**Auburn City Fire Department**

**Shaded Fuel Break Prescription**





# Shaded Fuel Break

The objective of a SFB is to reduce, modify, and manage fuels within designated areas that may enhance mitigation efforts in the event of a wildland fire situation. SFBs are generally placed in strategic locations along a ridge, access road, or other locations where fuels are modified to increase the probability of success for fire suppression activities. Ground resources can use the location for direct attack for firing out, air resources can use the location for fire retardant drops, and the public and fire resources can use the location for more strategic ingress and egress.

A SFB is generally defined as a carefully planned thinning of dense vegetation, so fire does not easily move from the ground to the overhead tree canopy. A SFB is not the removal of all vegetation in a given area, and a SFB by itself will **NOT** stop a wildland fire.

# Shaded Fuel Break Prescription

A SFB prescription is a document that describes the recommended fuels management activities in an identified area that will reduce fire behavior. It is expected that the post-treatment stand conditions will result in reduced fire behavior such as a decrease in fire intensity and the potential for sustained ignition (BCWS 2019).

The SFB prescription contains recommended guidelines for fuels management within an identified WUI to create a fuel model or vegetative arrangement where wildfire reduces intensity as it burns into the fuel break. A ground fire, burning grass and leaf duff is the desired fire behavior. An arrangement which provides the desired fire behavior effects involves an area where ladder fuels are removed, and tree or brush canopies will not sustain fire, and where the contiguous fuels arrangement is interrupted.

The goal is to protect human life and both public and private resources by reducing the risk and potential hazard of wildland fire by practicing management strategies that promote the preservation and restoration of natural resources and protection of cultural resources.

## Prescription

The ASFB is intended to provide increased wildland fire protection for the City of Auburn from a wildland fire igniting in the American River Canyon by diminishing the risk and/or rate of fire spread across the fuel break using specific treatment techniques that are suitable to the material being treated such as mowing, pruning, vegetation removal, and chipping.

#### Site Characteristics

The ASFB is situated atop the North Fork American River Canyon, in the Sierra Nevada Mountain Foothills. Elevations range between 1,100-1,600 feet above sea level, with slopes ranging between 0-90%.

The geography in and around the ASFB lands is characterized by steep canyons with sharp drops, jagged cliffs, and numerous intermittent and perennial drainages. These drainages, also known as “chutes” or “chimneys” are very steep v-shaped canyons with dense fuel loads of native and invasive vegetation, which can encourage fierce fire behavior. These drainages present exceptionally challenging fire suppression efforts, and there is often limited success in fire suppression because of the steep terrain and erratic fire behavior.

**Wind Patterns**

Winds moving through the American River Canyon are typically west to east with a southerly component and follow the diurnal patterns of up-slope/up canyon in the daytime and down- slope/down canyon at night. Because many of the canyons and drainages are also west to east oriented, the winds in these canyons can be extremely strong, and will funnel through these drainages, creating extremely hot, rapid and volatile fire behavior.

### Soils

Soils in the ASFB are generally well-drained, silty, sandy and gravelly mixtures developed over either granitic or metamorphic bedrock. Higher elevation soils are thin with numerous outcropping of igneous and metamorphic rock and have limited permeability.

### General Vegetation Types

The vegetative arrangement of the ASFB consists primarily of oak woodlands, chaparral, coniferous forests, and grasslands. A type-specific list of primary vegetation types is listed below:

* *Foothill Woodland* including: live oak, blue oak, gray pine, and some chaparral shrubs on south-facing slopes.
* *Valley Grassland* including: wild oat, soft chess, common foxtail, and red brome.
* *Chaparral* including: manzanita, chamise, toyon, ceanothus, and shrub varieties of various oaks.
* *Ponderosa Pine* including: Pacific ponderosa pine, Pacific madrone, California bay, interior live oak, blue oak, Douglas fir, black oak, and canyon live oak.
* *Streamside Woodland* including: palustrine (emergent mosses, persistent emergent vascular plants, shrubs or trees cover 30% or more of the habitat; if non-persistent emergent, other non-plant organisms, or no organisms dominate, the wetland is not a

riverine nor a lacustrine habitat) forest, dense thickets and thin stringers of palustrine scrub-shrub which includes willow scrub and some elderberry shrubs.

### Vegetation Description

Vegetation from 1 to 24 inches in height includes a diversity of annual grasses and forbes in the understory of the brush and tree fuels. Grasses, leaf litter and downed limbs comprise most surface fuels. Brush under 24 inches in height are distributed in clumps, comprised of manzanita, buck brush, poison oak, ceanothus, and currant. Small diameter oak, pine, and conifer are also present in the “sapling” form.

Vegetation greater than 24 inches in height include the above-mentioned brush up to 8 feet in height. California blackberry can be found in some areas shaded by tree crowns along natural water drainages. Invasive species have been found in the project areas, which include but is not limited to Scotch broom, French broom, edible fig, European olive, Himalayan blackberry, English ivy, tamarisk, star thistle, and “tree of heaven” of which can reach heights of up to 10 feet or more.

Trees form the dominant overstory/canopy to as much as 95% crown closure in some areas. Trees consist of oak, conifer, and pine. There is numerous “clumping” of oak throughout the project areas that generally consist of 3 to 5-inch diameter at breast height (dbh) stems numbering in 4 to 6 per clumpings. There are numerous pines that range in 3 to 5-inch dbh in the oak understory and mingled with the brush fuels.

Dead trees exist in the ASFB, which include long standing dead trees without limbs and/or a canopy and standing trees with limbs and canopies that contribute to the downed litter and stem wood adding to the fuel load.

### Fuel Arrangement and Continuity

Ladder fuels are well developed in the project areas that are comprised of ground fuels; annual grasses and forbes intertwined with the brush; and mid story fuels that grows directly under the tree canopy. In many areas the continuity of ground fuels to canopy cover is so dense that multiple brush and tree species do not achieve healthy growth and are forced to compete with each other. This fuel continuity among the ladder fuels adds to fuel loading of which increases fire intensity and prohibits larger tree species adequate growth to perhaps become resistant to wildfire.

### Cultural Values

The cultural resource values in this area originate from human activities during prehistoric, Native American (Maidu Indians), and historic periods (gold mining/ranching eras). The number of archaeological sites, both historic and prehistoric, are prevalent in this area.

#### Fuel Break Design Standards

A sound fuel management prescription follows three guiding principles: (1) it prescribes specific and measurable targets for fire behavior reduction; (2) it contains site specific considerations tied to wildland fire risk reduction objectives; and (3) it aligns with other legal, resource management

and non-statutory objectives including all applicable environmental policies and analyses (BCWS 2019).

In addition to these guiding principles, this prescription describes the various vegetative treatments, a maintenance prescription, conservation measures, and incorporation of site- specific/landscape features that will determine the SFB width in a given location.

#### Fuel Break Width and Length

SFB widths have always been quite variable, in both recommendations and construction, and there are no absolute standards for width or fuel manipulations; however, recommendations for SFB construction in northern California forests can range from 300 feet to ¼-mile wide bands where surface fuels are reduced and crown fuels are thinned (Agee, et al. 2000).

When designing a landscape-level SFB, a targeted width is recommended to reduce fire spread and intensity based on fuel types, ignition sources and variations in geographical features such as slope, topography, and access; although, the target width may be extended across the landscape to connect with natural or artificial barriers such as large rock outcrops, wet meadows, roads, canals/watercourses, or areas with low fuel loads or flammability (Bennett, et al. 2010). When possible, SFBs favor locations that are linked to road systems to facilitate firefighting access (CAL FIRE 2019).

In consideration of the fuel type, fuel density, steep topography, sources of ignition, residential density, limited ingress/egress, prevailing winds, and recorded fire history that exists across the landscape, the targeted width for the ASFB will be 600 feet in width, measured horizontally from a structure and/or dwelling unit along the eastern city limits of Auburn, onto Reclamation-owned lands in the ASRA. The ASFB may be extended beyond 600 feet in areas where fire activity is likely to increase (in drainages, steep slopes, limited access, etc.), and where natural or artificial barriers exist to aid in fire suppression activities and increase firefighter safety, at reasonable and practicable locations.

The boundaries of the ASFB have been realigned to reflect the targeted width, as described above and as shown in figures 2 and 3.

#### Implementation

Implementation consists of removing or pruning trees, shrubs, brush and other vegetative growth within the project area as prescribed. All work will be accomplished by use of hand crews, biological treatment or mechanical equipment; supported by chippers and/or pile burning as determined appropriate on a case-by-case basis, as determined by Reclamation. Mechanical equipment will consist of: string trimmers, loppers, chainsaws, pole saws, wood chippers, and McLeod’s.

### Standard Fuel Treatments

Trees up to the 6-inch dbh class are eligible for removal under this prescription. Due to operational needs, it may be necessary to remove an occasional tree with a dbh larger than 6 inches based on forest health and project objectives. Treatments will focus on removing dead, dying, diseased, decadent, or dense trees and chaparral species before any healthy trees are removed. When healthy small trees and chaparral are removed, the focus is on spacing that will help prevent fire from spreading from the forest floor into the tree canopy.

Removal also benefits the forest by increasing growing capacity with an increase in available nutrients, water, and sunlight. Individual trees under 6-inch dbh may be also be retained for diversity if they do not disrupt project objectives, but this will only be done on a case-by-case basis after deemed necessary by Reclamation.

The following measures will be applied when constructing the SFB:

### Understory Fuels

Understory fuels over 1 foot in height are to be removed to develop vertical separation and low horizontal continuity of fuels. Individual plants or pairs of plants may be retained provided there is a horizontal separation between plants of 3 to 5 times the height of the residual plants and the residual plants are not within the drip lines of an overstory tree.

### Brush & Mid-Story Fuels:

It is desirable to remove as much brush as possible within the shaded fuel break area. However, if individual plants or pairs of plants are desired to be left, leave plants with the following characteristics: young plants less than 5 feet tall and individual or pairs of plants that are no more than 5 feet wide.

From a fuels management perspective, retain the following brush species in descending order:

### Category 1

* + Dogwood
  + Redbud

### Category 2

* + Toyon Buckeye
  + Coffeeberry
  + Lemmon Ceanothus
  + Buck brush (Wedge leaf ceanothus)

### Category 3

* + Whitethorn Deer brush
  + Manzanita
  + Chamise
  + Yerba Santa
  + Scrub Oak
  + Non-native species (such as olive, fig, broom, etc.) will be targeted for removal

### Hardwood & Over-Story Fuels:

Remove smaller trees and retain larger, more vigorous trees. This approach removes ladder fuels, raises the base of the tree crowns, and increases the spacing between tree crowns. Large trees are more fire-resistant due to thicker bark. This approach tends to shift species composition away from shade-tolerant species that have thin bark and are often abundant in the understory.

Thinning from below is a common approach in even-age stands. In cases where an uneven-age stand is desired (a forest containing three or more age classes), a modified approach can be used; however, the presence of young, smaller trees can act as ladder fuels and increase the chances of a crown fire.

If the branches of adjacent trees are overlapping within the stand, crown density is high enough to sustain crown fire under the right weather conditions and terrain. Conversely, if trees are widely spaced (crowns spaced more than one dominant tree crown width apart), crown fires are less likely to occur. Factors that tend to influence increased crown spacing includes steep slopes, locations with high winds, and fuel density (Bennett, et al. 2010).

Trees up to the 6-inch dbh may be removed to create horizontal and vertical separation from residual trees. Exception to this size limit shall be trees that have significant defect, and/or which do not have a minimum of a 16-foot saw log or trees, such as saplings, that do not present an undesirable effect. Live but defective trees larger than the 6-inch dbh providing cavities for wildlife use will be retained.

Trees may be removed to create horizontal distances between residual trees from 20 feet between trunks, and up to 8 to 15 feet between tree crown drip lines. Larger overstory trees (≥ 6-inches dbh) do count as residual trees and, to reduce ladder fuels, shall have vegetation within their drip lines removed.

Branches of residual trees will be pruned to a height of 8 to 10 feet off the forest floor, not to reduce the live crown ratio below 1/2 of the height of the tree.

When constructing the ASFB, tree canopy opening shall be limited to no more than 60% of the overall SFB canopy.

Criteria for residual trees (≤ 6-inch dbh):

**Hardwood trees**: Leave trees that have vertical leaders and thrifty crowns with at least 1/3 live crown ratio.

Retain hardwood tree species in descending order:

* + Valley Oak
  + Blue Oak
  + Black Oak
  + Big Leaf Maple
  + Madrone
  + Live Oaks

**Conifers**: Leave trees that have single leaders and thrifty crowns with at least 1/3 live crown ratio.

Retain conifer tree species in descending order:

* + Sugar pine
  + Ponderosa pine
  + Douglas fir
  + Knob-cone Pine
  + Gray Pine
  + White fir
  + Incense cedar

Intolerant to shade species have a higher preference as leave trees because their seed will be less likely to germinate in the understory.

### Snags:

Snags are a conduit for fire during a wildland fire; however, they also provide excellent wildlife habitat in their natural state. The following is the criteria of when snags shall be retained:

* + 18-inch diameter class or larger and not more than 30 feet in height which are not capable of reaching a road or structure provided there is a separation of least 100 feet between snags.

### Wetlands:

Wetlands and riparian areas will not be adversely affected for treatment and ground operations.

### Watercourse and Lake Protection Zone (WLPZ):

The WLPZ means a strip of land, along both sides of a watercourse or around the circumference of a lake or spring, where additional practices should be undertaken for the protection of the quality and beneficial uses of water, fish, and riparian wildlife habitat, other forest resources, and for controlling erosion.

WLPZ widths and operational limitations shall be in conformance and consistent with Title 14, California Code of Regulations, 936.5, Procedures for Determining Watercourse and Lake Protection zone Widths, as approved by the California Board of Forestry.

### Class I watercourse (Fish bearing):

Exclude from equipment operations (except on existing roads) and remove one thousand hour and smaller sized dead fuels (≤ 5 inches in diameter).

### Class II watercourse (Aquatic habitat for non-fish aquatic species):

No treatment of overstory and the treatment of understory will not reduce vegetative cover below 50%. One thousand-hour and smaller sized dead fuels (≤ 5 inches in diameter) will be removed. Ground based equipment will not operate within the zone except on existing roads. Prune residual trees.

### Class III watercourse (No aquatic life present):

Full SFB prescription will be implemented but no ground-based equipment will operate within exclusion zones on existing roads.

The following table may be used to identify the standard width of a WLPZ:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Procedures for Determining Watercourse and Lake Protection Zone Widths** | | | | |
| Water Class  Characteristics or Key Indicator Beneficial Use | Class I   1. Domestic supplies, including springs, on site and/or within 100 feet downstream of the operations area and/or 2. Fish always or seasonally present onsite, includes habitat to sustain fish migration and spawning | Class II   1. Fish always or seasonally present offsite within 1,000 feet downstream and/or 2. Aquatic habitat for non-fish aquatic species. 3. Excludes Class III waters that are tributaries to Class I waters | Class III  No aquatic life present; watercourse showing evidence of being capable of sediment transport to Class I and II waters under normal high-water flow conditions after completion of tree operations. | Class IV  Human-made watercourses, usually downstream of established domestic, agricultural, hydroelectric supplies or other beneficial uses. |
| Protection Width | 150 feet | 100 feet | 25 feet < 30% slope, 50 feet > 30% slopes | 25 feet < 30% slope, 50 feet > 30% slopes |

## Grass Field Prescription

Implementation consists of mowing and possibly re-establishing native grass species on the project area. All work will be accomplished by use of mechanical equipment, and/or hand crews.

Threatened and endangered plant and animal species, such as elderberry and other sensitive species, shall not be removed or treated, or otherwise adversely affected.

Cultural resources are of a major concern in any area where they may exist. These resources will be protected.

#### Prescription

**Grass:**

Grass fuel breaks should be a minimum of 300 feet wide. Grasses are to be maintained below four (4) inches in height just after the grasses cure and before they form seed heads; cut in early summer.

Project activities will aim to influence the establishment and retention of native grasses; therefore, in areas where native stands of grasses are present, project activities such as mowing, prescribed burning and prescribed grazing will be implemented after the native grasses have formed seed heads and dropped their seeds.

**Wetlands:**

Wetlands and riparian areas will not be adversely affected for treatment and ground operations.

**Maintenance Prescription**

Once fuels have been modified within an area, maintenance activities should be planned and implemented on a regular basis to keep the effectiveness of the original treatment. If no maintenance activities occur, the effectiveness of the original treatment will diminish every year, potentially yielding no net effect within 5 years. The necessary maintenance activities will be minimal if implemented on an annual basis.

#### Prescription

The original prescription treatment should be followed for maintenance. Possible fuel reduction techniques to be utilized for maintenance include the following:

**Hand Work:**

Use of hand tools by crews or individuals to maintain under growth and manage ladder fuels such as, string trimmers, loppers, and McCleod’s. This technique is labor intensive and potentially expensive (>$1000 per acre). Impacts to soils are negligible.

### Mechanical Work:

Use of mechanical equipment such as pole saws, chainsaws, chippers, mulchers, string trimmers and loppers. This technique is moderately expensive (as low as $400 per acre) but is heavily influenced by topography and accessibility.

### Chemical Controls:

Use of California registered herbicides. This is the most cost-effective technique. Implementation usually requires one or two individuals for ground application. This technique has negligible soil effects but may not be appropriate for certain areas such as riparian zones, watercourses, and areas of listed plants.

### Prescribed Browsing:

Use of goats in a controlled setting to browse within appropriate areas to reduce fuel levels. Browsing goats can be an effective tool to control grasses and low growing vegetation, when controlled properly, can have little impact to the environment. Costs may vary.

### Prescribed Burning:

The use of planned and controlled burning operations to reduce fuel levels. Control lines are established prior to burning. Burning and Air Pollution permits are required to conduct these operations. This technique varies in cost per acre depending on complexity of project. Burning is becoming more difficult to complete due to air regulations.

## Best Management Practices That May be Applicable

This section serves as a source of additional environmental protection actions that Reclamation and its contractor(s) may take to protect sensitive resources. This section may be used by Reclamation and its contractor(s) when resources not identified through the pre-defined environmental compliance process are encountered in the field, or additional protection is desired. The purpose is to provide examples to the public and a guide to the field of potential best management practices (BMP) that may be implemented during the project in consultation with federal regulatory agencies.

### General Best Management Practice Recommendation

Upland Habitat Protection

To avoid impacts to nesting birds and/or raptors:

* + Aim to avoid working during the active nesting season (May 1 – August 15) as feasible
  + If work is to be done during the nesting season, a qualified biologist or observer trained to identify nest sites will survey the project area no more than one day ahead of the crew.
  + Remove all temporary flagging, fencing, trash, debris, and/or barriers from the project site upon completion of project activities.
  + Project activities that may damage or kill an elderberry shrub will maintain a 20-foot buffer from the dripline during the dormant period (November-March) and a buffer of 165 feet from the drip-line using fencing or flagging.

Habitat elements (nest trees, downed logs and woody debris, cavities and tree hollows, snags, large dead branches, etc.) that provide valuable habitat may be identified and retained where no immediate risk to infrastructure exists.

Aquatic Habitat Protection

* + Avoid removing vegetation from the stream or stockpiling it in the stream bed or on its bank. The sites selected on which to push this material out of the stream should be selected based upon least damaging impacts to resources including sensitive uplands resources. Retain downed woody debris on upland slopes to hold soils.
  + Avoid removing living native vegetation from the channel, bed, or banks of the stream.

### Erosion Control

* + No high ground pressure vehicles should be driven through project areas when soils are wet and saturated to avoid compaction and/or damage to soil structure. Indicators of saturated soil conditions may include, but are not limited to:

(1) areas of ponded water,

* + 1. pumping of fines from the soil or road surfacing material during timber operations,
    2. loss of bearing strength resulting in the deflection of soil or road surfaces under a

load, such as the creation of wheel ruts, (4) spinning or churning of wheels or tracks that produces a wet slurry, or (5) inadequate traction without blading wet soil or surfacing materials.

* + Recommend not using mobilized equipment on slopes exceeding 65 percent or on slopes greater than 50 percent where the erosion hazard rating is high or extreme.
  + Recommend avoid placing spoil on the stream side slope where it could enter the stream, or over vegetation.
  + Locate permanent spoil storage sites away from a stream/lake, to avoid spoil washing back into a stream/lake, and away from where it should cover aquatic or riparian vegetation, intact upland vegetation, and areas documented with sensitive species.

### Activity-Specific Best Management Practice Recommendations Herbicide Treatments

* + No insecticides, herbicides, fertilizers or other chemicals that might harms sensitive species or their habitat will be used in project activities.
  + Herbicides shall be applied by a certified pest control applicator per the label, following all applicable laws and regulations.

References

Agee, James K., et al. "The use of shaded fuel breaks in landscape fire management." *Forest Ecology and Management*, 2000: 59.

BCWS, British Columbia Wildfire Service. *BCWS Fuel Management Prescription Guidance.*

British Columbia Wildfire Service, 2019.

Bennett, Max, et al. *Reducing Fire Risk on Your Forest Property.* Technical Report, Corvallis, OR: Pacific Northwest Extension, 2010.

CAL FIRE, California Department of Forestry and Fire Protection. Sacramento, CA: California Natural Resources Agency, 2019.

Davis, L.S. *The economics of wildfire protection with emphasis on fuel break systems.*

Sacramento, CA: California Division of Forestry , 1965.

Green, L.R. "Fuelbreaks and other fuel modification for wildland fire control." In *USDA Agricultural Handbook*, by USDA Forest Service, 499. 1977.

Green, L.R., and H.E. Schimke. *Guides for fuel-breaks in the Sierra Nevada mixed-conifer type.*

Berkeley, CA: USDA Forest Service, Pacific Southwest Forest and Range Expt. , 1971.

Reclamation, Bureau of, and California State Parks. *Interim Auburn State Recreation Area Resources Management Plan.* Resources Management Plan, Folsom, CA: Bureau of Reclamation, 1992.

Reclamation, Bureau of, California State Parks, and CAL FIRE. *Auburn State Recreation Area Prefire Management Plan.* Fire Management Plan, Folsom, CA: Bureau of Reclamation, 2002.

Scott, Joe H., and Robert E. Burgan. *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model.* General Technical Report, Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station, 2005.