

Programmatic Design Features for Ecological Resources

Many design features are similar for different types of ecological resources (plant communities and habitats, wildlife, aquatic resources, and special status species¹). Design features for avoiding or minimizing impacts on all these types of ecological resources in general and during the various project phases are presented in the following sections. They were identified to avoid, reduce, and/or mitigate impacts on ecological resources from solar energy development identified and discussed in Section 5.10 of the Draft and Final Solar PEIS.

General

ER1-1 Project developers shall consult with the BLM and other Federal, state, and local agencies in the early phases of project planning to help ensure compliance with Federal regulations that address the protection of fish, wildlife, and plant resources, with appropriate Federal, state, and local agencies.

- (a) Assessing compliance with pertinent regulations for ecological resources shall include, but is not limited to, the following:
- Developing in coordination with the BLM and USFWS strategies for complying with regulatory requirements of the Bald and Golden Eagle Act.
 - Developing in coordination with appropriate Federal and state agencies (e.g., BLM, USFWS, and state resource management agencies) measures to protect birds (including migratory species protected under the Migratory Bird Treaty Act [MBTA]).
 - Contacting appropriate agencies (e.g., BLM, USFWS, and state resource management agencies) early in the project planning process to identify potentially sensitive ecological resources such as aquatic habitats, wetland habitats, unique biological communities, crucial wildlife habitats, and special status species locations and habitats located within or in the vicinity of the areas occupied by the solar energy facility and associated access roads and ROWs.

¹ Special status species include the following types of species: (1) species listed as threatened or endangered under the ESA; (2) species that are proposed for listing, under review, or candidates for listing under the ESA; (3) species that are listed as threatened or endangered by the state or are identified as fully protected by the state; (4) species that are listed by the BLM as sensitive; and (5) species that have been ranked S1 or S2 by the state or as species of concern by the state or USFWS. Note that some of the categories of species included here do not fit BLM's definition of special status species as defined in BLM Manual 6840. These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

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- Reviewing maps and supporting information regarding desert tortoise connectivity habitat made available through the Solar PEIS project Web site (<http://solareis.anl.gov>) and consulting with the BLM and USFWS early in project planning to receive instructions on the appropriate desert tortoise survey protocols and the criteria the BLM and USFWS will use to evaluate the results of those surveys (see Appendix B, Section B.5.3, for additional information).
 - Consulting with the USACE regarding the siting of solar energy generating facilities and energy transmission infrastructure in relation to hydrological features that have the potential to be subject to USACE jurisdiction.
 - Considering restrictions on timing and duration of activities developed in coordination with the BLM, USFWS, and other appropriate agencies to minimize impacts from project activities on nesting birds (especially passerines and listed species).
 - Considering recommendations contained in *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocol and Other Recommendations in Support of Golden Eagle Management and Permit Issuance*.
 - Adhering to instruction Memorandum 2010-156, the *Bald and Golden Eagle Protection Act—Golden Eagle National Environmental Policy Act and Avian Protection Plan Guidance for Renewable Energy*, until programmatic permits from the USFWS are available. The analysis of potential impacts on, and mitigation for, golden eagles shall be made in coordination with the USFWS.
 - Avoiding take of golden eagles and other raptors. Mitigation regarding the golden eagle shall be developed in consultation with the USFWS and appropriate state natural resource agencies. A permit may be required under the Bald and Golden Eagle Protection Act.
 - Discussing potential impacts on sensitive habitats resulting from operation of vehicles and construction of structures, including transmission lines, within the environmental analysis.
- (b) Methods to minimize regulatory conflicts for ecological resources may include, but are not limited to, the following:

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- Including submittal of a jurisdictional delineation for consultation with the USACE, in accordance with the 1987 wetlands delineation manual and appropriate regional supplement; avoidance, minimization and compensation proposals.
- Identifying an LEDPA and analyzing within the environmental analysis. A USACE permit, Nationwide verification, or approved jurisdiction letter shall be provided to the BLM prior to a decision.
- Developing measures to ensure protection of raptors in coordination with appropriate Federal and state agencies (e.g., BLM, USFWS, and state resource management agencies).
- Developing measures to ensure protection of bats in coordination with appropriate Federal and state agencies (e.g., BLM, USFWS, and state resource agencies).
- Developing measures to ensure mitigation and monitoring of impacts on special status species in coordination with appropriate Federal and state agencies (e.g., BLM, USFWS, and state resource management agencies).
- Consulting with the USFWS upon discovery of federally listed threatened and endangered species during any phase of the project. An appropriate course of action shall be determined to avoid, minimize, or mitigate impacts. All applicable terms and conditions and conservation measures listed in the programmatic Biological Opinion, issued by the USFWS, shall be followed.
- Informing project personnel that only qualified biologists are permitted to handle listed species according to specialized protocols approved by the USFWS.
- Considering plants, wildlife, and their habitats in the facility's Dust Abatement Plan.
- Limiting herbicide use to non-persistent, immobile substances. Only herbicides with low toxicity to wildlife and non-target native plant species shall be used, as determined in consultation with the USFWS. Section 5.10.2.1.5 of the Draft Solar PEIS discusses the potential impacts of herbicides on wildlife. All herbicides shall be applied in a manner consistent with their label requirements and in accordance with guidance provided in the Final Solar PEIS on vegetation treatments using herbicides.

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Prior to application of herbicide treatments, a qualified person, such as a biologist, shall conduct surveys of bird nests and of special status species to identify the special measures or BMPs necessary to avoid and minimize impacts on migratory birds and special status species.

- Developing a SWPPP for each project that avoids, to the extent practicable, changes in surface water or groundwater quality (e.g., chemical contamination, increased salinity, increased temperature, decreased dissolved oxygen, and increased sediment loads) or flow that result in the alteration of terrestrial plant communities or communities in wetlands, springs, seeps, intermittent streams, perennial streams, and riparian areas (including the alteration of cover and community structure, species composition, and diversity) off the project site.
- Utilizing block or check valves on both sides of the waterway or habitat to minimize product release from pipelines that transport hazardous liquids (e.g., oils) that pass through aquatic or other habitats. Such pipelines shall be constructed of double-walled pipe at river crossings.
- Considering compensatory mitigation and monitoring of significant direct, indirect, and cumulative impacts on, and loss of habitat for, special status plant and animal species.
- Incorporating key elements on the identification and protection of ecological resources (especially for special status species), including knowledge of required design features, in instructions to all personnel. Incorporate the knowledge into a WEAP that is provided to all project personnel prior to entering the project worksite. The WEAP shall be provided on a regular basis, so as to ensure the continued ecological awareness of the project worksite during all phases of the project's life. The base information the WEAP provides shall be reviewed and approved by the BLM prior to the issuance of a Notice to Proceed and incorporate adaptive management protocols for addressing ecological changes over the life of the project, should they occur.
- Planning for vegetation management that is consistent with applicable regulations and agency policies for the control of noxious weeds and invasive plant species (Sections 5.10.1.1.2 and 5.10.1.1.4 of the Draft Solar PEIS discuss the need for local and regional native plants in revegetation and restoration).

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- Developing measures for fire management and protection that minimize the potential for a human- or facility-caused fire to affect ecological resources and that respond to natural fire situations (Sections 5.10.1.1.2 and 5.10.1.1.3 of the Draft Solar PEIS discuss the potential impacts of fire on native plant communities).
- Developing measures to investigate the possibility of revegetating parts of the solar array area.
- Designating a qualified biologist who will be responsible for overseeing compliance with all design features related to the protection of ecological resources throughout all project phases, particularly in areas requiring avoidance or containing sensitive biological resources. This person shall be reviewed and approved by the USFWS and the BLM for designation as a qualified biologist.
- Conducting pre-construction surveys, in coordination with BLM, USFWS, and state agency statutes, programs, and policies.
- Conducting seasonally appropriate inspections by a qualified biologist or team of biologists to ensure that important or sensitive species or habitats are not present in or near project areas. Attendees at the inspections may include appropriate Federal agency representatives, state natural resource agencies, and construction contractors, as appropriate. Habitats or locations to be avoided shall be clearly marked.

Site Characterization, Siting and Design, Construction

ER2-1 Solar facilities shall be sited and designed, and constructed to avoid, minimize, or mitigate impacts on ecological resources.

- (a) Methods to avoid, minimize, or mitigate impacts on ecological resources may include, but are not limited to the following:
- Siting and designing projects to avoid and minimize direct and indirect impacts on important, sensitive, or unique habitats in the project vicinity, including, but not limited to waters of the United States, wetlands (both jurisdictional and non-jurisdictional), springs, seeps, streams (ephemeral, intermittent, and perennial), 100-year floodplains, ponds and other aquatic habitats, riparian habitat, remnant vegetation associations, rare or unique biological communities, crucial wildlife habitats, and

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habitats supporting special status species populations (including designated and proposed critical habitat).

- Incorporating measures to exclude tortoises from entering solar energy development sites. Examples include, but are not limited to, tortoise-proof fencing (fence specifications should be consistent with those approved by the USFWS in the Desert Tortoise Field Manual [USFWS 2009]) and tortoise guards at all road access points where desert tortoise-proof fencing is interrupted.
- Reducing the attractiveness of solar energy development and infrastructure areas to opportunistic predators such as desert kit fox, coyotes, and common ravens. Examples include, but are not limited to, litter control programs; measures to discourage the presence of ravens on-site, including elimination of available water sources; designing structures to discourage their use as potential nest sites; use of hazing to discourage raven presence; and active monitoring of the site for presence of ravens.
- Considering opportunities to upgrade or maintain crossings along existing facilities (e.g., roads, railroads, and aqueducts) such that desert tortoise occupancy and connectivity are not compromised.
- Avoiding siting projects in designated critical habitat, ACECs, or other specially designated areas that are identified as necessary for special status species and habitat conservation.
- Considering siting projects on previously disturbed lands in close proximity to energy load centers to avoid and minimize impacts on remote, undisturbed lands.
- Designing project facilities to reduce the number of stream crossings within a particular stream or watershed (e.g., access roads and utilities could share common ROWs, where feasible), and locating facilities in pre-disturbed areas to reduce potential for habitat fragmentation.
- Preventing establishment and spread of invasive species and noxious weeds within the ROW and in associated areas where there is ground surface disturbance or vegetation cutting. Developers should consider siting project facilities and activities, including associated roads and utility corridors, out of occupied habitats of special status animal species.

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- Determining, in coordination with appropriate Federal and state agencies, the translocation of special status species, including the steps to implement the translocation and the follow-up monitoring of populations in the receptor locations, as determined in coordination with the appropriate Federal and state agencies. Developers should plan for translocation of special status species when appropriate.
- Considering the salvage of Joshua trees (*Yucca Brevifolia*), other *Yucca* species, and most cactus species in coordination with the local BLM field office.
- Considering conducting interim and final restoration activities as soon as possible after development activities are completed in order to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
- Implementing revegetation, soil stabilization, and erosion reduction measures to ensure temporary use areas are restored.
- Conducting a nesting bird survey or other necessary survey for nesting birds. If active nests are detected, the nest area shall be flagged, and no activity shall take place near the nest (at a distance determined by the BLM in coordination with the USFWS and/or appropriate state agencies), or until the appropriate agencies agree that construction can proceed with the incorporation of agreed-upon monitoring measures.
- Siting and designing project activities away from habitats occupied by special status animal species. Developers should consider establishing buffers around sensitive habitats to prevent destructive impacts associated with project activities (e.g., identified in the land use plan or substantiated by best available information or science in consultation with the BLM).
- To the extent practicable, avoiding entry into aquatic habitats, such as streams and springs, during site characterization activities until surveys by qualified biologists have evaluated the potential for unique flora and fauna to be present.
- Planning for and developing measures that identify management practices to minimize increases in nuisance animals and pests in the project area. The plans should identify nuisance and pest species that are likely to occur in the area, risks associated with these species, species-specific control measures, and monitoring requirements.

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- Designing solar facilities to avoid, minimize, and mitigate impacts on wetlands, waters of the United States, and other special aquatic sites.
- Locating and designing individual project facilities to minimize disruption of animal movement patterns and connectivity of habitats. Section 5.10.2.1.2 of the Draft Solar PEIS discusses the potential impacts of habitat loss and fragmentation on wildlife.
- Avoiding surface water or groundwater withdrawals that adversely affect sensitive habitats (e.g., aquatic, wetland, playa, microphyll woodland, and riparian habitats) and habitats occupied by special status species.
- Designing water intake facilities to minimize the potential for aquatic organisms from surface waters to be entrained in cooling water systems.
- Demonstrating, through hydrologic modeling, that the withdrawals required for the project are not going to affect groundwater discharges that support special status species or their habitats.
- Considering the use of fencing and netting for evaporation ponds to prevent their use by wildlife.
- To the extent practicable, locating meteorological towers, solar sensors, soil borings, wells, and travel routes to avoid sensitive habitats or areas where wildlife (e.g., sage-grouse) is known to be sensitive to human activities.
- To the extent practicable, avoiding siting solar power facilities near open water or other areas that are known to attract large numbers of birds.
- To the extent practicable, placing tall structures, such as meteorological towers and solar power towers, to avoid known flight paths of birds and bats.
- Implementing current guidelines and methodologies in the design and analysis of proposed transmission facilities in order to minimize the potential for raptors and other birds to collide or be electrocuted by them.

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- Placing mechanisms to visually warn birds (permanent markers or bird flight diverters) on transmission lines at regular intervals to prevent birds from colliding with the lines.
- Designing transmission line support structures and other facility structures to discourage use by raptors for perching or nesting (e.g., by using monopoles rather than lattice support structures or by use of anti-perching devices).
- Considering spanning important or sensitive habitats with transmission line conductors within the limits of standard structure design.
- Using low-water crossings (fords) during the driest time of the year. Developers should consider using rocked approaches to fords and returning the crossing to pre-existing stream channel conditions after the need for a low-water ford has passed.
- Employing noise reduction devices (e.g., mufflers) to minimize the impacts on wildlife and special status species populations. Explosives shall be used only within specified times and at specified distances from sensitive wildlife or surface waters as established by the BLM or other Federal and state agencies.
- Minimizing the number of areas where wildlife could hide or be trapped (e.g., open sheds, pits, uncovered basins, and laydown areas). Movement of a discovered special status species that is hidden or trapped is prohibited. If necessary, the animal should be moved only to remove the animal from the path of harmful activity, until the animal can escape.
- Implementing measures for proper trash removal and storage, such as using secured containers and periodic emptying, on the project site to reduce attractive opportunistic species, such as common ravens, coyotes, and feral cats and dogs.
- Constructing, improving, and maintaining access roads to minimize potential wildlife/vehicle collisions and facilitate wildlife movement through the project area.
- Limiting project vehicle speeds and using shuttle vans and carpooling in areas occupied by special status animal species. Traffic shall yield to wildlife, allowing safe road crossing.
- Utilizing existing access roads, utility corridors, and other infrastructure to the maximum extent feasible.

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- Locating staging and parking areas within the site of the utility-scale solar energy facility to minimize habitat disturbance.
- Considering rolled and compacted on-site construction access routes to allow trucks and equipment to access construction locations.
- Minimizing vehicle use off of access roads and foot traffic through undisturbed areas.
- Constructing fences (as practicable) to exclude livestock and wildlife from project facilities.
- Prohibiting project personnel from bringing firearms and pets to project sites.
- Placing food refuse and other garbage in closed containers so it is not available to scavengers.
- Reducing the collection, harassment, or disturbance of plants, wildlife, and their habitats (particularly special status species) through employee and contractor education about applicable state and Federal laws.
- Advising personnel to minimize stopping and exiting their vehicles in the winter ranges of large game while there is snow on the ground.
- Coordinating with BLM and appropriate project personnel to handle unreasonable traffic delays caused by wildlife in roads. Utilizing appropriate personnel to move live, injured, or dead wildlife off roads, ROWs, or the project site.
- Reporting any vehicle-wildlife collisions. Observations of potential wildlife problems, including wildlife mortality, shall be immediately reported to the BLM or other appropriate agency authorized officer.
- Considering road closures or other travel modifications (e.g., lower speed limits, no foot travel) during crucial periods (e.g., extreme winter conditions, calving/fawning seasons, raptor nesting).
- Conducting pre-construction surveys by qualified personnel, such as a qualified biologist, in areas with potential to adversely

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affect special status species (Section 5.10.4.1.1 of the Draft Solar PEIS) and utilizing approved survey techniques or established species-specific survey protocols to determine the presence of special status species in the project area.

- Considering the number of qualified biological monitors (as determined by the Federal authorizing agency and USFWS) to be on-site during initial site preparation and during the construction period to monitor, capture, and relocate animals that could be harmed and are unable to leave the site on their own.
- Relocating wildlife found in harm's way from the area of the activity. Qualified personnel shall be required to relocate some animals such as rattlesnakes.
- Establishing a controlled inspection and cleaning area to visually inspect construction equipment arriving at the project area and to remove and collect seeds that may be adhering to tires and other equipment surfaces.
- To the extent practicable, avoiding placement of transmission towers within aquatic and wetland habitats, or other sensitive habitats such as riparian habitats. If towers must be placed within these habitats, they shall be designed and installed to not impede flows or fish passage.
- Designing necessary stream crossings to provide in-stream conditions that allow for and maintain uninterrupted movement and safe passage of fish during all project periods.
- Considering cutting trees in stream buffers that are able to grow into a transmission line conductor clearance zone within 3 to 4 years.
- Considering the use of helicopters where access roads do not exist or where access roads could not be constructed without significantly impacting habitats.

Operations and Maintenance

ER3-1 The developer shall manage vegetation utilizing the principles of integrated pest management, including biological controls to prevent the spread of invasive species, per the *Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States*, and the *National Invasive Species Management Plan, 2009*. Consultation with the BLM shall be maintained through operations and maintenance of the project,

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employing an adaptive management strategy and modifications, as necessary and approved by the BLM.

- (a) Methods to manage vegetation, including controlling for invasive species, during operations and maintenance of the project may include, but are not limited to, the following:
- Using certified weed-free seed and mulching.
 - Cleaning vehicles to avoid introducing invasive weeds.
 - Educating project personnel on weed identification, the manner in which weeds spread, and methods for treating infestations.
 - Considering periodic monitoring, reporting, and immediate eradication of noxious weed or invasive species occurring within all managed areas.
 - Limiting vegetation maintenance and performing maintenance mechanically rather than with herbicides.
 - Considering retaining short (i.e., less than 7-in. [18-cm] tall) native species during maintenance and operation activities.
 - Reducing risk of non-native and nuisance aquatic species introductions. Developers should decontaminate equipment used in surface water, especially equipment used to convey water (i.e., pumps).
 - Monitoring for and eradicating invasive species.
 - Reestablishing vegetation within temporarily disturbed areas immediately following the completion of construction activities.
 - Focusing revegetation efforts on the establishment of native plant communities similar to those present in the vicinity of the project site. Considering dominant native species within the plant communities that exist in adjacent areas and have similar soil conditions for revegetation.
 - Considering post-translocation surveys for target species (especially if the target species are special status species) and releasing individuals to protected off-site locations as approved by Federal and state agencies.

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- ER3-2** The developer shall, in consultation with the BLM and appropriate Federal, state, and local agencies, manage projects so as to minimize impacts on ecological resources during operations and maintenance of the project, employing an adaptive management strategy and modifications, as necessary and approved by the BLM.
- (a) Methods to minimize impacts on ecological resources during operations and maintenance of the project shall include, but are not limited to, the following:
- Monitoring for increase in predation of special status species (e.g., desert tortoise, Utah prairie dog, and greater sage-grouse) from ravens and other species that are attracted to developed areas and use tall structures opportunistically to spot vulnerable prey.
 - Turning off all unnecessary lighting at night to limit attracting wildlife, particularly migratory birds.
- (b) Other methods for maintaining compliance with ecological resource design elements during operations and maintenance of the project may include, but are not limited to, the following:
- Monitoring for and reporting bird mortality species (e.g., raptors) that are associated with power lines to the BLM and the USFWS.
 - Monitoring for the effects of groundwater withdrawals on plant communities.
 - Monitoring unavoidable impacts on wetlands and waters of the United States.
 - For projects that affect desert tortoise linkages, developing and implementing a Desert Tortoise Habitat Linkage Management and Monitoring Plans and a Desert Tortoise Population Connectivity Effectiveness-Monitoring Plan as described in the USFWS Biological Opinion and Conservation Review for the Solar Energy Program (July 20, 2012).
 - Removing raptor nests only if the birds are not actively using the nest.
 - Considering relocating nests to nesting platforms. Reporting on relocated or destroyed nests to the appropriate Federal and/or state agencies.

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- Coordinating with the USFWS and BLM project personnel in the event that a raptor nest is located on a transmission line support structure.
- Removing raven nests only when inactive (i.e., no eggs or young). The removal of raven nests may be addressed in the minimization measures that incorporate the most current USFWS guidance (e.g., FONSI, *Implementation of a Desert Tortoise Recovery Plan Task: Reduce Common Raven Predation on the Desert Tortoise, 2008*).
- Considering trench breakers and/or sealing the trench bottom to maintain the original wetland hydrology where a pipeline trench drains a wetland.
- Minimizing removal of deadfall or overhanging vegetation in streams for crossings.
- Installing fish screens on cooling water intakes to limit the potential for impingement impacts on organisms in surface water sources used for cooling water.
- Maintaining areas left in a natural condition during construction (e.g., wildlife crossings) in as natural a condition as possible within safety and operational constraints.
- Avoiding use of guy wires to minimize impacts on birds and bats. If guy wires are necessary, permanent markers (e.g., bird flight diverters) shall be used to increase their visibility.
- Maintaining native vegetation cover and soils and minimizing grading.
- Monitoring unavoidable impacts on wetlands and waters of the United States.
- Instructing personnel to avoid harassment and disturbance of local plants and wildlife.
- Informing personnel of the potential for wildlife interactions around facility structures.

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Reclamation and Decommissioning

ER4-1 Reclamation of the construction and project site shall begin immediately after decommissioning to reduce the likelihood of ecological resource impacts in disturbed areas as quickly as possible.

- (a) Addressing ecological resource impacts during reclamation and decommissioning shall include, but is not limited to, the following:
- Applying design features developed for the construction phase to similar activities during the decommissioning and reclamation phase.
 - Developing and implementing a Decommissioning and Site Reclamation Plan specific to the project, approved by the BLM in consultation with appropriate agencies, that incorporates adaptive management strategies.
 - Using weed-free seed mixes of native shrubs, grasses, and forbs of local sources where available, as required in the Decommissioning and Site Reclamation Plan.
 - Developing and implementing monitoring measures to ensure successful reclamation per the Decommissioning and Site Reclamation Plan.
- (b) Other methods to minimize ecological resource impacts during reclamation and decommissioning may include, but are not limited to, the following:
- Lightly raking and/or ripping and reseeded with seeds from low-stature plant species collected from the immediate vicinity in disturbed areas.
 - Reclaiming access roads when they are no longer needed, considering seasonal restrictions.
 - Filling or grading holes and ruts created by the removal of structures and access roads.
 - Considering maximizing area reclaimed during solar energy operations to minimize habitat loss and fragmentation.
 - Maintaining a clean and orderly worksite during and after decommissioning to ensure land is clear of debris.

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- Planning to return land surfaces to pre-development contours immediately following decommissioning.
- Expediting the reestablishment of vegetation for site stabilization.
- Continuing vegetation reestablishment efforts until all success criteria have been met, as identified within the Decommissioning and Site Reclamation Plan.
- Focusing revegetation on the establishment of native plant communities similar to those present in the vicinity of the project site. Considering dominant native species within the plant communities that exist in adjacent areas and have similar soil conditions for revegetation.
- Leaving the facility fencing in place for several years, or replacing it with new exclusion fencing, to assist reclamation (e.g., the fence could preclude large mammals and vehicles from disturbing revegetation efforts). Shorter times for maintaining fencing may be appropriate in cases where the likelihood of disturbance by cattle and wildlife is low.