Table 11.2 Best Management Practices.

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
01	Personnel	Worker Environmental Awareness Program/Training	●	5		
02	Personnel	On-site Designated Biologist(s), Authorized Biologist(s), and/or Biological Monitor(s)	●	6		
03	Pollution	Fueling of equipment will take place within existing paved roads and not within or adjacent to drainages or native desert habitats. Contractor equipment will be checked for leaks prior to operation and repaired as necessary.	●	3		(a) Pre-construction surveys for contaminants in drainages and off-site, "downstream" runoff areas. (b) Monitoring of drainages and off-site, downstream runoff areas during construction. (c) Adjust BMPs if BMPs are not adequately preventing/minimizing contamination.
04	Pollution	"All vehicles and equipment will be in proper working condition to ensure that there is no potential for fugitive emissions of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials…contaminated soil will be properly disposed of at a licensed facility."	●	5		
05	Pollution	Will use BMPs to minimize contamination of water or ephemeral drainages from construction site runoff.	▲	2	Need more information on what BMPs will be utilized.	
06	Pollution	Avoid use of toxic substances for road surfacing, road sealants, soil bonding and weighting agents.	●	1	Concern that only one project out of six mentions this BMP.	
07	Soil and Vegetation	"The anticipated impact zones...will be delineated with stakes and flagging prior to construction...Construction-related activities outside of the impact zone will be avoided."	●	4		

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
08	Soil and Vegetation	"Spoils should be stockpiled in disturbed areas presently lacking native vegetation."	▲	2	Concern about the establishment of invasive plants on stockpiled spoils.	(a) Cover the stockpile with tarp(s) or similar to prevent establishment and growth of invasive plants. (b) Monitoring and physical removal of invasive plants.
09	Soil and Vegetation	"New and existing roads that are planned for either construction or widening will not extend beyond the planned impact area."	●	3		
10	Soil and Vegetation	All vehicles will maneuver within the planned impact area.	●	2		
11	Soil and Hydrology	"BMPs will be employed to prevent loss of habitat due to erosion caused by project-related impacts." And/Or "Erosion and sedimentation control will be implemented during Project construction to retain sediment on-site and to prevent violations of water quality standards."	▲	4	Need more information on what BMPs will be utilized.	(a) Monitoring of soil/sediment runoff. (b) Adjust BMP if BMP is not adequately preventing/minimizing erosion and sedimentation.
12	Soil and Hydrology	"The solar fields shall be graded generally following the existing contours of the site to minimize the amount of ground disturbance."	●	1	Could also benefit site-level hydrology by minimizing alterations to water flow across the landscape.	

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
13	Vegetation	"…working around all shrubs and trees within the construction zone to the extent feasible" and/or "special-status plant impact avoidance and minimization."	▲	2	We are concerned about the extent to which this BMP can actually be applied to a solar facility. Contrast this BMP with a statement from another project: "Avoidance of some special-status plants may be feasible during construction of the proposed project, but over the long-term, avoidance is not practicable because of the need to reduce the standing vegetation to prevent fire hazards and to maintain clear access to wash the...mirror arrays and otherwise operate the facility." Developers have indicated that fire is a potential hazard and that vegetation underneath the solar arrays will need to be cleared. Vegetation may also need to be cleared for installation of solar arrays and potentially kept clear for maintenance.	Because vegetation has several important ecosystem functions, including reducing wind erosion, dust emission, water erosion, and loss of soil moisture, there is value in retaining as much existing native vegetation as possible. (a) Appropriate buffers around solar arrays to prevent fire hazards and allow for maintenance should be developed. (b) Site plans should indicate areas where vegetation can be left, such as areas along the perimeter of the facility.
14	Vegetation	"A Weed Management Plan shall be developed and implemented to minimize the introduction of exotic plant species."	●	3		Plan should include monitoring of invasive plants in and around facility site.
15	Vegetation	The disturbance area "shall be maintained free from nonnative invasive plant species. This can be accomplished through physical or chemical removal and prevention. If necessary, application of an approved herbicide (non toxic to wildlife) shall be" applied.	■	2	We are concerned with the residual chemicals that could runoff the facility site and into the surrounding native habitat. Exposure to herbicides has the potential to kill or alter the species composition of soil crusts.[4] Though non-toxic to wildlife species, runoff containing herbicides could negatively impact native plants and soil crusts off-site.	The control and removal of invasive plants is still necessary. (a) The BMP should rely primarily on physical removal of invasive plants. (b) If chemical means are necessary, conduct comparative testing of herbicides to determine if some are non-toxic or less toxic to native plants and soil crusts than others. (c) Monitoring of "downstream" native plants and soil crusts for impacts of chemical runoff.

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
16	Vegetation	"Preventing exotic plants from entering the site via vehicular sources shall include measures such as implementing Trackclean or other similarly effective methods of vehicle cleaning…Earth-moving equipment shall be cleansed prior to transport to the Project site."	●	3		
17	Vegetation	"Preventing exotic weeds from entering the site via materials sources shall require that weed-free rice straw or other certified weed-free straw be used for erosion control."	●	2	Concern that only two projects of six mention weed-free materials.	
18	Vegetation	Reclamation and restoration of temporary disturbance areas and/or reestablish vegetation quickly on disturbed sites.	▲	2	Need more information on methods for reclamation, restoration, and/or revegetation.	
19	Vegetation	"After Project completion, a seed mix of dominant plant species will be distributed within any extensive temporarily disturbed areas."	■	1	We are concerned that this will not aid in the establishment of native plant species. Considering that the estimated time for unassisted recovery of desert lands is hundreds of years, that complete ecosystem recovery is estimated to take over 3,000 years, and that invasive plants are better able to take advantage of habitat disturbances than native plants, we believe that it will likely take more than distributing seeds to ensure the recovery of native plants.[5,6] Resources might be wasted on a measure like BMP-19 when they could be better spent on more effective methods of habitat recovery.	(a) BMP should include a restoration plan for temporarily disturbed areas. (b) Plan should be implemented by a restoration ecologist. (c) Restoration efforts should use native and (if possible) local seeds to propagate plants. (d) Plants that have germinated (not seeds) should be used to increase the probability of successful plant re-establishment. (e) The restoration ecologist should monitor restoration efforts and employ adaptive management techniques to ensure successful restoration.

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ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
20	Fire	"Wildfires shall be prevented by all means possible by exercising care when driving and by not parking vehicles where catalytic converters could ignite dry vegetation. In times of high-fire hazard…trucks shall carry water and shovels or fire extinguishers in the field, and high-fire-risk installations (e.g., electric lines) shall be delayed. The use of shields, protective mats, or other fire-prevention equipment shall be used during grinding and welding to prevent or minimize the potential after fire. No smoking or disposal of cigarette butts shall take place within vegetated areas."	●	1	Concern that only one project out of six mentions a BMP to reduce fire hazards. This type of BMP should be adopted by other projects.	

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ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
21	Desert Tortoise	"Water will be applied to the construction right-of-way, dirt roads, trenches, soil piles, and other areas where ground disturbance has taken place to minimize dust emissions and topsoil erosion." "During the desert tortoise active season, a Biological Monitor will patrol these areas to ensure that water does not puddle for long periods of time and attract desert tortoise, common ravens, and other wildlife to the site."	■	4	This BMP raises two concerns. While dust emission and soil erosion are both serious problems for a desert ecosystem, we are concerned that the application of water will facilitate the proliferation of invasive plants. Invasive plants are able to take advantage of both disturbed areas and water runoff from impermeable surfaces, including paved and dirt roads. The application of water as a dust suppressant may create ideal conditions for invasive plant growth, though we recognize the importance of minimizing erosion and dust emission. The four projects that discuss the application of water to ground disturbances acknowledge that standing water could attract desert tortoise or non-native predators, like common ravens. To prevent tortoises, ravens, or other wildlife from being attracted to these water sources, BMP-21 states that a Biological Monitor will patrol these areas during the desert tortoise active season to ensure that water does not puddle for long periods of time. While this may reduce the likelihood that desert tortoises may become accustomed to this anthropogenic water source, we are concerned about the potential for these practices to attract a resident population of ravens. Ravens could be attracted to the water source at any time of year, become established around the water source, and then prey on tortoises during their active season.	If the only way to control dust emission from construction areas is to apply water, (a) an invasive plant control program should be implemented for areas where water is applied to minimize the establishment of invasive plants in disturbance areas. (b) A Biological Monitor should patrol the areas where water has been applied at all times (instead of just during the desert tortoise active season). However, developers will likely not be able to prevent common ravens from being attracted to and established around the site. This impact likely cannot be minimized.

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ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
22	Desert Tortoise	BMPs on desert tortoise site clearance surveys and relocation/translocation before construction.	■	5	While translocation can prevent direct mortality of desert tortoises from construction, it can sometimes be a cause of indirect mortality. Tortoise translocation in the California Desert has been characterized by a high-profile attempt by the Fort Irwin Army Base to translocate approximately 600 desert tortoises.[7, 8] In 2008, 27.2% of translocated tortoises died and in the following year 23.5% of translocated tortoises died, primarily from predation in both years.[9] Other reasons for translocation failures include extensive movement of translocated animals and homing behavior (i.e., attempts by animals to return to original habitats), inability of animals to locate food or water sources, and/or inability to find shelter in a new habitat.[10,11] Says Cameron Barrows, a researcher for the Desert Studies Initiative, "So what did we achieve? You feel better because we didn't let a bulldozer run over the tortoises, but all we did was move them someplace else where they often die anyway, and may spread disease to and disrupt the resident population." Under BMP-22, desert tortoise would be translocated (i.e., physically removed from the site) by a Designated Biologist to an off-site location. The number of individuals being translocated, the acreage of habitat being removed by the solar project, and the capacity of "new" habitats to support additional individuals are all important factors that influence the survival of translocated tortoises; these factors are not acknowledged by this BMP. Therefore, we are concerned that BMP-22 may not significantly reduce overall desert tortoise mortality from solar development.	There are no better alternatives. In some cases, translocated tortoises may survive, but at the population level, the only way to effectively reduce the impact of a solar facility on the desert tortoise is to not build the facility. If translocation is used as a BMP, desert tortoises should be monitored for survival post-translocation.

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
23	Desert Tortoise	Desert tortoise will be excluded from the project area via permanent tortoise-proof fencing and tortoise-proof gates at site entry points. Temporary fencing of utility corridors and tower locations during construction.	●	5		
24	Desert Tortoise	Personnel will utilize established roadways and existing tracks onsite. Cross-country vehicle and equipment use outside designated work areas will be prohibited. Personnel will follow established speed limits.	▲	5	Concern that speed limits vary between projects (15mph, 20mph, 25mph) to achieve the same objective. Which speed limit is most effective?	(a) Consult desert tortoise biologists and set an appropriate speed limit for all solar facilities across the desert.
25	Desert Tortoise	Vehicle and equipment parking and storage will occur within tortoise exclusion fence. If vehicle or equipment parking occurs outside of the tortoise exclusion fence, the ground under the vehicle will be inspected for the presence of desert tortoise before it is moved. BMPs provide rules for moving tortoises if found.	●	5		
26	Desert Tortoise	"Proposed channels that reroute the washes around the site shall be made as natural as feasible, with earthen bottoms that facilitate desert tortoise movement outside the site."	▲	1	Concern with type/material of channel bottom and whether it will obstruct groundwater recharge.	Construct artificial channels with permeable bottoms, using gravel and sand instead of packed earth.
27	Ravens and other predators	Raven management, monitoring, and control program or similar.	●	5		

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
28	Ravens and other predators	Trash Abatement Program. "Trash & food items will be contained in closed containers & removed daily to reduce the attractiveness to opportunistic predators such as common ravens, coyotes, & feral dogs."	●	5		
29	Ravens and other predators	"Standing water shall be minimized on site to the extent feasible to minimize the attractiveness to opportunistic predators…that may prey on sensitive species."	●	2	BMP-29 recognizes that opportunistic predators (e.g., the common raven) may be attracted to artificial water sources, and therefore seeks to minimize standing water on-site. We believe that BMP-29 is a very important BMP, but are concerned that it may have been overlooked by other applications. Contrast this BMP with statements from other projects about the need for/use of evaporation ponds.	
30	Ravens and other predators	"Road killed animals or other carcasses detected in the project area or on roads near the project area shall be picked up immediately upon detection and appropriately disposed of to avoid attracting common ravens and coyotes."	●	1	Concern that only 1 project out of 6 mentions a BMP to remove roadkill. This type of BMP should be adopted by other projects.	
31	Wildlife	"Underground pipeline construction shall involve nearly simultaneous trenching, laying of pipe, and backfilling so that no open trenches shall be left unattended during daylight hours. Any open trenches that cannot be backfilled shall be covered with steel plates at night."	●	3	Reduces potential for wildlife to become trapped in trenches or holes.	

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
32	Wildlife	Pre-construction clearance surveys and/or relocation for a variety of wildlife species, including western burrowing owl, American badger, desert kit fox, flat-tailed horned lizard, nesting migratory birds, gila monster.	■	6	As stated in BMP-22, relocation can prevent direct mortality from construction or other activities, but it can also be a cause of indirect mortality. In a 2000 study by Fischer and Lindenmayer, the authors found that translocations used to solve human-animal conflicts were often unsuccessful, resulting in high mortality of animals after translocation.[12] For more on why translocation can fail, see BMP-22. BMP-32 indicates that special-status wildlife, including western burrowing owl (*Athene cunicularia*), American badger (*Taxidea taxus*), and desert kit fox (*Vulpes macrotis arsipus*), would be passively relocated. These animals would be prevented from re-entering burrows, burrows would be destroyed, and individuals would be required to move off-site before the site is fenced. The distances that individuals would have to move in order to find suitable habitat may result in stress-induced mortality of those animals. The number of individuals being relocated, the acreage of habitat being removed by the solar facility, and the capacity of "new" habitats to support additional individuals are all important factors that influence the survival of relocated species; these factors are not acknowledged by this BMP. Therefore, we are concerned that BMP-32 may not significantly reduce overall wildlife mortality from solar development.	There are no better alternatives. In some cases, relocated wildlife may survive, but at the population level, the only way to effectively reduce the impact of a solar facility on the special status wildlife is to not build the facility. If relocation is used as a BMP, special status wildlife populations surrounding the project should be monitored to determine impacts from relocated individuals on the resident populations.
33	Wildlife	"If construction activities occur at night, all project lighting…shall be directed onto the roadway or construction site and away from sensitive habitat. Light glare shields shall be used, when necessary, to reduce the extent of illumination into adjoining areas."	▲	2	Concerns: potential for significant insect mortality and potential for lighting to affect nocturnal wildlife.	(a) Determine level of insect mortality and research impacts to nocturnal wildlife. (b) If necessary, restrict construction to daylight hours.

● - Effective ▲ - Potentially Effective ■ - Ineffective

ID #	Type of BMP	BMP	Rating	# of Facilities with BMP (of 6)	Comments or Concerns	Suggestions for Alternatives
34	Wildlife	"Prioritize and acquire land within the immediate vicinity of the Project that contributes to the preservation of adequate wildlife habitat connectivity." And/Or off-site mitigation for the permanent loss of special-status species' habitat.	▲	3	Concern about the availability and quality of habitat, especially if all permitted solar facilities attempt to acquire land as mitigation and the mitigation ratio is greater than 1:1.	See [the following chapter on mitigation]
35	Wildlife	Evaporation Pond Monitoring Program: monitoring bird populations and water quality at site evaporation ponds. "If significant adverse effects to birds are observed during the evaporation pond monitoring...additional monitoring may be needed to further assess impacts to bird species."	■	1	We are concerned that standing water in evaporation ponds could attract common ravens and other predators to the site. Two applications that we reviewed require on-site evaporation ponds for industrial wastewater, both of those applications indicate that they will monitor water quality, one of those applications (i.e., the source of BMP-35) acknowledges the need to monitor potential impacts to birds that might use the pond (e.g., waterfowl, shorebirds), but neither of those applications mentions that the evaporation ponds might also be attractive to common ravens. We are concerned that evaporation ponds could provide another resource that might attract opportunistic predators to a solar facility site. We are also concerned about the potential for minerals to bioaccumulate in birds that use the ponds. The health of birds that use the ponds might be negatively affected by minerals that could be in the water, including chloride, sodium, sulfate, selenium, chromium, and phosphate. Wording in the BMP also leads us to believe that birds might be at risk for salt toxicity.	(a) Prevent birds from using the ponds entirely, such as a physical barrier that still allows for evaporation. (b) Reduce the attractiveness of the pond(s) to ravens. This may involve covering up or disguising the pond(s).

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