

Preventing the Spread of Invasive Plants:



Best Management Practices for Transportation and Utility Corridors

California Invasive Plant Council

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Cover photos: Large photo – Utility corridors cross hundreds of miles of landscape and wilderness acting as potential vectors for invasive plant spread. Photo: Courtesy of Southern California Edison. Bottom left photo – Caltrans employees inspecting the performance of a vegetation control mat installed under an existing guardrail along highway. Photo: Jack Broadbent, California Department of Transportation.

Technical Advisory Team

In 2011, the California Invasive Plant Council formed a technical advisory team comprising of transportation, utility, and land management experts in the state. The technical advisory team guided the development of a set of voluntary invasive plant prevention best management practices (BMPs) for transportation and utility corridors.

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Purpose Statement

The goal of this manual is to present voluntary guidelines that help those managing transportation and utility corridors in California to prevent the accidental introduction and spread of terrestrial invasive plants.

Invasive Plants

Federal Executive Order 13112 defines an invasive species as an alien (non-native) species whose introduction does or is likely to cause economic or environmental harm or harm to human health. While the majority of non-native plants do not pose a threat to natural or human systems, the Cal-IPC Invasive Plant Inventory identifies 200 species, approximately 3% of the plant species growing in the wild in California, as invasive. These plants have the capacity to alter native ecosystems, with potential detrimental implications for wildlife communities, fire regimes, water flow, and nutrient cycling. The term “weed” is used interchangeably with invasive plants in this manual.

Background

Transportation and utility corridors are at-risk sites for the introduction and spread of invasive plants. A corridor is a strip of land upon which linear facilities such as pipelines, roads, and power or communication lines are built and maintained. Regular use and the associated potential for soil disturbance within corridors provide opportunities for the movement of invasive plants through the landscape. Transportation and utility corridors may even cross geographic barriers that previously limited the spread of invasive plants.

Utility corridors and roads cross hundreds of miles of landscape and wilderness acting as potential vectors for invasive plant spread. Photo: Courtesy of Southern California Edison

Invasive plant seeds and other reproductive parts can be inadvertently transported by vehicles, equipment, people and animals. Soil and vegetation disturbance during construction and maintenance activities can also create suitable conditions for the establishment of invasive plants, and once invasive plants establish populations, these corridors can become sources of seeds that facilitate further spread. Invasive plant spread can be greatly reduced if agencies and workers implement prevention practices such as cleaning equipment and using weed-free materials.

Best Management Practices (BMPs)

Best Management Practices are methods or techniques found to be the most effective and practical in achieving an objective, such as preventing or minimizing invasive plant spread, while making optimal use of resources.

Prevention BMPs that minimize invasive plant spread in transportation and utility corridors can help:

- Reduce future maintenance needs and cost
- Reduce fire hazards
- Reduce herbicide use
- Enhance visibility, access and safety
- Limit liability for the governing agency or lessee
- Maintain good public relations
- Protect existing wildlife habitat, native plant populations and beneficial insects, as well as threatened and endangered species.

Target Audience

This manual was developed for the gas, electric, water and communication utilities sectors, and state and local transportation agencies. This manual provides task-oriented checklists and practices for field staff who play a direct role in corridor construction and maintenance activities or in preventing the spread of invasive plants. The manual also provides tools for management personnel, whose decisions are critical to prevention activities. These tools include integration strategies for executives, as well as planning guidelines for supervisors, environmental planners and landscape architects.

Scope

The primary focus of this manual is preventing the spread of terrestrial invasive plants. Therefore this manual does not focus on invasive plant control methods; however, control measures are discussed insofar as they relate to prevention. For example, mowing as a control method is not discussed, but because timing of mowing relates directly to potential for invasive plant spread, this aspect is included. Invasive aquatic plants and corridors along levees and railroads are outside of the scope of this manual.

Implementation of BMPs

Effective implementation of prevention BMPs will require a process of continuous learning. These voluntary BMPs were developed with the understanding that each situation and entity has different needs, constraints and resources. The applicability and effectiveness of BMPs will vary with existing land uses, degree of human disturbance, the objectives of the land owners, and the resources available for management activities. A discussion of Prioritizing BMP Implementation appears later in this section on page 4 to help determine which BMPs to emphasize depending on situational factors.

Conducting a thorough pre-activity assessment will help to identify which tasks can spread invasive plants (See Pre-Activity Assessment Outline on page 5). Many of these BMPs may overlap with existing practices or standard mitigations, such as those for Storm Water Pollution Prevention, clean air regulations, pest quarantines, or rare species protections.

Using This Manual

This manual provides BMPs to aid in preventing the introduction and spread of invasive plants. Its recommendations are voluntary; each organization can choose how to best incorporate this information into their operations.

Section I includes overview information on what BMPs are, why they are important, and how to best implement them. This section also provides recommendations for BMP prioritization.

Section II provides detail on a wide range of activity-specific BMPs for preventing the spread of invasive plants. These BMPs are organized into seven chapters: a chapter for general BMPs applicable to all activities, and six activity-based BMP chapters. Each BMP is appropriate for particular situations; users can select those that are suitable for their use. The BMPs described in Section II are structured as follows:

BMP Statement: Prevention BMP statements, in bold font, describe practices that can prevent the introduction and spread of invasive plants.

Considerations:

- a. BMP Considerations are listed below the BMP Statement
- b. BMP Considerations give more information about why the BMP is important, and may include details, suggestions, examples, and issues to consider when applying the BMP.

Section III presents ready-to-use checklists which contain only the BMP statements to provide a quick and portable reference for field activities. The checklists are divided into three categories: Routine Maintenance, New Projects, and Inspection & Cleaning. These checklists can be used as templates and be modified based on your needs.

Section IV has additional resources and information, a glossary and other references.

Definition and Categorization of Activities

Definition and categorization of activities vary among sectors and organizations. A utility company may consider “maintenance” to mean inspection and repair of facilities while a road agency may include activities such as vegetation management, trash management, and installing signage to be maintenance.

For this reason, the definition and scope of each activity and how it may spread invasive plants is described in the introduction of each chapter. When using this manual, consider your activity’s scope and potential impact as it relates to the potential to introduce or spread invasive plants. Refer to BMPs in related chapters to customize your prevention practices.

Overall Prevention Principles:

Take time to plan. Proper planning can reduce future maintenance costs by reducing the potential for invasive plant introduction and spread. A good first step is to conduct a pre-activity assessment of the work area to determine which activities could spread weeds and which BMPs are applicable.

Stop movement of invasive plant materials and seeds. The movement of workers, materials and equipment can carry weeds between sites. This manual identifies potential vectors of spread and how to eliminate them or minimize their effects.

Minimize soil and vegetation disturbance. Disturbance can allow invasive plants to colonize a new area. Disturbance should be minimized, and when it is unavoidable, managers should conduct follow-up monitoring to ensure early detection of any invasive plants that may have been introduced.

Maintain desired plant communities. A healthy plant community with native and desirable species provides resistance to invasive plant establishment.

Practice Early Detection and Rapid Response (EDRR). Early detection and eradication of small populations helps prevent the spread of invasive plants and significantly reduces weed management costs. Regular monitoring increases the chances of success.

Prioritizing BMP Implementation

The prevention BMPs in this manual are developed with the understanding that each situation and entity has different needs and resources. This outline can help you select which areas and species to prioritize when integrating BMPs into management activities.

Determine:

1. Management costs. Prioritize:

- Areas where future control costs will be high if invasive plants become established
- Areas where fire risk is high
- BMPs with approaches that are measurable in cost and effectiveness

2. Ecological value of habitats. Prioritize:

- Areas with threatened or endangered species and habitat
- Areas of high ecological or conservation value
- Areas where invasive plants have not invaded

3. Context of the area being managed. Prioritize:

- Wildland and natural areas
- Areas with new construction or disturbance
- Areas containing water bodies
- Areas with important scenic or recreational resources
- Areas where adjacent land owners are cooperative
- Areas where wildland interfaces with urban areas
- Wildland areas frequented by vehicles, equipment and foot traffic

4. Treatment of invasive species. Prioritize:

- Species known or suspected to be invasive but still in small numbers
- Species that can alter ecosystem processes
- Species that occur in areas of high conservation value
- Species with the potential to require high management costs
- Species that are likely to be controlled successfully
- Species determined to be of regional concern as identified through regional partnerships

Pre-Activity Assessment Outline

This assessment outline can help you proactively address activities that have the potential to spread invasive plants. A site assessment and a description of planned activities will need to be completed as part of this pre-activity assessment.

1. Conduct a site assessment to ascertain:

- A list of invasive plant species found in route to and within worksites. Include exact locations and densities, and the species' dispersal mechanisms.
- A list of priority areas for implementing prevention BMPs. Refer to Prioritizing BMP Implementation on the previous page for guidance on prioritization.

2. Describe each activity (e.g. roadside mowing, facility inspection, access road grading and maintenance, and pole/tower repair) to ascertain:

- Location(s) of the activity
- Location(s) of access routes
- Timing for the activity
- Tools and equipment to be used
- Materials to be moved, imported or exported
- Expected alteration of existing vegetation and soil

3. List the sequence of tasks that are included in the activity. Identify which tasks can be altered to reduce the likelihood of invasive plant spread based on:

Task location

- a. Is there a location for this task with less potential to spread invasive plants?
- b. Can access routes be changed to avoid traveling through invasive plant populations?
- c. If materials are being moved, is there a better location for materials to be stored?

Task timing

- a. Can the task be performed in a different time (earlier/later in the season) or in a different sequence (e.g. spraying after mowing)?
- b. Can invasive plant populations be treated before project tasks commence to reduce the spread of invasive plant parts and seeds?

Task method

- a. Is there a different method of performing the task that can reduce the risk of spread?
- b. Could using different tools/equipment/materials reduce the risk of spread?
- c. Are weed-free materials available?

4. Select BMPs from the following chapters to address the potential introduction and spread of invasive plants.

List of Best Management Practices

Chapter 1: General BMPs

- GN1: Provide prevention training to staff and contractors prior to starting work.
- GN2: Scout for invasive plants and evaluate risks before activities begin.
- GN3: Schedule activities to minimize potential for introduction and spread of invasive plants.
- GN4: Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.
- GN5: Designate waste disposal areas for invasive plant materials, and contain invasive plant material during transport.
- GN6: Plan travel routes to avoid areas infested with invasive plants.
- GN7: Clean tools, equipment, vehicles and animals before transporting materials and before entering and leaving worksites.
- GN8: Clean clothing, footwear and gear before leaving infested areas.
- GN9: Prepare worksites to limit the introduction and spread of invasive plants.
- GN10: Minimize soil and vegetation disturbance.
- GN11: After activities, monitor worksites for invasive plants.

Chapter 2: Planning

- PL1: Adopt official project or maintenance activity policy to prevent invasive plant spread.
- PL2: Include invasive plant risk evaluation as a component of initial project planning and environmental analysis.
- PL3: Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.
- PL4: Integrate invasive plant prevention BMPs and monitoring methods into environmental awareness training for staff, contractors and volunteers.
- PL5: Coordinate invasive plant prevention efforts with adjacent property owners, regional weed management groups, and local agencies.
- PL6: In the initial stage of planning, conduct site assessment for invasive plant infestations and incorporate findings into a GIS database and project drawings or maps.
- PL7: Develop monitoring plans to evaluate effectiveness of BMP implementation.

Chapter 3: Materials Management

- MM1: Use a weed-free source for project materials.
- MM2: Prevent invasive plant contamination of project materials when stockpiling and during transport.

Chapter 4: Vegetation Management

- VM1: Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.
- VM2: Develop a mowing policy to minimize the introduction and spread of invasive plants.
- VM3: Retain existing desirable vegetation and canopy where possible.
- VM4: Keep livestock and support animals clean.
- VM5: Render invasive plant material nonviable when disposing of materials on-site.

Chapter 5: Soil Disturbance

- SD1: Minimize soil disturbance and transport during project implementation.
- SD2: Implement erosion control practices.
- SD3: Manage existing topsoil and duff material.

Chapter 6: Revegetation and Landscaping

- RL1: Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.
- RL2: Acquire plant materials locally. Inspect delivered plants to ensure plant labels match specifications prior to planting.
- RL3: Revegetate and/or mulch disturbed soils as soon as possible.

Chapter 7: Routine Maintenance and Inspection of Facilities

- RM1: Identify prevention priorities with resource, facility, or corridor managers prior to starting work.
- RM2: Document invasive plant findings and communicate to resource, facility or corridor managers.
- RM3: Identify travel direction and cleaning locations prior to starting work.
- RM4: Designate lay-down and staging areas outside of infested areas prior to starting work.
- RM5: Carry portable cleaning tools that can be used without water.
- RM6: Develop brush control policy along access roads to minimize the introduction and spread of invasive plants.
- RM7: Minimize soil disturbance when maintaining access roads.
- RM8: Maintain facility site to limit the introduction and spread of invasive plants.



Chapter 1: General BMPs

General BMPs are integral prevention practices that apply to many of the activity-based chapters that follow. These practices include training, scheduling, scouting, cleaning, transport and monitoring, and should be integrated into each field activity. Cleaning is especially important because dirty vehicles, equipment and clothing can transport invasive plant parts and seeds, creating new infestations. Careful planning of work sequence and travel routes to avoid infested areas will also minimize accidental spread of invasive plants.

GN1: Provide prevention training to staff and contractors prior to starting work.

- a. Provide pre-work training on invasive plants. Training may include:
 - Field identification of invasive plants
 - Reproductive biology of invasive plants
 - Ecological and economic impacts of invasive plants
 - Invasive plant prevention BMPs
 - Inspection and cleaning protocols for vehicles, tools, equipment, clothes and personal gear
 - When and how to record and report occurrences for invasive plants
 - How to use prevention resources (reporting websites, checklists, etc)
 - How to treat materials infested with invasive plants
- b. Identify personnel responsible for inspection of cleaned tools, equipment and vehicles at facilities and field sites.

Prevention training for staff and contractors is key. Photo: Martin Hutten, Yosemite National Park

- c. Provide additional training to staff and contractors managing project materials. Training may include:
 - How to acquire weed-free materials
 - Project material inspection protocols
- d. Provide prevention resources at highly visible locations such as access points, workshops and trailers. Resources may include:
 - Invasive plant identification guides
 - Prevention BMPs, activity, and inspection and cleaning checklists (See Checklists on page 39)
 - Resources in other languages, when appropriate

GN2: Scout for invasive plants and evaluate risks before activities begin.

- a. Scouting for invasive plants should occur at likely introduction sites such as access points, lay-down areas, and staging areas. Wet areas may be especially susceptible.
- b. Gauge the extent and intensity of scouting based on:
 - Threat of invasive plants to sensitive or protected habitats
 - Size of the property or project
 - Type of activity (whether the activity disturbs ground or vegetation and the degree of disturbance)
 - Adjacent environment
- c. Scout both within and around activity areas.
- d. Consult local weed management groups and online resources to identify invasive plants in and around worksites.
 - Weed Management Areas (WMAs), County Agricultural Commissioner offices, and Resource Conservation Districts are key local groups that have broad awareness of infestations in a given area. Cal-IPC currently maintains an online list of WMAs (www.cal-ipc.org/WMAs).
 - Cal-IPC works with a range of partners to map invasive plants across the state. Occurrence data for invasive plants can be found online at CalWeedMapper (calweedmapper.calflora.org), Calflora (www.calflora.org), and the



Photo: John Luker, California State Parks, Angeles-District

Harding grass regrowth being treated before seed set.

California Department of Fish & Game’s BIOS viewer (www.bios.dfg.ca.gov). See Resources for Additional Information at the end of this manual.

- e. Document invasive plant findings and communicate them to resource, facility or corridor managers.
- f. Evaluate invasive plant risks. Determine invasive plant prevention and management needs at the onset of project planning. Prioritize treatment of invasive plants based on guidelines in Prioritizing BMP Implementation on page 4.

GN3: Schedule activities to minimize potential for introduction and spread of invasive plants.

- a. Consider the timing of invasive plant control efforts; determine whether planned efforts should occur before, during or after the activity based on the plant life cycle.
 - When feasible, schedule land-disturbing activities to occur before invasive plants set seeds to minimize spreading seeds of invasive plants. Keep in mind that seeds may be present in the soil.
 - Consider invasive plant reproductive biology and response to fire when planning prescribed burns.
 - Coordinate the timing of maintenance activities and weed control activities when feasible. For example, delay blading roads until two weeks after herbicide application and delay spraying after blading until vegetative regrowth has occurred.

- b. Prioritize reducing invasive plant seed production at roadside operational zone (from pavement edge to fifteen feet along roadway edge, or as appropriate) to reduce seed movement by vehicle.
- c. Conduct work under conditions that minimize the risk of spread (e.g. frozen ground, snow cover, seed absence, etc) when feasible.
- d. Avoid working during rain events and high winds. Wet conditions make it easier for seeds to be picked up by a vehicle and spread miles down the road.
- e. Develop site-specific plans for controlling existing invasive plants before ground-disturbing activities begin.
 - Treat invasive plants along access roads and staging areas before moving equipment into worksites.
 - Before removing invasive plants from drainage ditches, treat the entire infestation to ensure that the plant parts will not spread to adjacent and downstream areas. Avoid sidecasting (piling excavated soil on either side of a trench when digging a drainage ditch) of accumulated road materials infested with invasive plants. Stockpile in one area that

can be monitored. For details on managing excavated materials, see MM1d on page 22, MM2e on page 24, and SD3 on page 30.

- Before scraping road shoulders, treat invasive plants with the appropriate control measure or herbicide to render plants nonviable. This will help prevent the plants from spreading to adjacent areas by water, wind, equipment or vehicle.
- Manage invasive plants for three to five years prior to the planned disturbance to minimize invasive plant seed accumulation in the soil when feasible.

GN4: Designate specific areas for cleaning tools, vehicles, equipment, animals, clothing and gear.

- a. Designate sites for cleaning tools, vehicles, equipment, animals, clothing and gear before starting work. Preferred locations for cleaning are areas that are:
 - Already infested with invasive plants (with the assumption that you will leave clean)
 - Easily accessible for monitoring and control
 - Located away from waterways to avoid spreading invasive plants downstream



The Forest Service designed this portable washer to clean vehicles in challenging terrain. The system fits on a trailer and can be towed by a pickup truck. It reuses wash water and is inexpensive.

Photo: Courtesy of USDA Forest Service, Missoula Technology and Development Center.

- Contained with silt fences or soil berms
 - Paved or have sealed surfaces to avoid re-accumulation of soil and plant material on cleaned vehicles and equipment
 - Located away from sensitive species or natural resources
- b. Implement stormwater pollution prevention (SWPP) BMPs.
- Contain water run-off that may carry plant parts or seeds.
 - Install berms or silt fences along the perimeter of worksites to help prevent the spread of contaminated materials outside the cleaning area.
 - Dispose of water that contains plant parts and seeds from equipment washing at a waste management facility or incinerator, not a wastewater treatment plant.
- c. Consider the use of a portable cleaning station, especially when maintaining multiple linear utility sites with a variety of environmental conditions.
- The Forest Service Technology and Development program has developed a high-pressure mobile power washer mounted on a trailer that can be towed by a pickup. The washer can be used by two workers to wash vehicles from top to bottom in 5 minutes or less. All wash water is captured on a containment mat with a sump pump that recycles and filters the water for reuse. See US Forest Service-MTDC Portable Vehicle Washer on page 55 in Resources for additional information.

GN5: Designate waste disposal areas for invasive plant materials, and contain invasive plant material during transport.

- a. Appropriate disposal areas are where viable invasive plant materials can be destroyed.
- b. If disposing on-site, render invasive plants nonviable. See Chapter 4: Vegetation Management on page 25.
- c. If disposing offsite, contain invasive plant material in heavy-duty (3-mm or thicker, contractor quality plastic) garbage bags.

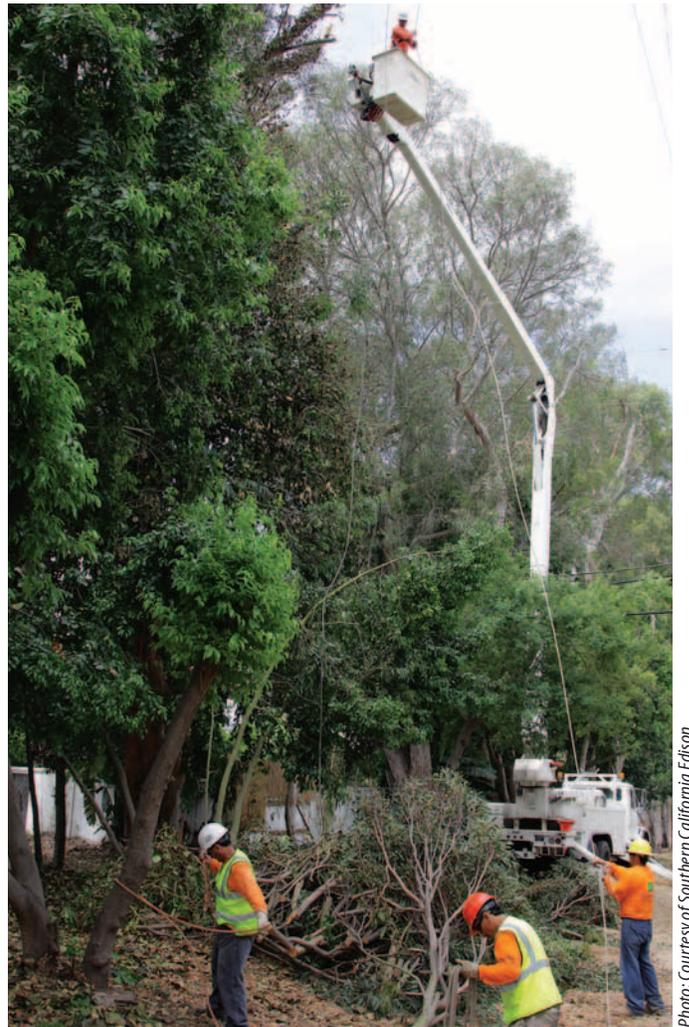


Photo: Courtesy of Southern California Edison

Take proper steps to dispose of brush and tree branches if the worksite is infested with invasive plants.

- Securely tie the bags and transport under tarps or in an enclosed truck to an appropriate disposal area.
- d. Locate debris burn piles in areas that minimize the possibility of invasive plant establishment.
 - e. Do not dispose of viable invasive plant material that has the ability to resprout or spread at a facility which produces mulch, spreadable sewage sludge, or chipped products.
 - f. Do not dispose of soil, seeds, or plant material down a storm drain. This action may promote the spread of invasive plants downstream.
 - g. Develop a monitoring plan for waste disposal areas, including burn piles, to preclude the introduction and spread of invasive plants.
 - h. Clean vehicles after transporting invasive plant material. See Inspection & Cleaning Checklist on page 52.



Photo: Marla Knight, USDA Forest Service

Contain waste water when washing vehicles to prevent spreading invasive plant parts.

- g. Limit the number of roads traveled to minimize soil disturbance and the risk of unintentionally transporting invasive plant parts and seeds on equipment into uninfested areas.
- h. Perform road maintenance such as road grading, brushing, and ditch cleaning from uninfested to areas infested with invasive plants. If possible, schedule such activities when invasive plant parts or seeds are least likely to be viable.

GN6: Plan travel routes to avoid areas infested with invasive plants.

- a. Avoid driving off-road whenever possible.
- b. When driving off-road or off-trail, avoid patches of invasive plants.
- c. Exclude areas infested with invasive plants from equipment travel corridors and staging areas.
- d. Avoid parking on the side of the road in areas infested with invasive plants.
- e. Prevent animals (grazing, pack and support) from entering areas infested with invasive plants.
- f. When traveling through infested areas cannot be avoided:
 - Consider the sequence of operations. Arrange travel routes from uninfested areas to infested areas. Work first in uninfested areas when vehicles and equipment are free from invasive plant material.
 - Treat invasive plants at access roads and staging areas before entering them.
 - Clean your vehicle before leaving the infested area.
 - Travel under dry conditions when feasible. Traveling under wet conditions, particularly along unpaved roads, greatly elevates the risk of picking up invasive plant seeds and transporting them.
 - Restrict travel to those periods when spread of seed is least likely, such as just prior to flowering or late in the season when seeds have already dropped.

GN7: Clean tools, equipment, vehicles and animals before transporting materials and before entering and leaving worksites.

- a. Integrate cleaning routines into field activities.
- b. Frequently wash vehicles, especially after driving off-road or off-trail or along roads bordered by a high density of invasive plants, and after traveling under wet conditions.
 - Consider covering vehicle grills with auxiliary screens when driving on dirt roads and traveling through areas heavily infested with invasive plants.
- c. Frequently inspect equipment storage areas for invasive plants.
- d. Avoid acquiring water for cleaning where access to the water is through infested areas.
- e. Remove soil, seeds and plant parts from the undercarriage, tires, sideboards, tailgates, and grills of all vehicles and equipment. Wash tires and under carriage if the travel route is muddy. (For detailed cleaning protocol, see Inspection & Cleaning Checklist on page 52.) Cleaning methods are divided into two categories:



Photo: Noa Rishe, California State Parks, Angeles District

Field staff cleaning seeds and plant parts from a vehicle with a handheld wire brush before leaving a site infested with invasive plants.

Cleaning without water

- Bristle brushes, brooms, scraper and other hand tools (to remove heavy accumulation of soil and debris prior to washing)
- High pressure air devices
- Vacuum
- Hand removal

Cleaning with water

- Wash on a paved surface to avoid creating mud. Contain waste water and splash to prevent invasive plant parts and seed from spreading.
 - High pressure washers (preferably with 2,000-psi): wash once for six minutes or two to three times for three minutes for best results.
 - Portable commercial wash unit with undercarriage washers and pressure hoses
- f. Clean carpet, rubber, nylon or plastic materials using:
- A vacuum cleaner
 - A variety of brushes with bristles of varying length and texture.
- g. Clean animals frequently. See VM4 on page 26.

GN8: Clean clothing, footwear and gear before leaving infested areas.

- a. Inform workers about possible seeds and invasive plant parts carried on their clothing, footwear and gear.
- b. Clean clothing, footwear and gear for soil, seeds and plant parts before leaving infested areas.
- c. See Inspection & Cleaning Checklist on page 52 for detailed cleaning protocol.
- d. Wear fabrics that do not retain invasive plant material:
- Cotton duck (canvas)
 - Nylon
 - Leather
 - Para-aramid DuPont™ Kevlar®¹
 - Meta-Aramid Ripstop DuPont™ Nomex®²

- Avoid brushed cotton, netting, Velcro, and bulky knits like wool and fleece

- e. Use special gear as appropriate:
- Nylon gaiters to cover socks and laces
 - Leather laces on leather boots
 - Rubber boots
- f. Carry appropriate equipment to help remove soil, seed, and plant parts. This may include wire brushes, small screwdrivers, boot brushes, extra water free of invasive species, and bags for plant materials.

GN9: Prepare worksites to limit the introduction and spread of invasive plants.

- a. Determine the degree that site preparation is needed for each activity and worksite. Not all prevention measures are needed when the worksite is already widely infested; however, all cleaning and waste-disposal BMPs should be implemented before leaving worksites to prevent spread to new areas.
- b. Position activity boundaries to exclude areas infested with invasive plants. Activity boundaries include staging areas, access roads and other temporary facilities. If this is not feasible, treat infested areas prior to their use.



Avoid fabric that retains invasive plant materials.

Photo: Martin Hutten, Yosemite National Park

1. DuPont™ and Kevlar® are registered trademarks of DuPont

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- c. Treat invasive plants at access roads and staging areas before entering them.
- d. Where possible, control invasive plants in areas adjacent to worksites and work routes.
- e. Limit the number of roads and access points used to help minimize soil disturbance, and to limit the risk of unintentionally transporting invasive plants into uninfested areas.
- f. Avoid management activities in infested areas when the soil is wet. If operations will occur when the ground is wet, consider closing areas where priority invasive plants are present, particularly along unpaved access roads. See Prioritizing BMP Implementation on page 4.

GN10: Minimize soil and vegetation disturbance.

- a. Retain soil cover and native/desirable vegetation in and around the activity area to the greatest extent possible to minimize the introduction and spread of invasive plant.
- b. Consider the impacts of different types of equipment. Plan to use equipment that minimizes soil and vegetation disturbance.
- c. Minimize the frequency of soil disturbance when feasible. If a site has to be cleared of vegetation regularly for maintenance (such as roadside blading, utility pole or ditch clearing), consider paving or otherwise protecting the site by using weed-free materials (gravel, mulch, decomposed granite), deep mulching, or a soil stabilizer. For more information on soil stabilizers, see RM7e on page 38.
- d. Maintain topsoil or ensure quality soil placement to establish desirable plant community. See SD3 on page 30.
- e. Stabilize disturbed soils using erosion control or stormwater pollution prevention BMP methods. See Chapter 5: Soil Disturbance on page 29.
- f. After disturbing soil, encourage prompt regeneration of desirable vegetation to limit introduction of invasive plants. See Chapter 6: Revegetation and Landscaping on page 31.

GN11: After activities, monitor worksites for invasive plants.

- a. Carry out the established monitoring plan. Partner with local Weed Management Areas (www.cal-ipc.org/WMAs), agencies and organizations to help with monitoring when possible.
- b. Monitor and maintain revegetation and landscaping at the site to support establishment of desired plant species.
- c. Monitor during multiple growing seasons, especially at times of germination and flowering, for a minimum of three years after project completion to ensure that any invasive plants are promptly detected and controlled. Monitoring areas include:
 - On-site cleaning areas and waste disposal areas
 - Areas where project or maintenance activities are performed
 - Areas where project materials are imported
 - Access routes, roads and other areas of concentrated use
 - Areas near salt licks, watering sites, loading/unloading areas and corrals if animals were used.
- d. If three years is not sufficient to control the re-establishment of invasive populations, monitoring and treatment should be continued until confident that invasion has been controlled.



Cover soil stockpiles to prevent invasive plant establishment. Monitor worksites for invasive plants following activities.

Photo: Ramona Robison, California State Parks



Chapter 2: Planning BMPs

Integrating prevention BMPs into transportation and utility corridor management can significantly minimize the introduction and spread of invasive plants. Effective planning reduces costs and enhances project success. This chapter addresses how and when to integrate prevention BMPs into corridor management, and highlights the importance of communication among staff and with adjacent property owners and local agencies.

An assessment of invasive plant risks and prevention measures should be included when initiating projects or maintenance plans. An invasive plant risk assessment analyzes the risk of new introductions, establishment and spread of existing infestations. Identifying invasive plant risks early in the planning process helps organizations develop strategies to prioritize prevention measures, allocate resources, and incorporate prevention costs in all budgets

Preventing the spread of invasive plants starts with planning and site assessment. Photo: Arpita Sinha, Cal-IPC

throughout the project life cycle. Additionally, tracking the costs and results of implementing prevention BMPs will provide references for future project planning and cost estimates, and will help to evaluate and improve the effectiveness of prevention measures.

In addition to the following BMPs, please also refer to:

- Chapter 1: General BMPs on page 9 for prevention measures applicable to all activities.
- Chapter 3: Materials Management on page 21 for procuring materials.

PL1: Adopt official project or maintenance activity policy to prevent invasive plant spread.

- a. Adopt reducing the introduction and spread of invasive plants as an environmental stewardship policy.
- b. Increase awareness of invasive plant impacts within the organization/agency.
- c. Consider using multi-disciplinary teams to address corridor-specific needs and site-specific invasive plant prevention and control challenges.

- d. Identify funding, priorities, and personnel assignments for invasive plant prevention measures. Consider having a dedicated invasive plant contact person.

PL2: Include invasive plant risk evaluation as a component of initial project planning and environmental analysis.

- a. Integrate invasive plant identification and risk analysis as a part of NEPA/CEQA processes. See <http://ceq.hss.doe.gov/> for National Environmental Policy Act (NEPA), <http://ceres.ca.gov/ceqa/> for California Environmental Quality Act (CEQA).
- b. Evaluate invasive plant spread risks and the long-term maintenance consequences with natural resource managers. Determine project alternatives and management needs based on pre-activity assessment. (See Pre-Activity Assessment Outline on page 5.)
- c. Incorporate invasive plant prevention into project layout, design, and implementation decisions.
- d. Develop mitigation plans for areas where avoidance of invasive plants is not possible.
- e. Include invasive plant prevention measures in resource management plans for ground and/or vegetation disturbing operations and maintenance activities.
- f. Designate known invasive plant occurrences in maintenance plans and any associated contracts.

PL3: Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.

- a. Include BMP costs in all budgets and estimates. Include costs for prevention training for staff and contractors, cleaning routines for clothing, tools, equipment and vehicles, site preparation and monitoring.
- b. Track cost and results of implementing BMPs as a reference for future project planning and cost estimates.



Photo: Martin Hutten, Yosemite National Park

Evaluate invasive plant risk as a part of project planning and environmental analysis.

- c. Integrate cleaning routines into all corridor management activities. For detailed cleaning protocols, see Inspection & Cleaning Checklist on page 52.
- d. Include invasive plant prevention measures as part of contract bid scope and specifications.
- e. Develop plant lists and design guidelines for revegetation and landscaping that will optimize resistance to invasive plant establishment. See RL1 on page 31-32.
- f. Plan to minimize soil and vegetation disturbance during activities. See GN10 on page 15.
- g. When designing vegetation management projects, consider the life cycle and dispersal mechanisms of the invasive plant species within and/or adjacent to worksites.
- h. Acquire documentation of invasive plants along roadways and address treatment strategies in the course of road maintenance activities.

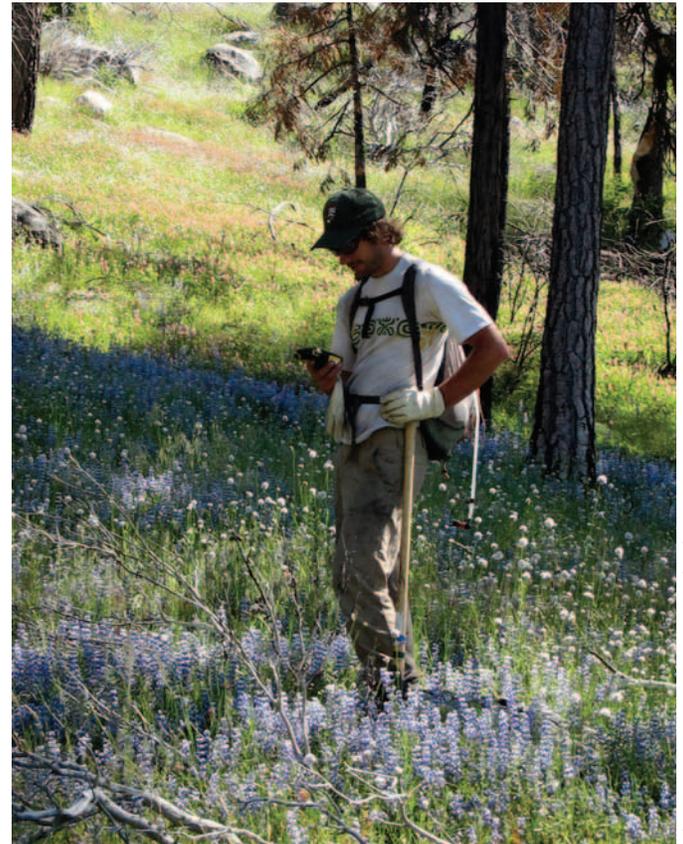
PL4: Integrate invasive plant prevention BMPs and monitoring methods into environmental awareness training for staff, contractors and volunteers.

- a. Incorporate invasive plant findings into facility inspection forms. Communicate invasive plant findings within and adjacent to the right-of-ways to resource managers for future treatment and prevention measures.
- b. Establish a webpage or information sharing group to promote communication, updates on new infestations and sharing of information.
- c. Provide pre-work training on invasive plants. See GN1 on page 9.
- d. Ensure department construction staff and contractors understand provisions for invasive plant prevention before construction and throughout the project. Invasive plant considerations should be routinely addressed by department staff and contractors during pre-bid, pre-construction, initial and weekly meetings, as appropriate.
- e. Provide prevention information and resources at high-visibility locations such as access points, workshops and trailers. See GN1 on page 9.
- f. Develop incentive programs to encourage invasive plant detection and reporting.
- g. Include invasive plant identification with Adopt-A-Highway and Adopt-A-Roadway programs.

PL5: Coordinate invasive plant prevention efforts with adjacent property owners, regional weed management groups, and local agencies.

- a. Coordinate prevention efforts with adjacent property owners to ensure their activities will minimize the introduction or spread of invasive plants into the project area or neighboring properties.
- b. Coordinate with local and state agencies to streamline record keeping systems of invasive plant infestation. Incorporate updates into appropriate GIS databases and share with local, state and federal agencies.

- c. Share new research and technology regarding invasive plant prevention with agencies, universities and the California Invasive Plant Council.



Document and record invasive plant infestations during site assessments.

Photo: Martin Hutten, Yosemite National Park

PL6: In the initial stage of planning, conduct site assessment for invasive plant infestations and incorporate findings into a GIS database and project drawings or maps.

- a. See GN2 on page 10 for considerations.

PL7: Develop monitoring plans to evaluate effectiveness of BMP implementation.

- a. Establish a periodic monitoring program based on knowledge of local invasive plant life cycles and reproductive biology (ideally three times a year when plants are identifiable and before seed set).

- b. Define “zero tolerance” zones in highly sensitive or protected habitats. Commit to keeping these areas weed-free through frequent monitoring and control efforts.
- c. Track results of implementing BMPs as a reference for future project planning and cost estimates.
- d. Develop follow-up treatments as needed based on monitoring results.
- e. Modify BMP implementation based on the following evaluation questions:
 - Were invasive plant populations reduced or adequately suppressed thus preventing spread?
 - Was the planned procedure used? If not, why did it vary from the original plan?
 - Were invasive plant prevention costs equal to, less than, or more than projected prevention costs?
 - What was the effect on the targeted invasive plant species?
 - Are other infestations of non-desirable invasive plants that were previously not present occurring?
 - Were there any side-effects on non-target organisms from implementing prevention measures?
 - Were available funding and staffing adequate?
 - Was personnel training adequate?



Photo: Doug Brown, California Department of Transportation

When monitoring results indicate invasive plant establishment, such as the giant reed pictured here, develop invasive plant treatment plans.



Chapter 3: Materials Management BMPs

Project materials are common vectors of invasive plant introduction into new areas. Contaminated project materials that are imported to worksites can introduce invasive plant seeds and reproductive parts which may lead to new infestations. This chapter includes practices for minimizing the spread of invasive plants from project materials.

Effective material management can prevent invasive plant spread at the source and minimize contamination during transport and stockpile. Because project materials are often managed by different entities or departments during different project phases, developing a procedure for procuring, storing, and inspecting materials at critical control points will streamline materials management and minimize contamination. Developing relationships with suppliers and requesting that they supply weed-free materials can help to increase demand and availability of these materials.

Using weed-free project materials such as gravel and mulch reduces the spread of invasive plants. Photo: Martin Hutten, Yosemite National Park

Project materials include:

- Erosion control materials (silt fences, fiber roll barriers, mulch and straw bales or wattle)
- Soil and aggregate (topsoil, fill, sand, gravel, and boulders)
- Landscape material (plants, seed, sod, fiber mulch, synthetic mulch, soil amendment)
- Animal/livestock feed
- Water (for cleaning or irrigation)
- Construction/building materials to which soil, seed, or other plant parts can adhere to.

MM1: Use a weed-free source for project materials.

- a. Select materials based on the environmental needs of the worksite. Verify how weed-free materials are produced and whether the screening criteria is based on noxious weeds or wildland invasive plants. Weed-free materials may not be 100% weed free, but using weed-free materials can reduce the probability of exposure to invasive plant parts and seeds.

- Noxious weeds are agricultural weeds listed by the California Department of Food and Agriculture. www.cdfa.ca.gov/plant/ipc/weedinfo/winfo_list-pestrating.htm
 - Cal-IPC's California Invasive Plant Inventory lists wildland invasive plants. www.cal-ipc.org/ip/inventory/
- Develop a procedure for procuring and storing weed-free materials and inspecting material sources. Update records at least annually. Cultivate relationships with suppliers to streamline sourcing of weed-free materials.
 - Provide training for planners, suppliers, field staff and contractors in material management and inspection.
 - Determine the degree to which weed-free project materials are needed for each worksite. Materials from an infested site may be suitable for a worksite that is already infested with the same species. Excavated material from areas containing invasive plants may be reused within the limits of the infestation.
 - For example, materials from a yellow starthistle infested site could be reused in areas already infested by yellow starthistle, but not in areas free of yellow starthistle.
 - Unused excavated material contaminated with invasive plants should be stockpiled on an impervious surface and treated until all viable invasive plant material is destroyed. Refer to MM2 on page 24, SD2 and SD3 on page 30 for addressing Storm Water Pollution Prevention BMPs for stockpiled materials.
- Use weed-free materials for erosion control and soil stabilization.
 - Use straws certified by a county agriculture department. When available, use certified weed-free rice straw and/or native grass straw. These types of straw have limited quantities of noxious weeds and may contain wetland species that may not survive in dry upland conditions.
 - For a list of weed-free straw suppliers, see Cal-IPC Weed-Free Forage and Straw Resources. www.cal-ipc.org/ip/prevention.



Photo: Matt Brown, USDA Forest Service

This straw bale is infested with yellow starthistle. Protect worksites from invasive plants by using weed-free project materials.

- Perform follow-up inspections at sites where straw and imported materials were used to ensure that any invasive plant introductions are caught early and treated.
- Use weed-free sand and gravel.
 - Any fill material brought on site should be clean, debris-free, and devoid of invasive plant parts or seeds. Do not borrow fill from weed-infested stockpiles, road shoulders or ditch lines.
 - Inspect aggregate material sources (including but not limited to surrounding ditches, topsoil piles, gravel/sand piles or pits, fence rows, roads, easements, and right-of-ways) annually and before purchasing and delivery.
 - For information about procuring weed-free aggregates, see Cal-IPC www.cal-ipc.org/ip/prevention.
 - Use weed-free seed. Verify seed mix to ensure it does not contain invasive plants.
 - Use local seeding guidelines to determine procedures and appropriate seed mixes.

- A certified seed laboratory should test each lot according to Association of Seed Technologists and Analysts (AOSTA) standards (which include an all-state invasive plant list) and provide documentation of the seed inspection test. Check state, federal, and California Invasive Plant Council lists to see if any local invasive plants need to be added to the list prior to testing. For more information on locating lists of invasive plants, see MM1a on page 21.
- Seed purchased commercially should have an analysis label that states the following:
 - Species
 - Purity: Most seed should be no less than 75%, and preferably over 85% pure. The rest is inert matter, weed seed, or other seed.
 - Weed seed content: The tag should state NO invasive plants are present. Only certified weed-free seed should be used. (Seed is usually certified to be “noxious weed free”, referring to the California Department of Food and Agriculture noxious weed list, and may still contain wildland invasive plants.)
 - Germination: Germination of desired seed generally should not be less than 50% for most species, although some shrubs and forbs will have less.
- h. Keep and reuse on-site weed-free materials rather than importing new materials.
 - Stockpile topsoil along perimeter of project for later use rather than importing topsoil. For details on topsoil management, see SD3 on page 30.
 - Consider using mulch from non-invasive plant species chipped on site when feasible.
 - Find local sources when off-site weed-free project materials are needed. Inspect project material suppliers as appropriate to determine if their sites are weed-free.
- i. Designate and use weed-free water sources for each project. Inspect water sources to prevent introduction of invasive plants or animals.
- j. Provide weed-free feed for livestock and pack animals before and after project use to limit invasive plant seed transport via manure.
 - For a list of weed-free forage suppliers, see Cal-IPC Weed-Free Forage and Straw Resources. www.cal-ipc.org/ip/prevention.
- k. If unable to obtain materials from a weed-free source:
 - Work with a local weed specialist to sterilize or treat materials and provide required documentations or certification for approvals. Monitor application areas.
 - If sources of fill material are infested, treat the invasive plants, then strip the infested topsoil and stockpile the contaminated material for several years to further deplete the soil seed bank. Check regularly for re-emergence of invasive plants and treat as needed.
 - Inspect and document the area where material from weed-infested sources were used annually for at least three years after project completion, to ensure that any invasive plants transported to the site are promptly detected and controlled. For monitoring protocol, see GN11 on page 15.
- l. Inspect project materials, sources, and storage areas for invasive plants annually and prior to each use to ensure that no invasive plants have invaded since the last inspection. Record the inspection results.



Contaminated project materials, like this gravel pile, can spread invasive plants to worksites.

Photo: Maria Knight, USDA Forest Service



Photo: Mona Robison, California State Parks

These certified weed-free rice straw wattles are contained in plastic packaging to protect them from invasive plant establishment.

- m. Inspect and clean construction/building materials that have been exposed to soil, seeds or plant parts.
 - n. When feasible, include penalties, performance standards, or withholding provisions in contract specifications by which a contractor is assessed monetary damages for importing invasive plants as a result of non-compliance with contract specifications.
- f. Active and inactive soil stockpiles must be:
 - Covered with soil stabilization material or a temporary cover. Soil stabilization materials used on bare slopes can be used for stockpiled soils. Temporary soil stabilization materials include:
 - Hydroseed (tackifier, fiber or seed)
 - Erosion control blanket (jute mesh or netting)
 - Mulch
 - Soil binder
 - Geosynthetic fabric
 - Surrounded with a linear sediment barrier (e.g. fiber roll).
 - g. For managing existing topsoil and duff materials, see SD3 on page 30.
 - h. Frequently monitor stockpiles, materials storage areas and borrow pits. Quickly treat new invasive plant populations prior to seed production.

MM2: Prevent invasive plant contamination of project materials when stockpiling and during transport.

- a. Plan where materials will be moved and which route is taken.
- b. Move only weed-free materials into uninfested areas. Moving materials from one infested location to another within a particular zone may not cause contamination, but moving materials from infested to uninfested areas could lead to the introduction and spread of invasive plants.
- c. Ensure transport vehicles are free of invasive plants and seeds before and after use.
- d. During transport, cover exposed piles of materials with geotextile fabric or impermeable material to prevent invasive plant contamination.
- e. Cover exposed piles of project materials with impermeable material to protect materials from wind and rain, and reduce germination of invasive plants.



Chapter 4: Vegetation Management BMPs

Integrating prevention BMPs into vegetation management can greatly minimize the introduction and spread of invasive plants. For example, scheduling vegetation management activities prior to seed production can reduce the spread of invasive plants. Life cycles of both invasive and desirable plants should be considered when scheduling activities. Mowing invasive plants after seed production will promote seed dispersal and increase the size of infestations.

Vegetation management activities may include but are not limited to: mowing, manual clearing, trimming, mechanized clearing and trimming, herbicide application, prescribed grazing and burning.

In addition to the following BMPs, please also refer to:

- Chapter 1: General BMPs on page 9 for prevention measures applicable to all activities.

- Chapter 7: Routine Maintenance and Facility Inspection page 35 for brush control along access roads.

VM1: Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.

- a. See GN3 on page 10 for scheduling activities.
- b. Manage vegetation with methods favorable to desirable vegetation. Coordinate management of invasive plants and desirable plants.
 - Select tools and approaches that optimize control of invasive plants while not harming desirable plants.
 - Select herbicides that are selective for target plants and harmless to desirable plants.

*Schedule mowing of invasive plants to minimize impact on desirable plants.
Photo: Noa Rishé, California State Parks, Angeles District*

VM2: Develop a mowing policy to minimize the introduction and spread of invasive plants.

- a. Identify invasive plants that should not be mowed (or conditions under which they should not be mowed) to avoid inadvertently spreading these invasive plants. Some invasive plants have the ability to sprout from stem and root fragments. Mowing these plants should be avoided.
- b. Consider which invasive plants, if any, are present when identifying areas for mowing.
- c. Consider timing of mowing of invasive plants and desirable plants.
 - Schedule mowing of desirable plants to occur after seed maturation, ensuring desirable plants grow unrestricted and produce seed.
 - Mow invasive plants when they have reached the early flowering stage (or well before seed development) to avoid spreading viable invasive plant seeds.
- d. Plan to mow the right-of-way prior to invasive plant seed maturation. This could be accomplished by identifying specific corridors that are either heavily infested with invasive plants or corridors that are in sensitive habitat areas, and prioritizing those areas in the mowing schedule.
- e. Limit mowing and other mechanical control to the minimum corridor width and maximum vegetation height needed to meet transportation and utility corridor requirements.
 - To reduce plant shock and root dieback of desirable plant species, mowing height should not be less than six inches. Mowing too low during the growing season will increase soil exposure to sun, increase soil temperatures and erosion risks, and encourage weed growth.
- f. Treat invasive plants in and adjacent to drainage ditches and streams before mowing. Invasive plants in the drainage system that are only mowed will grow and spread, and require additional mowing. For more information, see GN3 on page 10.
- g. Mowing equipment should be cleaned at least daily, as well as prior to transport or moving

between work zones. This is particularly important if mowing occurs after seed maturation. Clean and remove all soil and plant parts from the undersides of mower decks.

VM3: Retain existing desirable vegetation and canopy where possible.

- a. Identify and protect desirable vegetation on site. Desirable vegetation should be non-invasive and suitable for the conditions.
- b. Train personnel to identify invasive and desirable plants on-site. Provide identification guides to field staff.
- c. Revegetate or mulch disturbed ground and newly opened canopies when feasible to prevent colonization by invasive plants. See RL3 on page 33.

VM4: Keep livestock and support animals clean.

- a. Consider using transitional pastures when moving livestock from areas infested with invasive plants.
 - Allow animals to graze invasive plants only before they flower or set seed. If this is impossible, contain animals 4-14 days in a weed-free holding area before moving them into areas free of invasive plants.
- b. Provide weed-free forage or pelletized feed for livestock (preferably for three days or more) before and after project use to limit invasive plant seed transport via manure.



Flag native plants for avoidance before treating invasive plants.

Photo: Noa Rische, California State Parks, Angeles District

- c. Brush and clean animals — especially their hooves and legs — before leaving areas infested with invasive plants. Consider using a walk through trough with a seed treatment. See Inspection & Cleaning Checklist on page 52.
- d. Keep animals from entering areas infested with invasive plants (unless animals are being used to control invasive plants).

VM5: Render invasive plant material nonviable when disposing materials on-site.

- a. When composting invasive plants on site, consider the reproductive biology of the invasive plants :
 - Composting will render invasive plant material nonviable only if compost piles reach very high temperatures. Finished compost should be monitored for invasive plant emergence.
 - For large amounts of invasive plant material or for invasive plants with rigid stems, contain plant materials by placing them on asphalt or black plastic (4-mm-thickness minimum), covering with black plastic (4-mm-thickness minimum), and securing the edges with landscaping staples, large rocks or sand bags. Effectiveness of this method varies by plant species.
 - For smaller amounts of plant material or for plants with pliable stems, bag the material in heavy-duty (3-mm or thicker) garbage bags. Keep plant material bagged for at least one month. Effectiveness of this method varies by plant species.
 - Keep covered or bagged materials in the sun, preferably on a dark surface such as asphalt, to accelerate the decomposition process. Material is nonviable when partially decomposed, very slimy or brittle.
 - Monitor the bagged or covered material to ensure the plants do not escape through rips, tears or seams in the plastic.
 - Once material is non-viable, it can be disposed of in a landfill.



Prevent invasive plant materials from contacting soil when disposing of materials on-site.

Photo: Jim Bromberg, Point Reyes National Seashore

- b. When piling invasive plants on site to dry out:
 - To avoid root growth and reestablishment, prevent cut surfaces or roots of invasive plant stems from contacting soil.
 - Invasive plants with viable seeds or fruit attached should not be left on-site to dry out in an exposed manner.
- c. When burying invasive plants on-site:
 - Contain all invasive plant material in an excavated pit, cover with woven geotextile, and cover with a minimum of 3 feet of uncontaminated fill material. Effectiveness of this method varies by plant species.
 - This method is best used on a worksite that already has disturbed soil.
- d. Locate disposal site in an area that facilitates easy monitoring and control if infestations occur.
- e. Do not dispose of soil, seeds, or plant materials down a storm drain. This action is illegal and may promote the spread of invasive plants downstream.



Chapter 5: Soil Disturbance BMPs

Soil disturbance includes blading, scraping, blasting, contouring, ripping, grubbing, moving, removing, excavating, boring and cutting. Soil disturbance destabilizes and exposes soil, which can impact ground water and air movement, biological activity, root growth and seedling emergence. Disturbed soil provides an opportunity for invasive plants to establish, spread, and to colonize new areas. Once established, they often out-compete native species.

Soil disturbance often occurs during:

- Road maintenance
- Foundation excavation for new facilities or structures
- Thrusting, boring, trenching or testing associated with cable or pipe laying
- Vegetation clearing and uprooting
- Movement of vehicles and heavy equipment

Soil disturbance should be minimized whenever possible. Disturbed soil should be stabilized and covered as soon as possible to prevent the germination and growth of invasive plants. If a project location is infested with invasive plants, schedule treatment of these plants prior to ground disturbance to minimize spread of invasive plants into other uninfested areas. Project materials such as fill, aggregate and other materials, or vehicles and equipment, may also carry invasive plant seeds, which further increase the risk for infestation after soil disturbance.

In addition to the following BMPs, please also refer to:

- Chapter 1: General BMPs on page 9 for prevention measures applicable to all activities.
- Chapter 3: Materials Management on page 21 for procuring and managing erosion and project materials.
- Chapter 7: Routine Maintenance and Facility Inspection on page 35 for access road maintenance.

Minimize soil disturbance by selecting low impact equipment. Photo: Martin Hutten, Yosemite National Park



Photo: Cindy Roessler, Midpeninsula Open Space District

Install wattles and/or erosion control mats to reduce soil erosion.

SD1: Minimize soil disturbance and transport during project implementation.

- a. Consider the impacts of different types of equipment. Plan to use equipment that minimizes soil disturbance.
- b. Minimize the frequency of soil disturbance when feasible. If a site has to be cleared of vegetation regularly (such as roadside blading, utility pole or ditch clearing), consider paving or otherwise protecting the site by use of inert materials (gravel, mulch, decomposed granite), deep mulching, or using a soil stabilizer. For more information on soil stabilizers, see RM7e on page 38.
- c. Retain existing desirable vegetation and canopy where possible to minimize soil disturbance.

SD2: Implement erosion control practices.

- a. Implement Storm Water Pollution Prevention BMPs consistent with utility or agency permit conditions or internal policies and procedures.
- b. Contain and manage water runoff which may carry soil, seeds and plant material. Temporary construction fences installed along the perimeter of worksites can aid in preventing the spread of infested materials.
- c. When feasible, select paved or sealed surfaces for cleaning to avoid re-accumulation of soil and plant material on cleaned vehicles and equipment.

- d. Promptly revegetate and/or mulch disturbed soil after ground disturbing activities. (See Chapter 6: Revegetation and Landscaping on page 31.) Use mulch, seeding or a non-persistent cover crop as temporary cover during the delay between soil disturbance and revegetation.
- e. Protect soil stockpiles from raindrop erosion and reduce germination of invasive plants. For managing active and inactive soil stockpiles, see MM2f on page 24.

SD3: Manage existing topsoil and duff material.

- a. Save local existing topsoil for reuse. Plan topsoil management prior to soil disturbance.
 - Develop topsoil management plans on all projects that include grading or earthwork unless the topsoil and duff material are determined to be contaminated with invasive plants.
 - Identify on the plans where local topsoil and duff material within the grading limits are to be:
 - Removed or excavated
 - Stockpiled
 - Reapplied
- b. When excavating local topsoil and removing duff material, minimize the handling or re-handling of the material to reduce detrimental impacts to living soil microorganisms.
- c. Stockpile local topsoil and duff material in windrows no taller than ten feet for local topsoil and five feet for duff. Implement temporary erosion control measures. See MM2f on page 24.
- d. Seed local topsoil stockpiles that will remain in place for over six months with a fast growing native plant species to maintain living soil microorganisms. Covering topsoil stockpiles with impermeable barriers such as plastic sheeting may destroy living soil microorganisms. For temporary cover materials, see MM2f on page 24.
- e. Monitor stockpiles of topsoil and duff material regularly as they are highly susceptible to invasion by invasive plants. Determine management needs based on presence of invasive plants.



Chapter 6: Revegetation and Landscaping BMPs

Revegetation and landscaping work are often derived from different needs and carried out by different departments and staff. Revegetation is the process of replanting and rebuilding the soil of disturbed land. Landscaping modifies land to meet functional, aesthetic and regulatory requirements. Despite the differences, revegetation and landscaping share the fundamental goal of creating a weed-resistant plant community.

Creating a weed-resistant landscape requires planning and a thorough understanding of site ecology, which encompasses existing soil condition, hydrology, exposure, existing plant community and habitat, invasive plant risk assessment, human impact, and the surrounding environment.

Plant selection is critical to successful projects. Revegetation and landscaping with desirable non-invasive plants suitable for local conditions can

create weed-resistant communities that prevent or slow the establishment, growth, and reproduction of invasive plants. The following BMPs provide prevention measures for revegetation and landscaping projects.

In addition to the following BMPs, please also refer to:

- Chapter 1: General BMPs on page 9 for prevention measures applicable to all activities.
- Chapter 3: Materials Management on page 21 for procuring and managing revegetation and landscaping materials.

RL1: Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.

- a. Identify areas where revegetation or landscaping is needed to improve weed resistance of plant communities. Determine the goal of vegetation coverage. Evaluate annually for three years to determine if establishment of desirable vegetation is successful at resisting the invasive plant establishment.

Planting of native deer grass to optimize resistance to invasive plant establishment. Photo: Jack Broadbent, California Department of Transportation

- Develop weed-resistant plant communities in roadside operational zones (area from the edge of pavement extending outward a minimum of fifteen feet, or as appropriate) to reduce seed movement by vehicular traffic. Establish vegetation from the edge of pavement where possible. Consider using plants that have low growth forms or that do not create line-of-sight safety obstructions or increased fire risk potential, and are well adapted to roadside disturbance.
 - Revegetate or landscape with local native plants or appropriate non-invasive plants to prevent invasive plant introduction. Native species grown outside of the region may not establish well.
- b. Evaluate existing soil type, texture and health to determine vegetation selection, fertilization and maintenance needs.
- Improve unhealthy soil by adding healthy topsoil or compost and using aeration to incorporate oxygen into the soil.
 - Fertilization, if done improperly, can encourage weed growth and reduce the ability to establish native plantings. Organic fertilizers are better suited for native plants because they release nitrogen at a very slow and stable rate.
 - Do not fertilize areas treated with compost as the compost will provide plants with the needed micro-nutrients to support healthy growth. Compost should be supplied by participants in the US Compost Council's Seal

of Testing Assurance Program. A list of current STA program participants is available at: compostingcouncil.org/participants/#CA

- If improving soil health is not possible, choose vegetation with low soil-nutrient requirements.
- c. Develop a seed mix and plant palette that will occupy various planting zones/ecological niches in order to encourage a weed-resistant landscape.
- Select plants, with the aid of a professional consultant, based on existing soil conditions, drainage patterns, amount of rainfall or irrigation available, exposure and adjacent environment.
 - Use native material to the greatest extent possible.
- d. Encourage passive regeneration of native plant cover where site conditions permit and where the risk of weed invasion is low.
- e. Design irrigation systems with attention to irrigation timing, coverage and quantity to encourage the growth of desirable plants and discourage the growth of invasive plants. Too much water can stunt the growth of drought-tolerant plants and encourage undesirable water-loving invasive plants.

RL2: Acquire plant materials locally. Inspect delivered plants to ensure plant labels match specifications prior to planting.

- a. Identify sources of native and appropriate nonnative plant materials. Specify and use weed-free locally appropriate seed mixes that will occupy various niches in order to create weed-resistant landscapes.
- b. Use local native ecotypes when feasible. Native species grown outside of the region may not establish well or may carry diseases. Consider contract growing of local native plants.
- c. When using local native species is not feasible and the risk of weed invasion is high, use locally grown, non-invasive species proven to grow well locally.



Photo: Mona Robison, California State Parks

Revegetate disturbed worksites to reduce potential for invasive plant establishment.

- d. Do not plant invasive plants. Verify plant list does not contain invasive plant species by checking Cal-IPC's California Invasive Plant Inventory www.cal-ipc.org/ip/inventory/weedlist.php or checking with your local Agricultural Commissioner's Office.
- e. Check seed label for purity, composition, source and germination. Confirm consistency with specifications. See MM1 on pages 21-24.
- f. Have extra plant materials on hand. Plan for mortality of a percentage of container plants.

RL3: Revegetate and/or mulch disturbed soils as soon as possible.

- a. Use proper horticultural practices to promote healthy root and foliage growth that will aid in the vegetation's ability to withstand adverse conditions and to compete with weed growth.
 - Avoid use of fertilizers in areas with high infestations of invasive plants where fertilizer may favor growth and spread of invasive plants over desirable species.
 - Consider using compost or an organic slow release fertilizer when planting native species. Excessive nitrogen availability promotes the growth of weedy annual grasses, which could dry out of the site and crowd out slow-growing perennials.
 - Consider inoculation to improve establishment success for planted species. Inoculation refers to the adding of



Successful landscape planting with native sulfur buckwheat and lupines along highway.

Photo: Doug Brown, California Department of Transportation

“inoculants” which are mycorrhizal fungi that help with moisture retention and soil/root relationships in the first year of establishment.

- b. When revegetation is impossible, consider limited and judicious use of paving/hardscape, or otherwise protecting the site by use of inert materials (gravel, long-fiber mulch, decomposed granite), deep mulching or using a soil stabilizer. For more information on soil stabilizers, see RM7e on page 38.
- c. When using mulch:
 - Use weed-free mulch. See MM1 on pages 21-24.
 - Consider fire risk at the application site. Some long-fiber mulches such as shredded redwood bark (gorilla hair) are highly flammable.
 - Apply mulch at the recommended thickness to suppress the establishment and growth of invasive plants. Ensure mulch remains on-site. Lighter mulches will blow away in areas prone to heavy wind or rain fall; mulches can move if watering results in surface flow. Consider the use of tackifiers or biodegradable netting.
 - Supplement with additional mulch to retain thickness and effectiveness after it begins to decompose.



Revegetate or mulch disturbed areas to prevent invasive plants from establishing.

Photo: David Chang, Santa Barbara County Agricultural Commissioner's Office



Chapter 7: Routine Maintenance and Facility Inspection BMPs

Routine maintenance and operations often require access at regular intervals for facility inspection. Because accessing and maintaining these facilities may call for frequent travel through vegetated areas and various degrees of ground and vegetation disturbance, it is especially important to practice preventative measures. Practicing prevention BMPs will reduce the introduction and spread of invasive plants along the work route.

Utility corridors often cross hundreds of miles of landscape and wilderness. Maintaining these linear sites poses special challenges in cost and practice when implementing invasive plant prevention measures. Unlike a self-contained project area, access to these linear sites vary from year-to-year and may change frequently along the corridor. Worksite management also varies with changing environmental conditions as work progresses along these corridors.

Practicing prevention BMPs during routine maintenance reduces the potential for introduction and spread of invasive plants along corridors. Photo: Courtesy of Southern California Edison

The following BMPs describe specific measures to integrate into routine maintenance and facility inspection.

In addition to the following BMPs, please also refer to:

- Chapter 1: General BMPs on page 9 for prevention measures applicable to all activities.
- Chapter 4: Vegetation Management on page 25 for general prevention measures.
- Chapter 5: Soil Disturbance on page 29 for erosion control and topsoil management.

RM1: Identify prevention priorities with resource, facility, or corridor managers prior to starting work.

- a. Prioritize areas for implementing prevention BMPs. Refer to the Prioritizing BMP Implementation on page 4.
- b. For priority areas, identify which work tasks can spread invasive plants, based on Pre-Activity Assessment on page 5.

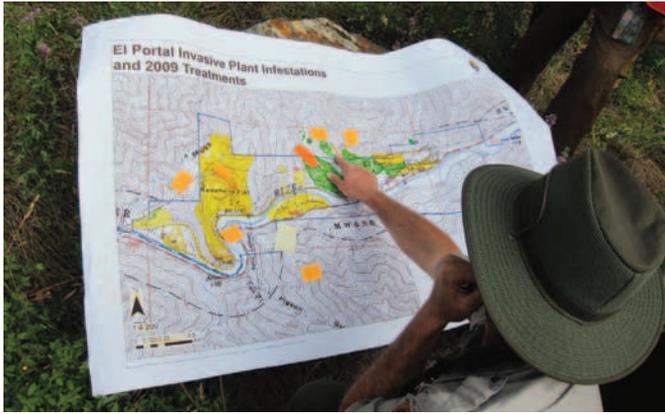


Photo: Martin Hutten, Yosemite National Park

Identify potential spread risks prior to starting routine maintenance activities.

- c. All cleaning and waste-disposal BMPs should be implemented before leaving worksites infested with invasive plants and before entering uninfested areas.
 - For more information on cleaning, see GN7 and GN8 on pages 13-14.
 - For disposing of invasive plants on-site, see VM5 on page 27.
 - For disposing of invasive plants off-site, see GN5 on page 12.

RM2: Document invasive plant findings and communicate to resource, facility, or corridor managers.

- a. Incorporate invasive plant findings into facility inspection forms. Communicate invasive plant findings within and adjacent to the right-of-ways to resource managers for future treatment and prevention measures.
- b. Survey or monitor for invasive plants at likely introduction sites such as access points, lay-down areas, and staging areas. Wet areas may also be especially susceptible.
- c. Gauge the extent and intensity of monitoring based on:
 - Threat of invasive plants to highly sensitive or protected habitats
 - Size of the property or project
 - Type of facility
 - Degree of disturbance from maintenance activities
 - Adjacent environmental conditions
- d. Inspect both within and around facility site.

RM3: Identify travel direction and cleaning locations prior to starting work.

- a. The sequence of maintenance operations often requires different access points for entry and exit. Arrange travel routes from uninfested areas to areas infested with invasive plants. Work first in uninfested areas when vehicles and equipment are free from invasive plant material. For more information on work route planning, see GN6 on page 13.
- b. Perform access road maintenance such as road grading, brushing, and ditch cleaning from uninfested areas to areas infested with invasive plants. Schedule such activities when invasive plant parts or seeds are least likely to be viable.
- c. Identify cleaning locations based on operational sequence, travel direction and presence of invasive plant population. Cleaning location may be in between worksites. For more details on choosing cleaning locations, see GN4 on pages 11-12.

RM4: Designate lay-down and staging areas outside of infested areas prior to starting work.

- a. Position inspection activity boundaries to exclude areas infested with invasive plants. If this is not possible, treat infested sites prior to their use.
- b. Establish equipment locations and job-site equipment storage areas in locations that minimize the potential for introduction and spread of invasive plants.

RM5: Carry portable cleaning tools that can be used without water.

- a. Remove soil, seeds and plant parts from the undercarriage, tires, sideboards, tailgates, and grills of all vehicles and equipment. For detailed cleaning protocol, see Inspection & Cleaning Checklist on page 52.

Cleaning tools include:

- Bristle brushes, brooms, scraper and other hand tools (to remove heavy accumulation of soil and debris)
- High pressure air compressor
- Vacuum
- Hand removal

RM6: Develop brush control policy along access roads to minimize the introduction and spread of invasive plants.

- a. Limit brush control and other mechanical control to the minimum width from the road edge to meet transportation and utility corridor requirements when feasible.
 - Water quality compliance and fuel reduction objectives may require additional widths from the road edge. Limit brush control to the minimum widths feasible.
- b. Treat brush or tree stumps to prevent regrowth and to reduce future vegetation control and disturbance.
- c. Develop a long-term access road vegetation management plan to reduce frequency of vegetation control and disturbance.
 - Develop a revegetation plan with low-growing groundcover that will resist the establishment of invasive plants and woody plants along access roads. See RL1 on pages 31-32.

- Consider paving or otherwise protecting the site by using weed-free materials (gravel, mulch, and decomposed granite), deep mulching, or a soil stabilizer. See RM7e on page 38 for more details on soil stabilizers.
- d. Take proper steps to dispose of brush trimmings that contain invasive plant parts and seeds
 - Do not chip invasive plant materials and scatter at worksites, unless the worksites are already widely infested with the same invasive plant.
 - Render invasive plant materials nonviable if leaving on-site. See VM5 on page 27.
 - Contain invasive materials during transport to waste disposal areas designated for invasive plants. See GN5 on page 12.

RM7: Minimize soil disturbance when maintaining access roads.

- a. Evaluate the need to grade each road or section of road rather than following a set schedule for road maintenance. This is especially important in areas infested with invasive plants or areas that are susceptible to infestation. Do not grade unless you must for road drainage, safety, or function.
- b. Keep the grader's blade 1 to 2 inches above the road surface when the primary goal is to remove rocks that have fallen onto the road. Do not disturb roadbed aggregates or soil along the road unless it is necessary. In such cases, use erosion control and/or reestablish desirable vegetation as soon as possible. See SD2 on page 30 and Chapter 6: Revegetation and Landscaping on page 31.
- c. Use only clean fill material from a weed-free source rather than borrowing fill from a weed-infested stockpile, road shoulder or ditch line. See Chapter 3: Material Management on page 21 for procuring and managing erosion control and fill materials.
- d. Clean road graders and other equipment immediately after operating in areas infested with invasive plants. Clean all dirt and plant parts from the undersides of equipment.



Photo: John Luker, California State Parks, Angeles District

Designate lay-down and staging areas outside of areas infested with invasive plants prior to starting work.

- e. Consider paving or treating the road surface with soil stabilizers to reduce routine road maintenance. Obtain necessary approvals from your Regional Water Quality Control Board prior to application.
 - Sources for soil stabilizers are listed in the U.S. Forest Service’s Backcountry Road Maintenance and Weed Management guide on page 55 in the Resources for Additional Information section.
 - Consider the use of water-based road dust-abatement products.
 - Use caution when applying stabilizers in areas infested with invasive plants. Some stabilizers include material, such as lignite, that tends to kill existing grasses and forbs. Invasive plants will quickly invade treated areas and out-compete desirable vegetation.

RM8: Maintain facility site to limit the introduction and spread of invasive plants.

- a. When feasible, maintain areas of concentrated use in a weed-free condition by surfacing with aggregate (gravel, rock, or decomposed granite), deep mulching, installing vegetation barriers or planting a dominant non-invasive groundcover and compacting freshly disturbed areas. These areas include but are not limited to pull outs, parking and staging areas.
- b. Where possible, control invasive plants in areas adjacent to facility sites and work routes so invasive plant seeds or other reproductive structures do not move into new areas.
- c. Designate and limit access points to facilities.



Caltrans employees inspecting the performance of a vegetation control mat installed under an existing guardrail along highway.

Photo: Jack Broadbent, California Department of Transportation

Checklists

The following checklists contain only the BMP statements to provide a quick and portable reference for field activities. The checklists are divided into three categories: Routine Maintenance, New Project, and Inspection & Cleaning. BMP selection depends on the particular nature of the project or conditions. Utilities and agencies are encouraged to modify and develop their own invasive plant prevention checklists according to their specific needs and organization structures. These checklists can be used as templates, modified to your needs, and accessed in the field on a Tablet PC, or printed and attached to a field notebook, clipboard, or corkboard in an office for easy reference.

Checklist A: Routine Maintenance and Facility Inspection

This checklist is designed for those who perform routine facility inspection and maintenance activities.

Checklist B: Routine Vegetation Management

This checklist is designed for those who perform routine vegetation management. Vegetation management activities may include but are not limited to: Mowing, manual clearing and trimming, mechanized clearing and trimming, herbicide application, and prescribed burning.

Checklist C (1-4): New Projects - By Activity

This checklist is designed for utilities and agencies that have separate departments implementing different project activities. This checklist is organized by: Planning, Vegetation Management, Soil Disturbing Activities, and Revegetation and Landscaping.

Checklist D (1-4): New Projects - By Phase

This checklist is designed for agencies who implement all project field activities under one department. This checklist is categorized by phase, which includes Planning, Pre-Activity, Activity, and Post-Activity.

Checklist E: Inspection & Cleaning

This checklist is designed for use before entering and leaving worksites and should be used when acquiring inspection and cleaning equipment.

Key to BMP Chapter Acronymns

GN – General BMPs, Chapter 1, page 9

MM – Materials Management, Chapter 3 , page 21

PL – Planning, Chapter 2 , page 17

RL – Revegetation and Landscaping, Chapter 6 , page 31

RM – Routine Maintenance, Chapter 7 , page 35

SD – Soil Disturbance, Chapter 5 , page 29

VM – Vegetation Management, Chapter 4 , page 25

Checklist A: Routine Maintenance and Facility Inspection

BMP #	BMP Statements		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>	Comments
RM1	Identify prevention priorities with resource, facility, or corridor managers prior to starting work.							
RM6	Develop brush control policy along access roads to minimize the introduction and spread of invasive plants.							
GN1	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
RM5	Carry portable cleaning tools that can be used without water.							
RM3	Identify travel direction and cleaning locations prior to starting work.							
RM2	Document invasive plant findings and communicate to resource or facility managers.							
RM4	Designate lay-down and staging areas outside of infested areas prior to starting work.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
RM7	Minimize soil disturbance when maintaining access roads.							
GN7	Clean tools, equipment, vehicles and animals to remove soil, seeds and plant parts before transporting materials and before entering and leaving worksites.							
GN8	Clean clothing, footwear and gear to remove soil, seeds and plant parts before leaving infested areas.							
RM8	Maintain facility site to limit the introduction and spread of invasive plants.							

Checklist B: Routine Vegetation Maintenance

BMP #	BMP Statements		Management	Project Management	Supervisors	Crews	Completed	Comments
VM1	Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.							
RM1	Identify prevention priorities with resource, facility, or corridor managers prior to starting work.							
VM2	Develop a mowing policy to minimize the introduction and spread of invasive plants.							
RM6	Develop brush control policy along access roads to minimize the introduction and spread of invasive plants.							
GN1	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
RM5	Carry portable cleaning tools that can be used without water.							
GN6	Plan travel routes to avoid areas infested with invasive plants.							
RM3	Identify travel direction and cleaning locations prior to starting work.							
RM2	Document invasive plant findings and communicate to resource or facility managers.							
RM4	Designate lay-down and staging areas outside of infested areas prior to starting work.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN7	Clean tools, equipment, vehicles and animals to remove soil, seeds and plant parts before transporting materials and before entering and leaving worksites.							

Checklist B: Routine Vegetation Maintenance *(continued)*

BMP #	BMP Statements						Comments
		Management	Project Management	Supervisors	Crews	Completed	
VM4	Keep livestock and support animals clean.						
GN8	Clean clothing, footwear and gear to remove soil, seeds and plant parts before leaving infested areas.						
VM3	Retain existing desirable vegetation and canopy where possible.						
VM5	Render invasive plant material nonviable when disposing of materials on-site.						
RM8	Maintain facility site to limit the introduction and spread of invasive plants.						

Checklist C1: New Project By Activity: Planning

BMP #	BMP Statements		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>	Comments
PL1	Adopt official project or maintenance activity policy to prevent invasive plant spread.							
PL2	Include invasive plant risk evaluation as a component of initial project planning and environmental analysis.							
PL3	Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.							
PL4	Integrate invasive plant prevention BMPs and monitoring methods into environmental awareness training for staff, contractors and volunteers.							
PL5	Coordinate invasive plant prevention efforts with adjacent property owners, regional weed management groups, and local agencies.							
PL6	In the initial stage of planning, conduct site assessment for invasive plant infestations and incorporate findings into a GIS database and project drawings or maps.							
RL1	Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.							
MM1	Use a weed-free source for project materials.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN3	Schedule activities to minimize potential for introduction and spread of invasive plants.							
PL7	Develop monitoring plans to evaluate effectiveness of BMP implementation.							

Checklist C2: New Project By Activity: Vegetation Management

BMP #	BMP Statements							Comments
		Management	Project Management	Supervisors	Crews	Completed		
GN1	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
GN2	Scout for invasive plants and evaluate risks before activities begin.							
VM1	Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.							
VM2	Develop a mowing policy to minimize the introduction and spread of invasive plants.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN6	Plan travel routes to avoid areas infested with invasive plants.							
GN7	Clean tools, equipment, vehicles and animals to remove soil, seeds and plant parts before transporting materials and before entering and leaving worksites.							
VM4	Keep livestock and support animals clean.							
GN8	Clean clothing, footwear and gear to remove soil, seeds and plant parts before leaving infested areas.							
GN9	Prepare worksites to limit the introduction and spread of invasive plants.							
VM3	Retain existing desirable vegetation and canopy where possible.							
VM5	Render invasive plant material nonviable when disposing of materials on-site.							
GN11	After activities, monitor worksites for invasive plants.							
PL7	Evaluate effectiveness of BMP implementation.							

Checklist C3: New Project By Activity: Soil Disturbance

BMP #	BMP Statements		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>	Comments
GN1	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
GN2	Scout for invasive plants and evaluate risks before activities begin.							
GN3	Schedule activities to minimize potential for introduction and spread of invasive plants.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear before starting work.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN6	Plan travel routes to avoid areas infested with invasive plants.							
GN7	Clean tools, equipment, vehicles and animals to remove soil, seeds and plant parts before transporting materials and before entering and leaving worksites.							
GN8	Clean clothing, footwear and gear to remove soil, seeds and plant parts before leaving infested areas.							
GN9	Prepare worksites to limit the introduction and spread of invasive plants.							
MM1	Use a weed-free source for project materials.							
MM2	Prevent invasive plant contamination of project materials when stockpiling and during transport.							
SD1	Minimize soil disturbance and transport during project implementation.							
SD2	Implement erosion control practices.							
SD3	Manage existing topsoil and duff material.							
VM5	Render invasive plant material nonviable when disposing of materials on-site.							
GN11	After activities, monitor worksites for invasive plants.							
PL7	Evaluate effectiveness of BMP implementation.							

Checklist C4: New Project By Activity: Revegetation & Landscaping

BMP #	BMP Statements							Comments
		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>		
GN1	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
GN2	Scout for invasive plants and evaluate risks before activities begin.							
RL1	Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.							
GN3	Schedule activities to minimize potential for introduction and spread of invasive plants.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN6	Plan travel routes to avoid areas infested with invasive plants.							
GN7	Clean tools, equipment, vehicles and animals to remove soil, seeds and plant parts before transporting materials and before entering and leaving worksites.							
GN8	Clean clothing, footwear and gear to remove soil, seeds and plant parts before leaving infested areas.							
GN9	Prepare worksite to limit the introduction and spread of invasive plants.							
VM3	Retain desirable vegetation and canopy where possible to increase competition for invasive plants.							
MM1	Use a weed-free source for project materials.							
MM2	Prevent invasive plant contamination of project materials when stockpiling and during transport.							
RL2	Acquire plant materials locally. Inspect delivered plants to ensure plant labels match specifications prior to planting.							
GN10	Minimize soil and vegetation disturbance.							
RL3	Revegetate and/or mulch disturbed soils as soon as possible.							
GN11	After activities, monitor worksites for invasive plants.							
PL7	Evaluate effectiveness of BMP implementation.							

Checklist D1: New Project By Phase: Planning

BMP #	BMP Statements		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>	Comments
PL1	Adopt official project or maintenance activity policy to prevent invasive plant spread.							
PL2	Include invasive plant risk evaluation as a component of initial project planning and environmental analysis.							
PL3	Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.							
PL4	Integrate invasive plant prevention BMPs and monitoring methods into environmental awareness training for staff, contractors and volunteers.							
PL5	Coordinate invasive plant prevention efforts with adjacent property owners, regional weed management groups, and local agencies.							
PL6	In the initial stage of planning, conduct site assessment for invasive plant infestations and incorporate findings into a GIS database and project drawings or maps.							
RL1	Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.							
MM1	Use a weed-free source for project materials.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN3	Schedule activities to minimize potential for introduction and spread of invasive plants.							
PL7	Develop monitoring plans to evaluate effectiveness of BMP implementation.							

Checklist D2: New Project By Phase: Pre-Activity

BMP #	BMP Statements		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>	Comments
GN1	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
GN2	Scout for invasive plant infestations and evaluate risks before activities begin.							
MM1	Use a weed-free source for project materials.							
MM2	Prevent invasive plant contamination of project materials when stockpiling and during transport.							
GN3	Schedule activities to minimize potential for introduction and spread of invasive plants.							
GN4	Designate specific areas for cleaning tools, vehicles, equipment, clothing and gear.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
GN6	Plan travel routes to avoid areas infested with invasive plants.							
GN7	Clean tools, equipment, vehicles and animals to remove soil, seeds and plant parts before transporting materials and before entering and leaving worksites.							
GN8	Clean clothing, footwear and gear to remove soil, seeds and plant parts before leaving infested areas.							
GN9	Prepare worksites to limit the introduction and spread of invasive plants.							

Checklist D3: New Project By Phase: Activity

BMP #	BMP Statements							Comments
		Management	Project Management	Supervisors	Crews	Completed		
Vegetation Management								
VM1	Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.							
VM2	Develop a mowing policy to minimize the introduction and spread of invasive plants.							
VM3	Retain existing desirable vegetation and canopy where possible.							
GN10	Minimize soil and vegetation disturbance.							
VM4	Keep livestock and support animals clean.							
GN5	Designate waste disposal areas for invasive plant materials and contain invasive plant materials during transport.							
VM5	Render invasive plant material nonviable when disposing of materials on-site.							
Soil Disturbance								
SD1	Minimize soil disturbance and transport during ground disturbance activities.							
MM1	Use a weed-free source for project materials.							
SD2	Implement erosion control practices.							
SD3	Manage existing topsoil and duff material.							
MM2	Prevent invasive plant contamination of project materials when stockpiling and during transport.							
Revegetation & Landscaping								
RL1	Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.							
VM3	Retain existing desirable vegetation and canopy where possible.							
MM1	Use a weed-free source for project materials.							
MM2	Prevent invasive plant contamination of project materials when stockpiling and during transport.							
RL2	Acquire plant materials locally. Inspect delivered plants to ensure plant labels match specifications prior to planting.							
GN10	Minimize soil and vegetation disturbance.							
RL3	Revegetate and/or mulch disturbed soils as soon as possible.							

Checklist D4: New Project By Phase: Post Activity

BMP #	BMP Statements							Comments
		<i>Management</i>	<i>Project Management</i>	<i>Supervisors</i>	<i>Crews</i>	<i>Completed</i>		
Monitoring								
GN11	After activities, monitor worksites for invasive plants.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
PL7	Evaluate effectiveness of BMP implementation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Checklist E: Inspection & Cleaning

Clothing and Gear:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Hats		
2. Hoods		
3. Collars and cuffs		
4. Clothing folds or flaps		
5. Ventilation openings		
6. Pockets		
7. Zippers		
8. Straps or Velcro grips		
9. Belts or buckles		
10. Buttons, fasteners, and rivets		
11. Laces or ties		
12. Gloves		
13. Pant cuffs		
14. Socks		

Boots or Shoes:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Shoelaces or ties		
2. Straps or Velcro grips		
3. Shoe tongues		
4. Treads		

Hand and Power Tools:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Chainsaw chain and body		
2. Hand saw blades		
3. Mower deck and blades		
4. Weed-eater blades and guard		
5. Crevices on all other tools		

Checklist E: Inspection & Cleaning *(continued)*

Large Equipment and Vehicles:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Truck bed		
2. Exhaust systems		
3. Vent openings		
4. Grills: Front and back		
5. Tray under radiator		
6. Top of transmission		
7. Stabilizer bar		
8. Shock absorber joint with axles		
9. Front and rear axles		
10. Top of front suspension units		
11. Wheel well/quarter panels		
12. Ledges under bumper (front and rear)		
13. Tire rims and treads		
14. Between rear wheel brake drums and the rim of the wheel		
15. At the bend in the fuel inlet tube		
16. Spare tire and mounting area		
17. Under the floor mat (inside cab)		
18. Under the seat (inside cab)		
19. Upholstery (inside cab)		
20. Beneath foot pedals (inside cab)		
21. Gear shift cover folds (inside cab)		

Livestock and Support Animals:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Underbelly		
2. Legs		
3. Hooves		
4. Coat or wool		
5. Ears		
6. Tack (saddles, blankets, panniers, etc.)		

Resources for Additional Information

General Resources

California Invasive Plant Council

<http://www.cal-ipc.org>

This site provides a wide range of invasive plant information specific to California. Resources include Invasive Plant Inventory, CalWeedMapper, invasive plant profiles with links to articles, publications, reports, and educational brochures.

California Department of Food and Agriculture Integrated Pest Control Branch

<http://www.cdffa.ca.gov/plant/ipc/index.html>

The Integrated Pest Control Branch conducts a wide range of pest management and eradication projects as part of the Division of Plant Health and Pest Prevention Services Pest Prevention Program. This site provides the Encycloweedia, noxious weeds and weed ratings, and the CalWeed Database.

Center for Invasive Plant Management

<http://www.weedcenter.org>

The Center for Invasive Plant Management (CIPM) is a hub for management information in the western U.S. This site includes plant biology and management information, education information, and publications. CIPM also provides grants to weed projects in western states. Grant information is available at this site.

Invasive.org: Center for Invasive Species and Ecosystem Health

<http://www.invasive.org>

This site provides an easily accessible archive of high quality images of invasive and exotic species of North America with identifications, taxonomy and descriptions for use in educational applications.

Invasive Species Council of California

<http://www.iscc.ca.gov>

The Invasive Species Council of California provides general information on invasive species in California including animals, plants, insects, and plant and animal disease.

National Invasive Species Council

<http://www.invasivespecies.gov>

The National Invasive Species Council (NISC) was established by Executive Order (EO) 13112 to ensure that Federal programs and activities to prevent and control invasive species are coordinated, effective and efficient.

National Invasive Species Information Center

<http://www.invasivespeciesinfo.gov>

This site is a gateway to invasive species information; covering Federal, State, local and international sources. The information center is maintained by the U.S. Department of Agriculture's National Agricultural Library.

USDA Forest Service Invasive Species Program— Control and Management

<http://www.fs.fed.us/invasivespecies/controlmgmt/index.shtml>

This page provides links for more information on research, management planning, Forest Service activities, and pest-specific control and management.

Prevention of Invasive Plant Introduction and Spread

A Builder and Contractor's Guide to Preventing the Introduction and Spread of Invasive Weeds

<http://ucanr.org/sites/csnce/files/57340.pdf>

El Dorado County's Invasive Weed Management Group provides an illustrated pamphlet with tips and considerations that contractors and landscapers can integrate into their general practice in order to stop unsightly and costly invasive plant infestations before they begin.

Best Management Practices for Roadside Invasive Plants

<http://www.nh.gov/dot/org/projectdevelopment/environment/documents/BMPsforRoadsideInvasivePlants.pdf>

The New Hampshire Department of Transportation's manual gives best management practices for preventing the introduction and spread of invasive plants along roadsides, as well as a list of common invasive plants in New Hampshire and their recommended control methods.

Caltrans Roadside Vegetation Management Erosion Control Tool Box

<http://www.dot.ca.gov/hq/LandArch/ec/index.htm>

This site is useful for large land restoration and revegetation projects. The Caltrans Erosion Control Toolbox is a one-stop reference for erosion control standards and guidance. The purpose of this site is to provide Caltrans Landscape Architects with a single location that provides access to the information necessary to design successful, effective and cost efficient erosion control treatments. The site also lists sources for commercially grown California native grass sod.

Caltrans Roadside Vegetation Management Tool Box

<http://www.dot.ca.gov/hq/LandArch/roadside/index.htm>

This tool box offers methods and techniques for permanent vegetation control that reduce the need for ongoing vegetation management. Since the adoption of IVM, District and Headquarters functional areas have completed research and field trials of a wide variety of

permanent vegetation control approaches. The toolbox includes treatments composed of both materials familiar to traditional highway construction contractors (such as asphalt concrete, portland cement concrete and road base) as well as less conventional materials or products (such as flexible coatings, rubber mats, and fiber weed control mats).

Hazard Analysis and Critical Control Point (HACCP) Planning for Natural Resource Pathways

<http://nctc.fws.gov/EC/Resources/pdf/HACCP%20Manual.pdf>

The HACCP plan is a structured process that assesses a natural resource management activity, identifies possible risks, and facilitates the removal or reduction of non-target (i.e. invasive) species. The five-step process records important elements of who, what, where, when, how and why of each activity to help manage target problems and improve best management practices.

Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species

<http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2010.pdf>

The U.S. Bureau of Reclamation has developed a set of procedures to address the transport of invasive species and pests through equipment movement. This manual provides guidance for inspecting and cleaning vehicles and large equipment.

Research on Invasive Weeds and Pest Control

http://www.dot.ca.gov/hq/LandArch/research/weeds_and_pests.htm

Caltrans has done extensive research on invasive and noxious species. The results and final reports of research that was conducted on the prevention and control of noxious weeds and their spread within and from the highway right-of-way can be found on the web link provided.

US Forest Service—Dangerous Travelers: Controlling Invasive Plants along America's Roadsides (Video)

<http://www.fs.fed.us/invasivespecies/>

The video outlines the best management practices that road crews should follow in their day-to-day operations.

This is the first in a series on “Best Management Practices for Invasive Species Prevention.” Order on DVD by contacting: USDA Forest Service; San Dimas Technology and Development Center; 444 East Bonita Avenue; San Dimas, CA 91773; (909) 599-1267.

US Forest Service—MTDC Portable Vehicle Washer

<http://www.fs.fed.us/t-d/pubs/pdfpubs/pdf04342819/pdf04342819dpi72.pdf>

The Missoula Technology and Development Center (MTDC) designed a portable vehicle-washing system that would wash a vehicle to remove dirt and mud deposits on the exterior of the vehicle within five minutes, fit on a single trailer that can be towed by a 3/4-ton pickup truck, reuse wash water, be operated easily by no more than two people, and be inexpensive to produce.

Resources for Transportation and Utility Corridors

Best Practices Handbook for Roadside Vegetation Management

<http://www.lrrb.org/pdf/200820.pdf>

The Minnesota Department of Transportation Office of Research Services provides best management practices to agency planners on how to manage vegetation to maintain a healthy roadside environment. These include practices such as developing an Integrated Roadside Vegetation Management Plan.

Environmental Procedures Manual: Chapter 4.8 Invasive Species

<https://www.dot.ny.gov/divisions/engineering/environmental-analysis/manuals-and-guidance/epm/repository/4-8invas.pdf>

The New York State Department of Transportation developed a list of procedures regarding the potential environmental effects of invasive plants, for all departmental projects, appropriate maintenance activities and roadside operations to consider and address.

National Cooperative Highway Research Program Synthesis 363 – Control of Invasive Species, a Synthesis of Highway Practice.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_363.pdf

This synthesis from the Transportation Research Board of the National Academies explores the extent which state departments of transportation are identifying actions that affect the spread, prevention and control of invasive species. The report documents successful practices and lessons learned. It also synthesizes the practice of developing Integrated Roadside Vegetation Management Plans and a variety of control mechanisms.

Statewide Roadside Vegetation Management Plan-Integrated Weed Management Component.

http://www.mdt.mt.gov/publications/docs/manuals/weed_mgmt_plan.pdf

This manual from The Montana Department of Transportation provides ecologically based integrated weed management strategies on roadsides that strengthen and support national, state, and county roadside vegetation management objectives. The manual provides a conceptual framework and recommendations for actions.

Roadside Revegetation: an Integrated Approach to Establishing Native Plants

<http://www.wfl.fhwa.dot.gov/programs/td/publications/>

This Federal Highway Administration report offers an integrated approach to facilitate the successful establishment of native plants along roadsides and other areas of disturbance associated with road modifications. It guides readers through a comprehensive process of: initiating, planning, implementing, and monitoring a roadside revegetation project with native plants.

Glossary

Ankle-gaiters: see Gaiters

Best Management Practices (BMPs): methods or techniques found to be the most effective and practical in achieving an objective, such as preventing or minimizing invasive plant spread, while making the optimum use of resources.

Brush control or Brushing: trimming or removal of shrubs.

CEQA: California Environmental Quality Act. A statute passed in 1970 to institute a statewide policy of environmental protection. <http://ceres.ca.gov/ceqa>

Clean: not contaminated with viable invasive plant parts and seeds.

Compost: a product resulting from the decomposition of organic matter that can be used as fertilizer and soil amendment. Compost feedstock materials include yard and landscape trimmings, agricultural crop residues, paper pulp, food scraps, wood chips, manure and “bio-solids.”

Contaminated: contains viable invasive plant parts and seeds.

Corridor: a strip of land upon which linear facilities such as pipelines, roads, or power and communication lines are built.

Critical control point: the best point, step, or procedure at which significant hazards can be prevented or reduced to minimum risk.

Desiccate: to kill a plant by thorough drying.

Disturbance: any activity leading to bare ground conditions that can be suitable for invasive plant introduction.

Early Detection and Rapid Response (EDRR): a cost-effective approach to invasive plant management that aims to detect newly established invasive plant infestations early and to remove them before they spread.

Environmental stewardship: responsible use and protection of the natural environment through conservation and sustainable practices.

Equipment: machinery such as mowers and bulldozers used during land or vegetation management activities.

Eradicate: the complete elimination of an invasive plant population, including all viable propagules.

Facility: space or equipment necessary for carrying out routine maintenance.

Gaiters: a protective covering for the lower leg and ankle designed to prevent snow, mud, gravel, or seeds from entering the top of the boot. Gaiters can also prevent seeds from adhering to pants, socks, boots and laces.

Infested: populated by invasive plants or their parts and seeds

Impact: the cumulative effect, economic and ecological, of an invasive plant population on natural resources.

Invasive plants: non-native plants that cause economic or ecological harm.

Monitoring: evaluating the success of prevention measures and management actions. This includes the regular inspection of worksites to detect change, in this case the presence or absence of invasive plants.

Mulch: a soil covering used to control weeds or erosion; retain moisture in soil and insulate soil from cold weather. Organic materials commonly used for mulch include wood chips, landscape trimmings, shredded bark, coarse compost, straw and shredded paper. Non-organic materials include crushed concrete and brick, stones, gravel, lava rock and plastic film.

Native plants: plants that evolved without human intervention in a particular region such as a California bioregion or watershed. These are usually species that occurred naturally before European colonization of North America.

NEPA: National Environmental Policy Act. A national law that established a U.S. national policy promoting the enhancement of the environment. <http://ceq.hss.doe.gov>

Nonviable: when a plant part or seed is unable to produce a new plant.

Pathways: processes, geographical corridors or management activities through which invasive plants can be introduced or spread.

Project materials: materials that soil and invasive plant parts and seeds can adhere to. These materials include soil, mulch, aggregate (sand and gravel), wood products (firewood and brush), landscape material (plants and seeds), erosion control materials (silt fence, straw bales, straw wattles, geotextiles, and rip rap), livestock feed, and packing/shipping materials or other construction materials (wood, pipes, wire, etc.).

Resprout: the action by which a plant part creates a new plant.

Scout: the act of searching for, locating, and documenting invasive plants on worksites.

Seed set: the plant reproductive stage during which seeds mature.

Site assessment: the act of surveying for invasive plant species found within the worksite, including documentation of exact locations and densities of invasive plants.

Side casting: piling excavated soil on either side of a trench when digging a drainage ditch.

Source populations: infestations of invasive plants which produce seed or other reproductive plant parts that can spread to new areas.

Staging areas: locations where tools, equipment and vehicles are assembled before and during projects.

Sterile: not able to reproduce.

Support animals: dogs, mules and horses.

Tools: implements used during land management activities, such as shovels and chainsaws.

Transitional pastures: designated areas where grazing animals can graze before and after being used for vegetation management.

Vectors: people or things that can carry invasive

plant parts or seeds from one place to another inadvertently.

Vehicle: cars, trucks and all terrain vehicles used during land management activities.

Viable: when an invasive plant part or seed is able to produce a new plant.

Waste-disposal areas: locations where waste can be disposed without the risk of spreading invasive plant materials.

Weed-free forage: feed for livestock from a clean source (not contaminated with viable invasive plant parts or seeds). There is no guarantee that weed-free forage is 100% weed-free, but using weed-free forage reduces the probability of contaminated forage being imported to worksites.

Weed-free materials: project materials from a clean source (not contaminated with viable invasive plant parts or seeds). There is no guarantee that weed-free materials are 100% weed-free, but using weed-free materials reduces the probability of contaminated materials being imported to worksites.

Weeds: used interchangeably with “invasive plants” (non-native plants that cause economic or ecological harm).

Worksite: a location or property where management activities occur.

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