APPENDIX E. OVERVIEW OF CONSIDERATIONS RELEVANT TO EXPOSURE AND RESPONSE ANALYSES

The following sections provide a high-level overview of considerations relevant to exposure and response analysis for each guild addressed in the Biological Opinion. (This section is not intended to take the place of site- or species-specific analysis in future step-down section 7 consultations or the technical assistance coordination process described in this programmatic Biological Opinion and the SMCRA Coordination Process and 2020 Dispute Resolution Process (Appendices A and B).

1.1.1 Birds – Cuckoos

The yellow-billed cuckoo represents this guild. Effects to cuckoos from mining may occur in the form of direct mortality, harassment, habitat loss, prey reduction, and fragmentation. Direct mortality of adults, juveniles, or eggs could occur if vegetation removal occurs when nesting cuckoos are present. Disturbance of individuals living within and adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Habitat could be lost directly through clearing and grubbing in riparian areas or through groundwater pumping. Groundwater pumping may result in depletion of surface flows, degradation and loss of riparian habitats, and local declines or extirpations of aquatic and riparian plants and animals. Loss of suitable breeding, roosting, or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Fragmentation of habitats as a result of coal mining reduce connectivity of cuckoo breeding areas and therefore reduce genetic dispersal. Reductions in flow regime in riparian areas could also reduce prey abundance (e.g., tree frogs, and adult aquatic insects, such as dragonflies, flies and beetles). Population viability would be affected if populations become isolated to the extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Without the implementation of special provisions or conservation measures, we expect cuckoos nesting in and around the footprint of individual surface coal mining operations to experience take in the form of loss of habitat, mortality, harassment, causing displacement, reduced productivity and survivorship as a result of noise and increased activity from mining activities occurring adjacent to occupied habitat.

Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through stepdown section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect cuckoos to

potentially be harassed, trapped, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of cuckoos to result in injury or death of individuals.

We do not expect future coal mining to occur near proposed designated critical habitat areas in Arizona but proposed critical habitat areas of riparian habitat may overlap with mining activity in Utah, Colorado, and New Mexico. If mining were to occur in yellow-billed cuckoo critical habitat, effects to the physical and biological features (PBFs) may occur. Removal of riparian vegetation cover would eliminate necessary habitat structure and likely their insect prey PBF. Replacement of riparian vegetation could occur but would likely not develop into suitable habitat before bond release. The loss of habitat could require mandatory wildlife enhancement measures that would reduce effects to some extent, but local changes to groundwater or hydrologic balance may be long-term.

1.1.2 Birds – Raptors

This guild is represented by the ESA-listed California condor (*Gymnogyps californianus*) and the Mexican spotted owl (*Strix occidentalis lucida*). Effects to raptors from mining may occur from direct mortality, harassment, habitat loss, and fragmentation. Direct mortality of adults, juveniles, or eggs could occur if vegetation removal occurs when nesting raptors are present. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Loss of suitable breeding, roosting, or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Fragmentation of forested habitats as a result of coal mining would affect connectivity of raptor breeding areas and therefore reduce genetic dispersal. Population viability would be affected if populations become isolated to the extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Habitat effects are more likely for habitat specialists like the Mexican spotted owl than for a generalist like the California condor.

Disturbance effects may come from lights from nighttime activities or from noise, or both. Artificial lighting may cause prey species to alter their behavior and be less available to foraging raptors. Noise may cause stress, behavioral alterations, or suppress breeding. Sources of noise include rock drills and blasting. The degree of effects depends largely on local conditions, including vegetation, topography, and weather. For example, OSMRE (2011) determined that on the Kayenta mine in Arizona, occupied habitat would have to be relatively close (less than two miles) to the activity for noise related disturbance to be an impact to individuals. Modeling further showed that mining related noises coming from many coal resource areas would not reach the level at which behavioral impacts would occur, even in adjacent habitats (OSMRE 2011).

Effects would be lessened by the requirement to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species. The plan would include protective measures to be

used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The operator would also be required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them.

Without the implementation of special provisions or conservation measures, we expect raptors nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect raptors to potentially be harassed, trapped, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of raptors to result in injury or death of individuals.

None of the designated critical habitat for the California condor overlaps the coal resources layer. Therefore, consequences to the critical habitat are highly unlikely given the distance from the closest boundary of the designated critical habitat to the areas within the coal resource layer.

Total Mexican spotted owl critical habitat overlaps mineable coal by 4.2%. The PBFs for the Mexican spotted owl pertain to forest structure and the maintenance of adequate prey species. If mining were to occur in Mexican spotted owl critical habitat, effects to the PBFs may occur. Removal of forest cover would eliminate the PBFs. Replacement of trees could occur but it would take decades to achieve trees of 12 inches diameter at breast height, as well as creation of large dead trees. These PBFs would not be present on the site, if at all, until long after the bond release had occurred. The loss of habitat could require mandatory wildlife enhancement measures that would reduce effects to some extent. Enhancement measures must be commensurate with the impact and must also be permanent whenever possible.

1.1.3 Birds – Woodpeckers

One ESA-listed species represents this guild, the red cockaded woodpecker (*Picoides borealis*). Effects to woodpeckers from mining may occur from direct mortality, disturbance, habitat loss, and habitat fragmentation. Direct mortality of adults, juveniles, or eggs could occur if vegetation removal occurs when nesting woodpeckers are present. Loss of suitable breeding, roosting, or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Fragmentation of forested habitats as a result of coal mining would affect connectivity of woodpecker breeding areas and therefore reduce genetic dispersal. Population viability would be affected if populations become isolated to the

extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

These effects will be lessened by the requirement to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed or proposed species. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values.

Without the implementation of special provisions or conservation measures, we expect woodpeckers nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect woodpeckers to potentially be harassed, trapped, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of woodpeckers to result in injury or death of individuals.

Critical habitat has not been designated for the red-cockaded woodpecker.

1.1.4 Birds – Passerines

This guild is represented by the ESA-listed southwestern willow flycatcher (*Empidonax traillii extimus*). Effects to passerines from mining may occur from direct mortality, harassment, prey reductions, habitat loss and habitat fragmentation. Direct mortality of adults, juveniles, or eggs could occur if vegetation removal occurs when nesting passerines are present. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of nest sites, resulting in failed nests and lower productivity. Habitat could be lost directly through clearing and grubbing in riparian areas or through groundwater pumping. Groundwater pumping may result in depletion of surface flows, degradation, and loss of riparian habitats, and local declines or extirpations of aquatic and riparian and aquatic plants and animals (OSMRE 2011). Loss of suitable breeding, roosting, or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Fragmentation of forested habitats as a result of coal mining would affect connectivity of passerine breeding areas and therefore

reduce genetic dispersal. Population viability would be affected if populations become isolated to the extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Noise and increased human activity in and around the mine may affect many passerines. OSMRE has consulted on the southwestern willow flycatcher in regard to the Kayenta Mine project, and found that willow flycatchers continued to use stopover sites while disturbances from noise and mining activity were occurring. However, the stopover habitat was nearly six miles away from the source of the mining noise (OSMRE 2011). Mining operations closer to passerine habitat may result in disturbance of individuals.

Effects to passerines will be lessened by the requirement to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect passerines nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance, and loss or reduction in emergent adult aquatic insect prey in riparian corridors. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in this further clarified for permits issued by State RAs in the SMCRA Coordination Process and 2020 Dispute Resolution Process (Appendices A and B) are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect passerines to potentially be harassed, trapped, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of passerines to result in injury or death of individuals.

If mining were to occur in southwestern willow flycatcher critical habitat, effects to the PBFs may occur. Removal of riparian vegetation cover would eliminate the riparian vegetation PBF and likely the insect prey PBF. Replacement of riparian vegetation could occur but would likely not develop into suitable habitat before bond release. The regulatory authority would have no control over the site after bond release and the landowner may choose to remove the vegetation.

That said, stream construction on surface coal mines occurs commonly as a means of replacing stream resources that have been disturbed by mining, and measures to maximize benefits for southwestern willow flycatcher can be incorporated into PEPs. For example, restoration of aquatic life and processes in such streams can be encouraged by establishing woody vegetation – trees and shrubs – in these streams' riparian areas and elsewhere in their watersheds. This can be accomplished by combining practices recommended by the Forestry Reclamation Approach for establishing forest trees on surface coal mines with those used commonly for riparian reforestation in non-mining areas. Successful riparian reforestation is a positive outcome for aquatic life, wildlife, and people, and can greatly enhance the overall reclaimed ecosystem (Zipper et al., 2018).

1.1.5 Birds—Wading Birds

This guild is represented by the ESA-listed whooping crane (*Grus americana*). This group includes cranes, herons, egrets, storks, spoonbills, and ibises. Wading birds have physical and behavioral adaptations for living in aquatic or semi-aquatic habitats. Their legs, neck, toes, and bills all may be specialized for living around water and finding food. Most wading birds are colonial nesters, however the one wading bird which may be affected by this action, the whooping crane, is not.

Effects to this guild may include habitat loss and low reproductive rates coupled with low juvenile recruitment. This guild is highly sensitive to human disturbance so it is unlikely that these birds would utilize and active mine site. The main population of whooping cranes migrates through the Central Flyway between Wood Buffalo National Park in north-central Canada and the Aransas National Wildlife refuge on the Texas coast. During this migration they have been observed using surface mines as stopover habitat. Whooping cranes are highly sensitive to human disturbance so it is unlikely they would use an active mine. They would also likely leave the area if mining operations began to get too close to the stopover areas they were using. Thus, we anticipate adverse effects to whooping cranes from this action would be rare.

Future state or private actions that are reasonably certain to occur include diversions and groundwater pumping, removal of riparian vegetation, livestock grazing, recreation, fire, agricultural development, and urbanization. If these activities occur in or near whooping crane habitat, loss or degradation of the habitat could occur or prey availability could be reduced, leading to disturbance and reduced reproductive success.

Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Effects to wading birds could be minimized or reduced by the hydrologic balance protections required by the regulations. Under the existing SMCRA regulations, mines are to be designed to prevent material damage to the hydrologic balance outside the permit area and to protect surface water and groundwater. Sediment control measures must be used to prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area.

With minor exceptions, mines must be designed so that all surface drainage is passed through a siltation structure before leaving the permit area, and discharges of water must meet applicable state and federal laws and effluent limitations.

Effects to wading birds will be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values.

Without the implementation of special provisions or conservation measures, we expect wading birds nesting or feeding in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect wading birds to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of wading birds to result in injury or death of individuals.

Critical habitat for the whooping crane will likely not be impacted by the action, since there is no overlap of mineable coal with designated critical habitat for whooping crane.

1.1.6 Birds – Shorebirds

This guild is represented by the ESA-listed piping plover (*Charadrius melodus*), rufa red knot (*Calidris canutus rufa*), and interior least tern (*Sternula antillarum*). Effects to this guild may occur through direct mortality, disturbance, and habitat degradation. Direct mortality may occur during active mining if nests or chicks are destroyed. Noise from surface coal mining operations may also cause birds to avoid nesting near active surface coal mining operations. Mining may also result in impacts to habitat through changes in water resources such as quality and quantity changes, diversions, and increases in sedimentation. These hydrologic changes may result in loss or degradation of nesting and foraging habitat. These effects may result in reduced nesting success and lowered population size. However, nesting and foraging habitat degradation is unlikely to result from coal mining. Coal mining is unlikely to affect the hydrograph and sediment deposition characteristics of larger river systems that create the sandbars and bare islands this guild depends on for nesting. Coal mining is also unlikely to affect foraging habitat (mud flats) on larger rivers for the same reasons. Positive effects may result from the creation of new nesting habitat through land reshaping by filling and excavating during reclamation. Interior least terns are known to nest on disturbed ground as would be created during vegetation removal.

If shorebirds such as interior least terns nest on land cleared for coal extraction, disturbance and mortality to adults and juveniles may occur from the mining process. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Effects to shorebirds could be minimized or reduced by the hydrologic balance protections required by the regulations. Under the existing SMCRA regulations, mines are to be designed to prevent material damage to the hydrologic balance outside the permit area and to protect surface water and groundwater. Sediment control measures must be used to prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, mines must be designed so that all surface drainage is passed through a siltation structure before leaving the permit area, and discharges of water must meet applicable state and federal laws and effluent limitations.

Effects to shorebirds will be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values.

Without the implementation of special provisions or conservation measures, we expect shorebirds nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect shorebirds to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of shorebirds to result in injury or death of individuals.

Critical habitat has not been designated for the interior least tern or the rufa red knot. Critical habitat has been designated for the Great Lakes breeding population, the northern Great Plains breeding population, and wintering populations of the piping plover. Only the Northern Great Plains breeding population critical habitat overlaps mineable coal, by approximately 32 percent.

The one overriding biological PBF for the Great Plains breeding population of the piping plover that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat. This biological process allows the physical processes to develop (USFWS 2002c). These processes occur on different habitat types in the northern Great Plains.

Critical habitat for the piping plover will likely not be heavily impacted since coal mining is unlikely to affect the hydrograph and sediment deposition characteristics of larger river systems that create the sandbars and bare islands this guild depends on for nesting. Coal mining is also unlikely to affect foraging habitat (mud flats) on larger rivers for the same reasons.

1.1.7 Birds – Grouse

This guild is represented by ESA-listed the Gunnison sage grouse (*Centrocercus minimus*). Effects to grouse from mining may occur from direct mortality, disturbance, habitat loss, and habitat fragmentation. Direct mortality of adults, juveniles, or eggs could occur if vegetation removal occurs when nesting grouse are present. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Loss of suitable breeding or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Fragmentation of sagebrush habitats as a result of coal mining would affect connectivity of grouse breeding areas and therefore reduce genetic dispersal. Population viability would be affected if populations become isolated to the extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Disturbance, in the form of noise and increased human presence, from mining activities may affect resting, dispersing, foraging, display, and nesting behaviors of individuals. These effects may induce some individuals to abandon affected areas. These individuals may then either have to relocate to other suitable habitat or continue to utilize the affected habitat despite the less than ideal circumstances. Individuals that stay in the degraded habitat may exhibit reduced fitness due to the increased disturbance. They may have increased stress due to the startling effects of intermittent noise or due to the threat perceived from the presence of tall structures. Intermittent noise disturbance may reduce nesting success due to an increased frequency of flushing from the nest, which would decrease time spent sitting on eggs or feeding hatchlings, and increase the likelihood of predation on the nest. Individuals that relocate to other suitable habitat may suffer increased mortality risk during dispersal and reduced fitness if after finding suitable habitat they have to compete with other individuals to claim a portion of the territory. Some areas may not have sufficient unoccupied habitat to absorb the displaced individuals.

These effects will be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values.

Without the implementation of special provisions or conservation measures, we expect grouse nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the 2020 SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect grouse to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of grouse to result in injury or death of individuals.

If mining were to occur in Gunnison sage-grouse critical habitat, effects to the PBFs would occur through vegetation removal. Replacement of vegetation could occur but it would take decades to achieve the type of vegetative community structure that comprises the PBFs. These PBFs would not be present on the site, if at all, until long after the bond release had occurred. The loss of the habitat, if not replaceable before final bond release, could require mandatory wildlife enhancement measures that would reduce effects to some extent. Enhancement measures must be commensurate with the impact and must also be permanent whenever possible.

1.1.8 Reptiles – Snakes

This guild is represented by the ESA-listed northern Mexican gartersnake (*Thamnophis eques megalops*), the narrow-headed gartersnake (*Thamnophis rufipunctatus*), the black pine snake (*Pituophis melanoleucus lodingi*), the eastern massasauga rattlesnake (*Sistrurus catenatus*), and the Louisiana pinesnake (*Pituophis ruthveni*).

The primary threats to the gartersnakes in this guild are predation and competition from harmful nonnative fish, frog and crayfish species (USFWS 2014n). The primary threat to the black pine snake and Louisiana pine snake is habitat loss, due to the loss of longleaf pine stands from conversion to other land uses as well as from fire suppression (USFWS 2014o). Habitat loss is also the primary threat to the eastern massasauga rattlesnake. Habitat for the eastern massasauga rattlesnake may be lost due to destruction of native habitat, conversion to agriculture, development and infrastructure conversion (Szymanski 2015). Mining is not specifically identified as a threat; however, any land use that would divert, dry up, or significantly pollute aquatic habitat would threaten the species in this guild that use it.

Effects to this guild from mining may occur from direct mortality, disturbance, and habitat loss or fragmentation. Site clearing could result in loss of existing vegetation and disturbance of the soil profile as well as possible direct mortality from crushing of individuals. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Habitat degradation may occur due to the delay in the return of suitable site conditions for prey species as well as

hibernation/aestivation. Streams that are mined through may be dewatered resulting in unsuitable habitat conditions for the riparian specialists in this guild. Habitat loss or degradation may result in reduced fitness due to loss of nest sites or reduced prey availability. Habitat fragmentation may lead to genetic isolation and increased vulnerability of remaining populations to disease, and loss due to stochastic events. These effects may lead to lowered population sizes. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

These effects will be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect snakes nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect snakes to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of snakes to result in injury or death of individuals.

If mining were to occur in black pine snake proposed critical habitat, effects to the PBFs would occur. Forest and groundcover would be removed, refugia would be eliminated and soil texture would be altered. Replacement of vegetation, groundcover, and soils could occur but would likely not develop into suitable habitat before bond release. The loss of the habitat, if it cannot be fully restored before final bond release, could require mandatory wildlife enhancement measures that would reduce effects to some extent. Enhancement measures would also have to be commensurate with the impact and permanent whenever possible.

1.1.9 Reptiles – Turtles

This guild is represented by the following ESA-listed species: the yellow-blotched map turtle (*Graptemys flavimaculata*), the ringed map turtle (*Graptemys oculifera*), the flattened musk

turtle (*Sternotherus depressus*) and the bog turtle (*Clemmys muhlenbergii*). Effects to this guild from mining may occur from direct mortality, disturbance, and habitat loss or fragmentation. Site clearing could result in direct mortality from crushing of individuals. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Effects to individuals may occur from direct mortality from crushing by heavy machinery during land clearing and construction of drainage control structures and other infrastructure. Effects to habitat may occur from land clearing which leads to habitat loss and fragmentation. Loss of breeding, feeding, and basking habitat may occur from these activities. Nest predation may also increase as a result of habitat loss close to riparian zones. Habitat loss from these activities is likely to be long term. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Habitat loss or degradation may also occur from changes in water quality or quantity caused by mining. Changes in water chemistry or sediment loading regimes may result in the loss or degradation of habitat, including nesting habitat. Water chemistry changes may also affect prey availability. Contaminants may accumulate in individual turtles, particularly in internal organs or in the blood, may be transferred maternally through eggs, and may affect females differently than males resulting in skewed sex ratios (Shuangying et al. 2011).

Habitat loss or degradation may result in reduced fitness due to loss of nest sites or nest predation. Habitat fragmentation may lead to genetic isolation and increased vulnerability of remaining populations to disease, and loss due to stochastic events. Exposure to contaminants or degraded water quality may cause individual turtles to abandon an area, have reduced fitness, suffer physiological effects, and produce fewer offspring. These effects may lead to lowered population sizes.

These effects will be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

That said, without the implementation of special provisions or conservation measures, we expect turtles nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to

minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect turtles to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of turtles to result in injury or death of individuals.

1.1.10 Amphibians – Salamanders

The ESA-listed species representing this guild include the Cheat Mountain salamander (*Plethodon nettingi*), the Jemez Mountains salamander (*P. neomexicanus*), and the Black Warrior waterdog (*Necturis alabamensis*). Effects to this guild from mining may occur from direct mortality, disturbance, and habitat loss or fragmentation. Site clearing and in-stream work could result in direct mortality from crushing of individuals, desiccation, or suffocation. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. If coal mining were to occur within or upstream from these species' habitat, effects may occur as a result of land clearing activities. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if marking is included in the survey protocol.

As salamanders lack the mobility to retreat from the mining area, the clearing and grubbing of surface vegetation and removal of soil and overburden or discharges of effluent would cause direct mortality to any individuals within the affected area. Long term habitat loss and/or fragmentation and degradation are likely while mining and reclamation activities occur. The long term loss of a tree canopy would increase ambient temperature at ground level and decrease soil moisture making the habitat unsuitable for salamander species. In addition, increased surface temperatures and soil compaction influence the type of vegetation that can survive on mined land and the extent and rate at which the premining plant community and associated fauna can recolonize the site. Reestablishment of suitable forest habitat for this guild would take many decades if not centuries (Petranka 1993). Reduced habitat availability would reduce suitable shelter and forage availability which in turn directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size. Disruptions of habitat may also lead to fragmentation or dissection of single large populations into smaller subunits and create barriers to dispersal and gene flow. The loss of genetic material in a population can reduce genetic variability and could be costly to populations if diseases are introduced or other ecosystem perturbations occur (Pauley 2008). All these stressors can lead to reduced fitness and lower population sizes.

These effects would be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. The plan must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the protection of fish, wildlife, and related environmental

values. These requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

Effects to salamanders would be reduced by sediment control measures and effluent limitations. Maintenance of riparian buffer zones of sufficient width to slow and reduce direct runoff from coal sites and associated contaminants into aquatic habitats. Maintenance of riparian corridors provides autochthonous leaf matter to streams, moderates stream water temperatures that supports salamanders and sensitive benthic macroinvertebrate prey, such as caddisflies and mayflies. Diversion ditches route sediment to ponds where the sediment settles out and ponds must meet effluent limitations.

Without the implementation of special provisions or conservation measures, we expect salamanders nesting in and around the footprint of individual surface coal mining operations or within close proximity to the affected area to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect salamanders to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of salamanders to result in injury or death of individuals.

Critical habitat is not designated for the Cheat mountain salamander. Critical habitat for the Jemez mountain salamander does not overlap mineable coal reserves.

Approximately 39% of designated critical habitat for the Black Warrior waterdog overlaps mineable coal (Table 1) and adverse effects to PBFs including water quality, invertebrate prey, and leaf-pack habitats are anticipated to occur.Coal mining in the Black Warrior River basin is an ongoing threat to the black warrior waterdog, and as of 2018 new coal mines have been proposed in Sipsey Fork and Mulberry Fork (Alabama Surface Mining Commission in 2012). Based on a review of publicly available Alabama Surface Mining Commission permit data, there appears to be many active mine permits and permitted point source discharges located within areas recently designated as critical habitat and considered occupied. Run off from coal surface mining can lead to stream acidification, sediment deposition on the stream bottom, and changes in bioavailabilty of contaminants. Black Warrior waterdog use stream leaf packs for both cover from predators and as a source of benthic macroinvertebrate prey, such as caddisflies and mayflies, and water quality impairments related to coal mine run off have also been linked to declines in benthic macroinvertebrate prey richness and abundance.

1.1.11 Amphibians – Frogs

The list of species that may be affected by the action includes the Chiricahua leopard frog (*Lithobates chiricahuensis*) and the Houston toad (*Bufo houstonensis*). Active coal mining currently exists within the range of the Houston toad, however, not within the known distribution of this species. Impacts of coal mining conducted within frog habitat may include, effects to the species as a result of direct mortality, increased sedimentation, changes to water chemistry including elevated conductivity, loss or modification of habitat, and creation of dispersal barriers. Although frogs are relatively mobile, the clearing and grubbing of surface vegetation and removal of soil and overburden would cause direct mortality to any individuals within the disturbance boundary. Long-term habitat loss and/or fragmentation and degradation are likely while mining and reclamation activities occur. The long-term loss of a tree canopy would increase ambient temperature at ground level and decrease soil moisture. In addition, increased surface temperatures and soil compaction influence the type of vegetation that can survive on mined land and the extent and rate at which the premining plant community and associated fauna can recolonize the site. Reestablishment of suitable forest habitat for this guild would take many decades if not centuries. Reduced habitat availability would reduce suitable shelter and forage availability which in turn directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size. Disruptions of habitat may also lead to fragmentation or dissection of single large populations into smaller subunits and create barriers to dispersal and gene flow. The loss of genetic material in a population can reduce genetic variability and could be costly to populations if diseases are introduced or other ecosystem perturbations occur (Pauley 2008). All these stressors can lead to reduced fitness and lower population sizes. Species-specific monitoring may be included as a permit condition and may result in harassment, capture and collection of individuals depending on the survey protocol.

These effects will be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

Effects to frogs would be reduced by sediment control measures and effluent limitations. Diversion ditches route sediment to ponds where the sediment settles out and ponds must meet effluent limitations. Sediment ponds used during mining activities are often converted to stock ponds or fish and wildlife habitat during reclamation. These water resources may provide potential suitable habitat previously unavailable to frogs prior to mining.

Within central Arizona, small isolated portions of the Colorado Plateau coal basin overlap portions (less than one percent) of the Chiricahua leopard frog's range. No active coal mining currently exists within the range of the species. However, if coal mining was conducted within Chiricahua leopard frog habitat, effects to the species may occur as a result of increased sedimentation, changes to water chemistry including elevated conductivity, loss or modification

of habitat, and creation of dispersal barriers. All these stressors can lead to reduced fitness and lower population sizes.

Effects to the Chiricahua leopard frog would be reduced by the requirements for sediment control measures and the effluent limitations. Diversion ditches route sediment to ponds where the sediment settles out and ponds must meet effluent limitations. Sediment ponds used during mining activities are often converted to stock ponds or fish and wildlife habitat during reclamation. These water resources may provide suitable habitat for the Chiricahua leopard frog previously unavailable to the frog prior to mining.

According to OSMRE's 2020 BE, no active coal mining currently exists within the known occupied distribution of the Houston toad, and the nearest mines to known populations are in reclamation only with no additional mining expected in the area. Houston toad total critical habitat overlaps 86% with mineable coal. However, if coal mining were conducted within Houston toad habitat, effects to the species may occur as a result of loss and modification of habitat, dispersal barriers, creation of sedimentation ponds that may not have suitable water chemistry and nutrients for larva and tadpole stages, and reclamation to a non-suitable habitat type. All these stressors can lead to reduced survival, habitat, and lower population sizes.

Effects to the Houston toad would be reduced by the requirements for sediment control measures and effluent limitations. Sediment ponds used during mining activities are often converted to stock ponds during reclamation. These water resources would provide vegetation, algae, and organic matter that would support larval and tadpool stages of the Houston toad and may replace smaller and more numerous ponds that were present before mining (that may have contributed to reduction of chorus magnitude). Enhancement of permanent ponds with wooded canopy along the fringe would improve the water temperature and provide shade to the water and adjacent soils and vegetation.

Without the implementation of special provisions or conservation measures, we expect frogs nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect turtles to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of frogs to result in injury or death of individuals.

Critical habitat for the Chiricahua leopard frog does not overlap mineable coal reserves. Approximately 86 percent of critical habitat designated for the Houston toad overlaps mineable reserves. However, the nearest mines to known populations are in late stages of reclamation and OSMRE does not anticipate additional mining within the area.

1.1.12 Insects – Bumble Bees

While data demonstrates that coal mining historically has not affected this species or its critical habitat, effects to the rusty patched bumble bee (*Bombus affinis*) may result from ground disturbance activities and habitat modifications that may result from coal mining and impact the bees breeding, feeding, and sheltering. The primary factors influencing the status include risks posed by "pathogens, pesticides, habitat loss and degradation, small population dynamics, and climate change" (82 FR3186-3209). Any rusty patched bumble bee occupying the area within the affected area of the mine during clearing and grubbing activities will likely be disturbed, or crushed. Rusty patched bumble bee nests and overwintering queens would be expected to be crushed by machinery during vegetation removal and construction. We expect rusty patched bumble bee workers foraging in the area would fly away or avoid the area during vegetation removal. Displaced workers will have to travel further to forage, which will affect the ability of the workers to provide sufficient resources to a colony, resulting in reduced health of some individual workers, reduced reproductive capacity of the queen, and reduced production of foundress queens and males. Clearing of herbaceous vegetation while rusty patched bumble bees are present in habitat is expected to have a direct effect on the quality, quantity, and timing of floral resources, thereby reducing survivability and reproductive success of queens; equipment used could crush individuals, queens, or colonies. Long-term and permanent land cover changes may also affect the rusty patched bumble bee.

Conventional reclamation techniques have not relied heavily on pollinator friendly species for revegetation. However, a presidential memorandum issued June 20, 2014 was designed to create a federal strategy to promote the health of honeybees and other pollinators. As a result of the Presidential Memorandum and the listing of the rusty patched bumble bee, reclamation techniques are incorporating more pollinator friendly species within revegetation plans. States that appear to have the highest overlap of mineable coal with rusty patched bumble bee range are Iowa, Illinois and West Virginia.

As stated above, provisions within the SMCRA regulations require a revegetation plan, including being compatible with the postmining land use, being compatible with the plant and animal species of the area, and meeting the requirements of applicable state and federal seed, poisonous and noxious plant, and introduced species laws or regulations. While these requirements do not necessarily result in reestablishment of habitat designed specifically for use by the Rusty patched bumble bee, they could be used by the Rusty patched bumble bee. Also, SMCRA regulations do not restrict the use of pesticides within the permit area; however, they are rarely used as they are only useful to certain types of cropland and only add an extra cost to the permittee, which provides limited use on coal mining operations.

Without the implementation of special provisions or conservation measures, we expect bees nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific

monitoring is included as a permit condition, we expect beetles to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of beetles to result in injury or death of individuals.

Critical habitat has not been designated for the rusty patched bumble bee.

1.1.13 Insects – Beetles

This guild is represented by the American burying beetle (*Nicrophorous americanus*). Effects to this guild from mining may occur from direct mortality, disturbance, and habitat loss or fragmentation. Effects to beetles, including the American burying beetle may occur as a result of ground disturbance activities and habitat modifications. Any beetles occupying the soil within the disturbance boundary of the mine during clearing and grubbing activities will likely be crushed. Long-term and permanent land cover changes may also affect beetles. Conventional reclamation techniques typically result in heavily compacted soils. Removal of the tree canopy increases ambient temperature at ground level and decreases soil moisture. These effects may produce soils ill-suited to ground beetle's reproduction and overwintering needs. All these stressors can lead to reduced fitness and lower population sizes. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals.

Provisions within the current regulations require the salvage and redistribution of topsoil during reclamation but these requirements do not necessarily result in reestablishment of soils suitable for use by burying beetles. The American burying beetle is commonly addressed in surface coal mining permits in eastern Oklahoma by surveying for presence/absence and timing land clearing activities to avoid disrupting soil during the reproductive season.

Without the implementation of special provisions or conservation measures, we expect beetles nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect beetles to potentially be harassed, captured, or collected depending on the survey or tagging protocols recommended by the Service. We would not typically expect Service-approved monitoring of beetles to result in injury or death of individuals.

Critical habitat has not been designated for the American burying beetle.

1.1.14 Insects – Butterflies

This guild is represented by the Mitchell's satyr butterfly (*Neonympha mitchelli mitchelli*), Dakota skipper (*Hesperius dacotae*). Effects to this guild from mining may occur from direct mortality, disturbance, and habitat loss or fragmentation. Effects to butterflies may occur as a result of ground disturbance activities and habitat modifications. Any butterflies occupying the vegetation within the disturbance boundary of the mine during clearing and grubbing activities may be crushed. All these stressors can lead to reduced fitness and lower population sizes. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals.

Due its restrictive habitat requirements and isolated populations, it is unlikely surface coal mining operations would be conducted directly through known Mitchell's satyr butterfly occupied habitat. However, if Mitchell's satyr butterfly habitat was mined the species may suffer effects including mortality, habitat degradation, and habitat loss. More potential exists for mines in proximity to Mitchell's satyr butterfly habitat to indirectly effect to the species by negatively impacting connected surface and/or groundwater hydrology. Mining can potentially impact surface and ground water quantity, quality, and flow. These changes could impact the vegetative community of a hydrologically connected Mitchell's satyr butterfly occupied wetland resulting in a habitat ill-suited to the foraging needs of the species. Reduced food supplies could lead to lowered survivorship and reproduction which could lead to lowered population size. Mining that resulted in habitat loss for the Dakota skipper could further fragment its habitat and lead to isolation of small populations resulting in dispersal barriers and restricted gene flow. Small, isolated populations are more likely to be extirpated if there is no opportunity for recruitment from other, nearby populations. The loss of genetic material in a population can reduce genetic variability and could be costly to populations if diseases are introduced.

Without the implementation of special provisions or conservation measures, we expect butterflies nesting in and around the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect butterflies to potentially be harassed, captured, or collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of butterflies to result in injury or death of individuals.

1.1.15 Fishes

Coal mining affects fish and the habitats upon which they depend. These effects occur to streams within the SMCRA permit boundary as well as to waters downstream of a permit boundary. Stream habitat loss may occur within the permit boundary by placement of excess spoil fills in streams, temporary or permanent diversion of streams, creation of instream sediment ponds and

impoundments, and hydrologic changes which degrade water quantity. Fish within filled streams may become trapped and suffer direct mortality. Habitat degradation may occur both on and off the permit boundary by producing changes in surface or ground water quantity and/or quality including: increased total suspended solids (TSS) and sediment load, introduction of contaminants (e.g., TDS, acidity, alkalinity, iron, aluminum, etc.), increased or reduced stream flow, and increased water temperature. These effects include: habitat fragmentation, geomorphic changes, chronic toxicity issues, altered food webs, and enhanced competition with other native and non-native species. These effects may reduce the fitness of listed fish species and reduce the availability and suitability of the habitats upon which they depend.

Clearing, grubbing, construction, and other earth moving and disturbance activities associated with coal mining operations produce point and non-point sources of sediment within and downstream of a coal mine. Sediment can affect fish through multiple pathways, including reproduction (lack of visual cues; reduction in interstitial spaces for benthic egg deposition or buried nests), feeding (altered prey base, reduced visibility of prey), and physiology (abraded or clogged gills). Consequently, fish exposed to unacceptable levels of sediment exhibit reduced survivability and reproductive success.

Most adverse impacts of surface coal mining operations on water quality occur as a result of the excavation and fracturing of the rock layers above the coal seam to produce spoil. Surface water and groundwater infiltrate the pore spaces in mine spoil placed in the backfilled area of a mine or in an excess spoil fill and react with air and the surfaces of the rock fragments to produce drainage with high ionic concentrations contributing to high total dissolved solids. Total dissolved solids cause toxicity through increases in salinity, changes in the ionic composition of the water and toxicity of individual ions. Elevated TDS and corresponding conductivity in freshwater streams interferes with native fish and other aquatic organisms' ability to osmoregulate. Sensitive fish species decline as osmotic tolerances are exceeded (Hitt et al. 2016). Elevated TDS also impact fish indirectly by modifying or reducing their macroinvertebrate food source.

In locations with geological formations that contain selenium, mining has sometimes resulted in elevated levels of selenium in streams draining the mine site. Mining exposes elemental selenium to air, thus, facilitating oxidation to selenite and selenate, which are soluble in water. Ziemkiewicz & Lovett (2012) experimentally found that the rate of selenium release from mine spoil can initially be rapid. Selenium bioaccumulates in fish tissues, causing reproductive problems, physical deformities, and, in extreme cases, mortality in fish in the affected waters (Lindberg, et al. 2011; Lemly, 1993, 2009).

Mining may affect the flow regime of streams by removing springs and otherwise causing changes in base flow, water temperature, seasonal variations in flow, and fluctuations in flow in response to storm events. Reclaimed mine sites generally exhibit reduced evapotranspiration (as a result of forest loss due to mining) and reduced infiltration of rainfall (as a result of soil compaction during reclamation), compared to unmined areas. Increased surface runoff in response to storms increases the potential for flood damage and may adversely impact the hydrologic function of the stream by causing stream channelization. These hydrologic changes

may affect the suitability of a stream for listed fish species. Channelized streams often lack habitat features such as pools, riffles and glides as well as suitable epifaunal substrate to support a diverse community of fish species. By causing geomorphic changes, altered flow regimes can eliminate fish spawning beds, fill in pools, and destabilize banks. These effects reduce the fitness of sensitive fish species by reducing the availability and suitability of the habitats upon which they depend.

All listed fish species with ranges that overlap mineable coal are anticipated to be affected by the action. In their BA, OSMRE considered the nature of these effects in reference to their likelihood to occur in waters that may be permitted for coal mining, or within watersheds of coal mining areas, as these activities are likely to cause at minimum effects to listed fish species and their habitats.

NPDES permits provide some protection to aquatic species, and CWA programs may require additional criteria to protect water quality standards. These requirements, coupled with site specific Protection and Enhancement Plans (PEP) should work in unison to minimize or prevent adverse impacts to ESA aquatic species, including sturgeon.

1.1.15.1 Fish – Sturgeon

This guild is represented by the ESA-listed Alabama Sturgeon (*Scaphirhynchus sutkussi*), Gulf Sturgeon (*Acipenser oxyrhynchus desotoi*), and Pallid Sturgeon (*Scaphirhynchus albus*). Coal mining's direct environmental effects generally occur far upstream of the large rivers inhabited by sturgeon. We anticipate effects from mining may extend farther downstream (Daniel et al. 2015). Therefore, although difficult to quantify, coal mining under the current program may indirectly affect sturgeon species. At a landscape level, coal mining contributes to the total anthropogenic impact on large rivers. Coal mining's alteration of upstream hydrology, fish, algal, and macroinvertebrate assemblages, food webs, and mining's contributions to sediment, metals, and conductivity loads may affect the health of downstream waters including large rivers and may indirectly contribute to a reduction in sturgeon species' fitness. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals.

Historically the range of Alabama sturgeon consisted of approximately 994 mi of river habitat in the Mobile River Basin in Alabama and Mississippi (USFWS 2010b). Alabama sturgeon has been recorded from the Black Warrior, Tombigbee, Alabama, Coosa, Tallapoosa, Mobile, Tensaw, and Cahaba rivers (Burke and Ramsey 1985, 1995). However, only 7 individuals were captured during targeted sampling efforts from the Cahaba and Alabama rivers (Kuhajda and Rider 2016), this decline has been attributed to impoundments and alteration of natural flow regimes, hydrology, sediment deposition as well as declines in water quality.

Effects to sturgeon are reduced by the hydrologic balance protections required. Material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

Without the implementation of special provisions or conservation measures, we expect sturgeon downstream of the footprint of individual surface coal mining operations to experience take in the form of harm through habitat loss and degradation. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect sturgeon to potentially be harassed, captured, or collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of sturgeon to result in injury or death of individuals.

The percentage of Alabama sturgeon total critical habitat that overlaps with mineable coal is 14.4%. The PBF's for Alabama sturgeon critical habitat are as follows:

(1)A flow regime (i.e., the magnitude, frequency, duration, seasonality of discharge over time) necessary to maintain all life stages of the species in the riverine environment, including migration, breeding site selection, resting, larval development, and protection of cool water refuges (i.e., tributaries). (2) River channel with stable sand and gravel river bottoms, and bedrock walls, including associated mussel beds. (3) Limestone outcrops and cut limestone banks, large gravel or cobble such as that found around channel training devices, and bedrock channel walls that provide riverine spawning sites with substrates suitable for egg deposition and development. (4) Long sections of free-flowing water to allow spawning migrations and development of embryos and larvae. (5) Water temperature not exceeding 32 °C (90 °F); dissolved oxygen levels not less than 5 mg/L (5 ppm), except under extreme conditions due to natural causes or downstream of existing hydroelectric impoundments, where it can range from 5 mg/L to 4 mg/L (5 ppm to 4 ppm); and pH (a measure of acidity) within the range of 6.0 to 8.5.

Since critical habitat for this guild is typically located in large rivers unlikely to be directly affected by coal mining, these types of effects to critical habitat are unlikely. However, other effects, such as degradation of water quality (acid mine effluent and heavy metals) or increased sedimentation may occur. That's said, we anticipate effects to be minimized by the use of special provisions or conservation measures, as identified through the coordination process.

1.1.15.2 Fish – Madtoms

This guild is represented by the ESA-listed Neosho Madtom (*Noturus placidus*) and the Yellowfin Madtom (*Noturus flavipinnis*). Effects to madtoms may occur from direct mortality, harassment, and habitat loss or degradation through increased sedimentation and water quality degradation. Sediment may degrade habitat and/or have effects to fish. It may clog gills; reduce aquatic insect diversity and abundance either directly or by blocking primary production; impair feeding success by reducing visibility of prey; bury nests; reduce growth rates; reduce disease tolerance; reduce spawning habitat and egg, larvae, and juvenile development; interfere with migration patterns; and reduce foraging efficiency (Waters 1995; Wood and Armitage 1997). Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals. Species-specific monitoring may be included as a permit

condition and may result in harassment, capture, and collection of individuals. Capture of young individuals could result in mortality.

In addition, madtoms, which are heavily dependent on chemoreception (detection of chemicals) for survival, might be susceptible to human-induced disturbances such as chemical and sediment inputs, because the olfactory (sense of smell) "noise" they produce could interfere with a madtom's ability to obtain food and otherwise monitor its environment (Etnier and Jenkins 1980; USFWS 2010c). These effects may lead to lowered survivorship, lowered reproductive success, and reduced fitness, all of which may lead to lowered population sizes.

Without the implementation of special provisions or conservation measures, we expect madtoms within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect madtoms to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Critical habitat for the Neosho and yellowfin madtoms does not overlap mineable coal basins.

1.1.15.3 Fish – Darters

This guild is represented by 15 ESA-listed darters (Table 1). Effects to darters may occur from may occur from direct mortality, harassment, and habitat loss or degradation through increased sedimentation and water quality degradation. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals. Capture of individuals could result in mortality. Sediment may degrade habitat and/or otherwise affect fish. It may clog gills; reduce aquatic insect prey diversity and abundance either directly or by blocking primary production; impair feeding success by reducing visibility of prey; bury nests; reduce growth rates; reduce disease tolerance; reduce spawning habitat and egg, larvae, and juvenile development; interfere with migration patterns; and reduce foraging efficiency (Waters 1995; Wood and Armitage 1997).

Elevated conductivity disrupts effective osmoregulation in fish and macroinvertebrates and impacts an organism's ability to extract energy from food, regulate internal pH and water volume, excrete wastes, develop embryos properly, and fertilize eggs (USFWS 2013n; Pond et al. 2008; USEPA 2011), and has been shown to negatively affect biological communities through loss of sensitive insect taxa and lowered fish diversity (Chambers and Messinger 2001; Fulk et al. 2003; Pond et al. 2008, 2014; Pond 2004; Stauffer and Ferreri 2002; Hitt and Chambers 2014; Black et al. 2013). Loss of sensitive insect taxa may result in reduced prey availability for darters and darters have been shown to be less abundant in areas of high conductivity (USFWS 2015e).

These effects may lead to lowered survivorship, lowered reproductive success, and reduced fitness, all of which may lead to lowered population sizes.

Without the implementation of special provisions or conservation measures, we expect darters within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect darters to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Coal mining may adversely affect PBFs for critical habitat of darters. It may alter flow regimes, channel characteristics, and reduce water and sediment quality. PBFs shared in common among darters in this guild include a prey base of diverse benthic macroinvertebrates, stream geomorphology and suitable substrate, suitable flow regimes including hydrological connectivity, adequate water quality characterized by moderate stream temperatures, acceptable dissolved oxygen concentrations, moderate pH, and low levels of pollutants. Adequate water quality is defined as the quality necessary for normal behavior, growth, and viability of all life stages.

Effects to darter critical habitat would be reduced by the required hydrologic balance protections. Material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable state and federal laws and effluent limitations.

1.1.15.4 Fish – Minnows

This guild is represented by 12 ESA-listed species of cyprinids, all of which are currently classified within the subfamily Leuciscinae. Effects to minnows may occur from direct mortality, disturbance, and habitat loss or degradation through increased sedimentation and water quality degradation. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals. Capture of individuals could also result in mortality. Sediment may degrade habitat and/or otherwise affect fish. It may clog gills; reduce aquatic insect diversity and abundance either directly or by blocking primary production; impair feeding success by reducing visibility of prey; bury nests; reduce growth rates; reduce disease tolerance; reduce spawning habitat and egg, larvae, and juvenile development; interfere with migration patterns; and reduce foraging efficiency (Waters 1995; Wood and Armitage 1997).

Elevated conductivity disrupts effective osmoregulation in fish and macroinvertebrates and impacts an organism's ability to extract energy from food, regulate internal pH and water volume, excrete wastes, develop embryos properly, and fertilize eggs (USFWS 2013n; Pond et al. 2008; USEPA 2011) and has been shown to negatively affect biological communities through loss of sensitive insect taxa and lowered fish diversity (Chambers and Messinger 2001; Fulk et al. 2003; Pond et al. 2008, 2014; Pond 2004; Stauffer and Ferreri 2002; Hitt and Chambers 2014; Black et al. 2013; Hitt et al. 2016). Loss of sensitive insect taxa may result in reduced prey

availability for minnows. Increased conductivity may result in decreased minnow species richness (Fulk et al. 2003). These effects may lead to lowered survivorship, lowered reproductive success, and reduced fitness, all of which may lead to lowered population sizes.

Effects to minnows would be reduced by the hydrologic balance protections required. Material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

Without the implementation of special provisions or conservation measures, we expect minnows within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect minnows to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Coal mining may adversely affect PBFs for critical habitat of the laurel dace. It may alter flow regimes, channel characteristics, and reduce water quality and increase sedimentation.

Effects to Laurel Dace critical habitat would be reduced by the required hydrologic balance protections. For example, material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. To address these issues, measures such as siltation structures should be properly installed and should effectively filter surface runoff before leaving the permit area and discharges of water must meet applicable state and federal laws and effluent limitations.

Critical habitat for the humpback chub, bonytail, and Colorado pikeminnow is located in large rivers and is less likely to be directly affected by coal mining. However, effects to PBFs for the three species may occur, such as alteration of water quantity or water quality and an increase in sedimentation.

1.1.15.5 Fish – Suckers

This guild is represented by the ESA-listed Zuni Bluehead Sucker (*Catostomus discobolus yarrow*) and the Razorback Sucker (*Xyrauchen texanus*). Effects to suckers may occur from direct mortality, disturbance, and habitat loss or degradation from increased sedimentation, elevated conductivity, and changes to water quality. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals. Capture of individuals could also result in mortality. Sediment may degrade habitat

and/or otherwise affect fish. It may clog gills; reduce aquatic insect diversity and abundance either directly or by blocking primary production; impair feeding success by reducing visibility of prey; bury nests; reduce growth rates; reduce disease tolerance; reduce spawning habitat and egg, larvae, and juvenile development; interfere with migration patterns; and reduce foraging efficiency (Waters 1995; Wood and Armitage 1997). Elevated conductivity disrupts effective osmoregulation in fish and macroinvertebrates and impacts an organism's ability to extract energy from food, regulate internal pH and water volume, excrete wastes, develop embryos properly, and fertilize eggs (USFWS 2013n; Pond et al. 2008; USEPA 2011), and has been shown to negatively affect biological communities through loss of sensitive insect taxa and lowered fish diversity (Pond et al. 2008, 2014; Pond 2004; Stauffer and Ferreri 2002; Hitt and Chambers 2014; Black et al. 2013).

These effects may lead to lowered survivorship, lowered reproductive success, and reduced fitness, all of which may lead to lowered population sizes. These effects are reduced with increased distance downstream from active mining. For larger river species such as the Razorback Sucker, some effects from coal mining are less likely. However, since effects from mining may extend farther downstream (Daniel et al. 2015), other effects may occur. Therefore, although difficult to quantify, coal mining under the current program may indirectly affect both sucker species. At a landscape level, coal mining contributes to the total anthropogenic impact on large rivers. Coal mining's alteration of upstream hydrology, fish, algal, and macroinvertebrate assemblages, food webs, and mining's contributions to sediment, metals, and conductivity loads may affect the health of downstream waters including large rivers and may indirectly contribute to a reduction in sucker species' fitness.

Effects to suckers may be reduced by the required hydrologic balance protections. Material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

Without the implementation of special provisions or conservation measures, we expect suckers within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect suckers to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Coal mining may adversely affect PBFs for critical habitat of suckers. It may alter flow regimes, channel characteristics, and reduce water and sediment quality. Effects to sucker critical habitat would be reduced by hydrologic balance protections. Damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected.

Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

1.1.15.6 Fish – Trout

This guild is represented by the ESA-listed Apache Trout (*Oncorhynchus apache)*, Greenback Cutthroat Trout *(Oncorhynchus clarkia stomias)*, and the Gila Trout *(Oncorhynchus gilae)*. Effects to trout may occur from direct mortality, disturbance, and habitat loss or degradation from increased sedimentation, elevated conductivity, and changes to water quality. Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals. Capture of individuals could also result in mortality. Sediment may degrade habitat and/or otherwise affect fish. It may clog gills; reduce aquatic insect diversity and abundance either directly or by blocking primary production; impair feeding success by reducing visibility of prey; bury nests; reduce growth rates; reduce disease tolerance; reduce spawning habitat and egg, larvae, and juvenile development; interfere with migration patterns; and reduce foraging efficiency (Waters 1995; Wood and Armitage 1997). Elevated conductivity disrupts effective osmoregulation in fish and macroinvertebrates and impacts an organism's ability to extract energy from food, regulate internal pH and water volume, excrete wastes, develop embryos properly, and fertilize eggs (USFWS 2013n; Pond et al. 2008; USEPA 2011) and has been shown to negatively affect biological communities through loss of sensitive insect taxa and lowered fish diversity (Pond et al. 2008, 2014; Pond 2004; Stauffer and Ferreri 2002; Hitt and Chambers 2014; Black et al. 2013).

These effects may lead to lowered survivorship, lowered reproductive success, and reduced fitness, all of which may lead to lowered population sizes.

Without the implementation of special provisions or conservation measures, we expect trout within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect trout to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Critical habitat is not designated for any of the trout species in this guild that may be affected by the action.

1.1.16 Crustaceans – Crayfishes

This guild is represented by the ESA-listed Big Sandy crayfish (*Cambarus callainus*), the Guyandotte River crayfish (*C. veteranus*), and the Slenderclaw crayfish (*Cambarus cracens*). The Guyandotte River crayfish has experienced a significant reduction in its historical range and is now restricted to two streams (Loughman et al. 2016). There has been a likely reduction in the

Big Sandy crayfish's historical range as well. The populations of both species appear to be depressed, critically so for the Guyandotte River crayfish. Threats to the slenderclaw crayfish include hydrologic variation and alteration, poultry farming and agriculture, degraded water quality, low abundance, and non-native species. Slenderclaw crayfish range overlaps with mineable coal, but coal mining is not mentioned as a threat. Effects to crayfish from mining may come from direct mortality, harassment, and habitat loss or degradation of aquatic habitat from increased conductivity, increased sedimentation, and increased levels of manganese and iron. Water quality is degraded in both the Big Sandy and Upper Guyandotte River basins with metals and pH impairment common (USFWS 2016e). The sources of these impairments include: coal mining; roads; logging; oil and gas development; on-road and off-road transportation; and residential/commercial development and associated stream modifications.

Recent field study shows the Guyandotte River crayfish has not been found in streams with conductivity higher than 460 µS/cm or sulfate levels higher than 200 mg/l (Loughman 2016). Because both species are tertiary burrowers, increased sedimentation may render habitat unsuitable, and allow them to be outcompeted by secondary burrowers. Excessive iron and manganese may adversely affect reproduction and immature egg cells, as well as bonding to their exoskeletons, reducing overall health. These effects may reduce overall fitness, leading to reduced population size.

Species-specific monitoring may be included as a permit condition and may result in harassment, capture, and collection of individuals. Capture of individuals could also result in mortality. Crayfish may be more sensitive to elevated conductivity during molting. They may experience stressful molts or die in mid-molt.

Properly designed, monitored and enforced effects to crayfish are reduced by the hydrologic balance protections required by SMCRA regulations. Under the regulations, mining operations must avoid material damage to the hydrologic balance outside the permit area and must protect surface water and groundwater. The regulations also require sediment control measures to prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. The regulations require, with minor exceptions, all surface drainage to pass through a siltation structure before leaving the permit area and that discharges of water meet applicable state and federal laws and effluent limitations.

Even after the implementation of special provisions or conservation measures, we expect crayfish within and downstream of the footprint of individual surface coal mining operations to continue to experience take in the form of mortality, and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect crayfish to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Critical habitat has been proposed but has not been finalized for Big Sandy crayfish, Guyandotte River crayfish, and slenderclaw crayfish. Proposed critical habitat for the Big Sandy crayfish

overlaps mineable coal by 90% and 100% of proposed critical habitat for the Guyandotte River crayfish overlaps mineable coal. Given the high degree of overlap of mineable coal with proposed designated critical habitat for both Big Sandy River crayfish and Guyandotte River crayfish effects to critical habitat from the action are anticipated to occur.

Adverse effects to PBFs to proposed critical habitats for Big Sandy River crayfish and Guyandotte River crayfish from coal mining that are anticipated include alterations to flow regimes, channel characteristics, reductions to water quality, increased sedimentation, and reduced invertebrate prey abundance and diversity. Effects to proposed crayfish critical habitat would be reduced by hydrologic balance protections. Damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

1.1.17 Mollusks – Freshwater Mussels

This guild is represented by 51 species of freshwater mussels (Table 1). Effects to mussels from mining may occur as direct mortality, disturbance, and habitat loss or degradation from increased sedimentation (including coal fines) and turbidity, and increased metals concentrations. Effects from mining may extend farther downstream (Daniel et al. 2015). If mussels inhabit stream beds that are mined through or that function as a low-water crossing, they would likely be killed by direct contact with mining equipment. Species-specific monitoring or relocation efforts may be included as a permit condition and may result in harassment, capture, and collection of individuals. Capture or relocation of individuals could also result in mortality.

Specific biological effects from sedimentation include reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates, limited burrowing activity, physical smothering, and disrupted host fish attraction mechanisms (USFWS 2013b). Sedimentation may also cause physical changes in the habitat which can result in mussels being dislodged, transported downstream, or stranded. Sediment contamination from coal mining also affects survival and growth of mussels (Wang et al. 2013). Recruitment failure can occur due to clogging of interstitial spaces needed for juvenile mussel survival (USFWS 2013b). Since juvenile mussels ingest sediment when they feed, contaminants which may be in the sediment are ingested as well and may bioaccumulate. This may affect juvenile survival.

Research indicates that mussel populations were inversely correlated with coal fines in the substrate and when coal fines were present, decreased filtration times and increased movements were noted in laboratory-held mussels (Kitchel et al. 1981). Increased turbidity can interfere with the feeding ability of sight-feeding fishes that may serve as hosts and may also reduce mussels' ability to attract fish hosts. All of the above-mentioned effects may result in reduced reproductive success, reduced recruitment and lower population numbers.

Coal mining may result in the release of metals and other trace elements to which mussels are known to be sensitive (Price et al. 2011, 2014; Zipper et al. 2014; Soucek et al. 2003). SMCRA requires iron, manganese, and pH to meet effluent limits but not other metals and trace elements. Increased metals concentrations may disrupt enzyme efficiency, alter filtration rates, reduce

growth, and change behavior (USFWS 2012b, 2013b). This may result in reduced recruitment or mortality.

Without the implementation of special provisions or conservation measures, we expect mussels within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect mussels to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Coal mining is listed as a threat to critical habitat for a number of mussel species. It is mentioned as an activity involving a Federal action that may destroy or adversely modify critical habitat for the slabside pearlymussel and the fluted kidneyshell: "Contaminants associated with coal mining (metals, other dissolved solids), municipal effluents (bacteria, nutrients, pharmaceuticals), and agriculture (fertilizer, pesticides, herbicides, and animal waste) cause degradation of water quality and habitats. The Clean Water Act has been insufficient to significantly reduce or remove these threats to the fluted kidneyshell and slabside pearlymussel" (USFWS 2013e). Coal mining is mentioned as an activity that is negatively affecting water quality in Neosho mucket and rabbitsfoot habitat: "Coal mining activities, resulting in heavy metal-rich drainage, and associated sedimentation has adversely affected many drainages…low pH commonly associated with mine runoff can reduce glochidial attachment rates on host fish" (USFWS 2012b). The pH of effluent from mines is required to be between 6.0 and 9.0 standard units, which prevents the mobilization of acid-soluble metals (Price et al. 2011). Iron, manganese, and solids must also meet effluent limitations. Other metals and trace elements do not have to meet any effluent limits.

Coal mining may otherwise adversely affect PBFs for critical habitat of mussels. It may alter flow regimes, channel characteristics, and reduce water and sediment quality. Effects to mussel critical habitat under the SMCRA regulations would be reduced by the required hydrologic balance protections. Material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

1.1.18 Mollusks – Freshwater Snails

This guild is represented by five ESA-listed species of freshwater snails (Table 1). Effects to freshwater snails from mining may occur as direct mortality, or habitat loss or degradation through sedimentation. Effects from mining may extend farther downstream (Daniel et al. 2015). Snails in stream beds or wetlands that are mined through or that function as a low-water crossing

would likely be killed by direct contact with mining equipment. Species-specific monitoring may be included as a permit condition and may result in capture and collection of individuals. Capture of individuals could also result in mortality.

Excessive sedimentation can make their habitat unsuitable for feeding or reproduction. Periphyton upon which they may feed may be smothered, and respiration, growth, and reproductive success may be impaired. All these stressors can lead to reduced fitness and lower population sizes.

Effects to snails may be reduced by the required hydrologic balance protections. Material damage to the hydrologic balance outside the permit area must be prevented and surface water and groundwater must be protected. Sediment control measures must prevent, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area. With minor exceptions, all surface drainage is required to be passed through a siltation structure before leaving the permit area and discharges of water must meet applicable State and Federal laws and effluent limitations.

Without the implementation of special provisions or conservation measures, we expect freshwater snails within and downstream of the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss, degradation, and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect mussels to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Critical habitat is not designated for any of the freshwater snail species in this guild that may be affected by the action.

1.1.19 Mollusks – Terrestrial Snails

This guild is represented by the flat-spired three-toothed snail (*Triodopsis platysayoides*). If mining were to occur in terrestrial snail habitat, effects may occur from direct mortality and habitat loss. Snails in habitat that is cleared, grubbed, and mined through would likely be killed by direct contact with mining equipment. Species-specific monitoring may be included as a permit condition and may result in capture and collection of individuals. Capture of individuals could also result in mortality. Habitat loss leads to reduced food availability and egg laying area which in turn directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size.

These effects would be lessened by the requirement to identify habitats of unusually high value for fish and wildlife and for a fish and wildlife protection and enhancement plan. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These

requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect terrestrial snails within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect snails to potentially be harassed, captured, collected, or killed depending on the survey protocols recommended by the Service.

Critical habitat is not designated for the flat-spired three-toothed snail.

1.1.20 Mammals – Bats

The four ESA-listed bats representing this guild are all in the family Vespertilionidae. Effects to bats from mining may occur through direct mortality, disturbance, and habitat loss and degradation by elimination of forested roosting and foraging habitat. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Habitat could be lost directly through clearing and grubbing in riparian areas or through groundwater pumping. Groundwater pumping may result in depletion of surface flows, degradation, and loss of riparian habitats, and local declines or extirpations of aquatic and riparian plants and animals (OSMRE 2011). Loss of suitable breeding, roosting, or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Fragmentation of forested habitats as a result of coal mining would affect connectivity of bat breeding areas and therefore reduce genetic dispersal. Population viability would be affected if populations become isolated to the extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging and nest monitoring is included in the survey protocol.

Bats in habitat that is cleared, grubbed, and mined through may be killed by direct contact with mining equipment. Species-specific monitoring may be included as a permit condition and may result in harassment, capture and collection of individuals. Loss of foraging habitat leads to lowered food availability while loss of roosting habitat may lead to lowered reproductive success, both of which directly affect survivorship and reproduction and may lead to lowered population size. There may also be effects to bats that roost or hibernate in caves from blasting vibrations that disturb or disrupt hibernation or maternity roosts. Blasting may cause hibernating bats to arouse and use up energy reserves necessary for hibernation (USFWS 2011a). In maternity caves it may cause mothers to abandon pups prematurely. Both of these situations

could lead to mortality which could lead to lowered population size. Abandoned mines may collapse or may have surrounding habitat that affects mine airflow or is less valuable for swarming, which makes the abandoned mines less likely to support the species' roosting needs.

These effects would be lessened by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. The plan must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable or restoring habitats of unusually high value for fish and wildlife.

Range-wide guidelines for the development of protection and enhancement plans for the Indiana bat were developed by a group comprised of OSMRE, Service, and representatives of several state regulatory authorities (USFWS et al. 2009). These measures include replacement of forested habitat, limitations on blasting vibration levels, time of year restrictions on tree cutting, buffer zones around maternity colonies and hibernacula, and other habitat replacement and enhancement measures. Time of year restrictions on tree cutting are especially important as they prevent direct mortality by ensuring occupied trees will not be cut down.

Without the implementation of special provisions or conservation measures, we expect bats within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect bats to potentially be harassed, captured, and collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of bats to result in injury or death of individuals.

Both the Virginia big-eared bat and the Indiana bat have critical habitat designated (USFWS 1976, 1977a, 1979). Critical habitat for these bats consists of caves in several eastern states. None of the critical habitat overlaps mineable coal; therefore, there should be no adverse effects from this action to the critical habitat of these species.

1.1.21 Mammals – Cats

This guild is represented by three listed species in three different genera: Canada lynx (*Lynx canadensis*); Gulf Coast ocelot (*Leopardus pardalis*); and jaguarundi (*Herpailurus yagouaroundi*).

If mining were to occur in Canada lynx habitat, effects may occur from habitat loss and fragmentation; disturbance to denning or foraging; mortality from vehicle collisions; and changes in winter access which may increase competition and disturbance (USFS 2017). Habitat loss or fragmentation is possible from subsidence, landslides, or the installation of mine ventilation boreholes at underground mines (OSMRE 2019). Habitat loss leads to reduced food availability which in turn directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size. Habitat fragmentation leads to reduced dispersal and genetic exchange, reducing population viability.

In the action area, ocelots, and jaguarundis, are associated with the Tamaulipan thornshrub communities in southern Texas. The ocelot's range overlaps mineable coal by approximately 21%; the range of the jaguarundi overlaps mineable coal by approximately 25%. Effects of the action on jaguarundi and ocelot would be unlikely, if they occurred at all, due to the rarity and specific habitat requirements of these species. However, if effects do occur mortality from vehicle strikes and habitat loss is possible. Future state and private actions likely to occur include industrial development, such as liquefied natural gas terminals.

These effects would be reduced by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. The plan must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable, or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect mammals within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect mammals to potentially be harassed, captured, and collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of mammals to result in injury or death of individuals.

Approximately 1% of designated critical habitat for Canada lynx overlaps with mineable coal. Given the habitat preference of Canada lynx in the northwest for evergreen forests on steep slopes, it is anticipated that coal reserves may be inaccessible for mining, and therefore; effects from coal mining are less likely to occur within the designated critical habitat for the species. If

effects were to occur to PBFs they are likely to be related to habitat fragmentation through construction of roads in remote or roadless areas and habitat loss through changes in land use.

No critical habitat is designated for either Gulf Coast jaguarundi or ocelot.

1.1.22 Mammals – Jumping Mice

This guild is represented by the ESA-listed Preble's meadow jumping mouse (*Zapus hudsonius preblei*), and the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*). If mining were to occur in jumping mice habitat, effects may occur primarily from direct mortality, disturbance, and habitat loss and fragmentation. Disturbance of individuals living adjacent to surface coal mining operations may occur from the increased presence of human activity, noise, and dust generated during the mining process. Such disturbance could result in increased energetic costs associated with stress and abandonment of normal behaviors. Habitat could be lost directly through clearing and grubbing in riparian areas or through groundwater pumping. Groundwater pumping may result in depletion of surface flows, degradation, and loss of riparian habitats, and local declines or extirpations of aquatic and riparian plants and animals (OSMRE 2011). Loss of suitable breeding, sheltering, or foraging habitat could result in reduced breeding success and stress due to competition for remaining suitable habitat. Population viability would be affected if populations become isolated to the extent that adults and juveniles cannot successfully disperse between remaining patches. These effects would result in fewer offspring and lowered population size. Species-specific monitoring may be included as a permit condition and may result in harassment of individuals or capture and collection of individuals if tagging is included in the survey protocol.

Without the implementation of special provisions or conservation measures, we expect mammals within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect mammals to potentially be harassed, captured, and collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of mammals to result in injury or death of individuals.

Approximately 4.4 percent of Preble's meadow jumping mouse critical habitat overlaps mineable coal. The PBFs that could be affected if coal mining were to occur in Preble's meadow jumping mouse critical habitat are as follows:

(1) Riparian corridors: (a) Formed and maintained by normal, dynamic, geomorphological, and hydrological processes that create and maintain river and stream channels, floodplains, and floodplain benches and that promote patterns of vegetation favorable to the PMJM; (b) Containing dense, riparian vegetation consisting of grasses, forbs, or shrubs, or any combination

thereof, in areas along rivers and streams that normally provide open water through the PMJM's active season; and (c) Including specific movement corridors that provide connectivity between and within populations. This may include river and stream reaches with minimal vegetative cover or that are armored for erosion control; travel ways beneath bridges, through culverts, along canals and ditches; and other areas that have experienced substantial human alteration or disturbance.

(2) Additional adjacent floodplain and upland habitat with limited human disturbance (including hayed fields, grazed pasture, other agricultural lands that are not plowed or disked regularly, areas that have been restored after past aggregate extraction, areas supporting recreational trails, and urban–wildland interfaces).

Critical habitat for the New Mexico meadow jumping mouse was designated in 2016. Approximately 9.3 percent of this critical habitat overlaps mineable coal. The PBFs that could be affected if coal mining were to occur in New Mexico meadow jumping mouse critical habitat are as follows: (1) Riparian communities along rivers and streams, springs and wetlands, or canals and ditches that contain: (a) Persistent emergent herbaceous wetlands especially characterized by the presence of primarily forbs and sedges (*Carex* spp. or Schoenoplectus pungens); or (b) Scrub-shrub riparian areas that are dominated by willows (*Salix* spp.) or alders (*Alnus* spp.) with an understory of primarily forbs and sedges.(2) Flowing water that provides saturated soils throughout the New Mexico meadow jumping mouse's active season that supports tall (average stubble height of herbaceous vegetation of at least 61 cm (24 inches) and dense herbaceous riparian vegetation composed primarily of sedges (*Carex* spp. or *Schoenoplectus pungens*)) and forbs, including, but not limited to one or more of the following associated species: spikerush (*Eleocharis macrostachya*), beaked sedge (*Carex rostrata*), rushes (*Juncus* spp. and *Scirpus* spp.), and numerous species of grasses such as bluegrass (*Poa* spp.), slender wheatgrass (*Elymus trachycaulus*), brome (*Bromus* spp.), foxtail barley (*Hordeum jubatum*), or Japanese brome (*Bromus japonicas*), and forbs such as water hemlock (*Circuta douglasii*), field mint (*Mentha arvense*), asters (*Aster* spp.), or cutleaf coneflower (*Rudbeckia laciniata*). (3) Sufficient areas of 9 to 24 km (5.6 to 15 mi) along a stream, ditch, or canal that contain suitable or restorable habitat to support movements of individual New Mexico meadow jumping mice. (4) Adjacent floodplain and upland areas extending approximately 100 m (330 ft) outward from the boundary between the active water channel and the floodplain (as defined by the bankfull stage of streams) or from the top edge of the ditch or canal.

If mining were to occur in jumping mouse critical habitat, effects to the PBFs would occur. Removal of riparian vegetation cover would eliminate the riparian vegetation PBF. Replacement of riparian vegetation could occur but would likely not develop into suitable habitat before bond release. Under SMCRA the regulatory authority would have no control over the site after bond release, and the landowner may choose to remove the vegetation.

These effects will be reduced by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement

measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable, or restoring habitats of unusually high value for fish and wildlife.

1.1.23 Mammals – Other mammals

The guild of other mammals is represented by the ESA-listed Utah prairie dog (*Cynomys parvidens*), and black-footed ferret (*Mustela nigripes*). If mining were to occur in Utah prairie dog habitat, effects may occur primarily from habitat loss and fragmentation. Approximately 13% of Utah prairie dog's range overlaps mineable coal. Habitat loss leads to reduced food availability which in turn directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size. Habitat fragmentation leads to reduced dispersal and genetic exchange, reducing population viability.

If mining were to occur in black-footed ferret habitat, effects may occur primarily from habitat loss. Approximately 11% of black-footed ferret habitat range overlaps with mineable coal. Prairie dog burrows and vegetation that they rely on for food would be eliminated. Habitat loss leads to reduced food availability, which, in turn, directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size.

These effects will be reduced by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable, or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect mammals within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect mammals to potentially be harassed, captured, and collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of mammals to result in injury or death of individuals.

No critical habitat is designated for either the Utah prairie dog or black-footed ferret.

1.1.24 Mammals – North American wolverine

There appear to be two separate wolverine populations in the contiguous United States: one in the North Cascades in Washington, and one in the northern Rocky Mountains in Idaho, Montana, and Wyoming, as well as the Wallowa Range in Oregon (USFWS 2016g). Approximately 2% of its range overlaps mineable coal.

If mining were to occur in wolverine habitat, effects may occur from habitat loss or degradation. Habitat loss leads to reduced food availability, which, in turn, directly affects survivorship and reproduction. Lowered survivorship and reproduction lead to reduced population size. However, these effects are unlikely since little if any mining is likely to take place in wolverine habitat. There is very little information regarding wolverine response to human disturbance, but it appears they can adjust to moderate amounts of disturbance (USFWS 2016g).

These effects will be reduced by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable, or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect mammals within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect mammals to potentially be harassed, captured, and collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of mammals to result in injury or death of individuals.

No critical habitat is designated for the North American wolverine.

1.1.25 Mammals – Grizzly Bear

There would likely be little effect on grizzly bears from this action due to the small amount of habitat overlap with mineable coal (1%) and their large home ranges.

These effects will be reduced by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable, or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect mammals within the footprint of individual surface coal mining operations to experience take in the form of mortality, and harm through habitat loss and disturbance. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize take associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in the this programmatic BiOp and the 2020 coordination and dispute resolution process (Appendices A and B) are expected to minimize or avoid impacts to ESA-resources. In the event species-specific monitoring is included as a permit condition, we expect mammals to potentially be harassed, captured, and collected depending on the survey protocols recommended by the Service. We would not typically expect Service-approved monitoring of mammals to result in injury or death of individuals.

Critical habitat is not designated for the grizzly bear.

1.1.26 Plants – Xeric Species

This guild is represented by 18 species; eight are listed as endangered and nine are listed as threatened (Table 1). Effects to this guild from mining under the current program may occur from direct mortality or habitat loss and degradation. Species-specific monitoring or relocation may be included as a permit condition. No adverse effects would likely be associated with plant surveys; however, relocation efforts would include collection and possible mortality of plants. Plants within the permit boundary may be directly killed from vegetative clearing, grubbing, and from coal excavation. Effects from disturbance may occur as a result of: (1) increasing dust, which increases tissue temperature and reduces photosynthesis, vigor, and water use efficiency (Farmer 1993; Sharifi et al. 1997); (2) degrading habitat of pollinators and other beneficial organisms; and (3) erosion and sedimentation that may bury plants.

Effects to habitat may occur by: (1) habitat fragmentation (the division of continuous habitat into smaller, more isolated remnants) which modifies plants' interactions with other individuals of the same species and their pollinators (e.g., lower cross-pollination); (2) increasing edge effects (this fragmented habitat results in an increased boundary, or transition habitat) which may decrease acceptable habitat and create a suitable entry for plants that outcompete species in this guild (e.g., noxious weeds); (3) further introducing noxious weeds and other aggressive plants by moving soil and contaminated machinery throughout the permitted site, and (4) lowering the number of pollinator visits by spraying pesticides (including herbicides to kill unwanted plants that are not the within this xeric guild but are also utilized by this guild's pollinators). Effects

may also occur from harming or destroying seeds by increasing erosion, soil compaction, and sedimentation that may bury or otherwise preventing successful seed germination and establishment.

Effects during reclamation may occur from: (1) introducing plant species within the approved reclamation seed mix that are designed to grow and spread (i.e., reproduce) quickly to prevent erosion. These (and other species brought in via contaminated machinery) can outcompete individuals and/or outcompete plants that are a source of nutrition for pollinators that also visit the species in this guild; (2) changing the topography, contour, and/or aspect of the landscape. Some species in this guild prefer south facing and steep slopes and very specific soil characteristics. Without accurate reconstruction of the original landscape this habitat may be eliminated within the permit boundary; and (3) the homogenization of topsoil during its redistribution. This not only changes the soil structure and composition but also changes the depth where the seeds occur within the soil profile, lowering seed bank viability (seeds are very important to the persistence of most of the species within this guild). Changes in soil structure can also lead to a breakdown of the obligate association between fungal communities and some plant species, reducing plant viability.

Other effects to this guild are not likely within the permit boundary. If mining occurs in their habitats, they are likely to be directly affected as described above. However, effects are possible on adjacent and other connected lands. These effects may be created by certain postmining land uses such as livestock grazing and permanent structures such as buildings, roads, or impoundments.

Effects from roads may result from an increase in human activity. Permanent roads can result in access points to undisturbed adjacent lands, causing the increased use of off-highway vehicles and other types of human activity, including camping and hiking. These activities can kill and injure plants and destroy and degrade habitat by entering into habitat and running over and/or trampling individuals and disturbing the ground, introducing competitive plants species via contaminated equipment, and affecting pollinator habitat to cause lower reproductive capacity. These activities may also create habitat fragmentation and edge effects through repeated disturbance. Activities near habitat can result in its degradation due to an increase in soil erosion, compaction, dust, and introduction of plants that outcompete ESA-listed xeric species.

Other permanent structures (e.g., buildings, fences, permanent water diversions, and impoundments), especially those located on or near the former permit boundary also have the potential to cause impacts on adjacent lands by concentrating disturbance activities in and around these structures and may serve as similar access points and result in the same effects as permanent roads.

Effects may also occur from reclaiming lands using approved plant species that establish quickly, produce a large amount of biomass, persist, reproduce, and spread on their own. These characteristics that support soil stabilization and certain wildlife also tend to produce aggressive and permanent populations on adjacent and otherwise connected lands. These plants have the ability to degrade habitat by outcompeting individuals and by changing the soil, light, and water characteristics of this habitat. They may also outcompete other plants that are used by the pollinators of the xeric guild, further degrading the habitat by lowering local populations of pollinators.

These effects may result in lower population vitality (e.g., greater susceptibility to competition and disease) reduced reproductive success, and reduced fitness, which may lead to a lower number of populations and lower population sizes.

Species within this guild tend to be short plants with shallow root systems that can be affected by the addition and/or removal of soil into their habitat. Sedimentation, siltation, and erosion (including air pollution as a result of erosion, i.e., the collection of dust onto plant tissues) of soils may affect this guild, by either adding or removing too much soil from their habitats. Adding too much soil to their habitats could result in the burying of adults, seedlings, and seeds, a reduction in photosynthetic capacity and root growth, and change the surface hydrology to individual plant habitat resulting in the loss of water available to plants. Excess dust may also prevent pollinators from successfully fertilizing these plants.

The effects of sedimentation, siltation, and erosion (including air pollution as a result of erosion) would be lessened by retaining sediment within disturbed areas and diverting runoff away from disturbed areas to avoid excess sedimentation and erosion outside the permit area; and requirements that would reduce dust and erosion from surface activities, including roads.

Topsoil is required to be protected from contaminants, unnecessary compaction, and erosion that would interfere with revegetation. Seeds and the seed bank are an important part of this guild's reproductive strategy, and seed longevity of many of the species within this guild is unknown. Topsoil salvage and direct haul topsoil salvage (using topsoil to reclaim an area directly after it is removed from its original area) may allow these seeds to germinate and establish populations.

These effects will be reduced by the requirements to develop a protection and enhancement plan that describes how the operator will minimize disturbances and adverse impacts to fish and wildlife, including ESA-listed and proposed species and designated or proposed critical habitat. These plans must include protective measures to be used during mining and enhancement measures that will be used during reclamation and the postmining phase to develop terrestrial and aquatic habitat. The mining permit applicant is also required to identify habitats of unusually high value for fish and wildlife. Identification of these habitats would make it possible to avoid or restore them. Effects would also be reduced by the requirements for protection of fish, wildlife, and related environmental values. These requirements include avoiding disturbing, enhancing where practicable, or restoring habitats of unusually high value for fish and wildlife.

Without the implementation of special provisions or conservation measures, we expect xeric plants within and adjacent to the footprint of individual surface coal mining operations to experience mortality and harm through habitat loss and degradation. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize impacts associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect minimal adverse impact from Service-approved surveys of xeric plants. If species-specific plant relocation is included as a permit condition, we expect target plants to experience effects in the form of collection and possible mortality.

If mining were to occur in the critical habitat of the Debeque phacelia, effects to the PBFs would occur. Removal of topsoil, the vegetative community, and landscape characteristics would eliminate PBFs. Topsoil formation could occur, but it would take many years to reform and the landscape characteristics may never return. These PBFs would not be present on the site, if at all, until long after the bond release had occurred. That said, we anticipate effects to critical habitat to be minimized through the coordination process, when the Service has the opportunity to identify measures that will minimize effects.

1.1.27 Plants – Mesic Species

This guild is represented by 18 species; nine are listed as endangered and nine are listed as threatened (Table 1). Effects to this guild from mining may occur from direct mortality or through habitat loss and degradation. Species-specific monitoring or relocation may be included as a permit condition. No adverse effects would likely be associated with plant surveys; however, relocation efforts would include collection and possible mortality of plants. Plants within the permit boundary may be directly killed from vegetative clearing, grubbing, and from coal excavation. Effects from disturbing individuals may occur as a result of damage to soil (erosion, sedimentation, and compaction) that may bury or expose individual plants.

Effects to habitat may occur by: (1) habitat fragmentation (the division of continuous habitat into smaller, more isolated remnants) which modifies plants' interactions with other individuals of the same species and their pollinators (e.g., lower cross-pollination), (2) increasing edge effects (this fragmented habitat results in an increased boundary, or transition habitat) which may decrease acceptable habitat and create a suitable entry for plants that outcompete species in this guild (e.g., invasive weeds), (3) further introducing noxious weeds and other aggressive plants by moving soil and contaminated machinery throughout the permitted site, and (4) lowering the number of pollinator visits by spraying pesticides (including herbicides to kill unwanted plants that are not the within this mesic guild but are also utilized by pollinators). Effects may also occur from harming or destroying seeds by increasing erosion, soil compaction, and sedimentation that may bury and/or otherwise harm seeds, preventing successful germination and establishment.

Effects during reclamation may occur from: (1) introducing plant species within the approved reclamation seed mix that are designed to grow and spread (i.e., reproduce) quickly to prevent erosion. These (and other species brought in via contaminated machinery) can outcompete individuals and/or outcompete plants that are a source of nutrition for pollinators that also visit the species in this guild; (2) changing of topography, contour, and/or aspect of the landscape. Some species in this guild prefer south facing land and rock outcrops. Without accurate reconstruction of the original landscape this habitat may be eliminated within the permit boundary; and (3) the homogenization of topsoil during its redistribution. This not only changes the soil structure and composition but also changes the depth where the seeds occur within the soil profile, lowering seed bank viability. Changes in soil structure can also lead to a breakdown of the obligate association between fungal communities and some plant species, reducing plant viability.

Other effects to this guild are not likely within the permit boundary. If mining occurs in their habitats, they are likely to be affected as described above. However, effects are possible on adjacent and other connected lands. These effects may be created by certain postmining land uses (e.g., intensive livestock grazing, agricultural development) and establishing permanent structures such as buildings, roads, or water impoundments.

Effects from roads may result from an increase in human activity. Permanent roads can result in access points to undisturbed or minimally used adjacent lands, causing the increased use of off-highway vehicles and other types of human activity, including camping and hiking. These activities can kill and injure plants and destroy and degrade habitat by entering into habitat and running over and/or trampling individuals and disturbing the ground, introducing competitive plants species via contaminated equipment, and affecting pollinator habitat to cause lower reproductive capacity. For example, the two species that occur in glade habitats may experience dramatic habitat loss and individual death when access to these environments increases human activities, as these open habitats within forests could be used for camping and off-highway vehicle use. These activities may also create habitat fragmentation and edge effects through repeated disturbance. Activities near habitat can result in degradation due to an increase in soil erosion, compaction, and introduction of plants that outcompete these mesic species.

Other permanent structures (e.g., buildings, fences, permanent water diversions, and impoundments), especially those located on or near the former permit boundary also have the potential to cause impacts on adjacent lands by concentrating disturbance activities in and around these structures and may serve as similar access points and result in the same effects as permanent roads.

Effects may also occur from reclaiming lands using approved plant species that establish quickly, produce a large amount of biomass, persist, reproduce, and spread on their own. These characteristics that support soil stabilization and certain wildlife species also tend to produce aggressive and permanent populations on adjacent and otherwise connected lands. These plants have the ability to degrade habitat by outcompeting individuals and by changing the soil, light, and water characteristics of this habitat. They may also outcompete other plants that are used by the pollinators of this guild, further degrading the habitat by lowering local populations of pollinators.

These actions could result in loss of individuals and habitat, and also habitat degradation and fragmentation, and could result in demographic fluctuations and lowered genetic diversity. These effects may result in lower population vitality (e.g., more susceptibility to competition and disease), reduced reproductive success, and reduced fitness, which may lead to a lower number of populations, and lower population sizes.

These effects to mesic species under the current requirements would be lessened by several performance standards. Requirements specific to erosion control measures would reduce dust and erosion from surface activities, including roads, and would provide pollinators of these species further protection. Requirements designed to protect soil resources, including the seed bank, would reduce effects to the species within this guild that exist in prairie and grassland habitats. Soil that is redistributed without first being stored would allow these species a chance to germinate and establish viable populations.

Surface and ground water levels and flow rates (i.e., quantity) are important to this guild and can be affected by coal mining. SMCRA regulations have performance standards designed to protect seasonal water quantity fluctuations including: protection of surface water flow rates and required surface water monitoring; required compliance with all applicable State and Federal water quality laws and regulations; requirements that all diversions of perennial and intermittent streams have no adverse effect on water quantity (i.e., seasonal flow rates); and establishment of standards to prevent discharge structures from affecting quantity below the disturbance area.

Some species of this guild rely on water quality that is based upon local and specific water quality characteristics; these habitats and individuals connected to surface and ground water are sensitive to deviations from these local water quality conditions. Changes in water quality may result in habitat degradation and reduced fitness of individual plants. Requirements to protect local water composition (i.e., surface and ground water quality) include: protection of surface and groundwater quality; required surface and groundwater quality monitoring; requirement to use diversions that will not adversely affect the water quality and related environmental resources of streams; and the protection of water quality from durable rock fills, refuse pile contamination, permitted roads, and the waters below the lowest coal seam when mountaintop removal mining is used.

Sedimentation, siltation, erosion, and compaction of soils may also affect this guild, by either adding or removing too much soil to or from their habitats, and changing the density (e.g., compaction) of soil within habitat. This could result in the burying of seedlings and seeds, a reduction in photosynthetic capacity and root growth, and hydrologic and drainage changes to individual plant habitat. Requirements protecting against sedimentation, siltation, erosion, and compaction of soils require to the extent possible, the prevention of additional contributions of sediment to runoff outside the permit area and the minimization of erosion.

If mining were to occur in the critical habitat of the Short's bladderpod, effects to the PBFs would occur. Removal of topsoil and the vegetative community, and the change in landscape characteristics would eliminate PBFs. Topsoil formation could occur but it would take many years to reform landscape characteristics, and they may never return. These PBFs would not be present on the site, if at all, until long after bond release had occurred.

Without the implementation of special provisions or conservation measures, we expect mesic plants within and adjacent to the footprint of individual surface coal mining operations to experience mortality, and habitat loss and degradation. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize impacts associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect minimal adverse impact from Service-approved surveys of mesic plants. If species-specific plant relocation is included as a permit condition, we expect target plants to experience take in the form of collection and possible mortality.

1.1.28 Plants – Hydric Species

This guild is represented by 20 species; eight are listed as endangered, 12 are listed as threatened, and one is proposed to be listed as threatened (Table 1).

Although coal mining is not mentioned as a threat to most of the species analyzed, mining is specifically mentioned as a threat to four species. The Federal Register listing for Kral's water plantain (*Sagittaria secundifolia*) lists land being cleared for surface mining as a threat and describes how these activities contribute to water quality degradation and increase stream turbidity and siltation (USFWS 1990a). The 2014 5-year review for this species reiterates this threat (USFWS 2014s). The Navajo sedge (*Carex specuicola*) recovery plan lists the lowering of the aquifer as a main threat to this species (USFWS 1987), and the Kayenta surface mine

(located on the Navajo Indian Reservation) does pump water from an aquifer where populations of this species occur (USFWS 2014k). In 2011, OSMRE determined that pumping to support mine operations would not decrease flows in seeps/springs that support Navajo sedge based on hydrogeology of the sedge habitat and groundwater monitoring. Since 2006 these mining operations have decreased their use of this aquifer, but the threat remains (USFWS 2014k). Competing demands on the aquifer and the impact on springs is unclear, but it appears a combination of factors including mining operations, diminished aquifer recharge due to drought, and regional domestic demand for drinking water, have contributed to increasing drawdown of the aquifer. The recovery plan for harperella (*Ptilimnium nodosum)* mentions pollution from coal mines entering into the Potomac River and the reactivation of a coal mine (in North Carolina) upstream from populations as threatening this species (USFWS 1990b). This reactivation of the North Carolina mine has not happened as of yet and it does not appear likely. The Cumberland rosemary (*Conradina verticillata*) has historically been threatened by the downstream effects of coal mining (USFWS 1991b), and this has been reiterated in its latest 5-year review (USFWS 2011f).

Effects to this guild from mining may occur from direct mortality or through habitat loss and degradation. Species-specific monitoring or relocation may be included as a permit condition. No adverse effects would likely be associated with plant surveys; however, relocation efforts would include collection and possible mortality of plants. Plants within the permit boundary may be directly killed from vegetative clearing, grubbing, and from coal excavation. Large scale disturbances such as permitted coal mining operations create dramatic changes to local and watershed-scale environments. Many species in this guild prefer open canopy habitats that experience occasional disturbance such as fires and scouring floods during certain times of year. Disturbances from coal mining create effects to this guild that are larger in size, longer in time, and occur more often and in different locations than the occasional disturbances that benefit these species.

Effects to this guild from mining may occur from direct mortality by killing (e.g., running over, clearing land for mining, creating impoundments and diversion structures within species' habitats) or degrading habitat. Effects from degraded habitat may occur as a result of damage to soil (erosion, sedimentation, and compaction) that may bury or expose individual plants, and impounding or diverting water away from habitat.

Effects to habitat may occur by: (1) erosion, sedimentation, and siltation, (2) changing the seasonal hydrology of ground and surface water, (3) disturbing pollinators and other beneficial organisms, (4) habitat fragmentation (the division of continuous habitat into smaller, more isolated remnants) which modifies plants' interactions with other individuals of the same species and their pollinators (e.g., lower cross-pollination), (5) increasing edge effects (this fragmented habitat results in an increased boundary, or transition habitat) which may decrease acceptable habitat and create a suitable entry for plants (e.g., noxious and other invasive weeds) that outcompete species in this guild, (6) further introducing noxious weeds and other aggressive plants by moving soil and contaminated machinery throughout the permitted site, and (7) lowering the number of pollinator visits by spraying pesticides (including herbicides to kill unwanted plants that are not the within this hydric guild but are also utilized by pollinators). Effects may also occur from harming or destroying seeds by increasing erosion, soil compaction, and sedimentation that may bury and/or otherwise harm seeds, preventing successful germination and establishment.

Effects during reclamation may occur from: (1) introducing plant species within the approved reclamation seed mix that are designed to grow and spread (i.e., reproduce) quickly to prevent erosion: these plants (and other species brought in via contaminated machinery) can outcompete individuals and other plants that are a source of nutrition for pollinators that also visit the species in this guild, (2) redirecting or otherwise affecting ground and surface water flow when reconstructing the landscape: these modifications may change the seasonal differences in water regime within these species' habitats, and (3) the homogenization of topsoil during its redistribution: this not only changes the soil structure and composition but also changes the depth where the seeds occur within the soil profile, lowering seed bank viability. Changes in soil structure can also lead to a breakdown of the obligate association between fungal communities and some plant species, reducing plant viability.

Other effects to this guild are not likely within the permit boundary. If mining occurs in their habitats, they are likely to be directly affected as described above. However, effects are possible on adjacent and other connected lands. These effects may be created by certain postmining land uses (e.g., intensive livestock grazing, agriculture, residential development, timber production) and establishing permanent structures such as buildings, roads, or permanent water impoundments and diversions.

Effects from roads may result from an increase in human activity. Permanent roads can result in access points to undisturbed or minimally used adjacent lands, causing the increased use of off-highway vehicles and other types of human activity, including camping, hiking, mountain biking, and horseback riding. These activities can kill and injure plants and destroy and degrade habitat by entering into habitat and running over and/or trampling individuals and disturbing the ground, introducing competitive plants species via contaminated equipment, and affecting pollinator habitat to cause lower reproductive capacity of the species within this guild. These activities may also create habitat fragmentation and edge effects through repeated disturbance. Activities near habitat can result in degradation due to an increase in soil erosion, sedimentation, siltation, and compaction, and introduce plants that outcompete these hydric species.

Other permanent structures(e.g., buildings, fences, permanent water diversions, and impoundments), especially those located on or near the former permit boundary also have the potential to cause impacts on adjacent lands by concentrating disturbance activities in and around these structures and may serve as similar access points and result in the same effects as permanent roads. Permanent structures such as diversions and impoundments can also affect habitat by altering the season flow regime of both surface and groundwater, resulting in degraded habitat.

Effects may also occur from reclaiming lands using approved plant species that establish quickly, produce a large amount of biomass, persist, reproduce, and spread on their own. Those characteristics that support soil stabilization and some wildlife also tend to produce aggressive and permanent populations on adjacent and otherwise connected lands. These plants may also affect seasonal ground and surface water flow and have the ability to degrade habitat by outcompeting individuals and by changing the soil, light, and water quality characteristics of this habitat. They may also outcompete other plants that are used by the pollinators of this guild, further degrading the habitat by lowering local populations of pollinators. These effects may result in lower population vitality (e.g., more susceptibility to competition and disease) reduced reproductive success, and reduced fitness, which may lead to lowered population sizes and genetic diversity.

Surface and ground water flow rates are important to this guild and can be affected by coal mining. Many of these species persist in their current locations due to occasional scouring of the streambed (i.e., surface water quantity fluctuations throughout the year), which eliminates direct competition and can create higher sunlight conditions by washing away habitat populated by taller plants. These surface water produced scouring events may also dislodge individual plants from this guild which then travel downstream, potentially establishing new populations.

Some species of this guild rely on water quality that is based upon localized, consistent chemical constituents (i.e., local, specific water quality characteristics). Therefore, habitats and individuals connected to surface and ground water (e.g., saturated soils, streams) are sensitive to deviations from these local water quality conditions. Changes in flow regimes, water quality and water quality may result in habitat degradation and reduced fitness of individual plants.

There are a number of requirements to protect local water composition (i.e., surface and ground water quality) including: protection of surface and groundwater quality and requirement of surface and groundwater quality monitoring; requirement that diversions not adversely affect the water quality and related environmental resources of streams; and protection of water quality from durable rock fills, refuse pile contamination, permitted roads, and the waters below the lowest coal seam when mountaintop removal mining is used.

Sedimentation, siltation, erosion, and compaction of soils may also affect this guild, by either adding or removing too much soil to or from their habitats, and changing the density (e.g., compaction) of soil within habitat. This could result in the burying of seedlings and seeds, a reduction in photosynthetic capacity and root growth, and hydrologic and drainage changes to individual plant habitat.

Seeds and the seed bank are an important part of this guild's reproductive strategies. Topsoil salvage and direct haul topsoil salvage (using topsoil to reclaim an area directly after it is removed from its original area) may allow these seeds to germinate and establish populations. If topsoil is protected from contaminants, unnecessary compaction, and erosion that would interfere with revegetation and reclamation it would benefit these species.

Without the implementation of special provisions or conservation measures, we expect hydric plants within and adjacent to the footprint of individual surface coal mining operations to experience mortality, and habitat loss and degradation. Conservation measures incorporated into individual permits through coordination with the Service will help avoid or minimize impacts associated with mining activities. The species-specific protective measures incorporated into permits through step-down section 7 consultations and the technical assistance coordination process described in SMCRA, its implementing regulations, and further clarified in the SMCRA Coordination Process and 2020 DRP documents (Appendices A and B), are expected to minimize or avoid impacts to federal trust resources. In the event species-specific monitoring is included as a permit condition, we expect minimal adverse impact from Service-approved surveys of hydric plants. If species-specific plant relocation is included as a permit condition, we expect target plants to experience take in the form of collection and possible mortality.

The four species in this guild that have designated critical habitat are Navajo sedge, Pecos sunflower, Neches River rose-mallow, and Texas golden gladecress. Designated critical habitats for Navajo sedge and Pecos sunflower do not overlap with mineable coal; therefore, there should be no adverse effects from coal mining to the critical habitat of these species.

Neches River rose-mallow and Texas golden gladecress designated critical habitats overlap approximately 100% with mineable coal. Coal mining in Neches River rose-mallow designated critical habitat may affect PBFs such as intermittent or perennial wetland habitats and may impact habitat through land disturbance, removal of native woody or associated herbaceous vegetation, and thereby increasing opportunities for nonnative species to establish. PBFs for the Texas golden gladecress that may be adversely affected by coal mining include land disturbance that changes soil profiles, destroys outcrop ledges, and leads to the establishment of nonnative and native shrubs, trees, and vines into formerly open-sun, herbaceous, glade vegetation communities.