biological surveys and consultations with state agency biologists before beginning drilling and production activities, would result in identification of potential impacts on species of special concern and their habitat. With implementation of an oil and gas management plan, the designation of SMAs, and the application of mitigation measures, impacts on species of special concern would be short to long term, negligible to minor, and adverse.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land. Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could cause harm to or mortality of plant, fish, and wildlife species of special concern. Required biological surveys and consultations with TWRA or other state agency biologists would result in identification of potential impacts on species of special concern and their habitat, and the application of appropriate mitigation measures would reduce adverse impacts on species of special concern.

Similar to alternative B, the NPS would implement an oil and gas management plan under alternative C that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. The establishment of SMAs would further protect natural areas, including areas of Big South Fork NRRRA and Obed WSR where resources and values, including species of special concern, would be particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Park staff would evaluate all wells that are

candidates for plugging and reclamation to determine their potential for impacts on park unit resources and values. Sites would be prioritized for plugging and reclamation based on a number of factors, including the proximity of well sites to SMAs.

Therefore, the new management framework and the establishment of SMAs to further protect park resources and values under alternative C would result in localized short-term negligible to minor adverse impacts on species of special concern at sites throughout the park units, and the long-term beneficial effects described under alternative A would be more likely to be realized sooner.

**Directionally Drilled Wells**—As described under alternatives A and B, wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact listed species in the park. It is also possible that some wells may be directionally drilled from outside the SMAs to develop hydrocarbons underlying the SMAs. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could increase for operations sited closer to the park or SMA boundary, where habitat disturbance or destruction could affect special status species. Impacts would depend on proximity to the park units, site-specific environmental conditions, and mitigation measures being employed. Based on these factors, indirect impacts on species of special concern in the park could range from no impact to localized to widespread, short- to long-term, minor adverse impacts, with the potential for major adverse impacts due to a well blowout, fire, or large uncontrolled release. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

The same actions identified as contributing cumulative effects under alternative A would apply to alternative C. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to minor adverse impacts as well as the long-term beneficial effects of alternative C, would result in short- and long-term minor to moderate adverse cumulative impacts on species of special concern. Designation of SMAs under alternative C would minimize adverse impacts on these species in the SMAs and their setbacks, providing more consistent and certain protection in these areas, and would benefit several species dependent on geology, rivers, streams, wetlands, and forested areas. However, actions on adjacent lands have adversely affected and could continue to adversely affect these species or their habitat, often without adequate mitigation. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

### **Conclusion**

Similar to alternatives A and B, limited geophysical operations would result in short-term negligible adverse impacts on species of special concern from vegetation trimming, disturbance and noise during access, and vibrations. Under alternative C, with adequate setbacks, implementation of mitigation measures, and the establishment of SMAs, impacts on species of special concern in the park from drilling and production would be long term, negligible to minor, and adverse. Impacts from plugging and reclamation of wells at either park would result in localized short-term to long-term minor adverse impacts on species of special concern. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact species of special concern, and effects could range

from no impact to indirect, localized to widespread, short- to long-term, minor adverse impacts. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts under alternative C would be similar to those described for alternative B, with short- and long-term minor to moderate cumulative adverse impacts on species of special concern. When compared to the broader area of analysis, alternative C would directly impact a relatively small area and would contribute minimally to overall adverse cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, identification and protection of SMAs, and expedited well plugging.

## **SOUNDSCAPES**

### **GUIDING REGULATIONS AND POLICIES**

The NPS Organic Act (16 USC 1) establishes the NPS and authorizes the NPS “to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” An important aspect of the natural communities that the NPS wishes to preserve within our national parks is the natural soundscape, which protects visitor experience as well as wildlife.

Regarding general park soundscape management, *NPS Management Policies 2006*, section 4.9, Soundscape Management, requires that the NPS “preserve, to the greatest extent possible, the natural soundscapes of parks.” It also states the NPS “will restore to the natural condition wherever possible those park soundscapes that have become degraded by the unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts” (NPS 2006c, section 4.9, p. 56). Additionally, Director’s Order 47: Soundscape Preservation and Management (NPS 2000) was developed to emphasize NPS policies “that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources.” This Director’s Order also directs park managers to measure acoustic conditions, differentiate existing or proposed human-made sounds that are consistent with park purposes, set acoustic goals based on the sounds deemed consistent with park purposes, and determine what noise sources are impacting the park units (NPS 2000).

### **METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS**

The methodology used to assess impacts on the natural soundscape from the management of oil and gas operations in Big South Fork NRR and Obed WSR is consistent with *NPS Management Policies 2006* (NPS 2006c) and Director’s Order 47: Soundscape Preservation and Noise Management (NPS 2000). The policies require the type, magnitude, duration, and frequency of occurrence of noise to be described in the affected environment, as well as the significance of noise levels or impacts.

Impacts on the natural soundscape were assessed based on three general phases associated with oil and gas operations that would occur within Big South Fork NRR and Obed WSR: (1) geophysical exploration, (2) drilling and production, and (3) plugging and reclamation. The specific activities associated with each phase were evaluated in terms of the types of equipment typically used, the potential duration and frequency of occurrence of the activities, and the potential approximate noise level generated at various distances from the noise sources. Each of these factors was subsequently used to determine the degree of the impact associated with the three phases of oil and gas operations relative to natural ambient

sound levels within the park units as well as visitor use. As discussed in chapter 3, data collected at Great Smoky Mountains National Park was used as a surrogate for estimating the natural ambient sound levels within Big South Fork NRR and Obed WSR, since the natural soundscape had not previously been studied at these two park units. Similarities between the geologic settings of Big South Fork NRR, Obed WSR, and Great Smoky Mountains allowed for the use of surrogate data.

Potential noise levels at various distances from pieces of heavy construction equipment typically used during oil and gas operations were estimated (table 32). The Federal Highway Administration's (FHWA) Roadway Construction Noise Model contains a database of common construction equipment, which was developed from the largest urban construction project in the United States (the Central Artery Tunnel project in Boston, Massachusetts). The database includes a list of the noise levels produced by each piece of construction equipment at a distance of 50 feet, per the equipment specifications. Additionally, the Federal Transportation Administration Transit Noise and Vibration Impact Assessment guidelines contain typical equipment noise levels at 50 feet from the source (FHWA 2006). A drill-rig/rotary-drilling noise level was obtained from a noise analysis conducted for the Pinedale Anticline Oil and Gas Exploration and Development Project in Pinedale, Wyoming (BLM 1999). The report documents a measured noise level of 63 dBA from a typical drill in Wyoming at a distance of 200 feet. This noise level was used for the purposes of the analysis at Big South Fork NRR and Obed WSR, although land in Wyoming may be generally sparsely vegetated or contain low-growing vegetation and few trees. It is assumed that in Big South Fork NRR and Obed WSR, noise levels from a drill rig could be further attenuated at a distance of 200 feet. These references were used to subsequently approximate noise levels at distances beyond 50 feet, which may be audible within the park units. As the construction equipment may be thought of as point sources of noise, the radiation pattern is such that the noise level would drop off at a rate of 6 dBA per doubling of distance from the source, based solely on source geometry without taking site surface conditions into consideration (Caltrans 1998).

In addition to the stationary sources of noise from the expected construction equipment, during geophysical exploration, there is a potential for the use of seismic vibrator technology to create noise related to the generation of seismic waves (ground vibration) as well as truck engine noise. Consideration was also given to increased vehicular sources of noise due to transporting construction equipment and crew members to and from the well sites. Noise levels generated by vehicular sources vary by the volume of traffic, the speed of traffic, and the proportion of trucks included in the volume. Typically, the loudness of traffic noise is increased by heavier traffic volumes, higher speeds, and greater proportions of trucks (FHWA 1995). Additionally, inclines cause greater laboring of vehicle engines, thereby resulting in increased traffic noise levels, especially for heavy trucks. However, as the distance from the vehicular source increases, noise levels are affected by terrain features, man-made obstacles, vegetation, and the distance from the source in general. Typically, noise levels drop off at a rate of 3 dBA per doubling of distance from a traveling vehicular sound source (FHWA 1995). It is assumed that any vehicles traveling through the park would be traveling at slow speeds.

**TABLE 32. EQUIPMENT NOISE LEVEL PREDICTIONS (dBA)**

Distance from Source (feet)	Grader/Bulldozer/Concrete Pump Truck/Chainsaw	Dump Truck	Front-End Loader	Drill Rig/Rotary Drilling	Concrete Mixer Trucks	Diesel Truck
50	85	84	80	75	82	88
100	79	78	74	69	76	82
200	73	72	68	63	70	76
400	67	66	62	57	64	70
800	61	60	56	51	58	64
1,600	55	54	50	45	52	58
3,200	49	48	44	39	46	52
6,400	43	42	38	33	40	46
12,800	37	36	32	27	34	40
25,600	31	30	26	21	28	34

**Notes:**

Equipment noise levels represent specification values for a reference distance of 50 feet from the equipment source.

Predicted noise levels beyond 50 feet from the source were estimated, using the Federal Highway's (see table 32) assuming a 6 dBA per doubling of distance drop-off rate for a point source (stationary equipment sources may be regarded as point sources) based solely on source geometry (Caltrans 1998).

Equipment noise levels at the distances shown in this table will vary based on additional attenuation measures, including vegetation, topography, and climate conditions.

Noise from a drill rig/rotary drilling was estimated based on a measured level of 63 dBA at 200 feet for a typical drill in Wyoming. Although land in Wyoming is generally more sparsely vegetated or contains low-growing vegetation, unlike Big South Fork NRR and Obed WSR, this noise level is consistent with a report on air-rotary drilling published by the National Institute for Occupational Safety and Health (NIOSH 2009). The report identified noise levels of approximately 90 dBA measured within 6 feet of the rig. This level was extrapolated to 50 feet and compared to the extrapolated level at 50 feet from the Wyoming data. The levels were within 2 decibels of each other.

Two sets of thresholds were formulated for identifying soundscapes impacts, one of which is for developed areas of the park and the other for undeveloped areas of the park. Note that developed areas are the areas of the park with facilities and larger concentrations of visitors. Undeveloped areas lack park facilities other than roads or trails, and concentrations of visitors are usually low.

The impact intensity threshold definitions are based on the potential for changes to soundscape characteristics, as follows:

**DEVELOPED AREAS OF THE PARK**

*Negligible:* Natural sounds predominate and human-caused noise is rarely audible, except when in very close proximity to the source. When human noise is present, it is passing and occurs at measurable but low levels in local areas.

*Minor:* Natural sounds usually predominate and human-caused noise is infrequently audible. When noise is present, it is passing, occurs at low to medium levels in local areas, and is rarely audible at a distance.

*Moderate:* Human-caused noise is present occasionally at medium levels, but is relatively short-lived. When noise is present, it is occasionally audible at a distance from the source.

*Major:* Human-caused noise is commonly present throughout an area and masks natural sounds for extended periods. Medium and high noise levels are occasionally experienced when in close proximity to the source. Even at greater distances from the source, a natural soundscape free of human-caused noise exists less than 50% of the time.

## UNDEVELOPED AREAS OF THE PARK

*Negligible:* Natural sounds predominate, although human-caused noise may be audible very infrequently in local areas. When noise is present, it is at very low levels (mostly immeasurable), passing, and rarely audible from a distance.

*Minor:* Natural sounds predominate, although human-caused noise is present occasionally in local areas. When noise is present, it is at measurable but at low levels, passing, and rarely audible at a distance.

*Moderate:* Human-caused noise is present occasionally across most of an area. When present, it is at medium levels that may mask natural sounds briefly, and may be audible at a distance.

*Major:* Human-caused noise is commonly present throughout an area and masks natural sounds for extended periods. Noise is audible at a distance and noise levels may be high in close proximity to the source.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As discussed in “Chapter 2: Alternatives,” minimal geophysical exploration is expected due to the abundance of subsurface geologic data that is available. Any geophysical exploration would most likely take the form of conventional seismic surveys in areas of existing roads where data could be collected quickly and inexpensively, using seismic vibrator technology. Lines would be laid on foot; therefore, potential sources of noise would result from the team of survey crew members working in the park units and noise from the vibrator truck used as the seismic source. Depending on the topography and vegetation, conditions of existing roadways, and the equipment needed for data collection, some vegetation clearing may be necessary; it is assumed such clearing could be done using small hand tools, such as chainsaws, handsaws, axes, and/or shovels.

Since it is likely that only conventional seismic surveys would be necessary, work would likely be completed in a period of 1 to 4 weeks, with most surveys lasting 1-3 days. Although activities associated with geophysical exploration would elevate ambient noise levels within the park units, work would be short in duration, lasting only the length of the survey period.

Per appendix B, there are numerous statutory and regulatory requirements as well as recommended mitigation measures applicable to geophysical exploration that would potentially reduce the degree of impacts. This includes prohibitions on oil and gas operations within the gorge in Big South Fork NRA; the establishment of 500-foot setbacks per the 9B regulations; and deed restrictions that prohibit oil and gas operations on nearly all the federal lands within Obed WSR. If applied, any recommended mitigation measures that would avoid high visitor use areas, impose time stipulations, reduce vehicle speeds, and require the proper maintenance of equipment (refer to appendix B for details and specific mitigation measures) would reduce human-induced noise levels as well as the extent of elevated noise levels throughout the park. Additionally, such measures would provide temporary noise-free periods.

With the implementation of mitigation measures coupled with the expected short-duration and intermittent sources of elevated noise levels, impacts on the natural soundscape from human-induced noise sources would be short term, negligible to minor, and adverse in both developed and undeveloped areas of Big South Fork NRA. Negligible impacts would mainly occur in areas at a distance from the geophysical operations, where noise could be occasionally discernible. Within Obed WSR, adverse impacts would be short term and negligible, since the 9B regulations and deed restrictions would prohibit oil and gas operations on nearly all federal lands within the boundaries of the park unit.

**Drilling and Production**—Based on the forecast of oil and gas activities, there would be up to 20 new wells in Big South Fork NRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR. It is also assumed that 125 wells at Big South Fork NRA and 2 wells at Obed WSR would be worked over or serviced under this alternative, as staffing limitations and resources allow for review of the proposed projects

As mentioned above, most of the adverse impacts associated with oil and gas operations within either park unit would result from the drilling and production phase, as this phase necessitates the majority of the heavy construction equipment and has the potential to be long in duration. Potential sources of noise associated with drilling and production include the construction of roads and trails for accessing the site, preparation of the drill site, drilling operations, cement work, well servicing, and workover operations. Table 32 presents some of the typical construction equipment associated with each of these activities and their associated noise levels predicted at various distances from the source. As described in the “Methodology, Assumptions, and Impact Thresholds” section above, predicted levels are representative of noise attenuation at a rate of 6 dBA per doubling of distance from the sound source (the noise level drop-off rate from a stationary point source purely due to the geometry of the source). However, additional attenuation would be realized due to vast amounts of vegetation cover as well as intervening topography at the park.

Accessing new well locations in remote areas would require upgrading of existing roadways and/or construction of new roads and trails to accommodate heavy construction equipment and increased truck traffic. Subsequently, once the drill site is accessed, clearing, grading, cutting, filling, and leveling of the wellpad is required to prepare the drill site to accommodate the rig and other equipment. Common equipment used for the construction of access roads as well as preparation of the wellpad includes graders, bulldozers, front-end loaders, and dump trucks. Concrete mixer and pump trucks may also be used for the cementing of oil-well casing. As shown in table 32, graders, bulldozers, concrete mixer trucks, and dump trucks all produce similar noise levels at a distance of 50 feet (graders, bulldozers, and concrete mixer trucks produce 85 dBA, while dump trucks produce 84 dBA) and would be the loudest pieces of equipment used for site access and wellpad preparation. Compared to the likely range of wintertime noise levels within both park units of 24 to 33 dBA as well as the summertime range of 22 to 43 dBA (see “Chapter 3: Affected Environment”), human-induced noise levels would still exceed natural ambient noise levels as far as 6,400 feet from such equipment without considering attenuation from intervening topography or vegetation. At a distance of 12,000 to 25,000 feet (2.3 to 4.7 miles), noise

levels would start to decrease to natural ambient noise levels. Actual noise levels produced during site access and wellpad preparation activities would be highly dependent, however, on the number of pieces of equipment used, combinations of equipment used in conjunction with one another, and the percentage of time the equipment is operating at full power. Additionally, actual noise levels at a distance from the sources would vary depending on topography features and the types of vegetation cover. Therefore, noise levels may be further reduced by such features, and in many parts of the park, distances at which noise levels are attenuated to the natural ambient level would likely be shorter.

After establishing access to the site and prepping the wellpad, mobilizing the drill rig and beginning the drill work would result in additional elevated noise levels. Specifically, hauling the drill rig and other equipment to the location would require about 10 to 25 large truckloads, as described in appendix H, thereby resulting in a temporary increase in vehicular sources of noise. Diesel trucks operating around the site typically produce a noise level of 88 dBA at 50 feet, which would begin to decrease to the natural ambient sound levels at a distance of 12,000 to 25,000 feet (2.3 to 4.7 miles), without considering attenuation from intervening topography, vegetation, and terrain. Elevated noise levels would also arise during drilling, which is a continuous, 24-hour-a-day, 7-day-a-week operation. As indicated in appendix H, rotary drilling is used almost universally in modern drilling. Based on the noise levels indicated in table 32, noise from a rotary drill would begin to attenuate to the natural ambient sound level at a distance of 6,400 feet (1.2 miles), not accounting for additional attenuating factors such as vegetation and topography. As described above, vegetation and topography would likely reduce the distance at which noise levels from heavy construction equipment would attenuate to the natural ambient level. Although noise levels associated with drilling operation equipment are similar to noise levels produced by construction and earthmoving equipment during the site access and wellpad prepping activities, the intensity of the impacts during drilling would potentially be greater due to the continuous nature of the drilling operation.

If the drilled wells are advanced to the production stage, the use of heavy construction equipment to lay pipelines would result in elevated noise levels similar to those described above for the site access, preparation, and drilling. Additionally, over the course of time that the well is in production, well servicing and workover operations may be necessary. Depending on the maintenance necessary, well servicing may last only 1 or 2 days, requiring minor equipment and a workover rig (a scaled-down drilling rig). Major workover operations may last more than a month and could require some limited drilling operations. The production phase would still necessitate the use of some noisy construction equipment, noise could be sporadic, occurring mainly during servicing operations, or more regular and continuous, especially for gas motors and pumpjacks on existing oil well operations. Activities leading up to the production phase that are mostly part of the drilling operations would likely result in the greatest intensity of impacts.

As described under geophysical exploration, there are numerous statutory and regulatory requirements as well as recommended mitigation measures applicable to drilling and production that would potentially reduce the degree of impacts. Such regulations include the prohibition of oil and gas operations within the gorge, the establishment of 500-foot setbacks per the 9B regulations, and deed restrictions within Obed WSR. An additional mitigation measure, not discussed under geophysical exploration, includes the scheduling of work during times least likely to affect threatened and endangered species per the ESA. Such mitigation would reduce noise-related impacts on wildlife and would also provide noise-free periods. As described under geophysical explorations, any recommended mitigation measures that would avoid high visitor use areas, impose time stipulations, reduce vehicle speeds, and require the proper maintenance of equipment (refer to appendix B for details and specific mitigation measures) would reduce human-induced noise levels as well as the extent of elevated noise levels throughout the park. Additional mitigation measures recommended specifically for the drilling and operation phase include avoiding direct impacts by siting surface operations outside the boundaries of the park units. This



mitigation measure is applicable to both directionally drilled wells and production facilities. This measure would potentially reduce the degree of impacts, depending on the location of drilling and production facilities relative to the park boundaries. Further, mitigation measures to reduce sounds and durations of operations to minimize impacts on wildlife would also reduce the degree of the impact on the natural soundscape. The use of existing roadways would also substantially reduce the degree of impacts, considering that loud, heavy construction equipment is typically used for the construction of new roads and trails. Specifically, within Big South Fork NRRRA recommendations to establish access roads adjacent to, but not within, the gorge area would reduce the level of adverse impacts on the gorge area. Additional mitigation measures specific to the drilling and production phase that would potentially reduce the degree and extent of impacts by reducing noise levels at the source include the use of electric motors rather than diesel engines and the incorporation of sound-absorbing materials and/or mufflers.

In general, considering the implementation of mitigation measures and given the temporary nature of activities within the drilling phase (constructing the access roads and preparing the wellpads would last several weeks to a month), the nature of construction equipment to be used, and the extent throughout the park units to which noise levels would remain above natural ambient noise levels, impacts would be short term, minor to moderate, and adverse within both park units in both developed and undeveloped areas. Adverse impacts associated with the production phase would be long term and minor to moderate, as production would continue to occur until the wells are depleted, but sources of noise over the course of production would be very sporadic, occurring when wells need to be serviced. Also, since there is a small potential for new production (RFD scenario indicates a total of 18 new wells for both park units and well workovers/servicing), drilling is expected to occur on a less frequent basis and most noise would be associated with the current production of oil and gas. Further, since the potential for new production is small and would occur over a period of 15 to 20 years, there could be years without drilling operations. The intensity of the impacts would potentially be greatest within the quietest areas of either park. Further, in areas with higher concentrations of visitors, elevated noise levels would interfere with the enjoyment of the natural quiet. Specifically within Obed WSR, the prohibition of oil and gas activities on nearly all federal lands coupled with the expected use of directional-drilling techniques (which minimizes activities within park boundaries) would potentially reduce impacts to minor, depending on the location of the drilling relative to the park boundary. Minor impacts would also result during quick (1- to 2-day) well-servicing procedures requiring small pieces of equipment.

**Plugging and Reclamation**—As indicated in “Chapter 2: Alternatives,” in addition to the production phase, the majority of the oil and gas activities within both park units would be associated with the plugging and reclamation phase. Activities associated with this phase that would potentially result in adverse impacts include the use of heavy construction equipment and trucks to reopen and repair access roads, remove production equipment and plug wells, and restore contours. Specifically, typical equipment used in opening up and/or repairing access roads includes a small bulldozer, backhoe, and hand tools (gas-powered chainsaw, shovels, axes, etc.). As indicated in table 32, bulldozers and chainsaws could produce 85 dBA at a distance of 50 feet from the source, while a backhoe would produce a noise level of 80 dBA (FHWA 2006). Noise levels would begin to decrease to the natural ambient sound levels at a distance of 3,200 to 6,400 feet, depending on the source, although attenuating factors including vegetation and topography would likely reduce this distance. Reopening and/or repair of access roads would likely be short term, lasting only a few days to weeks, depending on the condition of the roads. During reclamation, similar earthmoving equipment would be necessary in addition to a small dump truck for the potential removal of contaminated soils. The dump truck would produce noise levels similar to that of the earthmoving equipment (see table 32). Depending on the degree of contamination at the well site, reclamation could last a few days to a few years. During plugging, trucks and cement mixer and/or pumping trucks would be used, producing similar noise levels to the earthmoving equipment used during site access and reclamation (see table 32). Plugging would be short term, lasting only 2 to 5 days, depending on the equipment in the well, wellbore conditions, number of plugs to be set, and other factors.

Additional sources of noise associated with this phase would include the use of ORVs or pick-up trucks to transport people and supplies.

Under alternative A, plugging and reclamation activities would be guided by the 9B regulations, and environmental compliance for these operations would be conducted on a case-by-case basis, thereby potentially reducing impacts on the natural soundscape. As detailed in appendix B, recommended mitigation measures, including the use of methods to minimize surface disturbance to access wells within the gorge area at Big South Fork NRRRA, reduction of vehicle speeds to minimize chances of injuring wildlife, and scheduling work during seasonal times least likely to affect threatened and endangered species, would also potentially reduce human-induced noise levels. Specifically, reductions in vehicle speed would result in quieter vehicle noise emissions, and limiting work periods to particular seasons would provide temporary noise-free periods. Minimizing surface disturbances to access wells may reduce the necessity for heavy construction equipment, thereby reducing the degree of impacts.

Considering the implementation of recommended mitigation measures, the potential use of heavy construction equipment associated with this phase, coupled with increased vehicle use and the number of wells proposed to be plugged and reclaimed under this alternative (including within the gorge area), impacts would cover a large extent of both park units. In general, impacts associated with this phase would be short term, moderate, and adverse due to the short duration of most activities and the nature of the equipment to be used. Additionally, as part of reclamation and per 9B regulations, natural conditions would be restored, which would include replacing natural soils for vegetation and the reestablishment of vegetation communities that can help attenuate noise by reflecting, scattering and absorbing sound and by providing the habitat that supports natural sounds. Such procedures would potentially create a long-term benefit to the natural soundscape.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact soundscapes in the park units. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could be greater for operations sited closer to the park boundary. The drilling or plugging and reclamation of wells that have been directionally drilled would result in short-term minor to moderate adverse impacts, with the degree of impact dependent upon the location of the directionally drilled well relative to boundaries of either of the park units. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to soundscapes are expected to diminish and contribute less to cumulative impacts over time. Several past, present, and future actions discussed in the “Cumulative Impacts Scenario” section of this chapter would potentially contribute to adverse cumulative impacts on the natural soundscape of both park units while some of these actions would also potentially create beneficial impacts.

Construction, use, and maintenance of new and existing dirt roads; vehicular traffic, including ORV use and gravel hauling; park maintenance activities; logging and timber harvesting; agricultural activities; plugging and reclamation of oil and gas wells; and visitor activities within each park unit have the potential to contribute to adverse cumulative impacts by creating elevated human-induced noise levels above the natural ambient noise levels within each park unit. Specifically, use of heavy construction equipment would result in increases in noise within the park units. Past and current logging and

agricultural activities within Obed WSR not only create an additional source of human-induced noise but potentially reduce the noise attenuation effects otherwise created by the forested lands.

In addition to activities occurring within park boundaries, development outside of each park (including industrial activities and commercial growth, coal mining, and surrounding residential development) could contribute to cumulative impacts. Such development increases the number of people within the surrounding areas, thereby adding more vehicles to nearby roadways that pass through the park units and run along park boundaries. Increased numbers of vehicles would potentially result in elevated levels of noise outside, and potentially within, the park boundaries, especially in Big South Fork NRRRA along state highways 92 and 52. Coal bed methane/shale gas drilling is an ongoing activity in the vicinity of the park units, in addition to ongoing mining operations around the park units. Such activities could create elevated levels of human-induced noise within the park units, depending on the proximity of the operations to park boundaries as well as the noise levels produced at the coal mining sites. An additional source of noise both within and outside Big South Fork NRRRA is the Big South Fork scenic railway, which runs through the gorge area of the park and is in planning for expansion north to Yamacraw. This expansion would increase the extent to which noise from the operation of the train impacts the natural soundscape of Big South Fork NRRRA.

Although many of these actions would result in adverse impacts on the natural soundscape, beneficial impacts would also arise from some of the aforementioned actions, as well as from other actions. Specifically, the NPS plans to plug and reclaim 14 abandoned wells at Big South Fork NRRRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control, and another 39 wells would soon be plugged over a period of about 2 years, using ARRA funding. The plugging and reclamation of these wells has resulted and would result in long-term beneficial impacts on the natural soundscape due to revegetation and its effects on sound attenuation. Additionally, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed changes focus on improving resource protection aspects of the regulations while accounting for advances in oil and gas technology and industry practices. Changes would also include enhancing incentives for operators to conduct directional drilling while minimizing indirect impacts of such operations. These changes could have long-term beneficial impacts on the natural soundscape, particularly from the use of directional drilling, which would locate heavy construction equipment and other noise sources associated with oil and gas operations outside of park boundaries. Further, focusing on resource protection measures would include consideration of impacts on the natural soundscape as an important park resource. Resource protection measures may impose certain timing stipulations, which would in turn provide noise-free periods within the park units.

Overall, the impacts of these actions, combined with the short-term and long-term negligible to moderate adverse impacts as well as the beneficial effects created by the implementation of alternative A, would result in short- and long-term minor to moderate adverse cumulative impacts on the natural soundscape. When compared to the broader area of analysis and the variety of cumulative actions, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## **Conclusion**

It is expected that limited geophysical explorations would result in potential short-term negligible to minor adverse impacts from noise related to work crews and use of seismic vibration technology. Based on the RFD scenario, most activities would be associated with the production of existing wells, while drilling and development of new well sites would be less frequent. The greatest intensity of impacts would be associated with equipment and vehicles used during the drilling and production phase, resulting in short-term to long-term minor to moderate adverse impacts. Long-term adverse impacts would arise

from continuous production at existing wells until the wells are depleted, and noise would be sporadic over the course of production, occurring during well-servicing operations, as well as continuous from ongoing pumpjack and motor operation. Impacts on soundscapes associated with plugging and reclamation would be short term, minor to moderate, and adverse. As wells are plugged and abandoned, revegetation of the well sites would potentially allow for a return to the sound attenuation effects lost when native vegetation was cleared to establish the wellpad, a long-term beneficial impact. The drilling or plugging and reclamation of directionally drilled wells would result in short-term minor to moderate adverse impacts, with the degree of impact dependent on the location of the directionally drilled well relative to boundaries of either of the park units. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short-term and long-term negligible to moderate adverse impacts as well as the beneficial effects created by the implementation of alternative A, would create short- and long-term minor to moderate adverse cumulative impacts on the natural soundscape. When compared to the broader area of analysis and the variety of cumulative actions, alternative A would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

### **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

#### **Analysis**

**Geophysical Exploration**—As described under alternative A, minimal geophysical exploration is expected and would most likely take the form of conventional seismic surveys in areas of existing roads where data could be collected quickly and inexpensively, using seismic vibrator technology. As a result, impacts under alternative B from the noise associated with work crews, vehicles, and use of seismic vibration technology would be very similar to those described under alternative A, which would be short term, negligible to minor, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A.

As described under alternative A, most of the adverse impacts associated with oil and gas operations within either park unit would result from the drilling and production phase, as this phase necessitates the majority of the heavy construction equipment and has the potential to be long in duration. Potential sources of noise associated with drilling and production include the construction of roads and trails for accessing the site, preparation of the drill site, drilling operations, cement work, well servicing, and workover operations. Similar to alternative A, noise levels would be as loud as 85 dBA at the work site, from the use of such equipment as bulldozers, graders, cement mixer and pump trucks, dump trucks, drill rigs, and diesel trucks hauling large equipment and materials, and long-term sources of noise include pumpjacks and associated motors on oil wells.

However, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to oil and gas operations in order to provide for long-term protection of park resources and values, including the natural soundscape. Specifically, the NPS would conduct increased inspections and monitoring of both current and new operations to identify sites that may be impacting, or threatening to impact, park resources, rather than depending on the state for enforcement of regulations. The 9B regulations would be enforced at any such sites, and operations found to pose a

significant threat to federally owned or controlled lands would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). Although this practice would be mostly beneficial to protecting park resources like water resources and soils, such inspections and monitoring would ensure established mitigation measures are being followed for all park resources, including the natural soundscape. Sound mitigation could be required under new plans of operation or increased inspections/enforcement, including replacing or servicing older motors on pumpjacks, which would reduce noise from existing operations in the parks. Additionally, NPS outreach and public education efforts that offer training to oil and gas operators would further promote protection of park resources.

The plan would promote long-term protection of park resources, including the natural soundscape, and provide for additional oversight and mitigation of some noisier operations, providing an improvement to the soundscape in certain areas of the parks. However, impacts from all operations would be similar to those under alternative A due to the nature of the drilling and production activities and associated equipment, and impacts would be short term to long term, ranging from minor to moderate, and adverse.

**Plugging and Reclamation**—Similar to the description under alternative A, activities associated with this phase that would potentially result in adverse impacts include the use of heavy construction equipment and trucks to reopen and repair access roads, remove production equipment and plug wells, and restore contours. As a result, impacts would be similar to those described under alternative A. However, the implementation of alternative B includes a new management framework developed specifically for plugging and reclamation activities. As part of this management framework, steps would be taken to create no additional redistribution (vegetation removal and road repair). Requirements for developing access roads would be driven by plugging equipment needs. As such, the potential exists for reduced use of some heavy construction equipment, but also for several sites to be plugged simultaneously. Additionally, as part of reclamation, the management framework would require the restoration of natural conditions (per 9B regulations), which would include replacing natural soils for vegetation and the reestablishment of vegetation communities. Such procedures would allow for a return to the sound attenuation effects that would have been lost with the clearing of vegetation to develop the well site.

With the implementation of mitigation measures and consideration of the new management framework for plugging and reclamation, impacts would be short term, minor to moderate, and adverse. Additionally, the new management framework for plugging and reclamation would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner, albeit with the possibility of greater short-term impacts if multiple wells are plugged at the same time.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact soundscapes in the park units. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could be greater for operations sited closer to the park boundary. The drilling or plugging and reclamation of wells that have been directionally drilled would result in short-term minor to moderate adverse impacts, with the degree of impact dependent upon the location of the directionally drilled well relative to boundaries of either of the park units. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on the natural soundscape from actions considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions,

when combined with the short- and long-term negligible to moderate adverse impacts as well as the additional long-term beneficial impacts that could be realized under alternative B, would result in short-term and long-term negligible to moderate adverse cumulative impacts. Proactive enforcement of CLPRs and the plan itself may help limit noise impacts in the park, but noise impacts would remain from a variety of sources inside and outside the park boundary. When compared to the broader area of analysis and the variety of cumulative actions, alternative B would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts.

## **Conclusion**

Similar to alternative A, under alternative B limited geophysical explorations would result in potential short-term negligible to minor adverse impacts from the noise associated with work crews, vehicle/truck use, and seismic vibration equipment. Also similar to alternative A, it is expected that drilling and production conducted under alternative B would result in potential short-term to long-term minor to moderate adverse impacts on the natural soundscape. However, under alternative B, with increased inspections and the implementation of a management plan, there would potentially be some increased certainty that mitigation measures would be implemented to promote protection of park resources, including the natural soundscape, although the range of impacts would likely remain the same due to the nature of the activities and associated equipment. Impacts from plugging and reclamation would be short term, minor to moderate, and adverse, and could include increased short-term impacts if well plugging occurs in multiple locations at the same time. However, as wells are plugged and abandoned, long-term benefits would arise from the effects of revegetation on restoring sound attenuation. Additionally, the new management framework for plugging and reclamation established under alternative B would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. The drilling or plugging and reclamation of directionally drilled wells would result in short-term minor to moderate adverse impacts, with the degree of impact dependent upon the location of the directionally drilled well relative to boundaries of either of the park units. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

The adverse and beneficial impacts of the cumulative actions, combined with the short- and long-term negligible to moderate adverse impacts as well as the additional long-term benefits that could be realized under alternative B, would result in short-term and long-term negligible to moderate adverse cumulative impacts. When compared to the broader area of analysis and the variety of cumulative actions, alternative B would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts. Alternative B would provide long-term cumulative benefits due to its proactive management and enforcement and expedited well plugging.

## **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

### **Analysis**

**Geophysical Exploration**—Implementation of alternative C would result in impacts from geophysical exploration similar to those described for alternatives A and B, simply due to the equipment needs for the activity. However, unlike alternatives A and B, which allow for oil and gas operations in all areas of the park where federal rights exist and where CLPRs do not prohibit such activities, under alternative C, SMAs would be created to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations and operations may be limited or restricted in SMAs unless otherwise approved in a plan of operations. Specifically, seven SMAs would be established that restrict geophysical

exploration by a No Surface Use provision (geophysical exploration would be allowed within the Special Scenery SMA). Additional restrictions would be imposed by the creation of setbacks ranging from a 100- to 1,500-foot radius (depending on the SMA and its purpose) extending from the boundary of the SMA. Within this radius, geophysical exploration would also be restricted. Although SMAs and associated setbacks would reduce noise levels within the SMAs by resulting in the noise source being located farther from the SMA, elevated noise levels would still result in locations where operations are occurring. Additionally, timing stipulations for geophysical operations would be created within the Visitor Use, Administrative Areas, and Trails SMAs as well as the Cultural Landscapes and Cemeteries SMA that would provide for an approximate 6-month period (April to October) of limited geophysical operations. As such, temporary noise-free periods may be established during this time within those areas of Big South Fork NRR.

Since minimal geophysical exploration is expected and would include the use of existing roads as well as pedestrian access, and SMA restrictions would limit noise in sensitive areas, impacts from geophysical operations are expected to be short term, negligible, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described under alternative A. However, unlike alternatives A and B, under alternative C, SMAs would be created that restrict drilling and production operations by a No Surface Use provision, unless otherwise approved in a plan of operations. Additional restrictions would be imposed by the creation of setbacks ranging from a 100- to 1,500-foot radius (depending on the SMA and its purpose) extending from the boundary of the SMA. Within this radius, drilling and production would also be restricted. As a result, there is an increased chance for directional drilling, which would locate noisy equipment and activities away from SMAs and possibly outside the park boundaries, thereby reducing noise levels from future operations within SMAs and possibly the park. The locations within the park boundaries where noise levels would be reduced to the natural ambient level would be dependent on the location of the directional-drilling activity relative to the park boundaries. For wells drilled within the park, outside the SMAs and setbacks, noise levels would be reduced within the SMAs, although not to the natural ambient level. As setbacks range from 100 to 1,500 feet, noise levels produced by drilling and production would still be relatively high compared to natural ambient noise levels at the boundaries of the SMAs (refer to table 32 for projected noise levels of bulldozers, graders, cement mixer and pump trucks, drill rigs, and diesel trucks). Depending on the distance from SMA boundary, noise levels would be further reduced but would still be above ambient noise levels for approximately 2 to 4 miles from the source (see table 32). As with geophysical operations, timing stipulations would be created within the Visitor Use, Administrative Areas, and Trails SMAs as well as the Cultural Landscapes and Cemeteries SMA that would provide for an approximate 6-month period (April to October) of limited drilling and production operations. Such stipulations would also be set for drilling activities in the Special Scenery SMA. As such, temporary noise-free periods or periods of reduced noise may be established during this time in that specific area of the park.

Impacts on the natural soundscape from drilling and existing production would range from short term to long term, minor to moderate, and adverse, as described under alternative B. However, compared to alternatives A and B, with the implementation of SMAs and associated setbacks noise levels may be reduced within the certain areas of the park units, especially in Big South Fork NRR, since Obed WSR currently has deed restrictions restricting operations within the park boundary. Timing stipulations that limit drilling and production would potentially reduce adverse impacts to minor, depending on whether operations are scaled down or shut down completely. If operations cease for periods of time, short-term, beneficial impacts would result.

**Plugging and Reclamation**—Impacts from plugging and reclamation of depleted and abandoned wells would be similar to those described for alternative B, particularly since this phase would generally be guided by the 9B regulations and the new management framework that was described under alternative B. As part of reclamation, the management framework would promote the restoration of natural conditions (per 9B regulations), which would include replacing natural soils for vegetation and the reestablishment of vegetation communities. Such procedures would allow for a return to the sound attenuation effects that would have been lost with the clearing of vegetation to develop the well site.

Although the same wells identified for plugging and reclamation under alternative B would also be identified under alternative C as part of the new management framework, under alternative C the NPS would consider the proximity of well sites to the SMAs when prioritizing wells for plugging and reclamation. Such considerations would temporarily reduce the potential for impacts in those locations until the wells near such SMAs are in need of plugging and reclamation.

Similar to alternative B, impacts would be short term, minor to moderate, and adverse, although with less impact on areas protected with SMA designations and setbacks. As wells are plugged and reclaimed, some additional long-term beneficial effects would arise from the enforcement of 9B regulations to reestablish native vegetation that can attenuate noise.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath the park units could indirectly impact soundscapes in the park units. The types of impacts are expected to be similar to those described above for operations inside the park, but the intensity of impacts could be greater for operations sited closer to the park boundary. The drilling or plugging and reclamation of wells that have been directionally drilled would result in short-term minor to moderate adverse impacts, with the degree of impact dependent upon the location of the directionally drilled well relative to boundaries of either of the park units. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

### **Cumulative Impacts**

Impacts on the natural soundscape from actions considered under the cumulative impact scenario would be the same as described for alternative A. The effects of these actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the additional short-term and long-term beneficial impacts that could be realized under alternative C, would result in short-term and long-term negligible to moderate adverse cumulative impacts. The SMA restrictions would provide more consistent protection of natural soundscapes in and around the SMAs, but noise from adjacent lands could continue to adversely impact the park units. When compared to the broader area of analysis and the variety of cumulative actions, alternative C would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, SMA identification and protection, and expedited well plugging.

### **Conclusion**

It is expected that geophysical explorations conducted under alternative C would result in potential short-term negligible adverse impacts from the presence and activities of work crews and vehicle/truck use. Drilling and production conducted under alternative C would result in potential short-term to long-term minor to moderate adverse impacts on the natural soundscape, as described under alternatives A and B. However, under alternative C the opportunity for directional drilling would more likely be realized and could therefore reduce future noise levels within Big South Fork NRR or in SMAs. Also similar to



alternative B, impacts under alternative C from plugging and reclamation would be short term, minor to moderate, and adverse, but the new management framework for plugging and reclamation established under alternative C would increase the certainty that wells would be plugged and reclaimed to applicable standards, and therefore, the long-term beneficial effects described under alternative A would be more likely to be realized sooner. The drilling or plugging and reclamation of directionally drilled wells would result in short-term minor to moderate adverse impacts, with the degree of impact dependent upon the location of the directionally drilled well relative to the boundaries of either of the park units. In addition, there would be long-term beneficial impacts as a result of reclaiming the wellpads and access roads of well sites drilled from outside the park units.

Cumulative impacts would be similar to those described for alternative B, with short-term and long-term negligible to moderate adverse cumulative impacts. The actions under alternative C would help ensure protection of natural soundscapes in certain areas of the park units. When compared to the broader area of analysis and the variety of cumulative actions, alternative C would directly impact a relatively small area and would contribute minimally to the overall cumulative impacts. Alternative C would provide long-term cumulative benefits due to its proactive management and enforcement, SMA identification and protection, and expedited well plugging.

## **CULTURAL RESOURCES**

### **GUIDING REGULATIONS AND POLICIES**

Federal actions that have the potential to affect cultural resources are subject to a variety of laws. The National Historic Preservation Act of 1966 (as amended) is the principal legislative authority for managing cultural resources associated with NPS projects. Generally, Section 106 of the act requires all federal agencies to consider the effects of their actions on cultural resources listed on or determined eligible for listing on the National Register of Historic Places (NRHP). Such resources are termed historic properties. Agreement on how to mitigate effects on historic properties is reached through consultation with the State Historic Preservation Officer; the Tribal Historic Preservation Officer, if applicable; and the Advisory Council on Historic Preservation, as necessary. In addition, federal agencies must minimize harm to historic properties that would be adversely affected by a federal undertaking. Section 110 of the act requires federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties to the NRHP.

The National Historic Preservation Act established the NRHP, the official list of the nation's historic places worthy of preservation. Administered by the NPS, the NRHP is 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 criteria applied to evaluate properties are contained in 36 CFR 60.4. 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 of 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).

Cultural resources that meet the eligibility criteria for listing on the NRHP are considered “significant” resources and must be taken into consideration during the planning of federal projects.

Other important laws or Executive Orders designed to protect cultural resources include, but are not limited to:

- NPS Organic Act—to conserve the natural and historic objects within parks unimpaired for the enjoyment of future generations
- American Indian Religious Freedom Act—to protect and preserve for American Indians access to sites, use and possession of sacred objects, and freedom to worship through ceremonials and traditional rites
- Archeological Resources Protection Act—to secure, for the present and future benefit of the American people, the protection of archeological resources and sites that are on public lands and Indian lands
- NEPA—to preserve important historic, cultural, and natural aspects of our national heritage
- Executive Order 11593 (Protection and Enhancement of the Cultural Environment)—to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the United States
- Executive Order 13007 (Indian Sacred Sites)—to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites

Through the legislation and Executive Orders listed above, the NPS is charged with the protection and management of cultural resources in its custody. This is further implemented through Director’s Order 28: Cultural Resource Management (NPS 1998c), NPS *Management Policies 2006* (NPS 2006c), and the 2008 “Programmatic Agreement among the NPS (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers for Compliance with Section 106 of the *National Historic Preservation Act*” (NPS 2008e). These documents charge NPS managers with avoiding, or minimizing to the greatest degree practicable, adverse impacts on park resources and values. Although the NPS has the discretion to allow certain impacts in park units, that discretion is limited by the statutory requirement that park resources and values remain unimpaired, unless a specific law directly provides otherwise.

## **METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS**

The NPS categorizes cultural resources by the following categories: archeological resources, historic structures, cultural landscapes, museum objects, and ethnographic resources. A review of reference materials regarding cultural resources within the park units, as well as communications with NPS staff, was completed to identify and evaluate potential impacts on cultural resources. Museum objects would not be affected by this plan and are not discussed further in this section.

Cultural resources are an important component of Big South Fork NRRRA and Obed WSR. Only a portion of the two park units has been formally inventoried for cultural resources. The Big South Fork NRRRA contains more than 1,600 documented archeological sites, which may represent only 40% of the estimated total for the park unit. However, none of these has been evaluated for eligibility to the NRHP. In addition, 13 farm buildings, 4 bridges, and a coal tippie at Big South Fork NRRRA are considered eligible for listing in the NRHP. Several recognized and administrative cultural landscapes exist within the boundaries of Big South Fork NRRRA, including the “Rural Historic District,” farmsteads, cemeteries, bridges, and other features.

An estimated 340 rock shelters may exist within Obed WSR, none of which have been evaluated as eligible for the NRHP. There are currently no historic structures eligible for listing on the NRHP at Obed WSR. Although there are some possible cultural landscapes, no features or landscapes at Obed WSR are currently managed as such.

Ethnographic consultations were initiated as part of this planning process, but at this time, no specific ethnographic resources that might be affected by oil and gas developments have been identified. Consultation with the seven tribes and other park-affiliated communities, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations.

Oil and gas operations can adversely impact cultural resources if proper surveys and protection measures are not implemented. However, federal laws and regulations and NPS policies provide management tools for protection and management of cultural resources. The impact intensity threshold definitions are based on the potential for changes to cultural resource characteristics, as follows:

### **Archeological Resources**

*Negligible:* The impact would be at the lowest levels of detection or barely measurable, with no perceptible consequences, to archeological resources.

*Minor:* The impact on archeological sites is measurable or perceptible, but it is slight and affects a limited area of a site or group of sites. The impact does not affect the character defining features of a NRHP eligible or listed archeological site and would not have a permanent effect on the integrity of any archeological sites or result in loss of important information potential.

*Moderate:* The impact is measurable and perceptible. The impact changes one or more character defining feature(s) of an archeological resource but does not diminish the integrity of the resource to the extent that its National Register eligibility is jeopardized. Disturbance of a site would not result in a substantial loss of important information.

*Major:* The impact on archeological sites is substantial, noticeable, and permanent. The impact is severe or of exceptional benefit. For National Register eligible or listed archeological sites, the impact changes one or more character defining features(s) of an archeological resource, diminishing the integrity of the resource to the extent that it is no longer eligible for listing in the National Register. Disturbance of a site would be substantial and would result in the loss of most or all of the site and its potential to yield important information.

## Historic Structures

- Negligible:* The impact would be at the lowest level of detection or barely perceptible and not measurable.
- Minor:* The impact on historic structures is measurable or perceptible, but it is slight and affects a limited area of a site or group of sites. The impact does not affect the character defining features of NRHP eligible or listed properties and would not have a permanent effect on the integrity of any historic structures.
- Moderate:* The impact is measurable and perceptible. The impact changes one or more character defining feature(s) of historic structures but does not diminish the integrity of the resource(s) to the extent that National Register eligibility is jeopardized.
- Major:* The impact on historic structures is substantial, noticeable, and permanent. For National Register eligible or listed historic structures, the impact changes one or more character defining features(s) of the resource, diminishing the integrity of the resource to the extent that it is no longer eligible for listing in the National Register.

## Cultural Landscapes

- Negligible:* The impact would be at the lowest levels of detection or barely perceptible and not measurable.
- Minor:* The impact on cultural landscapes is measurable or perceptible, but it is slight and affects a limited area. The impact would not affect the character-defining features of a cultural landscape listed on or eligible for the NRHP.
- Moderate:* The impact is measurable and perceptible. The impact would alter character-defining features of the cultural landscape but would not diminish the integrity of the landscape to the extent that its NRHP eligibility would be jeopardized.
- Major:* The impact on cultural landscapes is substantial, noticeable, and permanent. The impact would alter character-defining features of the cultural landscape, diminishing the integrity of the resource to the extent that it would no longer be eligible for NRHP listing.

## Ethnographic Resources

- Negligible:* The impact would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices.
- Minor:* The impact would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices.

*Moderate:* The impact would be apparent and would alter resource conditions. The alteration would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's beliefs and practices, even though the group's beliefs and practices would survive.

*Major:* The impact would alter resource conditions. The alternative would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of beliefs and practices, to the extent that the survival of a group's beliefs and/or practices would be jeopardized.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Therefore, since designated existing access roads would be used and lines would be laid on foot, without the use of heavy vehicles or ORVs, there would be limited impacts on surface cultural resources. Because of the restrictions at Obed WSR, these operations would not be allowed within the park unit.

*Archeological Resources*—Impacts on cultural resources from geophysical exploration could occur as a result of the vibrations caused by the proposed seismic vibrator technology, including settling and burial of artifacts located in soft soils, and collapses of features due to oscillation and ground motion. Increased access to areas by exploration crews 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. However, cultural resource surveys would be conducted as deemed necessary by resource specialists, and with application of the mitigation measure that states that operators will not alter, destroy, or collect any object, structure, or site of historical, archeological, or cultural value (appendix B), geophysical surveys would result in long-term, negligible to minor, adverse impacts on archeological resources.

*Historic Structures*—Possible impacts on historic structures located within the vibration zone include cracking of foundations, breaking of glass window panes, settling and burial of artifacts located in soft soils, and collapse of structures and features due to oscillation and ground motion. Currently, there are 13 Cumberland-style farm structures that have been assessed as eligible for inclusion in the NRHP (NRHP 2009; Des Jean 2010). Additionally, three abandoned railroad bridges, a vehicular low-water timber bridge, and a large steel coal-mine tipple have also been identified as eligible for inclusion in the NRHP (NPS 1996). Currently, there are no sites listed in the NRHP at Obed WSR (NRHP 2009). With application of the mitigation measure that states that operators will not alter, destroy, or collect any object, structure, or site of historical, archeological, or cultural value (appendix B), and with the application of offsets from historic structures in plans of operation, there would be localized, long-term, negligible, adverse impacts on historic structures associated with these sites.

*Cultural Landscapes*—Eight cultural landscapes, including those eligible for listing on the NRHP (Parch Corn Creek, Litton Slaven farm site, Oscar Blevins farm site, Lora Blevins farm site, Ranse Boyatt farm site), must be protected from non-federal oil and gas operations at Big South Fork NRRA. The noise from

the seismic vibrator operations and the sight of the work crews and their equipment could adversely impact how visitors experience the cultural landscape at these sites (see also the “Soundscapes” and “Visitor Use and Experience” sections). With application of the mitigation measures described in appendix B, including conducting surveys to document the location and significance of any cultural landscapes, there would be localized short-term minor adverse impacts on the cultural landscapes associated with these sites.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result, exploration operations that could occur in the park units would result in no impact or negligible adverse impacts on potential ethnographic resources.

**Drilling and Production**—Similar to geophysical surveys, drilling operations are relatively short term. However, the intensity of impacts is much higher, due to the equipment and materials needed to drill a well and the potential duration of the operation. Site preparation may include extensive clearing, grading, cutting, filling, and leveling of the wellpad using heavy construction equipment. Soil material suitable for plant growth is often removed first and stockpiled for later use in reclamation. The operator may also dig reserve pits to hold large volumes of drilling mud and drill cuttings.

Surface drilling and production operations (including the placement of flowlines) would not directly impact cultural resources in areas where operations would not be permitted under CLPRs, including the 9B regulations, the gorge restrictions at Big South Fork NRR, and deed restrictions at Obed WSR. As described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRR, and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR, plus well workovers/servicing.

*Archeological Resources*—Potential adverse impacts on cultural resources from the construction and maintenance of access roads, wellpads, flowlines, and pipelines on up to 36 acres in Big South Fork NRR under the RFD scenario would be avoided or mitigated by applying CLPRs, particularly those of the National Historic Preservation Act, and through consultation with the State Historic Preservation Officer. The NPS would require that a qualified third-party monitor be present during appropriate operational phases to help protect subsurface resources. If buried cultural resources cannot be avoided, impacts would be mitigated by recovery of data (excavation) and 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 by drilling crews 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 by construction activities associated with drilling and production. This would have a long-term minor to moderate adverse impact on individual archeological sites; however, the impact on archeological resources as a whole would likely be minor or less. Most of the known archeological sites can be protected from direct impacts from road construction and well drilling and production by avoidance. When significant sites cannot be avoided, impacts would be avoided or mitigated by excavating the site, using methodologies defined in a reviewed and approved research design.

*Historic Structures*—All of the known historic structures are visible and would not be damaged by construction activities associated with drilling and production. Impacts relating to noise effects on the visitor experience of viewing historic structures is included in the “Visitor Use and Experience” section, below. With application of the mitigation measure that states operators will not alter, destroy, or collect

any object, structure, or site of historical, archeological, or cultural value, the sites can be protected from direct impacts from road construction and well drilling and production by avoidance. With this mitigation, impacts would be negligible and adverse.

*Cultural Landscapes*—Visual impacts from drilling and production operations on cultural landscapes would be more substantial if wellpads were placed in relatively close proximity to the sites, where visitors would be able to see the operation and all associated equipment and tanks. Exploratory drill rigs can reach heights of 180 feet, which would be readily visible through clearings and open spaces. The operations, especially drilling, would increase the presence of work crews and equipment. Although drilling is a 24-hour operation, it is temporary and would have short-term minor to moderate adverse impacts. Long-term minor adverse impacts could occur to cultural landscapes from the visual presence of wellpads, and impacts could occur to visitor experience of cultural landscapes, which is included in the “Visitor Use and Experience” section, below.

*Ethnographic Resources*—Ethnographic resources consist mainly of the cultural values of the tribes claiming traditional associations with the area. Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result, new drilling and production would result in negligible to minor adverse impacts on potential ethnographic resources.

*All Cultural Resources*—The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact cultural resources, especially historic structures and cultural landscapes if they are in the vicinity of the release or fire. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be major adverse impacts that could be considered long-term, 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 both on the ground and in the form of monetary compensation.

**Plugging and Reclamation**—As described in the forecast of oil and gas activities in chapter 2, it is assumed that approximately 50 wells at the park units would be plugged and reclaimed under this alternative. Full-scale reclamation could include the following removal of structures, equipment, and debris used or generated during operations; removal or remediation of contaminated soils; and recontouring of disturbed areas to near original grade.

*Archeological Resources*—Well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles during reclamation activities could disturb and compact soil, increase soil erosion, and release oil and other contaminating and hazardous substances. Application of CLPRs, particularly National Historic Preservation Act requirements, would prevent adverse impacts on known archeological resources from plugging, abandonment, and reclamation operations. It is assumed that previously drilled wells have already disturbed any extant cultural sites. However, during reclamation activities within the Big South Fork NRR, it is possible that soils containing cultural material would be disturbed, thus displacing or destroying subsurface artifacts and resulting in long-term minor adverse impacts.

*Historic Structures*—Potential adverse impacts on historic structures from plugging, abandonment, and reclamation operations include the displacement of or damage to built features from vibrations and/or movement of soils containing structural remains, which would be avoided or mitigated by applying CLPRs, particularly those of the National Historic Preservation Act. Through consultation with the State Historic Preservation Officer, mitigation would be identified to reduce adverse effects, and adherence to this mitigation would result in localized long-term negligible to minor adverse impacts on historic structures throughout the park units.

*Cultural Landscapes*—The noise from the drill rigs and the sight of the work crews and their equipment could adversely impact how visitors experience the cultural landscape at these sites, as discussed further in the “Visitor Use and Experience” section, and introduce ground disturbance to the landscape. However, reclamation of sites and replanting with native vegetation would restore the natural character of the area, and may lessen any impacts related to disturbance in cultural setting or landscape. Consultation with the State Historic Preservation Officer would be conducted to identify mitigation to reduce adverse effects. There could be both short-term minor adverse impacts and long-term beneficial impacts on cultural landscapes as a result of plugging and reclamation.

*Ethnographic Resources*—Impacts could include limited access to or use of sacred sites or effects on the physical integrity of the sites. Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result, plugging and reclamation activities would result in negligible or minor adverse impacts on potential ethnographic resources.

**Directionally Drilled Wells**—Impacts on cultural resources in Obed WSR (and Big South Fork NRR, if it should occur) from wells directionally drilled from outside the park to bottomholes beneath the park could occur, but would be limited, since the operations would not be on park property. Unknown subsurface archeological resources could be damaged by drilling through sites and cultural materials at drilling locations outside the park, but it is unlikely that archeological sites in the park would be disturbed, due to the depth of the directional boreholes. Runoff or erosion could occur, impacting surface archeological sites within the park units. Impacts could range from no impact on historic structures, cultural landscapes, and ethnographic resources to long-term minor adverse impacts on archeological sites, to potentially major adverse effects in the case of a well blowout, fire or uncontrolled release that reaches cultural resources in the park. There would also be long-term beneficial impacts from the restoration of vegetation and natural site appearance.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to cultural resources are expected to diminish and contribute less to cumulative impacts over time. However, several actions described in the “Cumulative Impacts Scenario” section of this chapter would contribute 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 that could provide unauthorized access to cultural resources; earthmoving activities associated with construction and maintenance of dirt roads and oil and gas wellpads; park maintenance activities, including installation and maintenance of roads, trails, developed sites, and cultural structures/landscapes; logging and timber harvesting; coal mining; agricultural activities; commercial and/or residential development; and the planned plugging of 14 orphaned wells at Big South Fork NRR and plans to plug and reclaim an additional 39 wells at Big South Fork NRR. All of these actions could involve ground disturbance and destruction of sensitive cultural resources. Similar activities occurring outside the park could affect



cultural resources. Cumulatively, these would have a long-term minor to moderate adverse impact on cultural resources.

Conversely, the information provided by cultural resource surveys required of the NPS prior to carrying out park activities or permitting oil and gas operations would increase the NPS knowledge of the resources in the park, and would be used to preserve cultural resources, a beneficial cumulative impact. Over the long term, protection provided to cultural resources in the park under CLPRs, particularly the well-defined regulatory process under the National Historic Preservation Act and consultation with the State Historic Preservation Officer, would result in the preservation of important cultural resources and traditional cultural practices, which would have a beneficial cumulative impact on cultural resources in the park.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative A, would have long-term minor to moderate adverse cumulative impacts on cultural resources. Protection provided to cultural resources in the park under CLPRs would protect most cultural resources and provide for recovery of unknown artifacts that are disturbed. However, there would be a potential for moderate adverse impacts on important cultural sites that may not be visible from the surface. Actions under alternative A could contribute moderately to cumulative impacts.

## **Conclusion**

It is expected that geophysical exploration under alternative A would result in short- and long-term localized negligible to minor adverse impacts on cultural resources as a result of soil disturbance and vibration. Considering the number of wells in areas where non-federal oil and gas operations would be permitted in the park, drilling and production activities under alternative A would have short-term and long-term negligible to minor adverse impacts on cultural resources as a result of impacts on soils, historic artifacts, and cultural landscapes. Overall, eventual reclamation of these sites and cessation of operations under alternative A would result in localized short-term and long-term negligible to minor adverse impacts and long-term beneficial impacts on cultural resources. Under alternative A, wells directionally drilled and produced from outside the park units to bottomholes beneath the park units, and the reclamation of these wells, could impact cultural resources within the park units, resulting in effects ranging from no impact to localized, long-term, negligible to minor, adverse impacts. There would also be long-term beneficial impacts from the restoration of vegetation and natural site appearance. For both in-park and adjacent directionally drilled wells, up to major short-or long term adverse impacts could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative A, would result in long-term minor adverse cumulative impacts on cultural resources. The actions under alternative A could contribute moderately to cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Because of the restrictions at Obed WSR, these operations would not be allowed within the park unit.

However, under alternative B the NPS would implement an oil and gas management plan that requires that oil and gas operations are conducted in a way that best protects park resources and values, including cultural resources and would provide for more frequent inspections and monitoring.

*Archeological Resources*—As described under alternative A, exploration operations (seismic surveys) could have adverse impacts on unknown archeological sites. Under alternative B there would be a formal oil and gas plan in place, including increased monitoring of operations, but there would still be the possibility of loss of unknown archeological resources due to vibration or crew disturbance, but with mitigation and surveys used to provide offsets from known resources in plans of operation. Therefore, impacts under alternative B would be essentially the same as described for alternative A: long-term, negligible to minor, and adverse.

*Historic Structures*—Impacts on historic structures located within the vibration zone would be the same as described for alternative A. Although a formal oil and gas plan would be in place, there would still be some potential for damage to structures from ground vibration. With the mitigation measures described in appendix B, such as avoiding known cultural resources, conducting operations to minimize site disturbance, and not allowing operators to alter, destroy, or collect any object, structure, or site of historical, archeological, or cultural value, there would be localized long-term negligible to minor adverse impacts on historic structures associated with these sites under alternative B.

*Cultural Landscapes*—Impacts on cultural landscapes located within the park units would be the same as described for alternative A. The noise from the seismic vibrator operations and the sight of the work crews and their equipment could adversely impact how visitors experience the cultural landscape at these sites. With the mitigation described in appendix B, there would be localized short-term minor adverse impacts on the cultural landscapes associated with these sites.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result, exploration operations that could occur in the park units under alternative B would result in negligible to minor adverse impacts on potential ethnographic resources.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workovers/servicing would be very similar to the impacts described in alternative A. However, under alternative B the NPS would implement an oil and gas management plan that provides for, increased inspections and monitoring and a proactive approach to identify activities that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production would still occur, this alternative would protect park resources and values, including cultural resources, better than alternative A.

*Archeological Resources*—As described under alternative A, potential adverse impacts on cultural resources would occur from the construction and maintenance of access roads, wellpads, flowlines, and pipelines under the RFD scenario, which could disturb up to 36 acres in the park units. These impacts would be avoided or mitigated by applying CLPRs, particularly those of the National Historic Preservation Act, and through consultation with the State Historic Preservation Officer. If buried cultural resources cannot be avoided, impacts would be mitigated by recovery of data (excavation) and

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 by drilling crews 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 have an adverse impact.

As noted, it is possible that important cultural sites may not be visible from the surface and could be damaged by construction activities associated with drilling and production. This could have a long-term minor to moderate adverse impact on individual archeological sites; however, the impact on archeological resources as a whole would likely be minor or less. Most of the known archeological sites can be protected from direct impacts from road construction and well drilling and production by avoidance and the required third-party monitoring. When significant sites cannot be avoided, impacts would be avoided or mitigated by excavating the site, using methodologies defined in a reviewed and approved research design.

*Historic Structures*—All of the known historic structures are visible and would not be damaged by construction activities associated with drilling and production. The sites can be protected from direct impacts from road construction and well drilling and production by avoidance. With mitigation measures, such as avoiding known cultural resources, conducting operations to minimize site disturbance, and not allowing operators to alter, destroy, or collect any object, structure, or site of historical, archeological, or cultural value, adverse impacts would be negligible under alternative B.

*Cultural Landscapes*—Visual and noise impacts from drilling and production operations to cultural landscapes and park visitors experiencing these landscapes would be more substantial if wellpads were placed in relatively close proximity to the sites, where visitors would be able to see the operation and all associated equipment and tanks. The height of drill rigs would make them readily visible through clearings and open spaces. The operations, especially drilling, would increase the presence of work crews and equipment. Although drilling is a 24-hour operation, it is temporary and would have short-term minor to moderate adverse impacts on cultural landscapes under alternative B.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result of adhering to mitigation identified through consultation, alternative B would result in negligible to minor adverse impacts on potential ethnographic resources.

*All Cultural Resources*—Although up to major adverse impacts could occur in the unlikely event of a well blowout, fire, or uncontrolled release (as described for alternative A), the risk of that occurring is less under alternative B due to increased monitoring and inspections.

**Plugging and Reclamation**—It is assumed that approximately 50 wells at the park units would be plugged and reclaimed under this alternative. Full-scale reclamation can include the following: removal of structures, equipment, and debris used or generated during operations; removal or remediation of contaminated soils; and recontouring of disturbed areas to near original grade.

*Archeological Resources*—As described under alternative A, well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles during reclamation activities could disturb and compact soil, increase soil erosion, and release oil and other contaminating and hazardous substances. Application of CLPRs, particularly those of the National Historic Preservation Act, would ensure that adverse impacts on archeological resources from plugging, abandonment, and reclamation operations would be avoided or mitigated. It is assumed that previously drilled wells have already disturbed any extant cultural sites. However, during reclamation activities within the Big South

Fork NRRA, it is possible that soils containing cultural material would be disturbed, thus displacing or destroying subsurface artifacts and resulting in long-term minor adverse impacts under alternative B.

*Historic Structures*—Potential adverse impacts on cultural resources from plugging, abandonment, and reclamation operations would be avoided or mitigated by applying CLPRs, particularly those of the National Historic Preservation Act, and mitigation, as recommended through consultation with the State Historic Preservation Officer, would result in localized long-term negligible to minor adverse impacts on historic structures throughout the park units.

*Cultural Landscapes*—The noise from the plugging equipment and the sight of the work crews and their equipment could adversely impact how visitors experience the cultural landscape at these sites. However, reclamation of sites and replanting with native vegetation would restore the natural character of the area, and may lessen any impacts related to disturbance in cultural setting or landscape. The new management framework under alternative B also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. With these specific reclamation activities, there could be both short-term minor adverse impacts and long-term beneficial impacts on cultural landscapes as a result of reclamation.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result of mitigation identified during consultation, plugging and reclamation activities that could occur on up to approximately 87 acres would result in negligible to minor adverse impacts on potential ethnographic resources under alternative B.

**Directionally Drilled Wells**—Impacts on cultural resources in the park units from wells directionally drilled from outside the park units to bottomholes beneath the park units could occur. Unknown subsurface archeological resources could be damaged by drilling through sites and cultural materials at drilling locations outside the park. Runoff or erosion could occur, impacting surface archeological sites within the park units, but it is unlikely that archeological sites in the park would be disturbed, due to the depth of the directional boreholes. Impacts could range from no impact to negligible adverse impacts on historic structures, cultural landscapes, and ethnographic resources, and to long-term minor adverse impacts on archeological sites, with a chance of major adverse impacts due to well blowouts, fires and uncontrolled releases. There would also be long-term beneficial impacts from the restoration of vegetation and natural site appearance.

### **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 A. The adverse and beneficial effects of the cumulative actions, when combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative B, would have long-term minor adverse cumulative impacts on cultural resources. The more proactive planning and enforcement under alternative B would help limit adverse impacts, but there could still be moderate adverse impacts on important unknown subsurface cultural sites. The actions under alternative B would contribute moderately to cumulative impacts.

### **Conclusion**

Impacts under alternative B would be similar to those described for alternative A for all cultural resources categories. It is expected that geophysical exploration under alternative B could result in long-term localized negligible to minor adverse impacts on cultural resources as a result of soil disturbance and

vibration. Considering the number of wells in areas where non-federal oil and gas operations would be permitted in the park, drilling and production activities under alternative B would have short-term and long-term negligible to minor adverse impacts on cultural resources as a result of impacts on soils, historic artifacts, and cultural landscapes. Increased inspections and monitoring and implementation of a comprehensive management plan under alternative B would better provide for the protection of cultural resources in the park. Overall, eventual reclamation of these sites and the cessation of operations under alternative B would result in localized short-term and long-term negligible to minor adverse impacts and long-term beneficial impacts on cultural resources. Under alternative B, wells directionally drilled and produced from outside the park units to bottomholes beneath the park, and the reclamation of these wells, could impact cultural resources within the park, with effects ranging from no impact to localized, long-term, negligible to minor, adverse impacts. There would also be long-term beneficial impacts from the restoration of vegetation and natural site appearance. Although up to major adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

The adverse and beneficial effects of the cumulative actions, when combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative B, would have long-term minor adverse cumulative impacts on cultural resources. The actions under alternative B could contribute moderately to cumulative impacts.

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C the NPS would establish SMAs to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C geophysical exploration would not be allowed in any of the SMAs, including those designated specifically to protect cultural resources, such as the Cultural Landscapes and Cemeteries and Cliff Edge SMAs unless approved in a plan of operations. At Obed WSR, designation of all federal lands within the boundaries of the park unit as an SMA would preclude these operations from occurring in the park unit.

*Archeological Resources*—The impacts under alternative C would be similar to those described for alternatives A and B. However, under alternative C there would be a No Surface Use restriction in the Cliff Edge SMA, where archeological sites are likely to occur unless approved in a plan of operations. Generally, a 100-foot setback would be required for all oil and gas operations (exploration, drilling, and production) unless an operator can demonstrate that these activities would not negatively impact the associated archeological resources and/or sites eligible for listing on the NRHP. In addition, previously described mitigation relating to cultural resource surveys, recovery of data (excavation), and preservation of recovered materials and associated records would be implemented. Some resources, such as cemeteries and rock shelter sites within the gorge at Obed WSR, would be protected by the SMAs, but there could still be impacts on unknown subsurface archeological resources. As a result, there could be long-term negligible to minor adverse impacts on archeological resources, with a reduced risk of disturbing significant unknown sites in and around protected SMAs.

*Historic Structures*—Farm structures, bridges, and a large steel coal-mine tippie have been identified as eligible for inclusion in the NRHP at Big South Fork NRR. Cemetery features are also considered

historic structures and would be identified as SMAs under alternative C in this plan. Unless otherwise approved in a plan of operations, there would be 100-foot setbacks from cemeteries for geophysical exploration from these cultural sites; this distance would help reduce vibrational impacts on the sites. With the SMA setbacks and mitigation described in appendix B, such as avoiding known cultural resources, conducting operations to minimize site disturbance, and not allowing operators to alter, destroy, or collect any object, structure, or site of historical, archeological, or cultural value, there would be localized long-term negligible adverse impacts on historic structures associated with these sites.

*Cultural Landscapes*—Eight cultural landscapes have been identified at Big South Fork NRR and would be identified as SMAs (e.g., Cultural Landscapes and Cemeteries SMA and Managed Fields SMA) under alternative C in this plan. Unless otherwise approved in a plan of operations, there would be a 1,500-foot setback for geophysical exploration from these cultural sites, and this distance would help reduce visual impacts on these sites. The noise from the seismic vibrator operations and the sight of the work crews and their equipment could adversely impact how visitors experience the cultural landscape at these sites. However, visual and noise impacts would be reduced based on the setback distance from the sites. With the mitigation described in appendix B, such as conducting surveys to document the location and significance of any cultural landscapes, there would be localized short-term negligible adverse impacts on the cultural landscapes associated with these sites.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result of mitigation recommended by this consultation, geophysical exploration activities would result in no impact or negligible adverse impacts on potential ethnographic resources.

**Drilling and Production**—Under alternative C, the operations would be the same as under alternatives A and B; however, there would be No Surface Use restrictions in the Cultural Landscape and Cemeteries and Managed Fields SMAs, and setbacks would be required from the outer boundary of the SMA unless approved in a plan of operations. A 100-foot setback from cemeteries and a 1,500-foot setback from cultural landscapes would be required for all operations, and there would be a No Surface Use restriction in the Cliff Edge SMA unless approved in a plan of operations. Generally, a 100-foot setback would be required for all oil and gas operations (exploration, drilling, and production) unless an operator can demonstrate that these activities would not negatively impact the associated resources.

*Archeological Resources*—Impacts from drilling and production under alternative C would be similar to those described under alternatives A and B. There could be potential adverse impacts on cultural resources from the construction and maintenance of access roads, wellpads, flowlines, and pipelines under alternative C, with up to 36 acres of new development in Big South Fork NRR. Impacts to most sites would be avoided or mitigated by applying the SMA restrictions and CLPRs, and a qualified third-party monitor would be present during appropriate operational phases to help protect subsurface resources. If buried cultural resources cannot be avoided, impacts would be mitigated by recovery of data (excavation) and preservation of recovered materials and associated records. However, the loss of any undetected cultural resources would have an irreversible adverse impact. Increased access to areas by drilling crews 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 have an adverse impact. SMAs would provide protection for cemeteries and other sensitive resource areas, such as the gorge at Obed WSR, but they may not provide direct protection for unknown archeological sites, so impacts on archeological resources parkwide may be similar to those described for the other alternatives, unless wells are directionally drilled from outside the parks to avoid SMAs of any kind. Taking into consideration the

number of wells to be drilled parkwide, there could be long-term negligible to minor adverse impacts on archeological sites, but with less risk of disturbing significant unknown sites in and around SMAs.

*Historic Structures*—All of the known historic structures are visible and would not be damaged by construction activities associated with drilling and production. With the Cultural Landscapes and Cemeteries SMA setbacks and mitigation measures described in appendix B, such as avoiding known cultural resources, conducting operations to minimize site disturbance, and not allowing operators to alter, destroy, or collect any object, structure, or site of historical, archeological, or cultural value, there would be localized long-term negligible adverse impacts on historic structures associated with these sites.

*Cultural Landscapes*—The noise from the drill rigs and the sight of the work crews and their equipment could adversely impact how visitors experience the cultural landscape at these sites. The height of drill rigs would make them readily visible through clearings and open spaces. The operations, especially drilling, would increase the presence of work crews and equipment, especially since drilling is a 24-hour operation. However, visual and noise impacts would also be reduced based on the setback distance from the sites. With the Cultural Landscapes and Cemeteries SMA setbacks and mitigation measures described in appendix B, such as avoiding known cultural resources, there would be localized long-term negligible adverse impacts on the cultural landscapes associated with these sites.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that potential adverse impacts are mitigated. As a result, drilling and production and pipeline operations that could occur on up to 36 acres at Big South Fork NRR and 3 acres at Obed WSR would result in no impact or negligible adverse impacts on potential ethnographic resources.

*All Cultural Resources*—Although up to major adverse impacts could occur in the unlikely event of a well blowout, fire, or uncontrolled release (as described for alternative A), the risk of that occurring is less under alternative B due to increased monitoring and inspections.

**Plugging and Reclamation**—Similar to alternatives A and B, well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could disturb soils and damage cultural resources.

*Archeological Resources*—Impacts under alternative C for well plugging; shutting down, abandoning, and removing flowlines and pipelines; and use of heavy equipment and vehicles during reclamation activities would be the same as under alternatives A and B. As with alternatives A and B, it is assumed that previously drilled wells have displaced any extant cultural material. During reclamation activities within the Big South Fork NRR, it is possible that soils containing cultural material would be disturbed, thus displacing or destroying subsurface artifacts and resulting in long-term minor adverse impacts under alternative C from plugging, abandonment, and reclamation operations.

*Historic Structures*—Potential adverse impacts on historic structures from plugging, abandonment, and reclamation operations, such as displacement of or damage to built features from vibrations and/or movement of soils containing structural remains, would be mitigated by avoiding historic structures. With the Cultural Landscapes and Cemeteries SMA setbacks, there would be localized long-term negligible adverse impacts on historic structures associated with these sites.

*Cultural Landscapes*—Within the Cultural Landscapes and Cemeteries and Managed Fields SMAs setback areas, there would be localized long-term negligible adverse impacts on the cultural landscapes associated with these sites. The noise from the drill rigs and the sight of the work crews and their

equipment could adversely impact how visitors experience the cultural landscape at these sites. However, visual and noise impacts would also be reduced based on the setback distance from the sites. Reclamation of sites and replanting with native vegetation would restore the natural character of the area, and may lessen any impacts related to disturbance in cultural setting or landscape. There could be both short-term minor adverse impacts and long-term beneficial impacts on cultural landscapes as a result of reclamation.

*Ethnographic Resources*—Consultation with the seven tribes, as described in chapter 3, would be undertaken as project-specific plans of operations are developed, in the effort to identify ethnographic resources and associated community concerns and ensure that they are not adversely impacted by proposed oil and gas operations. As a result, plugging and reclamation activities that could occur on up to 94 to 106 acres at Big South Fork NRRA and 7 acres at Obed WSR, plugging and reclamation activities that could occur in the park units would result in no impact or negligible adverse impacts on potential ethnographic resources.

**Directionally Drilled Wells**—Impacts on cultural resources in the park units from wells directionally drilled from outside the park units or SMAs to bottomholes beneath the park units or SMAs could occur. Unknown subsurface archeological resources could be damaged by drilling through sites and cultural materials at drilling locations outside of the park, but it is unlikely that archeological sites in the park would be disturbed, due to the depth of the directional boreholes. Runoff or erosion could occur, impacting surface archeological sites within the park units. Impacts could range from no impact to negligible adverse impacts on historic structures, cultural landscapes, and ethnographic resources, to long-term minor adverse impacts on archeological sites with a chance of major adverse impacts due to well blowouts, fires and uncontrolled releases. There would also be long-term beneficial impacts from the restoration of vegetation and natural site appearance.

### **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 A. The adverse and beneficial effects of the cumulative actions, when combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative C, would have long-term minor adverse cumulative impacts on cultural resources. The more proactive planning and enforcement under alternative C and the prohibition of geophysical exploration and drilling/production in certain SMAs with high cultural resource values would help limit adverse impacts, but there could still be moderate impacts on important unknown subsurface resources, although there would be a much lower level of risk compared to the other alternatives. The actions under alternative C would contribute moderately to cumulative impacts.

### **Conclusion**

Impacts under alternative C would be similar to alternatives A and B, although SMAs and setbacks that were designed to protect cultural resources and directional drilling from outside the park to avoid SMAs would more fully protect some sensitive cultural sites (such as cemeteries and rock shelter sites within the gorge) from impacts. It is expected that geophysical exploration under alternative C would result in short- and long-term localized negligible to minor adverse impacts on cultural resources as a result of soil disturbance and vibrations. In areas where non-federal oil and gas operations would be permitted in the park, drilling and production activities under alternative C would have short-term and long-term negligible to minor adverse impacts on cultural resources as a result of impacts on soils, historic artifacts, and cultural landscapes. Eventual reclamation of these sites and the cessation of operations under alternative C would result in localized short-term and long-term negligible to minor adverse impacts and long-term beneficial impacts on cultural resources. Under alternative C, wells directionally drilled and produced from outside the park units to bottomholes beneath the park units, and the reclamation of these



wells, could impact cultural resources within the park, resulting in effects ranging from no impact to localized, long-term, negligible to minor, adverse impacts. There would also be long-term beneficial impacts from the restoration of vegetation and natural site appearance. Although up to major adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections and SMA protection.

Cumulative impacts would be similar to those described for alternative B, with long-term minor adverse cumulative impacts on cultural resources. The actions under alternative C would contribute moderately to cumulative impacts because of the continued potential for moderate adverse impacts on important unknown subsurface cultural sites, but the designation of SMAs with a No Surface Use stipulation would result in a lower probability of harm to previously unidentified cultural resources in SMAs from ground-disturbing activities.

## **VISITOR USE AND EXPERIENCE**

### **GUIDING REGULATIONS AND POLICIES**

The NPS *Management Policies 2006* (NPS 2006c) state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all park units and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the park units (NPS 2006c, section 8.2). Similarly, NPS *Management Policies 2006* state that the NPS and its concessioners, contractors, and cooperators will “seek to provide a safe and healthful environment for visitors and employees.” Further, NPS *Management Policies 2006* state that the NPS will “strive to identify and prevent injuries from recognizable threats to the safety and health of persons and to the protection of property by applying nationally accepted codes, standards, engineering principles, and the guidance of Director’s Orders 50B, 50C, 58, and 83 and their associated reference manuals” (NPS 2006c, section 8.2.5.1).

The importance of visitor use and experience is highlighted in the Big South Fork NRRRA 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 NRRRA.

### **METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS**

Potential impacts on visitor use and experience were considered for all phases of oil and gas development. Several topics are described in this section in order to focus on those attributes that contribute to a positive visitor experience at the park: public access, visual quality/night sky, natural soundscapes, odors, and human health and safety (soundscapes are addressed in detail in a separate section of this chapter and only referenced here). Oil and gas operations that are anticipated under the RFD scenario and the forecast of oil and gas activities are analyzed in this section. In addition, the impacts of CLPRs, including regulatory requirements, operating stipulations, and mitigation measures relevant to visitor use and experience, are described in the following section.

The impact intensity threshold definitions are based on the potential for changes to visitor use and experience characteristics, as follows:

- Negligible:* Visitors would not likely be aware of the effects associated with implementation of an alternative. Current visitor experience and use would remain without derogation of park resources and values.
- Minor:* Visitors would likely be aware of the effects associated with implementation of an alternative; however, the changes to visitor experience and use would be slight and a small number of visitors would be affected. Current visitor experience and use would remain without derogation of park resources and values.
- Moderate:* Changes in visitor use and experience would be readily apparent and would likely affect a small number of visitors. Current visitor experience and use would remain without derogation of park resources and values, but visitor satisfaction might be measurably affected. Some visitors who desire to continue their use and enjoyment of the activity/visitor experience at current levels would be required to pursue their choice in other available local or regional areas.
- Major:* Visitors would be highly aware of the effects associated with implementation of an alternative. The change in visitor use and experience would affect many visitors and would preclude future generations of some visitors from enjoying park resources and values. Some visitors who desire to continue their use and enjoyment of the activity/visitor experience would be required to pursue their choice in other available local or regional areas.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Given the restrictions at Obed WSR, these operations would not be allowed within the park unit.

**Access**—During implementation, seismic operations may preclude use of the survey areas including some park roads by fishermen, hikers, hunters, and other visitors to Big South Fork NRR. Mitigation measures provided for in appendix B, such as scheduling operations outside of peak visitation periods, would minimize impacts on visitor access. Given these mitigation measures, the limited amount of geophysical exploration expected during the life of this plan, the minimal amount of disturbance, and the limited duration (weeks) of conventional seismic surveys, there would be short-term localized negligible to minor adverse impacts on visitors as a result of access restrictions.

**Visual Quality**—During geophysical operations, the flagging used to mark site lines and the presence of oil and gas personnel and their vehicles could cause adverse visual impacts for visitors to Big South Fork NRR. CLPRs and mitigation that would minimize visual impacts include a 500-foot setback from waterways, visitor use areas, and administrative and other use areas; removing trash and debris; and

removing flagging after surveys are completed. With mitigation, the limited geophysical exploration operations expected would result in localized short-term negligible to minor adverse impacts on visual quality.

*Noise*—Noise associated with seismic surveys would occur from the use of vehicles and Vibroseis® trucks, personnel working in the area, and other equipment used, such as chainsaws. Noise generated by the seismic vibrator operations would be intermittent and typically over a period of one to three days. With the implementation of operating stipulations and mitigation measures, noises associated with geophysical exploration operations would result in localized short-term negligible to minor adverse impacts.

*Odors/Health and Safety*—Seismic surveys would not be expected to contribute many offensive odors or smells, unless spills of fuels or other hazardous chemicals occurred or exhaust fumes were particularly offensive. However, seismic exploration could expose park visitors to hazards associated with increased vehicular traffic. Setbacks required from visitor use and administrative areas under 36 CFR 9.41(a) would help separate visitors from seismic operations. Warning signs would be posted and notices placed in the park and the local newspaper about the operations. All generated wastes would be cleaned up and disposed of promptly. The seismic survey would have health-and-safety plans in place in order for their plan of operations to be approved. With these stipulations and mitigation measures in place, and given the limited extent of seismic exploration expected, there would be short-term localized negligible to minor adverse human health and safety impacts on visitors.

**Drilling and Production**—Surface drilling and production operations (including the placement of flowlines) would not directly impact visitor use and experience in protected areas, where operations would not be permitted under CLPRs, including the 9B regulations, the gorge restrictions at Big South Fork NRA, and deed restrictions at Obed WSR. However, as described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRA, and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR. It is also assumed that 125 wells at Big South Fork NRA and 2 wells at Obed WSR would be worked over or serviced.

*Access*—Where drilling and production operations would be permitted in Big South Fork NRA, the operation areas (access roads and wellpads) would be closed to visitor access. Under the RFD scenario and the forecast of oil and gas operations, drilling and production operations could restrict visitation on up to 36 additional acres in the park unit over a 15 to 20 -year period. Due to safety concerns, 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 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 new drilling and production expected in Big South Fork NRA, it is assumed that few visitors would be affected by restricting access to 36 acres of the park unit, and current visitor use and experience would remain relatively unchanged from new operations, although the planned workovers and servicing of existing operations could cause access delays or restrictions. Overall, impacts on visitor access would be long term, minor, and adverse.

*Visual Quality*—Visual impacts on visitor experience from drilling and production operations would be more substantial than other types of impacts, especially if wellpads were placed in relatively undisturbed settings where visitors would be readily able to see the operation and all associated equipment and tanks. Although the rigs used in Tennessee and Kentucky are usually slightly smaller, drill rigs can reach heights of 180 feet, which would be visible from several locations within the park. Rigs may also be visible to park visitors in boats at Big South Fork NRA on the Big South Fork Cumberland River or any of its

tributaries, and at Obed WSR on the Obed River or Clear Creek. Site clearing would remove up to 1.5 acres of vegetation for each wellpad, and access road construction would result in visible cuts through park vegetation, depending on determination of the least impacting methods to be used. Lighting of the drilling rig could interfere with visitors' night-sky views, depending on where the operations are sited. The operations, especially drilling, would increase the presence of work crews and equipment. Since drilling is a 24-hour, 7-day a week operation, these impacts would be continuous, and could last a week or two up to a few months.

Production operations, although having a less intrusive human presence, would be visible for 20 years or longer. Coming across an oil production rig could be an unpleasant experience for visitors seeking a natural, outdoor experience at the Big South Fork NRR. The visual presence of oil and gas operations in a natural setting would adversely impact the areas by displacing the visitor or lessening the quality of the visitor experience.

Mitigation measures that would reduce visual impacts during drilling and production operations include a 500-foot setback for visitor use areas and siting the wellpads so they are screened from view by vegetation and topography. Flowlines would be sited to minimize additional land disturbances. Drilling and production equipment could be painted to blend in with the surrounding environment. Sites would be kept clean and orderly, and any spills, waste, or trash would be promptly cleaned up and removed from the operations site. There are also several measures that can be used to mitigate the effects on night sky that would adversely affect visitor experience in the immediate area.

With the implementation of these measures, impacts on visual quality could range from localized, short term, moderate, and adverse during drilling or workovers to long term, minor to moderate, and adverse during production. The impacts would be less for those visitors less concerned with the presence of such operations, and where operations are naturally screened from view.

*Noise*—As discussed in more detail elsewhere in the chapter, there would be increased noise from construction activities (vehicles, chainsaws, and earthmoving equipment), drilling rigs, and the drilling or workover crew that could adversely affect visitor use and experience. 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 noted in the “Soundscapes” section (table 32), a drill rig at a distance of 1,600 feet is associated with a noise level of about 45 dBA, while near the drill rig, sound levels are approximately 75 dBA. The 500-foot setback required for visitor use and administrative areas under the NPS 36 CFR 9B regulations would result in reducing the adverse impacts from drilling rig noise, but would not reduce sounds to background levels. As a result, there would be short-term localized moderate adverse impacts from drilling operations if they were close enough to a visitor use area (including cultural landscapes) to cause interference with the enjoyment or use of the area, and would conflict with visitor goals of having a natural outdoor or other desired experience.

Production operations would also cause long-term localized minor to moderate adverse impacts because of the noise associated with production equipment and the short-term use of loud machinery and workover rigs on site. However, most noise levels associated with production would be substantially less than those generated by a drilling operation.

*Odors/Health and Safety*—The primary source of odors would be from drilling or production operations, especially if spills or leaks occurred and oil or other chemicals were not quickly cleaned up and removed from the site. Mitigation measures to reduce adverse impacts from odors include the setbacks required under CLPRs, since odors would dissipate with increasing distance from the source. Also, proper handling of hazardous or contaminating substances would be required, including keeping lids on

containers, cleaning up spills, and preventing blowouts. With adequate setbacks and implementation of these measures, there would be short-term negligible to minor adverse impacts due to odors.

Drilling and production have the potential for well blowouts and releases of hydrocarbons or other hazardous substances, including drilling muds and gases such as H<sub>2</sub>S. Pumpjacks with automatic timers are also a safety hazard. Visitors could also be drawn to wellpads and sites out of curiosity, resulting in potential exposure to dangerous equipment or stored chemicals. Hunters, in particular, would need to keep a safe distance from oil and gas operations and avoid shooting near drilling rigs and production facilities (i.e., storage tanks, wellheads, and pumpjacks). There is the possibility of storm damage to drilling and production operations, which could spread hazardous and contaminating substances. Perforating or rupturing a storage tank containing oil, produced water, or treatment chemicals at a production facility would increase the threat of spills and subsequent harm to the public.

One of the biggest concerns for human health and safety is the potential exposure to hazardous and contaminating materials. During drilling and production operations, all potentially hazardous materials would be kept in completely enclosed storage containers. Drilling and production 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 and produced water 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 that operations are conducted in a manner that minimizes the potential for spills and provides for rapid spill response and cleanup, but there would not be inspections or monitoring beyond baseline workload levels under alternative A. 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.

In general, the required setbacks between oil and gas sites 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, security guards (during active drilling), secondary containment (liners and berms), and fencing around the pad and all associated tanks and equipment. In some situations, the park superintendent can restrict public access on any roads constructed and used exclusively for accessing oil and gas operations to safeguard human health and safety, and as may be necessary to protect park resources. The Big South Fork GMP states that oil and gas access roads should not be used for recreational use unless identified as part of the official roads and trails.

Precautions would also be taken to prevent well blowouts and the sudden accidental release of H<sub>2</sub>S during drilling operations. A well blowout could cause unpredictable damage near the well site. A blowout could release H<sub>2</sub>S and other gases, drilling fluids, formation waters, oil, or natural gas under pressure, which could spread some distance from the well site. If fires occurred, SO<sub>2</sub> could be produced. Preventing blowouts during drilling operations can be accomplished by using experienced drilling personnel, following required operating stipulations, and implementing mitigation measures that address high-pressure precautions (see appendix B). These measures include proper design and use of drilling muds, constant monitoring of the characteristics and volume of drilling mud to manage drilling conditions, and proper casing and cementing. Wells must be equipped with blowout preventers, which are tested periodically and can be used to shut in the well if needed. Plans of operations would also include an emergency response plan that would address H<sub>2</sub>S. For those wells that may emit H<sub>2</sub>S, a radius-of-exposure analysis would be performed prior to site selection.

However, the NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact visitor use and experience, depending on the location of the

release. 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 such as use of blowout preventers and implementation of SPCC plans would result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release.

Given the limited extent of drilling and production operations described in the forecast of oil and gas operations, as well as the operating stipulations and mitigation measures described previously, there would be short-term minor adverse impacts on human health and safety during drilling, and long-term minor adverse impacts during production.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

*Access*—Plugging and reclamation operations would have public access impacts similar to those described for drilling and production, but would be limited in duration to the time needed to plug and reclaim each operations site. Reclamation operations would not interfere substantially with visitor access, and when completed, would restore access to areas previously off-limits to visitors. Therefore, although there would be short-term minor adverse impacts on visitor access from activities related to plugging and reclamation of oil and gas production sites, these activities would ultimately result in long-term beneficial effects for visitors under alternative A.

*Visual Quality*—The presence of earthmoving, demolition, and other equipment associated with plugging and reclamation activities would have similar impacts on visual quality as described for drilling and production operations. Considering the smaller equipment that would be used and the greater number of wells to be plugged and reclaimed as compared to those that would be drilled and produced, there would be short-term (for the duration of the operation), minor to moderate, adverse impacts on visual quality during these activities.

However, plugging and reclamation would end disturbances from production activities, and the sites would be restored to their original character, although some roads may be left in place for private mineral access in the future. Reclamation of the wellpads following plugging of the wells would serve to reduce long-term visual impacts and eliminate the unnatural views of the site. The actual time required to reclaim the site's visual quality would depend on many factors, including the erosion potential of the site, productivity of the vegetation, topography, and soil characteristics, including contamination. The time needed for recovery could last from 1 to 3 years for grasses and shrubs, the predominant vegetation on the site, although it could take longer. Ultimately, the removal of the rig and associated structures and equipment, in conjunction with site reclamation, would have long-term localized beneficial effects on visual quality near the well sites.

*Noise*—The operations involved in site closure would cause temporary increases in noise from earthmoving, demolition, and other equipment, as described for drilling and production. However, mitigation measures would be used to reduce engine noise and to avoid peak visitor use periods. In addition, when closure and reclamation are completed, noise levels would return to background levels. As a result, there would be short-term minor adverse impacts on visitor experience from noise near the reclamation areas. However, plugging and reclamation would end noise disturbances from production activities, and would ultimately have long-term beneficial effects on visitor use and experience in the vicinity of the well sites.

*Odors/Health and Safety*—There could be odors during plugging and reclamation operations from heavy-equipment exhaust and from leaks and spills. Mitigation measures to reduce adverse impacts on visitor use and experience include the setbacks required under CLPRs, since odors would dissipate with increasing distance from the source. Also, proper handling of hazardous materials and contaminating materials would be required, including secondary containment, and promptly cleaning up spills. As a result, there would be short-term minor adverse impacts on odors and health and safety during plugging and reclamation activities.

Once plugging and reclamation is complete, there would be long-term beneficial impacts on odors and health safety issues associated with producing wells, as described in the previous section. Plugging and reclamation of orphaned wells would contribute to these beneficial effects by removing threats associated with exposure to hazardous wellhead equipment, ignition of flammable gases, possible flowline ruptures, and ingestion, inhalation, or absorption of spilled or released hydrocarbons, contaminants, or hazardous substances.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park units to bottomholes beneath them could indirectly impact visitor use and experience in the park, especially with regard to noise and visual impacts that can be experienced from within the park. The types of impacts are expected to be similar to those described above for operations inside the park, with the intensity of impacts depending on the proximity of operations to the park; site-specific environmental conditions, such as accessibility, slope, vegetation screening, and topography; and mitigation measures being employed. In addition, directionally drilled wells exempted from the NPS 36 CFR 9B regulations under 9.32(e) may not be fenced or signed, as is required of operations inside the park. Based on these factors, indirect impacts on visitor use and experience in the park could range from no impact to indirect, localized, short- to long-term, negligible to moderate, adverse impacts, with a chance of major impacts if a blowout, fire or large uncontrolled release occurred close to high visitor use areas in the park. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to visitor use and experience are expected to diminish and contribute less to cumulative impacts over time. However, several cumulative actions discussed in the “Cumulative Impacts Scenario” section of this chapter have the potential to contribute adverse cumulative effects on visitor use and experience at the park units. 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 short-term minor adverse impacts. Another maintenance activity for Big South Fork NRRA is prescribed fires. This activity could have short-term negligible to minor adverse 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 long term and beneficial subsequent to the prescribed fires due to the restoration of native plant communities associated with the fires. Remediation of existing oil and gas contamination in proximity to recreational sites, such as the Howard/White Unit No. 1 oil well on the boundary of Obed WSR, has the potential to contribute to cumulative impacts, which would have short- and long-term moderate adverse impacts on visitor use and experience. Agricultural activities on land adjacent to the park units, primarily logging activities and hay production, could result in long-term negligible 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 long-term adverse impacts on visitor use and experience.

In addition to traditional oil and gas development, coal bed methane/shale gas drilling is an ongoing feature in the vicinity of the park units. Further, there are ongoing mining operations around the park units. These activities could affect visitor use and experience due to noise and visual effects associated with these operations. In addition, acid mine drainage associated with active and abandoned mines impacts water resources, which can affect water-based recreation in the park units. Acid mine drainage could pose health and safety risks to visitors if they were to come into direct contact with such drainage, or indirect contact as a result of polluted water resources. Other 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 who are in the vicinity of these activities. Lastly, reclaiming some abandoned mine lands could result in long-term beneficial impacts on visitor use and experience due to the removal of abandoned mines and additional land becoming available to various visitor uses.

Additional cumulative actions that would have beneficial effects on visitor use and experience include, for example, the NPS's recent plan to plug and reclaim 14 abandoned wells at Big South Fork NRRRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Another 39 wells would be plugged and reclaimed using ARRA funding. The plugging and reclamation of these wells has resulted and would result in long-term beneficial impacts on visitor use and experience due to the improved condition of the sites. Additionally, the NPS has published an advance notice of proposed rulemaking in the Federal Register regarding a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 visitor use and experience, due to improving resource protection practices.

Overall, when the impacts of these actions are combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, there would be short- and long-term minor adverse cumulative impacts on visitor use and experience. Mitigation required under CLPRs would help minimize adverse impacts and protect visitors and staff in the park units. When compared to the area of analysis for this topic, alternative A would contribute moderately to both adverse and beneficial cumulative impacts.

## **Conclusion**

It is expected that geophysical exploration would result in short-term localized negligible to minor adverse impacts on park visitors as a result of temporary access restrictions and effects on visual quality, noise, odors, and human health and safety. In areas where non-federal oil and gas operations would be permitted in the park, drilling and production activities would have short- and long-term minor to moderate adverse impacts on visitor use and experience as a result of impacts on access, visual quality, noise, and health and safety. There would be long-term negligible to minor adverse impacts on odors. Eventual reclamation of sites at the cessation of operations would result in a localized long-term beneficial impact on visitor use and experience. Temporary effects on access, visual quality, noise, odors, and human health and safety would be short term, minor to moderate, and adverse. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact visitor use and experience in the park, with impacts ranging from no impact



to mostly indirect, localized, short- to long-term, negligible to moderate, adverse impacts. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts. For both in-park and adjacent directionally drilled wells, up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release if the event occurred in a high use visitor area.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would result in short- and long-term minor adverse cumulative impacts on visitor use and experience. The actions under alternative A would contribute moderately to both adverse and beneficial cumulative impacts in and around the park units.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRR, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. As a result, impacts associated with geophysical exploration in alternative B related to access, visual quality, noise, and health and safety would be very similar to the impacts described in alternative A, and would be localized, short term, negligible to minor, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRR and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workover/servicing would be very similar to the impacts described in alternative A. These activities would affect visitor use and experience as a result of restricted visitor access, visual impacts on visitor experience from drilling and production operations, increased noise from construction activities, increased odors, and increased human health and safety risks.

However, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRR and Obed WSR. Additionally, increased inspections and monitoring under alternative B would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production would still occur, this alternative would protect park resources and values, which form the basis for a positive visitor experience and allow diverse visitor uses, better than alternative A. Therefore, impacts on visitor use and experience due to drilling and production under alternative B might be slightly less adverse than under alternative A as a result of implementing the oil and gas management plan. With the exception of the unlikely event of a blowout, fire, or large uncontrolled release, impacts on visitor use and experience are expected to be short term, minor, and adverse during drilling (with possible short-term moderate adverse impacts due to unavoidable noise), and long term, negligible to minor, and adverse from production, as a result of temporary access restrictions and the effects on visual quality, noise, odors, and human health and safety.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

However, under alternative B the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRR and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities. The new management framework for plugging and reclamation would promote the plugging and reclamation of wells to applicable standards, but the impacts are expected to be the same as under alternative A. Temporary effects on access, visual quality, noise, odors, and human health and safety would be short term, minor to moderate, and adverse. Under this alternative the long-term beneficial effects described under alternative A would be more likely to be realized sooner, including increased visitor access, reduced visual impacts, decreased noise disturbances, and reduced health and safety impacts.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact visitor use and experience in the park, as described for alternative A. Impacts on visitor use and experience in the park units could range from no impact to indirect, localized, short- to long-term, negligible to minor, adverse impacts, with a chance of major impacts if a blowout, fire or large uncontrolled release occurred close to the park. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts.

### **Cumulative Impacts**

Impacts on visitor use and experience from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The effects of these actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative B, would have short- and long-term minor adverse cumulative impacts on visitor use and experience. The actions under alternative B would contribute moderately to both adverse and beneficial cumulative impacts in and around the park units.

### **Conclusion**

Similar to alternative A, it is expected that geophysical exploration under alternative B would result in short-term localized negligible to minor adverse impacts on park visitors as a result of temporary access restrictions and effects on visual quality, noise, odors, and human health and safety. In areas where non-federal oil and gas operations would be permitted in the park, drilling and production activities would have short- and long-term mostly minor adverse impacts on visitor use and experience as a result of impacts on access, visual quality, noise, odors, and health and safety, with possible short-term moderate adverse impacts due to unavoidable noise. Eventual reclamation of these sites at the cessation of operations would result in long-term localized beneficial impacts on visitor use and experience. Temporary effects on access, visual quality, noise, odors, and human health and safety would be short term, negligible to moderate, and adverse. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact visitor use and experience in the park, with effects ranging from no impact to mostly indirect, localized, short- to long-term, negligible to moderate, adverse impacts. However, reclamation of wells directionally drilled

from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

Impacts on visitor use from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative B, would have short- and long-term minor adverse cumulative impacts on visitor use and experience. The actions under alternative B would contribute moderately to both adverse and beneficial cumulative impacts.

### **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

#### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C, with the establishment of SMAs to further protect resources and values, impacts would be reduced in these areas. Geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRA, with the exception of the Special Scenery SMA unless approved in a plan of operations. Geophysical exploration would be allowed in this SMA at any time, while drilling activities in these areas would be limited during high visitor use periods (generally April through October). Since minimal geophysical exploration is expected and would include use of existing roads and pedestrian access, and would be limited to low visitor times during high visitor use periods, impacts on visitor use and experience associated with geophysical exploration in alternative C would be localized, short term, negligible, and adverse.

**Drilling and Production**—Under alternative C, actions would be limited or restricted in SMAs, unless otherwise approved in a plan of operations. Drilling and production would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRA. As with geophysical exploration, timing stipulations for drilling and production would apply in the SMAs for visitor use/administrative areas, trails, and cemeteries at this park unit. Timing stipulations would also apply in the Special Scenery SMA for drilling operations. Production activities would be allowed in the Special Scenery SMA based on the outcome of the viewshed analysis required under this alternative. There would be a No Surface Use restriction in the Sensitive Geomorphic Feature SMA, and a 500-foot setback would be required for drilling and production operations. There would be a No Surface Use restriction in the Cliff Edge SMA, and a 100-foot setback would be required for all oil and gas operations (exploration, drilling, and production) unless an operator can demonstrate that these activities would not negatively impact the associated resources, and timing restrictions may be applied to drilling operations to minimize impacts on species of special concern and to avoid impacts on soils from rutting.

There would be a No Surface Use restriction in the Managed Fields SMA, and a 100-foot setback for drilling and production. There would be a No Surface Use restriction in the Visitor Use/Administrative Area SMA, and a 1,500-foot setback would be required from the outer boundary of the SMA for drilling and production. All operations in the Visitor Use/Administrative Area SMA would be limited to low visitor times during high visitor use or visitation periods (generally April through October) to minimize impacts on visitors. There would be a No Surface Use restriction in the Cultural Landscapes and Cemeteries SMA, and a 100-foot setback from cemeteries and a 1,500-foot setback from cultural

landscapes would be required for all operations. All operations within the Cultural Landscapes and Cemeteries SMA would be limited during high visitor use or visitation periods (generally April through October) to minimize impacts on visitor use and experience. Trails would require a 300 foot setback for all operations. At Obed WSR, all federal property within the boundaries of the park unit would be subject to No Surface Use restrictions at all times of the year. Drilling and production activities would affect visitor use and experience as a result of restricted visitor access within Big South Fork NRRRA; visual impacts on visitor experience from drilling and production operations, especially if wellpads were placed in relatively undisturbed settings where visitors would readily be able to see the operation and all associated equipment and tanks; site clearing, which would remove up to 1.5 acres of vegetation for each wellpad; access road construction, which would result in visible cuts through park vegetation; and lighting of the drilling rig, which could interfere with visitors' night-sky views; increased noise from construction activities (vehicles, chainsaws, and earthmoving equipment), drilling rigs, and the drilling crew; increased odors from drilling or production operations, especially if spills or leaks occurred; and increased human health and safety risks due to the potential exposure to hazardous and contaminating materials.

Under alternative C the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. In addition, SMAs with restrictions on oil and gas exploration, drilling, and production activities would be established. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production would still occur, this alternative would protect park resources and values, as well as visitor use and experience, better than alternatives A and B. Therefore, impacts on visitor use and experience due to drilling and production under alternative C would be less adverse than under alternative B as a result of establishing the SMAs. With the exception of the unlikely event of a blowout, fire, or large uncontrolled release, impacts on visitor use and experience are expected to be short term, localized, negligible to minor, and adverse during drilling, with some areas subject to short-term moderate adverse noise impacts; and long term, negligible to minor, and adverse on visual quality, noise, odors, and human health and safety during production.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

However, under alternative C the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR, and would also establish several SMAs. Like alternative B, alternative C includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. SMAs would be used to prioritize the sites for plugging, and sites that present any hazard would be higher on the list for action. As a result, short-term impacts from these operations would still occur, but the new management framework for plugging and reclamation and SMA prioritization would increase the certainty that wells would be plugged and reclaimed to applicable standards and public hazards would be addressed quickly. Therefore, under this alternative, the long-term beneficial effects described under alternative A would be more likely to be realized sooner, including increased visitor access, reduced visual impacts, decreased noise disturbances, and reduced health and safety impacts.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact visitor use and experience in the park, as described for alternatives A and B. Impacts on visitor use and experience in the park units could range from no impact to indirect, localized, short- to long-term, negligible to moderate, adverse impacts, with a chance of major impacts if a blowout, fire or large uncontrolled release occurred close to the park. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts.

### **Cumulative Impacts**

Impacts on visitor use and experience from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The effects of these actions, when combined with the short- and long-term negligible to mostly minor adverse impacts as well as the long-term beneficial effects of alternative C, would have short- and long-term negligible to minor adverse cumulative impacts on visitor use and experience. The actions under alternative C would contribute moderately to both adverse and beneficial cumulative impacts.

### **Conclusion**

Under alternative C, with designation of SMAs and setbacks that preclude surface uses, it is expected that geophysical exploration would result in short-term localized negligible adverse impacts on park visitors as a result of temporary access restrictions and effects on visual quality, noise, odors, and human health and safety. With implementation of mitigation measures, and the establishment of SMAs with setbacks and/or timing to avoid high use visitor use periods, drilling and production activities would have short-term localized negligible to mostly minor adverse impacts on visitor use and experience during drilling, and long-term negligible to minor adverse impacts from the effects on visual quality, noise, odors, and human health and safety during production. Eventual reclamation of these sites at the cessation of operations would result in long-term localized beneficial impacts on visitor use and experience. Temporary effects on access, visual quality, noise, odors, and human health and safety would be localized, short term, negligible to minor, and adverse. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact visitor use and experience in the park, with impacts ranging from no impact to indirect, localized, short- to long-term, negligible to minor, adverse impacts. However, reclamation of wells directionally drilled from outside the park units to bottomholes beneath them would also result in long-term beneficial impacts on visitor use and experience, including visual quality, noise, odors, and human health and safety. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative C due to increased monitoring and inspections.

Cumulative impacts would be similar to those described for alternative B, with short- and long-term negligible to minor adverse cumulative impacts on visitor use and experience. The actions under alternative C would contribute moderately to both adverse and beneficial cumulative impacts.

## **PARK MANAGEMENT AND OPERATIONS**

### **GUIDING REGULATIONS AND POLICIES**

Park management and operations refers to the current staff available to adequately protect and preserve vital park resources and provide for an effective visitor experience. This topic also includes the operating budget necessary to conduct park operations.

## METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

Impacts were qualitatively assessed by comparing where surface uses would be permitted for oil and gas development in the park and determining whether this could affect park staff's ability to manage permitting activities as well as other natural-resource-related activities mandated by law, regulation, agreement, or litigation. The revised RFD scenario and the forecast of oil and gas activities presented in chapter 2 projects the number of wells that are anticipated to develop the hydrocarbons underlying the park over the next 15–20 years. Specific locations of hydrocarbon accumulations in the park are unknown, and the NPS cannot speculate where operators would conduct their operations. Because of the uncertainties of the petroleum industry and the financial considerations inherent in each operation, it is not possible to quantify the impacts on park operations and facilities; therefore, the estimates of the intensity of impact (negligible, minor, moderate, and major) presented in the following section are qualitative.

As individual projects are proposed, site-specific impact analyses would be conducted (as required under NEPA), which would further refine the assessment of environmental effects. This assessment of impacts is based on best professional judgment. The impact analysis area for evaluating direct and indirect effects, in addition to cumulative effects, is the Big South Fork NRR and Obed WSR (both park operations and facilities).

The impact intensity threshold definitions are based on the potential for changes to park management and operations characteristics, as follows:

*Negligible:* Actions would have no measurable impact on management or operation of the park units.

*Minor:* Actions would affect park management and operations in the park units in a way that would be difficult to measure. The impacts from oil and gas management would have little budgetary or material effect on other ongoing park management programs or operations, and would not be noticeable to the public.

*Moderate:* Actions would measurably affect park management and operations in the park units. Park staff workloads and priorities would need to be rearranged to implement oil and gas management actions. As a result, other ongoing park management programs or operations would be reduced in scope or potentially eliminated, and effects could be noticeable to the public.

*Major:* Management and operations in the park units would be noticeably affected, and would be markedly different from current conditions. Funding for management actions would exceed the current oil and gas management budget and would require additional personnel over and above what would normally be expected to be funded.

## IMPACT OF THE ALTERNATIVES

### Alternative A: No Action (Current Management Continued)

#### Analysis

**Geophysical Exploration**—As described in the forecast of oil and gas activities in chapter 2, minimal geophysical exploration is expected at Big South Fork NRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. Because of the restrictions at Obed WSR, these operations would not be allowed within the park unit. There would be an increased workload for NPS employees because of overseeing the permitting and compliance with all CLPRs and 9B regulations for these operations and conducting site inspections to monitor operator adherence to mitigation measures outlined in the approved plan of operations, which would result in short-term negligible to minor adverse impacts on park management and operations.

**Drilling and Production**—Drilling and production would be evaluated on a case-by-case basis to determine the effect on park resources, and problems, leaks, and violations would be handled through base workload inspections and monitoring, resulting in continued short-term minor to moderate adverse impacts on park management and operations, depending on the level of activity at any one time. The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park could adversely impact park management and operations in the short-term and up to a major level of intensity, depending on the amount of response and staff resources needed. However, the incident rates for such incidents are low and are not a typical expectation of project implementation.

Protected areas that are identified based on the application of CLPRs and the 9B regulations would result in areas where there could be No Surface Use restrictions or timing stipulations, and other mitigation measures may also be applied to limit the noise or visual impacts from drilling and production on park facilities (see appendix B). Typically, a 500-foot setback would be required from park facilities, based on the 9B regulations (36 CFR 9.41a). Drilling and production crews may need to use park roads and infrastructure, depending on the access that is available, potentially causing periodic demands related to large truck traffic that would require park staff attention. However, as described in the forecast of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRRA, and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR. It is also assumed that 125 wells at Big South Fork NRRA and 2 wells at Obed WSR would be worked over or serviced. Depending on the number of operations occurring at one time within the park, there could be short-term minor to moderate adverse impacts on park operations and facilities.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

Under alternative A, the plugging and reclamation of these wells would involve processing plans of operation on a case-by-case basis and overseeing the outcome of reclamation, which would increase the workload of NPS staff. NPS staff would need to review and approve plans and applications (for exemptions with mitigation) and subsequently monitor well abandonment and site reclamation to ensure that park resources are returned to approximate predisturbance conditions and that natural conditions and processes are restored, resulting in short-term minor to moderate adverse impacts on park management and operations that would be spread out over time. Once wells are plugged and sites reclaimed, there

would be long-term beneficial impacts due to preventing further pollution and degradation associated with the unplugged wells.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact park management and operations. If a drilling operation were conducted outside the park to access non-federal oil and gas underlying the park, there would be operational costs associated with monitoring impacts on resources within the park unless the operator is granted an exemption under 9.32(e) from all or a portion of the NPS 36 CFR 9B plan of operations requirements. The operator's impacts on park operational resources could be reduced because construction of access roads/channels and wellpads may be required outside the park boundary. NPS review and approval of plans and applications (for exemptions with mitigation) and subsequent monitoring of well abandonment and site reclamation is expected to ensure that any park resources are returned to approximate predisturbance conditions and that natural conditions and processes are restored. With the possible exception of response to major blowouts or spills that affect nearby park resources, oversight of directional drilling operations would result in short- to long-term negligible to minor adverse impacts on park management and operations.

### **Cumulative Impacts**

With the continuing reduction of impacts from oil and gas activities in both park units stemming from increased plugging and reclamation, and a corresponding decrease in new drilling and production, impacts to park management and operations are expected to diminish and contribute less to cumulative impacts over time. However, several actions discussed in the “Cumulative Impacts Scenario” section of this chapter have the potential to contribute to adverse and beneficial cumulative effects on park management and operations at the park units. The NPS plans to plug and reclaim 14 abandoned oil and gas wells at Big South Fork NRRA through a cooperative agreement with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. The plugging and reclamation of these wells resulted in short-term negligible to minor adverse impacts on park management and operations due to the increased workload of NPS staff, as well as long-term beneficial impacts due to preventing further pollution and degradation associated with the unplugged wells. Another 39 inactive wells would be plugged using ARRA funding over the next few years. Impacts on park management and operations from these plugging operations are expected to be short term, minor to moderate, and adverse, due to the increased workload of NPS staff.

In addition to oil and gas mining operations, there are an estimated 100 abandoned deep coal mine openings and associated spoil piles within Big South Fork NRRA. Mine reclamation efforts, funded by the Office of Surface Mining, have concentrated on areas with visitor access. Reclamation of these abandoned mines would have short-term minor to moderate adverse impacts on park management and operations within Big South Fork NRRA. There are two abandoned strip mines and one abandoned deep mine within Obed WSR, but these mines are not scheduled for reclamation in the foreseeable future.

ORV use is presently only allowed within Big South Fork NRRA for the purpose of transporting big game during hunting seasons. Federal regulations require all ORVs to be restricted to designated routes on all federal lands. ORVs can legally be used on multiple-use trails during deer- and hog-hunting seasons if the operator is actively involved in hunting. Although recreational ORV riding has been identified in the GMP, actual designations for ORV use are still in the planning stages. ORV use is not permitted in Obed WSR. Impacts from ORV use on park management and operations are expected to be long term, negligible to minor, and adverse, due to the increased workload on NPS staff related to supervising and managing such use at the Big South Fork NRRA.



The purpose of the GMP for Big South Fork NRRRA is to provide a clearly defined direction for resource protection and visitor use at the park unit for a period of 15 to 20 years (NPS 2005a). The GMP delineates several management zones within the park and outlines the desired resource conditions and setting, desired visitor experience, and the kinds/levels of management appropriate in each zone. The GMP outlines road and trail classifications and standards that were incorporated into the plugging and reclamation standards discussed in chapter 2, and that would also apply to any roads associated with current and new oil and gas operations. The GMP for Obed WSR established a management zone system representing area-specific applications of management objectives, a resource management strategy, enhanced and expanded visitor-oriented programs and facilities, and boundary expansion (NPS 1995a). Implementation of the GMPs for each park unit is expected to result in long-term negligible to minor adverse effects on park management and operations, because the workload may increase for NPS staff; however, the implementation of the GMPs would likely prevent further degradation of park resources, a long-term benefit on park resource management.

Visitor activities such as horseback riding, biking, hunting, recreational rock climbing, swimming, kayaking, hunting, and fishing all occur within Big South Fork NRRRA and/or Obed WSR. Although visitor uses are not expected to change, visitation is expected to increase slightly over the life of this plan, with annual fluctuations. This expected increase in park visitation would likely result in long-term negligible to minor adverse effects on park management and operations.

The NPS has published an advance notice of proposed rulemaking in the Federal Register, seeking comments to assist the agency in developing a proposed rule to revise the 9B regulations governing non-federal oil and gas development within the boundaries of NPS units. Generally, the proposed 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 minor adverse impacts on park management and operations due to the slightly increased workload for NPS staff that is expected to accompany the revised 9B regulations, with long-term benefits from the expected gradual increase in compliance and the reduced need for responding to problems or emergencies at unregulated sites.

The adverse and beneficial effects of these past, present, and reasonably foreseeable future actions, when combined with the short-term negligible to moderate adverse impacts of alternative A, would have short- and long-term minor to moderate adverse cumulative adverse impacts on park management and operations. The actions under alternative A would contribute moderately to both adverse and beneficial cumulative impacts.

## **Conclusion**

Given the limited seismic surveys (if any) projected in the park units, it is expected that geophysical exploration would require a slight increase in costs and staff time needed to oversee the operations, which would result in short-term negligible to minor adverse impacts on park management and operations. Site inspections and monitoring would continue to require staff attention, so drilling and production impacts would depend on the incidents reported and the limited number of new wells projected. Given the need to review all plans of operations on a case-by-case basis, drilling and production activities could result in short-term localized minor to moderate adverse impacts on park management and operations. Demands for staff time for plugging and reclamation oversight would increase the workload of NPS staff, resulting in short-term minor to moderate adverse impacts on park management and operations that would be spread out over time. Once wells are plugged and sites reclaimed, there would be long-term beneficial impacts due to preventing further pollution and degradation associated with the unplugged wells. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact park management and operations, resulting in short- to long-term negligible to minor adverse impacts. For both in-park and adjacent directionally drilled wells,

up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release.

The adverse and beneficial effects of past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to moderate adverse impacts as well as the long-term beneficial effects of alternative A, would have short- and long-term minor to moderate adverse cumulative impacts on park management and operations. The actions under alternative A would contribute moderately to both adverse and beneficial cumulative impacts.

## **Alternative B: Comprehensive Implementation of the 9B Regulations and a New Management Framework for Plugging and Reclamation**

### **Analysis**

**Geophysical Exploration**—As with alternative A, minimal geophysical exploration is expected at Big South Fork NRRRA, except for the limited possibility of conventional seismic lines in areas of existing roads where data could be acquired quickly and inexpensively, using seismic vibrator technology. The availability of a management plan may expedite the review of geophysical operations by making information available to operators from the beginning, and the park staff would still have very limited demands related to this phase given the minimal geophysical exploration expected at the park units. As a result, impacts associated with geophysical exploration in alternative B would be very similar to the impacts described in alternative A, and would be short term, negligible to minor, and adverse.

**Drilling and Production**—Because the forecast of oil and gas activities in chapter 2 applies to all alternatives, impacts associated with up to 20 new wells in Big South Fork NRRRA and up to 5 wells directionally drilled from outside the park unit in Obed WSR and well workover/servicing would be very similar to the impacts described in alternative A. Under alternative B, the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRRA and Obed WSR. Additionally, increased inspections and monitoring under alternative B would proactively identify sites that may be impacting, or threatening to impact, park resources beyond the operations area. This increase in inspections and monitoring would require more staff time to implement, and additional seasonal or term staff would be requested under this alternative. The 9B regulations would be enforced at any such sites, and operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production would still occur, this alternative would protect park resources and values better than alternative A, which would place more of a demand on park management and operations but could also serve to reduce staff time spent dealing with emergencies or reported violations or releases/leaks as the plan is implemented over time.

Under alternative B, operations associated with drilling and production could be allowed in all areas of the park units, with the exception of protected areas identified by CLPRs. This includes prohibitions on oil and gas operations in the designated gorge area (Big South Fork NRRRA); deed restrictions that require No Surface Use restrictions and the use of technically feasible methods that are least damaging, such as directional drilling (Obed WSR); and 500-foot setbacks from visitor use and administrative areas, as well as perennial, intermittent, or ephemeral watercourses, unless specifically authorized in an approved plan of operations (as required by 36 CFR 9.41). Typically, a 1,500-foot setback would be required from park facilities used for unit interpretations, based on the 9B regulations (36 CFR 9.41a). Drilling and production crews may use existing park roads and infrastructure, potentially causing periodic demands related to large truck traffic that would require park staff attention. However, as described in the forecast

of oil and gas activities in chapter 2, only up to 20 new wells are expected in Big South Fork NRRA, and only up to 5 wells, directionally drilled from outside the park unit, are expected in Obed WSR.

Depending on the number of operations occurring at one time within the park, with the exception of the unlikely event of a blowout, fire, or large uncontrolled release, there could be short-term minor to moderate adverse impacts on park operations and facilities, and long-term moderate adverse impacts relating to the additional staff time needed for more proactive enforcement and monitoring of new and existing well sites and operations. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections. Having consistent guidance on plan requirements provided to operators from the beginning would help reduce time required to process applications and address operator inquiries.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRRA and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

However, under alternative B, the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRRA and Obed WSR. This includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. This new management framework also includes goals and specific activities for protecting park resources and values during plugging and reclamation activities.

As in alternative A, NPS review and approval of plans and applications (for exemptions with mitigation) and subsequent monitoring of well abandonment and site reclamation is expected to ensure that park resources are returned to approximate predisturbance conditions and that natural conditions and processes are restored. The proposed management framework would reduce staff time in handling the applications. Also, consistent guidance on reclamation requirements would be provided to operators, which could reduce staff time spent managing plugging and reclamation requirements, resulting in short-term minor adverse impacts.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact park management and operations. Similar to alternative A, with the possible exception of response to major blowouts or spills that affect nearby park resources, these actions would result in short-term negligible to minor adverse impacts on park management and operations.

### **Cumulative Impacts**

Impacts on park management and operations from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The effects of these actions, when combined with the short- and long-term negligible to moderate adverse impacts of alternative B, would have short- and long-term minor to moderate adverse cumulative impacts on park management and operations. The actions under alternative B would contribute moderately to both adverse and beneficial cumulative impacts, and having plan requirements clearly articulated to operators from the beginning should help reduce impacts on staff over time.

## Conclusion

The costs associated with geophysical exploration under alternative B would be the same as under alternative A, as a result of NPS staff overseeing geophysical exploration projects as well as impacts on park infrastructure and resources due to an increase in oil and gas–related vehicular traffic. This could result in short-term negligible to minor adverse impacts on park management and operations. There would be an associated cost or time demand as a result of NPS staff implementing a proactive site inspection and monitoring program at regular intervals. Depending on the geographical extent of the area where drilling and production activities could occur and the ability of the park staff to conduct inspections, this could result in short-term minor to moderate adverse impacts on park management and operations, with reduced effects if staffing is increased from current levels. Having plan requirements readily available from the beginning should help reduce impacts on staff over time. The proposed management framework would reduce staff time spent in handling plugging and reclamation, resulting in short-term minor adverse impacts. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact park management and operations, resulting in short- to long-term negligible to minor adverse impacts. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

Impacts on park management and operations from other actions that were considered under the cumulative impacts scenario would be the same as described for alternative A. The adverse and beneficial effects of the cumulative actions, when combined with the short- and long-term negligible to moderate adverse impacts of alternative B, would have short- and long-term minor to moderate cumulative adverse impacts on park management and operations. The actions under alternative B would contribute moderately to both adverse and beneficial cumulative impacts.

## **Alternative C: Comprehensive Implementation of the 9B Regulations, a New Management Framework for Plugging and Reclamation, and Establishment of Special Management Areas**

### **Analysis**

**Geophysical Exploration**—Impacts associated with geophysical exploration under alternative C would be similar to the impacts described in alternatives A and B. However, under alternative C, SMAs would be established to further protect resources and values particularly susceptible to adverse impacts from oil and gas operations, or areas where certain resources are important to maintaining the ecological integrity of the park units. Under alternative C, geophysical exploration would not be allowed in any of the SMAs or associated setbacks at Big South Fork NRR, with the exception of the Special Scenery SMA unless otherwise approved in a plan of operations. Geophysical exploration would be allowed in this SMA at any time, while drilling activities in these areas would be limited during high visitor use periods (generally April through October). Since minimal geophysical exploration is expected and would include use of existing roads and pedestrian access, and would be limited during high visitor use periods, impacts on park management and operations associated with geophysical exploration in alternative C would be short term, negligible, and adverse.

**Drilling and Production**—Under alternative C, the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRR and Obed WSR, and would also establish SMAs where oil and gas exploration and drilling and production activities would be restricted unless otherwise approved in a plan of operations. The 9B regulations would be enforced at any such sites, and

operations found to pose a significant threat to federally owned or controlled lands or waters would be suspended by the superintendent until the threat is removed or remedied (see 36 CFR 9.33 and 9.51). As a result, although short-term and long-term impacts from drilling and production would still occur, this alternative would protect park resources and values better than alternatives A and B, which would place more of a demand on park management and operations when compared to alternative A, but could serve to avoid staff time spent dealing with emergencies or unanticipated reports of violations or releases/leaks. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative CB due to increased monitoring and inspections.

Under alternative C drilling proposals would be evaluated based on SMAs and the increased setbacks recommended from their boundaries (typically, 1,500 feet). This would result in areas where there could be No Surface Use restrictions or timing stipulations, and other mitigation measures may also be applied to limit the noise or visual impacts from drilling and production on park facilities (see chapter 2). Typically, a 1,500-foot setback would be required from park facilities used for unit interpretations, based on the 9B regulations (36 CFR 9.41a). Drilling and production crews may use existing park roads and infrastructure, potentially causing periodic demands related to large truck traffic that would require park staff attention.

Similar to alternative B, depending on the number of operations occurring at one time within the park, there could be short-term minor to moderate adverse impacts on park operations and facilities, with reduced effects if staffing is increased from current levels. There would be a need for additional staff time for more proactive enforcement and monitoring of new and existing well sites and operations. However, alternative C would help to reduce the amount of staff time needed to identify and delineate sensitive areas to be avoided, and having consistent guidance on plan requirements provided to operators from the beginning would help reduce time required to process applications and address operator inquiries.

**Plugging and Reclamation**—As indicated in the forecast of oil and gas activities in chapter 2, plugging and reclamation of wells is expected to be the primary oil and gas operation conducted in Big South Fork NRR and Obed WSR during the life of this plan. Between both park units, approximately 50 wells are expected to be plugged and reclaimed, resulting in the reclamation of approximately 87 acres of land.

As in alternatives A and B, NPS review and approval of plans and applications (for exemptions with mitigation) and subsequent monitoring of well abandonment and site reclamation is expected to ensure that park resources are returned to approximate predisturbance conditions and that natural conditions and processes are restored. However, under alternative C the NPS would implement an oil and gas management plan that clearly articulates the CLPRs applicable to the exploration, production, and transportation of non-federal oil and gas resources in Big South Fork NRR and Obed WSR, and would also establish several SMAs. Like alternative B, alternative C includes a new management framework for plugging and reclamation of wells, which would allow the NPS and operators to efficiently complete the compliance process for the plugging and reclamation of inactive wells that represent potential threats to park resources and values. SMAs would be used to prioritize the sites for plugging, and sites that present any hazard would be higher on the list for action. As a result, short-term impacts from these operations would still occur, but the new management framework for plugging and reclamation and SMA prioritization would increase the certainty that wells would be plugged and reclaimed to applicable standards. Consistent guidance on reclamation requirements would be provided to operators, which would reduce staff time spent managing plugging and reclamation requirements. As a result, there would be short-term minor adverse impacts on park management and operations.

**Directionally Drilled Wells**—Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact park

management and operations. Similar to alternatives A and B, with the possible exception of response to major blowouts or spills that affect nearby park resources, this would result in short-term negligible to minor adverse impacts on park management and operations.

### **Cumulative Impacts**

Impacts on park management and operations from other actions that were considered under the cumulative impact scenario would be the same as described for alternative A. The effects of the cumulative actions, when combined with the short- and long-term negligible to moderate adverse impacts of alternative C, would have short- and long-term minor to moderate adverse cumulative impacts on park management and operations. The actions under alternative C would contribute moderately to both adverse and beneficial cumulative impacts.

### **Conclusion**

Impacts on park management and operations under alternative C would be similar to those described for alternative B, but with additional effort needed to address proposed actions in the SMAs, especially for previously grandfathered operations. The costs associated with geophysical exploration under alternative C would be the same as under alternative B, as a result of NPS staff overseeing geophysical exploration projects as well as impacts on park infrastructure and resources due to an increase in oil and gas-related vehicular traffic. This could result in short-term minor adverse impacts on park management and operations. Similar to alternative B, there would be a need for additional staff time for more proactive enforcement and monitoring of new and existing wells sites and operations, which could have long-term minor to moderate adverse impacts. However, alternative C would help to reduce the amount of staff time needed to identify and delineate sensitive areas to be avoided, resulting in long-term minor adverse impacts. The proposed management framework would reduce staff time in handling plugging and reclamation, resulting in short-term minor adverse impacts. Wells directionally drilled and produced from outside the park to bottomholes beneath the park, and the reclamation of these wells, could indirectly impact park management and operations, resulting in short- to long-term negligible to minor adverse impacts. Although up to major short-term adverse effects could occur in the unlikely event of a well blowout, fire, or uncontrolled release, the risk of that occurring is less under alternative B due to increased monitoring and inspections.

Cumulative impacts would be the same as described for alternative B, with short- and long-term minor cumulative adverse impacts on park management and operations. The actions under alternative C would contribute moderately to both adverse and beneficial cumulative impacts.

## **SUSTAINABILITY AND LONG-TERM MANAGEMENT**

### **RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY**

For all alternatives in this plan/EIS, many impacts would be relatively short-term and all impacts would be mitigated to avoid impairment of park resources and values. Land disturbed during oil and gas operations would be reclaimed, equipment and contamination or wastes removed, and the ground restored to its natural contours. However, some surface disturbances resulting from oil and gas development may cause long-term effects, if the areas are not totally reclaimed or are reclaimed after a very long period of time. For example, access roads may be used for more than one wellpad or for other multiple uses. In such cases, long-term productivity would likely decrease and possibly be lost in the areas used for access roads. Also, in the unlikely case that wetlands cannot be avoided and the mitigation required is not successful in compensating for the original productivity of areas lost, there could be a loss in long-term

productivity in these areas. This would be the case if certain out-of-kind wetland mitigation would be approved for replacement of productive wetland acreage. Finally, short-term use related to oil and gas development could affect land and water resources and associated wildlife in the longer-term if substantial leaks or spills were to occur and require extended time for clean-up and remediation.

## **IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES**

Irreversible impacts are those effects that cannot be changed over the long term or are permanent. An effect to a resource is irreversible if it (the resource) cannot be reclaimed, restored, or otherwise returned to its pre-disturbance condition. Use of nonrenewable resources (such as oil and gas) represents an irreversible commitment of resources. An irretrievable commitment of resources refers to losses of production, harvest, or use of renewable natural resources.

For all the alternatives, there would be an irreversible commitment of the hydrocarbon resources underlying the parks, since oil and gas is being depleted at a much faster rate than it is being formed in the subsurface. This irreversible commitment of resources is not considered an impairment to park resources because private oil and gas development is not subject to impairment under the NPS Organic Act. Rather, Congress recognized the parks for the outstanding natural, scenic, and recreational values they provide, while providing for the private property right to develop these resources.

Another irreversible commitment of resources would occur if any significant cultural resources were destroyed during any phase of oil and gas development. However, the use of the seismic vibrator technique instead of shotholes as the source of seismic waves would reduce the chances of irreversible impacts due to earth disturbance and drilling, although some resources could be lost within the wellbores during well drilling or from vibrations impacts. Based on the small size of the wellbores and the forecast for only a small amount of exploration and relatively few wells, impacts from well drilling would be relatively minor. If buried cultural resources cannot be avoided, impacts would be mitigated by the recovery of data (excavation) and preservation of recovered materials and associated records, an irreversible adverse impact. Where seismic vibration is proposed, park staff would identify areas that require subsurface surveying prior to operations commencing to minimize the chances of impact, although unknown resources could be irreversibly affected.

For all alternatives, there would be an irretrievable loss of undeveloped areas for visitor use and experience where the ground is cleared and disturbed for oil and gas exploration and development, including access roads and wellpads. For the RFD scenario wells, this involves up to approximately 36 acres of Big South Fork NRA, and no additional acreage for Obed WSR, since all wells there would be directionally drilled from outside that park. The potential for these lands to produce vegetation or be viewed in an undisturbed state would be irretrievably committed for the duration of the oil and gas development operations, and until the site(s) have been reclaimed.

## **UNAVOIDABLE ADVERSE IMPACTS**

Unavoidable adverse impacts are adverse impacts that cannot be avoided and cannot be mitigated, and, therefore, would remain throughout the duration of the oil and gas operation. Under alternatives B and C, the implementation of this oil and gas management plan would provide clearer direction to the oil and gas operator and greater protection to park resources and values, thereby avoiding and mitigating potential damage to park resources and values. If an operator's proposal could potentially lead to a major adverse impact or impairment of park resources, the NPS would not approve the proposed operation until adequate resource protection (mitigation) is integrated into the operation. Also, any variance from SMA requirements or restrictions would need to be approved in a plan of operations, which would provide for avoidance of adverse impacts.

For any of the alternatives, there may be unavoidable adverse impacts if the mitigation proposed for any impacted wetlands or water resources is not successful and/or does not compensate for the original wetland functions and values or loss of water-dependent species. All alternatives would require avoidance of wetlands as the first mitigation measure. In the unlikely case that avoidance is not possible, it may be difficult to ensure that either the restoration of wetlands required through compensation or the reclamation of the wetlands after operations would have similar functions or values. Water resources would be protected by adherence to regulatory requirements for spill prevention and clean-up, but unexpected releases that breach containment could cause unavoidable adverse impacts until response is initiated and completed.

There may also be unavoidable adverse impacts on visitor uses and experiences /natural soundscapes if the setbacks and other mitigation measures do not provide enough of a restricted area between oil and gas operations and visitor use areas. There is a distinct possibility that the noise from drilling rigs, compressors, and other oil and gas operations could adversely impact visitor experience especially on a short-term basis. This would depend on the specific location, intervening topography and vegetation, noise mitigation techniques utilized, and the existing background noise levels in the vicinity of the operation.

Finally, there may be unavoidable adverse impacts related to unplanned releases (blowouts, spills, leaks, and fires). As stated throughout the analysis, the NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the park present a risk of release of contaminants that can adversely impact park resources and values, depending on the location of the release. 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 such as use of blowout preventers and implementation of SPCC plans would be expected to result in lessening the potential for spilled substances or a well fire to spread into the park, and for timely response and cleanup, so that there is a reasonable expectation that long term adverse impacts would not occur or be limited to minor to moderate levels of intensity, although there could be short-term major adverse effects during the release.