IV. FUEL TREATMENT METHODS

This chapter describes the primary fuel treatment methods the District will apply to Study Area vegetation types to reduce or modify fuel loads in accordance with the Vegetation Management Program presented in Chapter V. to achieve the Plan goals and objectives over time.

A critical component to any wildfire hazard reduction plan is identifying the methods in the "tool box" to reduce or otherwise modify the type and quantities of available fuel that wildfires need to grow and spread. Strategies for modifying fuels include changing the arrangement of fuels to disrupt fuel continuity, decreasing the total volume of available fuels, reducing the amount of volatile materials in the fuel load, and decreasing the available surface area across which fire can spread. The following fuel reduction methods are described in this chapter:

- Hand Labor;
- Mechanical Treatment;
- Chemical Treatment;
- Prescribed Burning and;
- Grazing.

For each of these methods this chapter provides a discussion of: specific techniques, personnel and equipment requirements; the timing of the treatment cycle; special considerations and limiting factors associated with the method; and best management practices (BMPs) to reduce potential adverse environmental effects associated with the use of each method. Appendix D contains more detailed descriptions of these fuel reduction methods.

This chapter also discusses issues related to the selection of an appropriate method depending on the fuel to be treated and the timing of treatment methods to achieve fuel reduction and resource management goals.

A. SELECTING THE APPROPRIATE METHOD

A number of factors should be considered prior to selecting the appropriate fuel reduction method to use including: the type of fuel to be treated, the overall prescription to achieve the

vegetation management goal; and cost, and availability of labor and equipment. Other key components of an effective fuel treatment strategy to be considered are effectiveness of the treatment method, potential environmental effects, length of time that the treatment will be effective, selection of a qualified contractor, appropriate training of personnel, scheduling of the fuel reduction actions, and appropriate levels of supervision to carry out prescribed fuel treatment methods and any associated BMPs.

1. Determine Fuel Characteristics

Three key factors influence the spread and intensity of wildfire: fuels, weather, and topography. Because changes in weather and topography are for the most part beyond human control, regulating the types and amounts of available fuel is key to reducing wildfire hazards. Determining the fuel characteristics prior to selecting the appropriate fuel treatment method(s) is an important step in the process. In this case, "fuel" includes anything that can burn – fallen leaves, branches, trees, grasses, shrubs, houses, structures and materials within these structures. In the East Bay Hills, dense plantings, overgrowth of under-story plants and grasses, and brush encroachment on buildings increase available fuel loads in the area and exacerbate the potential for a catastrophic wildfire.

To determine the appropriate treatment method, land managers first identify the characteristics of the "fuel" or vegetation type to determine *how* it will burn. Fuel characteristics to be considered include: the size and moisture level of materials, ratio of dead to live materials, presence of volatile chemicals, continuity and arrangement of ground fuels and plantings, topography underlying the fuel, and the overall amount of fuel available. Each fuel characteristic influences how easily it ignites, how rapidly a fire can spread, the duration of the fire, amount of heat generated, and flame lengths as well as how the fuel responds to changes in weather and moisture. These wildfire dynamics in turn influence the hazard rating assigned to each fuel type and, more importantly, the likelihood that fire suppression crews and equipment will be successful in containing a wildfire should one start.

2. Consider Fuel Management Prescription and Goal

Which treatment method is selected is also dependent on whether the prescription focuses on modification (such as pruning or limbing of trees) or removal of understory vegetation - such as grasses, flowering plants, and shrubs- or trees and saplings. Removing understory vegetation and ladder fuels can inhibit fire from traveling across the ground surface and can help prevent fire from climbing into the overstory and torching trees. Removal of vegetation is also critical in the creation of strategic fire routes, firebreaks and control lines, which are essential in providing evacuation routes, allowing firefighter access to an area and preventing the further spread of fires once they have begun. Tree removal can vary from cutting individual trees to thinning a stand or completely removing an overstory canopy. By removing trees from a high-risk area, less canopy fuel is available that could contribute to a

crown fire or ember production. Less surface fuels also are available since biomass production (branches, leaves, duff, etc.) from removed trees is decreased. Removing trees can reduce the potential for ember production and "spotting", heat output, spread rate, and potential ignitability depending on what vegetation, if any, replaces the tree. The choice and execution of the method for removing trees or other vegetation can either enhance overall forest health and its subsequent growth, or it can cause damage and scars that will last for decades.

3. Evaluate Overall Feasibility and Cost-effectiveness

Also critical to selecting the appropriate treatment method are the overall feasibility and cost-effectiveness of the proposed treatment. In order to provide a sustained wildfire risk reduction and resource management program, the selection of treatments that provide the greatest benefit for total cost will enable EBRPD to continue funding and operation of treatments throughout the life of the Plan. Cost considerations, including the feasibility of conducting treatment actions given site-specific conditions and timing, must be an integral part of planning for wildfire risk reduction and resource management in order to enable a sustained program that continues to address the Plan's goals into the future. As stated previously, the District is committed to applying adaptive management principles to wildfire hazard reduction and resource management activities. As new information is learned, recorded in the database, and used to inform future decisions regarding costs and long-term success of treatment techniques and objectives, the District will be able to design and implement increasingly successful and cost-effective vegetation management projects to implement the Plan.

B. TIMING CONSIDERATIONS FOR FUEL TREATMENTS

Once the fuel characteristics are determined and an appropriate treatment is selected, correct timing of the initial or consecutive treatments is important to achieve the desired fuel reduction performance standards and resource management objectives. Given the variable nature of fuels through changes in weather and season over time, determining when to schedule the treatment may often be just as important as the type of treatment selected. For example, fuel reduction in grasslands is typically related to the time when grass cures or dries out. Cutting grass too early will be ineffective as the grass will usually grow back, effectively negating the treatment. Conversely, cutting grass too late will leave the grass in a hazardous condition during periods of high fire danger. Fuel reduction activities also need to be conducted when the weather is not too dry or windy, as some treatment types (without appropriate precautions) may inadvertently start fires.

Identifying the appropriate timing for treatment methods to reduce potential impacts to special-status species or protected nesting birds is also an important consideration. Table

IV-1 identifies those months of the year when particular practices may need to be implemented (e.g., pre-treatment nesting surveys or avoidance of nests or breeding habitat) to avoid adverse affects to special-status species or protected nesting birds known to occur in the Study Area. The reader should note that the purpose of this table is to offer general guidance in regards to sensitive periods for special-status species, and it should be used and interpreted within the context of federal, State and local laws and regulations that protect environmental resources including wildlife. The table is not meant to imply that treatments absolutely cannot be scheduled during the sensitive periods but that mitigations and best management practices, such as pre-project nest surveys, may need to be implemented.

Table IV-1: Resource Considerations Treatment Calendar for Animals

Resource	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Nesting Songbirds		1	1	1	1	1	1					
Nesting Raptors		1	1	1	1	1	1					
Alameda Whipsnake				2	2	2	2	2	2	2		
Monarch Butterfly	3	3	3							3	3	3

1 = Potential for bird nesting. Pre-treatment surveys may be required in certain habitat types. Nest disturbance should be avoided.

2 = Active period for Alameda whipsnake. Treatments implemented during this period are subject to USFWS and CDFG permit guidelines.

3 = Located in Pt. Pinole Park only. Monarch butterfly bivouac sites to be protected from disturbance during this period.

Sources: Danielsen, C., R. McClure, E. Leong, M. Kelley, and C. Rice. 2000. Vegetation Almanac for the East Bay Hills. Hills Emergency Forum, Berkeley CA. Munz, P.A. and D.D. Keck. 1959. A California Flora. University of California Press. Berkeley and Los Angeles CA.

Timing treatment methods to either control or avoid the spread of invasive plant species is also critical. If timing windows – which are set according to specific environmental and natural resource criteria, such as optimal soil moisture levels or nesting periods for native birds and animals, for example – are missed for the selected treatments, an overall project could be delayed and become a multiple-year treatment, which could significantly increase the project's cost. The timing of treatments should strive to take advantage of these identified windows, such as the timing differences of native plant species seeding, and avoid periods when invasive species are in seed unless containment measures are used. In most cases, the timing and method of treatment can be modified to accommodate local habitat needs and still modify or decrease fuel loads to an acceptable level. Tables IV-2 and IV-3 identify timing considerations associated with invasive plant species; Appendix G provides additional information regarding the control of common invasive plants in the Study Area. Periods when invasive plant seeds are mature may vary from year to year depending on weather and other site-specific considerations.

Table IV-2: Resource Considerations Treatment Calendar for Woody Invasive Plants

Plant	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
French Broom	1	1	1	1	2	2	3	3				
Spanish Broom				1	1	2	3	3				
Acacia		1	1	1	1	1	3	3	3			
Blackberry				3	3	3	1	1	1			
Eucalyptus	1	1	3	3	3	3	3	3	3	3		1

1 = Conduct treatments during this time to avoid spreading seed. Treatment most likely to control pest plant late in this season, closer to seed set.

2 = Use caution; treatments may spread seed if not contained

3 = Use extreme caution; seed spread likely if not contained

Sources: Danielsen, C., R. McClure, E. Leong, M. Kelley, and C. Rice. 2000. Vegetation Almanac for the East Bay Hills. Hills Emergency Forum, Berkeley CA. Munz, P.A. and D.D. Keck. 1959. A California Flora. University of California Press. Berkeley and Los Angeles CA.

Table IV-3: Resource Considerations Treatment Calendar for Selected Herbaceous Invasive Plants

Plant	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Yellow Starthistle					1	1	1	3	3	3		
Hemlock				1	1	3	3	3				
Spurge			1	1	1	1	2	2				
Fennel					1	1	1	1	3	3		
Milk Thistle					1	1	3	3	3			

1 = Conduct treatments during this time to avoid spreading seed. Treatment most likely to control pest plant late in this season, closer to seed set.

2 = Use caution; treatments may spread seed if not contained

3 = Use extreme caution or avoid treatments; seed spread likely if not contained

Sources: Danielsen, C., R. McClure, E. Leong, M. Kelley, and C. Rice. 2000. Vegetation Almanac for the East Bay Hills. Hills Emergency Forum, Berkeley CA. Munz, P.A. and D.D. Keck. 1959. A California Flora. University of California Press. Berkeley and Los Angeles CA.

C. FUEL TREATMENT METHODS

1. Hand Labor

Hand labor methods for fuel treatment are used in every aspect of the fuels management program. Hand labor methods involve pruning, cutting or removal of trees, shrubs, and grasses by hand or using hand-held equipment; other hand labor methods involve bark pulling, removing dead wood and litter, mulching, and establishing new fire-resistant or low-risk plants. This process allows for selective removal of targeted species and has little impact beyond the removal of these targeted plants, leaving native species or other desirable vegetation in place, and is often used in conjunction with other fuel modification techniques.

Hand labor can be the preferred fuel reduction method where heavy equipment use is undesirable or impractical. Hand labor can also be used to remove selected trees and reduce the overall number of trees. This technique is useful where the existing density of

trees creates the potential for canopy fires or where vertical continuity of fuels is created by the clumped arrangement of different sizes of trees.


Hand labor crew

Hand labor generates debris when pulling, pruning, and cutting vegetation; this debris is not always removed from the site when it is needed for erosion control and the resultant fuel loading is acceptable. Requirements for cutting materials into smaller sizes or piling for burns does add additional time (and therefore costs) to hand labor fuel reduction efforts. Hand labor techniques typically have minimal environmental effects although large volumes of foot traffic, specifically in areas of steep slopes, can result in surface soil erosion or compaction and, as such, care should be taken to mitigate these effects. Chippers are often used in conjunction with hand labor to process cut materials into mulch for onsite disposal.

a. Treatment Cycle

The need to repeat hand labor treatment varies depending upon the materials being targeted as well as the rate and location of growth of the plant materials. The following can serve as basic guidance for when these activities should occur to maximize their effects on fuel reduction:

- Weed removal and mowing of native grasses is required on an annual basis, but timing is critical to maximizing effectiveness: if weeds are cut too early they will continue to grow, but if they are removed too late, seeds may already have been produced and distributed.
- Shrub removal depends on the specific type being targeted, but the time between treatments varies from annually to once every three to five years.
- Limbing lower branches to remove ladder fuels is the most long-lived treatment with a potential interval lasting as long as 10 years. The typical optimum treatment cycle is every 5 years.

b. Other Considerations

The following considerations pertain to hand labor techniques for fuel reduction.

- Hand labor techniques allow for targeting of specific plant species for pruning or removal.

- These techniques can be used in most physical conditions; conditions that would eliminate other treatment methods are often still treatable via hand labor techniques.
- These techniques allow for the involvement of community groups in fuel reduction and clearance activities.
- These techniques cannot be used effectively for all plants and plant types.
- Follow-up treatment or debris removal may be required.
- Hand labor techniques can constitute follow-up treatment for aesthetic purposes (e.g., from mechanical treatment or goat grazing).
- These techniques can be combined with other treatments (e.g., hand falling, then mechanical skidding and loading).

c. Best Management Practices for Hand Labor Methods

Based on site-specific conditions and the type of action proposed, EBRPD and its contractors would consider one or more of the following BMPs when hand labor techniques are used as the fuel reduction method:

Hand Labor Personnel Safety

- Use OSHA-compliant equipment, including personal protection equipment and hand tools.
- Provide or contract for adequate training and oversight of hand labor activities to ensure that hand labor personnel are familiar with safety requirements, equipment use, and any topographic or site-specific conditions.

Water Quality

- Treatment actions should not be conducted during storms.
- Treatment actions should avoid, when feasible, excessive foot traffic on steep slopes which could cause compaction and/or erosion to occur.
- Hand labor personnel should avoid driving support and haul trucks off established roads. If such traffic is determined by EBRPD and hand labor personnel to be necessary, inspection will be conducted to ensure that the ground is not saturated prior to traveling off-road, and that the ground can fully support the vehicles without excessive rutting of surface soils. Any ruts created as a result of off-road activities will be repaired and covered with mulch and/or wood chips to reduce potential runoff from these areas and reduce their potential for erosion.

- Hand labor personnel will take care to handle fuels and lubricants such that spilling and runoff of these substances does not occur.

Protected Species

- Personnel performing hand labor should be sufficiently trained prior to initiating any treatment action such that personnel are familiar with and able to identify protected species requiring avoidance measures, best management practices or other precautions prior to treatment.
- Avoid bird nests at all times during treatment to reduce any adverse impacts to these resources.
- Any scrub habitat should be inspected by qualified personnel prior to treatment to determine the presence or potential presence of Alameda whipsnakes (see also Resource Considerations and Guidelines for north coastal scrub regarding Alameda whipsnakes in Chapter IV).
- Nest surveys will be conducted by qualified personnel prior to treatment if such treatment is proposed between January 15 and July 15. Where nests are identified, treatment will include the protection and avoidance of nests until nestlings have fledged. Treatment actions where nests are found will include sufficient buffer areas to these nests (specifically for raptor species) the area of which should be determined by qualified biologist personnel according to site-specific conditions.

Invasive or Otherwise Targeted Species

- Personnel performing hand labor should be trained to identify and treat invasive pest species using appropriate treatment methods designed to prevent re-introduction and encourage long-term management.
- Require that all tools and equipment be cleaned of any remaining mud as well as plant or other biological materials following treatment of invasive or otherwise targeted species to avoid seed spread to other areas.
- Hand labor treatment actions should be timed to prevent the spread of invasive or otherwise targeted species. Such timing would generally require that treatment occur prior to seed setting of the invasive or otherwise targeted species or sufficiently after seed drop of these species to ensure maximum efficiency of the treatment action. Timing of proposed treatment actions will be determined by qualified personnel on a site-specific basis to avoid periods where seed setting is likely to occur or where seed drop has recently occurred.

Cultural Resources

- EBRPD will exclude documented cultural resources in the treatment area from hand labor that involves ground disturbance.
- A District staff member trained in cultural resources identification will demarcate the boundaries of previously documented cultural resources identified during hand labor treatment. These resources will be avoided by hand labor treatment consistent with the District's procedures for protecting cultural resources.[1]

2. Mechanical Treatment

Mechanical treatment involves cutting grasses and removing weeds, shrubs, and trees up to 24 inches in diameter through the use of a tractor or other machinery, including such operations as grading, mowing, mulching, chipping, mastication, and crushing. Other supporting activities include hand felling larger trees, establishing landings, creating skidding trails, and various yarding techniques.


Roadside mower

Heavy machinery is often used where terrain and the presence of numerous trees to be retained do not prohibit travel. Generally, using heavy machinery for mechanical treatment is faster than hand labor and relatively inexpensive. There is, however, limited control over which plants are cut during mowing operations; but machines can be guided around isolated areas of concern. Additionally, collateral impacts to small vegetation can also occur when machinery operates on top of these plants. Heavy machinery can also create excessive disturbances to surface soils when the ground is soft, leaving ruts and bared soil.

This technique can be used almost any time of year when the top soil is dry, but is faster when done in the summer or fall when brush is brittle and grass has cured. Because mechanical treatment methods almost always utilize equipment with metal blades, combustion engines, and corollary fuels, they should be used with special precautions during high fire danger periods as the machines themselves (and metal blades striking rocks) can inadvertently start fires. Also, vehicles and equipment undercarriages should be cleaned, if necessary, prior to arrival and removal from the work site to reduce the risk of

[1] East Bay Regional Park District, 1989. *Guidelines for Protecting Parkland Archeological Sites*, Oakland, California.

transferring unwanted material, disease (such as sudden oak death), or seeds to other areas.

Mechanical treatments need to be selected according to a site's topography, access, vegetation type, and potential for negative environmental impacts. These treatment techniques are often used in combination with other fuel management methods, particularly hand labor (prior to mechanical treatment) and prescribed burning (following mechanical treatment.) As noted below within the description of individual mechanical treatment techniques, the appropriate timing of the treatments plays a large part in determining success and longevity.

Mechanical treatments require supervision and specialized training to ensure the desired results and minimize negative impacts. Several other agencies own specialized equipment and have staff trained in its operation. Chippers, mowers, brush cutters, grinders, feller-bunchers, tub grinders, hauling trucks, and yarders with a grappling hook are all types of equipment that can be specified for mechanical treatment techniques, as needed. As with hand labor, personal protection equipment is required and includes long pants and long-sleeved shirts, gloves, safety goggles, approved hearing protection, hard hats, and sturdy boots.

a. Treatment Cycle

Similar to the treatment life-cycles of the hand labor methods described above, repetition of mechanical treatments varies depending upon specific target materials and the desired outcome. For example:

- Mowing of weeds and grass is required on an annual basis.
- Grading of fire roads or fire breaks is required on an annual basis, although some roads and breaks may require only spot grading following the initial treatment if the road or break is used frequently enough to keep vegetation from growing back, or if its surface is treated with a chemical to inhibit future growth. Banks and berms that develop on either side of graded lanes should be blended back into the hillside on a three- to five-year cycle to reduce the interference with water flow.
- Shrub crushing or removal cycles vary according to species and treatment standards, with acceptable time between treatments typically varying from three to five years.
- The number of subsequent treatments depends on the species that encroach into treated areas; for example, removal of exotics or weed species on an annual basis should be anticipated until an acceptable, stable vegetation type is re-established in the treated area.

b. Other Considerations

The following considerations should be taken into account when determining if mechanical treatment is appropriate for fuel reduction in an area.

- While some newer machinery types can operate on extended slopes of 45 percent or more, equipment generally cannot perform well on steep slopes or other difficult physical or topographical site conditions, such as on rocky terrain or other irregular surfaces.
- Maneuverability limits use of some machinery within stands of trees or near rocky outcrops.
- These treatments are effective in large, flat areas and those covered by invasive species such as blackberry, poison oak, hemlock, or mustard, as well as in areas with other species potentially harmful to workers.
- Machine use could inadvertently distribute unwanted seeds, destroy ground nesting habitat, and spark wildfires.
- Topography and wet ground may limit access to trees and limit options for hauling felled material.

c. Best Management Practices for Mechanical Treatment

Mechanical treatment techniques generally result in increased ground disturbance relative to hand labor techniques, and therefore require the use of additional BMPs to mitigate potential effects. For all mechanical treatment actions that could result in substantial ground disturbance, EBRPD will implement erosion control BMPs that are consistent with the San Francisco Bay Regional Water Quality Control Board's standards. Based on site-specific conditions and the type of treatment action proposed, EBRPD and its contractors should consider one or more of the following BMPs, at a minimum to be included in any necessary erosion control plan, where mechanical treatment techniques will be used for fuel management:

Coyote brush spouting after mechanical treatment

Water Quality

- Use caution when conducting any mechanical treatment actions during the area's rainy season. Treatment actions should be stopped temporarily if rainfall or other inclement weather makes access inadvisable, or if continued vehicular travel or mechanical action is determined to cause unacceptable damage to roads, trails, or other lands.

- Surveys should be conducted that identify and delineate on-site soil and hydrological conditions prior to initiation of any mechanical treatment techniques. Any planned mechanical treatment actions should include all necessary measures to minimize activity in sensitive areas that could be wetter than normal, or in areas near hydrological resources. Wet areas will be clearly marked for high visibility and avoided by treatment operations until such time as they are determined to be sufficiently capable of supporting any mechanical treatment activities without causing excess rutting, erosion, or sedimentation to occur.
- All mechanical treatment actions should use equipment, methods, and/or techniques that minimize ground disturbance and alterations to the existing soil structure.
- Heavy equipment use (e.g., tractor-based yarding activities) should be concentrated at primary skid trails and landings. Skidding should be allowed only along clearly designated skidding trails. Mechanical treatment actions should be temporarily stopped and alternative treatment or removal methods considered if a single pass of equipment produces ruts deeper than 6 inches across a significant area of the site beyond primary skid trails and landings.
- Materials should not be dragged across park roads and drainage areas unless specifically allowed by EBRPD, and only then along routes recommended by equipment operators and approved by EBRPD. These routes should be created to minimize the total skidding distance needed; total area occupied by skidding trails should not exceed 15 percent of the treatment area.
- Skid trails should not cross streams except where absolutely necessary and only at locations previously determined by EBRPD staff and included in the site treatment prescription. Trees identified for removal growing near a drainage channel (based on stream type and approved buffer width) should be hand-felled perpendicular to the drainage channel rather than cleared using mechanical equipment. These trees should only be processed by a skidder where EBRPD determines that the skidder could safely handle the stems at a reasonable distance from the drainage channel based on stream type and approved buffer width; if it is determined that the tree cannot be safely handled by mechanized means at this distance, the tree should be lopped and scattered by hand labor treatment or left as a long log. Branches and debris should not be felled, loaded, skidded, or hauled across any stream or watercourse unless EBRPD approves such a measure. No drainage channel with running or standing water should be crossed by mechanical equipment while water is present to avoid runoff and contamination from vehicle use as well as rutting and erosion. Crossing should not occur until the drainage completely dries out.
- Personnel will avoid driving support and haul trucks off of established roads. Where this is necessary, personnel should ensure that the ground is not saturated before traveling

off-road and that the ground can support the vehicles without excessive rutting. Any ruts created should be repaired and covered with mulch and/or wood chips.

- Personnel will install and use waterbars, brush barriers, vehicle turnouts, or other methods as needed to control and capture potential runoff resulting from mechanical treatment actions. Other methods for controlling and capturing potential runoff could include broad-based dips, creating ditchlines inside of current drainage patterns (i.e., closer to treatment actions to capture runoff prior to reaching the drainage area), cross-drains, filter areas, sediment traps or pits, silt fences, hay bales, check dams or the in/outsloping and crowning of roads.
- All waste and trash generated by any treatment actions must be removed from the treatment site. Leftover materials can create a water pollution risk if they remain onsite and are later washed into water bodies through runoff.
- Maintain all roads in a desirable condition to prevent problems that may result from their use, such as washouts, slumping, clogging or bending culverts, and drainage erosion. Any damages that occur to roads as a direct result of treatment actions should be repaired upon completion of the treatment action.
- Upon abandonment of an access road or skid trail, all refuse and unstable fill material must be removed and road banks restored to original contours. Road banks must also be revegetated or have permanent waterbars installed.
- Refueling areas will be designated for larger projects requiring mechanical treatment actions. Fuel tanks and refueling areas will be provided with secondary containment, where feasible. Materials and supplies needed to promptly clean up spills will be adequately maintained and located onsite, and personnel will be familiar with proper cleanup and disposal techniques. Examples of containment and cleanup methods and materials include using drip pans and absorbent pads for all vehicle and equipment fueling; equipping all fuel nozzles with automatic shut-off capability to contain fuel dripping and leakage; ensuring all vehicle fueling operations are not left unattended; inspecting vehicles and equipment each day to identify any fuel, oil, or hydraulic leaks; and repairing any identified leaks immediately prior to further use or storage of the leaking equipment to minimize further impact to the site. Vehicles with persistent or recurring leaks will be removed from the site until such leaks are properly repaired. Onsite fueling of vehicles and equipment will only be performed when offsite fueling is determined by EBRPD to be impractical.

Protected Species

- EBRPD will give preference in contracting for mechanical treatments to trained, experienced personnel. As previously noted, personnel should be sufficiently trained prior to initiating any treatment action such that personnel are familiar with and able to

identify invasive or otherwise targeted species for treatment, and protected or otherwise identified species to be avoided during treatment.

- Mechanical treatment personnel will avoid bird nests at all times during treatment to reduce any negative impacts to these resources.
- Any scrub habitat scheduled for treatment from April through October will be inspected by qualified personnel prior to treatment to determine the presence or potential presence of Alameda whipsnakes. (see also Resource Considerations and Guidelines for north coastal scrub regarding Alameda whipsnakes in Chapter V).
- Nest surveys should be conducted by qualified personnel prior to treatment if such treatment is proposed between February and July and nest surveys are deemed necessary by a pre-treatment survey. Where nests are identified, treatment will include the protection and avoidance of nests until nestlings have fledged. Treatment actions where nests are found to occur should include sufficient buffer areas to these nests, specifically for raptor species, the area of which should be determined by qualified biologist personnel according to site-specific conditions.

Invasive or Otherwise Targeted Species

- EBRPD will require that all machinery and other equipment is cleaned of any remaining soil, plant or other biological materials following treatment of invasive or otherwise targeted species to avoid seed spread of these species to other areas.
- Mechanical treatment actions will be timed to prevent the spread of invasive or otherwise targeted species (see Tables V-2 and V-3 and Appendix G). Such timing would generally require that treatment should occur prior to seed setting of the invasive or otherwise targeted species or sufficiently after seed drop of these species to ensure maximum efficiency of the treatment action. Timing of proposed treatment actions will be determined by qualified personnel on a site-specific basis to avoid periods where seed setting is likely to occur or where seed drop has recently occurred.

Wildfire Precautions

- No mechanical treatment actions will take place during Red Flag warnings; machinery has the potential to start fires during periods of high fire danger. The fire department may specify extra precautions to allow continued equipment activity.
- The requirements listed in California Public Resources Code (PRC) sections 4431, 4435, 4442, and 4437 must be followed where any mechanical treatment action is planned. Weed-eaters, chain saws, small mowers, and other internal combustion engine-powered equipment must comply with these regulations, including that they must be equipped with approved spark arrestors. Equipment powered by properly-maintained exhaust-driven, turbo-charged engines as well as those equipped with scrubbers at properly-maintained water levels do not require spark arrestors. Motor vehicles, if

equipped with approved and properly-installed and routed muffler systems (as described in the California Motor Vehicle Code) do not require spark arrestors.

- The following fire suppression equipment must always be available and in adequate working condition at the treatment site, as well as on all mowers, per PRC section 4427(b):
  - One (1) round-pointed shovel with overall length not less than 46 inches
  - One (1) 5-gallon backpack water pump to serve as a fire extinguisher
  - One (1) fully-charged fire extinguisher, UL-rated at 4-BC or more, per truck, tractor, grader, or other heavy equipment located onsite
  - One (1) two-way radio or mobile telephone or pager equipped with "walkie-talkie" capabilities to enable reporting of fires or emergencies from the scene or when in an area of potential ignition.


Eucalyptus sprouts

Cultural Resources

- Prior to treatment, EBRPD will review its records of documented cultural resources in the treatment area. A trained District staff person will conduct a pre-treatment field review site assessment to identify previously undocumented cultural resources, and will demarcate (i.e., flag) the boundaries of any potentially significant and sensitive cultural resources in the treatment area. Where it is deemed necessary for additional study (i.e., subsurface investigation) to be undertaken, a professional archaeologist will be retained to provide recommendations regarding the documentation and protection of the cultural resources prior to project actions.
- EBRPD treatment actions will avoid the demarcated cultural resources.
- In the event that prehistoric or historical archaeological sites or artifacts; paleontological resources; or human remains are encountered during project construction, all ground disturbing activities will be halted within at least 50 feet and the finds will be protected in place (in accordance with EBRPD policy and State and federal law) until the find is evaluated by a qualified resource consultant, and appropriate mitigation, such as curation, preservation in place, etc., if necessary, is implemented. In the case of human remains, the requirements of Health and Safety Code §7050.5 will be met, which involve coroner, Native American Heritage Commission, and Most Likely Descendant notification and coordination.

3. Chemical Treatment

The primary use of chemical treatment is to prevent the re-growth of cut vegetation, particularly in areas which are inaccessible to heavy equipment and where soil disturbance is to be avoided. Using herbicides to control invasive plant species that exacerbate wildfire risk can be an efficient and cost-effective method that the District uses under the auspices of EBRPD's IPM policies and practices and in combination with other treatment measures (e.g., mowing, burning and hand removal). Recent studies conducted by the Marin Municipal Water District (MMWD) confirm this approach; the results of their studies on the use of non-chemical control methods for the control of invasive non-native plants indicated that non-chemical alternatives are ineffective for large-scale vegetation management projects. (See Appendix H for additional information on these studies). [2]

Chemical treatments, which most often include the use of herbicides to kill plants or prevent their growth, are typically considered only when in concert with other types of fuel reduction treatments. Application of herbicides immediately following some other treatment method whereby plants are cut or broken inhibits the damaged plants from sprouting again. Herbicides can also be used to kill herbaceous plants in open areas, such as grass and broadleaf forbs, and are typically applied while these weedy species are still actively growing. Application following another treatment method in which plants are trimmed or shortened can increase the effectiveness of the chemical treatment. Foliar treatments are generally not applied within several hours of significant rain because the herbicide may be washed off before it is effective, and not on windy days because of concerns for spray drift.

Herbicides do not remove any vegetation from an area's fuel load; the dead plant matter continues to exist at the site and could continue to be a fire hazard if not collected and disposed. Health, safety and environmental concerns have limited the widespread use of chemicals over the past 20 years, and repeated use of chemicals is not preferred because unwanted species develop resistance to herbicides. Additionally, concerns regarding water quality and other potential environmental impacts that may occur with prolonged use of and exposure to herbicides and other chemical applications further limit their frequent or widespread use as a fuel treatment method. Application of herbicides and other chemicals is typically performed by hand. Doing so provides flexibility in application and is ideally suited for small treatment areas.

Herbicide application requires specific training and licensing to ensure proper and safe use, handling, and storage. Only personnel with the appropriate license and/or certificate are

[2] The MMWD Board of Directors suspended the use of herbicides on their lands in August 2005. Since that time, the watershed staff has been "losing the battle against these non-native plants that exacerbate wildfire risk." MMWD estimates that 1,000 acres representing 5 percent of their watershed is seriously infested with invasive plants, primarily broom (www.marinwater.org). The other alternative methods tested by MMWD include: mechanical removal, hand removal, controlled burning, grazing, high intensity heat/flame, biological control, and water or foam (soap-based).

allowed to use chemicals to treat vegetation. Herbicide application is also only applied according to a prescription prepared by a pesticide advisor licensed in the county where chemicals are to be used. Personal protection equipment is essential to limit applicators' exposure to chemicals, and includes at a minimum long pants and long-sleeved shirts, gloves, safety goggles, hard hats, and waterproof boots.

a. Treatment Cycle

As with other treatment methods, chemical treatments require an annual project site assessment to evaluate efficacy of the prior year's applications. Retreatment for resprouts and/or control of invasive non-native broadleaf plants may require the work program schedule to reflect this need.

b. Other Considerations

Chemical treatment carries with it the following additional considerations.

- This treatment can be a very selective technique when applied by hand.
- Chemical treatment techniques can be used in almost all physical conditions, although windy conditions and periods of high temperature or low humidity can reduce the effectiveness of the application. Weather conditions must be taken into account prior to use throughout the year.
- All manufacturer's label directions must be carefully followed to reduce potential health risks related to chemical drift and skin contact.
- Standard BMPs and implementation guidelines must be followed to protect hydrological and biological resources.

c. Best Management Practices for Chemical Treatment

In general, BMPs associated with chemical treatment methods address the proper application of the chemical such that the minimum amount of chemicals are used while allowing for an effective treatment action to result. Ground disturbance and erosion do not typically result from the types of chemical treatments used to control vegetation. Based on site-specific conditions and the types of actions proposed, EBRPD and its contractors will incorporate the following BMPs when chemical treatment actions are used:

General Practices

- Information concerning the timing, location, and approximate amounts and types of pesticides or other chemicals to be applied during a chemical treatment action must be posted onsite to inform the public at least 24 hours in advance of such treatment. Signs

containing this information must adhere to an EBRPD-approved format and posted in a prominent location for at least 12 hours per manufacturers' instructions.

- When applying herbicides or other chemicals on cut stumps, onsite personnel will ensure that stumps are cut such that not more than 4 inches are left above ground, level from the uphill side of the stump. Stump cuts should be smooth, with a cleanly-cut surface, and with no projecting splinters.

Water Quality

- EBRPD and its contractors will ensure that any pesticide or other chemical applications are performed only by licensed or certified pest control operators registered to perform such services in the County where the treatment is to take place, and only under a prescription prepared by a licensed pesticide advisor. The pest control operator must record and provide written accounts of the total amount of pesticides and other chemicals applied each month, as well as type(s) of pesticides or chemicals used and total areas treated with each pesticide or other chemical. These data must be reported to the County Agricultural Commissioner as well as to EBRPD's IPM Program. Operators must maintain accurate and calibrated application equipment to ensure correct amounts of pesticides and other chemicals are applied.
- Any chemical treatment actions must be performed according to EBRPD integrated pest management (IPM) policies and practices; pest control operators selected by EBRPD or its contractors will be required to consult and use the advice and recommendations of EBRPD integrated pest management specialists and adhere to EBRPD pest management guidelines. For example, species-specific (instead of broad-spectrum) herbicides should be used wherever possible to avoid injury to non-target plants.
- EBRPD IPM specialists will oversee chemical application practices to ensure compliance with state and federal regulations and EBRPD IPM policies. Pesticide application prescriptions will include suitable distances from wetlands and water bodies, in compliance with the California Department of Food and Agriculture Regulations and state-approved product labeling. EBRPD IPM specialists will review application data to ensure the minimum amount of suitable chemicals are used during treatment actions to achieve the desired results.

Protected Species

- EBRPD will only contract for chemical treatments with trained, experienced firms or personnel. As previously noted, personnel will be sufficiently trained prior to initiating any treatment action such that personnel are familiar with and able to identify invasive or otherwise targeted species for treatment, and protected species to be avoided during treatment.

- Any chemical treatment actions identified for areas containing Alameda whipsnake or pallid bat habitat should only be conducted in accordance with a USFWS-approved treatment plan and under the supervision of EBRPD personnel. Accurate determination and marking of habitats and other areas to be avoided should be provided by a qualified biologist prior to the treatment action. (see also Resource Considerations and Guidelines for north coastal scrub regarding Alameda whipsnakes in Chapter IV).
- Any chemical treatment action within designated critical habitat of the California red-legged frog should be conducted in accordance with the U.S. District Court injunction and order covering 66 pesticides (USDC 2006).

4. Prescribed Burning


Prescribed burn

Prescribed burning reintroduces fire into the ecosystem as a more naturally-occurring treatment and can closely approximate the forces that have shaped the natural vegetation. Controlled burns reduce the volume of fuel through combustion; fires are conducted under specific regulations when conditions permit both adequate combustion and proper control. This technique can be used to burn piles of cut brush or trees (pile burns), or over a designated prepared area (broadcast burn). Both broadcast and pile burning are often used in conjunction with hand labor and mechanical treatment methods as a means of removing excess debris. These can be potent tools to reduce hazardous fuels while benefiting natural resource.

Broadcast burning is generally used in larger areas where a maximum amount of fuel reduction can be achieved through the fire. Treatment boundaries are often road and trail crossings, which reduces the number of fire breaks that need to be created by fire personnel, thereby reducing labor costs and time needed to prepare for the burn as well as minimizing the amount of surface soil disturbance and potential for soil erosion. Prescribed burns can be effective in vegetation types such as grasslands, pine stands, chaparral, and oak woodland where it can simulate natural fires and where the prescribed burn can be effectively controlled.

Prescribed burning can be a cost-effective way to quickly reduce the large volume of woody material that remains after other fuel reduction operations. A broadcast burn produces more uniform removal and minimizes areas of great burn intensity. Alternatively, tractors or hand

crews can create piles of material on flat or gently-sloping ground that can be burned during very wet conditions.

Prescribed burns must be conducted by trained fire management personnel only. Utilizing personnel and equipment from neighboring fire districts provides the added benefit of joint training under controlled rather than emergency conditions. If EBRPD wishes to benefit from cost-sharing aspects of CalFire's Vegetation Management Program, CalFire must conduct the prescribed burn.

Prescribed burning requires the development and approval of a prescription and a burn plan, which is typically developed by the local fire protection district in consideration of fuel reduction requirements, local weather conditions, and available resources for fire management, and is necessary in order to secure a burn permit. EBPRD has an active prescribed burning program in which it conducts burns using its personnel and equipment with support and cooperation from other fire protection agencies.

Timing is critical to the use of this treatment method because of variability in weather conditions as well as wildlife and botanical considerations. Fuel moisture content and weather conditions must be determined to assess if the targeted area is safe to burn, and periods of increased wildlife and botanical activity need to be avoided to limit potential negative impacts to these resources. Burning is permitted only on days determined by the Bay Area Air Quality Management District (BAAQMD). There are typically more permissive burn days available in the spring and early summer when there is a greater chance of atmospheric conditions conducive to smoke dilution and dispersion.

The following describes the steps that must be completed prior to initiating a prescribed burn.

Develop a Burn Plan: Working with a fire management specialist, a site-specific burn plan is developed that responds to and fulfills goals and procedures for the burn. This Plan takes into account the site characteristics and the likely behavior of the fire, including the heat output, length of burn, best ignition sources and locations, and optimal fire control methods. Each characteristic is closely tied to the type, age, density, and condition of onsite vegetation; the site's topography; solar exposure; and local and prevailing wind patterns. The burn plan identifies the limits of the burn area, locations of control lines, acceptable fuel moisture ranges and weather conditions, ignition patterns, and required personnel and equipment. A contingency plan that anticipates and describes actions to be taken in the event of an escape is a key component of an adequate burn plan.

In addition to an extensive internal (EBRPD) review, local and regional regulating agencies need to review the burn plan to identify potential site-specific environmental impacts and

develop mitigation measures, as required, to reduce impacts on soil erosion, plants, wildlife, air, and water quality as well as any cultural or paleontological resources that may exist within the area to be burned. The BAAQMD also requires preparation of a smoke management plan detailing the location of sensitive sites and actions to be taken to maximize smoke dilution, minimize smoke production, and minimize smoke intrusion into sensitive locations. With the exception of the BAAQMD permit, however, no additional permits are required for prescribed burns than for other fuel treatment methods.

Obtain a Burn Permit from the BAAQMD: Current air quality regulations limit open burning; however, burning to reduce fire hazards, for management of forest and rangelands, and to train fire protection personnel receives special accommodation under these regulations.[3] In addition to the preparation and approval of a smoke management plan, the BAAQMD requires notification of the burn and, with few exceptions, that burning is conducted on a permissive burn day. The BAAQMD selects these burn days based on air quality, weather conditions, and wind patterns, provides the burn's acreage allocation the morning of the burn, and must give their "all clear" designation prior to initiation of the burn.
Burn Site Preparation

Hand labor or mechanical treatment methods are often required prior to initiation of a prescribed burn to remove small trees and reduce the stand to a safe burning density, as well as to knock down tall brush, prune the lower branches of trees, and remove mid-level or understory fuels that could result in unwanted crown fires. Site preparation also includes the establishment of fire lines needed to control the fire if they do not already exist. These fire lines are typically constructed using foam or wet lines, roads and existing natural barriers, or by hand using scraping tools or mowing equipment; occasionally they are cut in with bulldozers or "burned in" with a strip of fire under conditions that limit fire spread.

Burn Notification: Notifying the local or surrounding communities, local fire departments, the media, and the BAAQMD is essential to avoid potential misinterpretation of the prescribed burn as a wildfire. Notification of interested and affected parties and the media are also repeated the day of the prescribed burn. Printed materials or interpretive signs are made available at the site and distributed to neighboring communities explaining the reason for the prescribed burn, the type of burn being conducted, and the intended result of the prescribed burn. Prescribed fires generate high levels of public safety concerns over the chance of the fire's escape from

Prescribed burn notification sign

[3] California Air Resources Board, 2008. http://www.arb.ca.gov/DRDB/BA/CURHTML/REG-5.

control lines, and the rapid distribution rate of smoke, ash, and particulate matter may raise additional concerns from the general public many miles downwind from the actual site of the prescribed burn.

Post Burn Follow-up and Evaluation: Following completion of the prescribed burn, the results are evaluated to determine if the need exists for additional treatment based on aesthetics and established goals. Additional treatment methods may include hand labor or mechanical removal of unburned or partially burned materials. Follow-up activities may take place over the following year or two years to reduce potential erosion impacts, improve aesthetics, or resolve outstanding fuel reduction concerns.

a. Treatment Cycle

As with other fuel treatment methods, repetition of prescribed burns varies depending upon specific target vegetation (e.g., grassland or brush); generally, removal of exotic or weed species requires annual treatment until the desired type and level of vegetation in the area is reestablished. A typical cycle for repeat burns is: annually to manage grasses; three to five years in shrub areas; and a longer cycle in closed canopy woodland where growth is slowed due to shading from the overstory. Subsequent treatment of areas that have received a prescribed burn depends on the variety of species that encroach into these areas.

b. Other Considerations

Prescribed burns require considerable levels of planning and preparation. The following should be considered with prescribed burns:

- The available burn days as determined by the BAAQMD.
- The potential risk of the prescribed burn escaping from control lines and fuel reduction zones.
- The amount and type of pre- and post-treatment required.
- The public acceptance and level of comfort with prescribed burning, specifically near populated or developed areas.
- The size of the area to be burned and desired length of the burn (single or multiple day burns).
- Physical configuration and access to site for establishing control lines and fuel reduction zones.
- Effectiveness in areas with dense overstory or steep terrain.
- Environmental considerations, including wildlife or species of special concern and cultural or paleontological resources in the area to be burned.

- Resources required for pre-burn planning and documentation as well as equipment and personnel needed before, during, and following the prescribed burn.
- Potential health risks from heat, fumes, and smoke.
- Potential for erosion and additional sedimentation to nearby water supplies.

c. Best Management Practices for Prescribed Burning

In general, BMPs associated with prescribed burns address the potential erosion issues along the fire lines and breaks, preservation of the duff layer within the burn area to maintain the infiltration capacity of the soils, and smoke production and distribution. Appropriately timing a prescribed burn is critical in order to meet the multiple objectives of resource needs, minimizing smoke and other potential impacts, and maintaining adequate fire control. Based on site-specific conditions and the type of action proposed, EBRPD and its contractors should consider the following BMPs when prescribed burning actions are to be used:

Erosion Control

- Personnel should ensure that ground cover is retained on 60 percent of the ground surface to prevent soil displacement from rain impact and to allow precipitation to absorb into the ground; where feasible, fire should not be allowed to burn sufficiently hot that the duff layer is destroyed. Actions should attempt to retain more groundcover in areas within 50 feet of a downslope water body. When water soaks into the ground there is less chance that it will run off and cause erosion into and around water bodies.
- Actions will include maintenance of buffer areas between the burn zone and nearby water bodies. Prescribed fires will not be actively ignited within the vegetative buffer zone. A minimum vegetation buffer of 25 feet should be maintained between burn areas and downslope water bodies for slopes under 5 percent, a 75-foot buffer between burn areas and water bodies for 5-10 percent slopes, and a 150-foot buffer for slopes over 10 percent. In most cases, fire can be allowed to “back” into riparian zones; however, no ignition should take place in the stream environment zone (i.e., the stream, its riparian corridor and adjacent marshes and wet meadows). High-intensity burns should be kept away from creeks and drainage buffer zones unless suitable measures, as determined by EBRPD, are used to ensure protection of water quality.
- Personnel will minimize the risk of erosion into water bodies from fire lines by:
    - Using existing barriers such as roads, trails, or wet lines as fire lines to minimize soil disturbance.
    - Constructing fire lines along the contour and avoiding straight up/downhill placement.
    - Establishing erosion control BMPs like water bars, turnouts, and sediment traps.

  - Fire lines must be restored upon completion of the prescribed burn if they are determined not to be used again. Erosion controls features must be placed, as necessary, to minimize the potential for additional impacts.

- Torch fuels will be mixed, and torches filled, only in designated fueling areas to isolate potential areas that could be affected by hazardous materials spills.

Smoke

Smoke from prescribed burns cannot be eliminated, and short-term reduction in air quality is inevitable when prescribed fires are used. However, most burning activities can be designed and implemented in a manner that minimizes impacts to local and regional air quality. Each project and fuel type will need to be monitored for smoke production, dispersal, and transport. The following BMPs can reduce potential impacts from smoke, and can be used singly or in combination:

- Each prescribed burn plan will include a smoke management plan describing avoidance techniques for sensitive areas and potential problems that could arise relating to smoke production and dispersion. The plan will include specific, detailed actions to be taken in the event onsite personnel or EBRPD determine negative impacts to be occurring in excess of acceptable levels.
- Prescribed fire actions will include measures to manage fuel moisture. Dry, dead fuels will be focused on for prescribed burns to minimize the amount of green materials being burned. If necessary, fuels should be modified prior to ignition to reduce high smoke-producing fuels; such actions could include the removal of heavy fuels, stacking and burning, or some combination of activities sufficient to reduce the amount of green fuels in the prescribed burn area prior to treatment. Burning prescriptions should balance the higher rate and level of consumption associated with burning under drier conditions with the increased atmospheric instability associated with wetter, cooler conditions and, therefore, less complete consumption.
- Each fuel type will be burned under its own prescription. Specific prescriptions should be created for understory burning of heavy, woody fuels; understory burning in duff and litter under mixed oak forests; and for slash piles and "jackpot" burning in heavy woody fuels. Prescriptions should emphasize "patchy" fuel consumption over much of the area defined for the prescribed burn. "Jackpots" of fuel should be removed during wetter, more fire-safe conditions, under conditions associated with


Prescribed burn

greater smoke dispersal and dilution, and prior to broadcast understory burning.

- Prescribed burn areas may be divided into smaller ignition units to facilitate cessation of burning if air quality conditions deteriorate beyond acceptable levels.
- Prior to a prescribed burn, ladder fuels reaching into the tree canopy will be removed to increase fire safety and reduce the possibility of additional green fuels being torched. Personnel should lop and scatter prunings or pile and burn these materials prior to understory burning. Steps will be taken to protect high-value snags and large downed trees to prevent ignition and long-term smoldering of these materials.
- Personnel should predict smoke production from prescribed burn actions by using weather information. This information should be used to further delineate prescribed burn areas and timelines.
- Prescribed burns can only be conducted on designated burn days as authorized by the BAAQMD, to maximize the dispersal and dilution of smoke produced. Prescribed fires may be executed on non-burn days as necessitated by logistical concerns; the BAAQMD may provide a variance when the prescription has been reached. Such logistical concerns may include expected end-of-season precipitation, availability of personnel, or narrow prescriptions. A test burn will be conducted prior to full implementation of the action to determine whether actual smoke dispersal will meet the requirements of the burn's smoke management plan.
- Personnel will patrol the burn to evaluate smoke dispersal and identify areas of smoke concentration near the outset of the prescribed burn action. Where areas of smoke concentration are identified additional measures (as stipulated in the prescribed burn plan) will be implemented by personnel.
- Ignition patterns should be managed such that smoke production is minimized; generally, burns should be ignited as backing fires against the wind and oriented such that fire spreads downhill, which will result in smaller particle sizes than those produced from a fire burning fast upslope.[4] Smaller particle sizes produced generally equates to improved visibility during and after the prescribed burn. In all understory burn units, areas downslope from the upper blackline should be strip-burned or treated with spot fires where the local fire behavior permits. These practices can reduce fire residence time and total fuel burned, and increase the potential for lower duff ignition and subsequent smoldering.
- Prescribed burns should be conducted when wind patterns are expected to carry smoke away from sensitive areas.

[4] G. Grey, 2001. *Caste Rock Ecosystem and Watershed Management Plan*.

- If smoke dispersal is determined by fire personnel to be inadequate or occurring in the wrong direction, or if smoke is determined to be spreading into sensitive areas, offending fires will be fully extinguished immediately.
- Adequate information concerning planned prescribed burning actions must be widely distributed prior to implementing the burn to reduce public concerns and criticisms. Notification of the burn should be distributed to adjacent residences and public service announcements should also be distributed to local media for dissemination. Smoke conditions should be monitored and documented on a smoke observation form, to be provided to EBRPD and fire personnel according to requirements in the prescribed burn plan. Any significant change in smoke emissions or column behavior will be reported to the onsite burn Incident Commander (burn boss).

Prescribed burning protected species notification

- Highway visibility in areas potentially affected by smoke from prescribed burning will be monitored at regular intervals, and temporary caution signs warning drivers of potential reduced visibility will be posted in advance of areas where visibility could potentially be impaired. Prior to implementing the prescribed burn, the California Highway Patrol and County Sheriff will be notified when highway or other roadways could potentially be impacted by smoke produced from the prescribed burn activities.

Protected Species

- EBRPD will only conduct prescribed burns with trained, experienced personnel serving as on-site supervisors. As previously noted, personnel should be sufficiently trained prior to initiating any treatment action such that personnel are familiar with and able to identify invasive or otherwise targeted species for treatment, and protected or otherwise identified species to be avoided during treatment.
- All prescribed burning in potential Alameda whipsnake or pallid manzanita habitat will be conducted in accordance with a USFWS-approved burn plan. This Plan should generally include applying fire in a manner that mimics the natural regimen required to perpetuate or regenerate the affected population. (See also Resource Considerations and Guidelines for north coastal scrub regarding Alameda whipsnakes in Chapter IV).
- Within sensitive wildlife habitats, brush piles will be burned in a manner that protects Alameda whipsnakes and other native wildlife that may have relocated to within the brush pile. This may include restacking the pile, igniting the burn pile in only one location to allow wildlife to escape, or feeding fuel into a single ignited pile from adjacent piles.

Potential retreats for whipsnakes, such as rock outcroppings, will be avoided and protected during prescribed burning.

- Prescribed burn activities will incorporate measures sufficient to protect active nests until nestlings have fledged. Prescribed burns potentially affecting occupied nests will be scheduled outside of fledgling periods, and sufficient buffer areas around raptor nests will be maintained at a size determined by a qualified biologist's site-specific recommendations. For raptors, the breeding season occurs from mid-March to mid-July.
- Snags containing protected or otherwise targeted species for retention will be protected from prescribed burn actions. Snags and other naturally-occurring structures occupied by listed or otherwise targeted species for retention will be protected from flames, heat, and smoke during prescribed burn activities.

Cultural Resources

- Cultural resources, both archaeological and those in the built environment, are fire-sensitive sites. Therefore, EBRPD or its contractors will ensure that recorded cultural resource sites are provided with appropriate protection during any prescribed burn. This may include conducting a pre-burn site assessment prior to any initial prescribed burn action on a site. The locations of any previously unrecorded cultural resources exposed by burning actions will be mapped and documented. All activities should be planned and executed in such a way as to cause the least amount of impact on cultural sites.
- EBRPD or its contractors will exclude any cultural sites within prescribed burn areas by constructing hand lines within the burn area or clearly delineating the boundaries of the burn area such that all cultural resources are fully excluded. This exclusion should be done shortly before the prescribed burn, and the hand lines removed immediately following to minimize potential risk of resource vandalism. Any digging, surface disturbance, or displacement of soil and vegetation within cultural sites must be avoided. Any mechanical equipment used prior to, during, or following the prescribed burn must be excluded from the cultural site. Foot traffic should be minimized on the cultural site such that the least amount of potential impact is caused. During prescribed burns, onsite personnel will closely monitor fire movement near cultural resources and ensure that fires do not cross into fire-sensitive cultural resource areas.
- All onsite personnel should be adequately informed and knowledgeable of the location of known cultural sites within and around the prescribed burn area. Personnel will also be sufficiently knowledgeable of proper treatment actions that can be applied at cultural sites. The Incident Commander will provide briefings and supervision to prevent potential disturbance of cultural sites.

- Following the completion of prescribed burning actions, all means of delineating site locations must be removed, and any hand lines or other features to identify the cultural sites must be obliterated.

Public Safety

Unique to prescribed burning is the concern of fire spreading outside prescribed boundaries. The following BMPs are practices that can reduce or otherwise assuage the public's level of concern and apprehension over prescribed burning.

- EBRPD or its contractors will prepare and disseminate press releases to local media informing the public of the prescribed fire.
- Patrol and signage levels around the area identified for the prescribed burn will be adequate to keep the public away from prescribed burn areas. Signs advising the public that a burn is in progress should be posted, at a minimum, along highways and major roadways in areas where smoke will be visible or could potentially pose a visibility concern. Signs should also be posted warning drivers about potentially-reduced visibility in advance of where these areas are determined to potentially occur.
- Patrols will be scheduled at regular intervals for both daylight and nighttime hours to monitor highway and primary road visibility. Personnel conducting such patrols will be sufficiently trained to identify and have knowledge of conditions in which reduced visibility could exist.
- EBRPD or its contractors will complete an escaped fire contingency plan for all burn units. Suppression actions will be taken on any prescribed fire according to the requirements set forth in this contingency plan if one or more of the following conditions exist:
    - People, facilities, and/or personal property are threatened
    - Prescription limits are likely to be exceeded, the resulting burn is expected to be of a higher intensity than desirable, and/or unacceptable tree mortality, scorch, or other resource damages may occur.
    - Fire threatens to spread beyond prescribed boundaries or beyond EBRPD jurisdictional boundaries.
    - Smoke poses a hazard or is determined to be an unacceptable nuisance.

5. Grazing


Goat grazing

This treatment method involves using grazing animals to consume, break off, or trample vegetation in order to reduce the amount or density of fuels and is most effective in grasslands (cattle or sheep) or shrublands (goats). While cattle and sheep do not effectively create fuel reduction zones, they can be used to maintain these features by shortening grasses and shrubs and removing vegetation debris, and can be used to do the same to the understory of tree stands; goats, by contrast, can and routinely are used to create fuel reduction zones. This method is particularly effective where the plants are palatable to the animals selected. As a fuel reduction technique, grazing does not need to be conducted each year if the intent is to control shrubs or maintain understory fuels; if the intent is to reduce grassland fuels in highly ignitable locations, grazing should be used annually. Historically, cattle have grazed the East Bay Hills, although goats are now often used for fuel management.

Grazing can be a relatively inexpensive treatment method and can even generate revenue when cattle grazing is contracted for large areas. Goat grazing typically requires a subsidy to be cost-effective, and sheep grazing is typically a cost-neutral treatment technique for the lease holder. Control of livestock movements and prevention of the impacts of overgrazing, including increased erosion from ground cover loss, stream bank breakdown, and meadow compaction is critical for successful use of this treatment method. Using professional herders or portable fences may be an alternative to fixed fencing where the treatment is ephemeral. Additional controls are also needed for protection of selected plant materials and riparian zones, and to prevent erosion or other undesirable environmental impacts.

In addition to the benefits of livestock grazing to reduce small diameter fuels and discourage invasion of grasslands by coyote brush, a recently-published guide for resource managers in coastal California and other sources cite beneficial impacts of livestock grazing for native grassland and wildflower restoration, weed management, and wildlife management (including endangered and otherwise protected species).[5]

[5] Bush, 2006. Bush, L. 2006. Grazing Handbook: A Guide for Resource Managers in Coastal California. Sotoyome Resource Conservation District. Santa Rosa, CA. 68 pp.

a. Treatment Cycle

As with the other treatment methods described previously, repetition of grazing treatments varies depending on specific target materials. Generally, removal of unwanted species should continue annually until the desired species have been able to establish themselves in the treatment area. Grazing of annual grasses each year can promote shrub growth where shrubs are already established. Grazing to remove shrubs from grasslands or understories can occur approximately once every three years or in two consecutive years every six years; other treatments can also be substituted within a grazing schedule to further modify or reduce fuel loads.

Intense grazing of animals for a short period of time in the summer season would mimic the animal herds to which native flora are likely to be adapted. This technique has been used experimentally as a tool for restoration of native perennial California grasslands. A greater number of wildflowers and native grasses could also result from this regimen and a lower grass height reduces fire hazards and could provide greater recreational opportunities. Grazing too early in the season could perpetuate annual grasses and over-grazing can result in detrimental environmental impacts when an excessive amount of vegetation is removed.

b. Other Considerations

Grazing can be an optimal fuel reduction method when appropriate conditions and desired outcomes align, but the following should be considered regarding grazing as a fuel reduction method.

- Herds that move from one site to another may spread the seeds of invasive alien plants; however, herds can be fed clean feed for three days before moving them to a new site to prevent the spread of undesirable species. This practice is unlikely, though, due to high costs and space considerations required for obtaining and providing certified clean feed as well as space for holding the goats during this quarantine period. As a result, this option may be infeasible or impractical.
- The nature of grazing and the corollary fencing requirements needed typically reduce its use as a viable treatment method for perimeter-only areas (i.e., those areas at the outside edge of larger treatment areas or plant communities.)
- Grazing animals can negatively impact water supplies and riparian areas if these areas are unprotected.
- Slope increases the potential for environmental damage from grazing livestock.

- Erosion concerns exist for each grazing animal: sheep consume plant materials closest to the surface: horses pulling plant roots out can create bare earth through high levels of hoof traffic, and goats browse above-surface vegetation and trample groundcover.
- Residual materials left from grazing can be an important part of erosion mitigation and can be controlled by type of animal, number of livestock, grazing season and length of time.
- Grazing limits the ability to protect individual species from treatment, and livestock will not eat all undesirable plants.
- Availability of some livestock is limited in the Bay Area.

c. Best Management Practices for Grazing

In general, BMPs associated with grazing address the potential impacts of exposing bare ground as a result of over-grazing and/or excessive hoof traffic. Grazing BMPs focus on preventing exposure of bare soil by properly managing the grazing activity. Based on site-specific conditions and the type of action proposed, EBRPD and its contractors should consider the following BMPs when grazing is considered for fuel reduction.

- EBRPD will require and implement a site-specific grazing management plan, with an agreement from the livestock tenant that quantifies resource and fuel load (known as residual dry matter, or RDM) goals. The plan will include detailed stocking levels, length of grazing periods, and seasons needed to achieve these goals, as well as monitoring activities and performance criteria to adequately assess the effectiveness of grazing activities.
- Livestock tenants generally install infrastructure improvements, such as water sources and salt blocks, needed to ensure even and consistent grazing patterns across treatment areas. Salt blocks, molasses buckets, and other supplements should be placed at least 400 yards from water sources.
- Prior to the introduction of livestock onto native habitats, all animals (especially goats) will be quarantined and fed only weed-free forage to ensure that invasive or otherwise unwanted plant species from offsite are not introduced through contact or carried on animals hooves, or through collection and deposition in animal feces.
- Livestock will generally be excluded from riparian areas. Only during limited circumstances and under the supervision of qualified personnel should livestock be used to reduce fuel loads in riparian areas.
- Livestock grazing will be closely monitored to determine when performance criteria are achieved. Once goals and desired fuel loads have been reached, livestock should be removed in a timely manner to avoid overgrazing and/or excessive hoof traffic.

- Inspections will occur with regular frequency and should pay particular attention to areas where bare ground is being exposed. Inspections should also note areas where animals are developing worn trails. Where excessive wear is occurring, livestock should be moved to other areas and alternative treatment methods considered if fuel reduction requirements have yet to be sufficiently reached.
- EBRPD or its contractors should retain the services of animal managers with specific experience in grazing operations for fuel reduction. These animal managers should ensure that livestock are moved promptly out of areas showing signs of overgrazing and/or excessive hoof traffic.

Cultural Resources

- EBRPD will exclude livestock from the vicinity of documented cultural resources deemed to be sensitive to grazing activities (e.g., a recorded site with human remains or midden).