Rim Fire Recovery

Fire and
Fuels Report

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INTRODUCTION

This report addresses the issues and opportunities for Fire and Fuels Management within the Rim Fire Recovery Project.

The Rim Fire started on August 17, 2013 in a remote area of the Stanislaus National Forest near the confluence of the Clavey and Tuolumne Rivers about 20 miles east of Sonora, California. Over the next several weeks it burned 257,314 acres, including 178,419 acres of National Forest System (NFS) lands and intermixed private lands. The remaining 78,895 acres are located within Yosemite National Park.

Fuel levels, risk of injury, and damage from wildfires are components of the Purpose and Need for the Rim Fire Recovery. Bringing fuel load levels and fuel arrangement to conditions that reduce the likelihood of stand-replacement fire in regenerated stands, particularly during early stages of stand development will promote the long term survival and growth of new conifers. .Predicted increases in fire hazard in the high-severity areas of the fire could be mitigated by salvage logging or by otherwise removing fire-killed trees or slash. Because the primary cause of high fire hazard in these areas is the slash fuel developing as fire-killed trees fall, removal of this heavy fuel load would prevent the predicted increase in fire hazard in these areas (Greenlee and Greenlee 2002).

Affected Environment

In many places in the western United States, organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires. Fuels buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fires result in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires. Uncharacteristically high fuel levels create the potential for fires that are uncharacteristically intense (Franklin and Agee 2003).

Fire risk is elevated in areas of human development, high-recreational use and along major roads. There is a need to reduce fuel loadings to meet desired levels and reduce adverse impacts from future wildfires.

Pre-Fire Conditions

As with many areas in the Sierra Nevada, the landscape has been heavily influenced over the last 150 years by past management activities that include mining, grazing, harvesting, fire exclusion, large high-severity fires, and more recent drought-related mortality during the late 1980's and early 1990's. At the stand level, the combination of past management activities, fire exclusion, and extensive drought related mortality had created relatively homogeneous areas typified by small trees existing at high densities (Oliver et al. 1996).

These high stand densities and high fuel loads created by overstocked stands with high accumulations of ladder fuels and canopy fuels. The combination of these factors increases the potential for stand-replacing high-severity fire events which were unfortunately realized when the Rim Fire burned across the landscape.

Post Fire Conditions

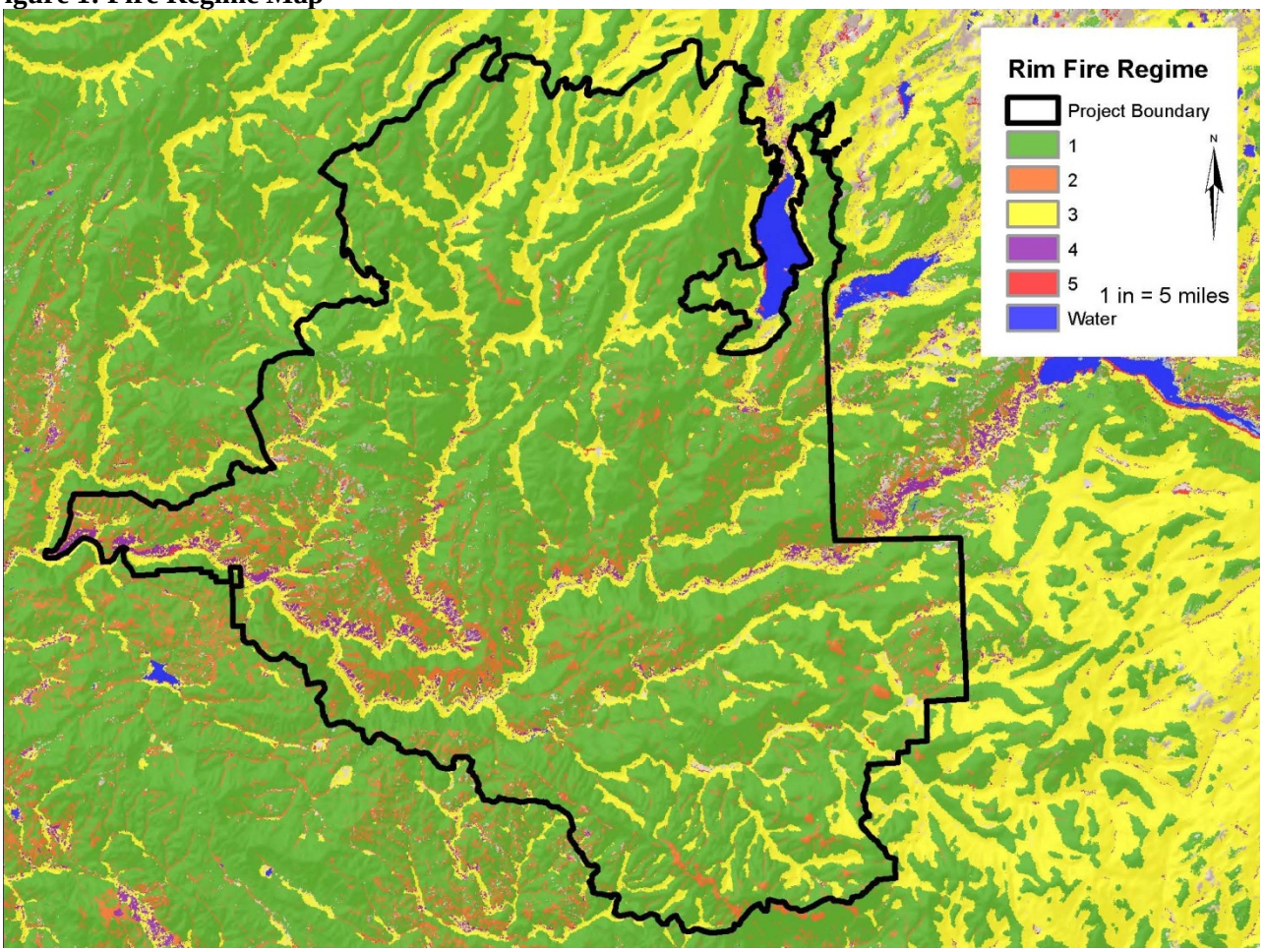
The Rim Fire burned with a range of severities. Within the approximate 257,314 acre fire area: 12, 120 acres were not burned, 50,609 acres were low severity, 87,966 acres were mixed severity, and 106,618 acres were high severity. Trees that were killed by the Rim Fire pose a hazard to the public and forest workers visiting, traveling, and working in these areas (Long 2014). As these snags age, they become less stable and increase the risk to all forest users (Ritchie et. Al. 2013). Once this material is on the ground, fire effects are likely to increase (Long et al 2010). Because of the higher fire effects and risk of hazard trees, suppression strategies will be limited.

In the high severity portions of the fire (approximately 106,618 acres) there are no surface fuels other than occasional patches of shrub, duff, and litter that remain. The standing material consists mainly of scorched trees. The patches of litter that remain will burn but there is no continuity for fire spread. Ladder fuels and the standing trees were either completely consumed or resulted in only boles remaining. These areas of the fire will not currently support a new large fire or a crown fire.

In the remainder of the burned areas (approximately 150,694 acres) the fire created a mosaic, leaving trees with brown needles and surviving trees as well as surface fuels ranging from completely consumed to pre-fire levels. Fires in this area of the project will burn as a mixed severity fire. A mixed-severity fire exhibits a wide range of effects on the dominant vegetation from little effect on soil heating or overstory vegetation to complete canopy mortality or extensive soil heating.

A fire regime is a generalized description of fire's role within an ecosystem- characterized by fire frequency, predictability, seasonality, intensity, duration, and scale (Barrett et al, 2010). These five regimes include:
I – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);
II – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
III – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);
IV – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
V – 200+ year frequency and high (stand replacement) severity

Figure 1: Fire Regime Map

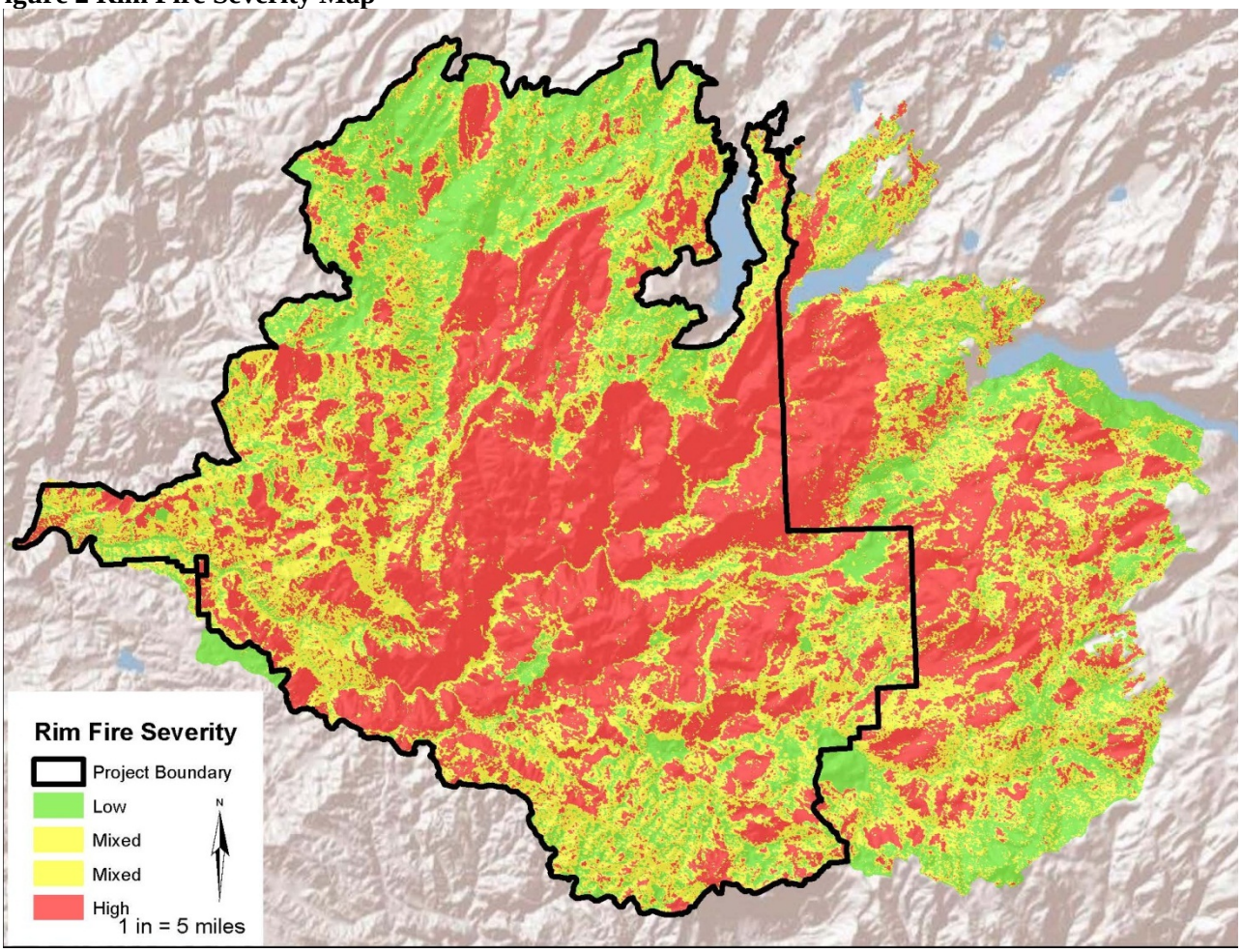


The majority of the project area is classified as Fire Regime I low and mixed severity (125,046 acres). In fire regime I areas of the project the fire severity was uncharacteristically high approximately 61,335 acres (49%) burned at high severity see table 1 below.

Table 1: Comparison of Expected Fire Severity and Actual Fire Severity Fire Regime within Project Area

Fire Regime	Fire Frequency	Fire Severity	Expected Severity Acres	Actual Fire Severity		
				Low	Mixed	High
I	0-35 years	Low to Mixed	125,046	20,588	43,123	61,335(49%)
II	0-35 years	High	14,641	1,573	5,095	7,972
III	35-100+ years	Mixed	31,079	10,709	11,482	8,888(54%)
IV	35-100+ years	High	3,095	436	1,337	1,322
V	200+ Year	High	197	82	83	32
No burn	N/A	N/A	2,710	2,710		

Figure 2 Rim Fire Severity Map



Analysis Framework

Guiding Regulations

The National Forest Management Act (NFMA) of 1976

The National Forest Management Act (NFMA) of 1976, including its amendments to the Forest and Rangeland Renewable Resources Planning Act of 1974 state that it is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans. Both acts also state "insure that timber will be harvested from national Forest System land only where – (ii) there is assurance that such lands can be adequately restocked within five years of harvest." The Forest Service has established a policy that this requirement is applied to salvage as well as to "green" timber sales. In addition, where no salvage is done, deforested lands should be reforested as quickly as practicable.

The National Fire Plan, Managing the Impacts of Wildfires on Communities and the Environment, September 8, 2000

Post-fire rehabilitation work improves lands that are unlikely to recover naturally from the effects of wildfires. This work, often implemented over the course of several years following a wildfire, includes reforestation, road and trail rehabilitation, fence replacement, fish and wildlife habitat restoration, invasive plant treatments, and replanting and reseeding with native or other desirable vegetation (NFP, 2000).

Stanislaus National Forest, *Forest Plan Direction*, April 2010

The Stanislaus National Forest "Forest Plan Direction" (USDA, 2010) presents the current Forest Plan management direction, based on the original Stanislaus National Forest Land and Resource Management Plan (USDA, 1991), as amended. The Forest Plan includes Goals, Strategies and Objectives for this project (pp. 5-7 and 11-15, USDA, 2010). Create a fire resilient forest where fire is an integral part of the system, not a landscape altering force. To sustain forests into the future, natural and prescribed fire will be an important tool to protect this area from another stand replacing event. Strategically place fuels treatments to modify wildfire effects, establish and maintain a pattern of area treatments that is effective in modifying wildfire effects. Reduce hazardous fuels in key areas to lessen the threat of high severity fire. Design economically efficient treatments to reduce hazardous fuels (pp. 191, USDA, 2010).

Forest Service Handbook, February 2011

All available methods for mitigation of danger tree hazards should be considered and applied as appropriate to local situations. These methods include but are not limited to commercial timber sales, land stewardship contracts, funds for burned area emergency rehabilitation, sales of firewood for personal use, and expenditure of appropriated funds (FSH 7709.59 sec 41.7, 2e).

- ***Forest Goal for Fire and Fuels:***

Provide a cost-effective fire management program to protect Forest resources, life and property, from the effects of wildfire. Maintain natural and activity fuels at levels commensurate with minimizing resource losses from wildfire. In wilderness, fire is allowed to play as nearly as possible its natural ecological role.

- ***Fire and Fuels Management Practices***

Smoke Management - Prescribed Fire. This practice is established for managing smoke from prescribed fire so that emissions meet applicable state and federal standards. Prescribed fire includes but is not limited to burning of timber residue, which improves wildlife habitat and range type conversion. Prescribed fires are managed by the local Air Pollution Control District (APCD) and the 1990 Clean Air Act (CAA) amendments, which require the application of Best Available Control Measures (BACMs) to reduce particulate emissions. BACMs are a combination of practices intended to reduce emissions to the lowest practicable amount. BACMs are accomplished by diluting or dispersing emissions, or by preventing potential emission sources whenever possible. Examples of BACMs include: 1) Reduction of pollutants by: limiting the mass of material burned; burning under moist fuel conditions when broadcast burning; shorten the smoldering combustion period; and increase combustion efficiency by encourage the flaming stage of fire when burning piles. 2) Dilution of pollutant concentrations over time by: reducing the rate of release of emissions per unit area; burning during optimum conditions; and coordinate daily and seasonally with other burning permittees in the area to prevent standard exceedences.

Fire Management- Fire Management includes preparing for, administering, and managing fire protection activities on wildlands within the Stanislaus National Forest. The practice of Fire Management includes but is not limited to the following types of activities: taking actions to reduce the number of human-caused fires (fire prevention), taking action to detect forest fires (fire detection), planning and implementing strategies prior to wildfire suppression (fire pre-attack), implementation of a wilderness fire program (prescribed natural fire), and suppression of wildfires (fire suppression). The objective of Fire Management activities is to respond to each wildfire ignition in a timely manner with appropriate forces at a minimum cost consistent with Land and Resource Management direction.

Fuels Management. Fuels Management includes research, inventory, planning, and implementation of the treatment of slash residue fuels created by past or current management activities (activity fuels), and or the treatment of naturally occurring fuels (natural fuels). The practice of Fuels Management includes but is not limited to the following types of activities: for example, burning (prescribed fire), re-arrangement, removal, type conversion, and fuel break construction. The objective of Fuels Management is to prepare timber harvest areas for natural or artificial regeneration, to improve range and wildlife habitat, to develop and maintain fuel profiles that contribute to the most cost efficient Fire Protection program consistent with Land and Resource Management direction.

Standards and Guidelines for Fire and Fuels

Strategically place area fuels treatments across the landscape to interrupt fire spread and achieve conditions that: 1) reduce the size and severity of wildfire and 2) result in stand densities necessary for healthy forests during drought conditions. Complete a landscape-level design of area treatment patterns prior to project-level analysis. Develop treatment patterns using a collaborative, multi-stakeholder approach. Determine the size, location, and orientation of area fuels treatments at a landscape-scale, using information about fire history, existing vegetation and fuels condition, prevailing wind direction, topography, suppression resources, attack times, and accessibility to design an effective treatment pattern. The spatial pattern of the treatments is designed to reduce rate of fire spread and fire intensity at the head of the fire.

Strategic placement of fuels treatments should also consider objectives for locating treatment areas to overlap with areas of condition class 2 and 3, high density stands, and pockets of insect and disease.

Avoid PACs to the greatest extent possible when locating area treatments. Incorporate areas that already contribute to wildfire behavior modification, including timber sales, burned areas, bodies of water, and barren ground, into the landscape treatment area pattern. Identify gaps in the landscape pattern where fire could spread at some undesired rate or direction and use treatments (including maintenance treatments and new fuels treatments) to fill identified gaps.

Vegetation within treatment areas should be modified to meet desired surface ladder, and crown fuel conditions as well as stand densities necessary for healthy forests during drought conditions. Site specific prescriptions should be designed to reduce fire intensity, rate of fire spread, crown fire potential, mortality in dominant and co-dominant trees, and tree density. Managers should consider such variables as the topographic location of the treatment area, slope steepness, predominant wind direction, and the amount and arrangement of surface, ladder, and crown fuels in developing fuels treatment prescriptions. Where young plantations (generally Pacific Southwest Region size classes 0x, 1x, 2x) are included within area treatments, apply the necessary silvicultural and fuels reduction treatments to: (1) accelerate the development of key habitat and old forest characteristics, (2) increase stand heterogeneity, (3) promote hardwoods, and (4) reduce risk of loss to wildland fire. In size class 2x plantations, treatments should be designed to reduce fire intensity, rate of fire spread and tree mortality. Design a sequence of fuel reduction projects to achieve the standards below.

Plantations (0x-2x) 3 inches and smaller surface fuel load: less than 5 tons per acre, less than 0.5 foot fuel bed depth, stocking levels that provide well-spaced tree crowns (for example, approximately 200 trees per acre in 4 inch dbh trees), less than 50% surface area with live fuels (brush), and tree mortality less than 50% of the existing stocking under 90th percentile fire weather conditions (2x type)

Design mechanical treatments in brush and shrub patches to remove the material necessary to achieve the following outcomes from wildland fire under 90th percentile fire weather conditions: (1) wildland fires would burn with an average flame length of 4 feet or less and (2) fire line production rates would be doubled. Treatments should be effective for more than 5 to 10 years. Design a sequence of fuel reduction treatments in conifer forest types (including 3x plantation types) to achieve the following standards within the treatment area: An average of 4-foot flame length under 90th percentile fire weather conditions. Surface and ladder fuels removed as needed to meet design criteria of less than 20 percent mortality in dominant and co-dominant trees under 90th percentile weather and fire behavior conditions.

Tree crowns thinned to meet design criteria of less than 20%probability of initiation of crown fire under 90th percentile weather conditions.

Activity Fuels

All management activities which generate woody residues will have an approved fuel treatment project plan. This plan will describe the methods of treatment to be used, the estimated total cost of treatment, method of funding, responsible parties to complete treatment, and necessary measures to maintain the acceptable fuel profile.

The scope of the plan should encompass the overall area affected by the activity and not be limited to each individual unit. The fuel treatments identified will meet the minimum level of treatment as described in the standards and guidelines.
The fuel bed will be expressed in terms of Resistance-to-Control (chains/person-hour handling construction rate) and Fire Intensity Levels (FIL)
Treat Fuel According to Following Priorities:

1. All current and proposed management activities expected to generate woody re residues.

Mechanical Thinning Treatments

For all mechanical thinning treatments2, design projects to retain all live conifers 30 inches dbh or larger. Exceptions are allowed to meet needs for equipment operability. For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside WUI defense zones:

- Design projects to retain at least 40 percent of the existing basal area. The retained basal area should generally be comprised of the largest trees.
- Where available, design projects to retain 5 percent or more of the total treatment area in lower layers composed of trees 6 to 24 inches dbh within the treatment unit.
- Design projects to avoid reducing pre-existing canopy cover by more than 30 percent within the treatment unit. Percent is measured in absolute terms (for example, canopy cover at 80 percent should not be reduced below 50 percent.)
- Within treatment units, at a minimum, the intent is to provide for an effective fuels treatment. Where existing vegetative conditions are at or near 40 percent canopy cover, projects are to be designed remove the material necessary to meet fire and fuels objectives.
- **Within California spotted owl Home Range Core Areas**: Where existing vegetative conditions permit, design projects to retain at least 50 percent canopy cover averaged within the treatment unit. Exceptions are allowed in limited situations where additional trees must be removed to adequately reduce ladder fuels, provide sufficient spacing for equipment operations, or minimize re-entry. Where 50 percent canopy cover retention cannot be met for reasons described above, retain at least 40 percent canopy cover averaged within the treatment unit.
- **Outside of California spotted owl Home Range Core Areas**: Where existing vegetative conditions permit, design projects to retain at least 50 percent canopy cover within the treatment unit. Exceptions are allowed where project objectives require additional canopy modification (such as the need to adequately reduce ladder fuels, provide for safe and efficient equipment operations, minimize re-entry, design cost efficient treatments, and/or significantly reduce stand density.) Where canopy cover must be reduced below 50 percent, retain at least 40 percent canopy cover averaged within the treatment unit.
- **Within California spotted owl PACs**: where treatment is necessary, remove only material needed to meet project fuels objectives. Focus on removal of surface and ladder fuels.

Salvage

Determine the need for ecosystem restoration projects following large, catastrophic disturbance events (wildfire, drought, insect and disease infestation, windstorm, and other unforeseen events). Objectives for

restoration projects may include limiting fuel loads over the long term, restoring habitat, and recovering economic value from dead and dying trees. In accomplishing restoration goals, long-term objectives are balanced with the objective of reducing hazardous fuel loads in the short-term. Salvage harvest of dead and dying trees may be conducted to recover the economic value of this material and to support objectives for reducing hazardous fuels, improving forest health, re-introducing fire, and/or re-establishing forested conditions.

- Design projects to reduce potential soil erosion and the loss of soil productivity caused by loss of vegetation and ground cover. Examples are activities that would: (1) provide for adequate soil cover in the short term; (2) accelerate the dispersal of coarse woody debris; (3) reduce the potential impacts of the fire on water quality; and (4) carefully plan restoration/salvage activities to minimize additional short-term effects.
- Design projects to protect and maintain critical wildlife habitat. Examples are activities that would: (1) avoid areas where forest vegetation is still largely intact; (2) provide for sufficient quantities of large snags; (3) maintain existing large woody material as needed; (4) provide for additional large woody material and ground cover as needed; (5) accelerate development of mature forest habitat through reforestation and other cultural means; and (6) provide for a mix of seral stages over time.
- Design projects to manage the development of fuel profiles over time. Examples are activities that would: (1) remove sufficient standing and activity generated material to balance short-term and longterm surface fuel loading; and (2) protect remnant old forest structure (surviving large trees, snags, and large logs) from high severity re-burns or other severe disturbance events in the future.
- Design projects to recover the value of timber killed or severely injured by the disturbance. Examples are activities that would: (1) conduct timber salvage harvest in a timely manner to minimize value local managers determine is not needed for long-term resource recovery needs.

In post fire restoration projects for large catastrophic fires (contiguous blocks of moderate to high fire lethality of 1,000 acres or more), generally do not conduct salvage harvest in at least 10 percent of the total area affected by fire. Use the best available information for identifying dead and dying trees for salvage purposes as developed by the Pacific Southwest Region Forest Health Protection Staff.

Outside of WUI defense zones, salvage harvests are prohibited in PACs and known den sites unless a biological evaluation determines that the areas proposed for harvest are rendered unsuitable for the purpose they were intended by a catastrophic stand-replacing event. Consider ecological benefits of retaining small patches of mortality in old forest emphasis areas.

Fuelbreak Construction and Maintenance

Use fuel breaks to break up large expanses of continuous fuels, provide for firefighter access and safety, increase suppression opportunities, and provide pre-existing control points for prescribed fires.
Priority setting for establishing Fuel Break Construction and Maintenance projects will consider the following factors:
1. Forest Service administrative sites or other Forest Service areas with high investment in buildings and facilities.
2. Areas that have high resource, economic, scenic, or historic value that cannot be replaced.
3. Protection of high value forest resource areas from high risk ignitions areas.

Plantation Design and Fire Protection Planning

Fuel treatment and protection planning are incorporated into reforestation project plans for the establishment of plantations. The fuel treatment planning will comply with the standards set in the Activity Fuel Standards and Guidelines while still maintaining the productivity of the site. Minimum levels of protection planning are established in the following Standards and Guidelines

Prescribed Fire and Prescribed Natural Fire

Prescribed fire will be considered as a management tool for all projects where it is shown to be cost effective and has the ability to meet resource management objectives.

Roadside Fuel Modification

To create a roadside fuel profile which will:
1. Limit the spread and intensity of roadside ignitions until initial attack units arrive.
2. Provide firefighter access to other fire defense systems.
3. Provide a line of defense for control of wildfire.

Methodology

Geographic Area Evaluated for Impacts

The Rim Fire Recovery Project treatment units are defined as the units where timber salvage harvest and fuels reduction treatments would occur as described by alternative under chapter 2 of the draft EIS. The direct and indirect effects analysis area is defined as the 176,768 acre project area where the Rim Fire burned not including Yosemite National Park. The analysis area is located in predominately Mediterranean California Mesic mixed conifer forest ranging in elevation from approximately 2,800 feet to 7,100 feet.

The analysis area is based on 1) acres burned in a distinct geographic area and administrative setting; 2) impacts to forest vegetation from the wildfire and subsequent effects of timber salvage harvest within the burned area; and 3) forest vegetation within the project area representing the furthest measurable extent that effects on forest vegetation and fuels would occur as a result of implementing any of the proposed alternatives. Ecologically, the dynamics between vegetation and fire and fuels are inherently linked; fire has a profound effect on vegetation establishment and development and conversely, vegetation treatments (and the absence thereof) have a profound effect on fuels accumulations and fire effects.

The direct, indirect, and cumulative effects analyses are based on a temporal scale. Documented past projects, including timber harvesting, wildfires, watershed improvements, and other activities described in Appendix B: Past, Present, and Reasonably Foreseeable Future Actions of the draft EIS were considered past actions within the analysis area. This vegetation structure and composition includes attributes of the current landscape including existing vegetation types, fuel treatments, burned areas, past sanitation harvest, and plantations.

For the purpose of the vegetation, fire, and fuels analysis, the temporal bounds include a 20-year horizon for future direct, indirect, and cumulative effects because modeling indicates that within 20 years, fuels profiles change dramatically after fire and extends beyond the fire return intervals for the project area.

The effects on fire behavior and fire suppression capability for each alternative will be analyzed. Fire effects will be demonstrated using Flame Length and Fireline Intensity based on Fuel models. Fuel models are described by the volume of 1-hr, 10-hr, 100-hr, and 1000-hr (CWD) dead fuels, herbaceous and woody live fuels as well as the fuel bed depth and moisture of extinction.

Fuel loadings, which include coarse woody debris, will be represented by fuel models for the project area. Coarse Woody Debris (CWD) is defined as having a minimum diameter (or an equivalent cross section) of 3” at the widest point and includes sound and rotting logs, standing snags, stumps, and large branches (located above the soil) (Enrong et. Al.; 2006; Harmon et al 1986). CWD is a 1,000 hour dead fuel. Fuel

conditions resulting from the alternatives will have associated effects on fire effects including potential fire intensity. The effect that a fire may have on resources depends on fire intensity and the conditions of the environment, including vegetation in which it burns.

The cumulative effects analysis area boundary for fuels is the 257,314 acre Rim Fire perimeter. Analysis for this project is done on an individual treatment unit basis, however, when treatments are concentrated in an area there are additive effects. Treated areas in this project along with past and reasonably foreseeable treatments in the vicinity of the project area will be analyzed.

Measurement Indicators

The effects of treatment on fuels, potential fire effects, and air quality are evaluated for each alternative.

Predicted fire effects: The predicted length of flame measured in feet and the predicted fireline intensity measured in BTU per foot per second at the head of the fire. Increased flame lengths can increase the likelihood of torching events and crown fires. Flame length is influenced in part by fuel type, fuel arrangement, fuel moisture, and weather conditions. Fuel type, flame length, and fireline intensity influence production rates, or how fast firelines can be constructed by different suppression resources, including hand crews and mechanical equipment. Flame lengths over 4 feet and/or fireline intensities over 100 BTU/FT/sec. may present serious control problems—they are too dangerous to be directly contained by hand crews (Schlobohm and Brain 2002; Andrews and Rothermel 1982). Flame lengths over 8 feet and/or fireline intensities over 500 BTU/FT/sec. are generally not controllable by ground-based equipment or aerial retardant and present serious control problems including torching, crowning, and spotting.

Predicting the potential behavior and effects of wildland fire is an essential task in fire management. Mathematical surface fire effects and fire effects models and prediction systems are driven in part by fuelbed inputs such as load, bulk density, fuel particle size, heat content, and moisture of extinction. To facilitate use in models and systems, fuelbed inputs have been formulated into fuel models (Scott and Burgan 2005). Table 2 below displays lists of fuel models that are or can be expected to be in the project area over the next 20 years.

Table 2: Fuel Models

Fuel Model	Description	Predicted Flame Length (Feet)	Fireline Intensity (BTU/FT/second)
NB9	Bare Ground	0	0
GR1	Short Grass Low Load	0-3	45
GR2	Short Grass Moderate Load	1-8	300
GS2	Grass and Shrub	4-8	500
SH1	Low Load Shrub	0-1	125
SH2	Moderate Load Shrub	1-4	400
SH5	High Load Shrub	12-25	3700
TU1	Low Load Dry Climate Timber-Grass-Shrub	1-4	80
TL1	Recently Burned	0-1	5
TL2	Low Load Broadleaf Litter	0-1	7
TL4	Small Down Log	1-4	25
TL5	High Load Conifer Litter	1-4	50
TL7	Large Down Logs	1-4	50
TL8	Timber Litter	1-4	150
SB4	Blowdown with brush and small tree intermixed	12-25	3000

FlamMap (Finney, M. A. 2006.) is designed to examine the spatial variability in fire effects assuming that fuel moisture, wind speed and wind direction are held constant in time thereby allowing for more direct comparison of fuel treatment effects. FlamMap's features allow the user to easily characterize fuel hazard and potential fire effects, as well as investigate fire movement and fuel treatment interactions. The fuel models that are used in this analysis are from publication, Scott and Burgan 2005. Fuel models used are estimates of what the fuel loading and fire effects are currently and what is predicted in the future. The results of the calculations and estimates are intended to show trends and potential effects and are not statistically accurate.

Fire effects modeling uses input variables to calculate fire effects. The three primary variables are fuels, topography and weather. Because fuels are the primary variable that management activity can influence it will be the variable for this analysis.

Analysis Methods

Fuels profiles were gathered and analyzed using representative 1/50th acre plots throughout the project area. The data was used to develop FVS runs that compared current fuel loading to future conditions. In some portions of the project area where FVS runs exhibited a high standard of deviation; additional plots were sampled to produce a more representative fuels profile. These data were used in the following analysis, data tables, graphs, and charts and are incorporated by reference.

The FlamMap modeling system will be used to display the estimated average fire effects for each alternative. Flame length, fireline intensities, and resistance-to-control will be used to measure the effects of all alternatives. Table 3 below outlines how flame lengths and fireline intensities influence fire suppression actions (Andrews et al 2011).

Table 3: Relationship of Surface Fire Flame Length and Fireline Intensity to Suppression interpretations

Flame length		**Fireline intensity**		**Interpretation**
feet	**meters**	**Btu/ft./s**	**kJ/m/s**	
< 4	< 1.2	< 100	<350	• Fires can generally be attacked at the head or flanks by persons using hand tools. • Hand line should hold the fire.
4 – 8	1.2 – 2.4	100 – 500	350 – 1700	• Fires are too intense for direct attack on the head by persons using hand tools. • Hand line cannot be relied on to hold the fire. • Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 – 11	2.4 – 3.4	500 – 1000	1700 – 3500	• Fires may present serious control problems—torching out, crowning, and spotting. • Control efforts at the fire head will probably be ineffective
> 11	> 3.4	> 1000	> 3500	• Crowning, spotting, and major fire runs are probable. • Control efforts at head of fire are ineffective.

Resistance-to-control is the relative difficulty of constructing and holding a control line as affected by resistance to line construction and fire behavior. The ratings in Table 4 were based on the assumption that few downed pieces greater than a 10-inch diameter were present. In computing the ratings, the number of large pieces (greater than 10 inch) by length class is more important than their loading in determining resistance-to-control. The more pieces greater than 10-inch diameter the less 3- to 10-inch diameter material would be required to reach the high and extreme resistance-to-control ratings (Brown et al 2003).

Table 4: Relationship of Fuel Loading to Resistance-to-Control

0-3 inch diameter (Tons Per Acre)	3-10 inch diameter (Tons per Acre)	
	High	Extreme
5	25	40
10	15	25
15	5	15

Fire Weather Discussion and Assumptions

For modeling purposes fire weather adjective defined as High (90th percentile weather) was used to predict fire effects in project area. Table 5 below displays the 90th percentile values taking from the Fire Family Plus (Main et. al., 1990) program using the Mount Elizabeth Remote Automated Weather Station during the period of April 1st, 1970 to October 31st, 2013.

Fuel moistures are the rate of change of the moisture content is dependent on the diameter of the woody fuel particle and the amount of change in environment conditions. Historically, the diameters of the woody fuel particles have been classified according to their "time lag". Time lag refers to the length of time that a particle responds to within 63.2% (1-1/e) of the new equilibrium moisture content (either drying or wetting). Larger diameter fuels generally have longer time-lags, meaning they respond more slowly to changes in environmental conditions. The time lag categories traditionally used for fire behavior and fire danger rating are specified as: 1hr, 10hr, 100hr, and 1000hr and correspond to round woody fuels in the size range of: 0-¼", ¼"-1", 1"-3", and 3"-8" (0-.635cm, 0.635-2.54cm, 2.54-7.62cm, and 7.62-20.32cm) respectively. Loadings (weight/area) of dead fuels in these size-classes are required to describe surface fuels for fire modeling (Anderson 1982).

Table 5: Weather Parameters High Conditions (90th Percentile Weather)

Parameter	**Value**
1 hour fuel moisture (0”-1/4” diameter)	4%
10 hour fuel moisture (1/4”-1” diameter)	5%
100 hour fuel moisture (1”-3” diameter)	7%
1000 hour fuel moisture (3”+ diameter, CWD)	9%
Herbaceous fuel moisture	30%
Woody fuel moisture	70%
20’ wind speed	10mph

Management Requirements

Chapters 1 and 2 of the draft EIS provide detailed information about the Management Requirements used for each alternative and were used for this analysis.

Type and Duration of Effects

Direct Effects: These are effects on forest vegetation and air quality that are directly caused by treatment implementation or, as with the No Action Alternative, a lack of treatment.

Indirect Effects: These are effects on forest vegetation and air quality that are in response to the direct effects of treatment implementation or, as with the No Action Alternative, a lack of treatment.
Duration of Effects: Direct effects would likely be limited to the project implementation phase. Indirect effects would last beyond the implementation period and occur within the temporal bound of the cumulative effect analysis described above in the Methodology section (Geographic Area Evaluated for Impacts) for forest vegetation. The air quality cumulative effects analysis boundary are described in the air quality section of the report.

Environmental Consequences

No Action Alternative

Under Alternative 2, no actions would be implemented to address the objectives and desired conditions identified in the purpose and need sections in chapter 1 of the draft EIS.

Direct and Indirect Effects

Existing stand conditions would persist and develop unaltered by active management. Standing snags would persist and the site would be rapidly colonized by grasses, forbs, and shrubs within three to five years. It is a reasonable expectation that the site would develop comparable to that of similar local fires that burned in the recent past where salvage did not occur including the Big Meadow Fire (2009), North Mountain Fire (2008), Early Fire (2004), Stanislaus Complex Fire (1987), and the Ackerson Fire (1996). On these sites, grasses such as cheat grass and shrubs such as Ceanothus (*C. cordulatus, C. velutinus*) and Manzanita (*Arctostaphylos patula*) species have occupied the site while standing snags dominate the overstory of the high severity burn areas. Shrub fuels would be established within 10 years, based on shrub regeneration observed in past fires like the Knight Fire in 2009. See Figure 3.

Figure 3. Knight Fire 2009. Photo taken in 2013

Hundreds of dead trees and very few live trees per acre characterize the forest structure. Snags have the highest fall rates in the first ten years within the smaller diameter classes, while larger snags persist for relatively longer time periods which are generally documented in existing scientific literature (Cluck and Smith 2007). Nearly all snags would be expected to fall by approximately 20 years post-fire contributing to greater fuel loads (Grennlee and Grenlee 2002. The limbs and boles from these fallen trees would accumulate as surface fuels. Over time, this fuel is expected to increase each decade as trees fall over. Within 10 years, surface fuels are projected to be 42 tons per acre. Within 30 years, surface fuels are projected to average 788 tons per acre and could reach as high as 280 tons per acre due to dead trees falling over. In the event of a wildfire this would create serious control problems, high suppression costs, and high volumes of smoke emissions. See Tables 6 below.

Additional snag recruitment would be expected through delayed mortality in the few live trees per acre. Those live trees injured during the fire may be more susceptible to biotic and abiotic agents that hasten delayed conifer mortality due to reduced tree vigor. This phenomenon is well documented in the scientific literature (Wagener 1961, Hood et al. 2007).

Both grass-forb cover and shrub cover present formidable competition for water and light with naturally established and planted seedlings. This competing vegetation would likely result in decreased survival of tree seedlings and would definitely inhibit growth for years if not decades. Consequently, the site would likely be occupied by brush intermixed with grass and forbs. Over time, ladder and crown fuels would develop where natural regeneration was established via seed from surviving mature conifers.

Large areas of untreated burned areas would exist. Brush species and standing snags would dominate these areas, and, over time, these snags would fall resulting in a brush field with high fuel loads arranged in a jackstraw pattern.

Predicted flame lengths and fireline intensities are displayed in Table 6. Under the No Action Alternative, flame lengths exceed 4 feet after five years and are projected to exceed 10 feet within 20 years. Fireline Intensities will exceed 500 BTU/FT/sec after five years and are projected to exceed 1,000 BTU/FT/sec after ten years. Resistance-to-control would be high within the first 10 years and extreme after 20 years.These increased flame lengths, fireline intensities, and resistance-to-control are a direct result of fire burning in dead and down logs, branches, and shrubs. Fires burning in stands under 90th percentile weather conditions in the No Action Alternative are expected to result in serious control problems. Fires may be too intense for direct attack on the head by persons using hand tools. Handline may not be relied on to hold the fire. Fires may present serious control problems torching out, crowning, and spotting, and control efforts at the fire head will probably be ineffective. Under the No Action Alternative, this general trend in high flame lengths (>10 feet), corresponding high fireline intensities, and extreme resistance-to-control problems is expected to continue at least 20 years into the future.

Consequently, accessibility would limit future forest management activities due to the high cost and safety concerns. Without treatments, survival and growth of natural regeneration that does become established would likely be reduced due to competing vegetation. These sites would be dominated by brush very similar to those effects seen on public lands in the Big Meadow Fire of 2009 and observed in past fires (North Mountain Fire, 2008; Early Fire, 2004; Stanislaus Complex Fire, 1987; and the Ackerson Fire, 1996). This could effectively function as a vegetation type conversion from forest cover to brush cover for nearly a century based on observations from areas left to naturally regenerate in the Wright Creek Fire 1949. Over sixty years later, these areas support natural establishment of white fire, incense cedar, ponderosa pine, and sugar pine; however, the area is dominated by brush species and the tree cover is not sufficient to qualify as forest cover.

The No Action Alternative would lead to higher fuel loads from branches and boles of dead and down trees. Over the long term (10+ years), not implementing treatments would result in increased surface fuels. Increased surface fuels would result in increased flame lengths, higher fireline intensities, and resistance-to-control problems leading to increased firefighter and public risk, and higher costs. Historically fires in the project area were low intensity with less than 25% of the stand being killed by fire. Fire effects under the No Action Alternative would result in higher stand loss as seen in the Rim Fire, with over 50% of the stand killed. It is expected that some fires, both human and lightning caused, would continue to escape initial attack under more severe weather conditions over the next 20-30 years. These fires are expected to kill natural regeneration and residual larger trees. Overall, the No Action Alternative would not reduce potential future surface fuels or predicted fire effects

Table 6. Flame lengths and fireline intensities under No Action Alternative

No Action	Flame Length (feet)	Fireline Intensity (BTU/FT/sec)	Fireline Interpretation
Existing Condition	≤2	100	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold the fire.
Year 5	≤4	500-1,000	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
Year 10	10	>1,000	Fires may present serious control problems torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Year 20	13	>1,000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Alternative 2 combined with the high fuel loading left in Yosemite National Park would mean that wildfires would cross boundaries with little chance of containing fires under 90th percentile weather conditions. Wildfires would burn until weather conditions changed to allow effective suppression actions to take place, similar to what was observed in the Rim Fire.

Figure 4 Alternative 2 Expected Fireline Intensity one year after Rim Fire

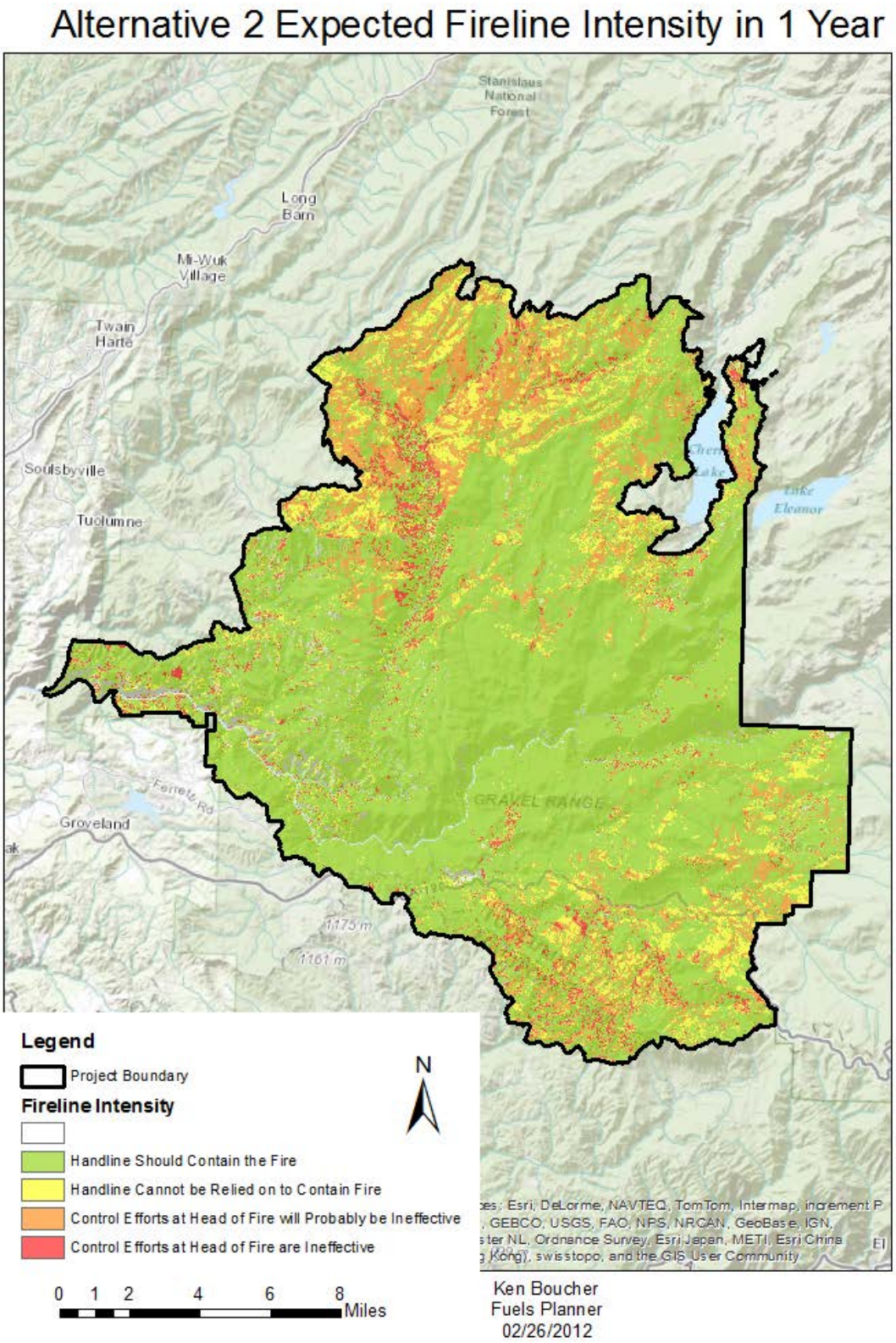


Figure 5 Alternative 2 Expected Fireline Intensity five years after Rim Fire

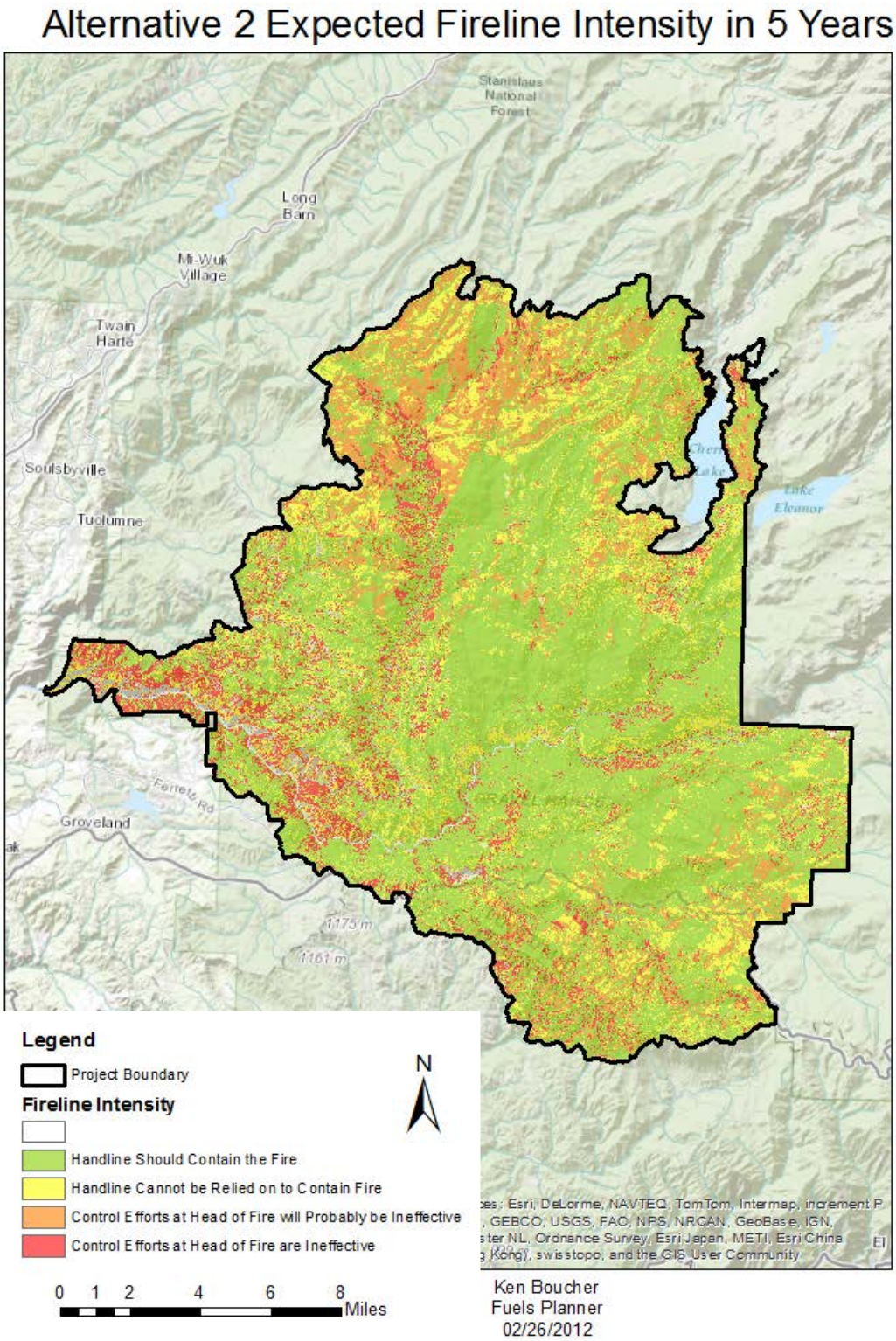


Figure 6 Alternative 2 Expected Fireline Intensity Ten years after Rim Fire

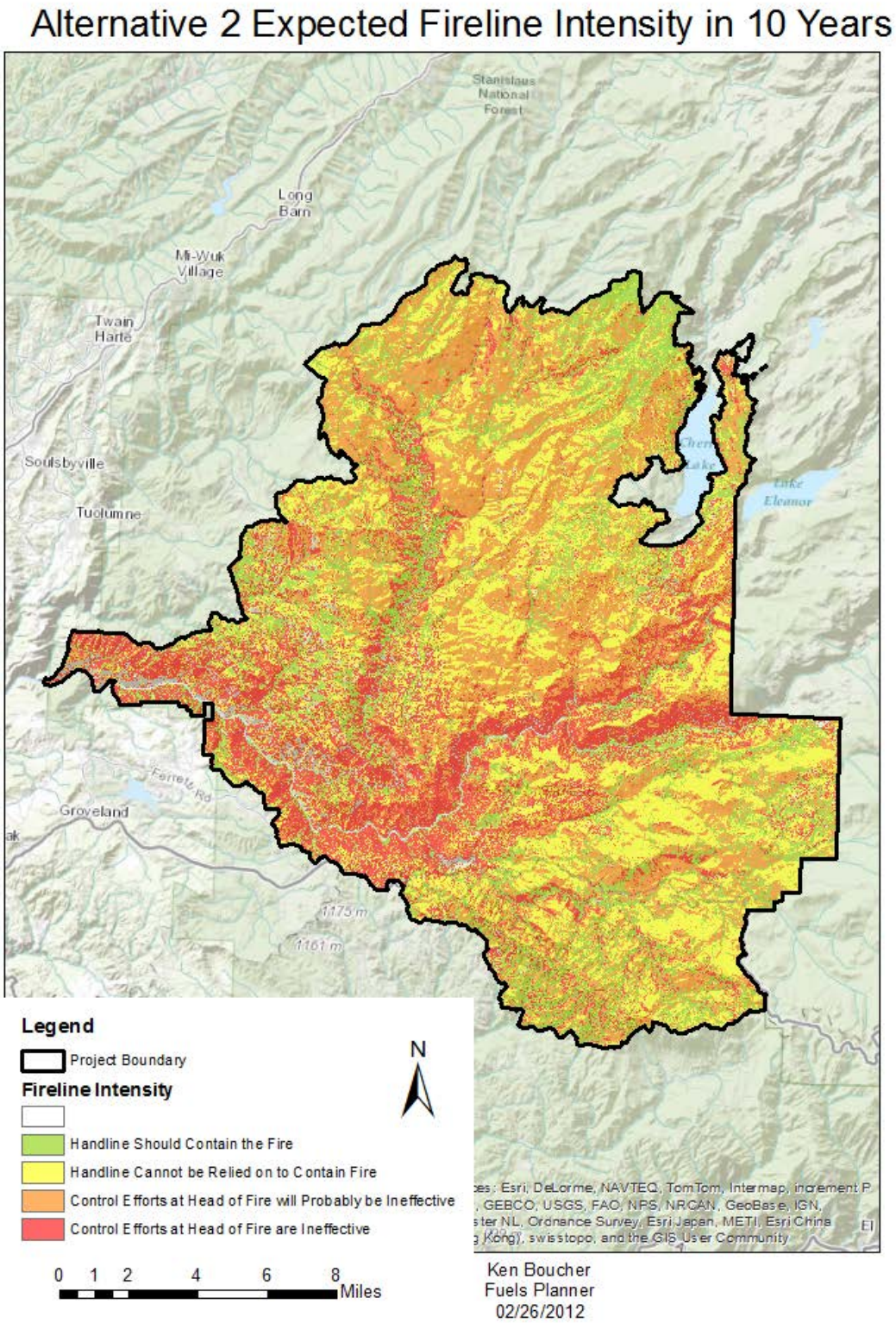


Figure 7 Alternative 2 Expected Fireline Intensity Twenty years after Rim Fire

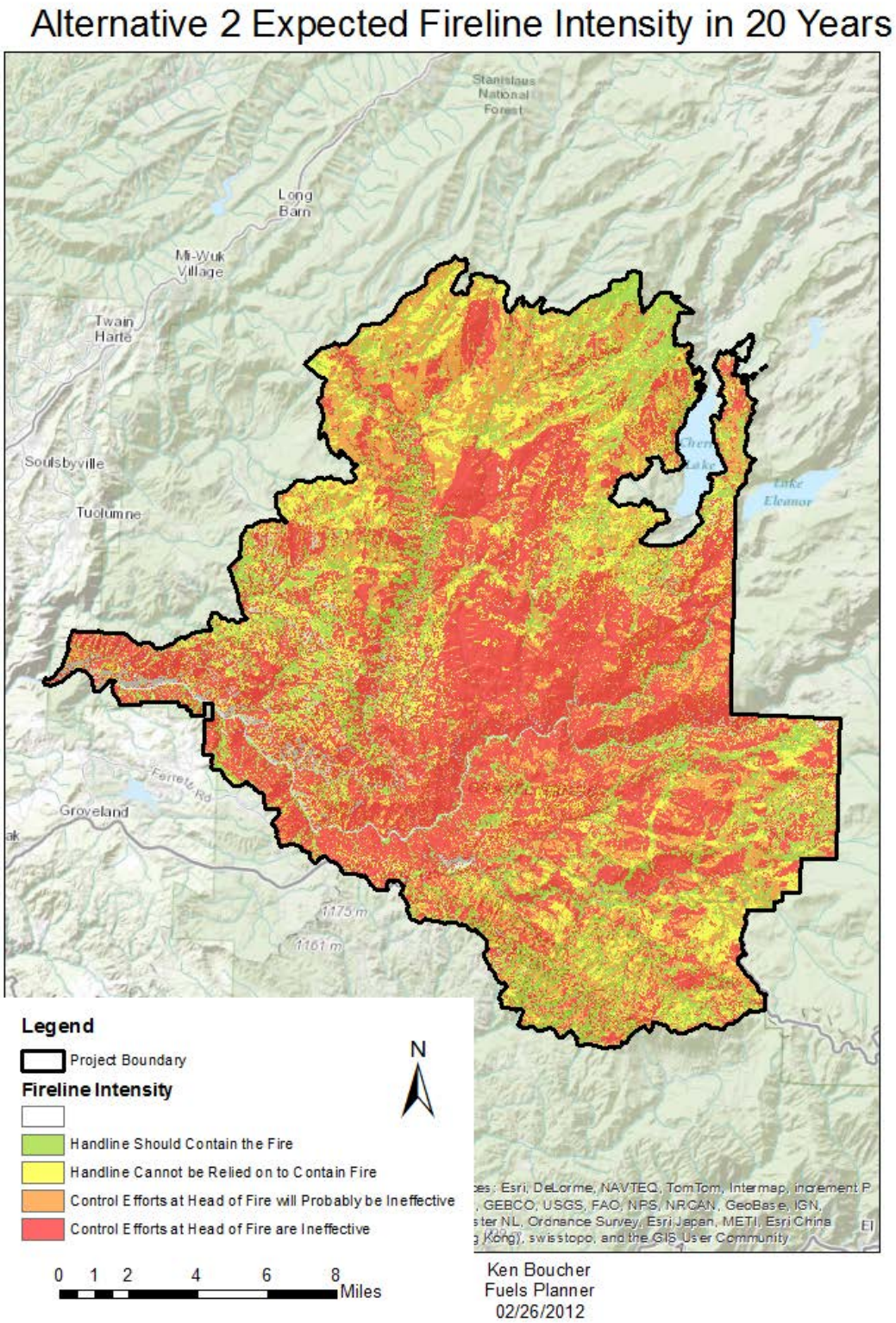


Figure 8 Alternative 2 Expected Flame Length one year after Rim Fire

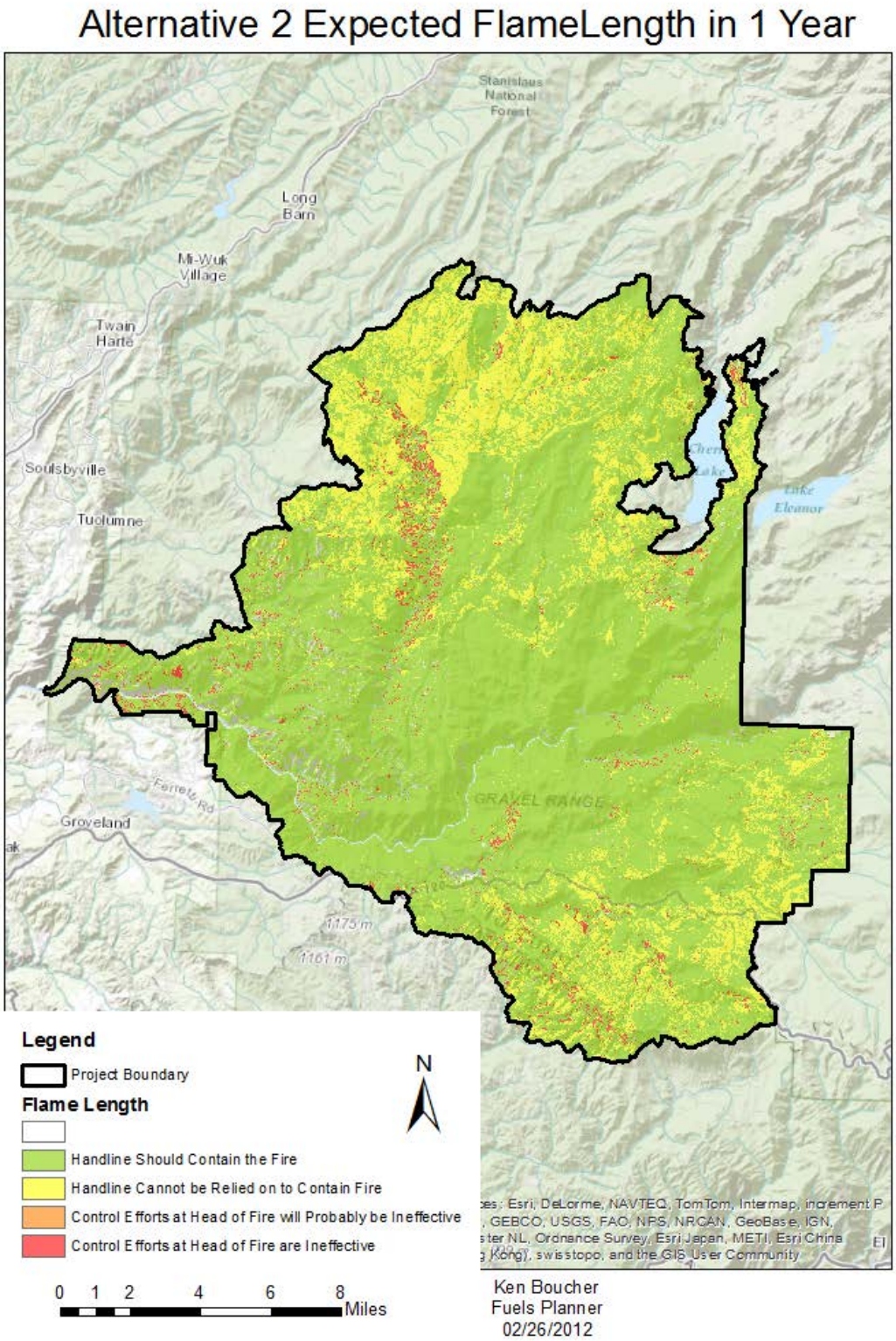


Figure 9 Alternative 2 Expected Flame Length Five years after Rim Fire

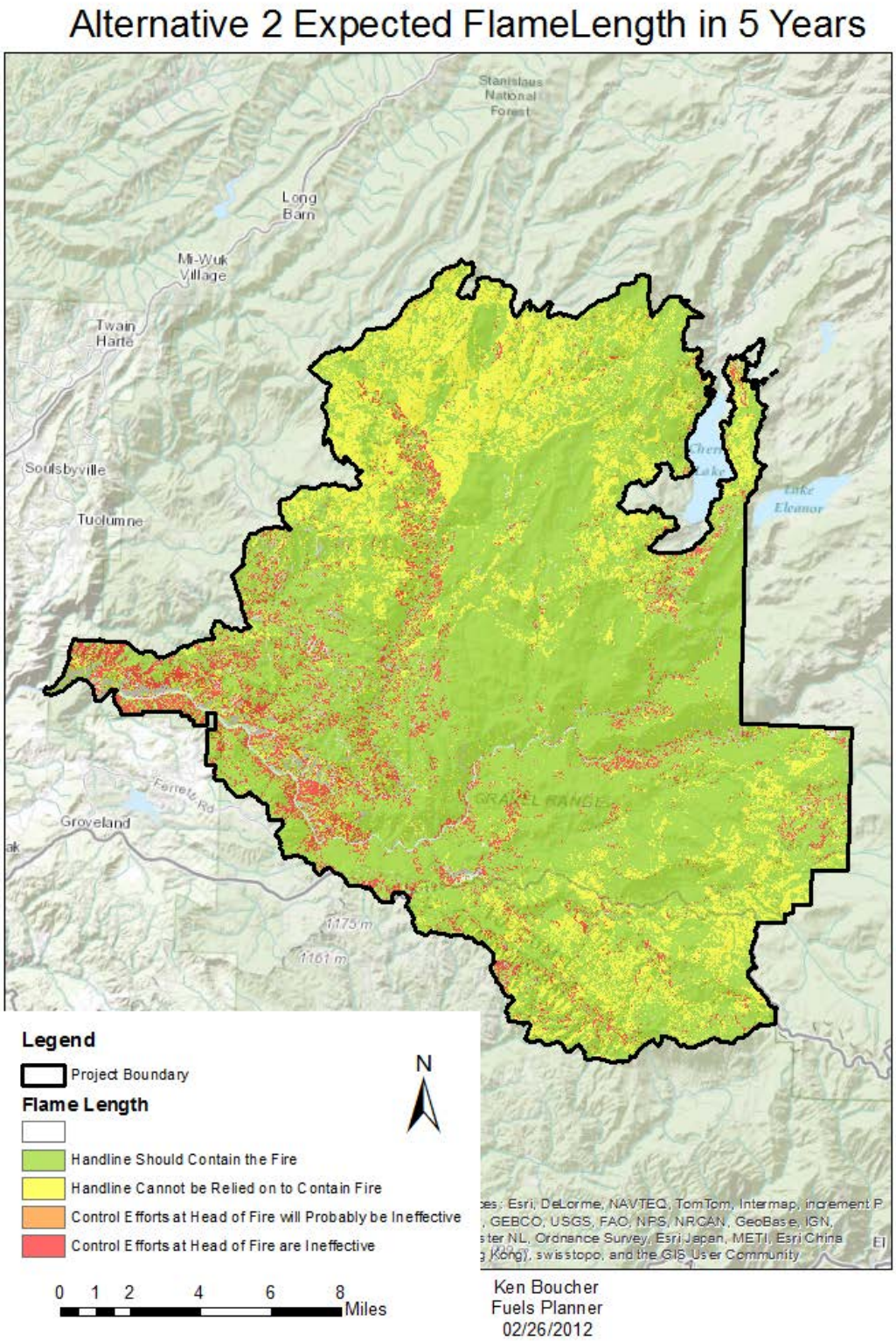


Figure 10 Alternative 2 Expected Flame Length Ten years after Rim Fire

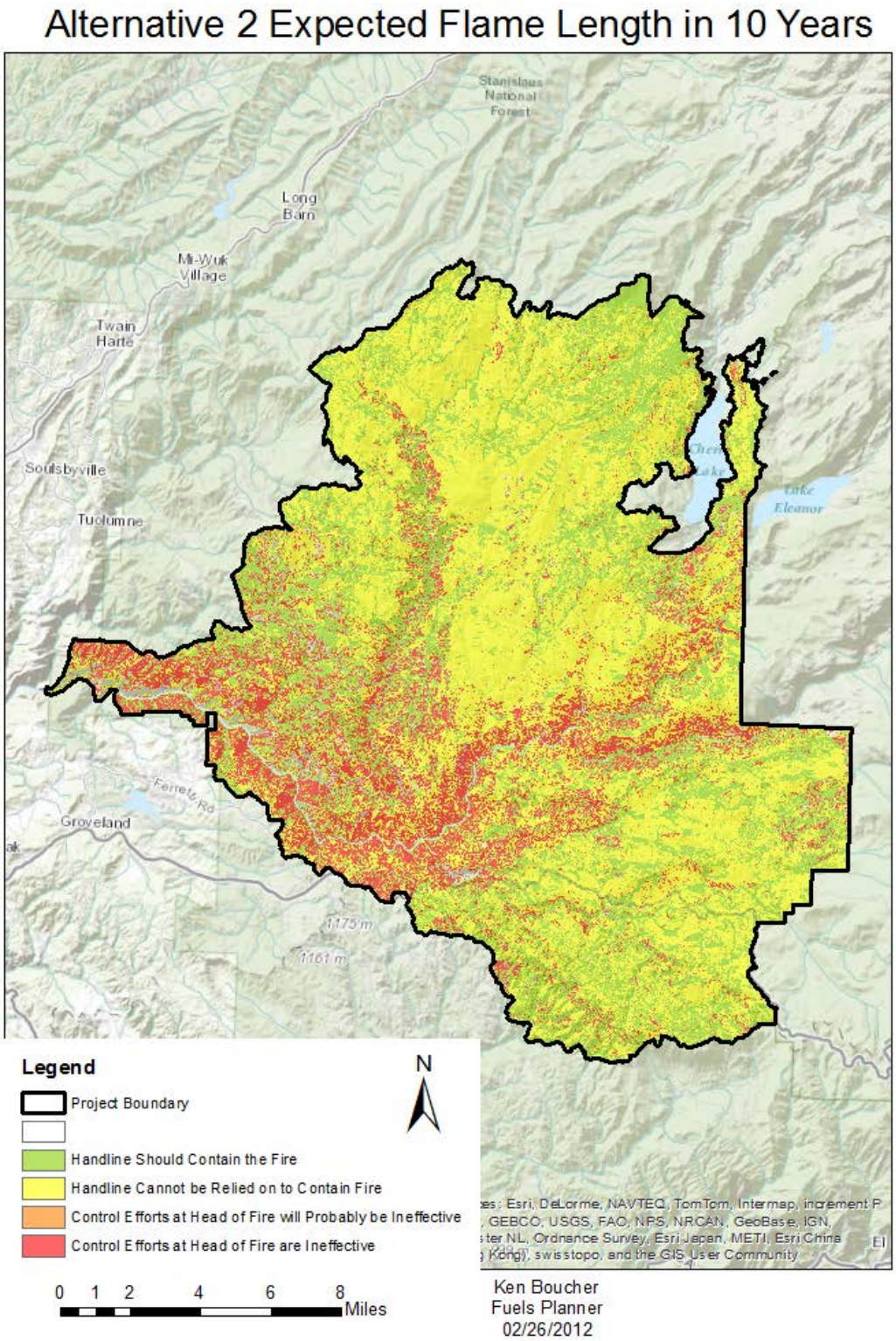
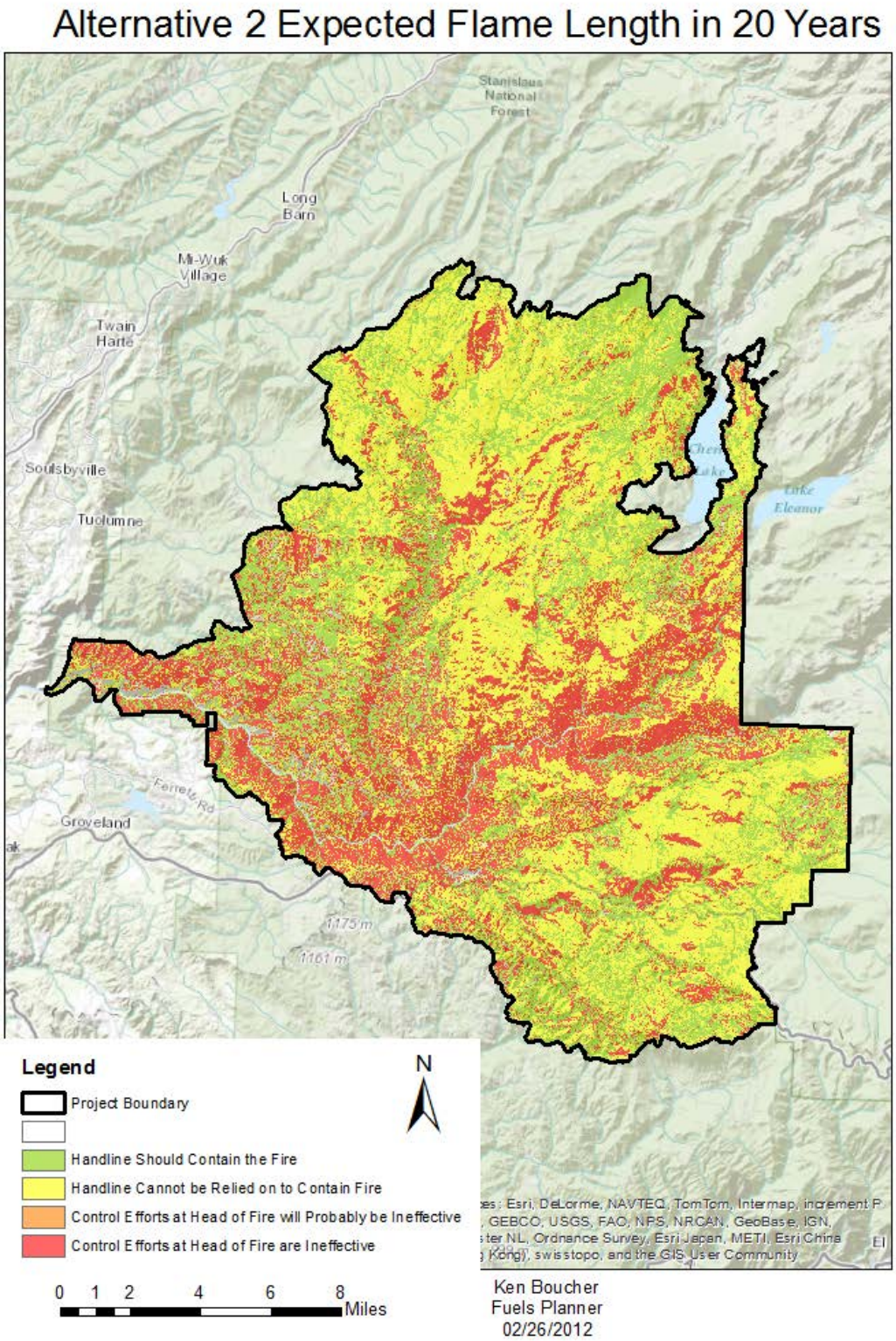


Figure 11 Alternative 2 Expected Flame Length Twenty years after Rim Fire



Cumulative Effects Common to All Alternatives
In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. Focusing on individual actions would be less accurate than looking at existing conditions because there is limited information on the environmental impacts of individual past actions, and it is not reasonably possible to identify each and every action over the last century that has contributed to current conditions. By looking at current conditions, the Forest Service is sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." For these reasons, the analysis of past actions in this section is based on current environmental conditions.

Past Projects. The cumulative effects of past management practices, fire exclusion, and high-mortality fires have largely shaped forest structure prior to the Rim Fire. On public and private lands, past harvest activities focused on removal of dominant and codominant trees and retention of biomass and even-aged management. During the Rim Fire, much of the area in this condition (high fuel loads, high stand density) burned with high severity (Fites et al. 2007). Post fire, these areas are now dominated by dead trees with little surface fuel other than timber litter, and down burned logs and will likely become dominated by shrub species within the next decade. Overall, past harvesting which focused on removal of live dominant and codominant trees, retention of biomass, and no treatment of surface fuels combined with completely untreated reserve areas, contributed to high severity fire patches of fire in the analysis area.

Wildfire Suppression and Fireline and Burned Area Emergency Rehabilitation (BAER) Efforts. Suppression tactics taken during the Rim Fire affected forest vegetation and fuels. The tactics included air drops of water and retardant, back burning, construction of control lines by bulldozers and hand crews, live and dead tree falling, and construction of staging areas, safety zones, escape routes, and drop points. These suppression tactics altered forest vegetation largely through removal of vegetation and/or fuel accumulations or re-arrangement of fuels. Due to the linear, localized, and dispersed effects of these activities, there is a negligible effect on remaining forest vegetation and fuels.

In addition, fireline and BAER rehabilitation efforts were implemented to reduce negative effects of these activities within the fire areas. Fire suppression rehabilitation activities include rehabbing roads, helispots, safety zones, and water sources to pre-incident conditions; applying erosion control measures such as waterbar construction to dozer and handlines, pulling vegetative debris back onto control lines, and removing debris deposited in stream channels as a result of suppression efforts.

BAER treatments within the analysis area included improvement of drainage structures, including culverts, to accommodate increased flows and debris resulting from the Rim Fire. These fireline and BAER rehabilitation treatments are also localized and dispersed across the landscape and have little to no measurable effects on fuel loading, fire effects, or fire severity.

Cumulative Effects for Alternative 2

Under Alternative 2, the harvesting of fire-killed and fire-injured trees would be along main roads under the Rim Fire Hazard Tree project. The maximum extent of these activities would be limited to approximately 150 to 200 feet of either side of main roadways. This would provide for safe travel along forest roads; however, due to the scale and scope of the project, large areas of untreated burned areas with brush and standing snags would exist. The access to these areas would be inhibited by hazard trees and downed logs along and on Maintenance Level 2 roads. Limited access to areas within the analysis area would slow firefighter access for direct attack.

When the effects of the non-action of Alternative 2 is combined with the effects of implementing the foreseeable private and Forest activities as stated in Appendix B, this alternative would not create strategic fire management points or aid in future fuels management, suppression and beneficial fire planning objectives. The cumulative effects of alternative 2 would be an increase in fire behavior over time and negative fire effects on the landscape.

ALTERNATIVE 1

DIRECT AND INDIRECT EFFECTS

It is recognized that Coarse Woody Debris (CWD) is an essential component of ecosystems within the Rim fire area, providing wildlife habitat, soil protection, and other important functions. CWD maintained at required levels, would meet resource needs. In dry forests of interior western North America, large woody debris was limited historically by frequent fire that consumed logs (Skinner 2002) an excess of CWD in the project area could result in a fire with intensity similar to that as seen during the Rim Fire of 2013. A fire of this magnitude could result in damage to homes and property, as well as resource damage from the fire and suppression actions associated to contain this type of fire (Long et. Al.;2010). In addition, fire suppression actions could be hindered by the fire effects associated with a high loading of CWD (Brown et. al., 2003) by slowing fireline production(resistance-to-control) rates and limiting suppression resources to indirect attack with heavy equipment (Andrews et al 2011).

The reduction of CWD through salvage harvest and treatment of non-merchantable fire- killed material encompasses approximately 27,826 acres and 99 miles (3,260ac.) of strategic roads. Treatments would lower fire intensities (Peterson et al 2009) and provide advantageous areas for fire suppression actions (Fites et al 2007).

Treatments would lower fire intensities and fire effects within the treated units would be significantly reduced. Suppression forces could enter these areas and take appropriate actions as needed to manage fires to achieve the desired condition. The reduction in snags would result in reduced spotting that is associated with snags when they burn.

Salvage harvest would reduce the larger diameter merchantable material greater than 16 inches in diameter from the site. Yarding of unmerchantable-size material or biomass removal (from approximately 4 inches to 16 inches in diameter), or jackpot burning (JPB) would treat the high density of the unmerchantable material. Piling or jackpot burning would treat the smaller diameter material and material not included in the previous treatment. After treatments the CWD is estimated to be approximately 10 tons per acre; these areas could be directly attacked with suppression resources increasing the chance of containing wildfires in the project area while maintaining resource needs (Brown et. al., 2003; Fites et. al., 2007). Fire-killed trees have lost most of their moisture making them brittle and more susceptible to breakage (Lowell et al., 2010). During the felling and removal process it is anticipated that there would be higher than normal breakage typically associated with timber felling. CWD would be left on site that does not exceed 10 tons an acre to meet resource needs. This compacted material would have minimal effect on fire behavior and resistance-to-control.

Proposed units would alter the spread and effect of fire in this area. Units were strategically placed to affect fire movement on the landscape and provide advantageous areas for fire suppression actions. As managers continue to move the forest toward the desired condition fire would be able to resume its natural role in

developing and sustaining these ecosystems. Continued management practices can and will alter the effects of wildland fire (Agee and Skinner 2005).

Completed project activities would reduce CWD, lowering fire effects within the treated units. The fuel model in treated units would be represented by TU1 Low Load Dry Climate Timber-Shrub-Grass. The area outside treated units would burn the same as Alternative 2. Placement of the treated units would reduce overall fire size within the project area by reducing fireline intensities and fire effects providing opportunity for suppression forces to take appropriate actions (Finney 2001). Altering the movement and effects of fire through the project area would result in more natural and mosaic burn patterns.

Fuels on the forest floor would consist of small diameter material and scattered larger logs. Snags and large logs may be present in the units to meet resource needs and Stanislaus Forest Plan Direction. These guidelines were developed with consideration for fire and its role in developing and sustaining these ecosystems. Duff and litter layers are currently not present at a level that would affect fire behavior and retaining the small diameter material on site would help accelerate the development of these layers. Out-year fire effects are expected to be dominated by young shrubs, small trees and hardwoods reoccupying the site.

As the vegetation matures, fuel loadings would increase. Continued maintenance designed to achieve the desired condition would maintain fuels profiles that allow fire to resume its ecological role and meet Stanislaus Forest Plan Direction.

Aerial hazards (snags) within the treated areas, excluding those left for resource needs, would be felled. Suppression forces would not be hindered by the high density of snags or high levels of CWD in the units which would allow immediate and appropriate action to be taken. Suppression actions would not be restricted by fire behavior; thus direct suppression actions would be possible within treated stands (fites et. Al., 2007).

Suppression forces would not be hindered by high densities of snags, CWD or by fire effects in the treated units. This would allow immediate and appropriate direct suppression action to be taken. The effect on fire suppression forces beyond year 20 would depend on the continued maintenance of the stands. Stands that are maintained and managed to achieve the desired condition would not adversely impact future suppression. Table 7 below displays the projected fire effects and production rates for Alternative 1 within treatment units using the FlamMap 5.0 modeling program.

Table 7. Predicted average flame lengths, fireline intensity and firefighter production rates under the Alternative 1 within treatment units (FlamMap 5.0).

Alternative 1	Flame Length	Fireline Intensity	Suppression Interpretation
1 Year Post-Activity	≤2	≤100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
Year 5	≤4	≤100	
Year 10	≤4	≤100	
Year 20	≤4	≤100	

In comparison to the No Action Alternative over time, Alternative 1 would result in relatively lower surface fuel loads, lowering potential flame lengths, fireline intensities, resistance-to-control, and potential mortality. Fuel loadings and potential flame lengths would be lowest in ground-based salvage harvest units where the treatment of submerchantable material (via biomass harvesting and removal or site preparation) would occur. While there is still potential for mortality in treated areas, it would remain lower than that of alternative 2 for wildfires occurring under 90th percentile weather conditions.

CUMULATIVE EFFECTS

Cumulative effects for Alternative 1 include safer access to the area due to the Rim Fire Hazard Tree removal along main roads and the level 2 roads in this project. In addition, fuels treatments would improve the safety for all users. Firefighter safety would be improved with the removal of the overhead snags as they pose one of the greatest hazards to firefighters. The treatment of CWD and smaller fire-killed vegetation would result in a reduction in fire effects and resistance-to-control thereby increasing safety during a wildfire event. Reduced fire effects would allow suppression forces to take appropriate action. Fire spread on public lands would be altered reducing the chance of fire spreading between the public and private lands interface.

Future wildfires within the project area will be affected on a landscape level by the combination of treatments implemented on privately owned Sierra Pacific Industries (SPI) land, the Rim Fire Hazard Tree removal and the adjacent Forest Service (Rim Fire Recovery treatment units) lands. Fuels treatments are strategic placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks and private land would further break up fuel continuities in the area, creating more opportunities for future suppression actions.

The treatment units running along the Westside of the private boundary would create lower fire effects by reducing CWD allowing suppression resources to suppress fires coming into or leaving the private public land interface. With the removal of fire-killed trees on both the private and public lands, future fuel loading conditions will be reduced and will result in a fire that would burn under more historical conditions. Any residual fuels left on SPI lands would be burned. This would further reduce fuel loading to approximately 10 tons per acre. On National Forest System lands, residual fuels would be reduced to approximately 10 tons per acre. As a result, the treated areas would burn as surface fires with low flame lengths and fireline intensities. These lower-intensity fires and lower resistance-to-control issues could be suppressed using direct attack with handtools.

Figure 12 Alternative 1 Expected Fireline Intensity One Year after Treatment

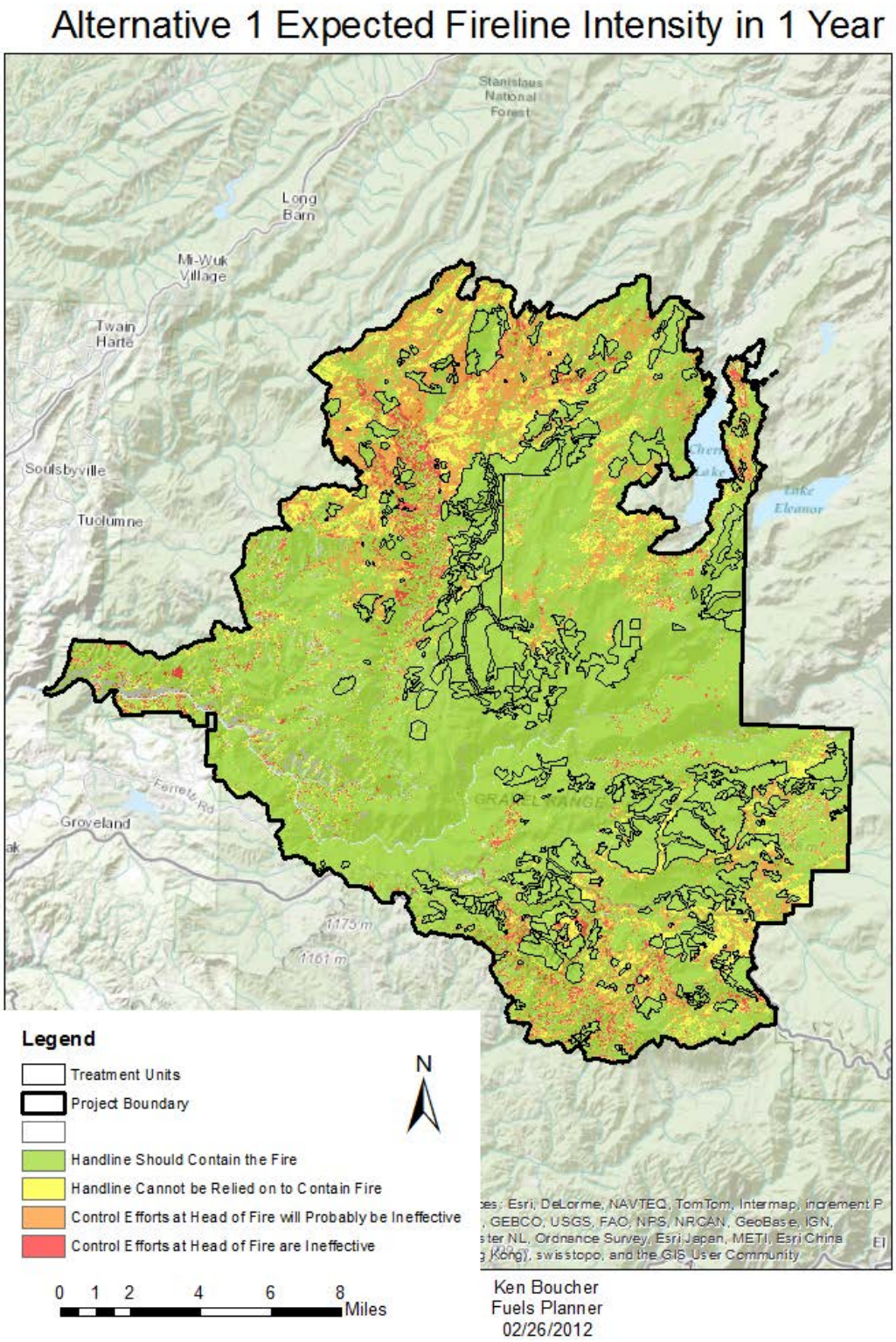


Figure 13 Alternative 1 Expected Fireline Intensity Five Years after Treatment

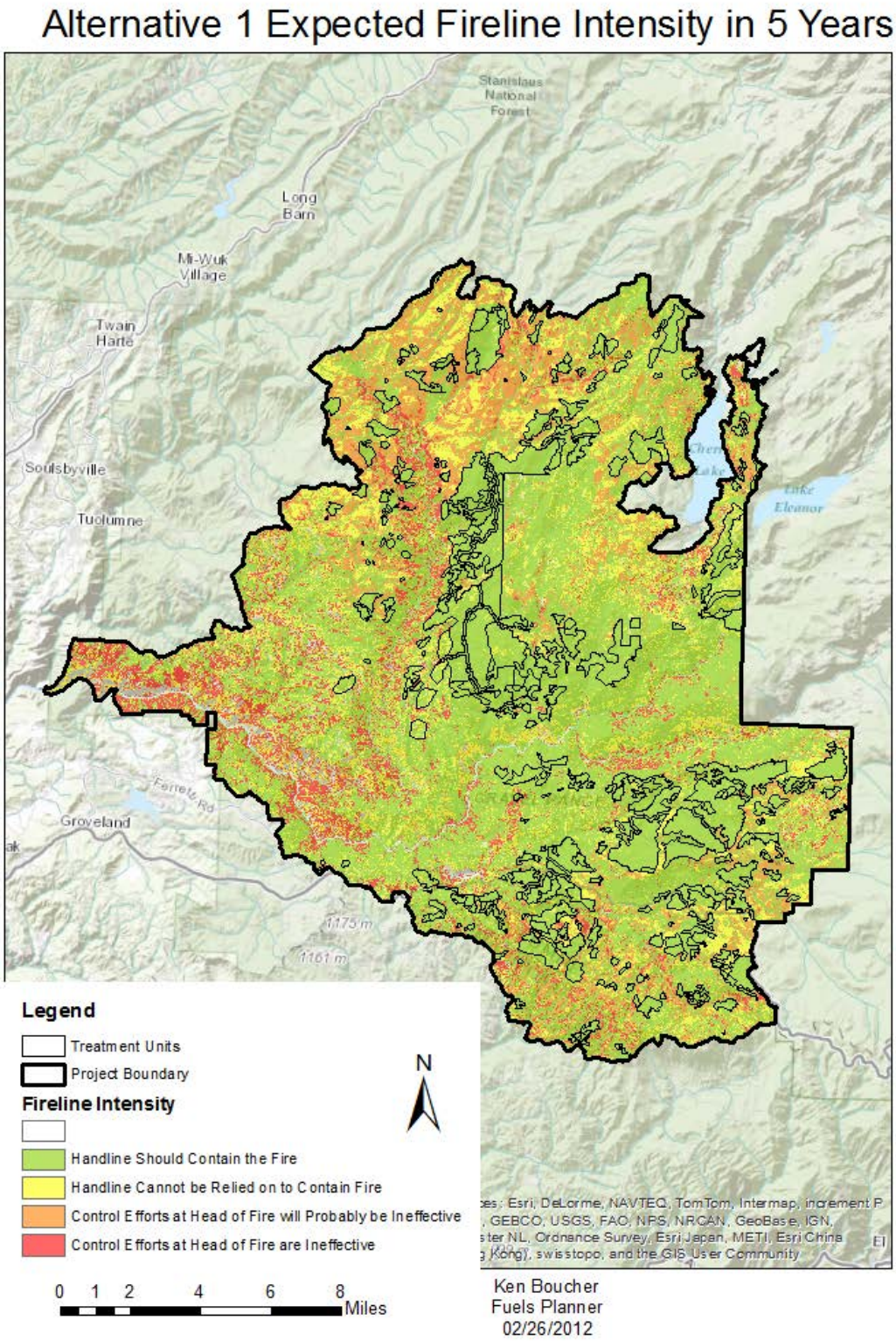


Figure 14 Alternative 1 Expected Fireline Intensity Ten Years after Treatment

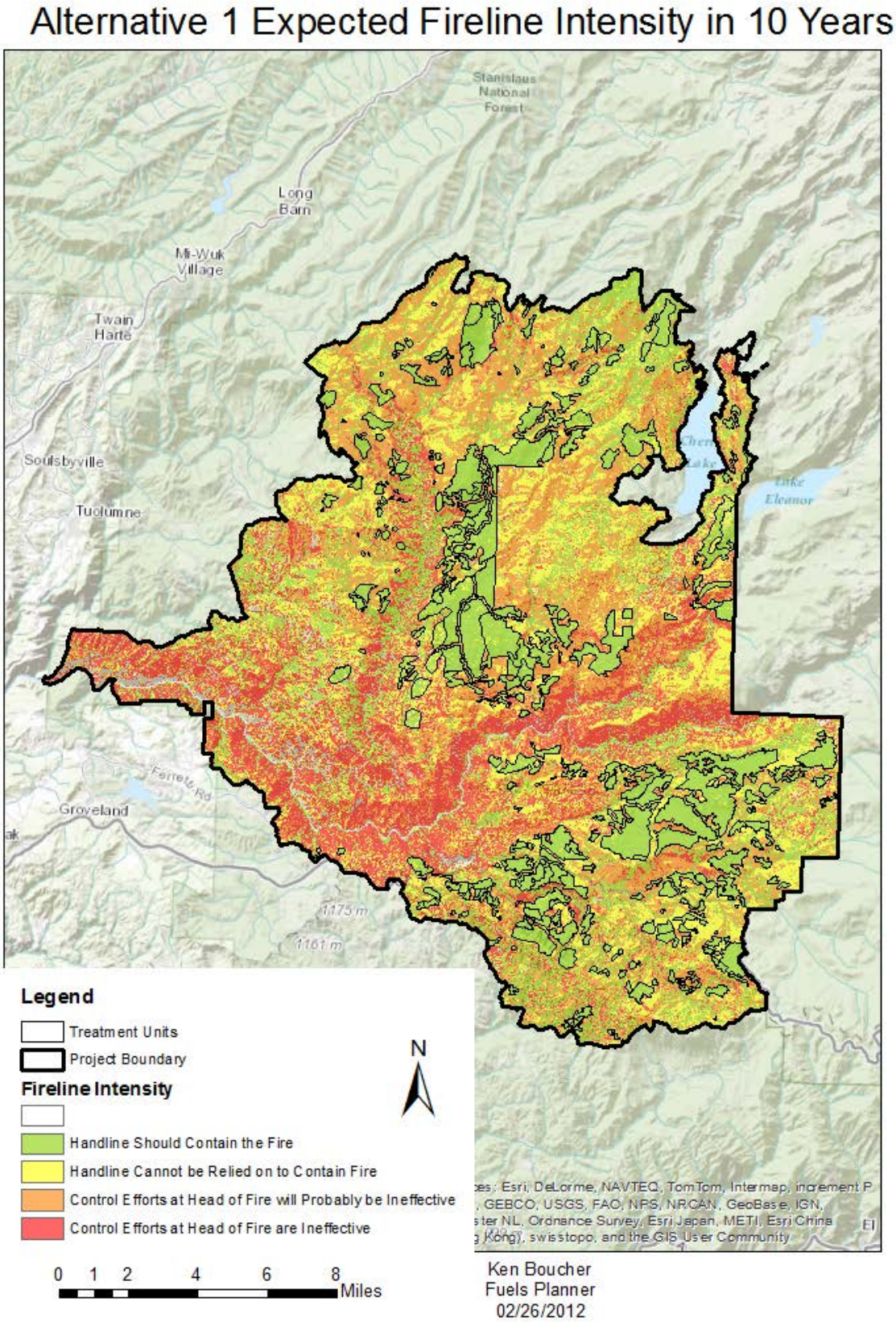


Figure 15 Alternative 1 Expected Fireline Intensity Twenty Years after Treatment

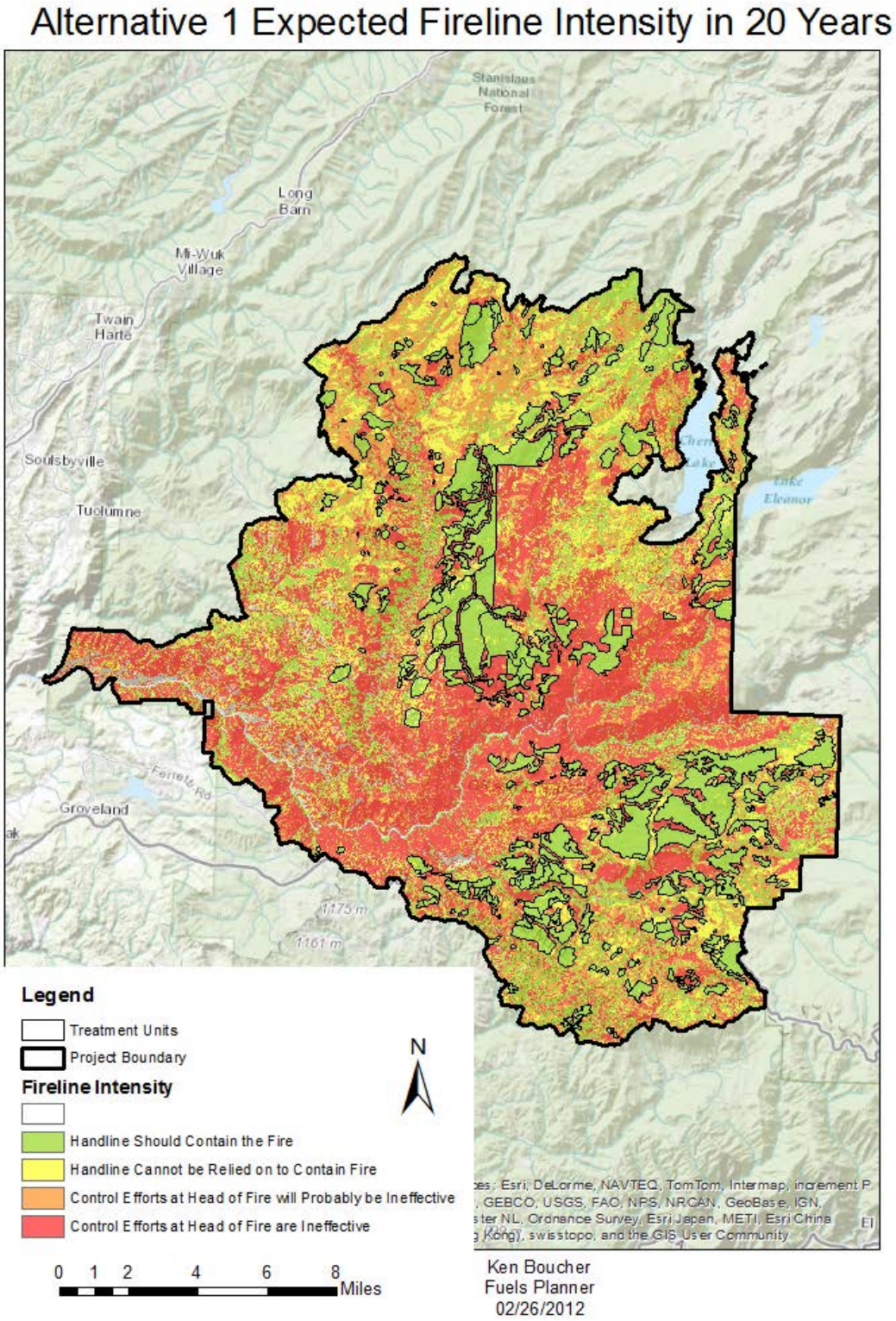


Figure 16 Alternative 1 Expected Flame Length One Year after Treatment

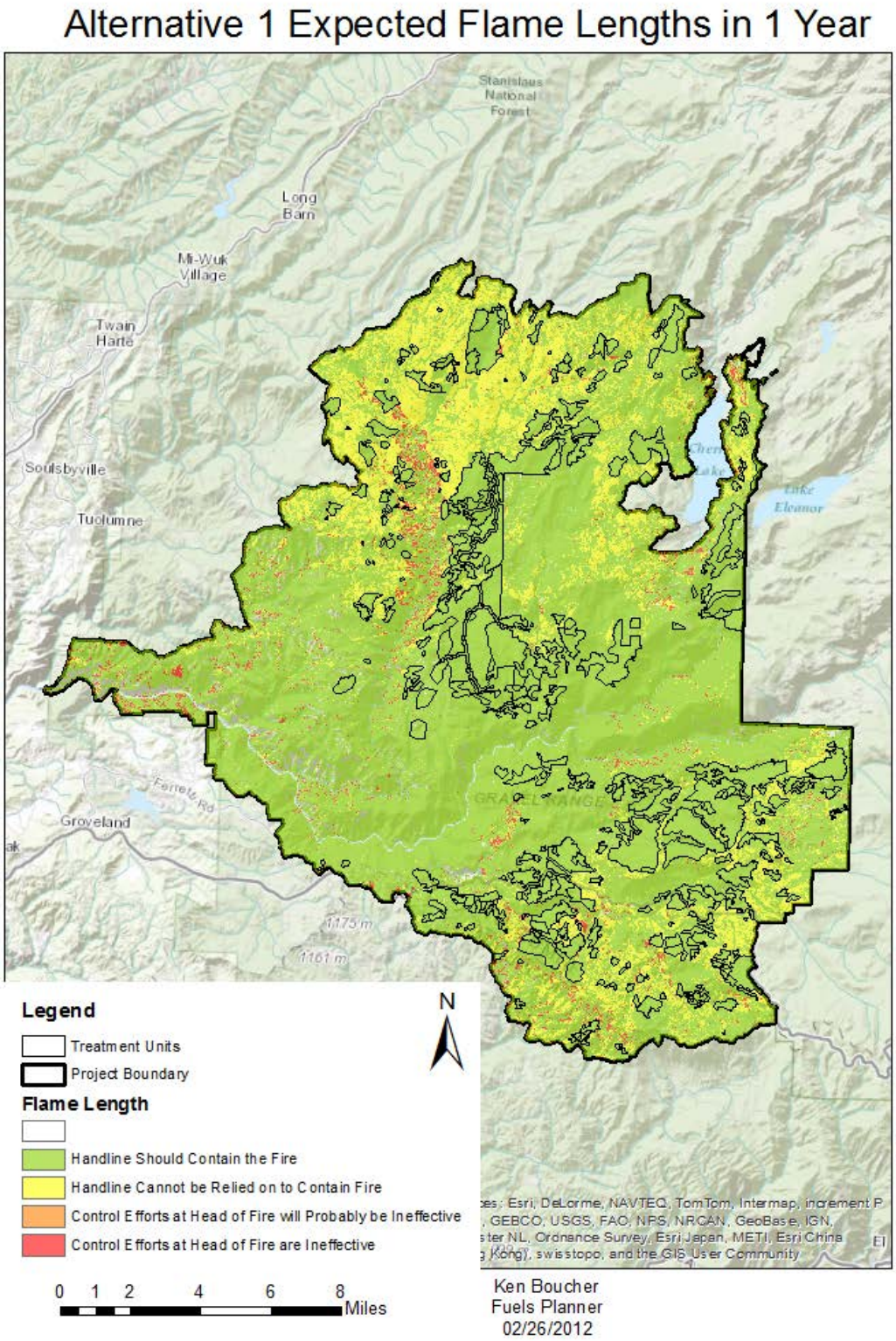


Figure 17 Alternative 1 Expected Flame Length Five Years after Treatment

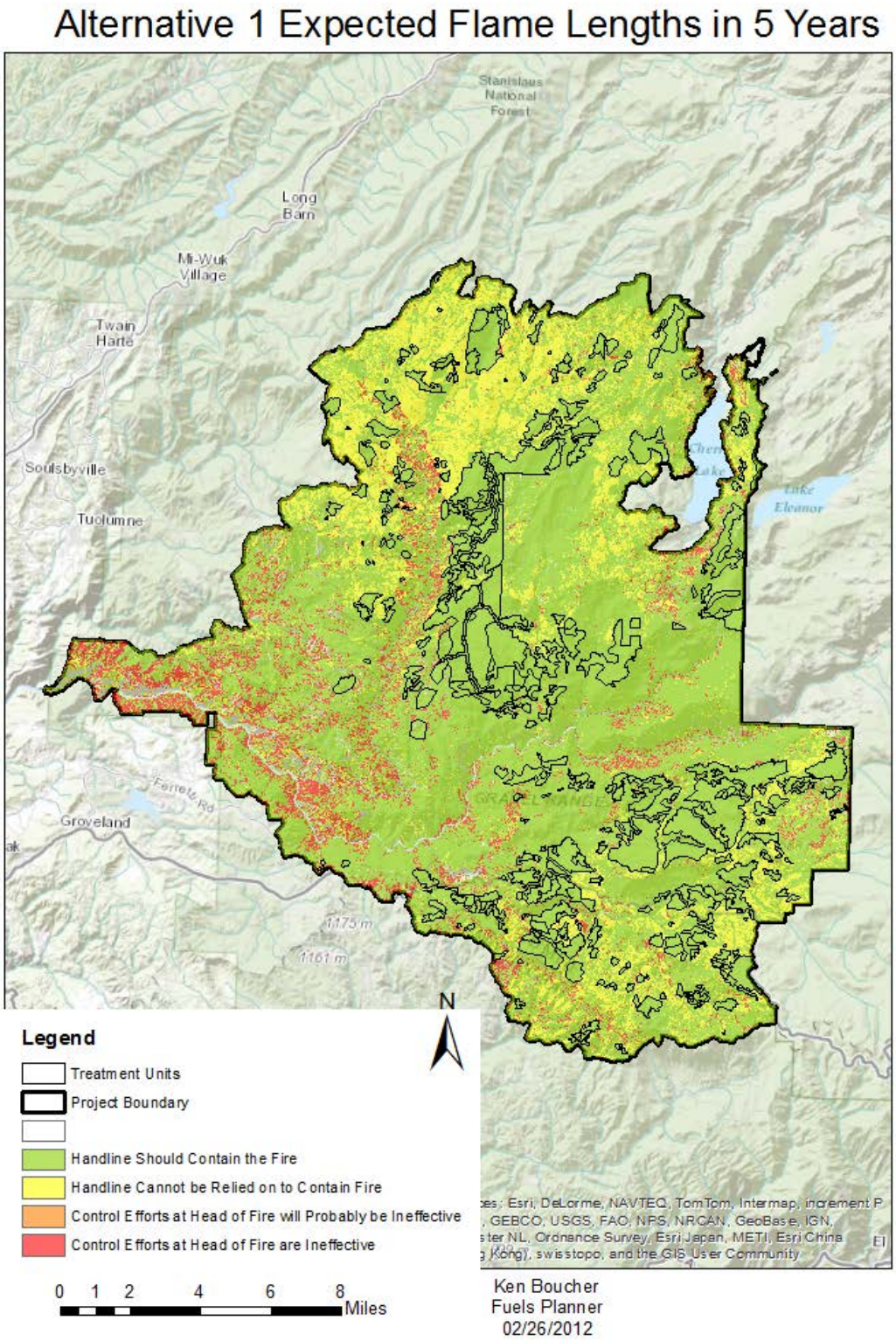


Figure 18 Alternative 1 Expected Flame Length Ten Years after Treatment

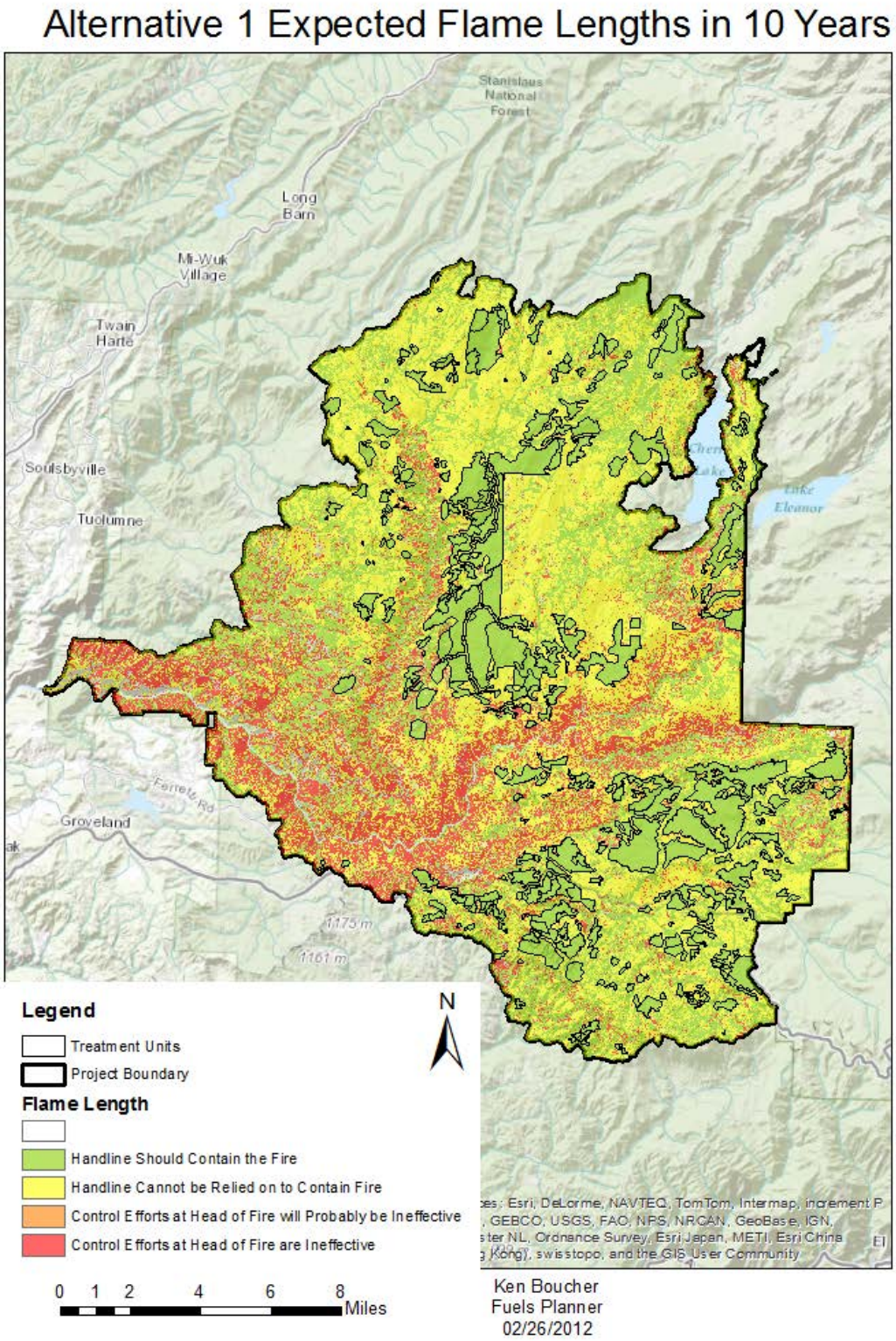
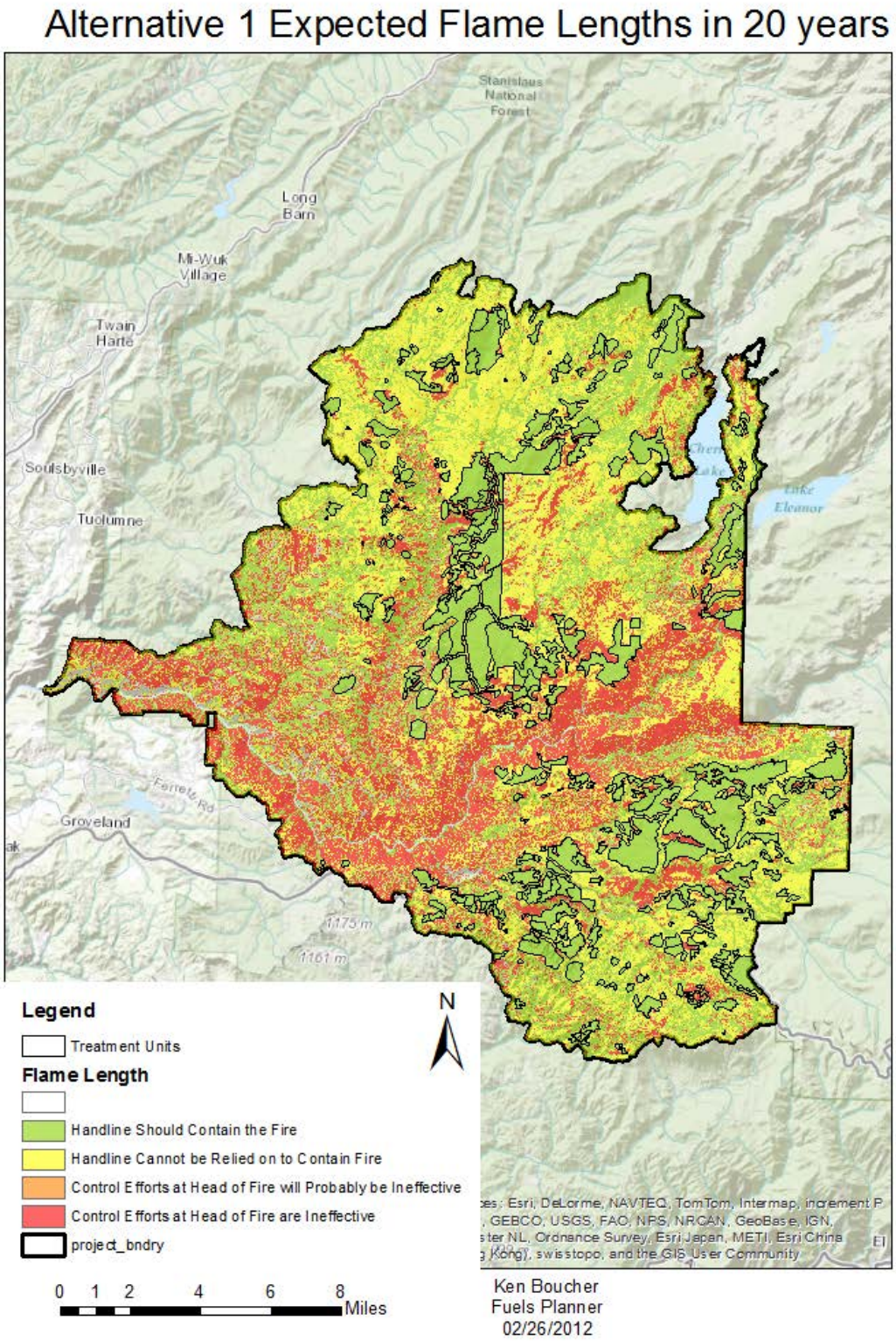


Figure 19 Alternative 1 Expected Flame Length Twenty Years after Treatment



Alternative 3

Strategic Fire Management Feature (SFMF)

Strategic fire management features (SFMF) were identified along roads and ridgelines to take advantage of natural or topographic features and established roadways. Features were also located adjacent to private property, and connected through private Sierra Pacific Industries (SPI) managed land. In addition to fire behavior modification, features create safe travel route options for emergency access/egress.

Trees that were killed by the Rim fire that are within a tree length and a half of all the SFMF pose a hazard to the public and forest workers traveling and working in these areas. As these snags age, they become less stable and increase the risk to all who use these SFMF. Within the treated areas the aerial hazards, (snags) would have been felled and the majority of the CWD removed. Suppression forces would not be hindered by the high density of snags in the SFMF which would allow immediate and appropriate action to be taken. Foot travel in the SFMF would be unimpeded except for the occasional large log. Vehicle access to the area would be less hazardous for firefighters and all forest users.

Strategically Placed landscape Area Treatment (SPLAT)

Strategically Placed Landscape Area Treatments (SPLAT) were identified along many features to reinforce and transition the vegetation density across the areas. These would also create locations for safer management actions as well. These areas can serve as strategically placed landscape treatments (SPLATs) to break up the continuity of the vegetation across the landscape, create mosaic patterns, and provide a network of opportunities for wildfire management objectives that allow for equal weight of natural resource and ecosystem benefits and protection of private property.

SPLATs and SFMF's were also located adjacent to approximately 163 private properties, Hetch Hetchy water and power infrastructure which supplies water to protect the health, safety and economic well-being of 1.7 million citizens, businesses and community organizations , and private Sierra Pacific Industries (SPI) managed land. In addition to fire behavior modification, SPLATs and SFMFs create safe travel route options for emergency access and egress.

Table 8 Population areas adjacent to SPLATs/SFMF

Population areas adjacent to SPLATs/SFMF		
Businesses and Camps	Communities	Ranches
Tawonga Jewish Community	Buck Meadows Town	Drew Meadow Ranch
Bay Area Water Supply & Conservation Agency (Hetch Hetchy)	Harden Flat Community	Guinn Ranch
Berkeley Summer Camp	Hulls Meadow Community	Meyers Ranch
Evergreen Lodge	Packer Canyon Community	Quinn Ranch
San Francisco Recreation Community Camp (Mather)	Peach Growers Community	Rogge Ranch
San Jose Summer Camp	Sawmill Mountain Community	
Spinning Wheel Vacation Rentals		
Tawonga Jewish Camp		

DIRECT AND INDIRECT EFFECTS

Alternative 3, like Alternative 1, would reduce CWD through salvage harvest and treatment of non-merchantable fire-killed material. Alternative 3 would encompass approximately 30,399 acres and 315 miles (15,253.) of SFMF. Treatments would lower fire intensities and provide advantageous areas for fire suppression actions.

Completed project activities would reduce CWD, lowering fire effects within the treated units. The fuel model in treated units would be represented by TU1 Low Load Dry Climate Timber-Shrub-Grass. The area outside treated units would burn the same as Alternative 2. Placement of the treated units would reduce

overall fire size within the project area by reducing fireline intensities and fire effects providing opportunity for suppression forces to take appropriate actions (Finney 2001). Altering the movement and effects of fire through the project area would result in more natural and mosaic burn patterns.

Salvage harvest would reduce the larger diameter merchantable material greater than 16 inches from the site; biomass removal (from approximately 4 inches to 16 inches in diameter) and jackpot burning (JPB) would treat the high density of the un-merchantable material. Piling and jackpot burning would treat the smaller diameter material and material not included in the previous treatment. After treatments the CWD is estimated to be between 10 to 20 tons per acre outside SPLAT units and 10 tons per acre inside SPLAT and SFMF units; these areas can be directly attacked with suppression resources increasing the chance of containing wildfires in the project area while maintaining resource needs (Brown et. al., 2003). CWD that does not exceed 10-20 tons an acre would be left on site for resource needs. This compacted material would have minimal effect on fire effects as shown in the table of fire effects, Table 9.

Table 9. Predicted average flame lengths, fireline intensity and firefighter production rates under the Alternative 3 within treatment units (FlamMap 5.0).

Alternative 1	Flame Length	Fireline Intensity	Suppression Interpretation
1 Year Post-Activity	≤2	≤100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
Year 5	≤4	≤100	
Year 10	≤4	≤100	
Year 20	≤4	≤100	

Fuels treatments are strategically placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks would further break up fuel continuities in the area, creating more opportunities for future suppression actions and safer ingress and egress routes. In addition, the strategic placement would increase fire suppression safety, reduce potential resource damage, and potentially lower suppression costs.

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Alternative 3 would result in relatively lower surface fuel loads, potential flame lengths, fireline intensities, resistance-to-control, and potential mortality. Fuel loadings and potential flame lengths would be lowest in ground-based salvage harvest units where the treatment of submerchantable material (via biomass harvesting and removal or site preparation) would occur. While there is still potential for mortality in treated areas, it would remain lower than that of Alternative 2 for wildfires occurring under 90th percentile weather conditions

Fuels on the forest floor would consist of small diameter material and scattered larger logs. Snags and large logs may be present in the units to meet resource needs and Stanislaus Forest Plan Direction. These guidelines were developed with consideration for fire and its role in developing and sustaining these ecosystems. Duff and litter layers are currently not present at a level that would affect fire behavior and retaining the small diameter material on site would help accelerate the development of these layers. Out-year fire effects are expected to be dominated by young shrubs, small trees and hardwoods reoccupying the site.

As the vegetation matures, fuel loadings would increase. Continued maintenance designed to achieve the desired condition would maintain fuels profiles that allow fire to resume its ecological role and meet Stanislaus Forest Plan Direction.

Fuels treatments are strategically placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks, SPLATs, and SFMFs would further break up fuel continuities in the area, creating more opportunities for future suppression actions and safer ingress and egress routes. In addition, the strategic placement would increase fire suppression safety, reduce potential resource damage, and potentially lower suppression costs.

CUMULATIVE EFFECTS

Cumulative effects for Alternative 3 include safer access to the area due to the Rim Fire Hazard Tree removal along main roads and the level 2 roads in this project. In addition, fuels treatments would improve the safety for all users. Firefighter safety would be improved with the removal of the overhead snags as they pose one of the greatest hazards to firefighters. The treatment of CWD and smaller fire-killed vegetation would result in a reduction in fire effects and resistance to control thereby increasing safety during a wildfire event. Reduced fire effects would allow suppression forces to take appropriate action. Fire spread on public lands would be altered reducing the chance of fire spreading between the public and private lands interface.

Future wildfires within the project area will be affected on a landscape level by the combination of treatments implemented on privately owned Sierra Pacific Industries (SPI) land, the Rim Fire Hazard Tree removal and the adjacent Forest Service (Rim Fire Recovery treatment units) lands. Fuels treatments are strategic placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks and private land would further break up fuel continuities in the area, creating more opportunities for future suppression actions.

The treatment units running along the Westside of the private boundary would create lower fire effects by reducing CWD allowing suppression resources to suppress fires coming into or leaving the private public land interface. With the removal of fire-killed trees on both the private and public lands, future fuel loading conditions will be reduced and will result in a fire that would burn under more historical conditions. Any residual fuels left on SPI lands would be burned. This would further reduce fuel loading to approximately 10 to 20 tons per acre. On National Forest System lands, residual fuels would be reduced to approximately 10 to 20 tons per acre. As a result, the treated areas would burn as surface fires with low flame lengths and fireline intensities. These lower-intensity fires and lower resistance-to-control issues could be suppressed using direct attack with handtools. Fuels treatments are strategic placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks would further break up fuel continuities in the area, creating more opportunities for future suppression actions.

Figure 20 Alternative 3 Expected Fireline Intensity One Year after Treatment

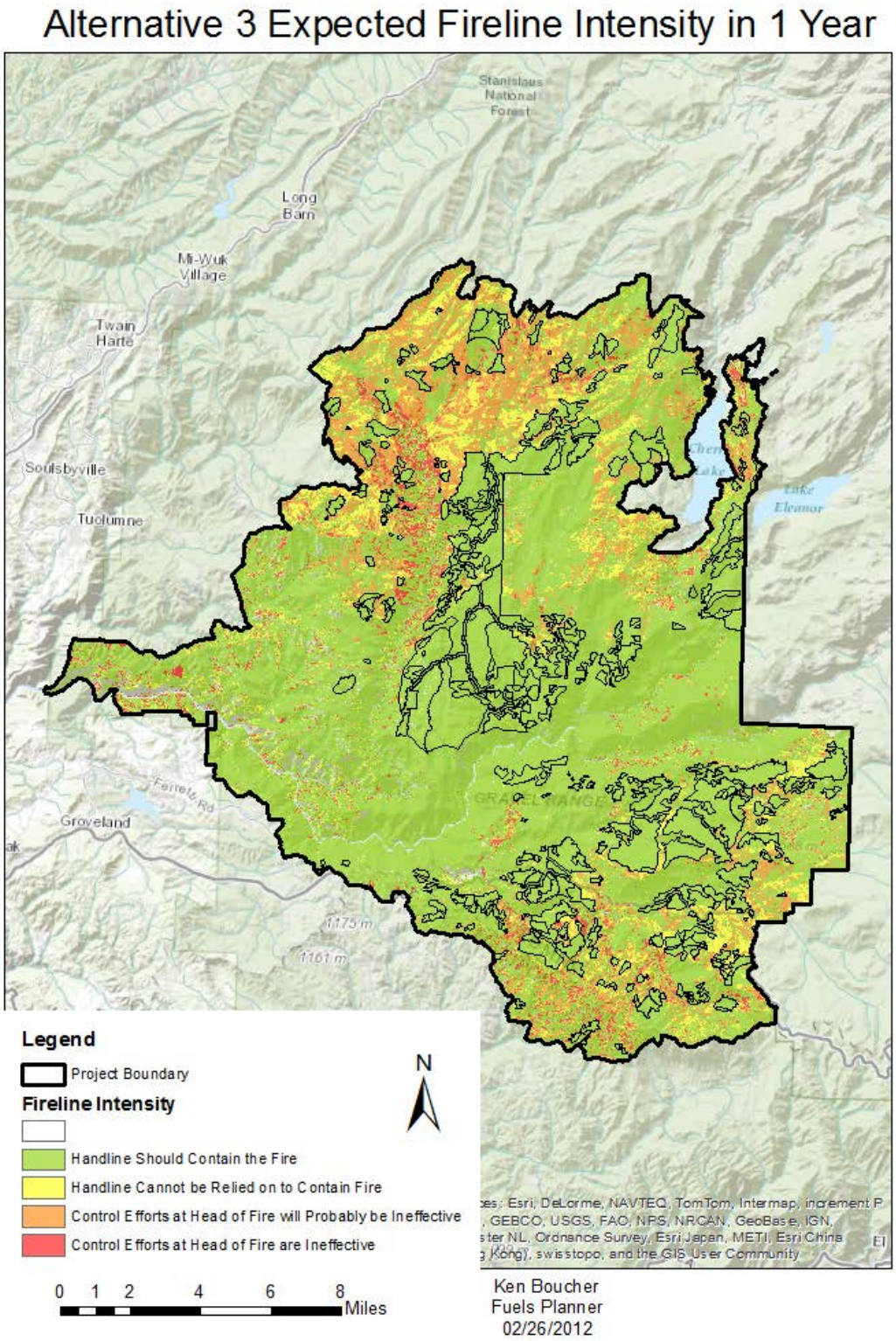


Figure 21 Alternative 3 Expected Fireline Intensity Five Years after Treatment

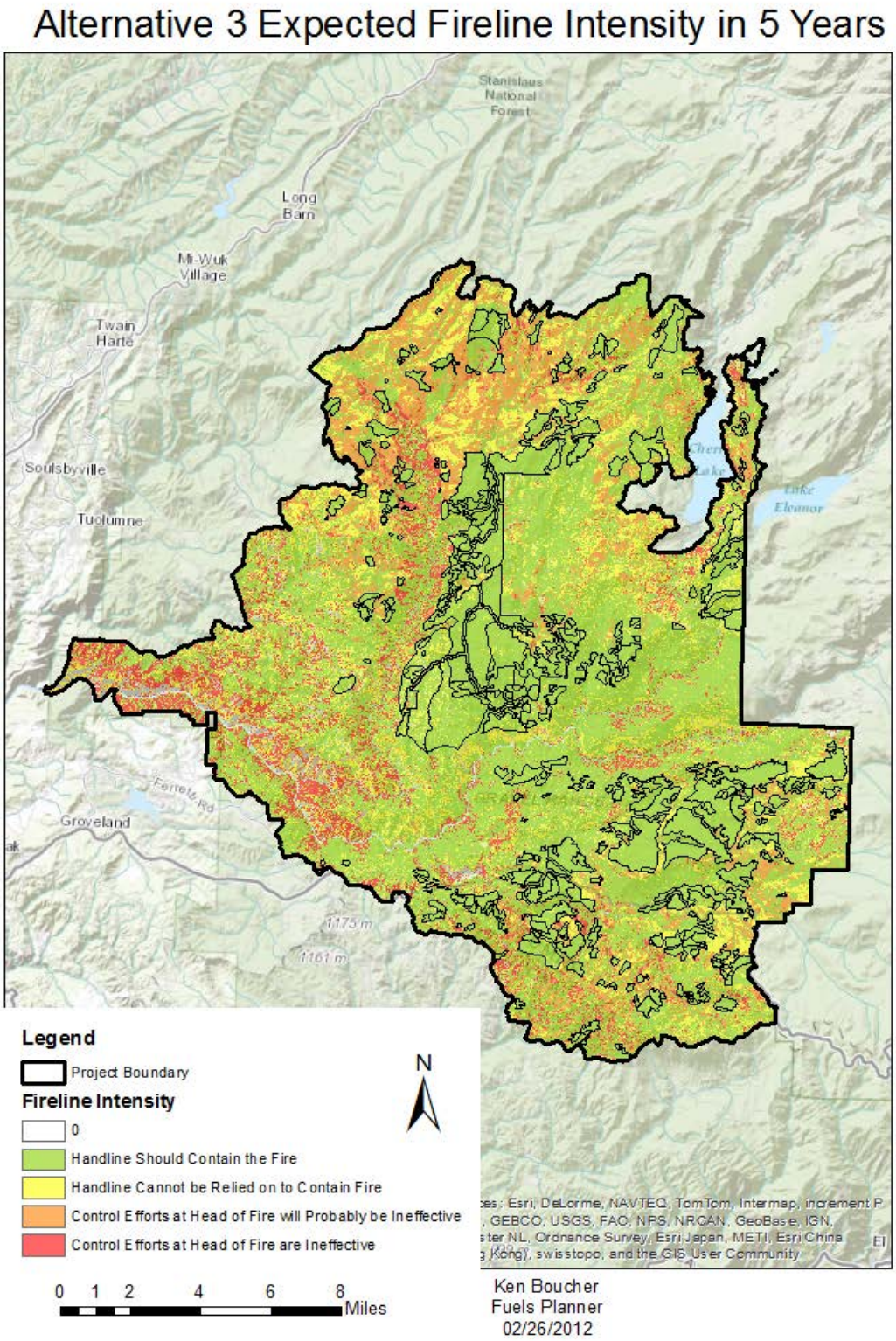


Figure 22 Alternative 3 Expected Fireline Intensity Ten Years after Treatment

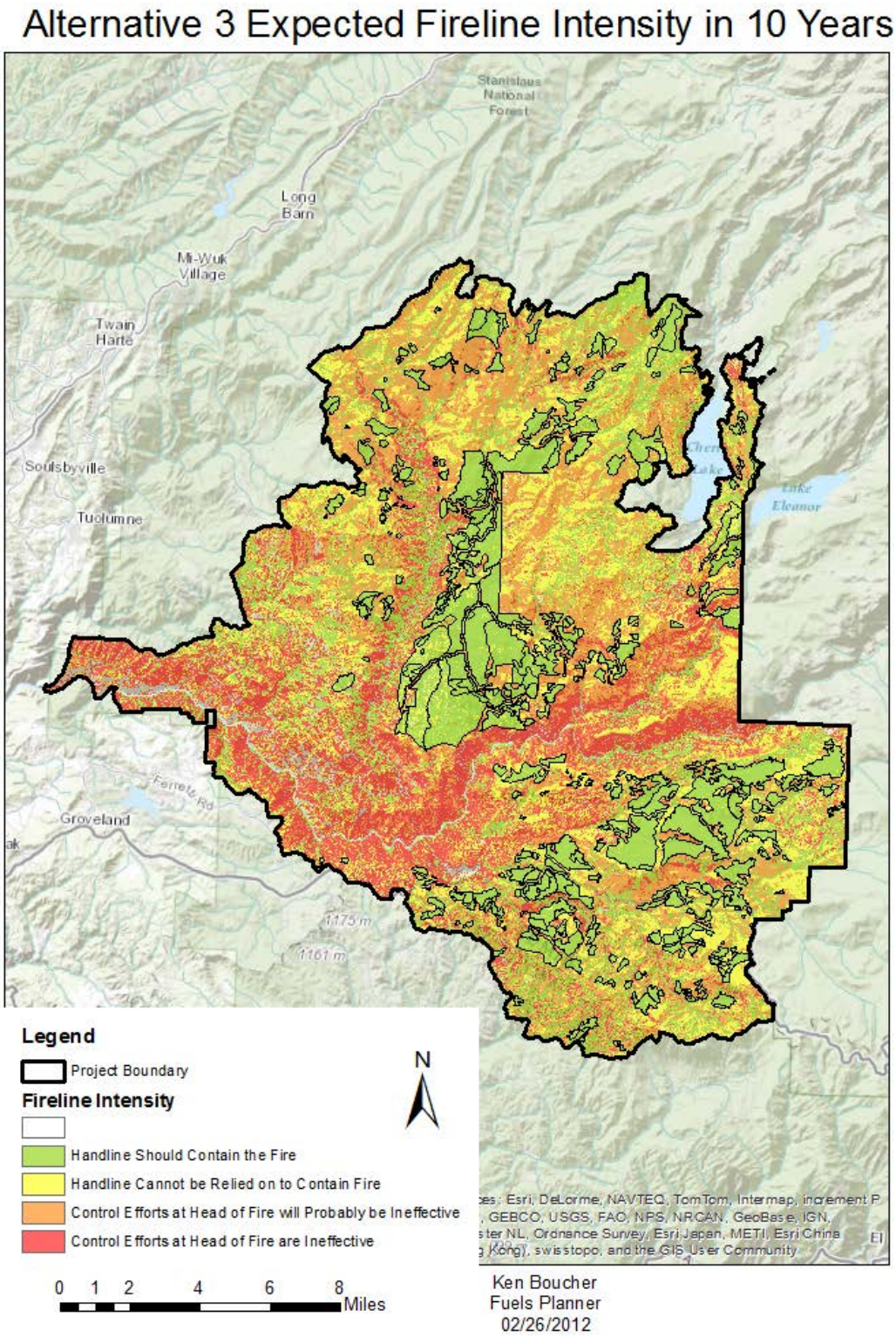


Figure 23 Alternative 3 Expected Fireline Intensity Twenty Years after Treatment

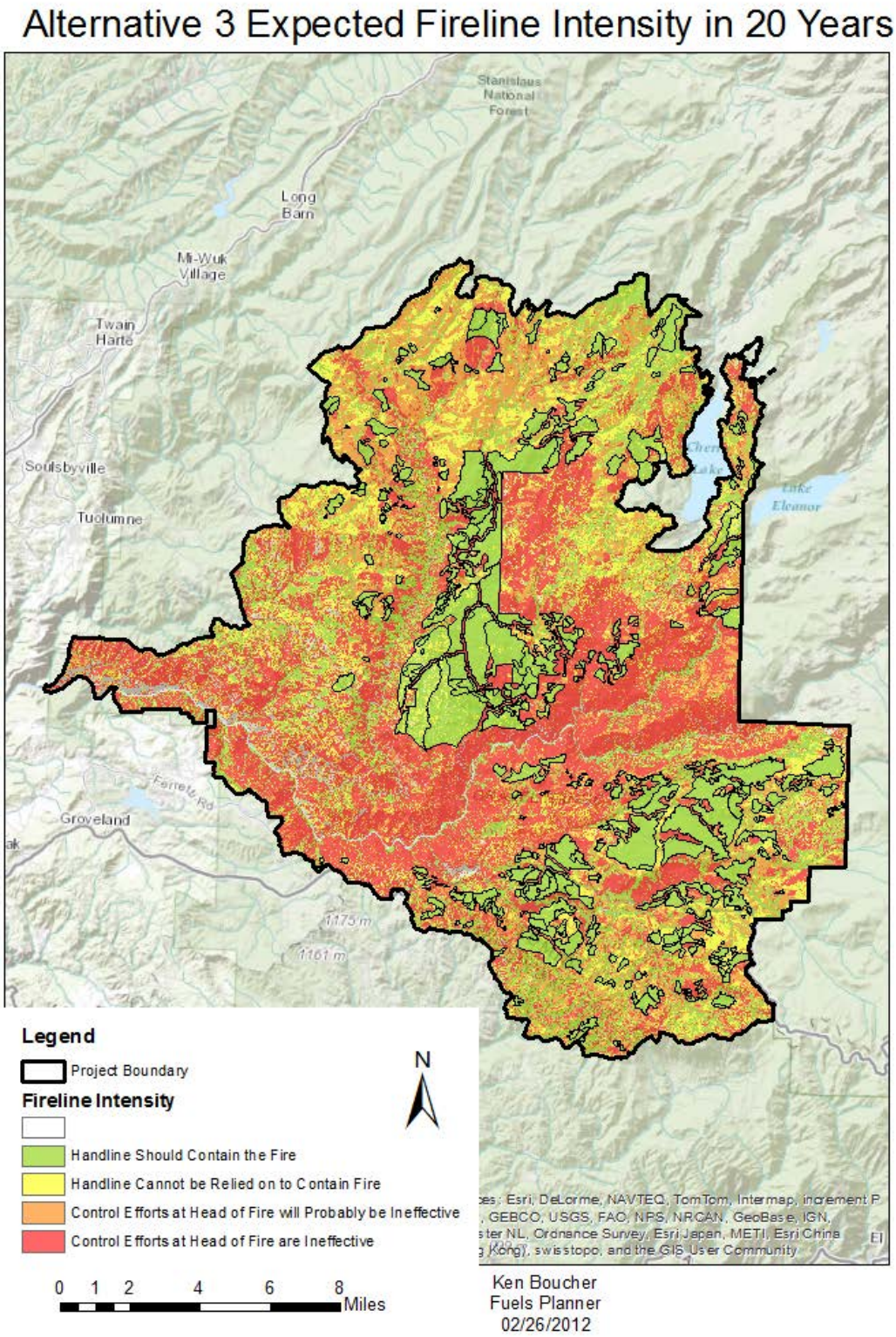


Figure 24 Alternative 3 Expected Flame Length One Year after Treatment

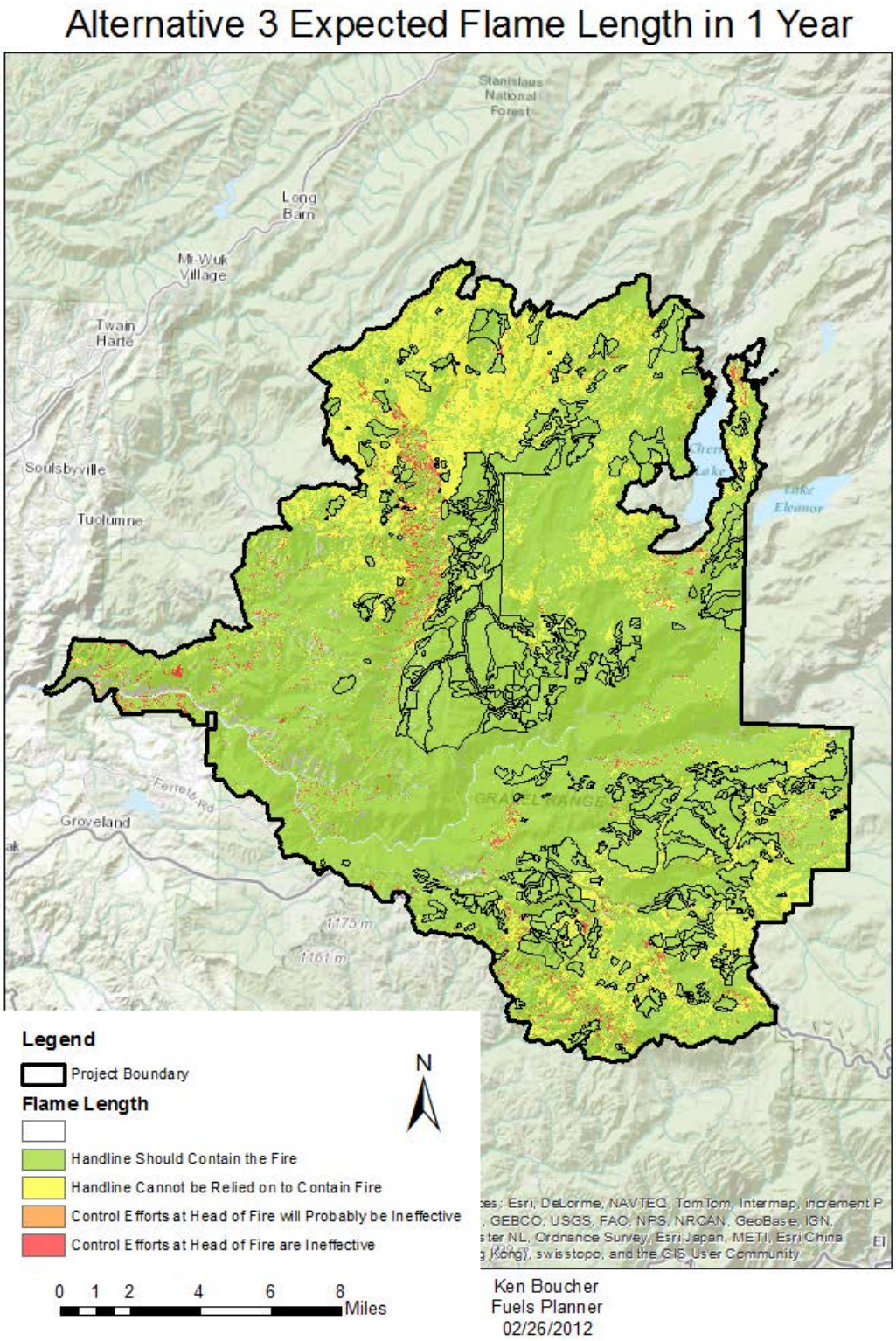


Figure 25 Alternative 3 Expected Flame Length Five Years after Treatment

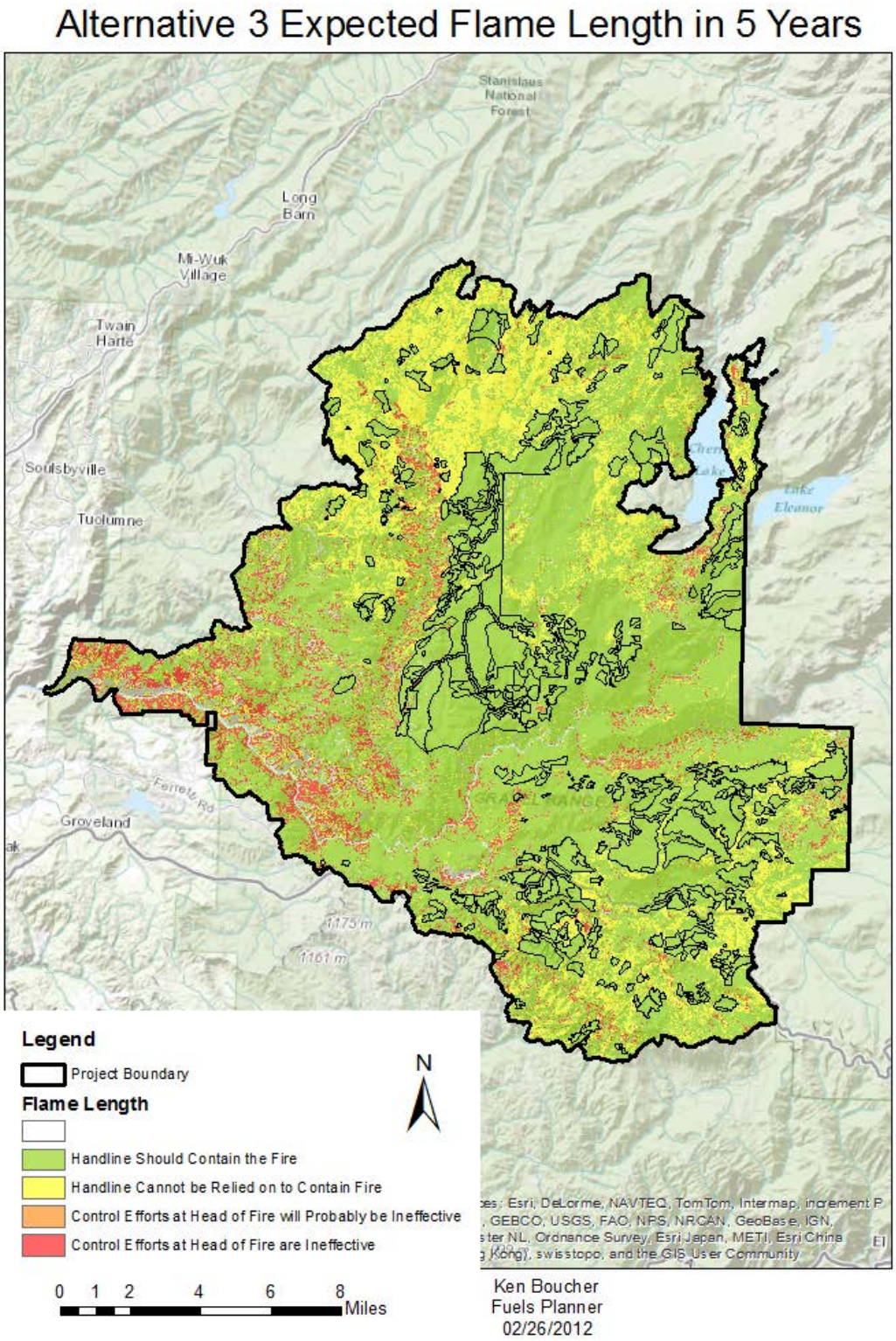


Figure 26 Alternative 3 Expected Flame Length Ten Years after Treatment

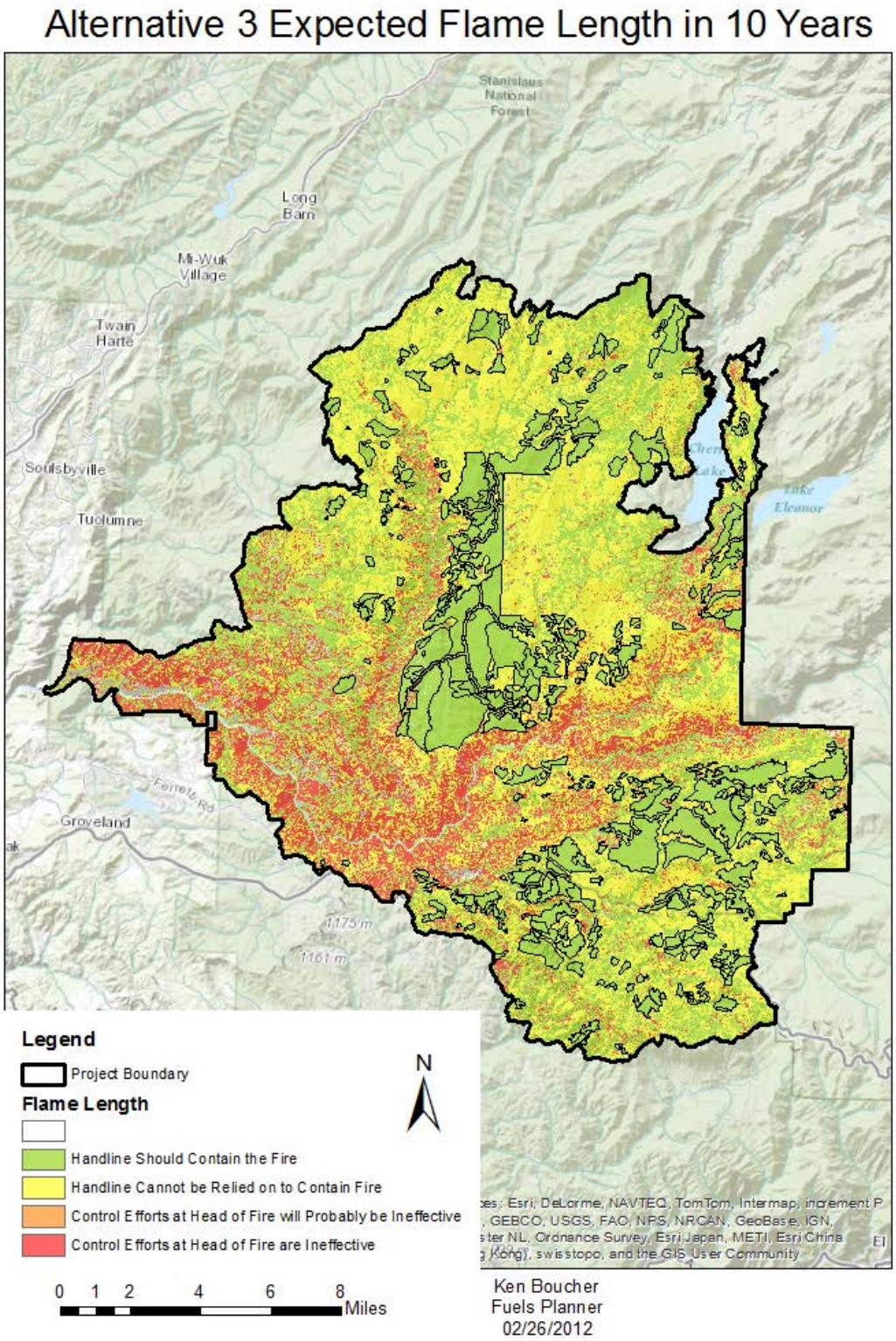
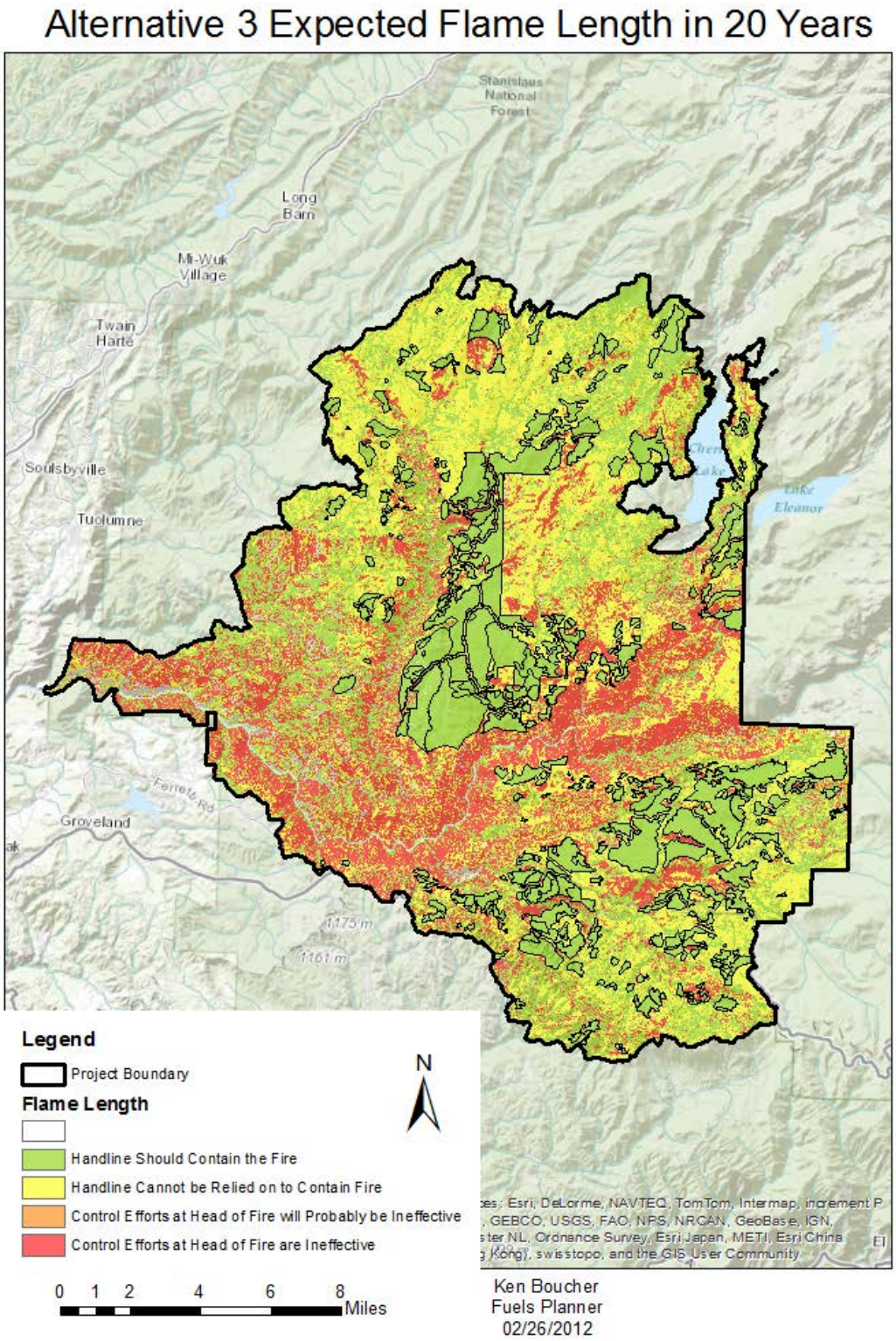


Figure 27 Alternative 3 Expected Flame Length Twenty Years after Treatment



Alternative 4

DIRECT AND INDIRECT EFFECTS

Alternative 4, like Alternatives 1 and 3, would reduce CWD through salvage harvest and treatment of non-merchantable fire-killed material. Alternative 4 would encompass approximately 27,826 acres and 325 miles (15,692 acres.) of SFMF. Treatments would lower flame lengths, fireline intensities, and resistance-to-control providing advantageous areas for fire suppression actions to take place.

Completed project activities would reduce CWD, lowering fire effects within the treated units. The fuel model in treated units would be represented by TU1 Low Load Dry Climate Timber-Shrub-Grass. The area outside treated units would burn the same as Alternative 2. Placement of the treated units would reduce overall fire size within the project area by reducing fireline intensities and fire effects providing opportunity for suppression forces to take appropriate actions (Finney 2001). Altering the movement and effects of fire through the project area would result in more natural and mosaic burn patterns.

Salvage harvest and treatments of the CWD would be similar to Alternative 3 and would reduce the CWD to be between 10 to 20 tons an acre, but on 494 fewer acres than Alternative 1 and 2,571 acres less than Alternative 3.

Salvage harvest would reduce the larger diameter merchantable material greater than 16 inches from the site; biomass removal (from approximately 4 inches to 16 inches in diameter) and jackpot burning (JPB) would treat the high density of the un-merchantable material. Piling and jackpot burning would treat the smaller diameter material and material not included in the previous treatment. After treatments the CWD is estimated to be between 10 to 20 tons per acre outside SPLAT units and 10 tons per acre inside SPLAT and SFMF units; these areas can be directly attacked with suppression resources increasing the chance of containing wildfires in the project area while maintaining resource needs (Brown et. al., 2003). CWD that does not exceed 10-20 tons an acre would be left on site for resource needs. This compacted material would have minimal effect on fire effects as shown in the table of fire effects, Table 10.

Table 10. Predicted average flame lengths, fireline intensity and firefighter production rates under the Alternative 4 within treatment units (FlamMap 5.0).

Alternative 1	Flame Length	Fireline Intensity	Suppression Interpretation
1 Year Post-Activity	≤2	≤100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
Year 5	≤4	≤100	
Year 10	≤4	≤100	
Year 20	≤4	≤100	

Alternative 4 would result in relatively lower surface fuel loads, potential flame lengths, fireline intensities, resistance-to-control, and potential mortality. Fuel loadings and potential flame lengths would be lowest in ground-based salvage harvest units where the treatment of submerchantable material (via biomass harvesting and removal or site preparation) would occur. While there is still potential for mortality in treated areas, it would remain lower than that of Alternative 2 for wildfires occurring under 90th percentile weather conditions

Fuels on the forest floor would consist of small diameter material and scattered larger logs. Snags and large logs may be present in the units to meet resource needs and Stanislaus Forest Plan Direction. These guidelines were developed with consideration for fire and its role in developing and sustaining these ecosystems. Duff and litter layers are currently not present at a level that would affect fire behavior and retaining the small diameter material on site would help accelerate the development of these layers. Out-year fire effects are expected to be dominated by young shrubs, small trees and hardwoods reoccupying the site.

As the vegetation matures, fuel loadings would increase. Continued maintenance designed to achieve the desired condition would maintain fuels profiles that allow fire to resume its ecological role and meet Stanislaus Forest Plan Direction.

CUMULATIVE EFFECTS

Cumulative effects for Alternative 4 include safer access to the area due to the Rim Fire Hazard Tree removal along main roads and the level 2 roads in this project. In addition, fuels treatments would improve the safety for all users. Firefighter safety would be improved with the removal of the overhead snags as they pose one of the greatest hazards to firefighters. The treatment of CWD and smaller fire-killed vegetation would result in a reduction in fire effects and resistance-to-control thereby increasing safety during a wildfire event. Reduced fire effects would allow suppression forces to take appropriate action. Fire spread on public lands would be altered reducing the chance of fire spreading between the public and private lands interface.

Future wildfires within the project area will be affected on a landscape level by the combination of treatments implemented on privately owned Sierra Pacific Industries (SPI) land, the Rim Fire Hazard Tree removal and the adjacent Forest Service (Rim Fire Recovery treatment units) lands. Fuels treatments are strategic placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks and private land would further break up fuel continuities in the area, creating more opportunities for future suppression actions.

The treatment units running along the Westside of the private boundary would create lower fire effects by reducing CWD allowing suppression resources to suppress fires coming into or leaving the private public land interface. With the removal of fire-killed trees on both the private and public lands, future fuel loading conditions will be reduced and will result in a fire that would burn under more historical conditions. Any residual fuels left on SPI lands would be burned. This would further reduce fuel loading to approximately 10 to 20 tons per acre. On National Forest System lands, residual fuels would be reduced to approximately 10 to 20 tons per acre. As a result, the treated areas would burn as surface fires with low flame lengths and fireline intensities. These lower-intensity fires and lower resistance-to-control issues could be suppressed using direct attack with handtools. Fuels treatments are strategic placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks would further break up fuel continuities in the area, creating more opportunities for future suppression actions.

Figure 28 Alternative 4 Expected Fireline Intensity One Year after Treatment

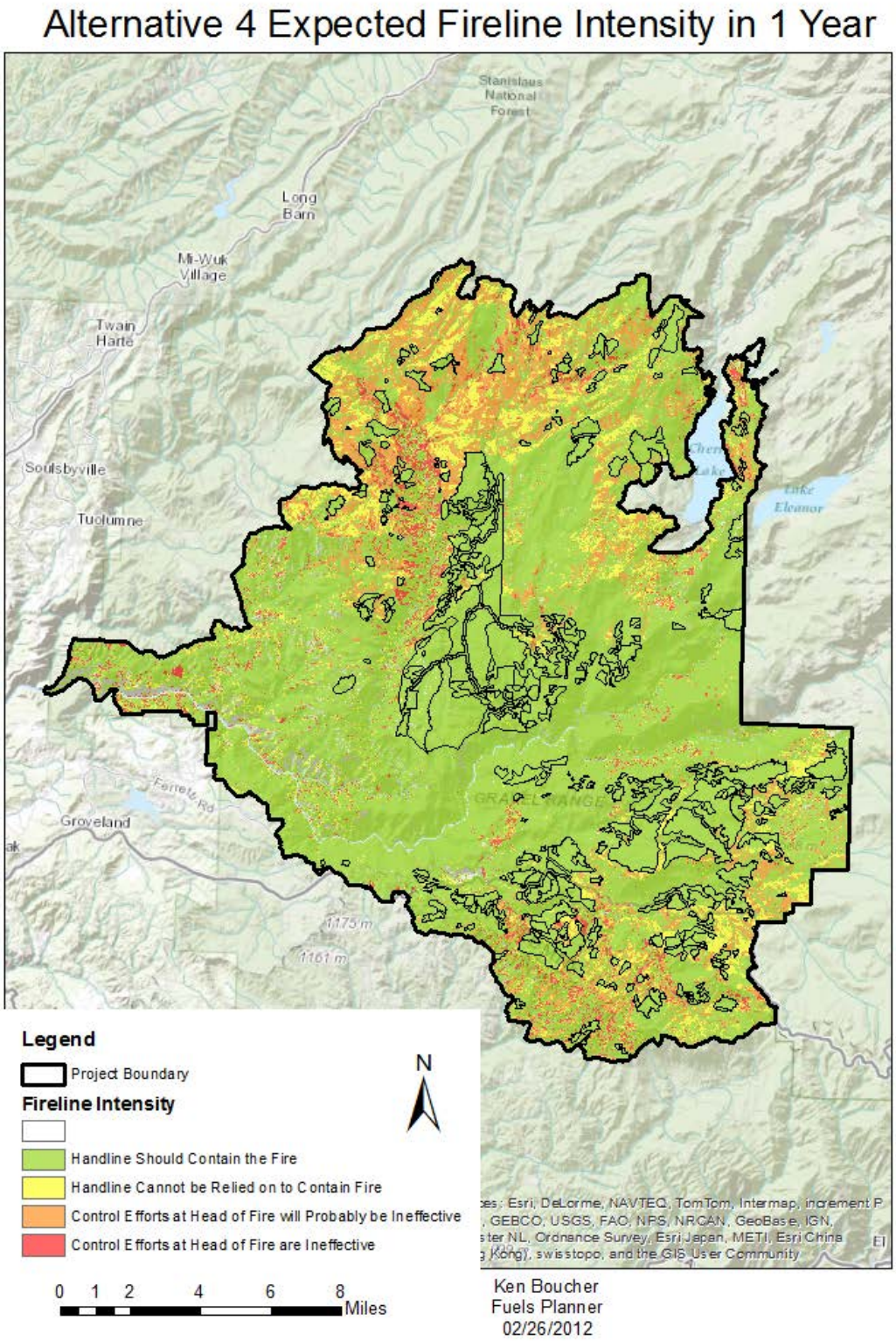


Figure 29 Alternative 4 Expected Fireline Intensity Five Years after Treatment

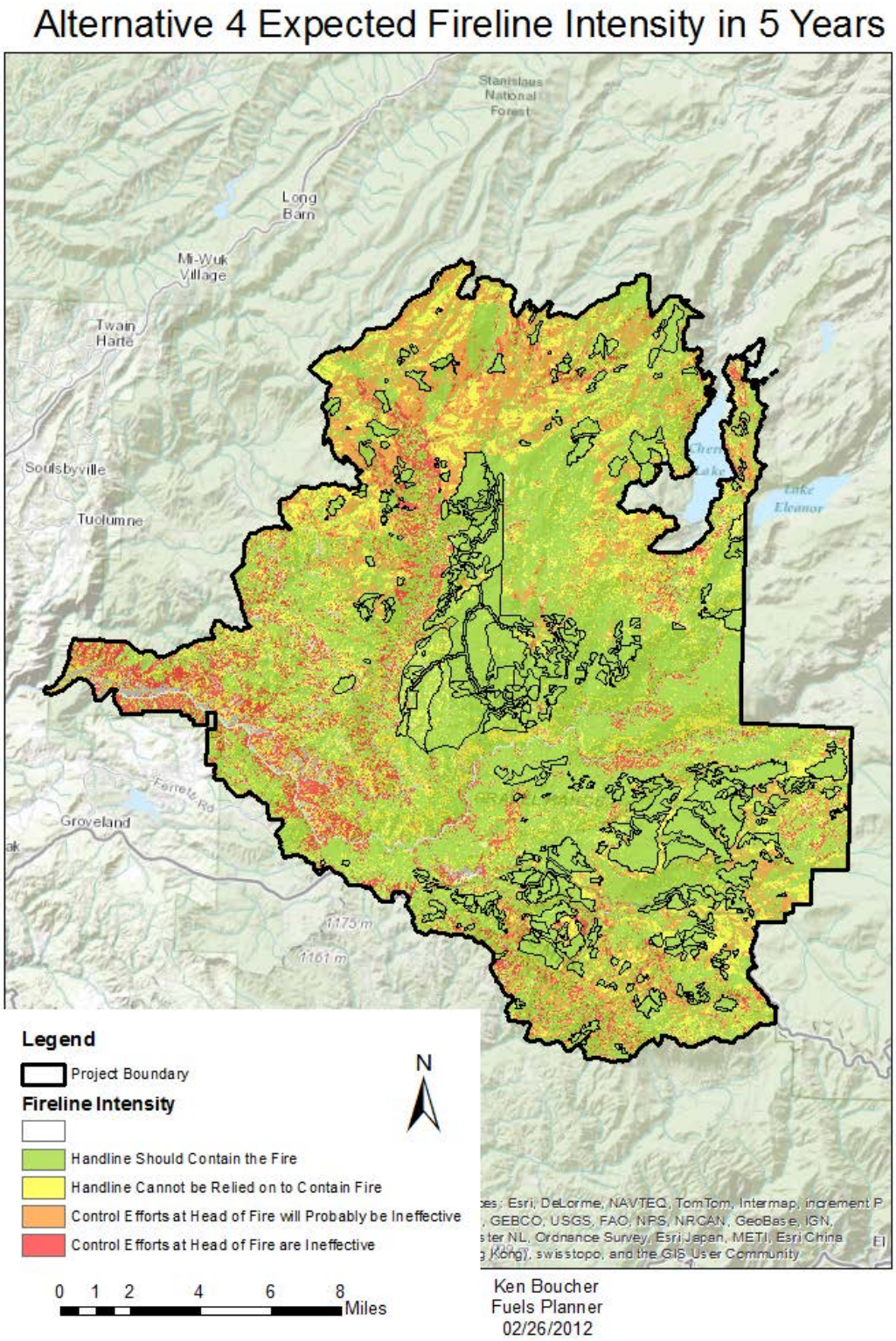


Figure 30 Alternative 4 Expected Fireline Intensity Ten Years after Treatment

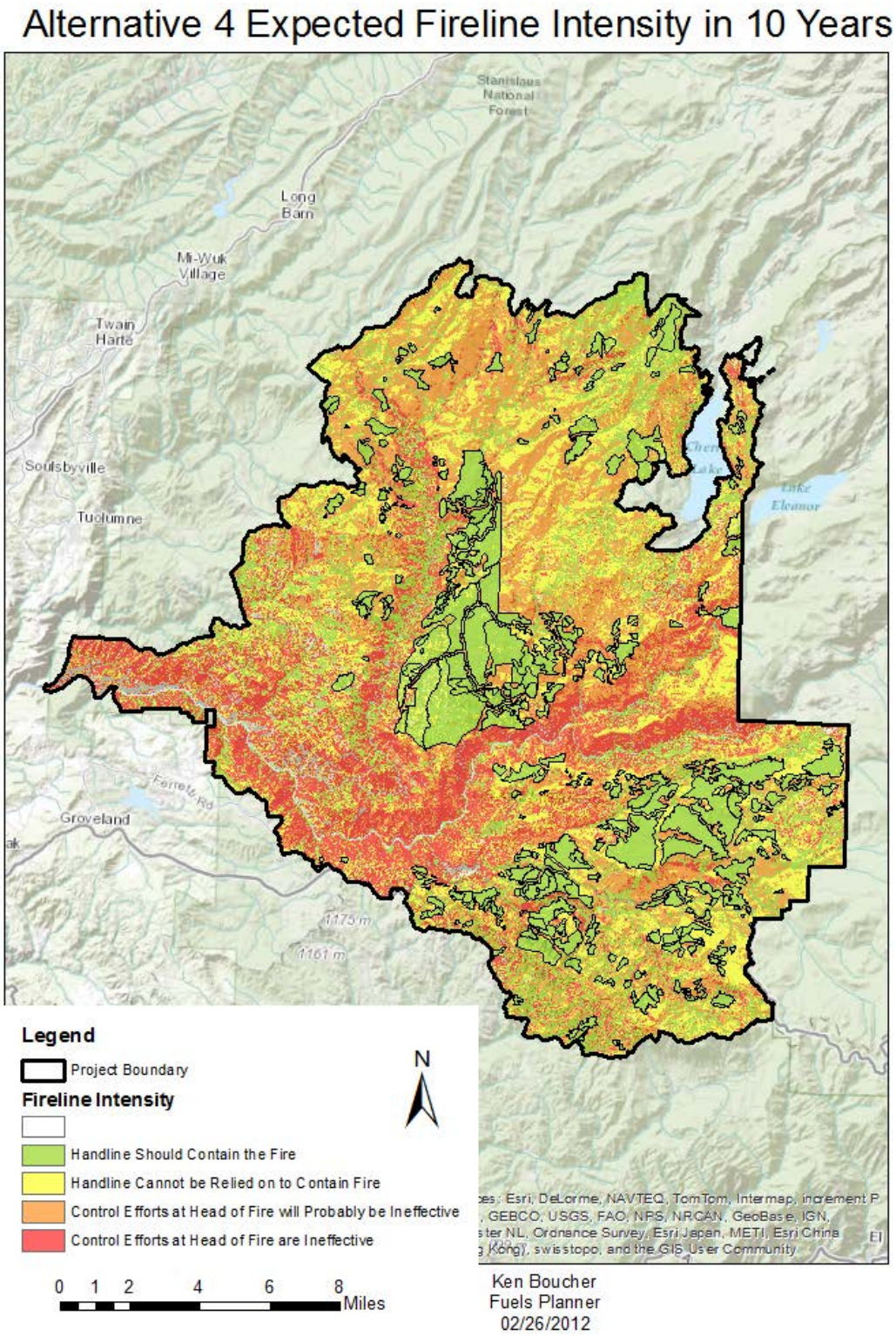


Figure 31 Alternative 4 Expected Fireline Intensity Twenty Years after Treatment

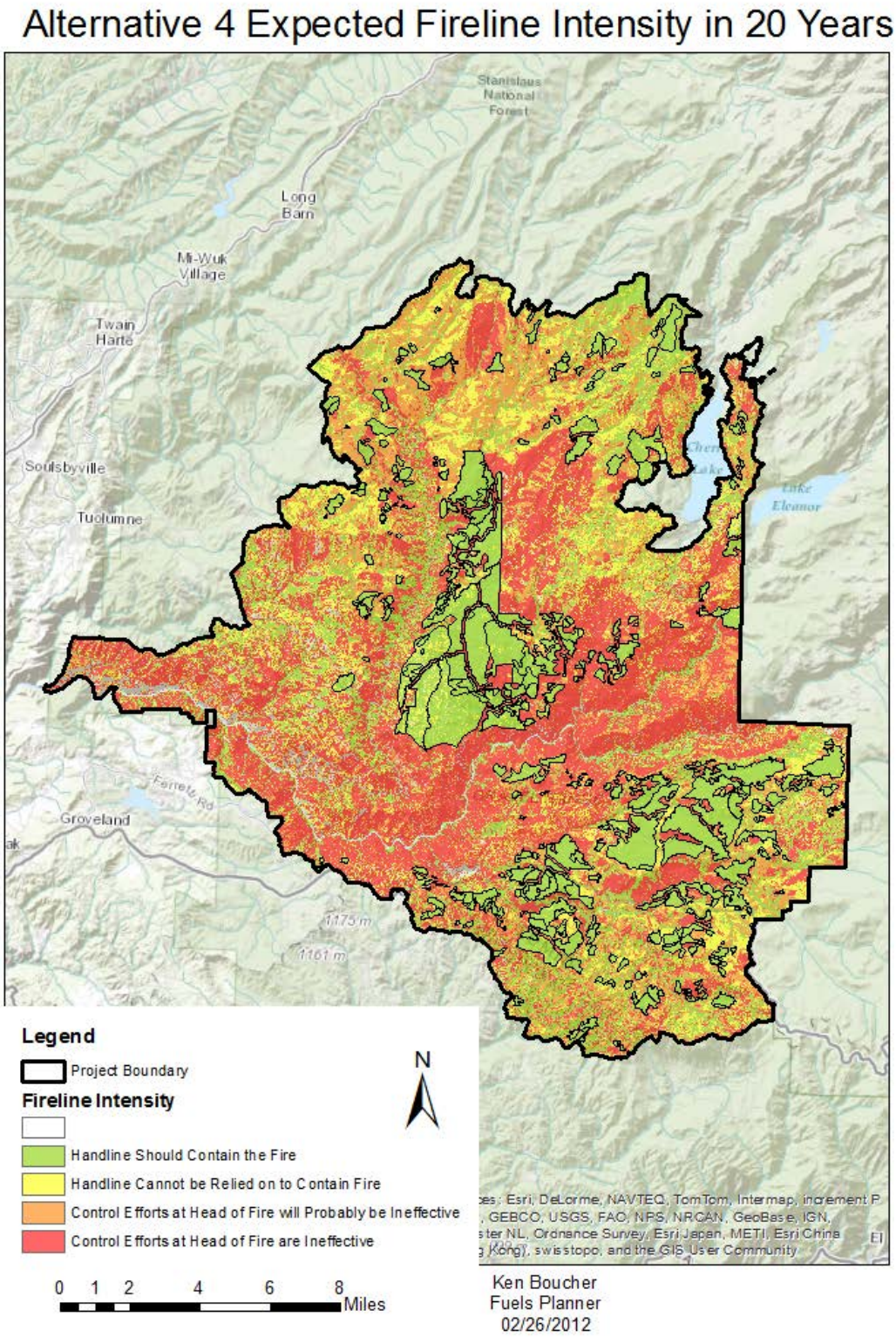


Figure 32 Alternative 4 Expected Flame Length One Year after Treatment

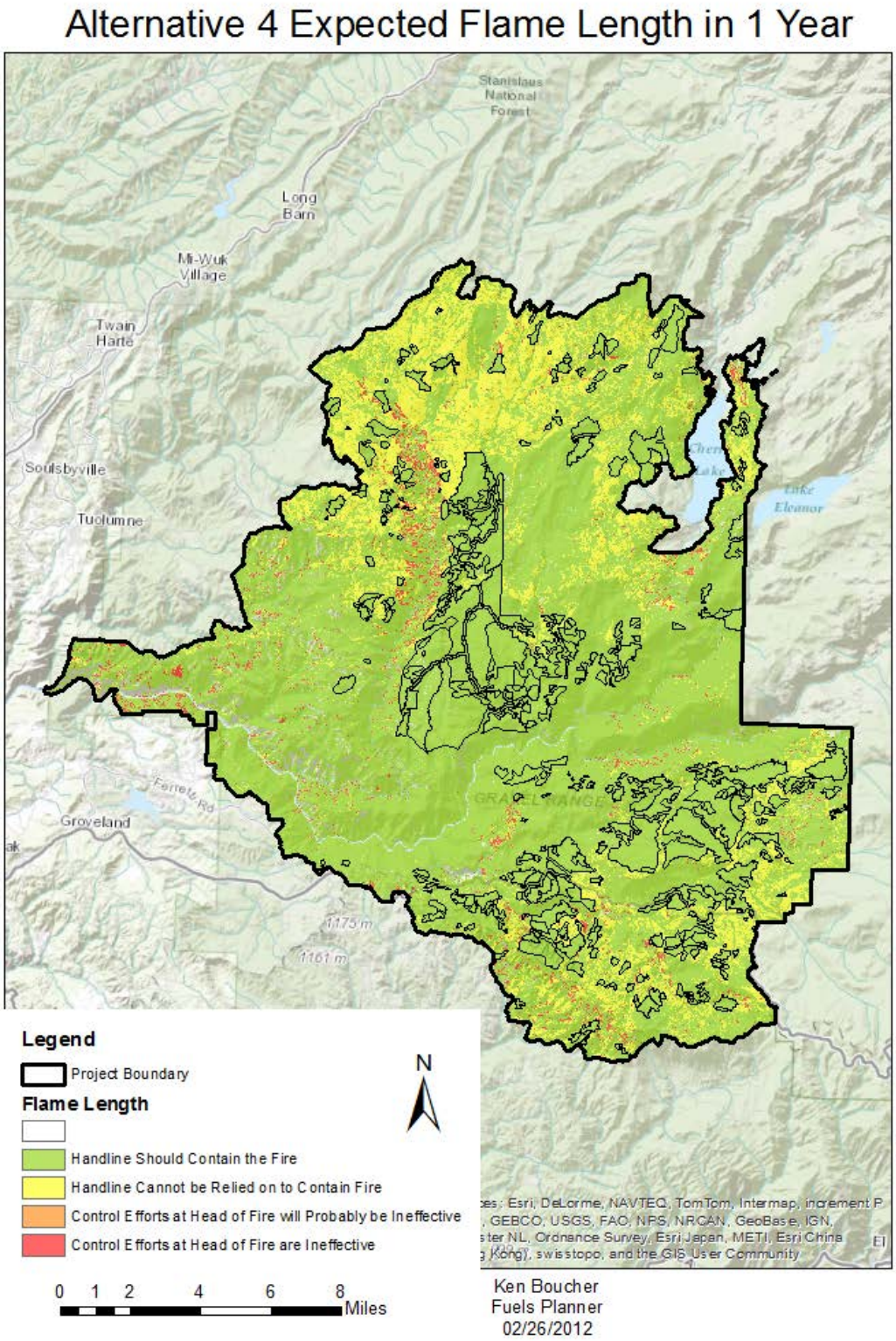


Figure 33 Alternative 4 Expected Flame Length Five Years after Treatment

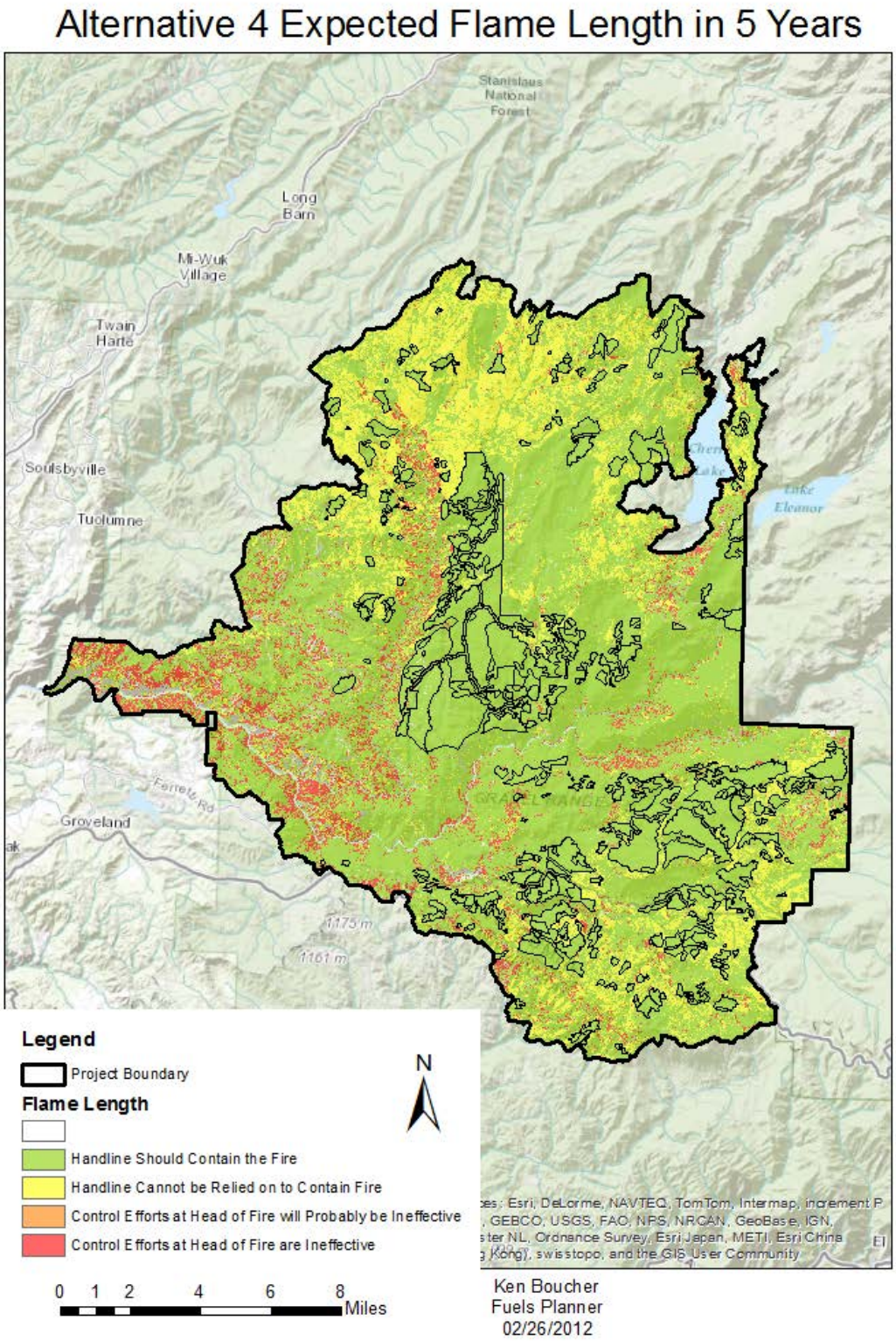


Figure 34 Alternative 4 Expected Flame Length Ten Years after Treatment

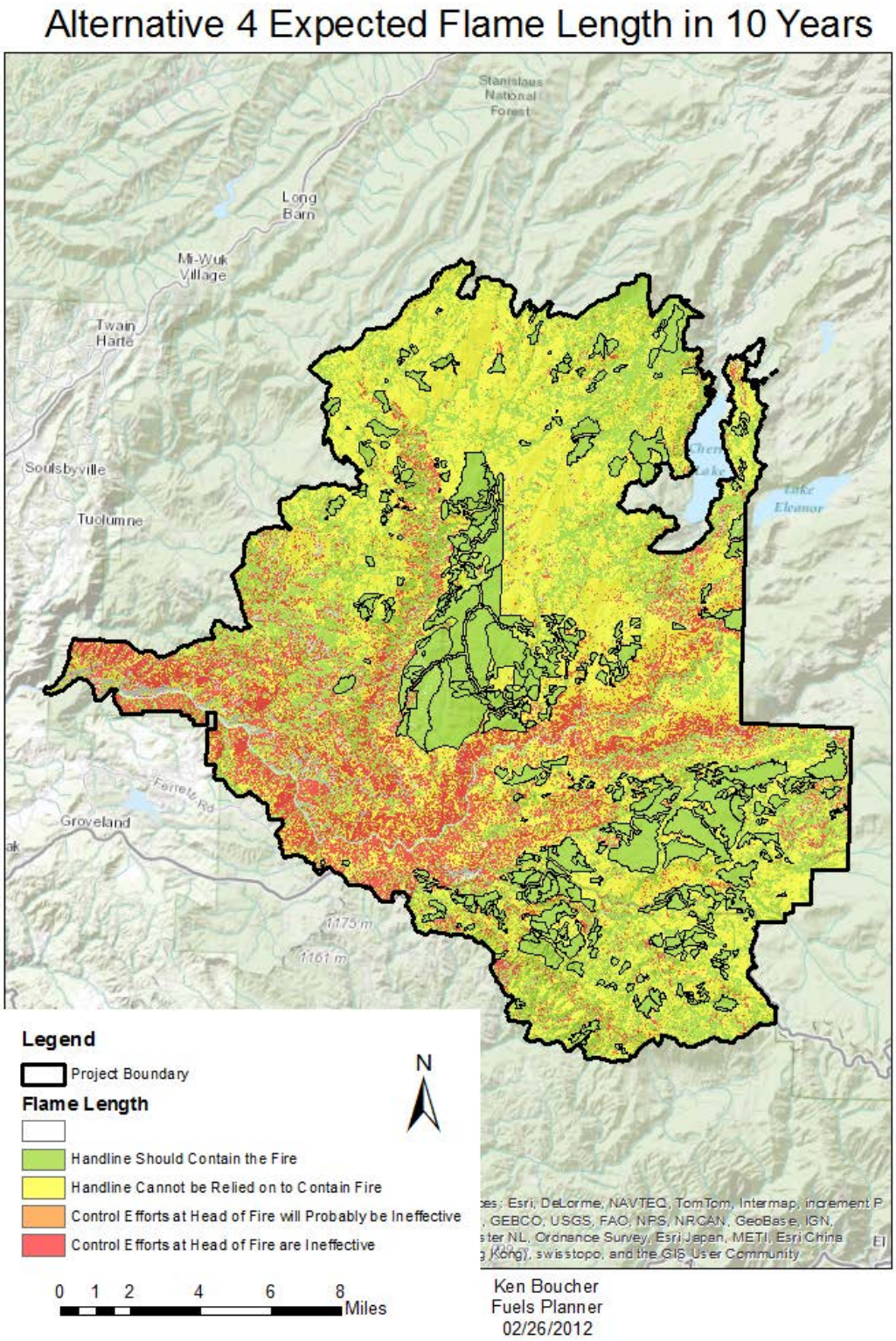
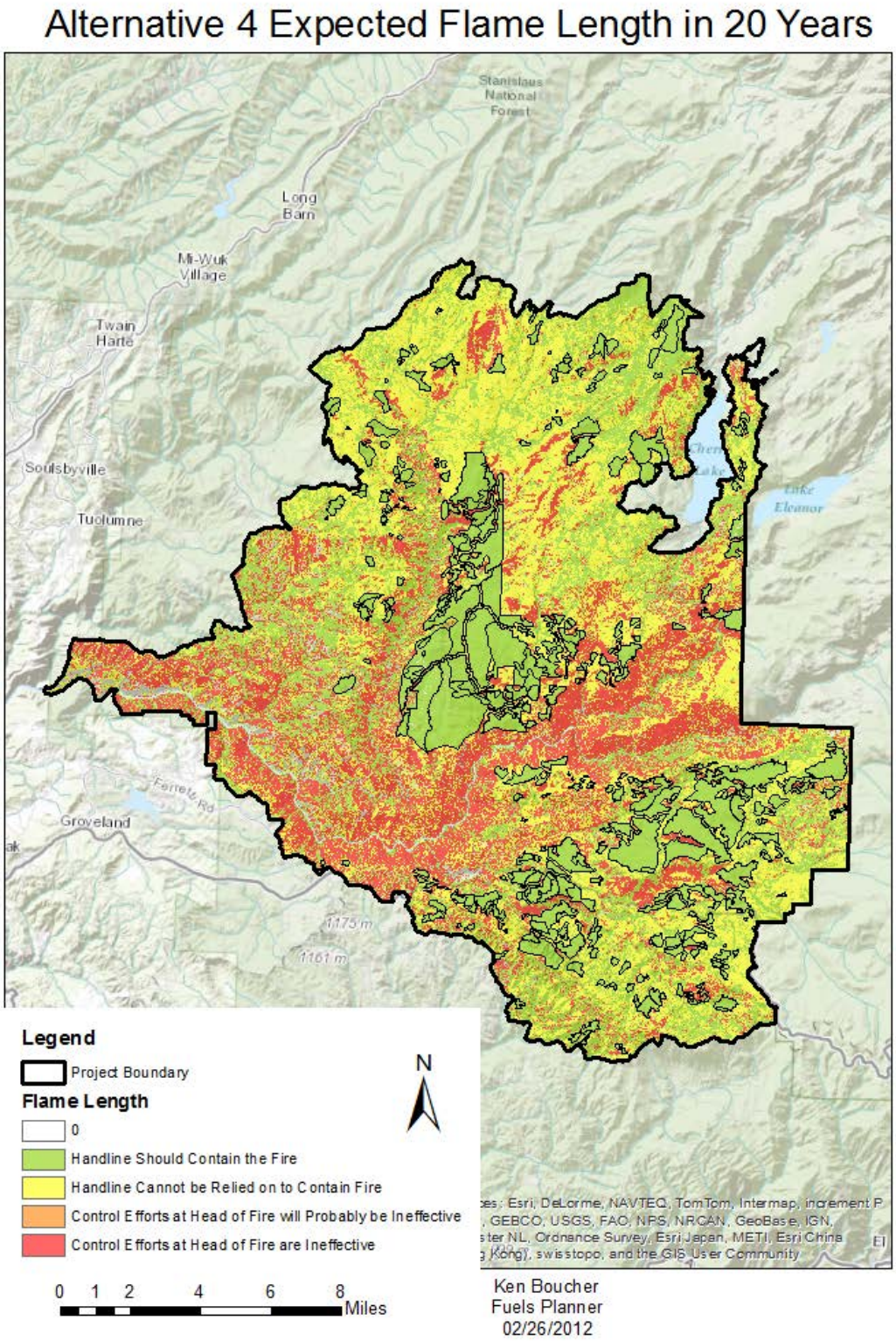


Figure 35 Alternative 4 Expected Flame Length Twenty Years after Treatment



Summary of Effects Analysis across All Alternatives

As noted above, with implementation of Alternative 2, travel would become increasingly hazardous as snags would decay and fall. Fire effects would exceed firefighter capabilities within a few years and suppression efforts would have to use indirect tactics. Future fires would be expected to burn with high intensities, impacting resources and killing most vegetation.

Therefore, Forest guidelines and direction for fire management would not be met after approximately 5 years with implementation of Alternative 2.

With implementation of alternatives 1, 3, or 4, fire intensities, as summarized in Table 11, would be reduced and safety improved so that firefighters could enter the area and take appropriate action. The three action alternatives would, therefore, meet Forest Plan direction for fire management.

Table 11: Fire effects by Alternative over the next 20 years

	Post activity		**5years**		**10 years**		**20 years**	
	Flame Length	**Fireline Intensity**	**Flame Length**	**Fireline Intensity**	**Flame Length**	**Fireline Intensity**	**Flame Length**	**Fireline Intensity**
Alternative 1	1	100	2	100	4	100	4	100
Alternative 2	2	100	4	500	10	≥1,000	13	≥1,000
Alternative 3	1	100	2	100	4	100	4	100
Alternative 4	1	100	2	100	4	100	4	100

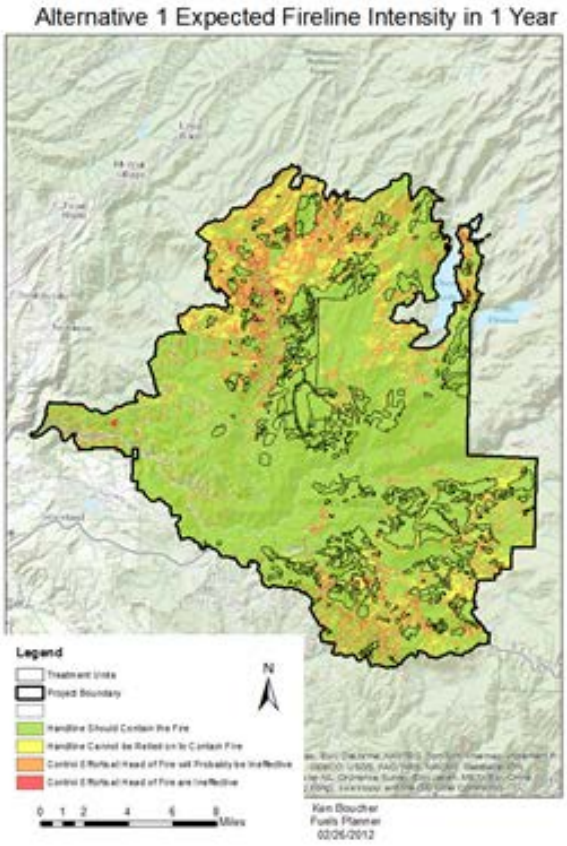
Alternative 1 reduces the most Coarse Woody Debris (CWD) down to 10 tons an acre which correlates to a reduction in fire effects and a low resistance-to-control (Brown et al 2003). Alternative 1 because of the lower CWD further increases the opportunities for suppression resources to contain fires spreading between the private and public interface. Compared to Alternative 3 and 4 the fire effects are negligible as all three action alternatives can be contained by handline.

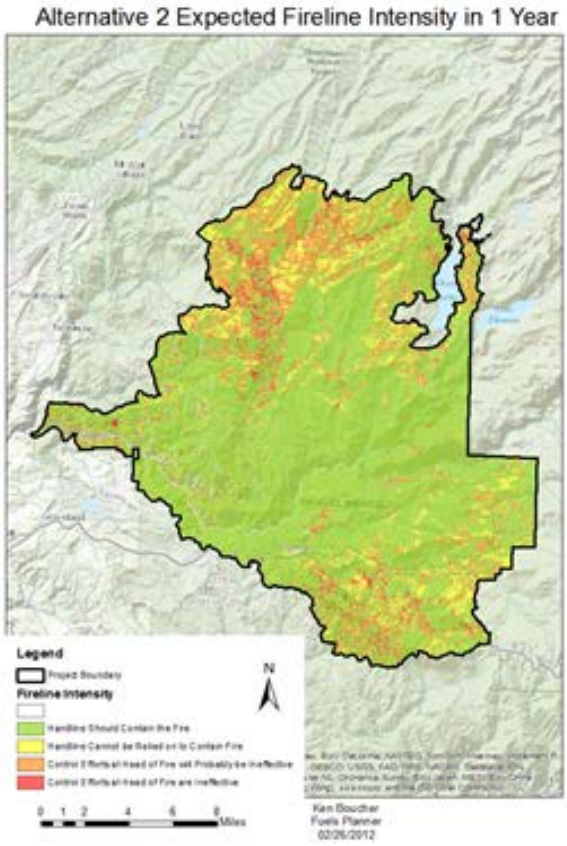
Alternative 2, no action, surface fuels are projected to average 42 tons per acre within 10 years and 78 tons per acre within 30 years. The amount of fuels on the ground would rate this alternative as an extreme resistance-to-control problem (Brown et. Al. 2003)

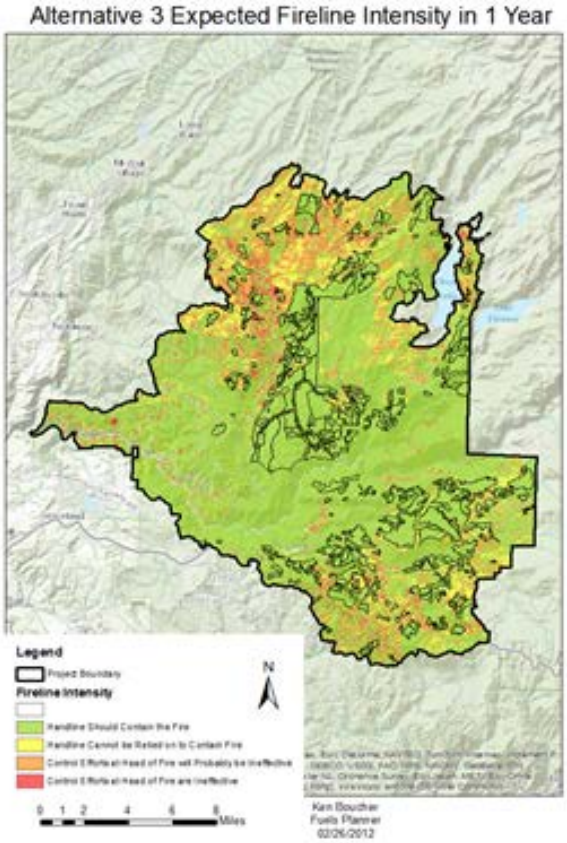
Alternative 3 reduces coarse woody debris to 10 to 20 tons an acre outside SPLAT units and 10 tons an acre inside SPLAT and SFMF units. Alternative 3 also treats approximately 2,077 more acres but approximately 16 less miles (308 ac.) than Alternative 1. Inside SPLAT and SFMF units the fire effects would be the same as Alternative 1, while outside the SPLAT units fire effects would be slightly higher. Handlines could still contain fires and resistance-to-control would be low.

Alternative 4 reduces coarse woody debris to 10 to 20 tons an acre outside SPLAT units and 10 tons an acre inside SPLAT and SFMF units. Alternative 4 treats approximately 494 less acres and approximately 11 less miles (158ac.) than Alternative 1 and approximately 2,571 acres less but approximately 5 miles (150ac.) more than Alternative 3. Inside SPLAT and SFMF units the fire effects would be the same as Alternative 1, while outside the SPLAT units' fire effects would be slightly higher. Handlines could still contain fires and resistance-to-control would be low.

Figure 36 Alternative Comparison of Fireline Intensity One Year after Treatment







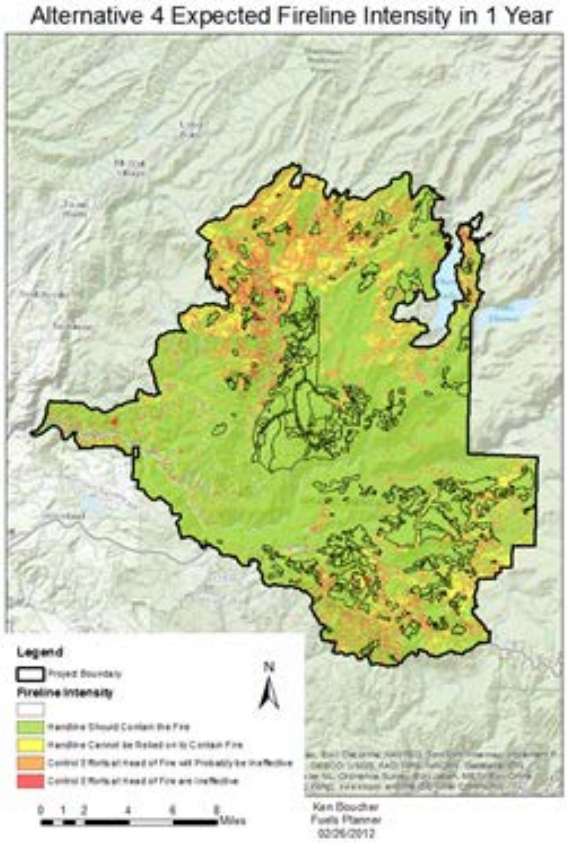
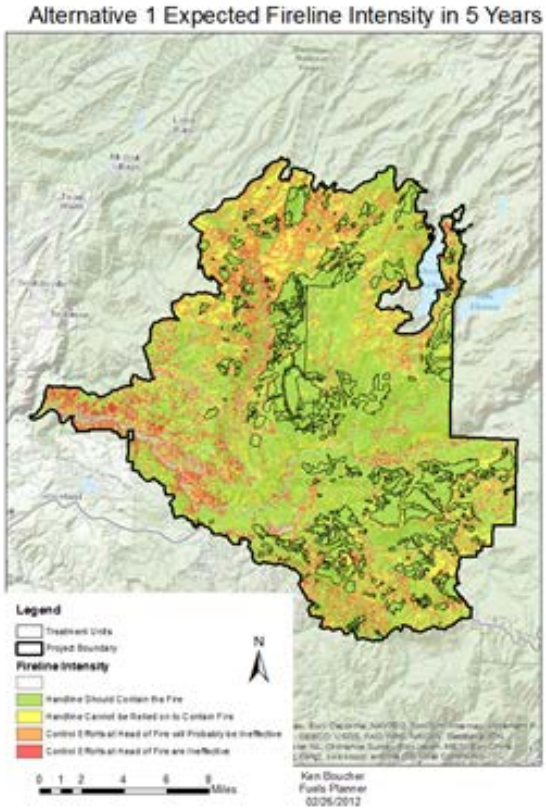
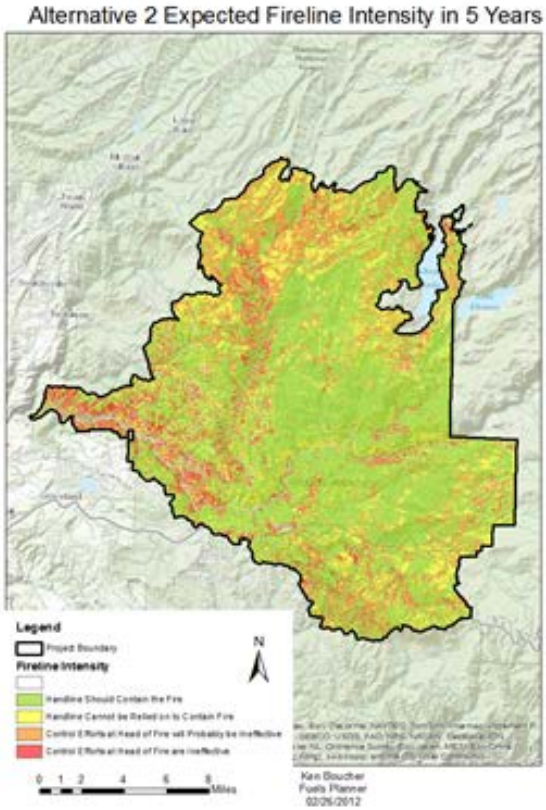
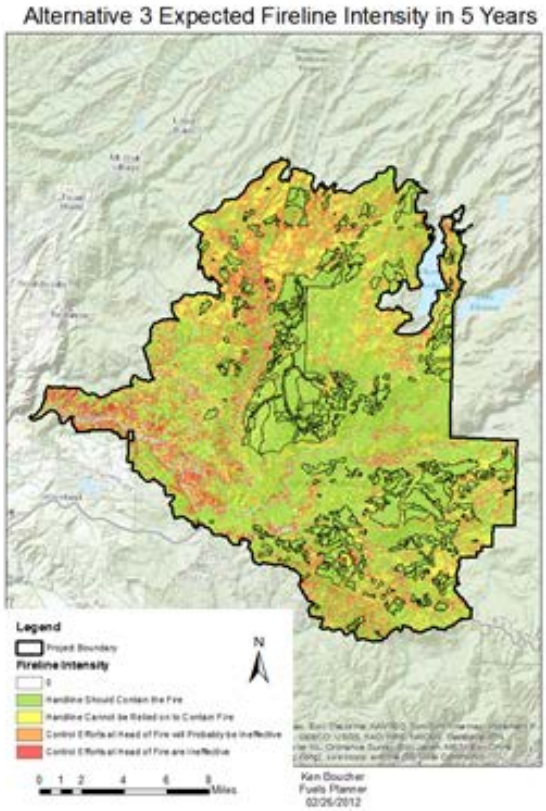


Figure 37 Alternative Comparison of Fireline Intensity Five Years after Treatment







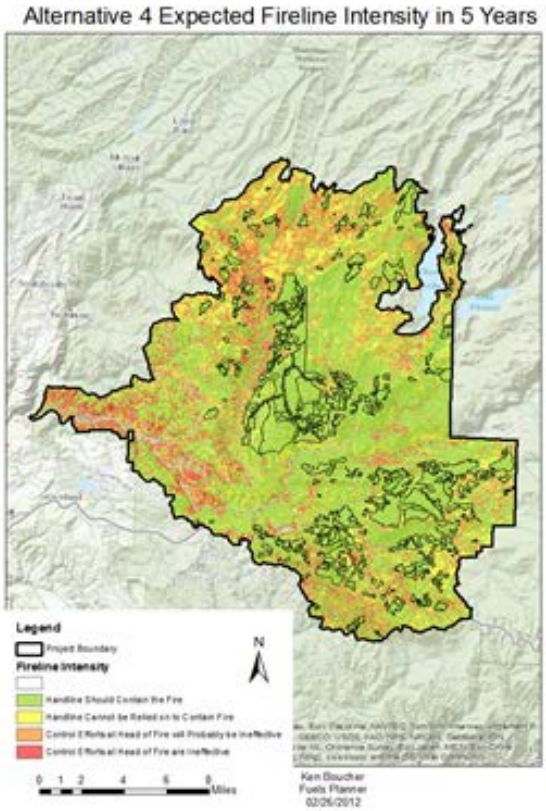


Figure 38 Alternative Comparison of Fireline Intensity Ten Years after Treatment

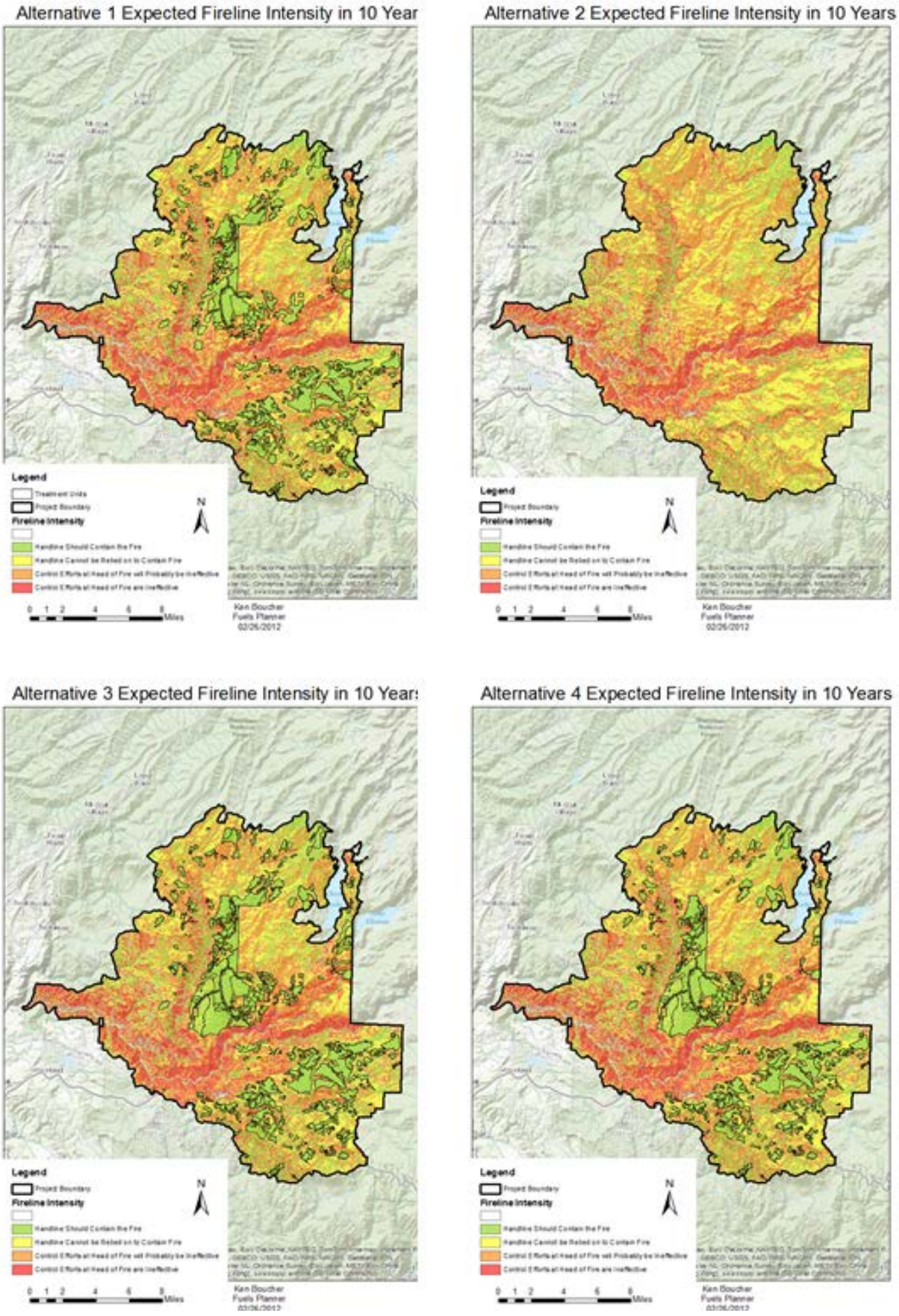
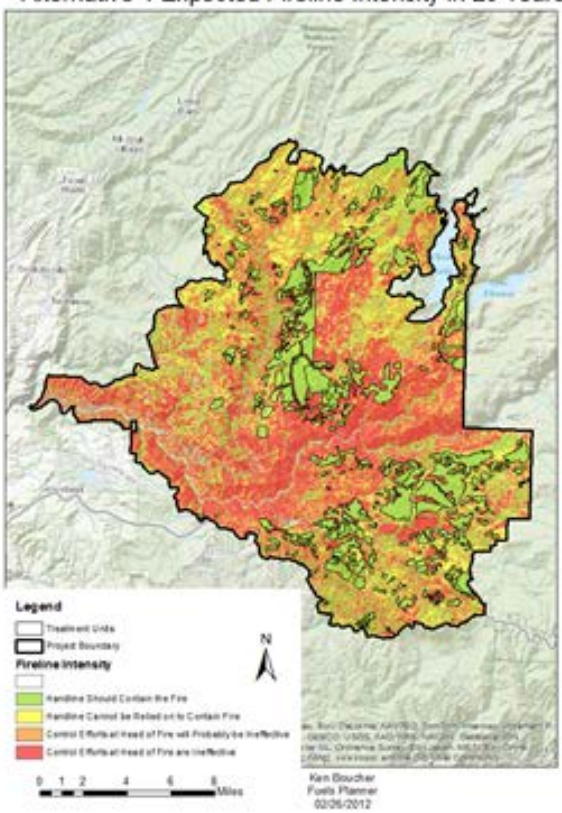
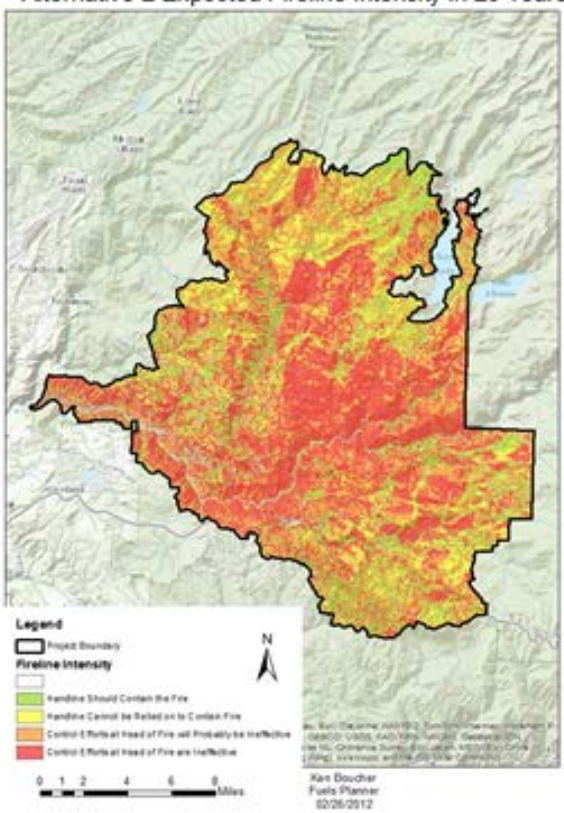


Figure 39 Alternative Comparison of Fireline Intensity Twenty Years after Treatment

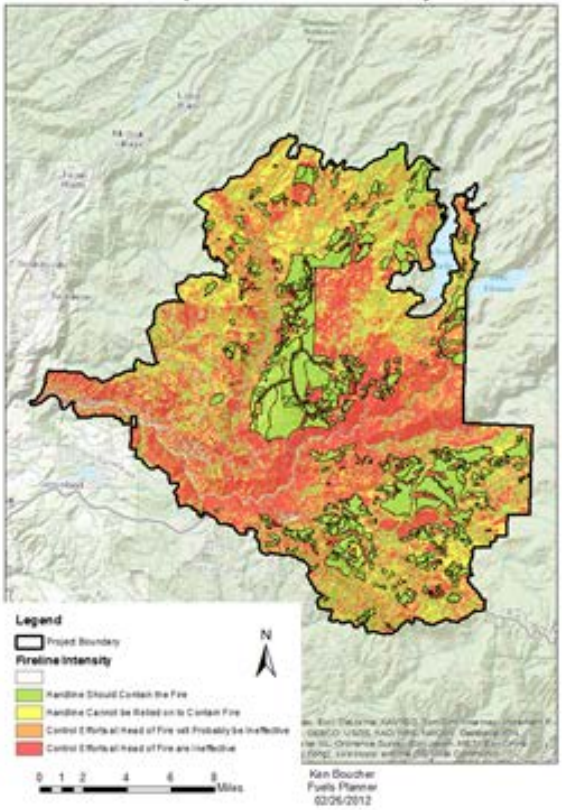
Alternative 1 Expected Fireline Intensity in 20 Years



Alternative 2 Expected Fireline Intensity in 20 Years



Alternative 3 Expected Fireline Intensity in 20 Years



Alternative 4 Expected Fireline Intensity in 20 Years

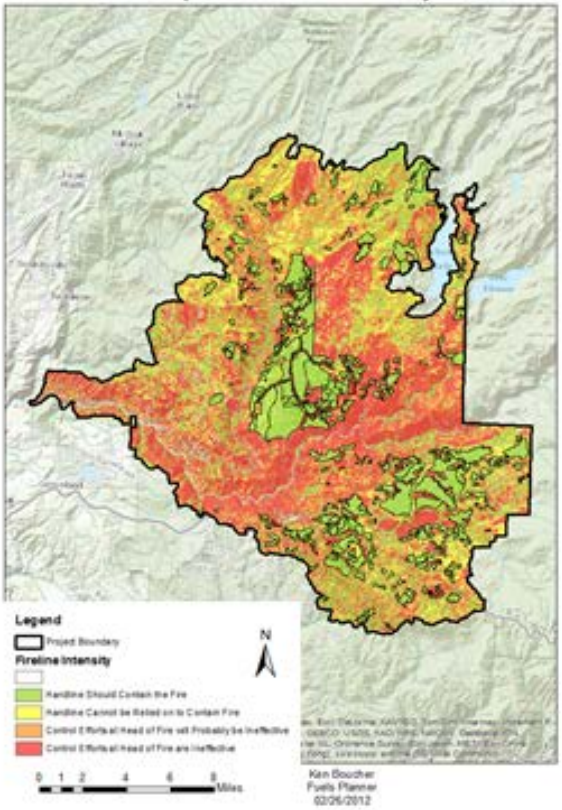
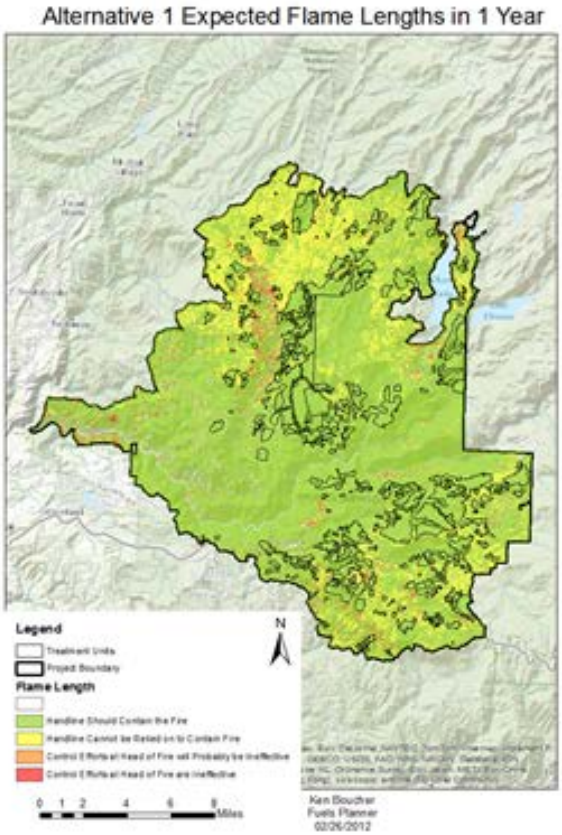
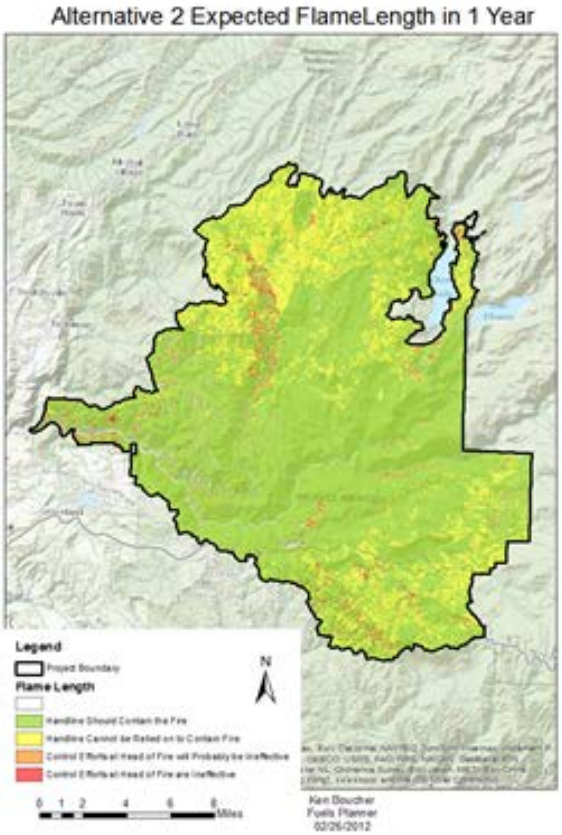
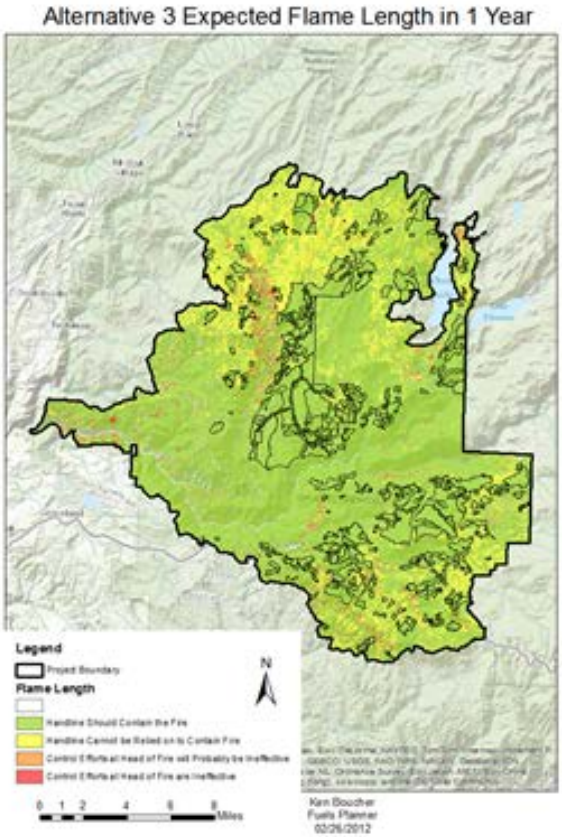


Figure 40 Alternative Comparison of Flame Lengths One Year after Treatment







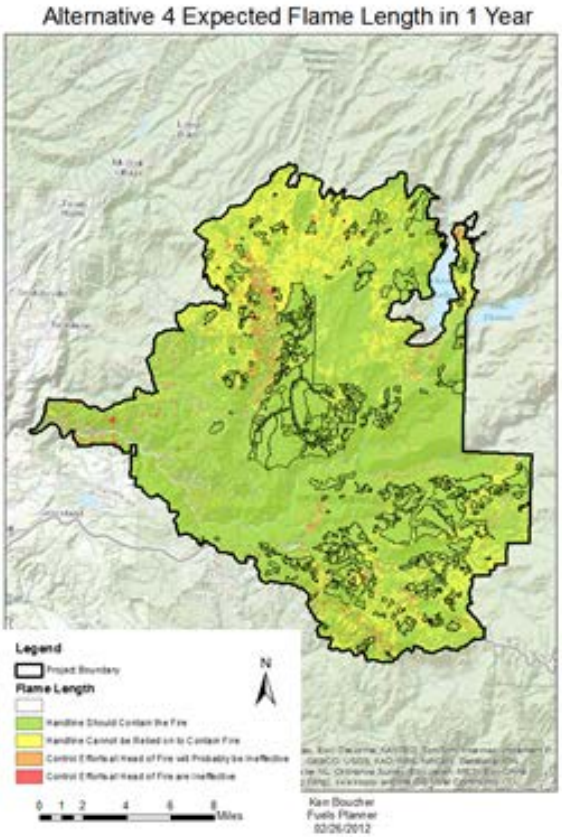
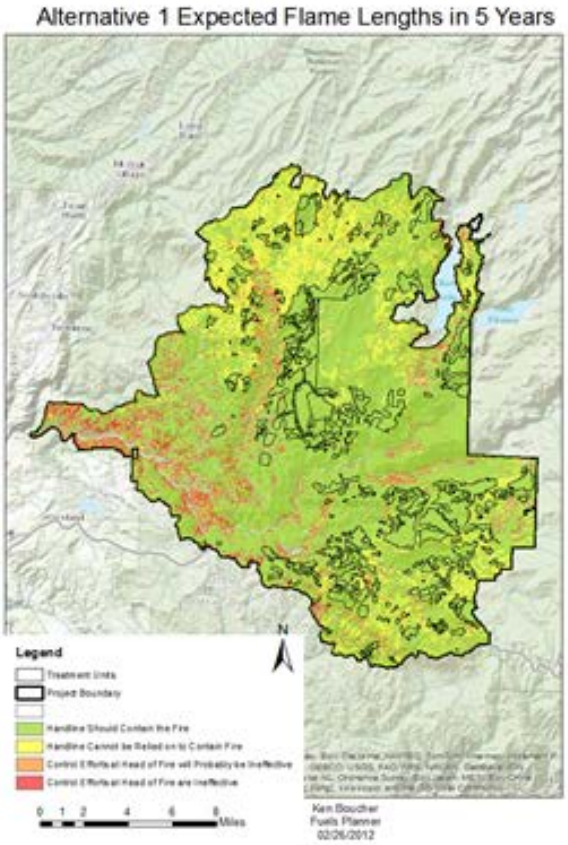
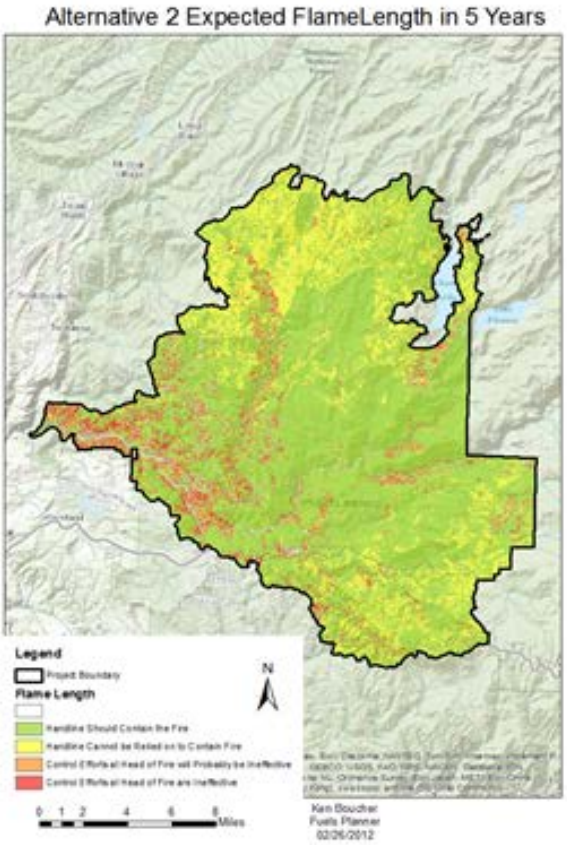
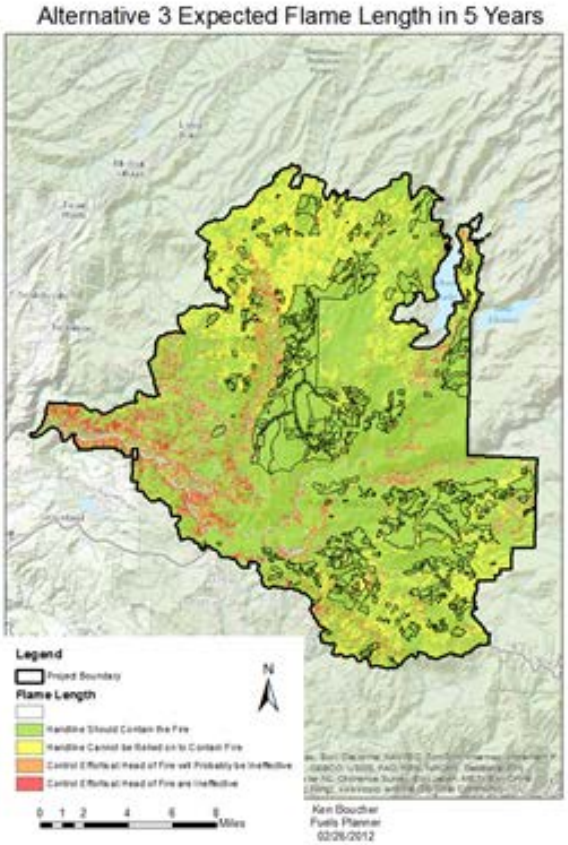


Figure 41 Alternative Comparison of Flame Lengths Five Years after Treatment







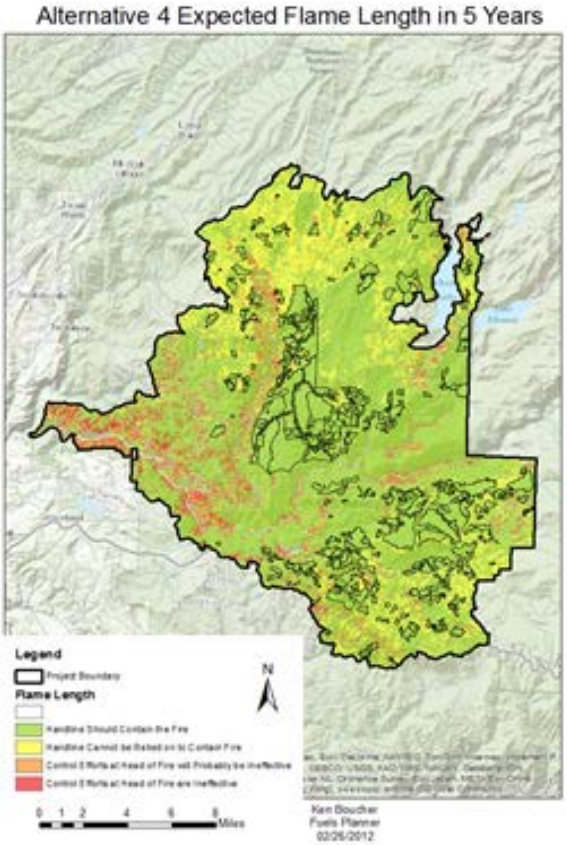
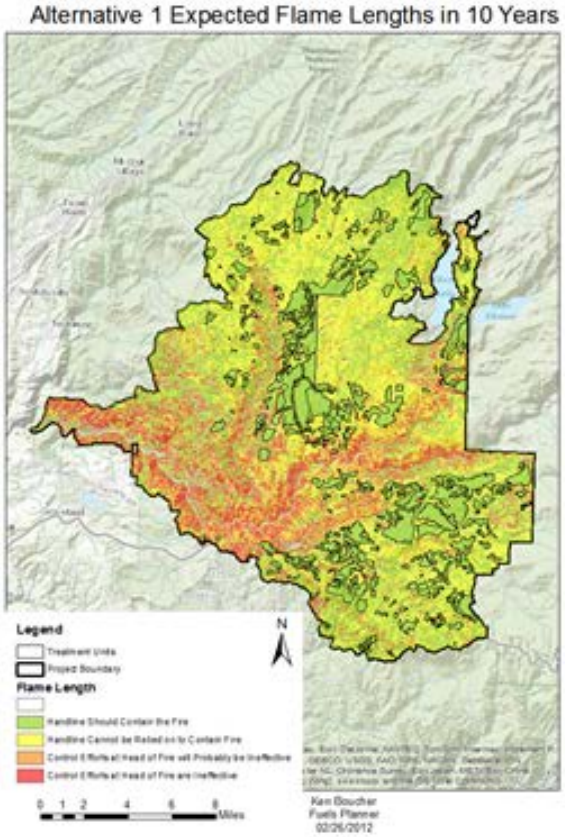
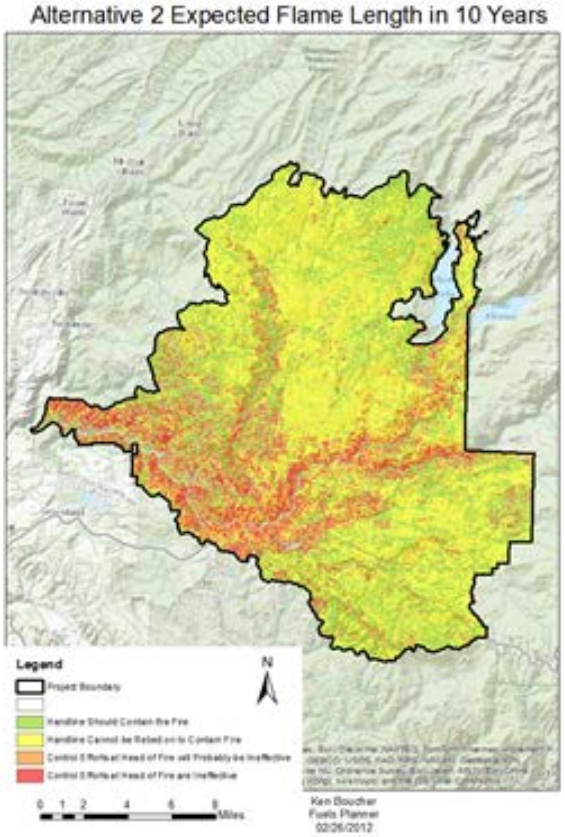
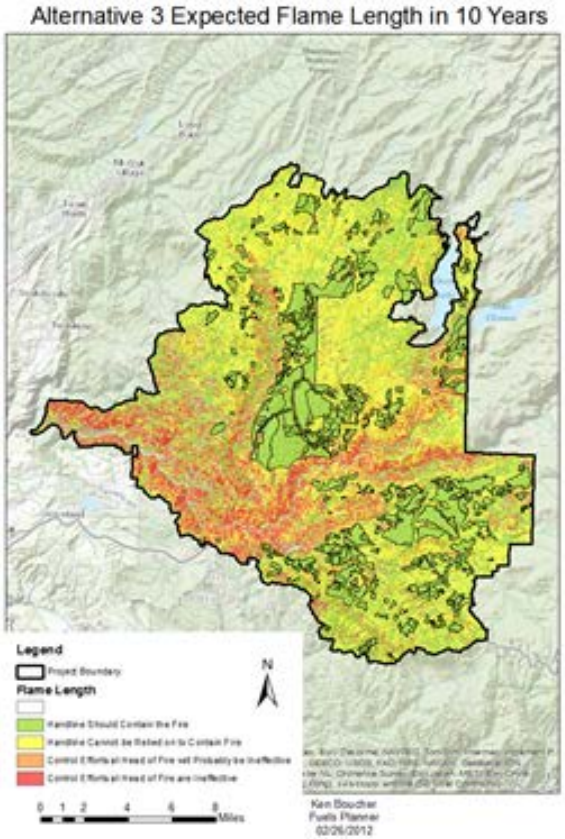


Figure 42 Alternative Comparison of Flame Lengths Ten Years after Treatment







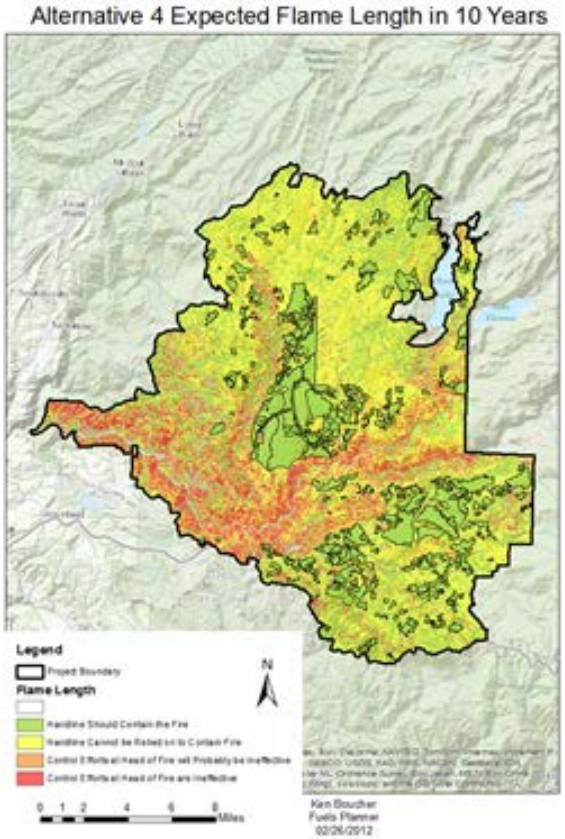
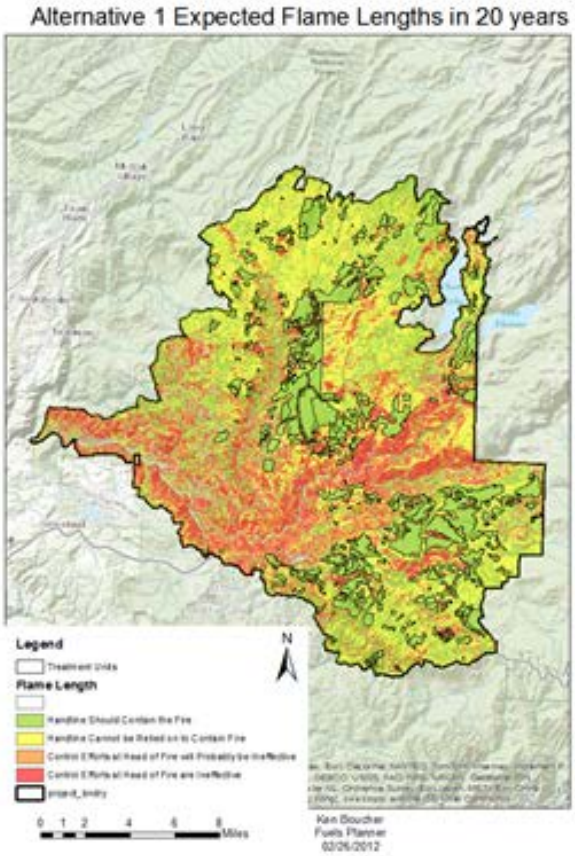
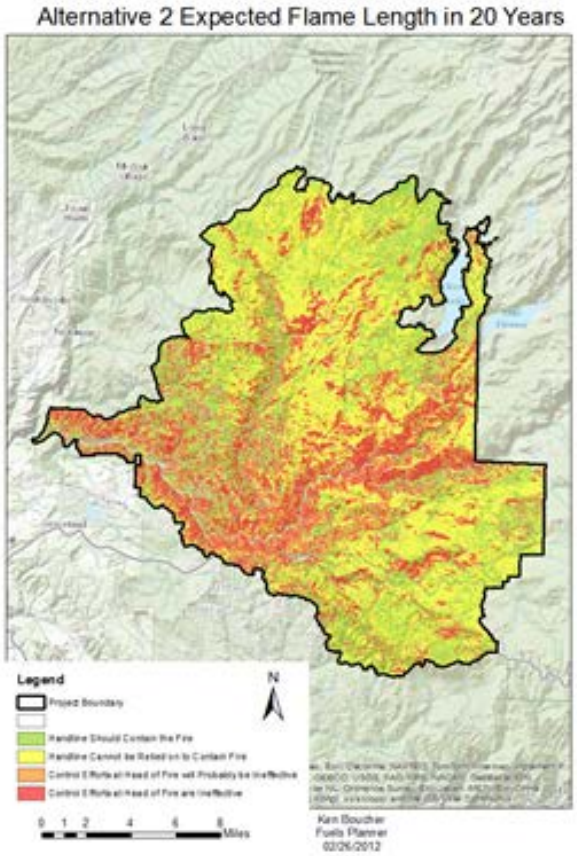
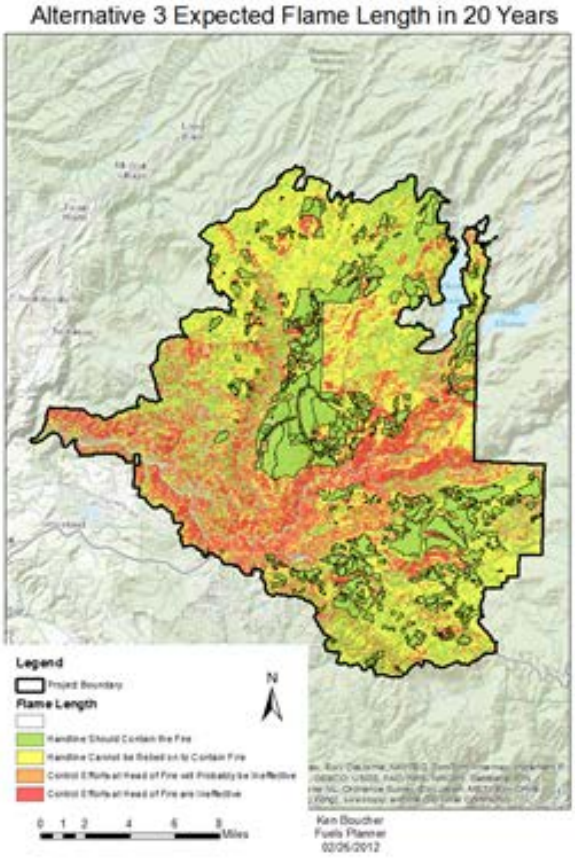
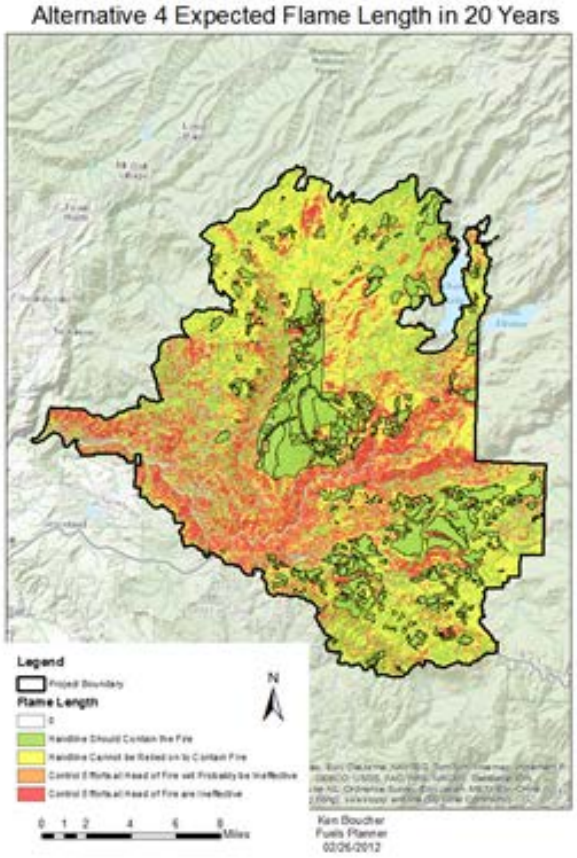


Figure 43 Alternative Comparison of Flame Lengths Twenty Years after Treatment









Minor Issues

Minor issues are identified in chapter 1 of the draft EIS. Those minor issues pertaining to management of forest vegetation, fuels, potential fire effects and air quality, and associated effects are addressed in detail below.

Issue: The FACTS database shows the acreage of all post-fire activities, including where several different activities (e.g., salvage logging, piling/burning of fuels, logging road skid trails, artificial reforestation, etc.) occur on the same acreage. As such, unless multiple actions on the same acreage are eliminated from the analysis, the result is a dramatic overstatement of the overall acreage burned, which results in a dramatic understatement of the proportion of Black-backed Woodpecker habitat that has been salvage logged

Response: The fuels report takes into account ground acres, not treatment acres. This shows actual acres that were burned as well as potential ground acres treated for each action alternative.

Issue: During the past three years, the California Department of Fish and Wildlife has utilized GPS and VHF radio-collars to collect migration and home range information regarding the Jawbone population of the Tuolumne deer herd. The Department of Fish and Wildlife now has a wealth of information regarding deer migration habits for this area. This information is available and should be incorporated into habitat improvement, logging and fuels reduction planning.

Response: The fuels treatments will incorporate habitat improvements through management requirements.

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