*Staub Forestry &*
*Environmental Consulting*

# Forest Management Plan for Covell Ranch

**Prepared for**
**The Nature Conservancy**

**Prepared by**
**Staub Forestry and Environmental Consulting**

**Stephen Staub, RPF #1911**
**Bill Ruskin, RPF 2248**
**Dylan Windt, Forestry/GIS Technician**

**February 25, 2011**

*6010 Highway 9, Suite 6 Felton CA 95018  Phone 831. 335.1452  Fax 831. 335.1462  staubtre@pacbell.net*
*Stephen R. Staub, Registered Professional Forester  License No. 1911*
*Cassady Bill Vaughan, Registered Professional Forester  License No. 2685*

# TABLE OF CONTENTS


INTRODUCTION 1

PROPERTY CHARACTERISTICS 1
- Topography 2
- Soils 2
- Watershed 2
- Vegetation 2
- Wildlife 3
- Sensitive Plants/Animals 4

MANAGEMENT OBJECTIVES 4

FOREST STAND CONDITIONS 4
- Forest Health 6
- Understory Vegetation 6

FIRE PROTECTION 8
- Existing Fire Environment/Hazards 8
- Fuel Conditions 9
- Potential Fire Behavior 10

MANAGEMENT ALTERNATIVES 11
- Forests Management Alternatives 11
  - Understory Treatments and Techniques 12
- Fire Management Alternatives 14
  - Fuel Breaks 14
  - Fire Breaks 14
  - Water Facilities 14
  - Trespass Control/Ignition Management 15
  - Emergency Ingress/Egress – Fire Roads 15

RECOMMENDED MANAGEMENT TREATMENTS 15
1. Bridge Street Fuel Break 16
2. Defensible Space Fuel Breaks 18
3. Cambria Pines Emergency Access Route 19
4. Internal Fire Road Access and Shaded Fuel Breaks 19
5. On-site Water Storage and Delivery 19
6. Shaded Fuel Break around the Cemetery 20

Monitoring and Adaptive Management 20

CONCLUSION 20

APPENDICES


References 22
Covell Ranch Sensitive Plant Species (Langford, 2000) 23
Guidelines for Genista Control, Hand Crews and Masticator Operations 24


MAPS


Soils 26
Watersheds 27
Fuel Breaks 28
Fire Defense Roads 29


TABLES


Average Per Acre Stocking Levels 4
Forest Vegetation Percentages 7
Table 1: Comparison of Monterey Pine Fuel Loads 9
Table 2: Comparison of Proposed Fuel Models for Monterey Pine at Covell Ranch 11


PHOTOS


Overstory Pine Mortality 5
Accumulation and impacts of fallen, dead trees 7
French broom on main trail 9
Ladder fuels increase rate of spread and torching potential 10

## Introduction

The Covell Ranch is a roughly 1460 acre property that contains nearly 900 acres of Monterey pine forest, the largest unfragmented area of native Monterey pine forest under a single ownership in Cambria. The Ranch is located immediately north and east of the community of Cambria. The Nature Conservancy has held a conservation easement on the property since 2000. Staub Forestry and Environmental Consulting collected plot data and took photos and other information on the property during fieldwork in August and September 2010 to characterize forest conditions and ecological processes on the property in order to address ongoing fuel management and fire hazard issues in an appropriate ecological context.

A number of relevant documents dealing with ecology and management of Monterey pine forest at Cambria have been reviewed as part of our work, including "Structure and Function of Monterey Pine Forest at Cambria," (Chorover, J. and J. McBride. 1987), "CT Ranch Forest Management Plan," (Smith, S. and M. DeLasaux. 1990), "Cambria Forest Management Plan" (Jones and Stokes, 2002) as well as property specific discussions of fuels and fire hazard in "Monterey Pine Forest Shaded Fuel Break Project in Cambria" (Bohlman 2004) and "Potential Wildfire Behavior – Covell Ranch" (Schmidt, 2010).

This Forest Management Plan is being prepared to meet the immediate need for current information and recommendations to address fire risk management issues and opportunities in cooperation with local fire agencies. While data collection is sufficient to describe characteristic forest conditions and processes, the primary focus of this plan is our evaluation and recommendations for fuel reduction treatments and fire protection improvements.

## Property Characteristics

Property characteristics including recent property history and soil and biological resources have been well described in the CT Ranch Forest Management Plan (Smith & DeLasaux, 1990 & referred to hereafter as FMP 1990) and the Easement Documentation Report (Langford, 2000). The property's long history of use for cattle grazing probably started in the mission era and likely became more intensive as an actively managed ranch from 1857 into the 1980s with some grazing under lease into the late 1990s. The sawtimber of the pine forest of the ranch was utilized for most of that period as well and supported a sawmill on the ranch itself into the mid 1960s. Following an unusual approach for the time, the Phelan Ranch selectively harvested its pine trees in order to meet its needs for production of both grass for cattle and sawtimber for lumber (Smith & DeLasaux, 1990). This mixed use approach was successful in maintaining pine forest cover on the ranch in the presence of active grazing, but undoubtedly led to repeated removal of the highest quality trees. This recent history of extensive use has influenced vegetation within forested areas, where grasses are a significant understory component, as well as in the primary grassland areas that occupy the northern portion of the Ranch.

### Topography

The property is located on the western coastal terraces at the southwest corner of the Santa Lucia range. Average slope over most of the forested area is quite moderate, usually from flat to a

maximum of 25%. Drainage swales create steeper, relatively short sideslope sections with slopes of 30 to 70% along portions of the southern boundary above the business district of downtown Cambria including the southernmost thousand feet of Bridge Street. Elevations range from 35 to 680 feet above mean sea level.

Soils

Soils on the property have been classified by the Soil Conservation Service (1984). The Monterey pine forest grows almost exclusively on San Simeon sandy loam soils on gentle to steep slopes. Monterey pine also grows on one small area of Concepcion loam that is located just east and north of the Cambria Cemetery and is bisected by the main ranch road. The following, heavier soils support grassland cover on the northern portion of the Ranch: Lodo clay loam, Los Osos loam, Los Osos-Diablo complex, and Salinas silty clay loam. These types are mapped by slope class on the attached Soils Map.

Watershed

The majority of the property (55%) drains into Cambria Meadows Creek in the northern portion of the property. The middle portion drains into Leffingwell Creek (26%) while the southern section drains into Santa Rosa Creek (19%). Cambria Meadows Creek and Leffingwell Creek are seasonal streams. Santa Rosa Creek flows year round. Considerable downcutting and bank erosion were observed in the north-trending portion of the Leffingwell Creek channel located west of the main ranch road in the west central portion of the main forest area. However, channel bank and bottom conditions stabilize where channel direction changes from north to northwest just west of the approximate center of the property. The watershed boundaries on the Covell Ranch are shown on the attached Watersheds Map.

Vegetation

The vegetation communities on the property summarized by Langford (2000) have been adapted below to reflect our assessment of the current extent of forest cover and parcel acreage but no detailed field or mapping review of non-forest types was made:

| Vegetation type | Acres | Percent |
|---|---|---|
| Monterey pine/coast live oak forest | 875 | 60.0 |
| Grassland | 566 | 38.9 |
| Riparian woodland | 8 | 0.5 |
| Coastal scrub | 3 | 0.2 |
| Chaparral | 2 | 0.1 |
| Disturbed/introduced species | 4 | 0.3 |
| Total | 1460 | 100.0 |

The forest vegetation is described in detail below. As noted in the report by Langford (2000) and confirmed by our fieldwork, the forested area of the property appears to be stable, and in some areas is expanding into associated grasslands on the favorable sandy loam soils of the San Simeon series as grazing and fire activity has declined or been eliminated. In the absence of

significant clearing and management for grazing or fairly regular ground fires, potential habitat for Monterey pine is probably close to the 1036 acres mapped as a Sensitive Resource Area (SRA) in the County's Local Coastal Plan (LCP). As a first approximation, the area of potential Monterey pine habitat here can be considered more or less the same as that of the underlying San Simeon and associated soils (Chorover and McBride, 1987).

Of potential botanical interest is the fact that mature Douglas fir trees (*Psuedotsuga menziesii*) occur in a small patch within the Monterey pine stand immediately west of the Leffingwell Creek channel in the west central part of the property. These trees are actively reproducing and appear as if they could be naturally occurring. If so, this would be noteworthy because this location is not recorded in the definitive work The Distribution of Forest Trees in California (Griffin and Critchfield, 1972) and would be the second southernmost known natural occurrence of the species. Stumps of mature Douglas-fir trees were observed and suggest that some of the larger specimens were cut and milled at some point in the last century. Given the property's long ranching history, however, it is possible that the species was introduced in the nineteenth or early twentieth century when Phelan Ranch operations were very active. Further investigation would be required to establish whether this is a native or introduced Douglas-fir stand.

Grassland areas of the property have been utilized for grazing for a long period of time, perhaps as early and probably well before the Phelan family began ranching operations in 1857. As a result, many of the native grass species which are not resistant to repeated grazing pressure are no longer present. The existing grassland areas are dominated by introduced annual grasses (*Briza spp., Avena barbata, Bromus diandrus, Lolium motiflorum,* etc). These are associated with common grassland forbs (*Erodium cicutarium, Hemizonia congesta ssp. luzulifolia, Plantago lanceolata,* etc.).

Riparian vegetation on the property is sporadic and narrowly linear along the channels of the seasonal drainages found on Covell Ranch, principally Cambria Meadows Creek. Species such as *Populus trichocarpa, Sambucus mexicana,* and *Salix lasiolepis* are characteristic in these areas. Where it occurs, the riparian vegetation of the property may be highly impacted by past grazing pressure. Where grazing pressure has been light the riparian vegetation is fairly intact.

Tiny occurrences of coastal scrub and chaparral communities appear on the most xeric soils and sites on the property and tend to have characteristics of both northern and southern coastal scrub communities. Dominant shrubs include: *Baccharis pilularis, Artemisia californica, Rubus ursinus, and Toxicodendron diversilobium.* Associated species include: *Mimulus aurantiacus, Pteridum aquilinum, Eriogonum parvifolium, Lotus scoparius,* etc.

Wildlife

Useful discussions of the wildlife habitats and species present on the property are contained in both Smith & DeLaSaux (1990) and Langford (2000). These reports point out the unique value of the forested area of the property in providing forage, roosting, and nesting habitat for multiple species. The combination of habitats on the property provides the opportunity for species to become resident (e.g., winter wren) that might otherwise be transient or migratory. The acorn mast crop from coast live oak provides an important forage source for both birds and mammals.

Sensitive Plants/Animals

A list of sensitive plant and animal species which may or do occur on the property is provided in the Langford report.

**Management Objectives**

The conservation easement for the property requires that it be managed and maintained in a manner that is, to the maximum extent possible, consistent with the preservation and protection of the conservation values of the property. Along with protection and restoration of riparian habitat associated with Cambria Meadows Creek and the extensive grasslands in the northern part of the property, a primary value and function of the easement is protection, management, and enhancement of the indigenous Monterey pine forest.

The current landowner, Ralph Covell, has an interest in continuing to graze the property wherever feasible. Control of livestock, limiting trespass and its inherent liability, and reducing the risk of wildfire, are his primary management objectives.

To a significant degree, these objectives are not necessarily conflicting. This management plan attempts to outline opportunities for projects which will assist in the implementation of both sets of objectives as funding becomes available.

**Forest Stand Conditions**

Reconnaissance level plot sampling (tenth acre fixed) laid out on a regular grid was conducted in August and September 2010 to evaluate forest characteristics in the main forested area south of Cambria Meadows Creek. Data on slope, aspect, tree diameter, height, condition including pitch canker symptoms, understory cover and regeneration were collected on 41 plots with detailed measurements on 460 trees 6" or larger in diameter measured 4.5' above the ground (dbh). The more isolated forest areas north of the south fork of Cambria Meadows Creek were only visually inspected for tree cover and condition and no measurements were made beyond establishing forest coverage of nearly 130 acres or 14.5% of the Monterey pine forest on the ranch. During the course of sampling within the main forest, attempts to stratify the forest into areas having common characteristics were unsuccessful, primarily because of tremendous, almost continuous variability in overstory and understory conditions. Without stratification, then, the table below summarizes results of our sampling of tree stocking levels in the main contiguous forest area south of Cambria Meadows Creek.

**Average Per Acre Stocking Levels**

| | Monterey Pine | Coast Live Oak | Total |
|---|---|---|---|
| # of Trees 6"+ dbh | 78 | 62 | 140 |
| # of Trees <6" dbh | 346 | 83 | 429 |
| Basal Area (sq. ft.) | 81 | 32 | 113 |

Stocking is dominated by trees in the 6" to 11" size class, which contains more than 50% of pines and more than 85% of oaks. Current total basal area stocking figures of 113 square feet are comparable to the 109 square feet found 20 years ago in this same area by Smith and DeLasaux in their CT Ranch FMP. Coast live oak appears to have increased its share of this total significantly during this time and now represents roughly 25% of total basal area stocking, up from roughly 10% in 1990. This change requires confirmation by more extensive sampling and may be due both to ongoing mortality of older, larger pines already noted in the 1990 FMP and also to recovery and growth of oaks after extensive firewood cutting that ended around 1940. Stocking of trees less than 6" dbh is good, still strongly dominated by Monterey pine, and indicates that natural regeneration of both species is active and appears to be maintaining density of forest cover but often with smaller, younger trees. Mature, even-aged forest stands with a high and closed canopy were infrequent and generally small. This heterogeneous pattern of stocking, frequently comprised of very small even-aged patches from a tenth to one-half acre in size and with both pine and oak regeneration and dead and down pine trees being widespread, was noted in the 1990 FMP and is characteristic of a mature to senescent uneven-aged forest that is actively regenerating. Although sampling parameters for regeneration were different making direct comparison impossible, it appears that current pine regeneration densities have declined somewhat since the sampling in 1990.

Probably the most striking feature of many areas in the Monterey pine forest of the Covell Ranch is the large amount of dead and downed pine trees that occur throughout the forest. This feature was noted with some concern in the 1990 FMP where the basal area of standing dead (aka snags) pines represented fully 25% of total pine basal area of living and dead trees combined. In addition, debris from fallen trees averaged more than 5% of the surface cover of the 1990 sample plots. Pine snags remain widespread currently but debris from fallen trees certainly has increased. It was routine for fallen material to cover 10% to 15% of the ground surface in our sample plots and several ran as high as 25% or more. There clearly has been a trend of mortality and failure of overstory pine trees over the last decade or more with significant accumulations of dead material in many areas.

**Overstory pine mortality**

**Accumulation and impacts of fallen, dead trees**

## Forest Health

The native population of Monterey pines at Cambria has been documented to have high rates of disease and pest occurrence generally, and the highest levels of dwarf mistletoe (*Arceuthobium campylopodum*) infestation of the three native Monterey pine populations in California. Western gall rust (*Peridermium harknessii* and *Peridermium cerebroides*) is the other major native disease and occurs at damaging levels, creating disfiguring growths of witches brooms and globose galls that retard growth. These findings were borne out by the extensive sampling done for the 1990 FMP, which found more than 60% of pine basal area stocking to have severe infections of western gall rust, 45% of pines to be severely infested with dwarf mistletoe while only 14% of sampled pines had no mistletoe infections at all. Current observations found symptoms of these diseases to be ubiquitous consistent with these earlier findings. It seems likely that more than 150 years of removing the best trees from the Cambria stands for wood products has narrowed the genetic base and increased disease susceptibility. Even though these diseases decrease stand vigor and cause some tree mortality of individual trees, especially in smaller size classes, Monterey pine forest has adapted to growing in their presence and is likely to persist in spite of them. They may predispose the stands to bark beetle infestation, however, and the combined effects of disease and beetle attack could have catastrophic consequences under severe drought conditions.

Pitch canker (*Fusarium circinatum*) incidence and severity were tallied during the current inventory sample and the results found the disease to be relatively low in frequency (about 15% with active symptoms) and generally light in affect. Out of more than 250 pines sampled, only two were observed with moderate symptoms plus one with a significant bole canker.

Activity of bark beetles and other native insects was observed throughout the forest but at the present time appear to be having impacts primarily at the individual tree rather than stand level. Other native root diseases and decays and stains are having similar impacts.

## Understory Vegetation

Understory cover and vegetation were evaluated as part of current sampling as well as in the 1990 FMP. In both cases, grass and forest litter (dead leaves, needles and small twigs) are by far the most prevalent kind of cover, together averaging more than 65% in southern area in 1990 with somewhat more grass than litter. Poison oak and blackberry vines are the next most frequent kind of cover followed by coffeeberry and toyon shrubs, but their occurrence is intermittent and patchy and rarely very dense. In contrast, grasses and similar were a significant understory component in most plots with native woodland grasses and sedges appearing to persist best in areas with moderately intact forest canopy. Occurrence of invasive plants, particularly French broom (*Genista monspessulana*), is not widespread but can be locally dense. Examples include the area and trails nearest homes toward the upper end of Sunbury and west of the Cemetery and portions of the steep slopes east of the southernmost portion of Bridge Street.

Understory composition did not appear to correlate well with parameters such as slope, aspect or overstory density. The relatively broad forest types of Chorover and McBride (1987) ultimately

proved to be the most applicable and useful for describing forest vegetation types and occurred in the following percentages in vegetation sampling for 41 plots:

**Forest Vegetation Type Percentages**

| | |
|---|---|
| 1. Monterey pine/coast live oak with light shrub component | 61% |
| 2. Monterey pine/coast live oak with heavy shrub component | 15% |
| 3. Monterey pine with grass understory component | 24% |

The light shrub type is defined as having >10% and <50% understory shrub cover; heavy shrub as having 50% or more shrub cover; and the grass type having 10% or less cover in its shrub layer. For typing purposes, vines such as poison oak, blackberry, and honeysuckle are considered part of the shrub layer along with characteristic shrubs such as toyon, coffeeberry and monkey flower as well as shrub-sized coast live oaks. It is important to remember that understory cover from the debris of fallen trees and broken understory plants, including coast live oaks, is comparable to the cover provided by the shrub layer.

Our sampling suggests that these descriptive forest types do not consistently occur in patch sizes large enough to be usefully mapped, at least at the level of resolution of our sampling relative to the size of the forest area. Heavy shrub cover as defined is very patchy and infrequent. The pine grass type tends to occur most in forest areas near the southern boundary and in the relatively gentle terrain east of Bridge Street and the main ranch road that runs north to the grassland where the forest canopy is generally more open.

**French broom on main trail near Sunbury - Mesic swale bottom sedge pine type**

One exception to the general lack of distinctive understory types is the occurrence of a number of gentle, low-lying swale areas dominated by sedges in the understory. These areas are of both ecological and fire protection interest. These linear, mesic areas of gentle drainage are too subtle to show clearly on topographic mapping but are very distinct and vary from as little as 20 to as much as 80+ feet in width and tend to have dominant forest cover of relatively healthy, mature pines. These areas could be GPSed and mapped relatively easily. They also suggest that soil moisture is a limiting factor on pine growth and health over much of the Covell Ranch.

Previous work and current sampling confirm that the native Monterey pine forest on the Covell Ranch is uneven-aged and has great variability in stand conditions. This uneven-aged character reflects both the absence of any stand replacing events such as catastrophic fire or extensive clearcut logging and has been to some degree maintained by a moderate disturbance regime over the last 150 years resulting from grazing and tree removals for both lumber and firewood. For a variety of reasons, the forest is characterized by high levels of disease and insect activity but continues to have effective levels of regeneration of both pine and oak.

Over the last 20 years there has been significant tree mortality, especially of older and larger trees, due to natural aging and the effects of pitch canker and other diseases and insects, resulting in high percentages of standing dead and downed pines that cover an increasing portion of the forest floor. As anticipated in the Cambria Forest Management Plan (2002), dead material is accumulating at rates that exceed the capacity of insects, fungi and microorganisms to decompose and recycle it. The absence of wildfire and the movement and grazing of large mammals, which are key components in the initial breakdown of coarse organic materials, have contributed to this excessive build-up of dead material in the understory.

Such conditions are not unique and no doubt have occurred before in the evolutionary history of Monterey pine. And there are a number of ecological benefits from having extensive resources of standing and downed dead wood. Even though continuing regeneration appears to be sufficient to maintain the forest, there are concerns about trends toward oaks increasing at the expense of pine, declining rates and increasing patchiness of regeneration, declining forest health, and increasingly hazardous quantities and structures of live and dead fuels in this valuable forest that abuts the community of Cambria on two sides.

**Fire Protection**

Existing Fire Environment/Hazards

There have been no recorded wildland fires for the last 100 years (Schmidt, 2010), and no detailed data or fire history information for the ranch has been found. Some charring indicative of a small ground fire some years ago was observed near the property line by residences east of Cambria Pines Drive. Lack of significant fire history on the property can probably be attributed to the generally cool, moist, climate of the area and good ignition management over the years. In a Potential Wildfire Behavior report prepared for TNC (Schmidt, 2010) the 97$^{th}$ percentile weather (the most extreme weather present for 3% of the year) shows a high temperature of 90 degrees and lowest relative humidity of 14% recovering to 40%. These are relatively moderate conditions for fire behavior when coupled with the low average slopes on the property.

Sampled fuel loading for the three primary vegetation types as developed by Chorover and McBride (1987) and applicable on Covell Ranch are depicted in Table 1 below. These data are cumulative averages of the samples taken for that study. As suggested above, it is presumed that there has been significant additional net accumulation in the 10 and 100 hr. fuel sizes in the intervening years. Extensive fuel sampling necessary to quantify fuel loading and net rates of accumulation on the ranch was beyond the scope of this planning effort but warrants further

study. The data collected in Cambria for the 1987 study is judged to be adequate for illustrative purposes. Total fuel loading at this time also appears to be comparable to that measured in Monterey pine stands near Ano Nuevo (Greenlee and Ruskin, 1983).

**Table 1. Comparison of Monterey Pine Fuel Loads.**
**(Actual Samples Versus Available Standard Fuel Models)**

| | | Tons/Acre | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 Hour | 10 Hour | 100 Hour | Live | 1000 hour | Duff |
| A | MP-HS | 0.06 | 0.22 | 0.41 | | 3.7 | 50.5 |
| | MP-LS | 0.05 | 0.19 | 0.46 | | 4.2 | 43 |
| | MP-G | 0.04 | 0.16 | 0.41 | | 5 | 24 |
| B | MP-L | 0.1 | 0.7 | 1.7 | 0.6 | 0 | 27 |
| | MP-LB | 0.2 | 1.2 | 2.9 | 16 | 3.1 | 55 |
| | MP-HB | 0.2 | 1.2 | 3.4 | 12 | 4.1 | 47 |
| C | FM 8 | 1.5 | 1 | 2.5 | 0 | | |
| | FM10 | 3 | 2 | 5 | 2 | | |
| D | TU 1 | 0.2 | 0.9 | 1.5 | 1.1 | | |
| | TU 3 | 1.1 | 0.15 | 0.25 | 1.75 | | |
| | TU 5 | 4 | 4 | 3 | 3 | | |

A- Cambria samples (Chorover and McBride, 1987)
B- Ano Nuevo samples (Greenlee and Ruskin, 1983)
C- NFFL fuel models, (Anderson, 1977)
D- "new fuel models", (Scott, 2005)

Fuel Conditions

Field comparison of fuel characteristics at Covell Ranch to stands of Monterey pine of similar density on the Monterey peninsula and Ano Nuevo presented some marked differences regarding potential fire hazard. The understory of the stands at Covell Ranch is almost devoid of manzanita (*Arctostaphylos sp.*), which is a major component within the other indigenous stands that have experienced catastrophic fires. Manzanita heights in excess of 12 feet are often seen in un-burned stands elsewhere and are a major source of ladder fuel and needle drape accumulation. At Covell Ranch the primary ladder fuels are toyon (*Heteromeles arbutifolia*) and coast live oak *( Quercus agrifolia*) and patches of fairly dense Monterey pine regeneration in the sapling to pole sizes. Occurrence of relatively dense ladder fuels presented by these species appears to be associated with areas of significant mortality in the overstory canopy of Monterey pine and can be considered to be in a "canopy replacement" phase. These may be characterized as a high density of sapling sized pine trees in fair to poor condition with interspersed toyon and coast live oak (see ladder fuels photos below). Needle drape is present but not extensive. In some areas substantial failure and breakage of smaller pole sized and larger trees has created pockets of very high dead fuel load.

As a result of the extensive pine regeneration and continuing die-off of older overstory trees, it is expected that fuel accumulation will continue on the ranch for the foreseeable future. At Point Lobos State Park it is estimated that net fuel accumulation in Monterey pine stands amounts to roughly one ton per acre per year (Gray, 2010).

**Ladder fuels increase rate of spread and torching potential**

Potential Fire Behavior

A major objective of both TNC and the landowner is to act conscientiously to abate the risk of catastrophic wildfire. To this end, TNC funded a recent study of Potential Wildfire Behavior for the Covell Ranch by David Schmidt (May, 2010). This document provides an extensive GIS based analysis of potential fire behavior using the Landfire system. This is one of several newer spatial analysis systems which incorporate existing fire modeling techniques with remotely sensed data to provide landscape level predictions of fire activity. In an effort to validate the results, existing fuels information was compared to the modeling assumptions in the study, and re-run through an alternate program for comparison.

As pointed out by Schmidt, historic weather data for the Cambria area is fairly limited. The alternative used to develop 90$^{th}$ and 97$^{th}$ percentile weather scenarios is a standard technique and was accepted for this purpose. These scenarios replicate typical high fire danger conditions but, it should be noted, do not represent extreme fire weather events.

Results of the study showed relatively low rates of spread and flame length for the vast majority of the forested area. The study also predicted no crown fire behavior. Two outputs that are of interest for firefighting purposes, spotting distance and ignition probability, are not covered in the results. These effects are directly related to the ability to control a working fire. Schmidt points out that forested areas were originally mapped as model TU1 and were later changed to model TU5 based on field observation of fuel loading. As can be seen in Table 1 above, model TU1 may be a better match for the lighter fuel component within the Monterey pine fuel types and has significantly less heavy fuels. NFFL fuel model 10 has been suggested for modeling Monterey pine at Point Lobos State Park (Gray, 2010). For the purposes of comparison the proposed models were tested with the suggested weather scenarios.

To produce the data in Table 2, the BehavePlus program (Andrews,et.al., 2008) was used (canopy cover was assumed to be 35%, an average slope of 10% was used for the forested area). As might be expected, rate of spread and flame length results are similar to that predicted by

Landfire, since both programs rely on the same equations originally developed by Rothermel (1972). As pointed out by Schmidt, it appears that TU1 may under-predict spread rate and intensity. Spotting distance and ignition probability were the same for all models. There is not a lot of difference in results between the 90th and 97th percentile weather, which is reasonable since the data are not markedly different.

**Table 2. Comparison of Proposed Fuel Models for Monterey Pine at Covell Ranch.**

| | 90th Percentile Weather | | | | 97th Percentile Weather | | | |
|---|---|---|---|---|---|---|---|---|
| | FL | ROS | Sp Dist | IG Prob | FL | ROS | Sp Dist | IG Prob |
| FM 10 | 2.3 | 1.7 | 0.3 | 20 | 2.5 | 2.1 | 0.3 | 28 |
| TU1 | 0.3 | 0.2 | 0.3 | 20 | 0.4 | 0.3 | 0.3 | 28 |
| TU5 | 3.4 | 2.1 | 0.3 | 20 | 3.7 | 2.5 | 0.3 | 28 |

FL- Flame Length (feet)
ROS- Rate of Spread (ch/hr)
Sp Dist- Spotting Distance (miles)
IG Prob- Ignition Probablity (percent)

Results of this comparison bear out the findings in the study by Schmidt. Regardless of the selected fuel model, spread rates and flame lengths are relatively moderate for the vast majority of the forested area in both weather scenarios. However in areas of increased slope and lower canopy base height, these factors are expected to increase dramatically. Ignition probability for firebrands resulting from torching is relatively low over most of the area. There is no predicted transition to crown fire for the weather scenarios used for the forested area.

Difficulty of control, as reflected by flame length and intensity, would be expected to increase drastically in areas where canopy is reduced and grass/fuel ladder & shrub/deadwood jackpots are the primary fire carriers (particularly in the vicinity of lower Bridge Street and the upper ranchland area). This would be accompanied by an increased risk of torching and spotting. As stated by Schmidt, the results of this type of modeling should be regarded as qualitative only. With continued fuel accumulations and potentially increased growth of shrubs and small trees projected in areas where mature overstory cover reaches the end of its lifespan, the risk of a stand replacing fire under extreme fire weather conditions cannot be discounted in the Monterey pine forest of Covell Ranch. These conditions support the need for a primary fuel break to reduce fuel continuity and provide safe entry and containment points for fire control operations.

## Management Alternatives

### Forest Management Alternatives

The Cambria Forest Management Plan (2002) provides an extensive list of management alternatives designed to address specific overstory and understory conditions in Monterey pine

forest in order to enhance forest health and public safety. Because all of the treatments are costly due to various combinations of the expertise, equipment, labor, and/or materials involved and the fact that there is not a positive economic value for the material being treated, there is little to no likelihood that active management of the Monterey pine forest on an area-wide basis within the Covell Ranch will be feasible in the near future unless considerable and currently unanticipated funding becomes available.

Fortunately, our sampling and observations indicate that this Monterey pine forest is maintaining and replacing itself in the presence of insects and diseases including pitch canker and in the absence of fire activity of any kind. Under these circumstances, there is no immediate need to manipulate overstory conditions on the Covell Ranch, the principal purpose of which is to promote pine regeneration. Relatively abundant pine regeneration was observed in open to moderate canopy conditions in both the pine/oak light shrub type and in the pine grass type, which dominate more than 80% of the area sampled. At least some healthy pine regeneration was present in the pine/oak heavy shrub type as well, though regeneration success in all forest vegetation types should be monitored to assure that long term replacement is in fact occurring. In short, there is no need to plant trees or scatter cones and seeds on the Covell Ranch at the present time. Isolated instances of hazard tree removal for public safety are the only immediate exception to this ability to let the overstory take care of itself for at least the near future.

As described in the forest and fuels section above, understory conditions are another matter altogether. Although portions of the forest are relatively open and well spaced with a variety of native plants and trees, growing space within 10 to 15 feet of the forest floor in many places is at a premium due to moderately dense mixes of live and dead plants and trees composed of both fine and coarse materials. In many areas dead and fallen material has broken or sits on live plants including pine and oak trees, preventing healthy growth. In shaded areas generally, a number of small trees have become established but often do not grow well and some droop, die or die back partially. In more open areas, sapling and shrub growth can be too dense for good health and often create a fire hazard as well. Excessive density is strongly correlated with loss of vigor and pathogen damage.

Control of what are currently relatively limited infestations of French broom should be a priority. Since broom is principally associated with areas of disturbance near homes and along roads and trails, access to most of the worst areas for control treatments is not difficult. Effective control requires appropriate seasonal timing and proper disposal to avoid spreading the long lived seeds, but can be accomplished with careful implementation of the methods listed below. As noted in the Cambria Forest Management Plan (2002), most of the invasive grasses that it would be desirable to reduce or eliminate from the understory cannot be effectively controlled.

Understory Treatments and Techniques

Chapter four of the Cambria Forest Management Plan discusses at length the objectives, methods, and ecological benefits and consequences of managing the forest understory to improve forest health and increase public safety. Methods for reducing and removing excessive understory plants and fuels can be summarized as follows:

- Hand clearing
- Mechanical clearing
- Chipping, which is a combination of hand and mechanical
- Pile burning
- Prescribed fire or controlled burns
- Grazing
- Chemical treatment

Any and all of these methods could be used on the Covell Ranch where understory conditions are too crowded, but the treatment method must be matched to both understory conditions and operational constraints. For example, prescribed fire is desirable in theory since fire has been such an important ecological factor in the evolution of this plant community. Prescribed fires have been implemented with some success in native Monterey pine forests at both Big Basin and Point Lobos State Parks, but some adverse biological impacts (large tree mortality and invasive plant infestations) have occurred in addition to the desirable effects (reduced fuel loading and increased pine regeneration). Initially, prescribed fire will only be appropriate on a small scale, experimental basis in more remote areas of the Covell Ranch due to cost, liability, and its potentially unintended biological consequences. However, if results of such test burning prove promising, its use should be expanded within the ranch, including in areas near homes, once effects and prescriptions are well understood.

Grazing in association with Monterey pine forests has been done successfully in agroforesty applications for years in New Zealand and Australia (Reid and Wilson, 1986). Historically and into the present, cattle have grazed within and in pastures adjacent to portions of all three native California populations of Monterey pines, including what is now the Covell Ranch. Grazing effects on pine regeneration and forest health vary with intensity and timing of grazing activity (Barbour et al., 2007). Severe grazing pressure will harm understory and overstory conditions but can be very effective in eliminating fire hazard. On the other hand, Chorover and McBride considered suitable grazing to be critical for maintenance of the pine/grass forest vegetation type.

Experience at both Covell Ranch (Ralph Covell, personal communication plus field observations) and ranches in the Ano Nuevo Monterey pine population indicate that pine regeneration and pine cover recruitment has occurred over the last twenty or more years in the presence of light, well-timed cattle grazing activity. Indeed, within the Ano Nuevo population at Big Creek Ranch in Swanton, pine encroachment into grazing areas had to be actively controlled to avoid reducing the area available for grazing (Frank McCrary, personal communication). Livestock grazing, principally cattle, sheep and/or goats, has been used to reduce fuel loading and fire risk in Wildland Urban Interface (WUI) areas in many parts of California in recent years. Use of grazing to control and maintain appropriate understory fuel conditions is feasible at Covell Ranch but should be prescribed by a qualified range manager to balance animal health and vegetation management objectives. Current grazing prescriptions for ecological benefits generally involve one to three short periods per year of well-timed, fairly high intensity grazing and use of at least some temporary fencing to keep livestock controlled within the project area. Grazing will not be particularly effective where excessive downed woody material is present, but can be a useful method for maintaining favorable understory conditions once downed woody material has been treated.

The remaining understory treatments use a variety of hand and mechanical methods to remove ladder fuels and to reduce or remove woody debris and are discussed at length in the Cambria Forest Management Plan (CFMP). In general, treatments should be applied in a manner consistent with the recommendations in the CFMP. However, removal of the duff layer to promote regeneration is not recommended because seedling recruitment is still sufficient. In addition, it has been shown that low ground pressure, tracked equipment can operate effectively and with appropriately minimized disturbance by operating up and down slopes up to 30% rather than on a contour. Understory treatments applied as needed would be desirable in most of the forest to reduce impacts of insects and disease, to improve regeneration success in specific locations, to enhance diversity, and to improve spacing for better growth. Due to the economic and funding constraints noted above, however, such treatments are likely to be confined to areas where forest health benefits also improve public safety by decreasing fire hazards.

## Fire Management Alternatives

### Fuel Breaks

A fuel break is defined as "a strategically located wide block, or strip, on which a cover of dense, heavy, or flammable vegetation has been permanently changed to one of lower fuel volume or flammability" (Green, 1977). A shaded fuel break is one in which surface fuels have been reduced and the crown cover of remaining trees has been raised and/or opened to reduce the risk of crown ignition. There are no standard prescriptions for fuel break width, overstory removal, and ground treatment, as it is understood that fuel breaks will be designed to fit local landscape and fuel conditions. Shaded fuel breaks to enhance access for initial attack and safety of fire personnel and equipment can range from as little as 20 feet on each side of a road to more than 150 feet on one side. A width of 300 feet has been historically specified for primary fuel breaks (Green, 1977). A fuel break is typically not designed to stop a fire but to give suppression forces "a higher probability of successfully attacking a wildland fire" (Agee, et al, 2000). Fuel breaks may provide an area from which to safely attack a fire as well as an anchor from which to start an indirect attack. When associated with a road they may be used to enhance safe ingress and egress to potential fire prone areas.

### Fire Breaks

By contrast a fire break is defined as a "…fireline wider than 10 feet, frequently 20 to 30 feet wide…." (Green,1977). These are by necessity devoid of all vegetation and are frequently constructed by bulldozer or other mechanical equipment. Firebreaks are often designed to be used as roads by fire equipment as both a primary and secondary fireline.

### Water Facilities

In order to facilitate fire control onsite, water development is an essential asset. Water may be provided through tanks supplied with proper fittings, hydrants, or ponds. Such facilities should be located so that fire equipment can make access easily during an emergency. Fittings should be checked often for condition and replaced as needed.

Trespass Control/Ignition Management

Unauthorized public use of the property has been an ongoing problem on the property for as long as anyone can remember (Ralph Covell, personal communication). In order to define such use as trespass on property where livestock is being grazed, the property must have an enclosing fence and be signed to exclude trespass with a minimum of 3 signs per mile, and at all entry points for roads and trails (Penal Code Sec. 602(h)).

According to CalFire's 5 year average fire cause statistics, the vast majority of fires are human caused. This may be associated with vehicle or equipment use, campfire, playing with fire, arson, or other activities. Managing access is therefore an important means of controlling potential unwanted fires. This includes installation of fences, gates and signage as appropriate. Attention should also be given to controlling the use of vehicles and fire on the property in the course of management. Care should be given to establish designated smoking areas for employees, limiting off road vehicle use and equipment use during high fire danger periods, and following all open burning requirements carefully.

Emergency Ingress/Egress – Fire Roads

Effective fire suppression and resident safety depend on the ability to access and exit the property in the event of an emergency. Primary roads should be maintained in a condition suitable to provide fire equipment passage with clearance of a minimum roadbed width of 24 feet in width for a two lane road and 12 feet for a one lane road. Minimum vertical clearance height of 13.5 feet should be maintained over the entire length and width of the fire road. Suitable vegetation clearance along the primary public access roads should be provided to allow for safe passage of vehicles and equipment and are may be supplemented by adjoining fuel breaks where wildland fuel conditions warrant. Secondary evacuation routes suitable for vehicle passage should be designed in the event that the primary route is blocked due to emergency activity.

**Recommended Management Treatments**

As mentioned above, only incidental custodial management of the Monterey pine forest on the Covell Ranch is expected to be feasible due to costs and requirements associated with active management for solely ecological objectives over most of the Covell Ranch. As outlined above, however, desirable understory treatments can have both ecological and fire protection benefits if properly implemented. A potential disadvantage of fuel reduction treatments, however, is that they can lead to increased incidence of invasive, non-native plants, particularly if soils are disturbed, cutting operations occur annually, or are poorly timed.

In view of the above factors, it is best to restrict operations to areas where there is a significant public safety benefit and ecological impacts will be predominantly positive and effects can be more easily controlled. Operations to improve emergency access and fire safety along Bridge Street and the ridge above downtown as well as next to the residential areas bordering the southwestern portion of the Ranch clearly emerge as the management actions most needed under current conditions and constraints.

Forest management priorities for fire control treatments and implementation are listed in order below and are entirely dependent on reestablishing fencing and gates to control trespass and permit grazing to maintain areas after initial treatment:

1. Establish a primary shaded fuel break from the southern property line up the hogback ridge to the S turn on Bridge Street and thence along the west side of Bridge Street to the Cemetery as shown on the attached Fuel Break Map.

2. Establish defensible space fuel reduction zones adjacent to residences along the western boundary from Sunbury south toward downtown and to residences on either side of the Cemetery in Cambria Pines as shown on the attached Fuel Break Map.

3. Investigate the feasibility of establishing gated emergency access for authorized personnel over the ranch road from the top of Bridge Street to Cambria Pines as shown on the Fire Defense Roads Map.

4. Improve internal fire road access for prevention and suppression activities on the ranch east of Bridge Street as shown on the Fire Defense Roads Map.

5. Install an emergency water supply tank for fire control purposes on the ranch near the Cemetery.

6. Establish a defensible space fuel reduction zone adjacent to the Cemetery itself as shown on the attached Fuel Break Map.

These recommended treatments are discussed briefly below and are expected be completed by a combination of hand crews and masticating equipment, using the complementary strengths of each to achieve both ecologically and cost effective results.

1. Bridge Street Fuel Break

As cited above, and referenced by Schmidt (2010) and others, a shaded fuel break should be constructed that utilizes upper Bridge Street and the broad, hogback ridge that parallels lower Bridge Street some 400' to 600' to the west. This will act as a primary break in the fuel continuity in the event of a major fire event, utilize topographic and constructed features effectively, and enhance safe ingress and egress for the property and fire personnel. The recommended fuel break width is 100 feet west from the edge of Bridge Street itself from the Cemetery south to the S-turn and 150 feet in width where following the ridge south of the Bridge Street S-turn down to the business district. See the attached Covell Ranch Fuel Break Map.

*Shaded Fuel Break Specifications*
All fuels within 20' of pavement shall be modified or removed as follows:
- Cut and remove all shrubs.
- Remove all dead standing trees.
- Remove all dead fallen material.

- Remove all dead tree limbs within 10 feet of the ground and live limbs to the same height or on small trees to 50% of the height of the tree.
- All cut material shall be removed from the area or chipped to a depth of not more than 2" or pile burned.

Beyond 20' from pavement, the following shaded fuel break standards shall apply:

- Non-irrigated grass of other herbaceous vegetation that dries and cures should be grazed, mowed or cut to a maximum height of 4".
- Fall all dead trees and remove or treat all material 6" in diameter and smaller as feasible.
- Remove all tree limbs within 8' of the ground except where removal would exceed 1/3 the height of the tree. Where located on slopes in excess of 30%, remove all limbs within 10' of ground level subject to the same exception.
- Remove all dead tree limbs within 10' of the ground. Prune out dead wood from retained shrubs and trees.
- All cut material must be removed, pile burned, chipped and spread, or lopped and scattered to within 12" or less of ground level.
- Shrubs should have an average horizontal separation of twice their height. Groups of shrubs can be retained but should have extra clearance around them to maintain average separation. Shrubs should not be retained directly under tree canopies unless there is good vertical separation between the top of the shrub and the lowest tree limb. Ideally, vertical separation should be at least three times the height of the shrub.
- Tree canopies should remain distinct if possible. For fire control purposes, 10 feet or more of separation is preferred but may tend to dry out the site and encourage invasive plants. Removal of healthy mature trees which do not pose a safety hazard is rarely necessary and should be done only as a last resort and in consultation with a qualified forester. Dense groups of young oaks or pines that are taller than 4' should be thinned to achieve crown separation, usually to 8' or more horizontal spacing.
- Invasive species shall be treated appropriately as described in the guidelines attached at the end of this plan to discourage regrowth and seeding.
- Remaining ground fuels shall be maintained at a height of less than 18".

Existing fencing at the road edge must be reinstalled and maintained as needed to limit public access, and new fencing should be installed at the property perimeter and to help provide a secure grazing perimeter within the fuel break and adjoining forest areas as shown on the Covell Ranch Fuel Break Map. It is anticipated that perimeter and roadside fencing will be of standard 4-wire, metal fence post design, possibly with smooth wire for the lowest run to enhance small animal passage.

Exact positioning of fuel break boundaries is subject to the judgment and discretion of local fire officials, whose input has been incorporated into this plan. The fire agencies have prevention programs in place to address fuel reduction and defensible space requirements. After initial treatment to establish this shaded fuel break, appropriate grazing is planned to control and maintain understory fuel loading and structure at suitable levels. Occasional supplemental fuel reduction work by available CDC or CCC camp crews is also anticipated.

After the fuel break has been established, incremental expansion to a width of 300' is recommended as funds become available and positive ecological effects confirmed by monitoring over a period of years.

Total length/width of fuelbreak: 4100 feet by 100 to 150 feet.
Area: approximately 12 acres

2. Defensible Space Fuel Breaks

In order to provide adequate defensible space between the wildland areas of Covell Ranch and homes along its southwestern boundary, a series of defensible space shaded fuel break projects should be implemented, prioritized as outlined above. To be effective, this must be a cooperative project between TNC, Covell Ranch, individual property owners, and local fire agencies. Subject to the judgment and discretion of local fire officials, the goal will be to create a 100 foot wide shaded fuel break on the Covell Ranch where it adjoins existing inhabited structures. The shaded fuel break specifications outlined above should be implemented here as well.

Invasive plant species should be treated and/or removed as necessary to control and prevent spread within the defensible space area. Residential clearance activities and trespass have resulted in spread of French broom in a number of areas and so cooperation in this effort can benefit all parties. It appears that direct access to the worst infestation area east of the topmost homes at Sunbury might be obtained by working cooperatively with residents and/or the School at the end of Ashby.

The fire agencies (CalFire and Cambria CSD Fire Department) have prevention programs in place that set defensible space requirements in relation to private structures and lots along the boundary. Minimum setbacks to establish site specific clearance requirements, including proper handling of invasive species, will be developed in cooperation with the fire agencies. We recommend that fuel break work meeting the minimum requirements of PRC 4291 be conducted within the boundary of but not at the expense of Covell Ranch.

As with the Bridge Street Fuel Break, existing fencing must be reinstalled and maintained as needed to limit public access and trespass and to permit fuel break maintenance with planned livestock grazing. Occasional supplemental fuel reduction work by available CDC camp crews is also anticipated.

Total length of fuel breaks by segment from south to north as shown on Fuel Break Map:

| | |
|---|---|
| - West perimeter from Sunbury south to downtown | 5,410' |
| - Sunbury/School field east to Cemetery | 2,220' |
| - Cambria Pines north of Cemetery | 1,400' |
| Estimated Total | 9,030' |

Width: 100' measured from the property line to assure uniformity of treatment.
Area: approximately 22 acres

Notes:
• CalFire recommends that the Bridge Street and Defensible Space Fuel Breaks shown on the Covell Ranch be extended onto the neighboring larger parcel to the northwest where it adjoins residences in Cambria Pines.

• The area of this Defensible Space Fuel Break includes the Covell Ranch perimeter next to the school field area, which does not have inhabited structures, located between the residences on Sunbury and Cambria Pines.

• This Defensible Space Fuel Break does not include the Cemetery itself whose vegetative cover is already equivalent to a shaded fuel break. As a result, establishing shaded fuel break conditions adjacent to the Cemetery, where fences impede fire control and suppression activities, is a lower priority and so is listed separately below.

3. Cambria Pines Emergency Access Route

Establishment of connecting emergency access from Cambria Pines to Bridge Street as shown on the Fire Defense Roads Map would significantly improve access for fire control and evacuation during emergencies. Investigation into its feasibility is strongly recommended. An existing ranch road leads from Bridge Street toward the southern end of Cambria Pines Drive next to the Covell Ranch boundary. Because Cambria Pines Drive is a full six or more feet below the level of the ranch road at this location, establishing a functional road link with gated access for use only by emergency personnel requires careful planning to minimize grading impacts and is likely to entail official review and approval. If landowner and agency cooperation to construct such a connecting route can be achieved, however, the public safety benefits would be considerable.

4. Internal Fire Road Access and Shaded Fuel Breaks

A long term objective should be to keep existing ranch roads east of Bridge Street shown on the Fire Defense Roads Map open and clear to fire road standards. In future years as project funding becomes available, the objective should be to establish shaded fuel break conditions 20 feet on either side of these roads. Obviously the main, north-south ranch road is the highest priority. It is anticipated that such work could be accomplished with a masticator or flail mower due to the gentle slope in most areas while taking standard precautions to control invasives such as genista.

5. On-site Water Storage and Delivery

Development of long term water storage on Covell Ranch for emergency and fire protection use should be considered in a cooperative arrangement between the Ranch owner and local fire agencies. A preferred alternative would be the installation of a 10,000 to 20,000 gallon concrete tank or rainwater augmented cistern located near the end of Bridge Street by the Cemetery for easy filling access and use by fire equipment. Such facilities can be relatively inexpensive and longlasting fire protection improvements.

6. Shaded Fuel Break around the Cemetery

Because Cemetery fencing hampers access for fire suppression, establishment of a 100' wide shaded fuel break around the Cemetery perimeter is recommended to improve safe access for fire protection personnel. Although not as high a priority as fuel breaks adjacent to residences in view of relatively fire safe conditions within the Cemetery itself, continuity of shaded fuel break conditions for suppression is important and ideally would be accomplished at the same time as the Defensible Space Fuel Breaks for residences on either side.

Total length/width of fuel break: 2520 feet by 100 feet.
Area: approximately 6 acres.

TOTAL AREA OF SHADED FUEL BREAKS ON COVELL RANCH = +/- 40 ACRES

Once these fuel breaks are established and if additional funding becomes available, extend perimeter shaded fuel break treatments to the steeper slopes along the southern property line east of Bridge Street and immediately east of lower Bridge Street itself.

Monitoring, Follow-up and Adaptive Management

It is important to monitor these treatments over time so that their effectiveness, the need to revise treatment specifications, and the timing of follow-up treatments can be evaluated. Photo-point monitoring starting with a before treatment photo set is recommended as it is often both the simplest and most immediately coherent way of gauging fuel reduction results. Photo series are often used as part of fuel model assessments. Fixed photo points should be identified in the field at a specified interval such as every 500 or 1000 feet and GPSed if possible. Treatment monitoring is recommended annually for the first five years and additional treatments prescribed as necessary. Maintenance of fuel break conditions by grazing appears entirely feasible but should only be done under the guidance of a qualified range manager.

These treatments should be considered a critical first step in improving forest conditions by active management. In reviewing current forest conditions, it is clear that all of the treatments outlined in the Cambria Forest Management Plan could and should be tried on a site specific basis to improve forest conditions. While it appears that the combination of economic realities and regulatory constraints will prevent more widespread management in the near term, any measures that might facilitate utilization of materials and active management in an environmentally appropriate manner should be encouraged by agencies and the public alike. Ongoing monitoring of forest conditions and scientific research into applied management and its effects should be similarly encouraged.

## Conclusion

Although pine regeneration has been documented over the last more than twenty years to be relatively abundant, the need to enhance the health and safety of the native Monterey pine forests of Cambria through active management has been recognized in every study and document

reviewed in preparing this plan. The Cambria Forest Management Plan (2002) is explicit that its goals of improving forest health, maintaining biological diversity, reducing hazards to life and property, and maintaining and enhancing the aesthetic values of the forest are interrelated and can best be achieved by sensitive implementation of the variety of management measures listed in the plan.

Although forest-wide management activities are warranted, practical considerations require focusing the first treatments next to downtown and adjacent residential areas where forest health and aesthetic improvements from management will also significantly improve community safety and well being. Except where obvious hazard trees should be removed, the treatments prescribed in this plan will affect only the density and distribution of understory vegetation and dead material. As a result, implementing operations following detailed guidelines will be of limited scope and can be undertaken relatively quickly and with minimal impacts. The shaded fuel break prescriptions in this plan are entirely consistent with the understory fuels treatment recommendations and techniques in the Cambria Forest Management Plan and will affect less than 5% of the Monterey pine forest on the Covell Ranch. The conditions created within the shaded fuel breaks will more closely resemble the more open understory conditions typical of a more natural fire regime of periodic ground fires and leave the existing overstory intact, creating desirable diversity rather than fragmentation. Treatment projects will of course be subject to appropriate environmental and regulatory review and community notice.

**References**

Agee, J.K., B. Bahro, M. A. Finney, P.N. Omi, D. Sapsis, C.N. Skinner, J.W. vanWagtendonk, and C.P. Weatherspoon. 2000. The Use of Fuelbreaks in Landscape Fire Management. Fire Ecology and Management. Vol. 127. pp 55-66.

Barbour, M. T. Keeler-Wolf, and A. Schoenherr, Eds. 2007. Terrestrial Vegetation of California, 3rd Edition. University of California Press. Pages 509-516.

Bohlman, D. 2004. Monterey Pine Forest Shaded Fuel Break Project in Cambria. Unpubl. Draft to Monterey Pine Forest Ecology Cooperative.

Chorover, J. and J. Mc Bride. 1987.Structure and Function of Monterey Pine Forest at Cambria, California. The Nature Conservancy.

Gray, George. 2010. Point Lobos Fire Management Plan. Calif. Dept of Parks and Recreation, unpubl. draft.

Green, L.R. 1977. Fuelbreaks and other fuel modification for wildland fire control. USDA Agr. Hdbk.499.

Greenlee, J. and W. Ruskin. 1983. Photographic Key to Fuel Types and Fire Behavior in Big Basin Redwoods State Park. Cal. Parks and Rec. Unpl.

Langford, J. 2000. Easement Documentation Report, The Cambria Coast Ranch (The C.T. Ranch). Prepared for The Nature Conservancy.

Pebble Beach Community Services District. 2009. Fire Defense Plan for Pebble Beach.

Reid, R. and G. Wilson. 1985. Agroforestry in Australia and New Zealand. Goodard and Dobson.

Schmidt, Dave. 2010. Potential Wildfire Behavior Covell Ranch, Cambria, California. The Nature Conservancy.

Smith. S. and M. DeLasaux. 1990. CT Ranch Forest Management Plan. Prepared for CT Ranch, Inc.

Soil Conservation Service. 1984. Soil Survey of San Luis Obispo County, California. United States Department of Agriculture.

**Covell Ranch Sensitive Plant Species per Langford, 2000.**

| Species | Taxa | Status |
|---|---|---|
| Hickman's onion | *Allium hickmanii* | CNPS 1B,C1 |
| La Cruz manzanita | *Arctostaphylos cruzensis* | CNPS 1B, C2 |
| Hearst's manzanita | *Arctostaphylos hookeri ssp. hearstitorum* | CNPS1B,CE |
| San Simeon baccharis | *Baccharis plummerae ssp. glabrata* | CNPS 1B |
| Dwarf goldenstar | *Bloomeria humilis* | CNPS 1B,C2 |
| Arroyo de la Cruz mariposa lily | *Calochortus clavatus ssp. recurvifolius* | CNPS 1B, C2 |
| San Luis Obispo sedge | *Carex obispoensis* | CNPS 1B |
| Hearst's ceanothus | *Ceanothus hearstiorum* | CNPS 1B, C2 |
| Maritime ceanothus | *Ceanothus maritimus* | CNPS 1B, C2 |
| Chorro bog thistle | *Cirsium fontinal var. obispoensisi* | CNPS 1B, CE/FE |
| Compact cobwebby thistle | *Cirsium occidentale var. compactum* | CNPS 1B,C2 |
| Monterey spineflower | *Chorizanthe pungens var. pungens* | CNPS 1B, CT |
| Branching beach star | *Corethorgyne leucophylla* | CNPS 4 |
| Saint's daisy | *Erigeron sanctarum* | CNPS 4 |
| Small leaved lomatium | *Lomatium parviflorum* | CNPS 4 |
| Santa Lucia bush mallow | *Malacothamnus palmeri var. palmeri* | CNPS 4 |
| Dudley's lousewort | *Pedicularis dudleyi* | CNPS 1B, C2 |
| Gairdner's yampah | *Perideridia gairdneri* | CNPS 4 |
| Monterey pine | *Pinus radiata* | CNPS 1B, C2 |
| Hoffman's sanicle | *Sanicula hoffmannii* | CNPS 4 |
| Adobe sanicle | *Sanicula maritima* | CNPS 1B, C2 |
| Cook's triteleia | *Triteleia ixioides ssp. cookii* | CNPS 4 |
| | | |

Status: CNPS 1B: Plants rare, threatened or endangered in California or elsewhere
CNPS 4: Plants of limited distribution
CE: State listed, endangered
CT: State listed threatened
FE: Federally listed endangered
C1: Enough data are on file to support federal listing
C2 : Threat and/or distribution data are insufficient to support federal listing

## Guidelines for Genista Control Treatments by Hand Crews and for Hand Crew and Masticator Operations for Fuel Reduction

Genista Treatment Guidelines for Hand Crews:

To minimize spread of invasive species and impacts of masticator operations, crews should treat by hand fuel break areas containing genista (French broom) and large downed wood prior to using a masticator for fuel reduction.

- At commencement of crew work, have a genista control methods meeting with crew and captain to agree on seasonally and locationally appropriate methods of genista control. The general treatment keys are:

  - Pull plants when soil is damp enough and removal will not create erosion. Cut plants just above soil when soils are dry or uprooting too disruptive.

  - Plants without seedheads can and should be left on site. Smaller plants should be placed in contact with the ground and perpendicular to the fall line of the slope as much as possible without covering desirable understory plants. Larger concentrations or sizes of broom without seedheads should be piled and lopped.

  - Plants with seedheads should be segregated from all other material and removed from the site if possible. Under no circumstances should they be chipped and broadcast on site. If seedheaded plants cannot be removed from the site, they should be concentrated in a relatively small number of piles and lopped on site. This will concentrate the seed and make subsequent control much easier.

  - Ideally, follow-up chemical treatment will control subsequent sprouting and seedling growth.

Large Woody Debris Treatment Guidelines for Hand Crews:

Chainsaw large and/or long downed wood/fallen trees only as necessary to facilitate masticator access wherever masticators will be used. While providing only necessary access, preserve the longest lengths of tree boles possible (largely in contact with the ground) as this provides the greatest ecological function and benefit.

- Crew supervisors should coordinate this activity to prevent excessive chainsawing or cutting into firewood rounds. The objective is simply to allow the masticator to move through areas of downed wood by cutting openings in logs/trees that the masticator can push through without piling up material or unduly damaging retained vegetation. Single logs/trees that a masticator can maneuver around do not need to be cut at all. As with pruning, try to assure good access for masticating while sawing as little as possible. Hence, supervisor involvement to educate and make judgment calls during operations.

- Look to cut woody plants, principally oaks, pine regen, smaller down wood, and toyon, growing adjacent cut log pieces that will be pushed into or over for access by the masticator.

- Break up dense jackpots of tree falls too large for a masticator to treat or maneuver around.

Masticator Guidelines:

- A masticator should not be used when soils are wet or when soil compaction impacts might become significant.

- Equipment should be tracked and exert low ground pressure as measured in pounds per square inch (psi) for such equipment.

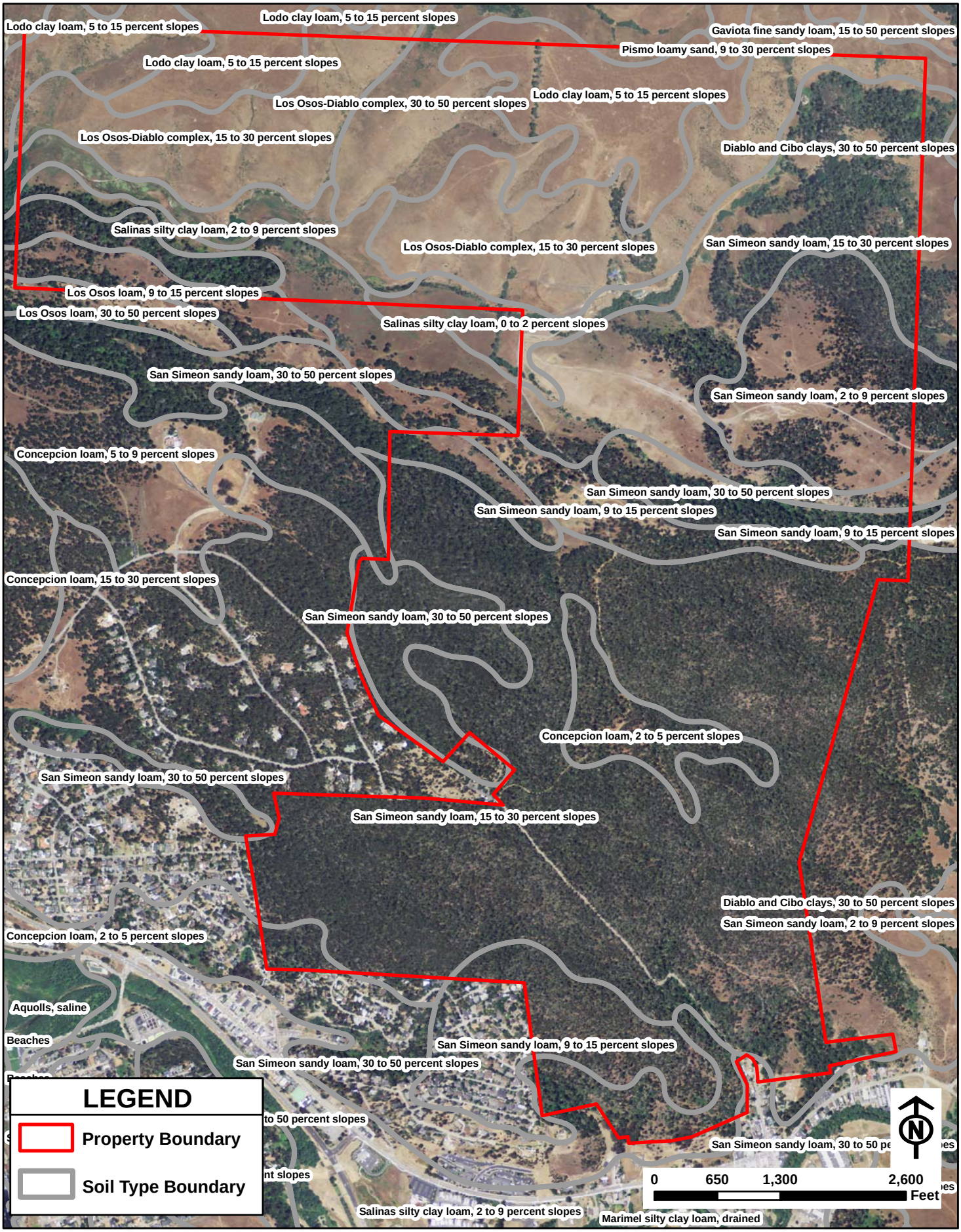
- Equipment should minimize soil disturbance by operating with the slope (up and down the fall line) as much as possible. Percent slope limitations generally should not exceed 30% but should be set consistent with levels of beneficial minor disturbance caused by equipment and operator capacities.

- No grading or excavation of any kind is permitted to facilitate masticator operation.

- Cutting and mulching head should be kept at or above the duff layer, never into mineral soil.

- Equipment operator should demonstrate reasonable ability to distinguish native versus invasive species and operate equipment without harming residual vegetation. Smaller understory vegetation to be retained should be flagged or otherwise marked to assist the operator.

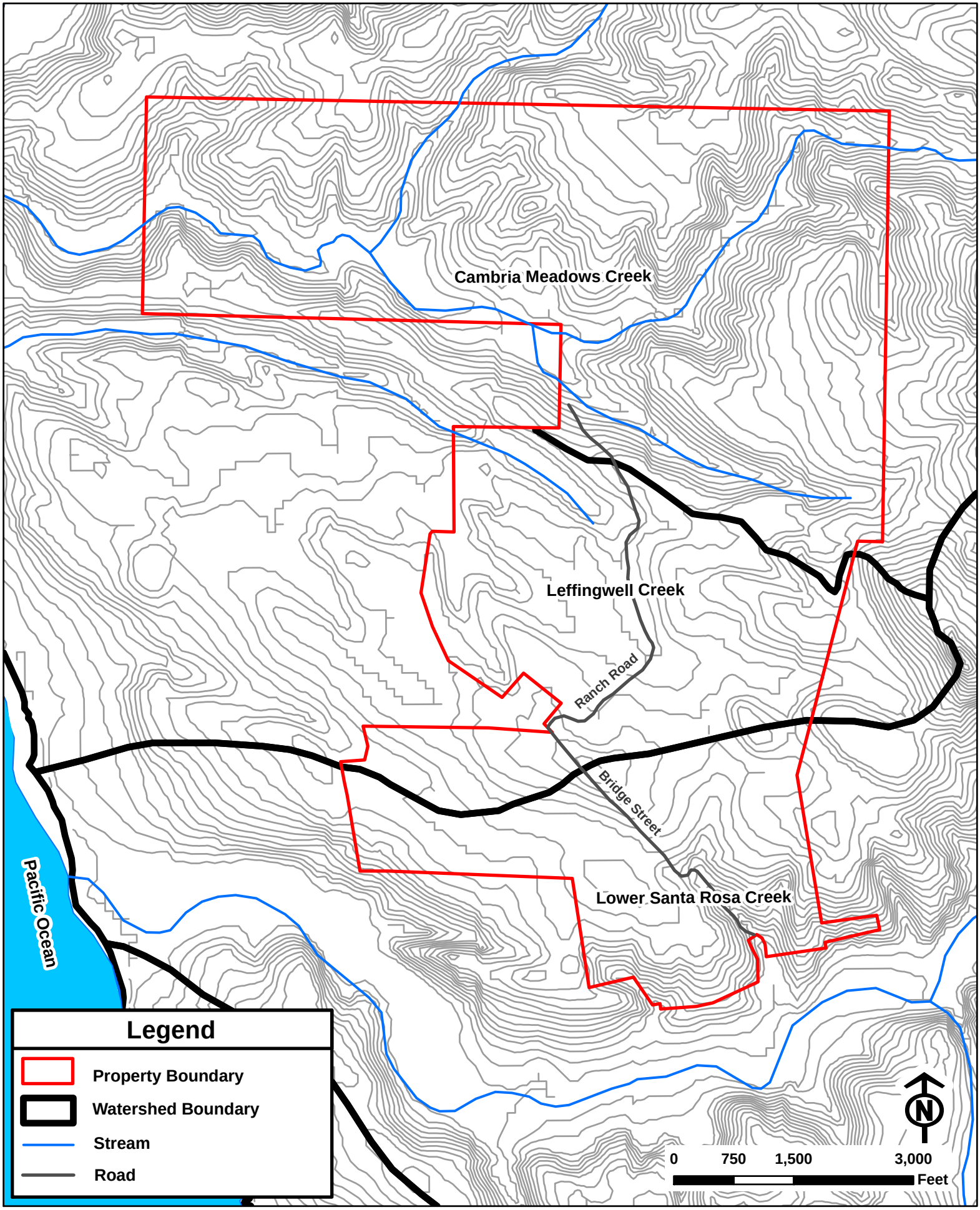
# COVELL RANCH SOILS MAP




Staub Forestry
& Environmental Consulting

FMP: Covell Ranch Conservation Easement
Date: November 5, 2010

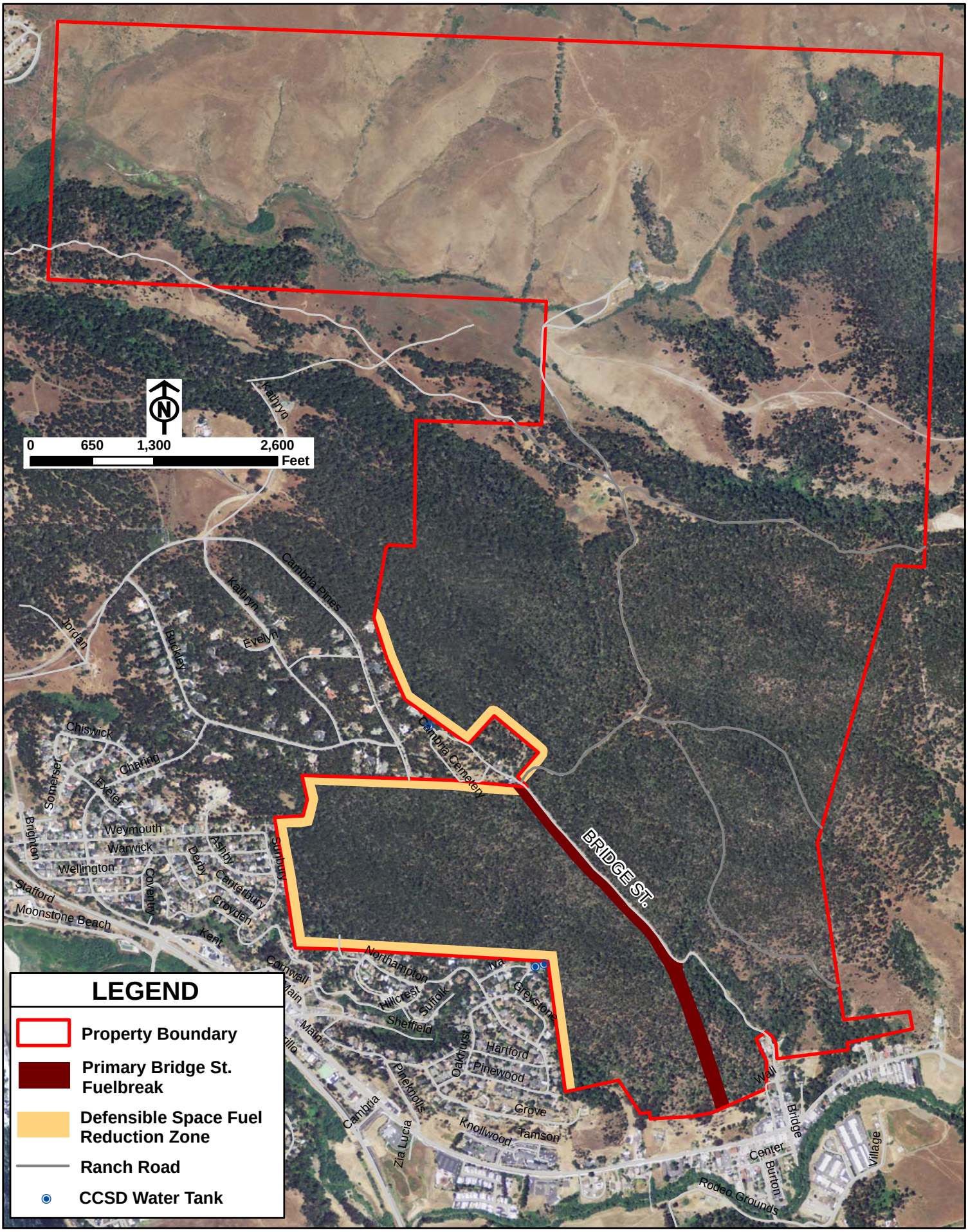
# Covell Ranch Watersheds Map




Staub Forestry &
Environmental Consulting

FMP for Covell Ranch and TNC
Date: February 22, 2011

# COVELL RANCH FUEL BREAK MAP



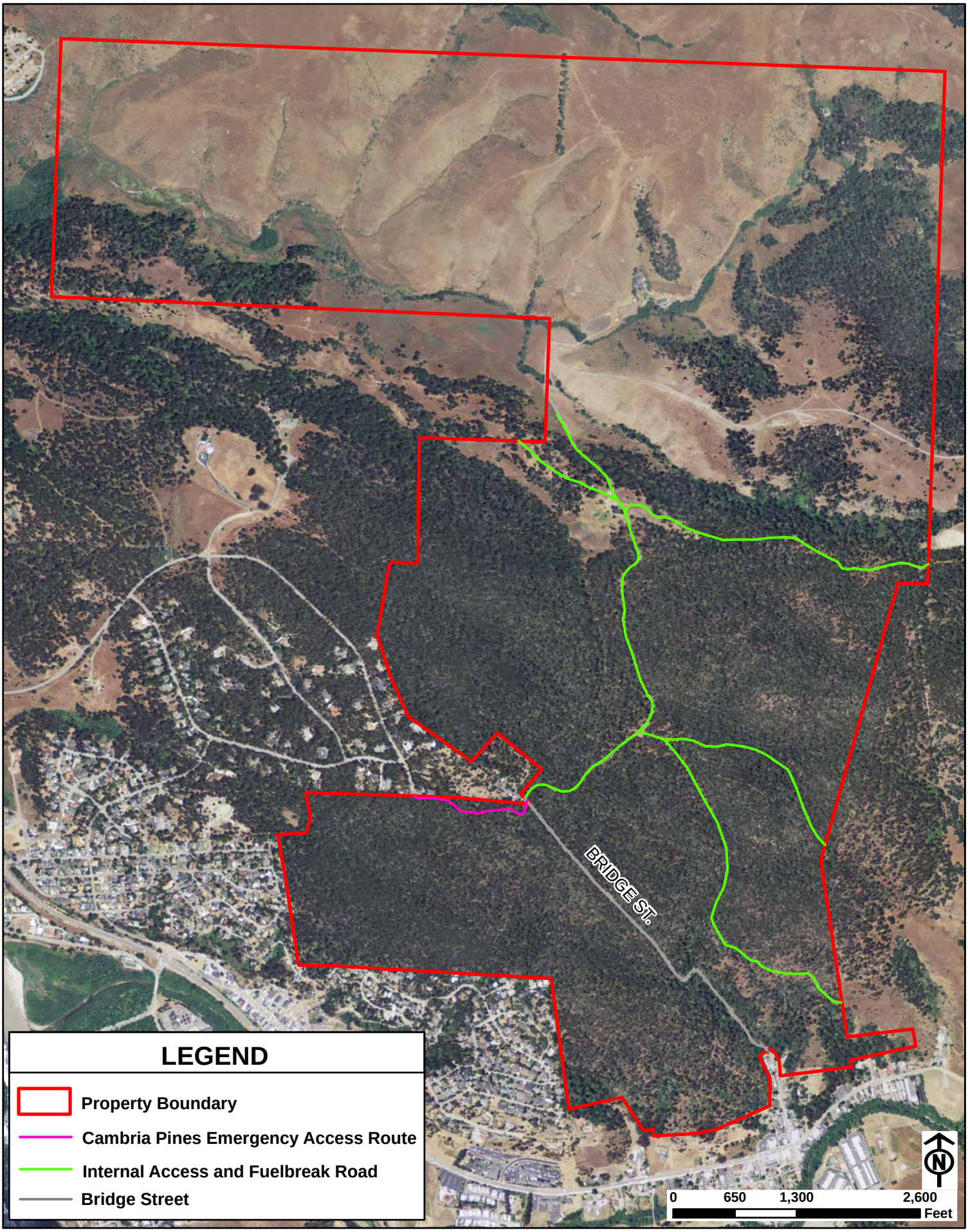

## LEGEND

- Property Boundary
- Primary Bridge St. Fuelbreak
- Defensible Space Fuel Reduction Zone
- Ranch Road
- CCSD Water Tank

Staub Forestry
& Environmental Consulting

FMP for Covell Ranch and TNC
Date: February 22, 2011

# COVELL RANCH FIRE DEFENSE ROAD MAP




Staub Forestry
& Environmental Consulting

FMP: Covell Ranch Conservation Easement
Date: November 5, 2010