Stewardship Fireshed Analysis

For the

Eddy Late-Successional Reserve

Fire and Fuels Deliverable

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Introduction

This document includes the Stewardship Fireshed Analysis (SFA) deliverable for all required steps:

(a) Define the analysis area (hereinafter referred to as "Assessment Area")

(b) Identify the protection targets

(c) Define the problem fire

(d) Design treatment patterns

(e) Test the proposed treatment pattern

(f) Clearly display trade offs

(g) Develop monitoring and adaptive management strategy

This is clearly not the end of the Fireshed Analysis process, as it will be carried on to citizen and agency collaboration meetings, Forest Service meetings, and contractor Interdisciplinary Team (ID Team) meetings throughout the planning and environmental analysis process for the environmental impact statement. New treatment patterns will be tested, and new treatments may be developed through the collaborative process.

Need for Action

Fires in the Klamath Mountains are frequent and generally of mixed severity, moderate to high intensity. Fire exclusion and other management activities in the Klamath Mountains over the last 100 years have led to changes in the frequency and intensity of wildfires. Past fire suppression policies that controlled all fires have caused changes in stand structures, including higher densities of brush, small trees, and shade-tolerant tree species. Past fire suppression has also increased accumulation of dead and down woody material and other organic debris (ground fuels) and has led to larger and more intense wildfires in the Klamath Mountains. These unnaturally intense wildfires permanently damage soil, degrade watersheds of already at-risk fish stocks, and remove all vegetation over large areas, thereby slowing natural recovery.

The combination of overstocking, periodic drought, insects, and diseases have also contributed to increasing tree mortality. Moisture stress, brought on by overstocking and drought, has reduced tree vigor, thereby predisposing trees to attack by insects and disease. The continuation of current trends could jeopardize the continued existence, continuity, and functionality of late-successional old-growth (LSOG) forests and other habitats.

Stewardship and Fireshed Assessment Process

"Stewardship & Fireshed Assessment (SFA) is an interdisciplinary and collaborative process for designing and scheduling fuels reduction and integrated vegetation management projects consistent with the goals of the *Healthy Forests Restoration Act*, National Fire Plan, and national forest land and resource management plans. Key to the Stewardship & Fireshed Assessment [sic] process is defining the fire threat and identifying critically threatened

areas in order to change the outcome of the next large wildfire. The SFA process works well to address the short-term, interim strategy of treating strategic locations within the forest to reduce the severity of future wildfires. In the long term, the SFA process will be used to develop multiple resource strategies that will need to be employed to address the landscape-scale fire and forest health problems that threaten our forests" (http://www.wildfirelessons.net/Additional.aspx?Page=57).

The *process* was developed by the Pacific Southwest Regional Office of the USDA Forest Service Fuels Management Staff. It was designed to promote the *collaborative* development of treatments for a large landscape. Its intent is to bring together diverse disciplines, stakeholders, and the Forest Service management team to develop projects that protect the forests, and the communities around the forest, from catastrophic (standing-replacing) wildfires.

The process requires the use of several fire behavior models (FARSITE, FLAMMAP), a weather and fire history analysis tool (FIREFAMLY Plus), and Arc GIS. Appendix A presents definitions for the various models used for this Eddy Gulch Late-Successional Reserve (LSR) SFA. The models require weather inputs and the development of vegetation and fuel model landscapes for use in FARSITE and FLAMMAP to model the various treatment proposals under a proposed action, additional action alternative(s), and no-action alternative analyzed in an environmental document. Each alternative must have a landscape developed that will mimic the recommended treatments, and those treatments must then be modeled using FARSITE and/or FLAMMAP. The SFA requires a minimum of four meetings with an *interdisciplinary team* to develop the alternatives. Then, after initial design of alternatives, Arc landscapes are developed for each alternative, and FARSITE landscapes are then developed in FARSITE, with weather data and a comparison of the fire model runs with an actual fire in a similar landscape. Next, each alternative is run to determine which alternative would effectively reduce fire risk.

Eddy Gulch LSR SFA

Step (a): Define the Analysis Area

Map 1 in Appendix B spatially depicts the SFA evaluation area and essentially includes the entire boundaries of the old Salmon River Ranger District. This boundary was chosen so that the large fire history analysis could be performed. The actual fire and fuels evaluation area for this SFA is confined to the boundary set by the data delivered from the Klamath National Forest. Appendix B lists the weather data used for this SFA, all maps, and sample photos of existing conditions in the Eddy Gulch LSR.

Step (b): Identify the Protection Targets

A requirement of the SFA for the Eddy Gulch LSR Project is identification of protection targets (Table 1). These targets are based on protection of life and property first, then other high-value resources identified by the ID Team and Salmon River Community Wildfire Protection Plan (SRCWPP, October 2007). These targets are all of critical concern to the public and the agencies (such as the Forest Service, CalFire, volunteer fire departments) tasked with providing protection inside the Klamath National Forest.

The "protection targets" are shown on Maps 2 and 3 in Appendix B. Map 2 highlights areas of concern in the Klamath National Forest, such as community wildland-urban interface (WUI) areas, watersheds, emergency ingress and egress routes, and northern spotted owl (NSO) nest sites and habitat, as well as other important resources and historic features. Map 3 highlights areas of concern presented in the Salmon River CWPP. Some of the WUI project areas are inside the SFA evaluation area.

TABLE 1: Protection Targets

Protection Target
Public Safety and associated Infrastructure: Provide safe travel routes for the public and suppression forces; provide protection of private property.
Archeological sites, private lands, NSO core areas, late-successional habitat characteristics, Riparian Reserves, areas of early to late-successional habitat that could sustain late-successional characteristics.
Plantations: Protect habitat of other special species.

Step (c): Define the Problem Fire

Methodology

A fireshed workshop was held on October 10, 2007, in Willows, California, at the Mendocino National Forest office (see Appendix C for a summary of the workshop). At that time, the Landscape file was given to RED, Inc. Communications (RED) by Bernie Bahro (the Forest Service Region Five Fuels Specialist). That Landscape file has been tested by RED's fire and fuels specialists with FARSITE, fire history, and site visits to provide validation of the model. Further validation will be done as the treatments are developed and site-specific fuels analysis is completed in the spring of 2008.

A basic weather stream for FLAMMAP and FARSITE fuel moistures and winds was developed during the workshop. Further analysis of weather and fire history created a more specific set of weather data for the modeling that has been done by RED.

This further analysis brought the team to the conclusion that the fires of 2006 would provide the most detailed information for further development of the behavior modeling used for this SFA. The three fires used for background were Uncles, Hancock, and Rush—all three fires were close to the Eddy Gulch LSR. The selection of these fires was also validated by conversations with the District Ranger and the fire and fuels staff on the Scott-Salmon River Ranger District. The wind files used in this SFA were developed using hourly wind data from the Blue Ridge Remote Automated Weather Station (RAWS) for July 23-30, 2006. Sawyers Bar RAWS wind and weather data for the same days were reviewed but not used for the first Problem Fire. Through conversations with the local Ranger District and fire and fuels staff from the Salmon side of the District, it was felt that Sawyers Bar would reflect conditions that were too warm and dry, and that the location of the Sawyers RAWS—which is in a canyon—would not reflect winds that occur higher on the slopes. For fuel moisture conditions, 90th percentile weather data was used from the Blue Ridge RAWS for daily weather data from July 1 thru October 31, 2006—the primary fire months. The use of 90th percentile weather data in these simulations is required by RED's contract with the Government (Klamath National Forest) for the Eddy Gulch LSR Project. The FARSITE files are located in a file that accompanies this SFA. A PowerPoint presentation (Appendix D) is also part of this SFA deliverable—the presentation was developed for use at citizen and agency collaboration meetings.

Current Fuel Conditions and Fire Behavior

Fire behavior describes how a fire burns—where it burns, how fast it travels, how much heat it releases, and how much fuel it consumes. It is important to understand what controls fire behavior and how to predict it. This knowledge helps predict fire effects, conduct prescribed burns, predict wildfire risk, and control wildfires.

Fire behavior is controlled by three interacting components: fuels, weather, and topography. Fuels provide the energy source for fire. Fuel availability, which depends on both fuel arrangement and fuel moisture, determines if fires will burn as ground, surface, or crown fires. Weather elements, such as temperature, relative humidity, wind, precipitation, and atmospheric stability, also combine to influence fire behavior by regulating fuel moisture and rate of spread. Topography can influence fire indirectly, by mediating wind patterns, or directly—fires burning upslope spread faster than fire burning on flat land.

The model runs used to define current fire behavior conditions in the Eddy Gulch LSR were based on landscape fuels and stand structure data provided by the Regional Fireshed Assessment (FSA) Team, historic weather from Blue Ridge RAWS and Sawyers Bar RAWS, and Fire Behavior information from the 2006 large fires (Uncles, Hancock, and Rush). On-site visits helped to validate the information, and meetings with local fire personnel brought local fire experience.

Weather. As stated above, Appendix B presents the 2006 RAWS weather data used for this SFA. The data represents typical California weather with long, hot, dry summers followed by moist wet winters. During the fires of 2006, temperatures were generally over 100 degrees Fahrenheit (°F), with humidity less than 15 percent, and winds typically out of the west at 5-10 miles per hours (mph), with higher winds when cold fronts passed through.

Topography. The topography of the Eddy Gulch LSR, and Klamath National Forest overall, has a great effect on fire behavior and suppression capabilities.

Flame Length. The current flame length in many areas is between 11 and 20 feet. This is based on fire behavior runs performed to establish criteria for the problem fire.

Rate of Spread. 30 to 60 feet per minute

Crown Fire Activity. More than 50 percent active or passive crown fire over the area.

The Problem Fire

The "problem fire" is not so much a single modeled wildfire, as it is a combination of data and attributes, including historic weather, historic fire behavior and conditions, existing fuels and topography, and historic ignitions that would contribute to fire spread and severity. This allows for modeling the potential of a future fire on the Eddy Gulch LSR landscape to demonstrate what fire would do to vegetation, and potentially to public and private concerns, if treatments were not implemented to reduce the problem fire potential. This modeling and fire experience also allows the modeler to test the vegetation treatment prescriptions and alternatives against the problem fire to analyze their effectiveness in reducing wildfire effects and potential resource losses. The problem fire was based on a discussion of several historical large fires (Map 4) on the old Salmon River District and fires that the District Ranger and fire and fuels staff felt would depict future fire based on current fuel conditions and worst-case weather conditions in the Klamath National Forest. Maps 5, 6, and 7 depict potential problem fires. Map 8 is the FlamMap run—the FlamMap run was developed using the fuels landscape from the Regional FSA Team and the 90th percentile weather from the Blue Ridge RAWS.

The Eddy Gulch LSR is one of the few areas of the Klamath National Forest that has not been impacted by wildfires in the past 100 plus years. It is one of the few areas that has a substantial amount of NSO habitat, and fire behavior modeling shows it is an area at risk from high-intensity wildfires. The primary drivers for the consideration of treatments proposed for the Eddy Gulch LSR Project are the results of the FLAMMAP runs, recent large fire near the LSR, and current fuel conditions from stand modeling and fire risk from lightning.

Step (d): Design Treatment Patterns

A set of potential treatment areas were originally designed in coordination with the forest fire and silviculture specialists. These potential treatment areas were used to start the process of evaluation of vegetation and location of these areas for possible implementation of treatments. These proposed areas were then further analyzed through site visits by RED's fuels, silviculture, and wildlife specialists (the "Core" ID Team) to begin the development of a set of logical treatments that would provide protection of areas of importance to the public, wildlife, natural resources and areas identified in the Salmon River CWPP.

Potential treatment patterns and preliminary treatments were then developed by the Core ID Team through an interdisciplinary approach and tested through modeling fire behavior. These preliminary treatment areas and treatment prescriptions are designed to reduce the size and intensity of large fires from inside the Eddy Gulch LSR, as well as from fires initiating outside the LSR threatening to enter the area. The decision to develop a scheme of Fuel Reduction Zones (FRZs) along ridges was determined to be the best tactic for treatments in the Assessment Area because of the limited road access and steep terrain of the LSR. The FRZs will provide opportunities for use of large-scale prescribed fire inside the areas bordered by FRZs and will permit the use of Appropriate Management Response (AMR) during wildfire suppression. AMR can provide Fire Management with opportunities to allow fire to burn at low to moderate intensity surface fire with a pattern of varied severity through the managed area. The proposed treatment areas are displayed on maps located in Appendix C.

The fuel management objectives for mechanical and prescriptive fire treatments that will be applied in the FRZs and in the prescribed fire area outside the FRZs are to

- increase average tree size, thereby increasing tree resiliency to disturbance events;
- reduce tree mortality from wildfire events;
- reduce excessive accumulation of down woody material in size classes smaller than 3 inches in diameter;
- facilitate prescribed burning programs to maintain fuel profiles at levels to protect late-successional characteristics;
- allow for the implementation of prescribed fire in large areas outside of FRZs in order to reduce ground fuel accumulations and scorch to kill brush and reduce the crown base height within the stands through fire pruning the lower limbs of trees. The objective of this treatment is to reduce wildfires impacts in the larger area and keep a wildfire effects to primarily surface fires, with occasional torching;
- favor Douglas-fir, ponderosa pine, sugar pine, incense-cedar, and Black Oak within treatment areas, and where sites permit, in an effort to increase resiliency to wildfire;
- implement mechanical thinning treatments to improve growth rates and minimize mortality, which is enabling development toward higher levels of older and larger trees;
- construct FRZs throughout the LSR to give fire managers better options for AMR, which is defined as "specific action taken in response to a wildland fire to implement protection and fire use objectives;" and
- develop vegetation treatments that support sustainability of LSOG conditions across the landscape to provide habitat for LSOG-dependent species. Fire and wind disturbance do not create events at a scale or intensity that degrade or eliminate LSOG habitat values. Insects and diseases occur only at endemic levels in the Assessment Area.

These treatment objectives will move a large part, in particular the Assessment Area, of the Eddy Gulch LSR toward the desired future conditions displayed in Table 2.

TABLE 2: Indicators for Fuel Profile Desired Conditions

Fuel Profile	Strategically placed fuel treatments inside the Fuel Reduction Zones	Prescribed fire fuel treatments outside the Fuel Reduction Zones
Crown Fuels	65 to 115 trees per acre, 40%-60% crown closure, 0.025 to 15 kg/m^3 crown bulk density	Reduce the number of conifers 6 inches and less diameter at breast height (dbh), by 55%-70% (this will require several reentries of prescribed fire over a 20-year period)
Ladder Fuels	8- to 15-foot crown base height or a gap between the tops of understory trees to the lowest limbs of residual trees of 15 to 20 feet	Prune, with fire, the lower limbs of trees up to 15 feet, raising the crown base height of residual trees 15 to 20 feet (this will require several reentries of prescribed fire over a 20-year period)
Ground Fuels	Less than 2 tons per acre 1-hour fuels; less than 3.5 tons per acre 10-hour fuels; less than 5 tons per acre 100-hour fuels; 0.5-foot fuel bed depth	Less than 2 tons per acre 1-hour fuels; less than 3.5 tons per acre 10-hour fuels; less than 5 tons per acre 100-hour fuels; 0.5-foot fuel bed depth (recognizing that prescribed fire will cause a spike in surface fuels within 7 years from the tree kill caused by the first prescribed fire).

Fuel Reduction Zone Treatments

Within the strategically located FRZs, the intent is to implement mechanical and prescriptive fire treatments to reduce stand densities, fuel ladder conditions, and fuel accumulations, with the added objective of providing a zone to reduce the threat of wildfires spreading into adjoining drainages. This type of management would also provide safe ingress and egress routes, which includes roads that are key access routes for firefighters and escape routes for residents and other publics. Specifically, the design of treatments in FRZs will consider the following:

1. Aspect/Slope Position: located on well-defined ridges
2. Species emphasis in order of importance for retention: sugar pine, ponderosa pine / Jeffrey pine, Douglas-fire, incense-cedar, and white fir
3. Canopy cover retention: 40 to 60 percent
4. Average basal area retention: approximately 110 square feet per acre emphasis on retaining large diameter trees over 20 inches
5. Thinning density variation: 15 to 20 percent of each stand can be left unthinned
6. Large Tree Treatment: Trees greater than 20 inches will rarely be removed, but may be removed for culturing of larger trees. Thin to drip line plus 20 feet around large (24 inches or larger) sugar pine and ponderosa pine; drip line plus 10 feet around other large species

Large-Scale Prescribed Fire Treatments

The large-scale prescribed fire treatment areas, as well as the AMR areas, have similar objectives to allow fire to burn under conditions of low to moderate severity, with some passive crown fire activity, resulting in a mosaic of low to moderate effects. These large-scale burns will add to the effectiveness of the FRZs and reduce wildfire losses. Prescribe fire prescriptions should

- be written to reduce the surface fuels in the 1- and 10-hour time-lag range from 70 to 100 percent and the 100-hour time-lag range from 50 to 60 percent;
- raise the crown base height to 15 feet over much of the area through two prescribed burn entries;

- reduce the number of conifers 6 inches or less in diameter and have low live vegetation to ensure removal of ladder fuels in the timber stands;
- burn in a mosaic in brush fields and not burn more than 70 percent of the brush stand in the first entry;
- maintain the down log and snag retention guidelines for burning in LSRs; and
- follow the standards and guides recommended by the U.S. Fish and Wildlife Service for prescribed fires in NSO nest sites and core areas on the Klamath National Forest, as contained in the Biological Assessment for Prescribed Fire And Fuels Hazard Reduction, 2007-2011, Klamath National Forest.

Step (e): Test the Proposed Treatment Pattern and Prescription

As further planning is completed for the Eddy Gulch LSR Project, the proposed treatment prescriptions will continue to be tested using the problem fire weather data and the landscape model developed for Eddy. Testing will require the use of both FARSITE and FLAMMAP runs. FARSITE was the primary fire behavior model used to test the preliminary treatment prescriptions and pattern. The treatments were tested against the desired conditions for fuels developed for the Eddy Gulch LSR Project Preliminary Purpose and Need document (Appendix C contains the fire behavior runs for proposed treatments in the Eddy Gulch LSR Project Assessment Area).

Thus far, the modeling has indicated that the treatment prescriptions and patterns would be effective when applied to the landscape. The testing process will continue until the final proposed treatments and prescriptions are developed for analysis in the Eddy Gulch LSR Project environmental impact statement (EIS). The fire behavior modeling will also be used during public meetings to show participants the benefits or drawbacks of various treatment prescriptions and patterns.

Step (f): Cleary Display Tradeoffs

Tables 3 and 4 describe the benefits of proposed treatments and the trade-offs if those treatments are not implemented.

Step (g): Develop Monitoring and Adaptive Management Strategy

Monitoring Strategy

Monitoring strategies for the Eddy SFA will accomplish the following:

- Document differences in fuel profiles (stand structure and dead and down fuel loading) at the project level from data used in the Regional FSA.
- Detect changes from both individual and cumulative management actions and natural events. Provide standardized inventory data usable to fire managers.
- Compile information systematically.
- Provide a basis for changing fuels models and modifying FARSITE analysis.
- Link overall information management strategies for consistent implementation.
- Ensure prompt analysis and application of data in the adaptive management process.
- Distribute results in a timely manner.

TABLE 3: Benefits and trade-offs of treatments in FRZs.

Benefits of treatments in FRZs	Trade-offs
Mechanical thinning and prescriptive burning modifies the existing fuel profile by reducing tree densities, reducing crown closure, raising crown base heights; reducing dead and down fuels; scorching to kill brush, and reducing the number of conifers 6 inches or less diameter at breast height (dbh).	No change in fuel profiles (stand structure, composition, dead and down fuels)
Reduces extent of large fires by isolating fires within logical geographical features.	Limits AMR options outside of FRZs.
Reduces impacts on water in FRZs, with down stream benefits a. Sediment, turbidity, temperature b. Fish habitat	Areas outside FRZs in which modeling shows lethal wildfire effects (passive and active crown fire behavior) would not be mitigated by fuel treatments.
Reduces potential loss of NSO habitat by isolating wildfires.	No protection of NSO home range, core, or nesting sites outside of FRZs.
Improves public and firefighter safety: in FRZs and travel routes.	No opportunity to protect or accelerate late-successional characteristics outside of FRZs.
Potentially reduces the number of WUIs impacted	No opportunity to protect water quality in large segments of drainages.
Provides for project funding.	No protection of archaeological sites.
Provides wide range of Appropriate Management Response options.	No opportunity to protect or enhance native plants.
Provides opportunities for creating and/or increasing the size of openings: • Captures additional snow pack • Improves habitat	No opportunity to create or enhance openings and meadows.
Protects plantations and young stands.	No opportunity to mitigate invasive plants.
Improves visual quality.	
Produces potentially smaller wildfires, which produces less particulate matter and better air quality.	
Mechanical treatments with follow-up prescriptive burning will lengthen the longevity of fuel treatments.	

TABLE 4: Benefits and trade-offs of implementing prescriptive burning opportunities outside FRZs.

Benefits of Prescriptive Burn Opportunities	Trade-Offs
Modifies the existing fuel profile by raising crown base height and reducing dead and down fuels, scorching to kill brush, and conifers 6 inches or less dbh	Without mechanical pre-treatment, the objectives of prescriptive burning will diminish overtime, and a follow-up burning will be required sooner than in areas with mechanical thinning prior to prescriptive burning.
Reduces rates of spread, flame lengths, and fire line intensity (BTUs/second/foot); reduces mortality in residual vegetation	Prescriptive burning work loads in this area alone, if maximized, may stress the unit's ability to accomplish prescriptive burns.
Reduces impacts on water within prescriptive fire boundary by reducing potential impact on Riparian Reserves and water courses: • Sediment, turbidity, temperature • Fish habitat	Large prescriptive burns with no pre-treatment have a higher probability of not meeting prescriptive burn objectives.
Reduces potential loss of NSO habitat.	
Improves public and firefighter safety by • reducing fire behavior that impacts FRZs; and • assisting fire suppression efforts to contain fire because average flame lengths are 4 feet or less.	
Reduces impacts to WUIs and reduces hazards around NSO habitat, which have been included in low-intensity prescriptive burn(s)	
Provides wide range of AMR options over a much larger area of the Assessment Area.	
Provides opportunities for creating and/or increasing the size of canopy openings, which help capture snow pack.	
Protects and enhances plantations and young stands through direct prescriptive burn treatments.	
Improves visual quality.	

Potentially smaller wildfires and less available fuel on larger areas of Assessment Area equals less production of particulate matter and better air quality compared to effects of wildfire.	

The SFA is a process that does not end as long as the Assessment Area is being managed. Assessment and/or monitoring of the fuel profile and influences of topography and weather will continue during the planning and environmental analysis process for the Eddy Gulch LSR Project EIS and during implementation of project actions authorized by the Record of Decision on the environmental impact statement.

Adaptive Management Strategy

Adaptive management is an analytical process for adjusting management and research decisions to better achieve management objectives. This process recognizes that our knowledge about natural resource systems is uncertain; therefore, some management actions are best conducted as experiments in a continuing attempt to reduce the risk arising from that uncertainty. The goal of such experimentation is to find a way to achieve the objectives while avoiding inadvertent mistakes that could lead to unsatisfactory results (Goodman and Sojda 2004).

Adaptive Management in the Eddy Gulch LSR must consider possible impacts of implementing proposed treatments or not implementing the treatments and using adaptive management principals to adjust, as necessary, management actions when affected by

1. changes in policies or priorities;
2. changes in science; and
3. changes to the fuel profile from
    - fire,
    - pathogens, and
    - adjustments to inventories.

The steps listed below would be followed when applying an adaptive management approach to the Eddy Gulch LSR to mitigate or examine changes observed during monitoring:

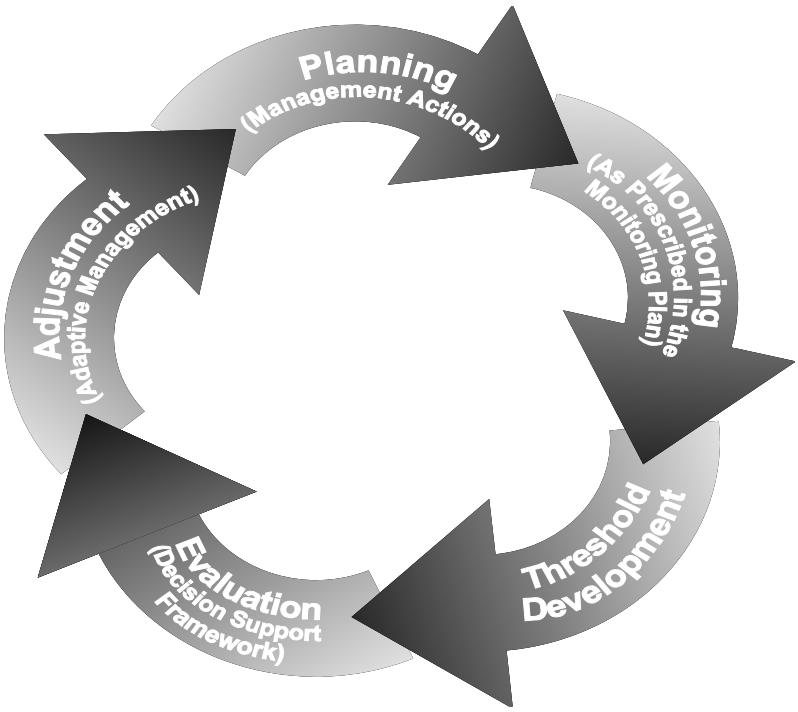
1. Existing conditions would be monitored to establish a set of baseline conditions. For the Eddy Gulch LSR Assessment Area, those conditions would be the fuel profiles, including the stand structures provided to the FSA team and used to complete the FSA. Effects stemming from changes in fire science or policy will have to be considered.

2. The Forest Service would consider applying a different type of treatment if monitoring indicated that baseline data has changed significantly and exceeded an established threshold, either from fire event(s), insect, diseases, weather induced damage, or significant changes in inventoried stand or ground fuel data.

3. The Forest Service would continue to apply the management action or treatment if results of the monitoring indicated changes produce acceptable results and no thresholds would be exceeded.

Adaptive management combines the advantages of scientific method with the flexibility to address the human and technical complexities inherent in managing complex environmental issues. The goal is to give policy makers a better framework for applying scientific principles to complex environmental decisions (Wall 2004). This process is displayed in Figure 1.

FIGURE 1: ADAPTIVE MANAGEMENT DIAGRAM



Appendix A
Model Definitions
(from http://www.fire.org/)

FARSITE

FARSITE is a fire behavior and growth simulator for use on Windows computers. It is used by Fire Behavior Analysts from the USDA FS, USDI NPS, USDI BLM, and USDI BIA, and is taught in the S493 course. FARSITE is designed for use by trained, professional wildland fire planners and managers familiar with fuels, weather, topography, wildfire situations, and the associated concepts and terminology.

What is FARSITE?

- FARSITE is a fire growth simulation model. It uses spatial information on topography and fuels along with weather and wind files.
- FARSITE incorporates the existing models for surface fire, crown fire, spotting, post-frontal combustion, and fire acceleration into a 2-dimensional fire growth model.
- FARSITE runs under Microsoft Windows operating systems (Windows 98, me, NT, 2000, and XP) and features a graphical interface.
- FARSITE users must have the support of a geographic information system (GIS) to use FARSITE because it requires spatial landscape information to run.

FIREFAMILY Plus

FireFamily Plus is a Windows program that combines the fire climatology and occurrence analysis capabilities of the PCFIRDAT, PCSEASON, FIRES, and CLIMATOLOGY programs into a single package with a graphical user interface

FLAMMAP

FlamMap is a fire behavior mapping and analysis program that computes potential fire behavior characteristics (spread rate, flame length, fireline intensity, etc.) over an entire FARSITE landscape for constant weather and fuel moisture conditions.

- FlamMap software creates raster maps of potential fire behavior characteristics (spread rate, flame length, crown fire activity, etc.) and environmental conditions (dead fuel moistures, mid-flame wind speeds, and solar irradiance) over an entire *FARSITE* landscape. These raster maps can be viewed in FlamMap or exported for use in a GIS, image, or word processor.
- FlamMap is not a replacement for *FARSITE* or a complete fire growth simulation model. There is no temporal component in FlamMap. It uses spatial information on topography and fuels to calculate fire behavior characteristics at one instant.
- It uses the same spatial and tabular data as *FARSITE*:
  - a Landscape (.LCP) File,
  - initial Fuel Moistures (.FMS) File,
  - optional Custom Fuel Model (.FMD),
  - optional Conversion (.CNV),
  - optional Weather (.WTR), and
  - optional Wind (.WND) Files.
- It incorporates the following fire behavior models:
  - Rothermel's 1972 surface fire model,

  - Van Wagner's 1977 crown fire initiation model,
  - Rothermel's 1991 crown fire spread model, and
  - Nelson's 2000 dead fuel moisture model.

- FlamMap runs under Microsoft Windows operating systems (Windows 95, 98, me, NT, 2000, and XP) and features a graphical user interface.
- Users may need the support of a geographic information system (GIS) analyst to use FlamMap because it requires spatial coincident landscape raster information to run.

FlamMap is widely used by the USDI National Park Service, USDA Forest Service, and other federal and state land management agencies in support of fire management activities. It is designed for use by users familiar with fuels, weather, topography, wildfire situations, and the associated terminology. Because of its complexity, only users with the proper fire behavior training and experience should use FlamMap where the outputs are to be used for making fire and land management decisions.

Appendix B
Weather Data, Maps, and Sample Photos of Existing Conditions

FireFamily Plus Percentile Weather Report

Station: 040203: BLUE RIDGE (KNF) Variable: BI

Model: 7G4PE3

Data Year: 2006

Date Range: July 1 - October 31

Wind Directions: SW, W, NW

Percentiles, Probabilities, and Mid-Points

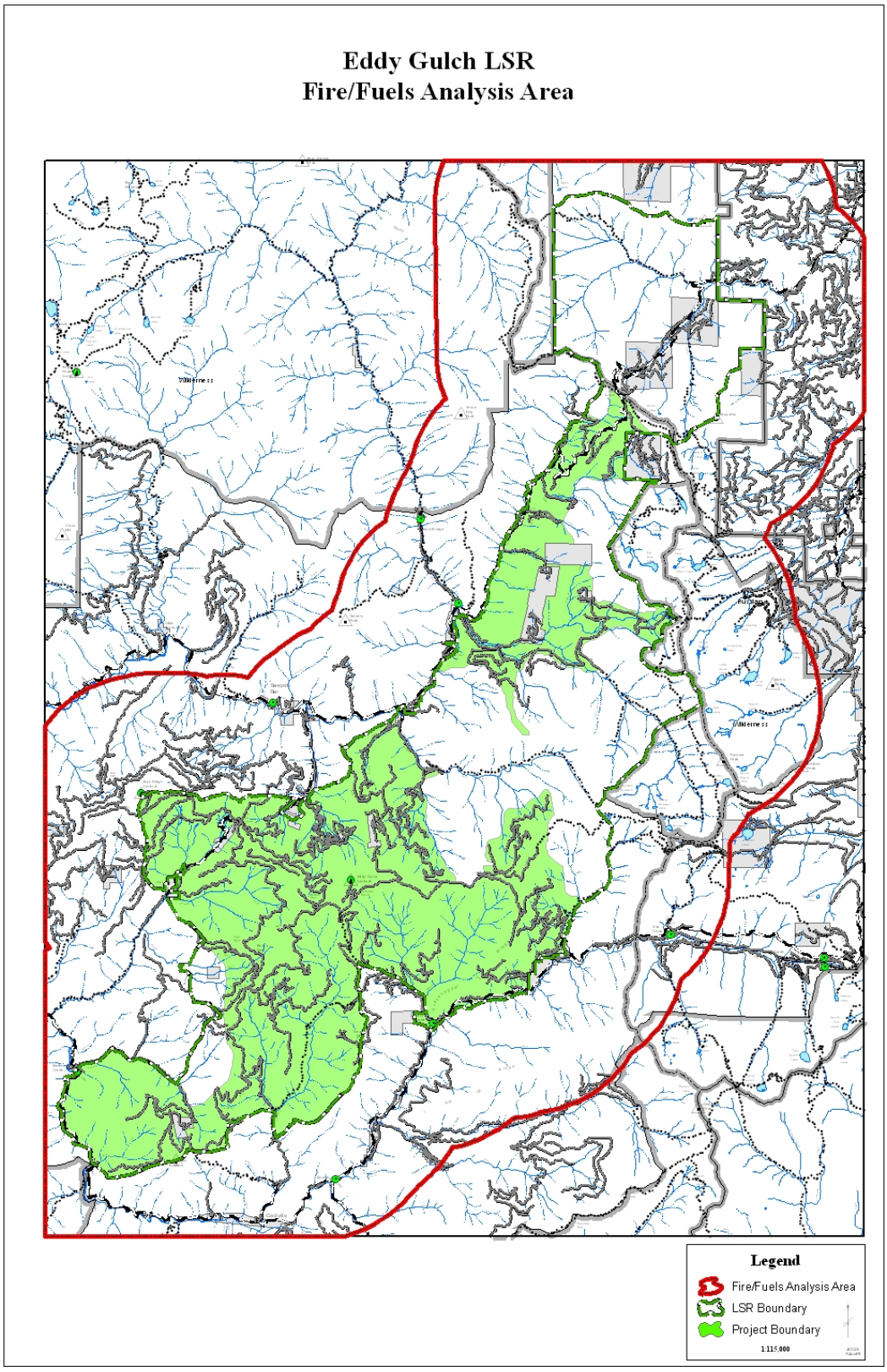
Variable/Component Range	Low	Mod	High	Ext
Percentile Range	0 – 15	16 – 89	90 - 97	98 - 100

Fuel Moistures

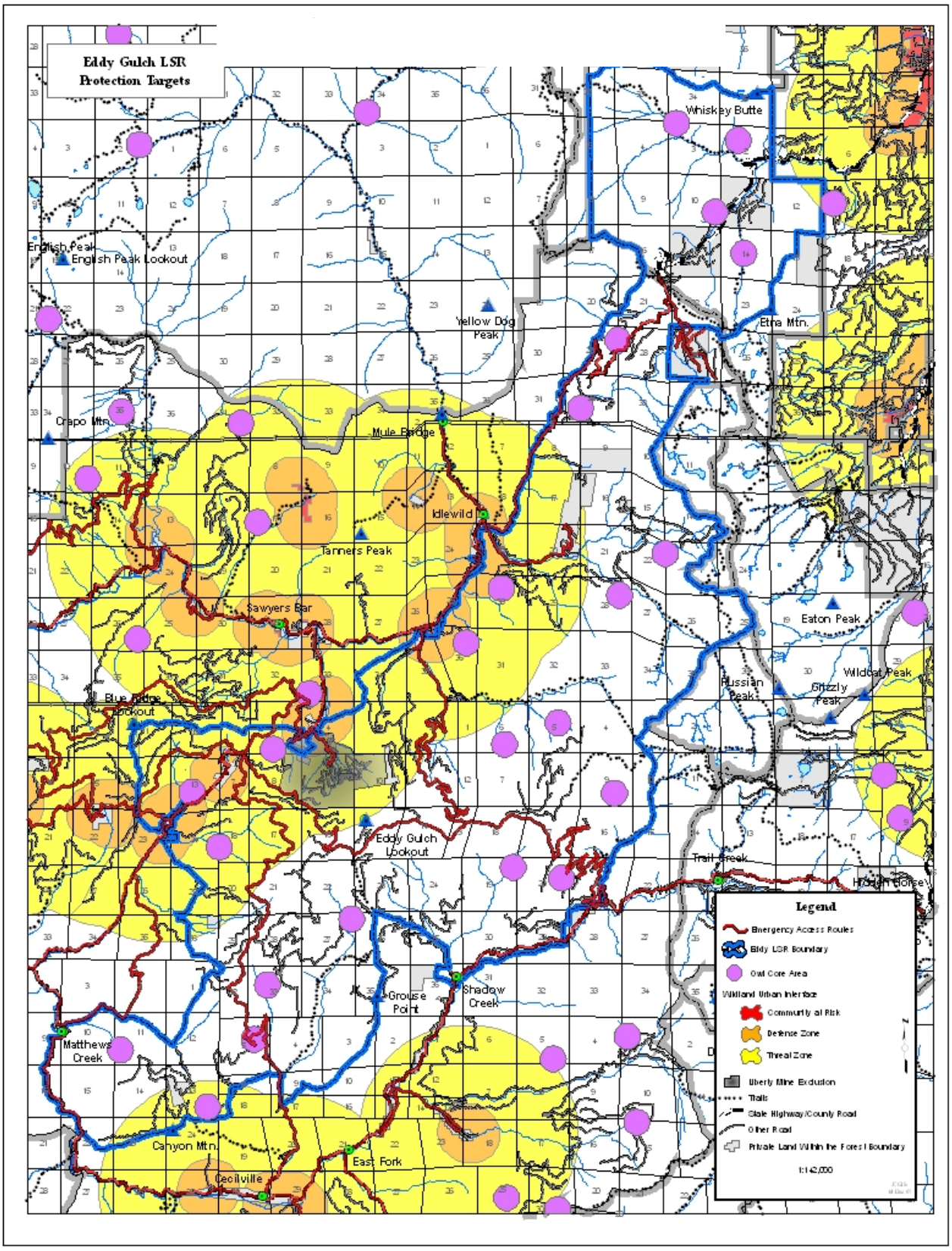
1 Hour Fuel Moisture	7.62	4.16	2.54	2.41
10 Hour Fuel Moisture	8.18	4.68	3.18	2.95
100 Hour Fuel Moisture	10.42	6.77	5.77	5.08
Herbaceous Fuel Moisture	34.07	37.07	32.11	30.00
Woody Fuel Moisture	72.18	70.00	70.00	70.00
20' Wind Speed	3.75	3.50	4.29	6.50
1000 Hour Fuel Moisture	8.99	8.41	7.49	6.99

123 Weather Records Used, 94 Days With Wind (76.42%)

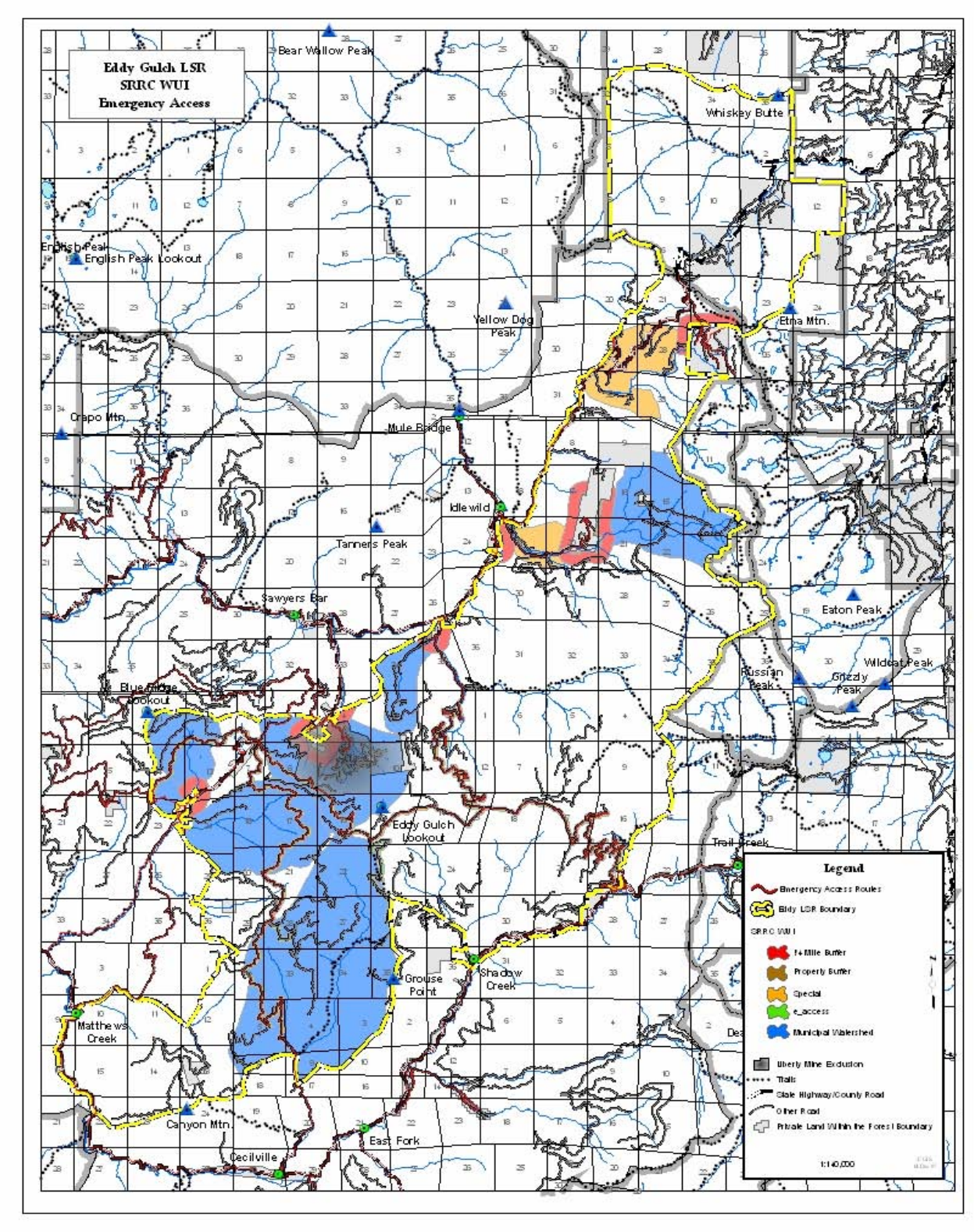
Numerous other 90th percentile runs were done, including a wider range of years with very similar outcomes in weather for the July thru October 31 period, with winds primarily out of the west, and the fuel moistures only minor differences. The 90th percentile winds were not used; the actual hourly wind speeds and directions from Blue Ridge for July 2006 were used in the simulation. Weather files from Blue Ridge and Sawyers Bar were used as the base to develop weather files for FARSITE to condition the fuel moistures.



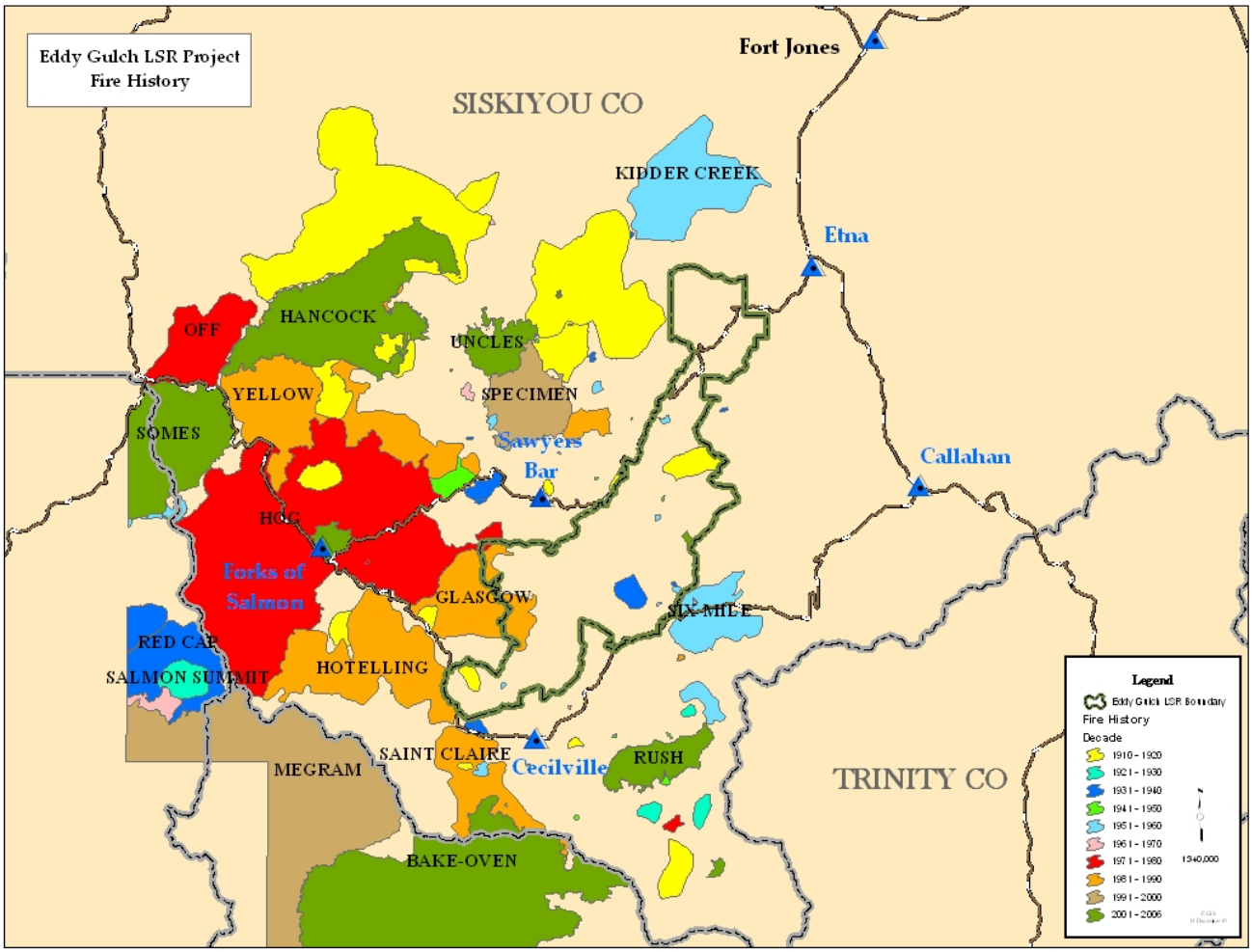
MAP B-1. SFA Evaluation Area.



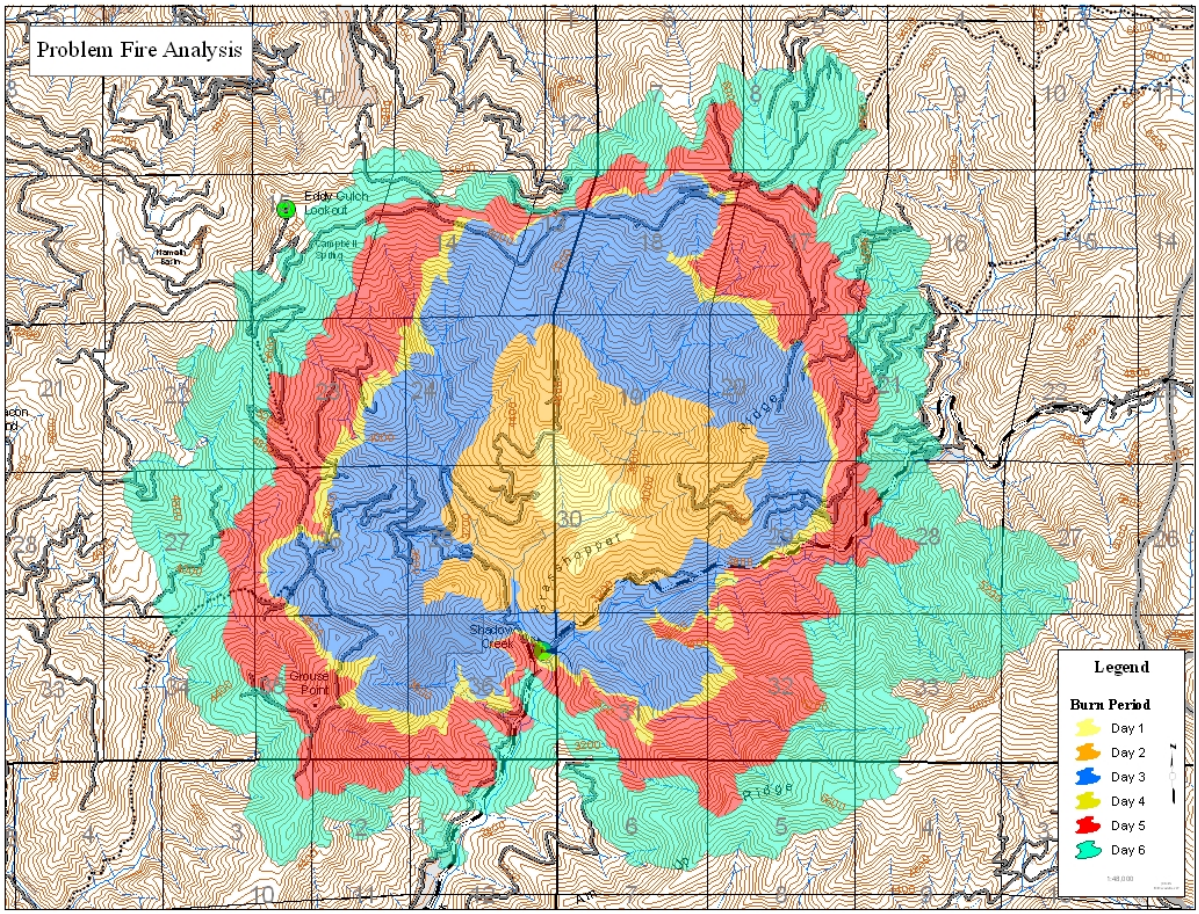
MAP B-2. Protection Targets in the Eddy Gulch LSR.



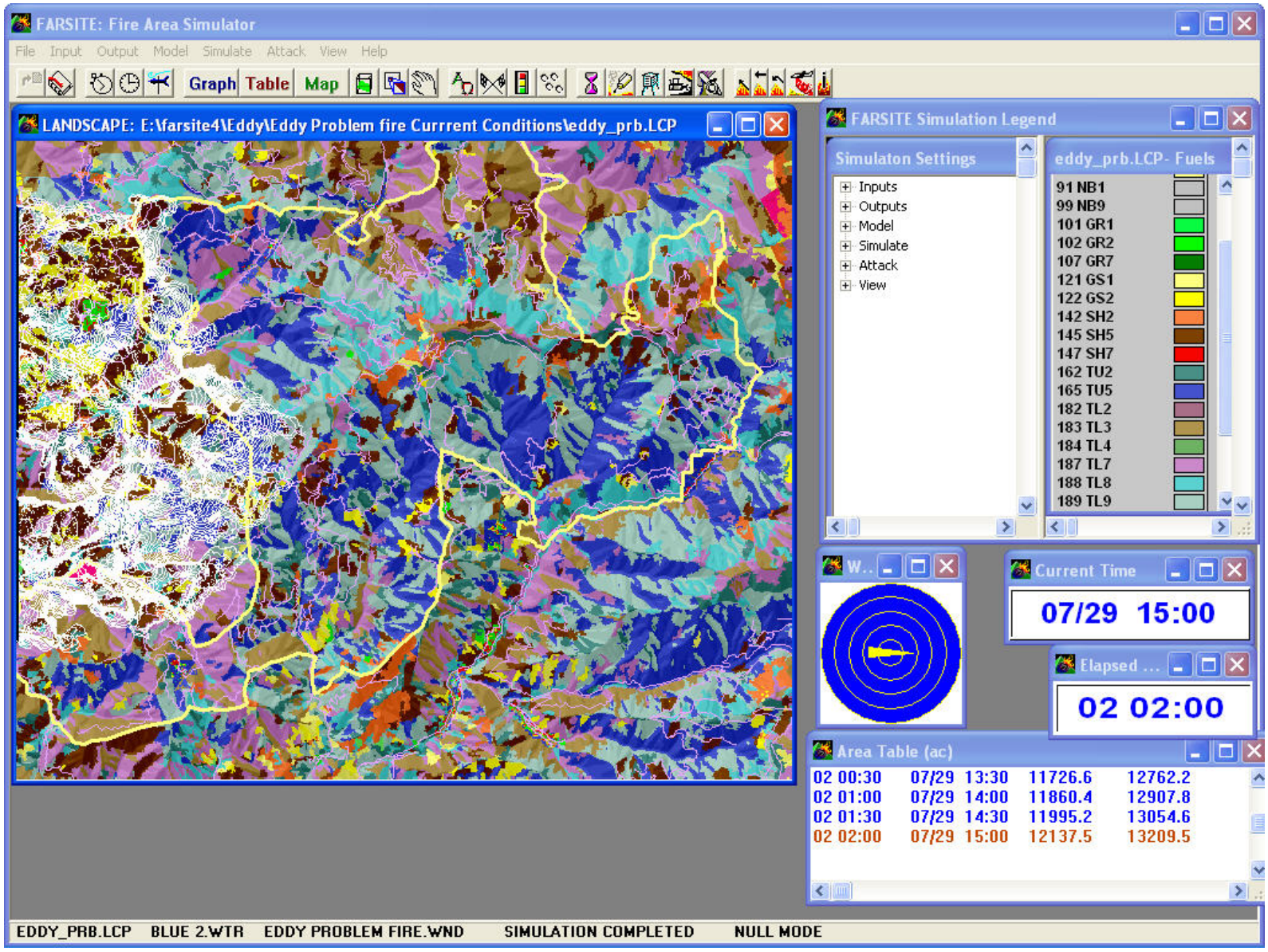
MAP B-3. Protection Targets as Shown in the Salmon River Community Wildfire Protection Plan.



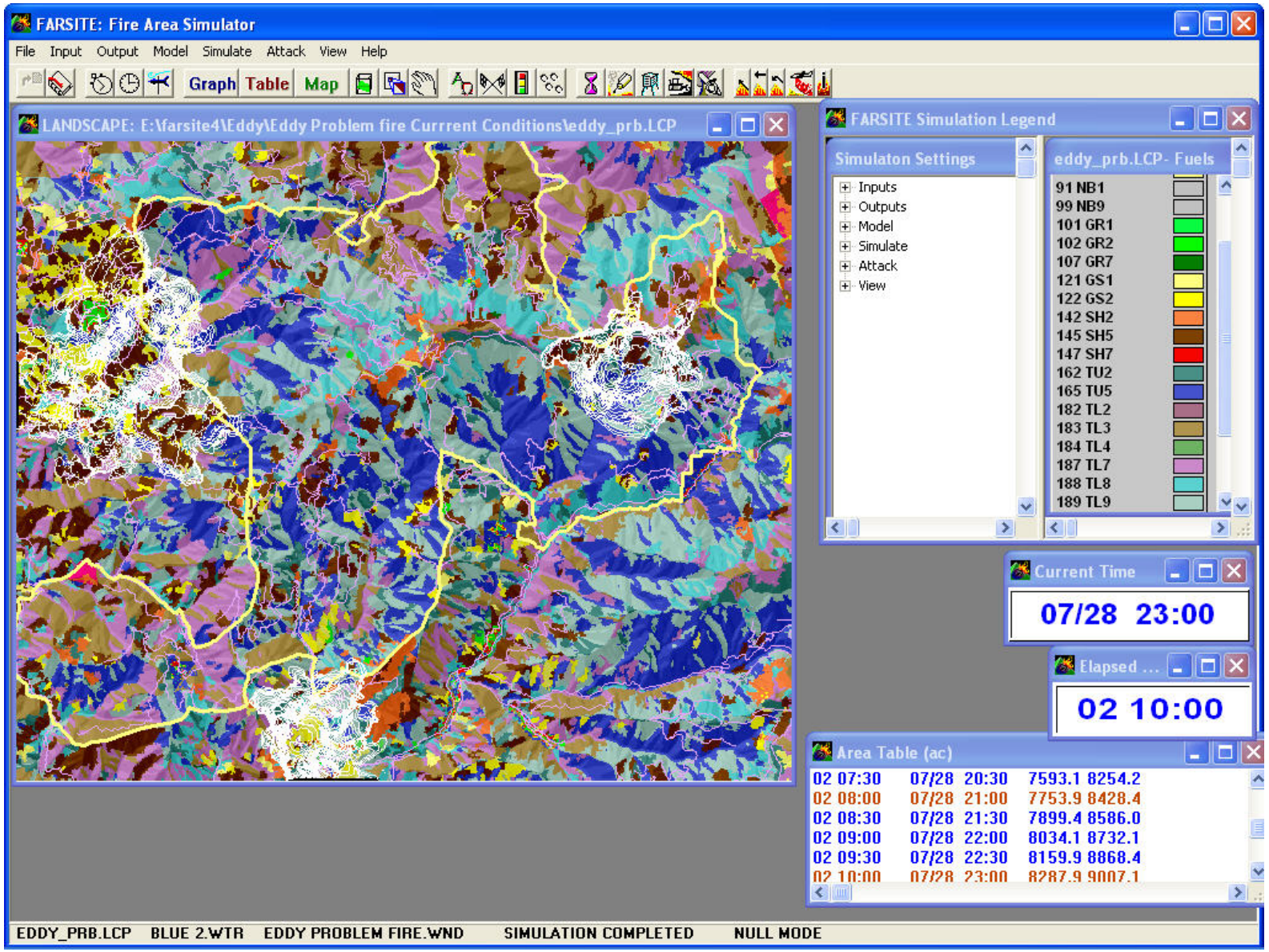
MAP B-4. Historical Large Fires.



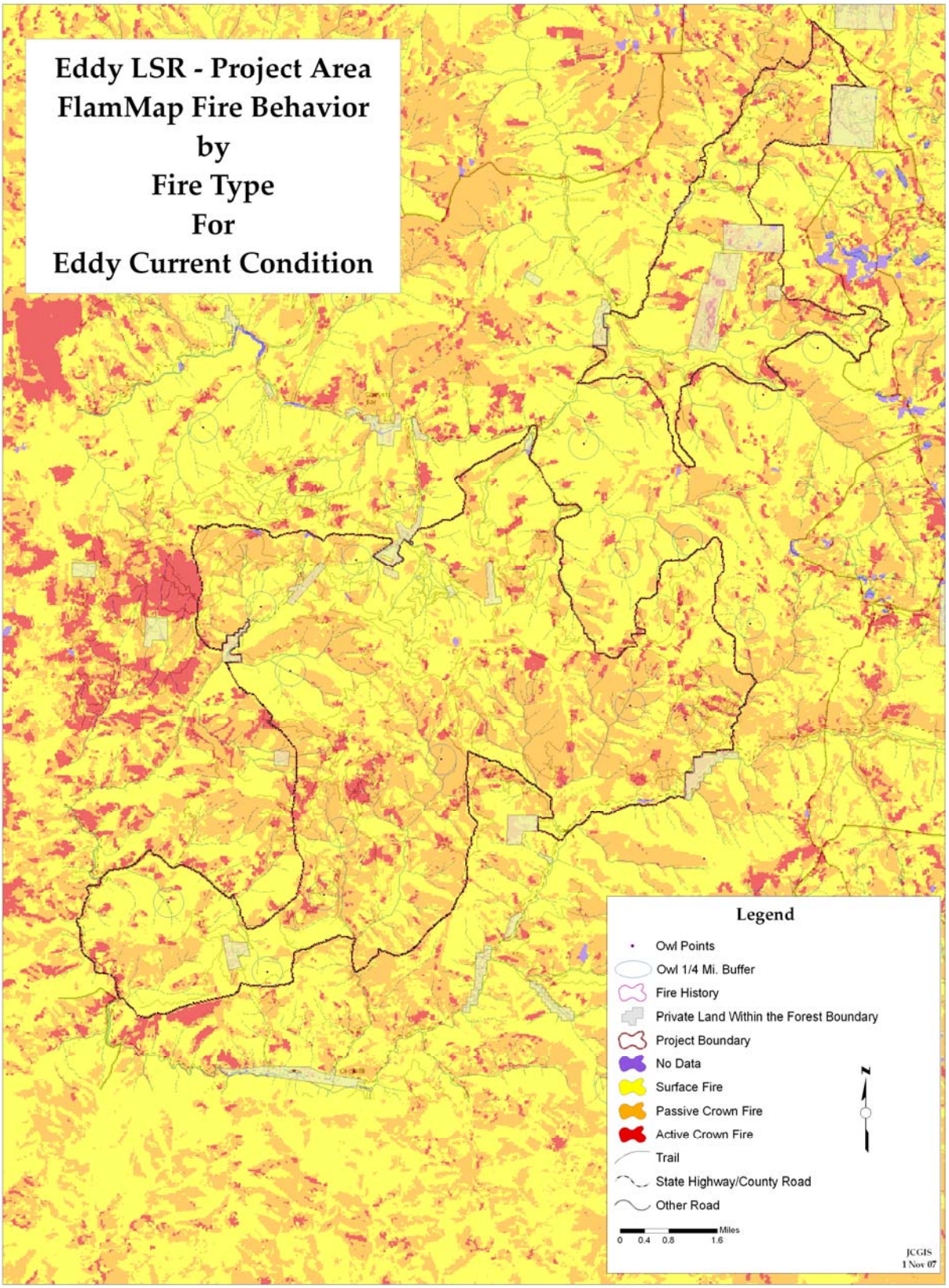
MAP B-5. Potential Problem Fire (Inside Eddy Gulch LSR).



MAP B-6. Large fire threat from outside the Eddy Gulch LSR.



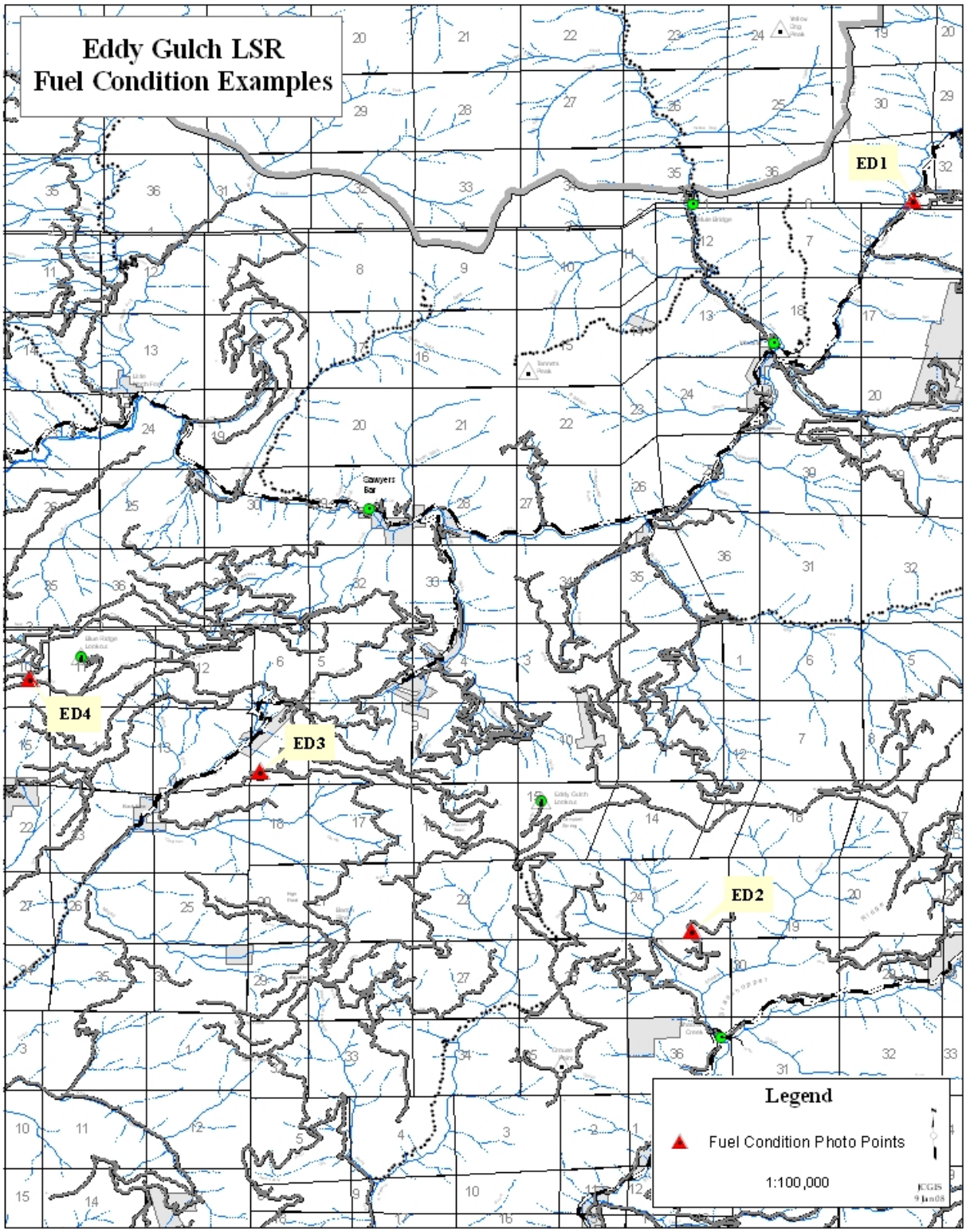
MAP B-7. Potential problem fire (multiple fire starts).



MAP B-8. FlamMap run.

Appendix B (continued)
Sampling of Photos Depicting Existing Conditions

The following photos are only a sampling of the fuels conditions currently found in the Eddy Gulch LSR Assessment Area. A more in-depth sampling will occur in the spring of 2008, including a more in-depth analysis of the fuel loading and potential fire behavior using Fuel Management Analyst to evaluate project-specific fire behavior and fuels structures and a plot photo of the site.



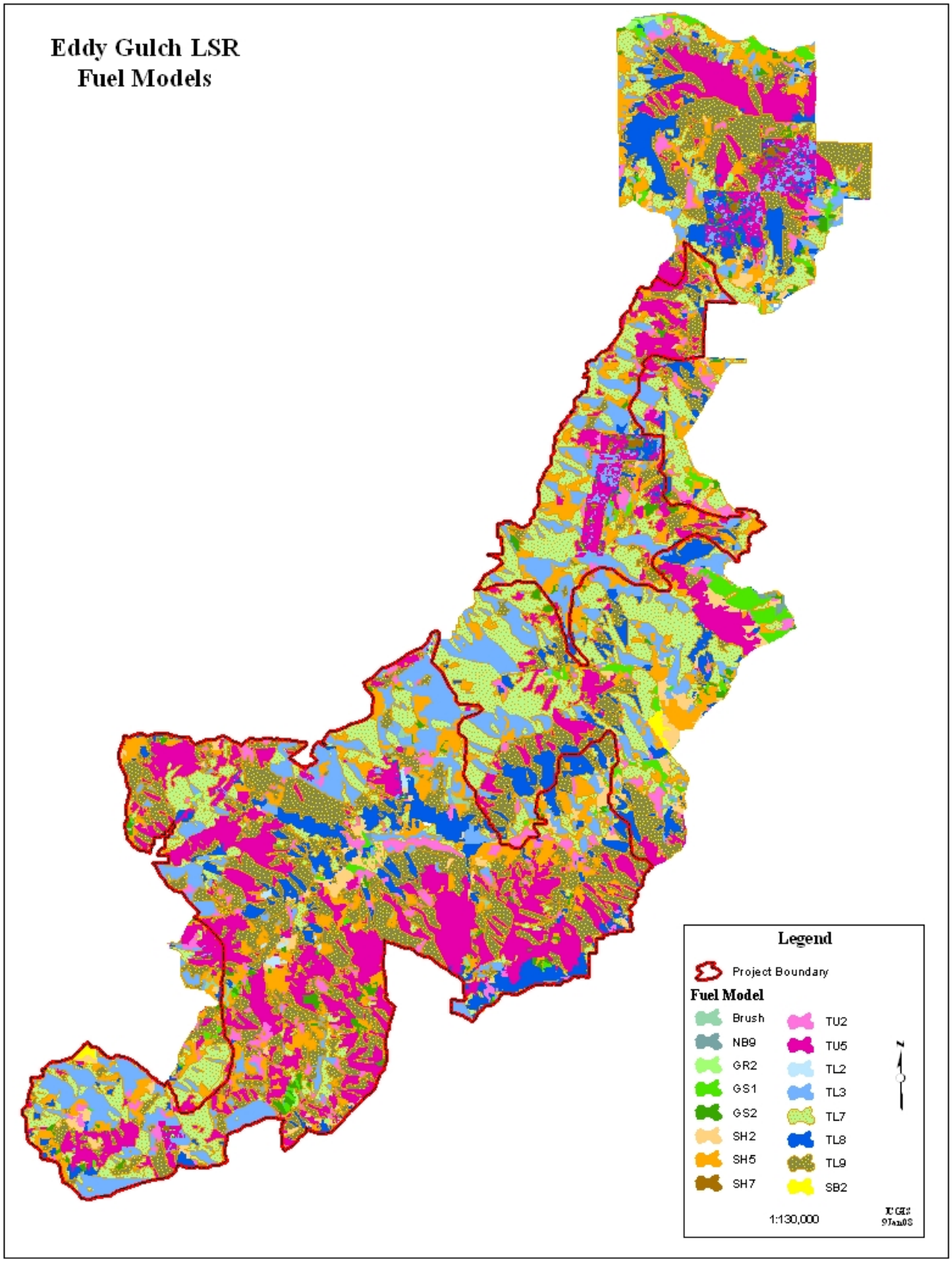
MAP B-9. Fuel condition photo points.

Fuel Model TL 7: Heavy load forest litter, spread rate 4 to 7 chains/hour, flame length 2 to 3 feet.

Fuel Mode TU 5: Heavy forest litter, spread rate 10 to 20 chains/hour, flame length 5 to 10 feet, crown fire potential passive to active.

Fuel Model TU 5: Heavy forest litter, spread rate 10 to 20 chains/hour, flame length 5 to 10 feet, crown fire potential passive to active depending on ladder fuels.

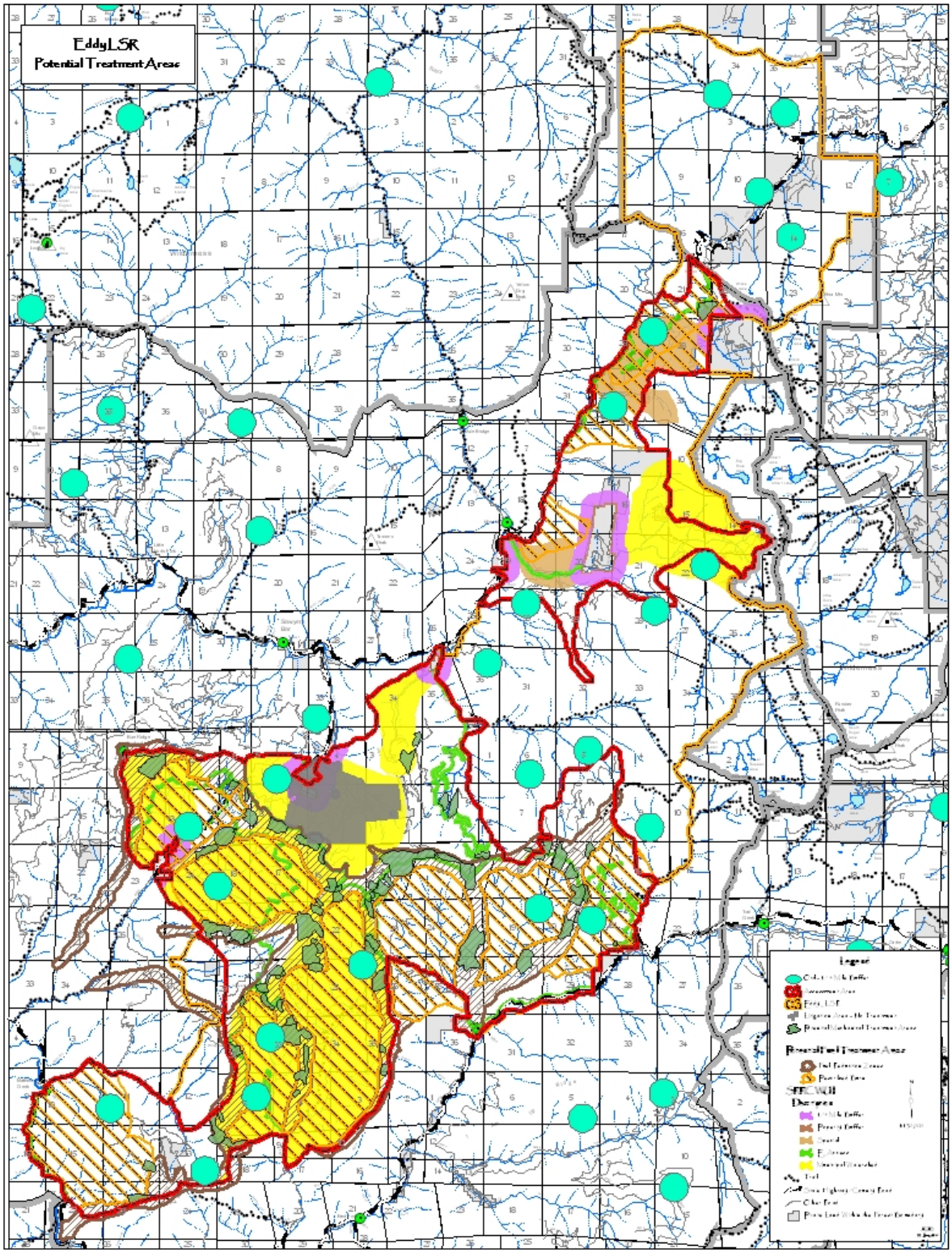
Fuel Model SH 5: Heavy fuel load, spread rate 50 to 150 chains per hour, flame length 10 to 20 feet.



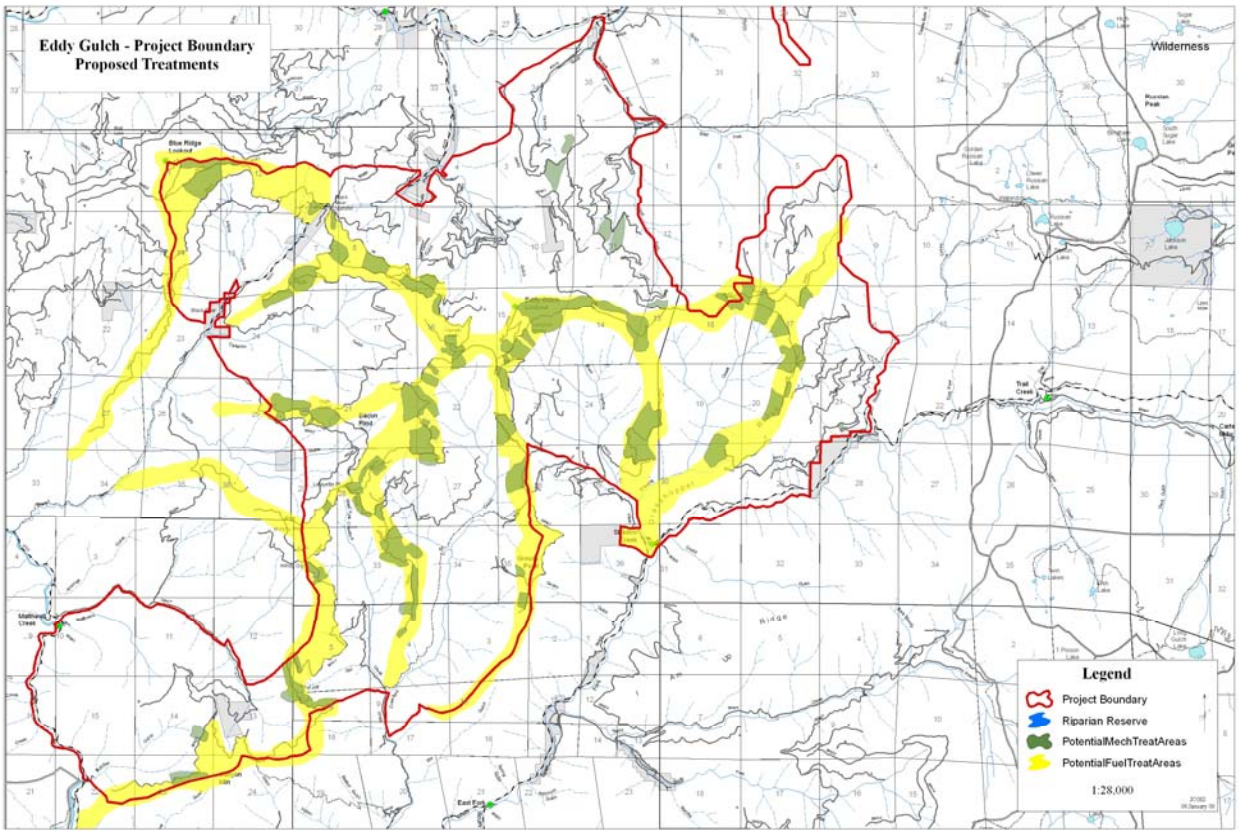
MAP B-10. Eddy Gulch LSR fuel models.

Appendix C

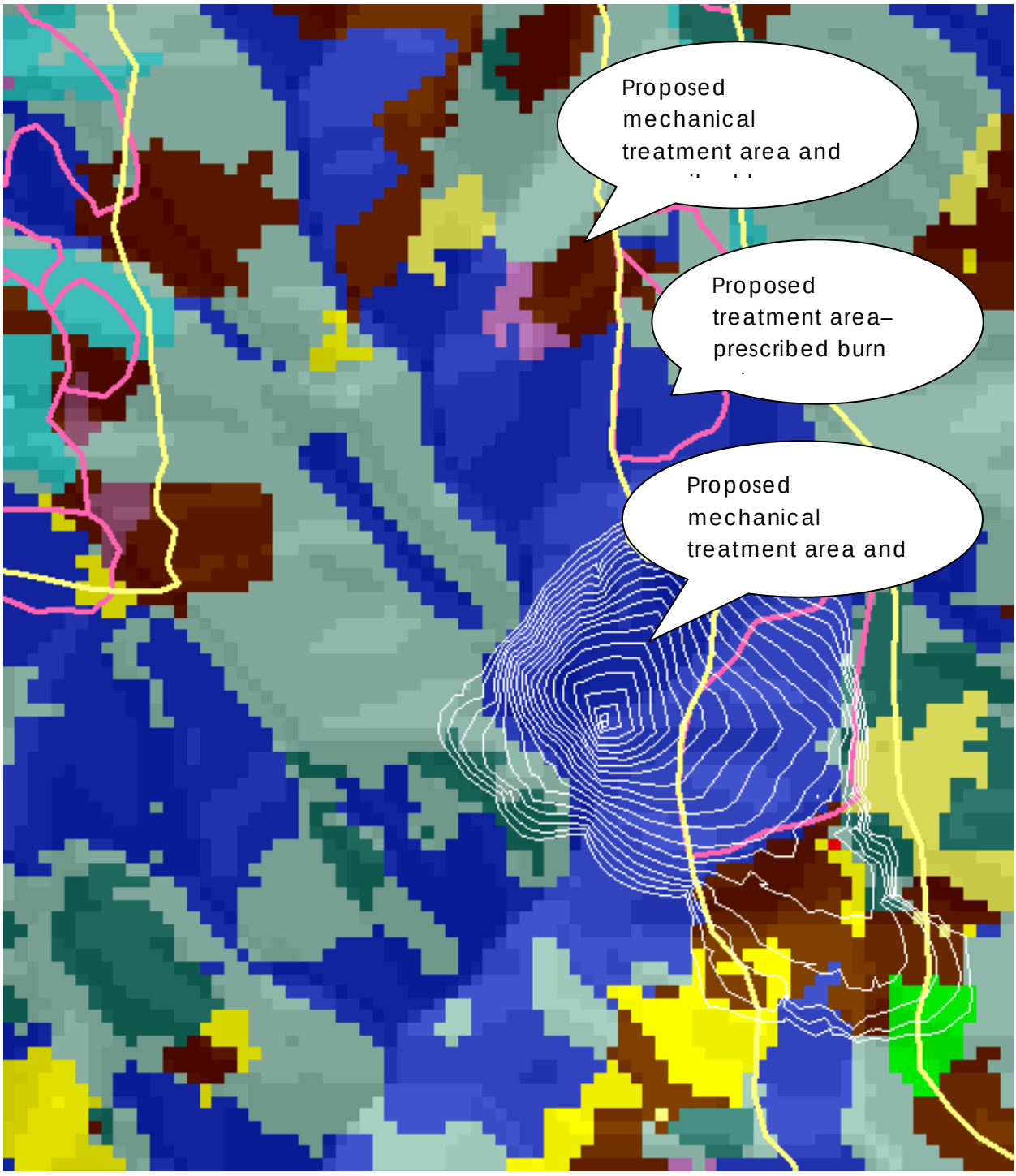
Proposed Treatment Pattern



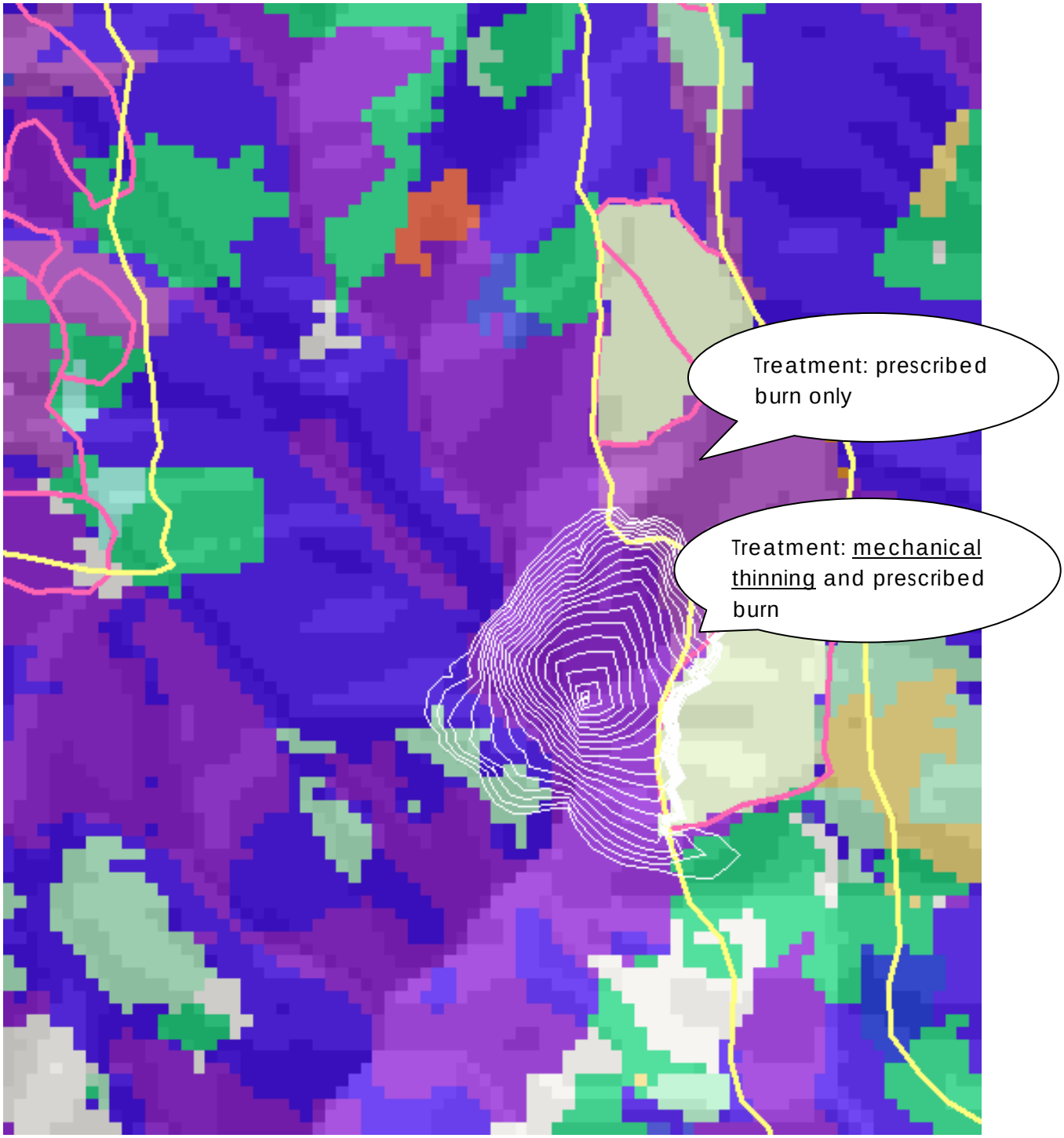
MAP C-1. Eddy LSR potential treatment areas.



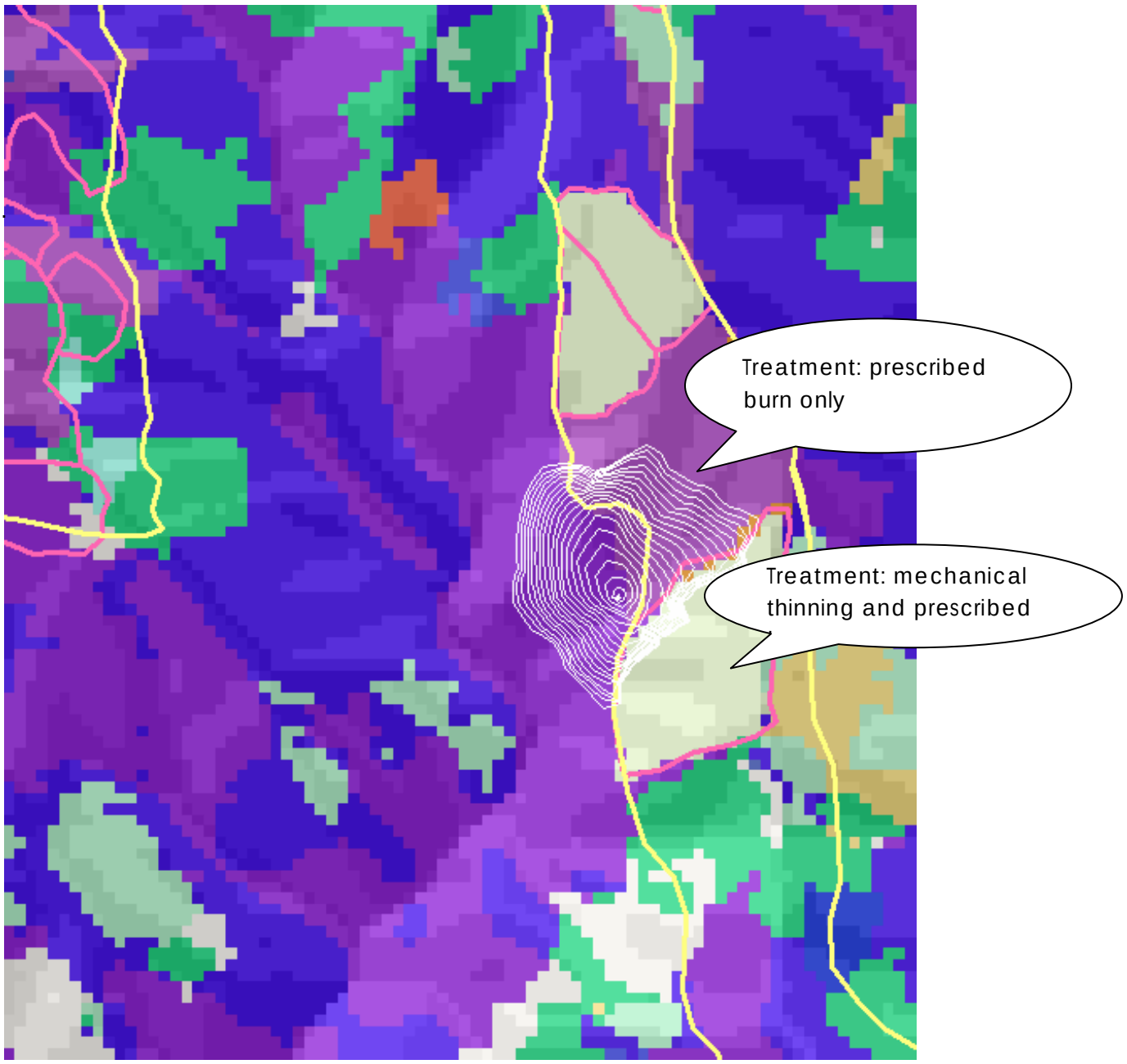
MAP C-2. Eddy Gulch LSR Project proposed treatments.



MAP C-3. Pre-treatment problem fire: fire size–225 acres.



MAP C-4. Post-treatment fire, same ignition points–110 acres.



MAP C-5. Ignition location changed–treatments remain the same.

Fuel Model Description in Eddy Project (Appendix C continued)

The below table was developed using Fuels Management Analyst spreadsheet for fuel model comparison.

Fuel Models Within the Assessment Area				
Fuel Moistures FM1=3, FM10=4, FM100=5, Slope 40%, Mid-flame wind speed 0-8 MPH*				
Fuel Model	**Total Acres**	**Description**	**Rate of Spread (Chains/Hour)**	**Flame Length (Feet)**
5(Brush)	122.9	Low Load Dry Climate Shrub	10-60	4-12
102(GR2)	69.0	Low Load Dry Climate Grass	15-150	4-9
121(GS1)	193.6	Low Load Dry Climate Grass-Shrub	10-60	3-7
122(GS2)	585.2	Moderate Load, Dry Climate Grass Shrub	10-80	4-10
142(SH2)	729.1	Moderate Load Dry Climate Shrub	5-25	4-9
145(SH5)	3502.8	High Load, Dry Climate Shrub	10-170	10-25
147(SH7)	75.0	Very High Load Dry Climate Shrub	10-110	8-23
162(TU2)	1503.9	Moderate Load, Humid Climate Timber-Shrub	5-35	3-6
165(TU5)	8001.0	Very High Load Dry Climate Timber-Shrub	5-25	6-12
182(TL2)	96.2	Low Load Broadleaf Litter	1-4	1
183(TL3)	5258.8	Moderate Load Conifer Litter	1-5	1-2
187(TL7)	5455.3	Large Down Logs	2-7	2-3
188(TL8)	2896.7	Long-Needle Litter	3-18	2-5
189(TL9)	8648.1	Very High Load Broadleaf Litter	5-25	4-8
202(SB2)	46.8	Moderate Load Activity Fuel or Low Load Blowdown	8-45	5-11

*This is not 90th percentile weather but worst case.

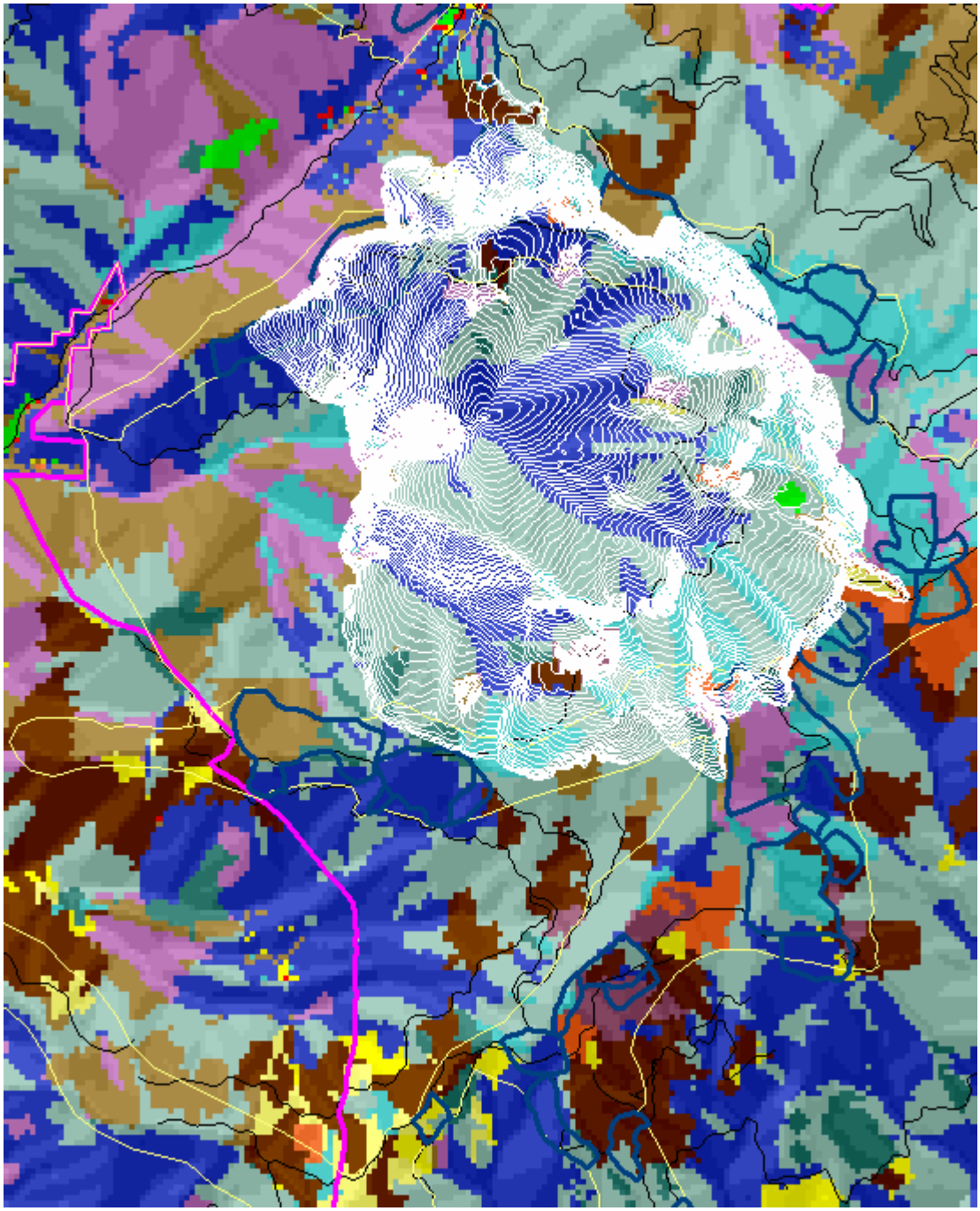


TABLE C-6. Pre-treatment problem fire 2,200 acres.

Appendix D

Summary of Regional Fireshed Assessment Meeting
Willows, California
October 10, 2007

Attendees:

- RED: Brooks Henderson, Barry Callenberger, and Jim Harvey in the morning
- Klamath National Forest: Debi Wright, Fuels Specialist; Toby Herald, Division Chief KNF; Clint Isbell, Fire Ecologist, KNF
- Regional Fireshed Assessment (FSA) Team, Bernie Bahro

The group met and discussed how to best approach the Steward Fireshed Analysis (SFA) for the Eddy Late-Successional Reserve (LSR), from both the District fire management personnel and RED perspectives. We discussed the data necessary to successfully complete the SFA being carried out by RED, Inc. Communications (RED) in the Eddy Gulch LSR and the assessment on the larger fireshed being done by the Forest and the Regional FSA Team. It is considered to be mutually beneficial for the Forest Service and the contractor to work together, in conjunction with the KNA, District, and FSA cadre, capitalizing on the tools and skills of the regional cadre, for a successful completion of the larger fireshed analysis and the Eddy Gulch LSR environmental impact statement.

Recommendation by Forest Service representative is that RED develops the project proposal for completion of "Option 4: Steward Fireshed Analysis" to include timeframes, as well as identified level of involvement of Forest Service personnel (whether regional cadre or KNF representatives) if RED deems this to be necessary for successful completion of Option 4. Recommend, at a minimum, that public collaboration between RED and larger fireshed assessment process be integrated so that public receives a consistent message. Regardless of RED's plan to complete the Option 4 requirements, there will need to be close coordination between RED and the larger fireshed assessment team so that RED's proposed treatments can be included in the larger assessment.

Currently, RED is contractually obligated to complete the SFA, with a due date of October 15, 2007. This date is not realistic for two reasons: (1) the award date of the contract was later than originally established in the RFP, but the completion date for Option 4 was not rolled back; and (2) the original time frame for completion of the SFA for the Eddy Gulch LSR by RED was not realistic. RED could not begin to make substantial progress on the SFA task before foundational work by the Regional SFA team and Klamath National Forest personnel with local knowledge was complete for even an initial model run. This was completed at our meeting in Willows on October 9 (2007).

In order for RED to produce a quality product in the Eddy EIS, a strong foundation needs to be established by providing good fireshed analysis information. In order to do this, we are proposing the fireshed analysis completion date should be pushed out to December 15, 2007. Keep in mind that the SFA process is a dynamic one and will be a continual part of the EIS analysis process past the final signature by the Line Officer. Some of the additional uses of the SFA will be to present the findings at several community meetings, analyze the effectiveness of treatments, validate the landscape used in the present fire behavior modeling with the 2006 vegetation and the new Forest Inventory data, use it to finalize the Proposed Action and continue to validate the Proposed Action, to design any additional action alternative, and to assess effects of no action. It will also be important to have participation by the FSA team in collaboration meetings for the Eddy Gulch LSR project, as

well as RED participation in FSA community meetings to be sure that our messages do not conflict with each other when it comes to purpose and need.

RED needs to outline how they will meet Option Item 4. This includes outlining the timeframes, as well as the level of interactive involvement with KNF personnel. This will be a more appropriate topic of discussion at our ID Team next week.

One of the important discussions in the morning evolved around the 2006 vegetation layer provided to RED. This layer is immensely important to the SFA; however, Bernie does not believe it has all the necessary data needed for the development of the landscape files for FARSITE and FLAMMAP fire behavior modeling. The missing data is new labeling of the vegetation polygons and the latest Forest Inventory data (FIA). This is scheduled to be completed in January 2008. This will not be a problem in completing the Eddy SFA, but it will need to be evaluated once the data becomes available. This will not affect RED's analysis, and we can move forward on the fire behavior analysis with the provided landscape. Later assessment of the newer data will be required once the new data is provided.

The current fireshed layer is based on 1994 data grown forward. Problems associated with growing the data forward, and the effects to the fire model, were resolved yesterday. The FIA data (tree list) associated with the 2006 layer will not be available until January. The SFA, and associated development of the Proposed Action, can proceed with the 1994 dataset. Once the 2006 dataset is complete, it will be used by the region and forest. Although there will be some difference between the 1994 data "grown forward" and the 2006 data, it is not expected to be an issue for SFA work.

The following is a summary of what the group saw as deliverables for RED's SFA. Bernie Bahro previously shared this with the KNF and RED.

Fuels Standards and Deliverables Document, Step 2

2. (may be completed under Contract as Bid Option #4)
For the Stewardship Fireshed Analysis(SFA) (or similar process) use steps as defined below:

(a) Define the analysis area
(b) Identify the protection targets
(c) Define the problem fire
(d) Design treatment patterns
(e) Test the proposed treatment pattern
(f) Clearly display trade-offs
(g) Develop monitoring and adaptive management strategy

Step (e) will be evaluated once the proposed treatment patterns are selected by the Core IDT Steps b, d, f, and g will need to be finalized through the ID Team process facilitated by the fire behavior modeling.

A refinement of those deliverables from Bernie and the FSA Team:

1. The KNF has delineated its own fire sheds. The regional FSA cadre is mentoring the KNF and Scott-Salmon Ranger District on a fireshed assessment of 300,000 acres in area that includes the Eddy Gulch LSR evaluation area.
2. The Eddy Gulch LSR is included in the broader fireshed assessment for the Scott-Salmon fireshed (Salmon River Fireshed). RED will be included in any information and data sets required by the analysis of the larger fireshed so that the analysis of the Eddy Gulch LSR does not conflict with the analysis of the Salmon River fireshed. It is important that the forest and the EIS fire messages are clearly communicated to the public,

and that the fire messages do not conflict with each other; this can only be accomplished through collaboration.

3. RED, as part of its development of the EIS purpose and need, will provide the information on why the Eddy "fireshed" is a priority. This priority should not conflict with the KNF fireshed priorities.
4. RED, in developing the purpose and need, will establish the goals and desired conditions in this fireshed using the Klamath Forestwide LSR Assessment and the Scott-Salmon fireshed assessment.
5. RED will describe the existing conditions and assumptions for fire behavior, wildlife habitat, forest health, and community protection.
6. RED will identify opportunities and treatment proposals to move the existing landscape toward the desired conditions for fire behavior, forest health, and habitat.

At the Willows meeting, the group worked on some other key items important to the assessment and fire behavior modeling. Along with validating and correcting the landscape files for the fire behavior modeling, we collaboratively developed the Problem Fire scenario. This involved developing several weather element scenarios that will be used to develop the weather files for modeling. The potential fire starts and large fire potential areas were identified on a map by District fire folks; this information will be used to model the four fire types that we felt were a threat to the Eddy project area.

The following is a list of how this process can evolve and meet critical timelines for RED:

1. The Forest/Region provides data layers that are being used in the SFA process. This would allow RED Team members to focus on areas that represent the conceptual discussions that RED and Forest Service have had regarding ecologically sustainable function.
   a) Fuels layer: available after a calibration workshop with Forest, Cadre, and RED to establish an "existing condition." This was accomplished at the Willows meeting and the layer given to RED.
   b) Preliminary opportunities layers provided by SFA and Forest team.

      The following layers will be provided in the near future to RED:

      - FRCC (Fire Return Interval and Condition Class) data
      - Insulation layer
      - CWPP project layers with prescriptions
2. ID team members from RED will meet with members of the SFA cadre and the Line Officer, Ray Haupt, October 18 during RED's ID Team meeting at 1:00 pm for 3 to 4 hours.
3. RED will craft the existing and desired conditions; purpose and need, and preliminary Proposed Action for the Eddy Gulch LSR Project based on the field evaluations and collaborative fireshed assessment efforts with the Forest and Regional FSA cadre. This will be provided as part of the purpose and need package
4. The Citizen and Agency Participation Plan will include key dates for Regional FSA Cadre public collaboration efforts, as well RED's collaboration efforts for the Eddy Gulch LSR project.